Real versus Financial Barriers to Multinational Activity

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Abstract

Recent literature on multinational firms has stressed the importance of low productivity as a barrier to the cross-border expansion of firms. However, firms typically also need external finance to finance the costs of market entry. Hence, in addition to real barriers, financial constraints may restrict market entry. Building on a model of multinational firms facing real and financial barriers to exports and FDI, we provide empirical evidence on the importance of these barriers. We find that, in addition to productivity, financial factors at the affiliate and at the parent level matter for the intensive and the extensive margin of firms' foreign activities.

Keywords: multinational firms, heterogeneity, productivity, financial
                     constraints

JEL-classification: F2, G2

1   Motivation

The dominance of large firms in international trade and foreign direct investment (FDI) has become one of the main stylized facts of the international trade and finance literature. A recent study using European firm level data, for instance, concludes that multinational firms differ from national firms along a couple of dimensions. They are bigger, more productive, generate higher value added, pay higher wages, employ more capital per worker, and employ more skilled workers (Mayer and Ottaviano et al. 2007).

Similar differences in terms of firm size prevail in Germany (Table 3): Firms which own foreign affiliates and exporters are larger than their domestic counterparts. Yet, the two groups of firms also differ along a couple of other dimensions. Multinational firms, for instance, have lower debt ratios and higher liquidity than domestic firms. Instead, they are not necessarily more productive.

The main explanation that the theoretical literature holds in store to explain the characteristic size patterns of multinational firms are differences in productivity. Observed internationalization patterns would thus reflect real constraints since only the more productivity firms can afford to shoulder the fixed costs of market entry. Most of this literature considers the impact of financial constraints to be less important, arguing that FDI and the associated financing decision can largely be treated separately (Markusen 2002).

Yet, there is a potential second explanation for the dominance of large firms in international activities which rests on the presence of financial constraints. A well-known stylized fact in the corporate finance and banking literature is that smaller firms are more opaque and thus face greater difficulty in obtaining external finance than larger firms. Therefore, financial constraints might be a complementary explanation of prevailing patterns of multinational activity. This explanation gives a dual role for banks and other financial intermediaries in paving the way to international markets.

First, access to external finance can help firms to overcome financial constraints and enable firms to finance the costs of market entry. This effect is likely to be more important for FDI than for exports due to the higher fixed costs.

Second, the international expansion of banks and multinational firms often takes place in parallel, although the direction of causality has remained subject to debate. One reason for the link between the foreign expansion of banks and non-financial firms could be that banks serve as information intermediaries in foreign markets.

The purpose of this paper is to disentangle the relative importance of real and financial constraints for the cross-border expansion of firms. We use a detailed firm level dataset on German firms' foreign direct investments abroad, which we complement with information on productivity and financial barriers faced by these firms at home. We also use information on the exporter status of firms.

The theoretical framework used in this paper allows studying the interaction between real and financial constraints as determinants of the international expansion of firms. It is motivated by recent theoretical work stressing the importance of productivity for firms' international expansions. To this literature, Melitz (2003) has provided the seminal contribution; Greenaway and Kneller (2007) provide a recent survey. Helpman et al. (2004) extend the Melitz-model to account for multinational firms. The key to the model and its extensions is that, ex ante, firms (as well as other market participants) do not know firms' productivity. Upon entry, firms draw their productivity from a commonly known productivity distribution, and the level of productivity becomes common knowledge as well. Depending on the level of productivity, firms exit the market, they produce only for the domestic market, become exporters, or they set up affiliates abroad. Productivity affects market entry because there are fixed and variable costs of entering new markets. Costs of entering domestic markets are lower than costs of exporting which, in turn, are lower than costs of setting up foreign affiliates.

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 constraints 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 asymmetries of information. Hence, they face an additional barrier to going international.

Two recent papers introduce financial market constraints into the Melitz-model. Manova (2006) analyzes the impact of financial constraints on the selection into exporting. Firms need external funds to finance foreign expansions, and they differ with regard to the level of collateral they can pledge.[1] 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 that low productivity has on the entry into foreign markets. Manova (2006) tests these predictions using a panel of bilateral exports for countries and sectors. According to her results, the variation of credit constraints across countries and sectors provides one possible explanation for the many zeros in the matrix of bilateral trade. Manova shows that financially developed countries are more likely to export bilaterally and to ship greater volumes when they become exporters. Also, firm selection into exporting accounts for a third of the effect of credit constraints on export volumes, whereas two thirds are due to the impact on the level of firms' exports. Her results suggest that, given a firm's productivity level, financing constraints could deteriorate a firm's possibilities to "go abroad".

Chaney (2005) likewise has a Melitz-type model in which firms face financial constraints. In his model, firms not only make a random productivity draw upon entry, they are also hit by a liquidity shock. Since productivity and liquidity shocks are imperfectly correlated, the link between productivity and the propensity to export is non-linear: firms with a very low productivity never export, regardless of their level of liquidity. Firms with a very high level of productivity always export, regardless of their liquidity. Firms with an intermediate level of productivity may or may not export, depending on their liquidity.

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[1]   Chor et al. (2007) use a similar theoretical framework but focus on the impact of host country financial development on the relative importance of horizontal and vertical FDI.

Recent empirical evidence at the micro-level supports the link between financial constraints and the probability to export. Greenaway et al. (2007) use a panel of UK manufacturing firms over the period 1993 to 2002 and find that exporters exhibit better financial conditions than domestic firms. However, 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 financially healthy firms are not more likely to become exporters. Findings by Ber et al. (2002) for Israelian and Campa and Shaver (2002) for Spanish firms show that credit constraints are less tight for exporting than for non-exporting firms.[2]

Harrison et al. (2002) also study the link between financial constraints and FDI but their focus is on the impact of inward FDI on the tightness of the domestic credit market. This impact depends on where multinationals source their funds. If multinationals source their funds on international markets, credit constraints might be relaxed. If multinationals source their funds on the domestic market, credit constraints may tighten. While Harrison et al. (2002) take a host country perspective, their results are complementary to ours since we take a source country perspective.

Our approach differs from these earlier studies in three main regards. First, we theoretically analyze how productivity and financial constraints affect firms' choices between FDI and exports. Second, we test our model using data for German firms, which allow analyzing the financial structures and the productivity of German firms and of their foreign affiliates simultaneously. Third, our data allow analyzing different margins of international activities such as exports and FDI as well as the intensive and the extensive margin of foreign entry.

Our main data source on the foreign affiliates of German firms is a detailed firm level database provided by the Deutsche Bundesbank. The Micro-Database Foreign Direct

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

Investment (*MiDi*) provides balance sheet information on practically all affiliates of German firms worldwide. In addition to information on the internationalization patterns of German multinationals, we thus obtain information on the financial structures and size of their foreign affiliates. However, *MiDi* provides only very limited information on the German parent. In order to measure financial constraints at the parent level, we use a second database on the balance sheets of firms in Germany, the database *Dafne* provided by Bureau van Dyck. From *Dafne*, we also obtain information on the group of purely domestic firms as well as on domestic exporters without foreign affiliates.

In the following second part, we present a model of multinational firms which differ with regard to their productivity and access to external finance. The model shows the interaction of productivity and financial barriers to the expansion into foreign markets. In part three, we describe our data and provide descriptive statistics. Part four tests the theoretical model, and part five concludes. We find that productivity and financial constraints have a significant impact on firms' intensive and extensive margins of foreign activities as well as on the choice between exports and FDI.

2   International Activity and Financial Constraints: Theory

In this section, we propose a simple theoretical framework, which allows analyzing firms' choices between exports and FDI. Our model differs from earlier models of multinational firms by introducing uncertainty about firms' productivity and the need to obtain external finance to finance the fixed costs of market entry. Firms finance their foreign expansions using their own internally generated funds as well as external credit. These credits are secured by collateral. We also assume that there are differences in contract enforceability across countries, which could be linked to cross-country differences in financial institutions. (See Manova (2006) for a similar modeling strategy.). The model provides a set of testable implications concerning the impact of financial constraints, productivity, and host country characteristics on firms' internationalization choices.

To see how the model works, consider 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. Hence, we consider the case of horizontal FDI only.

To serve the foreign market, the firm has to incur some fixed costs F_i that depend on the mode of entering the foreign market, with $i = E$ in case of exports and $i = I$ in case of a foreign investment, and $F_E < F_I$. Hence, fixed cost of production are higher in the case of foreign production. Without loss of generality, we set the costs of purely domestic production equal to zero.

The firm faces an uncertainty about the revenues that can be generated on the foreign market. We abstract from exchange rate changes, i.e. revenues generated on the foreign market can be remitted 1:1 into domestic currency. Serving the foreign market yields positive revenues $\dfrac{R}{\tau_i}$ with probability p and zero revenues otherwise. This probability is the same for all firms, hence the likelihood of positive returns p captures the macroeconomic risk which firms face on foreign markets.

In choosing between exports and FDI, firms also have to consider transportation costs. Revenues generated from exports are subject to iceberg transportation costs that reduce the revenues R to $\dfrac{R}{\tau_E}$, with $\tau_E > 1$. In the case of FDI, there are no such iceberg costs, i.e. $\tau_I = 1$. The expected revenues depend also on the productivity of the parent firm β, which also spills over onto the foreign affiliate. Thus, total expected revenues are

$p \cdot \beta \cdot \dfrac{R}{\tau_E}$ in the case of exports and $p \cdot \beta \cdot R$ in the case of foreign investment.

To finance the undertaking, the investor can rely on retained earnings and on credits. Let E denote the retained earnings available for the project, and $D_i = F_i - E$ the credit necessary to finance the fixed cost. Furthermore, let $(1 + r_i)D_i$ denote the repayment plus interest rate that the investor promises to pay in case of success. In this version of the model, we assume that firms and creditors have the same information set. Hence, there are no asymmetries in information. Also, we do not distinguish between domestic and

foreign creditors, i.e. we implicitly assume that financial markets are perfectly integrated and focus on the implications of imperfect integration of goods markets only.

Even if the project is successful and generates positive returns, the creditor cannot be sure to receive the promised repayment, due to difficulties in contract enforcement. Thus, repayment can be enforced with probability $p \cdot \mu_i$, where μ_i captures the probability of contract enforcement if revenues are positive (which occurs with probability p). A natural assumption is that $\mu_I < \mu_E \leq 1$. Hence, we assume that contract enforcement becomes more difficult if the firm has set up an affiliate abroad. In our empirical analysis below, we will capture this type of legal uncertainty through a country-specific measure of political risk.

We assume that the credit can be partially secured with collateral that is related to the size of the investment. Thus, if the credit is not repaid, the creditor can seize the investment financed with the credit, but only with some probability λ_i, where $\lambda_I < \lambda_E \leq 1$.

Furthermore, there will be some efficiency loss when the collateral is liquidated, such that the investor loses all of the collateral D, but the creditor receives only $\dfrac{D_i}{\theta_i}$, with $\theta_I > \theta_E \geq 1$. The intuition is that the efficiency loss of liquidating the collateral is larger if the assets are located in a foreign country than if they are located at home.

We assume perfect competition in domestic banking markets so that credits will be granted such that the creditor expects to break even. This zero profit condition for banks implicitly determines the interest rate:

$$p\mu_i\left(1+r_i\right)D_i + \left(1 - p\mu_i\right)\lambda_i \frac{D_i}{\theta_i} = D_i \tag{1}$$

The firm's expected profits, in turn, can be summarized as follows:

$$p\left[\beta \frac{R}{\tau_i} - \mu_i\left(1+r_i\right)D_i\right] + D_i - \left(1 - p\mu_i\right)\lambda_i D_i - F_i. \tag{2}$$

The terms in parenthesis denote the revenues minus interest payments in case of positive revenues. To this we add the credit received minus the expected loss due to the

liquidation of the collateral if the credit is not repaid. Finally, we need to subtract the fixed production cost.

2.1 Determinants of Exports and FDI

In a first step, we solve the model for the determinants of exports and FDI separately. Solving for the interest rate, which is determined by the zero profit condition for banks, and inserting it into the expected profit function of the firms, together with $D_i = F_i - E$, yields

$$p\beta \frac{R}{\tau_i} - (1 - p\mu_i)\lambda_i \left(1 - \frac{1}{\theta_i}\right)[F_i - E] - F_i. \qquad (3)$$

The investor will undertake exporting or FDI only if the expected profit is non-negative. We first investigate how the expected profits of exports and FDI react to changes in the parameters. From this expected profit we can deduce the following comparative static results for adjustments along the extensive margin:

1. The larger the productivity of the project, measured by β, the larger are the expected profits in case of exports and FDI.
2. The larger the market size, measured by R, the larger are the expected profits in case of exports and FDI.
3. The higher are the fixed costs of f the project, as measured by F, the smaller are the expected profits in case of exports and FDI.
4. The lower is the risk of the project, captured by a larger p, the larger are the expected profits in case of exports and FDI.
5. The better the contractual enforcement, as measured by μ, the larger are the expected profits in case of exports and FDI.
6. The lower are the financial constraints, captured by larger liquidity/retained earnings E, the larger are the expected profits in case of exports and FDI.

From this model, we can derive the probability of a firm to engage in FDI or in exports as a function of the model's parameters:

$$\Pr(FDI) = a_0 + a_1\beta + a_2R + a_3F + a_4p + a_5\mu + a_6E \qquad (4)$$

where $a_1, a_2, a_5 > 0$ and $a_3, a_4 < 0$.

2.2 Relative Choice Between Exports and FDI

We now turn to the *relative* attractiveness of exports versus FDI. One main trade off between exports and FDI are fixed versus variable costs of entry. FDI is more costly in terms of fixed costs, but it helps saving on variable transportation costs. To see the firms' choices between exports and FDI more explicitly, we compare expected profits in case of exports

$$p\beta \frac{R}{\tau_E} - (1 - p\mu_E)\lambda_E\left(1 - \frac{1}{\theta_E}\right)[F_E - E] - F_E \qquad (5)$$

with those in case of FDI

$$p\beta \frac{R}{\tau_I} - (1 - p\mu_I)\lambda_I\left(1 - \frac{1}{\theta_I}\right)[F_I - E] - F_I. \qquad (6)$$

Note that $p\beta \dfrac{R}{\tau_E} < p\beta \dfrac{R}{\tau_I}$, as FDI does not involve any iceberg transportation costs.

Thus, we can make the following well known observations:

1. The larger the productivity of the project, measured by β, the larger are the expected profits in case of FDI relative to the expected profits in case of exports.

2. The larger market size, measured by R, the larger are the expected profits in case of FDI relative to the expected profits in case of exports.

Furthermore, our assumptions imply the following relationships: $(1 - p\mu_E) \leq (1 - p\mu_I)$, $\lambda_E \geq \lambda_I$, and $\left(1 - \dfrac{1}{\theta_E}\right) \leq \left(1 - \dfrac{1}{\theta_I}\right)$. Suppose now that the probability of seizing the collateral, λ, is sufficiently similar in case of financing exports and financing FDI, such that $(1 - p\mu_E)\lambda_E\left(1 - \dfrac{1}{\theta_E}\right) < (1 - p\mu_I)\lambda_I\left(1 - \dfrac{1}{\theta_E}\right)$. Then the expected profits in case of FDI relative to those in case of exports are smaller due to the difference in fixed costs. In addition, we can make the following observations:

1. The larger the liquidity/retained earnings, as measured by E, the larger the expected profits in case of FDI relative to the expected profits in case of exports.
2. Retained earnings increase the relative expected profits of FDI versus exports more if
   a. the risk of the project is larger, i.e. if p is smaller,
   b. the inefficiency in case of liquidation is larger, i.e. if θ is larger,
   c. contract enforcement is less efficient, i.e. if μ is smaller.

In the current version of the paper, we cannot test all implications of the theoretical model. We have information on the population of domestic firms as well as their exporter and FDI status. For FDI, we also have information on the countries of destination. Hence, we can test the model's implications for the choice between exports and FDI which are related to parent characteristics. We can also test implications of host country determinants for the volume of FDI. In the following section, we describe the data and the empirical modelling approach in more detail.

3   Data[3]

3.1 Balance Sheets and Multinational Status

The aim of this paper is to test the importance of real and financial constraints for the foreign investment and export choices of firms. Our data come from two sources.

The main data source is *Dafne*, a commercial database providing financial information for about 14,000 German firms in 2001 and 120,000 firms in 2006. This database provides information on a large panel of firms that are active in Germany. We use it to obtain information on parent-level financial constraints, productivity, and control variables such as total assets and sales.

The second data source is the firm level database on multinational firms *MiDi* (Micro-Database Direct Investment) provided by the Deutsche Bundesbank (Lipponer 2006). From this database, we obtain information on the countries in which firms are active, the

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[3]   See the Appendix for details.

volume of their activities abroad, and on the financial structures and productivity of their affiliates. We can also use *MiDi* to obtain information on the number of affiliates that a given firm owns abroad and information on the volume of FDI of German banks by country. Multiplying this with a measure of the importance of bank finance of the parent, we obtain a firm level measure of the importance of banks' presence abroad.

Coverage of the *Dafne* database has increased substantially over time, and service sector firms are well covered. In terms of sales and the numbers of firms, providers of various business services, including holding companies, account for about one third of the observations. This comprehensive coverage of service sector firms sets our study apart from earlier research focusing mostly on the manufacturing sector.

The representativeness of the data increases over time. While the median firm age is 12 years, the median duration in the dataset is only 3 years. This limits our ability to focus on those firms which have been in the sample for at least three or four years as in other related papers (see, e.g., Bond et al. 2004). Reducing the sample to those firms being in the dataset for at least 3 or 4 years would reduce our sample size to one half or one third, respectively, of all observations.

To eliminate outliers and to clean the sample, we start from the full *Dafne* dataset and drop firms with negative values for key variables such as sales, total assets, or total liabilities. Also, since we need information on cash flow and sales, we eliminate about one half of the observations for firms which do not report an income statement. Since we do not have information on mergers among the firms in the sample, we correct for possible merger-induced outliers by dropping observations with large changes in sales. We eliminate all entries where these variables double of half. This outlier correction results in a further reduction of observations, reducing the sample from 259,000 to 222,613 observations. However, due to missing data for quite a number of firms, in particular with regard to financial ratios, we use only about 20% or a maximum of about 46,000 observations for our regressions.[4]

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[4] Note that the number of observations shown in the regressions is smaller since (i) we use lagged values of the explanatory variables in order to reduce simultaneity problems and (ii) information on the volume of FDI is not available for all firms with foreign affiliates.

Using *Dafne*, we also obtain information on the extensive margin of German firms' international activities. We can identify German firms which hold 10% or more of the equity capital in foreign firms and German firms that export. We thus create three groups of firms:

- o Purely domestic German firms, i.e. firms which do not export and which do not hold affiliates abroad ('Domestic Firms') (95% of the firm-year observations),

- o Domestic firms that export but that do not have foreign affiliates ('Domestic Exporters') (5.5%),

- o German firms with foreign affiliates ('German MNEs') (3.7%).

Since we have no time-varying ownership and export information in *Dafne*, we use information on firms' status for the most recent year.

We merge the two datasets using the so-called *Crefo*-code, a firm identifier which classifies all firms in *Dafne* and a large share of the firms in *MiDi*. Overall, we have a similar number of firm-year observations in which we identify FDI firms based on *Dafne* and based on the matched *Dafne-MiDi* dataset. However, these samples do not exactly overlap. We have checked the distribution of parent sizes according to *Dafne* and *MiDi* though, and the patterns in the data are very similar. The advantage of using the combined *Dafne-MiDi* dataset, we can analyze the determinants of firms' foreign investments as a function of parent, affiliate, and host country characteristics.

Table 2 compares the structure of the full and of the reduced sample used for the regressions. The two samples are fairly similar in terms of the percentage allocation of the number of firms across sectors. In terms of the volume of sales, financial services are somewhat underrepresented in the reduced sample (share of 1.8% versus 6.8% of total sales). Similarly, business services are underrepresented with a share of 30.8% versus 40.8%. The sector transport and communication, in contrast, has a higher share in total sales in the reduced than in the full sample (21% versus 15%). Apart from these differences, the cross-sectoral patterns in the data are quite similar.

3.2 Financial Constraints and Productivity

As regards the measurement of firm level productivity, we start with a simple measure of capital productivity, i.e. total sales divided by the volume of fixed capital. To obtain a measure of the firms' capital stock, we include measures of financial capital in addition to plant and equipment to accommodate the fact that plant and equipment are insufficient measures of capital for firms in the services sector. We use productivity measures based on employment only as a robustness test since data on employment are extremely patchy. Only about 10% of the firms included in the database report employment figures. In addition to the ratio between sales and factor inputs, we use the residuals from estimating a simple production function by regressing output on labor, capital, time dummies, and industry dummies.

As regards the measurement of financial constraints, a standard measure in the corporate finance literature is cash flow, the idea being that a company's investment should depend on cash flow only if credit constraints bind. A typical investment equation would thus use investment as the dependent variable and Tobin's q as well as cash flow as explanatory variable. (See Bond et al. (2004) for details and a review of the literature.) However, inference on the cash flow variable might be problematic if stock market values deviate persistently from fundamentals and if this deviation is correlated with the fundamental value of the firm. In this case, financial variables such as cash flow might contain information about future profitability which is not captured by Tobin's q. Bond et al. (2004) thus propose using market forecasts of firm's future profitability as additional regressors. Their empirical results using data for UK firms show that financial variables indeed become insignificant when forecasts are included.

Applying this strategy to our German data would be the preferred option for estimating the impact of financial variables. However, one stylized facts of the German corporate sector is the relatively small share of traded firms. In our sample, only 1% of the firms (in terms of their number) are listed on the stock market. This implies that we do not have information on Tobin's q for most firms of interest, and we also lack analysts' forecasts. We deal with this problem by including sales growth and the stock of cash as proxies for future profitability (see Bond et al. 2004). Similarly, Campa and Shaver (2002) use

lagged sales growth and profit margins to capture time-varying firm-specific investment opportunities.

Moreover, we follow Greenaway et al. (2007) and proxy financial constraints using a number of firm level balance sheet variables. Due to incomplete and missing observations, we use the debt ratio, i.e. the ratio of total debt over total assets in our baseline specifications. Higher leverage can be taken as an indication that a firm has lower retained earnings. Hence, it implies that a firm is more likely to be credit constrained. Manova (2006) additionally suggests using the share of net property, plant and equipment relative to the total book value of assets as a measure for asset tangibility.

From *MiDi*, we obtain information on the financial constraints faced by the affiliates, which we model as closely as possible to the constraints faced by the domestic parent. Similarly, we compute capital and labor productivity of the affiliate, using total sales over capital and employment, respectively.

3.3 Country Level Data

Country-level explanatory variables such as host-country GDP, GDP per capita, and interest rate spreads are taken from the World Bank's World Development Indicators. GDP controls for the size of the market, and we expect a positive impact on the volume of FDI. GDP per capita captures the state of development of the host economy. The impact might be positive – if the horizontal FDI motive and thus market access considerations dominates – or negative – if the vertical or production cost motive dominates. We do not include GDP and GDP per capita simultaneously due to multicolinearity problems. Interest rate spreads are included as a measure of the state of development of the host country's financial system, with higher spreads indicating a lower competitiveness and/or greater inefficiency of the banking system.

To obtain a host-country measure of contract enforceability, we use a measure of host-country political risk taken from the International Country Risk Guide (ICRG).

The following Table summarizes the determinants of FDI and exports according to our theoretical model, the empirical measures, and the expected signs:

Theoretical determinants	Empirical measure	Exports	FDI	FDI $\succ$ Exports
Productivity of the project (β)	Capital productivity (parent)	+	+	+
Market size (R)	Host country GDP	+	+	+
Fixed costs of project (F)		−	−	−
Risk of project (p)	Volatility of affiliate's sales	−	−	
Contract enforcement (μ)	Host country political risk	+	+	
Financial constraints (F)	Debt ratio, cash flow, cash	−	−	+

4 Stylized Facts

When comparing the three groups of firms – purely domestic firms, exporters, and both exporters and FDI firms, as is done in Table 3, we find that firm size (total assets) is continuously increasing, productivity first increases and then decreases, the degree of bank dependence is falling as well, and the debt ratio of firms, i.e. their leverage, is falling.

In Graphs 1-4, we visualize the differences between exporters, FDI firms, and the rest of the sample by plotting the Kernal densities of size (Graph 1), capital productivity (Graph 2), cash flow (Graph 3), and the debt ratio (Graph 4) for different sub-sets of firms.[5]

Graph 1 confirms the stylized facts reported in many earlier papers using firm level data: exporters and FDI firms are larger than purely domestic firms. Results of two-sample Kolmogorov-Smirnov tests for equality of the distribution function confirm that exporters and FDI firms are significantly larger than domestic firms.[6]

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[5] FDI status is defined based on *Dafne*, but results using the *MiDi*-definition are very similar.

[6] Results are not reported but are available upon request.

However, going one step beyond a simple comparison of firm size, it is difficult to trace foreign status to differences in productivity across firms. Instead, mean productivity is very similar for the domestic and internationally active firms. Tests confirm that the distributions of productivity levels are different but no group has a significantly larger or smaller productivity.

The different groups of firms exhibit quite striking differences with regard to financial variables, in contrast. While internationally active firms report somewhat higher cash flow than domestic firms (Graph 3), they show an even more distinct distribution with regard to their debt ratios. Noting that debt ratios have been truncated at 100%, exporters and FDI firms are much less likely to have debt ratios close to or even exceeding values of 100%. Also, FDI firms have a bit lower debt ratios than exporters. Kolmogorov-Smirnov tests confirm that FDI firms and exporters hold significantly less debt than domestic firms.

Prima facie, these graphs suggest that heterogeneity with regard to the openness and international orientation of firms could be driven by financial factors just as by real factors and productivity. In the following, we turn to a more systematic analysis of these patterns in the data.

5 Productivity versus Financial Constraints: Regression Results

Our main testing equation relates financial constraints and productivity on the pattern to internationalization at the firm level. We are interested in two main questions. First, do financial constraints and productivity affect the probability to invest abroad or to become exporters? And what is the relative importance of these variables on the choice between FDI and exports? Second, to what extent do these factors affect the location and size of affiliates? We answer these questions in two steps. In a first step, we use the *Dafne* database to analyze the determinants of firms' extensive margins of foreign activities. In a second step, we use the *MiDi* data to analyze the size of affiliates and the volume of FDI across countries, i.e. the intensive margin.

5.1 Extensive Margin

Our first set of regression results refers to the extensive margin of international activities of German firms. Using the full *Dafne* dataset, we study the characteristics of firms which are exporters and which own affiliates abroad compared to purely domestic firms. Our empirical model is based on equation (4) but we add a number of control variables. Regressors are lagged by one period to account for the potential simultaneity of the explanatory variables. Our baseline regression for the extensive margin – the decision to enter a foreign market – is given by the following probit model:

$$\Pr(FDI)_{i,t} = \alpha_0 + \alpha_1 \left(\frac{Y}{K}\right)_{i,t-1} + \alpha_2 lev_{i,t-1} + \alpha_3 cashflow_{i,t-1} + \alpha_3 controls_{i,t-1} + \varepsilon_{i,t} \qquad (7)$$

where $\Pr(FDI)_{i,t}$ indicates whether a firm i has invested abroad in year t. In a similar way, we model $\Pr(X)_{i,t}$ as the probability of being an exporter in year t. We use the ratio of turn-over over fixed and financial capital (Y/K) as a measure of capital productivity. Financial constraints are measured as firm level leverage and cash flow ($lev_{i,t-1}$, $cashflow_{i,t-1}$). The vector of control variables $controls_{ks,t-1}$ includes measures for firm size, sales growth, and the stock of cash. We estimate equation (7) using a full set of sector and year dummies. These capture industry-level developments affecting all firms in a given sector as well as common macroeconomic effects.

Tables 4 and 5 show the results of probit regressions using a 0/1-dummy of being an exporter and owning foreign affiliates, as indicated in *Dafne*, as the dependent variable.[7] Column (1) has the baseline specification. In columns (2)-(4), we add alternative proxies for firms' financial constraints such as the short-term debt ratio, the degree of bank dependence, or asset tangibility. In column (5), we restrict the estimation to the last year

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[7]   To some extent, results using the definition of whether firms own foreign affiliates according to *MiDi* yield different results. There are two possible reasons for this. First, firms report their foreign investments in *MiDi* only if certain reporting thresholds are reached. Hence, firms with smaller FDI projects are more likely to be included in *Dafne* than in *MiDi*. Second, the match between firms in *MiDi* and *Dafne* is not perfect due to missing firm identifiers. In order to keep results comparable to the results for exporters, we mainly refer to the information on FDI status obtained from *Dafne*.

only since information on exporter and FDI status in *Dafne* is not time-varying. Finally, in column (6), we estimate the model only for those firms reporting positive cash flow.

Turning to the determinants of exporter status first, Table 4 shows a fairly robust relationship between our main control variables size, the productivity of capital, and cash flow. Larger and more productive have a higher probability of being exporters than the rest of the sample. Splitting the sample into firms with high financial constraints (low cash flow, high debt) and those with low financial constraints (high cash flow, low debt) shows that this result is driven by the firms with low financial constraints. (Results are available upon request.)

Also, older firms are more likely to export. These findings are largely in line with expectations and with earlier empirical evidence. Results on financial variables are mixed: On the one hand, higher cash flow increases the probability of exporting. On the other hand, the debt ratio as a measure of financial constraints is negative but insignificant. Generally, these results are quite robust against including alternative control variables.

Results on cash flow warrant special attention. The reported regressions allow the coefficient on cash flow to vary for firms with positive and negative cash flow. In unreported regressions using cash flow as a regressor only, we find a negative impact of cash flow on the probability of becoming a multinational firm. This finding is obviously at odds with prior expectations. However, if we allow the cash flow coefficient to vary across firms reporting positive and negative cash flow, we obtain the expected result. Higher cash flow increases the probability that a firm becomes multinational, and the negative impact of cash flow is confined to the sub-sample of firms reporting negative cash flow.

Most of the additional controls variables and alternative proxies for productivity have the expected sign and are significant as well. Firms with a higher degree of bank dependence and a higher share of tangible assets are more likely to export. The short-term debt ratio is insignificant. Unreported regressions using a residual-based measure obtained from a simple estimate of a production function show a negative sign for the productivity

variable. However, this result should be interpreted with caution since sample size shrinks considerably due to a lack of employment data.

Turning next to the results using the probability of being a multinational firm as a dependent variable (Table 5), we confirm that larger firms are more likely to be multinationals. However, results for productivity and financial constraints are somewhat reversed. The sign on the productivity variable tends to be positive, but it is generally insignificant. In contrast, the debt ratio as a measure for financial constraints is now negative and significant.[8] In unreported regressions, we find that this result is driven by firms facing low financial constraints. Higher sales growth increases the probability of owning affiliates abroad. Firm age is insignificant.

One tentative conclusion from these probit regressions is that real, i.e. productivity, barriers are a more significant barrier for exports than for FDI. For FDI, in contrast, which involves higher fixed costs, financial constraints matters more. We will return to the relative importance of these variables for exports and FDI below (see Table 7).

To check the robustness of our results, we split the sample along different dimensions. Tables 6a and 6b show results for small and large firms as well as firms from manufacturing and services sectors. Results for the main control variables are quite robust. It is interesting to note that some of our results are driven by the service-sector firms, which also dominate the sample in terms of their number. About 13,000 firm-year observations used for the regressions are for service-sector firms, only about 5,600 for manufacturing firms.

For FDI, the debt ratio is significant for the services sector, not for manufacturing firms. Also, the impact of cash flow is stronger for the service sector firms. Productivity is again insignificant with the exception of the manufacturing sub-sample, for which it even enters with a negative sign. For exports, we confirm the positive effects of productive, which is insignificant though for the group of small firms. The debt ratio is marginally significant only for the large firms, and cash flow is significant only for the firms in the services sector.

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[8]   This result is confirmed in unreported regressions using information on MNE status from *MiDi*.

In sum, these results provide some support for the hypothesis that financial constraints matter more for services than for manufacturing firms. There are no distinct differences between small and large firms, in contrast.

So far, we have analyzed the decision to engage in FDI or exports separately. Table 7 reports results from multinomial regressions using the group of purely domestic firms as the reference case. We show coefficient estimates and relative risk ratios (RRR). A RRR smaller than one means the event is less likely to occur in the multinational group (exporters or FDI firms) than in the control group of domestic firms. A RRR larger than one means the event is more likely to occur in the multinational group than in the control group.

Generally, these results show that size has a positive impact on the probability of exporting and FDI, but the effect is stronger for FDI. Also, results confirm the positive impact of productivity on the probability of exporting but not on FDI. The debt ratio affects the probability of FDI but not of exporting. Splitting the sample into manufacturing and services firms again confirms that the services firms drive these results.

In sum, our results show that parent-level financial constraints and productivity affect the extensive margin of foreign entry. At the same time, the effects differ for exports and FDI as well as for firms from different sectors.

5.2   Intensive Margin

In a second step, we analyze the determinants of the intensive margin of firms' foreign activities. We now focus on the size of the foreign investment while taking the decision to *become* a multinational as given. We check whether the volume of firms' foreign activities depends on parent, affiliate, and country characteristics. The dependent variable now becomes the volume of FDI $\log(FDI)_{ijk,t}$ of parent i in affiliate j in county k, and the regression equation includes control variables at the parent level ($Z_{i,t}$), at the affiliate level ($Z_{j,t}$), and at the country-level ($Z_{k,t}$):

$$\log(FDI)_{ijk,t} = \alpha_0 + \alpha_1 \left(\frac{Y}{K}\right)_{i,t-1} + \alpha_2 lev_{i,t-1} + \alpha_3 cashflow_{i,t-1} + \alpha_3 Z_{i,t}$$
$$+ \alpha_4 Z_{j,t} + \alpha_5 Z_{k,t} + \varepsilon_{ijk,t} \tag{8}$$

We estimate this model as a panel fixed effects model. The cross-section dimension is specified as a combination of parents and host countries. Therefore, time-invariant control variables such as distance drop out.

Results using the volume of FDI as the dependent variable are reported in Table 8. A number of parent-level explanatory variables affect the volume of FDI. Larger, more productive, and less indebted parents have larger foreign affiliates. The size of parents has an impact through the assets held at home and through the number of affiliates in foreign markets. More internationally-oriented firms, i.e. firms which own more foreign affiliates, also have larger affiliates. Cash flow, cash, and sales growth have no significant impact.

In addition, a couple of affiliate level characteristics affect the volume of FDI. The greater the tangibility of affiliates' assets, the lower the volume of FDI. This is consistent with a positive impact of asset tangibility on the affiliate's debt ratio, as is confirmed by unreported regressions. An affiliate's idiosyncratic risk does not have a significant impact, unlike predicted by our model.

Splitting the sample into large and small as well as firms from manufacturing and services gives some interesting additional results. The positive result for productivity is driven by the manufacturing firms only. The debt ratio, in contrast, is negative and significant for the small firms and the manufacturing firms. This is in contrast to our findings for the extensive margin, where we found an impact of financial constraints for the services, not for the manufacturing firms.

As regards the host country explanatory variables, we find a positive impact of foreign GDP, a weakly positive impact of political risk,[9] which is driven by the sub-sample of small firms. The volume of German banking sector FDI in the respective host country has a positive impact, particularly for small firms and for service sector firms. The foreign

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[9]   Note that the political risk variable is higher the lower a country's political risk.

lending rate as a proxy for the degree of development of the foreign capital market and the macroeconomic environment is insignificant.

6 Conclusions

Large firms dominate the group of multinational firms. Earlier literature focuses on differences in productivity across firms as an explanation for this stylized fact. More productive firms find it easier to shoulder the fixed costs of foreign entry, thus being more likely to entering new markets. This paper adds an additional, complementary explanation for the characteristics size patterns of multinationals: financial constraints.

Building on a theoretical model of firms' choice between serving the domestic market, exporting, and FDI, we show that the severity of financial constraints affects firms' internationalization patterns in a number of characteristic ways. Firms are more likely to engage in FDI or exports the higher their productivity, the weaker financial constraints, the larger foreign markets, the lower the fixed costs of investment, the lower project risk, and the better contract enforcement.

We test the model using data on German firms which comes from two data sources. From *Dafne*, we obtain information on German firms' balance sheets and financial ratios as well as on their exporter status. From *MiDi*, we obtain information on the volume of FDI and the countries in which these firms are active. Using these data, we analyze both the firms' extensive margin of foreign activities, i.e. the decision to become an exporter or a multinational firm as well as their intensive margin, i.e. the volume of FDI across countries.

Our empirical results provide support for the hypothesis that financial constraints as well as productivity matters for foreign entry. As regards the extensive margin of foreign activities, productivity barriers are relatively more important for export decisions than for FDI. Financial constraints in the form of high leverage, in contrast, affect FDI but not the probability of exporting. The intensive margin of firms' activities, in contrast, is affected both by real and financial constraints. Barriers to foreign entry also differ across sectors. In terms of the extensive margin of foreign activities, financial constraints seem to be

more important for services than for manufacturing firms. In terms of the intensive margin, manufacturing firms are affected more by financial constraints.

Our results bear potentially important policy implications. Models ignoring financial constraints would predict that enhancement of firm productivity could improve firms' access to foreign markets. Our results imply that lowering financial constraints might be equally important for some firms.

In terms of future research, our theoretical modeling approach naturally lends itself to the introduction of information asymmetries between firms and financial intermediaries such as banks. Hence, the model provides an explanation for the parallel foreign expansion of banks and non-financial firms, which we observe in the data.

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8   Data Appendix

Unless indicates otherwise, <u>parent-level information</u> comes from *Dafne* (Bureau van Dijk), <u>affiliate level information</u> comes from *MiDi* (Microdatabase Direct Investment, Deutsche Bundesbank), codes in italics refer to the original time series identifiers. <u>Country-level information</u> comes from the World Bank's World Development Indicators.

Variable	Definition
	Firm level data (parent)
Age	Actual year minus founding year (negative values due to mis-reporting of the founding year have been dropped)
Bank dependence	Liabilities vis-à-vis banks (*a300287*) / total liabilities (*a300274*) * 100, truncated at 100%
Cash	Cash (*a300167*)
Cash flow	Cash flows from operations (*a386099*)
Debt ratio	Total debt (*a300274*) / total assets (*a300001*) * 100, truncated at 100%
Employment	Number of employees
Exporter	0/1 dummy for domestic exports for last reporting year (*a11*)
Firms with foreign affiliate	(i) <u>based on *Dafne*</u>: 0/1 dummy for German firms with foreign affiliates for the last reporting year, (ii) <u>based on *MiDi*</u> 0/1 dummy for firms with foreign affiliates from *Dafne-MiDi*-merge
Liquidity	Short-term assets (*a300109 – a309650*) / short-term liabilities (*a309109*) * 100, truncated at 1000%
Number of foreign affiliates	Count of total number of affiliates world-wide obtained from *MiDi*.
Productivity	(i) <u>labor productivity</u>: turnover (*a300671*) / employment, (ii) <u>capital productivity</u>: turnover (*a300671*) / fixed assets (*a300022 + a300044*)
Sector definitions	We use two definition of sectors: (i) A <u>broad</u> definition of 28 sectoral groups is used for sample splits (see also Table 2), (ii) a <u>narrow</u> definition of about 64 sectors at the 2-digit-level, used to generate sector-level dummy variables
Size	Total assets €1,000 (*a300001*)
Sales	Turnover in €1,000 (*a380999*)
Short-term debt ratio	Short-term debt (*a309109*) / total assets (*a300001*) * 100, truncated at 100%
Tangibility	Fixed and financial assets (*a300022+ a300044*) / total assets (*a300001*) * 100, truncated at 100%
Wages	Personnel expenditure per employee in €1,000

Variable	Definition
Firm level data (affiliate)	
Debt ratio	Total debt (*p33*) / total assets (*p40*) * 100, truncated at 100%
Employment	Number of employees (*p05*)
Foreign direct investment	Aggregate foreign direct investment of parent *i* in country *j* in year *t*, i.e. data are aggregated across all affiliates in a given country for a given parent (*pdum1*).
Holding company	0/1 dummy for foreign affiliates of holding companies
Idiosyncratic risk	(Growth of sales of affiliate *i* in country *j* in year *t* – mean growth of German affiliates in country *j* in year *t*)^2
Productivity	(i) labor productivity: turnover (*p04*) / employment (*p05*), (ii) capital productivity: turnover (*p04*) / fixed assets (*p40*)
Sales	Turnover in €1,000 (*p04*)
Tangibility	Fixed and financial assets (*p11+p12*) / total assets (*p40*) * 100, truncated at 100%
Country-level data	
GDP	Host country GDP in constant USD, converted into 1,000 euro
GDP per capita	Host country GDP per capita in constant USD
Number of banks	Aggregate volume of FDI of German banks in country *j* in year *t*, calculated from *MiDi*.
Political risk	Composite risk index obtained from the International Country Risk Guide (ICRG). The data range from 0 to 100, with a higher number indicating lower country risk.

Country groups:

OECD: Australia, Belgium., Czech Republic, Finland, Germany, Hungary, Ireland, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Switzerland, United Kingdom, Austria, Canada, Denmark, France, Greece, Iceland, Italy, Korea, Mexico, New Zealand, Poland, Slovak Republic, Sweden, Turkey, United States

CEEC1: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia

CEEC2: Belarus, Bulgaria, Romania, Russia, and Ukraine

EZ11: Belgium, Germany, Ireland, Spain, France, Italy, Luxembourg, Netherlands, Austria, Portugal, and Finland, i.e. the euro area as of 1999.

nonEZ3: United Kingdom, Denmark, Sweden.

nonEZeurope: Rest of Europe including enlargement countries plus Switzerland and Norway.

RoW: All other countries worldwide.

Table 1: Descriptive Statistics

Data in panel (a) are based on *Dafne* and are used for the probit regressions on the determinants of the extensive margin. Data in panel (b) are used for the panel fixed effects regressions on the determinants of the intensive margin.

a) Extensive margin

Variable	Obs	Mean	Std. Dev.	Min	Max
Exporter (0/1)	222,613	0.06	0.23	0.00	1.00
FDI (0/1) (MiDi)	222,613	0.04	0.19	0.00	1.00
FDI (0/1) (Dafne)	222,613	0.04	0.19	0.00	1.00
Log size	222,575	7.59	2.32	0.00	20.01
Log capital productivity	77,701	1.43	1.99	-12.57	12.63
Log cash flow	211,914	4.13	3.77	-16.06	16.58
Log debt ratio	215,652	3.84	0.92	-7.63	4.61
Log cash	190,101	4.81	2.31	0.69	15.66
Log sales growth	108,314	0.81	2.50	-7.19	6.12
Log age	218,203	2.46	1.10	0.00	5.33
Log liquidity	14,122	4.24	1.06	-5.12	6.91
Log short-term debt ratio	61,929	3.35	1.08	-7.80	4.61
Log tangibility	88,451	3.28	1.08	-6.08	4.61
Log bank dependence	129,610	3.34	1.33	-9.48	4.61

b) Intensive margin

	Obs	Mean	Std. Dev.	Min	Max
Affiliate-level					
Log debt ratio affiliate	15,174	3.65	1.04	…	…
Log size affiliate	15,989	9.61	1.63	…	…
Log FDI	15,989	8.61	1.66	…	…
Log asset tangibility	15,724	2.71	1.53	…	…
Log risk	13,136	4.98	2.40	…	…
Parent-level					
Log size	15,989	12.65	1.97	3.30	18.67
Log cash flow	15,574	7.97	6.03	-14.90	16.58
Log negative cash flow	15,574	-0.89	2.73	-14.90	0.00
Log capital productivity	13,170	0.61	1.70	-9.17	7.44
Log debt ratio	15,924	3.42	0.81	-6.41	4.60
Log cash	15,151	8.29	3.10	0.69	15.65
Log sales growth	9,678	0.89	2.12	-3.91	5.43
Log number of foreign affiliates	15,989	2.38	1.16	0.69	5.37
Log age	15,564	3.41	1.17	0.00	5.31
Holding (0/1)	15,989	0.21	0.41	0.00	1.00
Country-level					
Log GDP (constant €)	15,820	19.92	1.61	13.14	23.43
Log lending rate	12,904	1.88	0.59	0.51	5.63
Log bank FDI	15,255	13.69	2.03	4.75	20.75
Log political risk	15,866	2.88	0.47	1.37	4.35

Table 2: Full versus Reduced Sample

This Table compares the full sample and the reduced sample used for the regressions. Data are based on *Dafne*.

	Full sample				Sample used for regressions			
	Number	%	Sales (million €)	%	Number	%	Sales (million €)	%
Agriculture	2,949	1.26	9,567	0.08	1,480	1.90	7,091	0.10
Chemicals	2,249	0.96	271,295	2.34	1,110	1.43	230,470	3.21
Construction	27,302	11.67	252,645	2.18	8,023	10.32	180,828	2.52
Education	1,166	0.50	14,370	0.12	323	0.42	9,894	0.14
Energy	5,718	2.44	1052676.18	9.07	3,551	4.57	861,841	12.02
Financial services	3,308	1.41	786,562	6.78	777	1.00	131,978	1.84
Fishing	33	0.01	53	0.00	18	0.02	43	0.00
Food & Tobacco	3,306	1.41	129,218	1.11	1,750	2.25	116,351	1.62
Furniture	2,468	1.06	28,261	0.24	879	1.13	20,920	0.29
Glas	2,031	0.87	120,967	1.04	855	1.10	106,505	1.49
Health	5,490	2.35	175,245	1.51	2,355	3.03	127,304	1.78
Hotels & restaurants	2,278	0.97	11,206	0.10	480	0.62	6,639	0.09
Coking plants	193	0.08	105,385	0.91	109	0.14	38,080	0.53
Leather	137	0.06	31,319	0.27	40	0.05	1,297	0.02
Machinery	7,537	3.22	220,061	1.90	2,795	3.60	169,085	2.36
Metals	10,453	4.47	195,032	1.68	3,229	4.16	133,961	1.87
Mining	794	0.34	81,560	0.70	339	0.44	63,080	0.88
Office equipment	5,819	2.49	154,011	1.33	2,298	2.96	108,892	1.52
Other services	8,948	3.83	305,983	2.64	2,595	3.34	199,138	2.78
Paper	4,205	1.80	112,683	0.97	1,582	2.04	89,845	1.25
Public administration	918	0.39	22,687	0.20	271	0.35	15,695	0.22
Business services	71,340	30.50	4741659.61	40.84	20,197	25.99	2208794.03	30.80
Rubber & plastics	2,782	1.19	51,688	0.45	1,017	1.31	36,729	0.51
Textiles	1,565	0.67	50,416	0.43	614	0.79	42,189	0.59
Trade & repair	45,913	19.63	659,652	5.68	15,554	20.02	502,995	7.01
Transport & comm.	12,147	5.19	1739964.38	14.99	4,435	5.71	1500414.11	20.92
Vehicles	1,560	0.67	273,414	2.36	601	0.77	253,067	3.53
Wood	1,270	0.54	10,939	0.09	420	0.54	7,989	0.11
Total	233,891	100.00	11609338.9	100.00	77,707	100.00	7171934.64	100.00

Table 3: Descriptive Statistics Domestic versus International Firms

Number of German firms and descriptive statistics refer to the non-exporters. Foreign firms according to *Dafne* are those reporting foreign affiliates for the last year of observations.

	Small firms			Large firms		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Log size	110,191	5.72	1.19	112,384	9.42	1.57
Log liquidity	5,178	4.21	1.04	8,944	4.26	1.08
Debt ratio	103,785	61.59	29.16	111,871	56.18	27.70
Log capital productivity	20,997	2.14	1.59	56,704	1.16	2.05
Log cash flow	101,281	2.72	2.60	110,633	5.42	4.19
Bank dependence	55,127	39.71	26.95	74,489	47.95	29.95
Tangibility	23,897	31.22	24.56	64,554	42.77	28.80
Log capital intensity	1,249	2.24	1.35	25,313	4.31	2.06
Log wages per capita	5,533	10.32	0.64	36,180	10.76	0.51
Log sales	88,526	6.57	1.38	96,129	9.38	1.79
	Non-Exporter			Exporter		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Log size	210,134	7.50	2.31	12,441	9.16	1.81
Log liquidity	12,836	4.21	1.08	1,286	4.52	0.85
Debt ratio	203,229	59.07	28.72	12,427	54.05	24.94
Log capital productivity	71,024	1.38	2.04	6,677	1.91	1.26
Log cash flow	201,270	4.03	3.75	12,412	5.71	3.90
Bank dependence	120,970	44.79	29.29	8,646	39.57	24.08
Tangibility	80,870	40.38	28.77	7,581	31.93	19.34
Log capital intensity	23,226	4.29	2.15	3,336	3.69	1.37
Log wages per capita	37,227	10.69	0.57	4,486	10.77	0.37
Log sales	173,839	7.93	2.11	10,816	9.82	1.76
	Non-FDI			FDI		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Log size	214,215	7.46	2.23	8,360	10.88	1.99
Log liquidity	12,699	4.20	1.07	1,423	4.57	0.89
Debt ratio	207,353	59.39	28.52	8,303	43.74	24.56
Log capital productivity	71,289	1.45	2.00	6,412	1.20	1.86
Log cash flow	205,371	4.05	3.65	8,311	6.06	5.83
Bank dependence	124,139	44.70	29.04	5,477	38.70	27.36
Tangibility	81,052	39.63	28.51	7,399	39.87	24.42
Log capital intensity	22,101	4.12	2.05	4,461	4.68	2.13
Log wages per capita	37,046	10.66	0.54	4,667	10.99	0.57
Log sales	177,773	7.93	2.06	6,882	10.84	2.03

Table 4: Probability of Being an Exporter

This Table reports results of probit regressions using a 0/1 dummy variable of being an exporter as the dependent variable. A full set of sector, region (German state), and time dummies is included. Columns (1)-(4) have results for the full panel, column (5) for the last year only, column (6) for firms with positive cash flow only. All explanatory variables are at the parent level.

	(1)	(2)	(3)	(4)	(5)	(6)
Log size t-1	0.107***	0.097***	0.131***	0.120***	0.133***	0.152***
	(4.90)	(3.32)	(4.76)	(5.22)	(5.75)	(9.49)
Log capital productivity t-1, sales	0.057***	0.057**	0.098***	0.102***	0.067***	0.056***
	(3.58)	(2.57)	(4.61)	(3.39)	(4.48)	(3.35)
Log cash flow t-1	0.047**	0.04	0.040*	0.035*	0.038*	-0.005
	(2.52)	(1.59)	(1.73)	(1.78)	(1.81)	(1.03)
Log negative cash flow t-1	-0.097**	-0.083	-0.073	-0.075*	-0.068	
	(2.55)	(1.64)	(1.51)	(1.89)	(1.54)	
Log debt ratio t-1	-0.038	-0.064	-0.161***	-0.047	-0.036	-0.043
	(1.16)	(1.14)	(3.23)	(1.40)	(1.12)	(1.28)
Log cash t-1	-0.001	-0.01	-0.007	0	0	0.005
	(0.07)	(0.67)	(0.58)	(0.02)	(0.03)	(0.46)
Log sales growth t-1	0.008	0.012	0.005	0.008	0.01	0.012*
	(1.31)	(1.24)	(0.66)	(1.27)	(1.08)	(1.81)
Log age	0.151***	0.161***	0.110***	0.148***	0.164***	0.164***
	(5.79)	(4.65)	(3.76)	(5.66)	(6.63)	(6.26)
Log tangibility t-1				0.080*		
				(1.85)		
Log bank dependence t-1			0.056***			
			(3.53)			
Log short-term debt ratio t-1		-0.017				
		(0.39)				
Constant	-2.741***	-0.596	-2.435***	-4.256***	-3.418***	-3.831***
	(3.70)	(0.68)	(2.83)	(5.35)	(4.10)	(5.07)
Observations	19,968	8,847	14,721	19,968	8,885	18,515
Pseudo R2	0.28	0.27	0.29	0.28	0.27	0.28
# clusters	9,817	5,056	7,494	9,817	8,885	9,372
Log likelihood	-5,518.46	-2,580.33	-4,072.38	-5,514.32	-2,291.38	-5,117.3

Table 5: Probability of Owning Affiliates Abroad

This Table reports results of probit regressions using a 0/1 dummy variable of owning foreign affiliates as the dependent variable. FDI status is based on *Dafne*. A full set of sector, region (German state), and time dummies is included. Columns (1)-(4) have results for the full panel, column (5) for the last year only, column (6) for firms with positive cash flow only. All explanatory variables are at the parent level.

	(1)	(2)	(3)	(4)	(5)	(6)
Log size t-1	0.282***	0.256***	0.320***	0.288***	0.292***	0.336***
	(12.51)	(8.94)	(11.20)	(12.38)	(12.62)	(18.64)
Log cash flow t-1	0.040**	0.046**	0.031	0.034*	0.03	-0.014***
	(2.19)	(1.99)	(1.37)	(1.79)	(1.44)	(3.14)
Log negative cash flow t-1	-0.125***	-0.131***	-0.101**	-0.115***	-0.101**	
	(3.42)	(2.79)	(2.18)	(3.04)	(2.31)	
Log capital productivity t-1, sales	-0.002	-0.051**	0.031	0.015	-0.002	0.00
	(0.13)	(2.36)	(1.51)	(0.60)	(0.13)	(0.03)
Log debt ratio t-1	-0.149***	-0.333***	-0.309***	-0.153***	-0.136***	-0.142***
	(4.96)	(5.41)	(6.43)	(5.05)	(4.64)	(4.44)
Log cash t-1	0.007	0.011	-0.004	0.007	0.006	0.008
	(0.63)	(0.84)	(0.32)	(0.68)	(0.53)	(0.75)
Log sales growth t-1	0.023***	0.020**	0.018**	0.023***	0.027***	0.028***
	(3.38)	(2.18)	(2.23)	(3.38)	(2.77)	(3.92)
Log age	-0.018	-0.02	-0.016	-0.019	-0.015	-0.006
	(0.73)	(0.63)	(0.57)	(0.78)	(0.63)	(0.24)
Log tangibility t-1				0.036		
				(0.95)		
Log bank dependence t-1			0.043***			
			(2.86)			
Log short-term debt ratio t-1		0.245***				
		(4.38)				
Constant	-2.780***	-2.209***	-4.516***	-3.677***	-4.609***	-3.933***
	(4.86)	(3.14)	(4.06)	(4.74)	(5.09)	(5.24)
Observations	22,924	10,463	16,705	22,924	9,992	21,337
Pseudo R2	0.32	0.34	0.36	0.32	0.29	0.32
# clusters	10,952	5,794	8,218	10,952	9,992	10,459
Log likelihood	-5,612.02	-2,878.54	-3,880.2	-5,610.87	-2,250.71	-5,082.99

Table 6: Probability of Owning Affiliates Abroad or of Being an Exporter, Sample Splits

This Table reports results of probit regressions using a 0/1 dummy variable of owning foreign affiliates as the dependent variable. A full set of sector, region (German state), and time dummies is included. All explanatory variables are at the parent level.

	FDI					Exporter				
	Full sample	Large firms	Small firms	Manu-facturing	Services	Full sample	Large firms	Small firms	Manu-facturing	Services
Log size t-1	0.282***	0.221***	0.358***	0.440***	0.202***	0.107***	0.011	0.284***	0.170***	0.055*
	(12.51)	(8.13)	(5.03)	(10.61)	(7.16)	(4.90)	(0.35)	(5.53)	(5.08)	(1.72)
Log cash flow t-1	0.040**	0.056***	-0.072*	-0.019	0.064***	0.047**	0.035	0.067*	0.033	0.063**
	(2.19)	(2.86)	(1.71)	(0.55)	(2.79)	(2.52)	(1.57)	(1.90)	(1.17)	(2.29)
Log negative cash flow t-1	-0.125***	-0.155***	0.066	0.002	-0.178***	-0.097**	-0.073	-0.122*	-0.055	-0.140**
	(3.42)	(3.90)	(0.78)	(0.03)	(3.92)	(2.55)	(1.58)	(1.71)	(0.94)	(2.55)
Log capital productivity t-1, sales	-0.002	-0.011	0.028	-0.076**	0.001	0.057***	0.052***	0.04	0.067**	0.054**
	(0.13)	(0.61)	(0.91)	(2.08)	(0.06)	(3.58)	(2.61)	(1.44)	(2.48)	(2.57)
Log debt ratio t-1	-0.149***	-0.135***	-0.143**	-0.079	-0.134***	-0.038	-0.076*	0.03	0.006	-0.055
	(4.96)	(3.92)	(2.43)	(1.45)	(3.65)	(1.16)	(1.88)	(0.53)	(0.12)	(1.18)
Log cash t-1	0.007	0.003	0.017	0.021	0.002	-0.001	0.01	-0.023	0.014	-0.022
	(0.63)	(0.29)	(0.64)	(1.28)	(0.16)	(0.07)	(0.82)	(1.17)	(1.01)	(1.32)
Log sales growth t-1	0.023***	0.024***	0.026*	0.014	0.022**	0.008	0.002	0.012	0.009	0.004
	(3.38)	(3.21)	(1.91)	(1.22)	(2.40)	(1.31)	(0.23)	(1.19)	(0.98)	(0.39)
Log age	-0.018	0.01	-0.205***	0.059	-0.079**	0.151***	0.155***	0.140***	0.209***	0.078*
	(0.73)	(0.37)	(3.39)	(1.46)	(2.39)	(5.79)	(4.81)	(3.28)	(5.76)	(1.89)
Constant	-2.780***	-3.962***	-2.511***	-4.851***	-1.408***	-2.741***	-2.449***	-3.131**	-4.197***	-1.616***
	(4.86)	(5.16)	(2.63)	(6.58)	(2.61)	(3.70)	(3.00)	(2.55)	(5.09)	(2.86)
Observations	22,924	13,139	7,930	5,582	13,156	19,968	11,287	7,794	5,466	11,980
Pseudo R2	0.32	0.27	0.17	0.32	0.28	0.28	0.3	0.21	0.13	0.16
# clusters	10,952	5,395	4,563	2,671	6,428	9,817	4,817	4,470	2,608	5,852
Log likelihood	-5,612.02	-4,618.72	-798.25	-2,013.5	-2,986.93	-5,518.46	-3,600.07	-1,724.2	-3,025.16	-2,142.81

## Table 7: Probability of FDI versus Exporting: Multinomial Logit

The dependent variable is defined as 0 = purely domestic firm, 1 = exporter but not FDI firm, 2 = FDI firm (domestic firm owning foreign affiliates according to *MiDi* or *Dafne*). A full set of sector, region (German state), and time dummies is included.
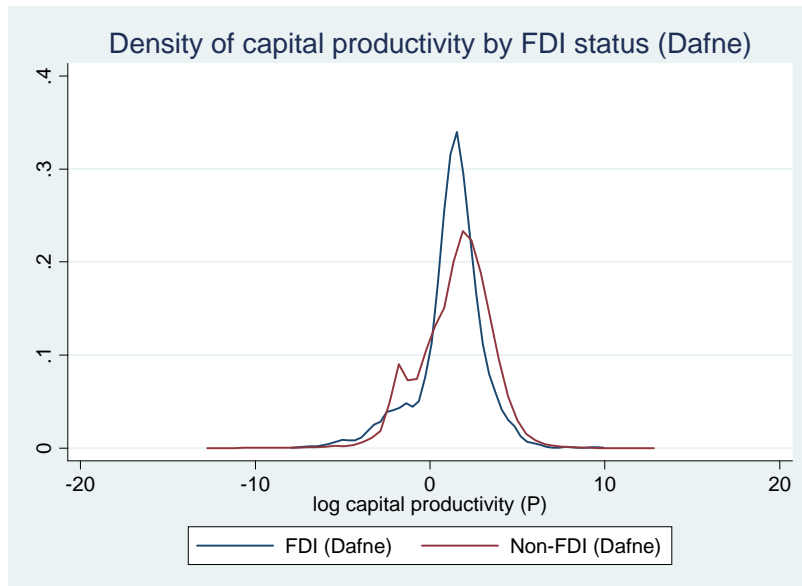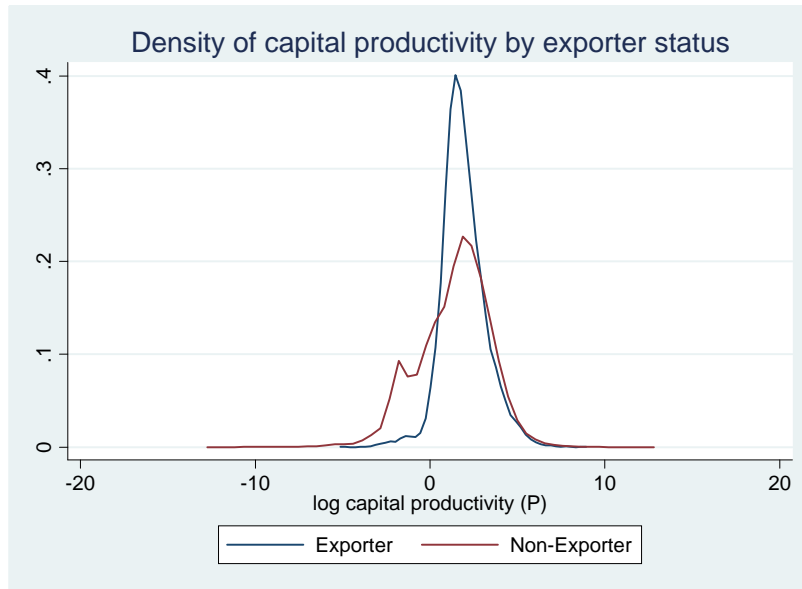
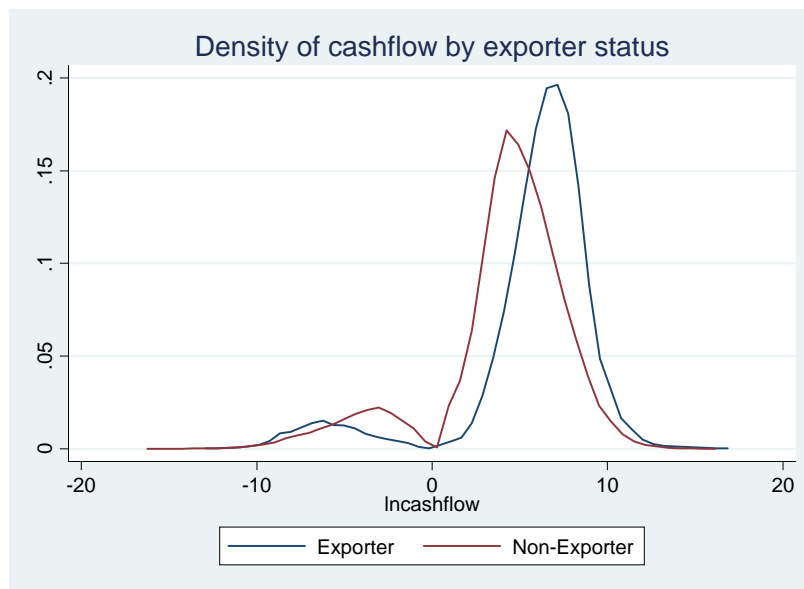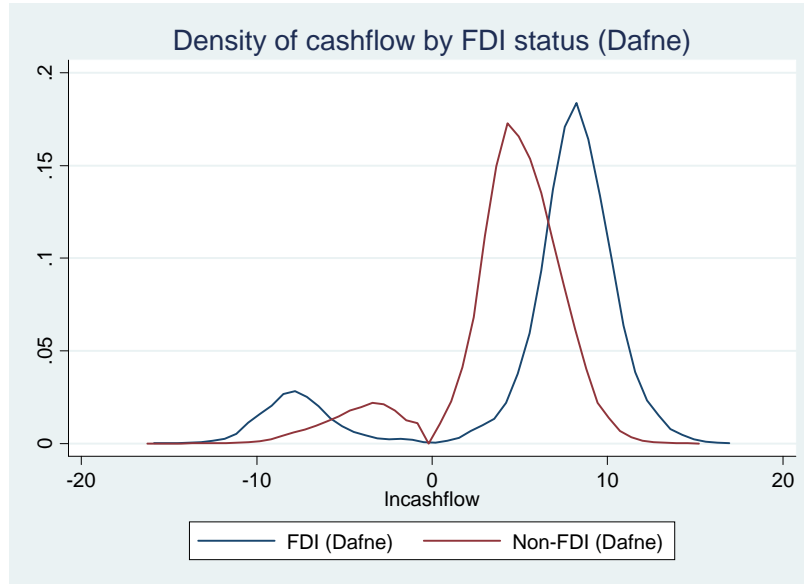|	Full sample		Manufacturing		Services	
	Coefficients	RRR	Coefficients	RRR	Coefficients	RRR
1 = Exports						
Log size (t-1)	0.173***	1.189***	0.451***	1.57***	-0.853	0.918
	(3.37)		(6.28)		(-0.95)	
Log cash flow (t-1)	0.069	1.071	-0.017	0.982	0.195**	1.215**
	(1.52)		(-0.29)		(2.48)	
Log negative cash flow (t-1)	-0.192**	0.825**	-0.021	0.979	-0.431***	0.649***
	(-2.09)		(-0.17)		(-2.73)	
Log capital productivity (t-1)	0.153***	1.166***	0.089	1.093	0.176***	1.192***
	(3.97)		(1.41)		(3.26)	
Log debt ratio (t-1)	0.025	1.025	0.113	1.121	-0.011	0.989
	(0.32)		(1.09)		(-0.08)	
Log cash (t-1)	-0.158	0.984	0.003	1.002	-0.017	0.982
	(-0.66)		(0.10)		(-0.37)	
Log sales growth (t-1)	0.013	1.013	0.028	1.028	-0.020	0.980
	(0.94)		(1.47)		(-0.81)	
Log age	0.203***	1.225***	0.318***	1.375***	0.142	1.152
	(3.53)		(3.99)		(1.56)	
2 = FDI						
Log size (t-1)	0.669***	1.952***	1.053***	2.868***	0.498***	1.645***
	(15.84)		(12.35)		(9.88)	
Log cash flow (t-1)	0.049	1.050	0.007	1.007	0.042	1.043
	(1.48)		(0.11)		(1.05)	
Log negative cash flow (t-1)	-0.192***	0.824***	-0.103	0.902	-0.177**	0.837**
	(-2.85)		(-0.77)		(-2.21)	
Log capital productivity (t-1)	0.169	1.017	-0.085	0.918	0.007	1.007
	(0.61)		(-1.21)		(0.24)	
Log debt ratio (t-1)	-0.220***	0.802***	0.016	1.016	-0.204***	0.815***
	(-4.15)		(0.16)		(-3.20)	
Log cash (t-1)	-0.004	0.995	0.032	1.032	-0.009	0.991
	(-0.24)		(0.95)		(-0.40)	
Log sales growth (t-1)	0.023**	1.023**	0.021	1.021	0.017	1.017
	(2.06)		(1.02)		(1.14)	
Log age	0.093**	1.098**	0.298***	1.347***	-0.007	0.933
	(2.25)		(4.03)		(-0.13)	
Observations	23,395		5,582		13,454	
Clusters	11,229		2,671		6,602	
Pseudo R²	0.34		0.28		0.27	

Table 8: Determinants of the Volume of FDI

This table reports results of fixed effects panel regressions using the Log volume of FDI of domestic multinational i in host country j as the dependent variable. Hence, the cross-section dimension of the panel is each combination of parents and host countries.

	Full sample	Full sample	Full sample	Small	Large	Manu-facturing	Services
Parent characteristics							
Log size	0.32***	0.34***	0.33***	0.51***	0.19**	0.42***	0.331**
	(4.44)	(4.00)	(3.94)	(3.60)	(1.98)	(4.05)	(2.22)
Log cash flow	-0.002	0.002	0.001	0.035*	-0.028	-0.003	-0.007
	(0.18)	(0.11)	(0.10)	(1.77)	(1.14)	(0.21)	(0.22)
Log negative cash flow	-0.009	-0.015	-0.015	-0.091**	0.052	0.01	-0.011
	(0.32)	(0.50)	(0.49)	(2.14)	(1.11)	(0.28)	(0.18)
Log capital productivity	0.12***	0.15***	0.14***	0.136	0.07	0.16***	0.112
	(2.83)	(3.13)	(3.02)	(1.53)	(1.27)	(2.62)	(1.33)
Log debt ratio	-0.076**	-0.076**	-0.077**	-0.21***	0.002	-0.12***	-0.003
	(2.43)	(2.29)	(2.31)	(3.25)	(0.06)	(2.97)	(0.04)
Log cash	0.008	0.002	0.003	-0.007	0.004	-0.003	-0.007
	(1.07)	(0.25)	(0.27)	(0.43)	(0.41)	(0.34)	(0.27)
Log sales growth	-0.008	-0.008	-0.008	-0.005	-0.007	-0.009	-0.007
	(1.56)	(1.43)	(1.46)	(0.53)	(0.96)	(1.43)	(0.60)
Log number foreign affiliates	0.51***	0.44***	0.44***	0.79***	0.136*	0.157**	0.55***
	(7.30)	(5.88)	(5.86)	(6.51)	(1.87)	(2.20)	(4.40)
Log age	-0.078	-0.134	-0.126	-0.48***	-0.06	-0.093	0.291
	(0.95)	(1.59)	(1.50)	(3.93)	(0.48)	(1.06)	(1.06)
Holding company (MiDi)	0.87***	1.07***	1.05***	0.92**	1.115**	0.092	2.77***
	(3.08)	(3.08)	(3.03)	(2.04)	(2.47)	(1.03)	(3.24)
Affiliate characteristics							
Log idiosyncratic risk	-0.001	-0.002	-0.002	-0.001	-0.004	0.003	-0.011
	(0.28)	(0.55)	(0.55)	(0.26)	(0.68)	(0.65)	(1.27)
Log tangibility	-0.14***	-0.14***	-0.14***	-0.23***	0.008	0.058**	-0.34***
	(3.91)	(3.09)	(3.10)	(3.89)	(0.19)	(2.29)	(4.32)
Country characteristics							
Log foreign GDP, USD		1.37***	1.044**	1.448**	0.474	1.149**	1.438*
		(3.54)	(2.50)	(2.55)	(0.87)	(2.53)	(1.69)
Log foreign lending rate		0.018	0.014	-0.011	0.047	0.015	0.057
		(0.26)	(0.21)	(0.13)	(0.49)	(0.21)	(0.41)
Log FDI of German banks		0.061*	0.059*	0.089**	-0.01	0.033	0.106*
		(1.81)	(1.72)	(2.12)	(0.22)	(0.90)	(1.66)
Political risk (ICRG)			0.782*	1.037*	0.632	0.418	1.163
			(1.75)	(1.80)	(0.99)	(0.93)	(1.20)
Constant	4.34***	-24.4***	-21.0***	-32.6***	-6.32	-22.2**	-32.6**
	(4.84)	(3.12)	(2.65)	(3.11)	(0.57)	(2.49)	(2.18)
Observations	7676	5907	5906	3030	2876	3649	2049
Number of group	3042	2443	2442	1100	1342	1429	912
R-squared	0.09	0.09	0.09	0.15	0.08	0.09	0.21

Graph 1: Firm Size by Multinational Status

Density of size by exporter status

Density of size by FDI status (Dafne)
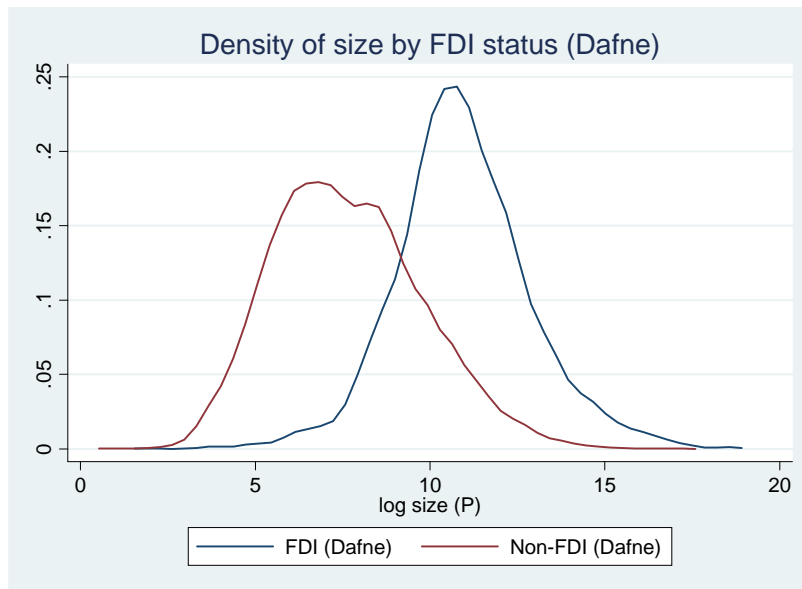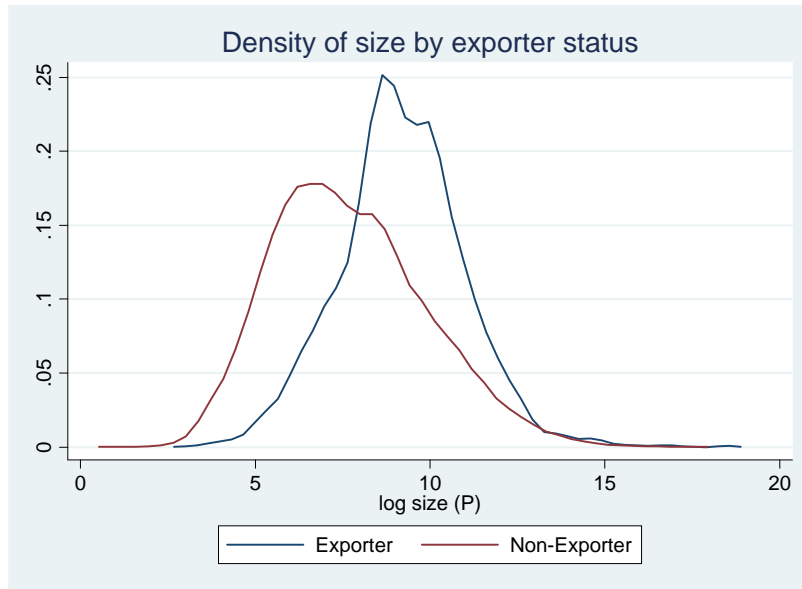
Graph 2: Capital Productivity by Multinational Status

Density of capital productivity by exporter status

log capital productivity (P)

Exporter —— Non-Exporter

Density of capital productivity by FDI status (Dafne)

log capital productivity (P)

FDI (Dafne) —— Non-FDI (Dafne)

Graph 4: Cash Flow by Multinational Status

Density of cashflow by FDI status (Dafne)

Density of cashflow by exporter status

Graph 4: Debt Ratio by Multinational Status

Density of debt ratio by exporter status

Density of debt ratio by FDI status (Dafne)