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Claudia M. Buch *
Iris Kesternich **
Alexander Lipponer ***
Monika Schnitzer ****

* Halle Institute for Economic Research (IWH), and CESifo
** University of Munich
*** Deutsche Bundesbank
**** University of Munich, CEPR, and CESifo

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Speaker: Prof. Dr. Klaus M. Schmidt · Department of Economics · University of Munich · D-80539 Munich,
Phone: +49(89)2180 2250 · Fax: +49(89)2180 3510

Financial Constraints and Foreign Direct Investment: Firm-Level Evidence [*]

Claudia M. Buch (Halle Institute for Economic Research (IWH), and CESifo)
Iris Kesternich (University of Munich)
Alexander Lipponer (Deutsche Bundesbank)
Monika Schnitzer[a] (University of Munich, CEPR, and CESifo)

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Abstract

Low productivity is an important barrier to the cross-border expansion of firms. But firms may also need external finance to shoulder the costs of entering foreign markets. We develop a model of multinational firms facing real and financial barriers to foreign direct investment (FDI), and we analyze their impact on the FDI decision. Theoretically, we show that financial constraints can affect highly productive firms more than firms with low productivity because the former are more likely to expand abroad. We provide empirical evidence based on a detailed dataset of German domestic and multinational firms which contains information on parent-level financial constraints as well as on the location the foreign affiliates. We find that financial factors constrain firms' foreign investment decisions, an effect felt in particular by firms most likely to consider investing abroad. The locational information in our dataset allows exploiting cross-country differences in contract enforcement. Consistent with theory, we find that poor contract enforcement in the host country has a negative impact on FDI decisions.

Keywords: multinational firms, heterogeneity, productivity, financial constraints
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[a] Corresponding author: University of Munich, Department of Economics, Akademiestr. 1, D-80799 Munich, Germany. Phone: +49 89 2180 2217, Fax: +49 89 2180 2767, e-mail: schnitzer@lrz.uni-muenchen.de

1. Motivation

Multinational firms are larger than their domestic counterparts. For European firms, Mayer and Ottaviano (2008) show that multinational firms are also more productive, generate higher value added, pay higher wages, employ more capital per worker, and they employ a larger number of skilled workers. In the theoretical literature, the characteristic size patterns of multinational firms are explained mainly by differences in productivity. According to this explanation, observed internationalization patterns reflect real constraints because only the more productive firms can afford to shoulder the fixed costs of market entry.

These stylized facts are confirmed by our data for German companies, where firms owning foreign affiliates are indeed substantially larger than purely domestic firms (see section 3.3). Yet, the two groups of firms also differ in a number of other respects. Multinational firms, for instance, have lower debt ratios and higher cash flows. This suggests difficulties in obtaining external finance as an additional impediment to foreign expansions.[1] However, most of the theoretical literature considers the impact of financial constraints to be of lesser importance, arguing that foreign direct investment (FDI) and the associated financing decisions can largely be treated separately.[2]

The purpose of this paper is to assess the importance of real and financial barriers for the cross-border expansion of firms, both theoretically and empirically. We focus on the decision to enter a foreign market, i.e., the extensive margin. Our model features limited contract enforceability and liquidation costs as two sources of inefficiencies in financial contracting that are particularly relevant for foreign investments.

Our research is motivated by recent theoretical work stressing the importance of productivity for firms' international expansions. Seminal papers focusing on firms' export decisions are Bernard *et al.* (2003) and Melitz (2003). Helpman *et al.* (2004) extend the Melitz model to account for multinational firms. The key to these models is that, ex ante, firms do not know their 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, they become exporters, or they set up affiliates abroad. The implicit assumption of these models is that firms can finance foreign operations internally and/or without incurring an external finance premium. Recent papers introduce financial constraints into the Melitz model. The focus of these models is on firms' decisions to export. Chaney (2005) predicts that financially constrained firms are less likely to be able to cover the fixed costs of exporting. Manova (2013) examines the impact of productivity and credit constraints on exports.

While the previous empirical literature analyzing the probability of exporting has focused on

[1] In the crisis that started in 2007, for instance, an increasing number of German firms reports credit constraints as an impediment to expansion into foreign countries (Deutscher Industrie- und Handelskammertag, 2009).

[2] See, for example, Markusen (2002).

productivity and other real determinants (Bernard and Jensen (2004), Wagner (2012)) recent empirical work shows that financial frictions affect export behavior. Using panel data on bilateral exports at the country level, Manova (2013) finds that financially more developed countries are more likely to export, and that the effect is more pronounced in financially vulnerable sectors. Firm-level studies show that firms enjoying better financial conditions are more likely to start exporting (Bellone *et al.*, 2010) and that financial constraints matter more for the extensive margin than for the intensive margin of exports (Berman and Héricourt, 2010). A study for Chile by Alvarez and Lopez (2013) arrives at the result that an improvement in financial development increases the probability of exporting of more productive plants and those with foreign ownership operating in manufacturing sectors that are more dependent on external finance. Stiebale (2011), in contrast, finds no effect of financial constraints on a firm's export decision once observed and unobserved firm heterogeneity is accounted for. Evidence on a possible reverse causality from exporting to financial conditions is mixed. Greenaway *et al.* (2007) establish that exporting firms are more likely to be financially healthy, whereas Bellone *et al.* (2010) and Forlani (2010) find no such evidence.

As FDI decisions involve higher fixed costs than export decisions, financial constraints are likely to matter even more. Yet surprisingly little research has been done on the impact of financial frictions in the context of multinational firm investment. Our contribution to the literature is thus theoretical and empirical. We theoretically analyze how productivity and financial constraints affect a firm's choice to become a multinational firm under conditions of limited internal funds and the need to obtain external debt finance, thus extending the current literature on export decisions. If firms finance investments that facilitate exporting, contractual frictions occur at the home country level (Manova, 2013). In contrast, when financing foreign investments, contractual frictions occur at the level of the host country as well because this is where the assets to be used as collaterals are located. Our model thus predicts that difficulties with contract enforcement at the host country level impede FDIs.[3]

Furthermore, we extend existing models by endogenizing the optimal choice of costly collateral which has implications for the impact of financial constraints. Finally, by allowing firm-level productivity and financial resources to be imperfectly correlated, we can separate a firm's motivation to invest abroad as a function of its productivity, and its ability to invest abroad as a function of its financial resources. Our model predicts that, if financial resources play a role, financial constraints are more strongly felt by large firms, as these firms are more likely to consider expanding abroad. This prediction differs from conventional models of investment under financial constraints. In this

[3]We restrict our analysis to FDI and hence do not distinguish different forms of entering a foreign market. Antras *et al.* (2009) instead study how the choice between FDI and arm's length contracting is affected by investor protection. Similarly, Carluccio and Fally (2012) investigate how the choice of an importer between sourcing from a vertically integrated firm versus outsourcing to an independent supplier reacts to financial development. In both papers, the overall level of international activity increases with better contract enforcement, as it does in our paper, while the internal solution is predicted to be *relatively* less likely to be used if the contractual environment improves.

literature, large firms are assumed to be less financially constrained than small firms. But, because small firms are insufficiently productive, they do no consider expanding internationally in the first place. Furthermore, in standard models investment choices are assumed to be continuous, so that, independent of firm size, each firm wants to do some investment. In our model, instead, we consider investments that require large fixed costs. Thus, only the most productive firms are willing to shoulder these fixed costs and hence are likely to suffer from being financially constrained.

For our empirical analysis, we use a detailed firm-level dataset which allows testing the predictions of our model.[4] Our data allow measuring financial constraints for purely domestic firms and for multinational parents. Note that a particularly interesting feature of our dataset on FDI is that we can actually observe the firms that do not invest and enter a foreign market.[5] In the context of domestic investment, in contrast, firms that do not cross the productivity threshold for entry are typically not observed. As predicted by our model, we find that productivity and financial constraints have a significant impact on German firms' internationalization decision. Economically, productivity and financial constraints are of similar importance, but financial constraints matter most to the subset of firms that consider investing abroad. Like our model suggests, our empirical analysis shows that financial constraints at the parent level have indeed a negative impact on the extensive margin of FDI.

From the Direct Investment Micro-Database (MiDi) provided by the Deutsche Bundesbank, we also obtain detailed information on the location of foreign affiliates, which allows testing the impact of host country conditions like weak contract enforcement. We confirm our prediction that FDI increases if contract enforcement improves.[6] In addition, we have information on the number of foreign affiliates a parent holds. This information is particularly interesting because we would expect that the more financially constrained firms are, the less they should be able to shoulder the fixed investment costs involved in multiple affiliates.

In contrast to earlier work focusing on manufacturing firms, our sample also contains services firms. Comparing the two samples, we find that manufacturing firms are more likely to suffer from financial constraints in their foreign expansion strategy.

In Section 2, we present our model of multinational firms. In section 3, we describe our data and provide descriptive statistics. Section 4 provides empirical evidence, and section 5 concludes.

[4]We use data on the balance sheets of firms in Germany merging the Dafne database provided by Bureau van Dijk, and the FDI database of the Deutsche Bundesbank.

[5]Similarly, Muendler and Becker (2010) study the intensive and the extensive margin of German firms' foreign investment but they look at the employment response to foreign expansions and do not study the impact of financial frictions

[6]Interestingly, Antras *et al.* (2009) find that the *relative* choice of FDI over arm's length contracting decreases as a function of investor protection, while the overall scale of multinational activity increases. Hence, this does not contradict our finding that the overall level of FDI is increasing in institutional quality. Similarly, Carluccio and Fally show that importing from integrated firms decreases in financial development *relative* to outsourcing, but that total importing increases. Thus, again this is not in contrast to the message of our analysis that international activity is hindered by underdeveloped institutional environments.

2. Theoretical Framework

In this section, we analyze a firm's choice to become a multinational firm in the presence of financial constraints. Firms incur a fixed cost of market entry as well as a variable cost of production. They finance their foreign expansion using internally generated funds as well as an external bank credit, potentially secured by collateral. Financing decisions are made under uncertainty.

Financial constraints are firm specific; they do not merely reflect differences across firms with regard to productivity. We do not specify the sources of "financial heterogeneity", but there are several reasons why firms may have different financial constraints. Firms differ, for instance, with regard to their customer structure and, thus, the probability of being hit by an adverse demand shock. Firms also differ with regard to the quality of their management and, thus, the ability of outside lenders to extract information on the profitability of an investment project.

Financial contracting in our model suffers from potential inefficiencies due to limited enforceability of financial contracts, a problem particularly relevant when investing in a foreign country. Enforceability differs across countries and may be linked to the development of the financial market as well as the presence of home country banks abroad. With limited contract enforcement, collateral may be required to obtain credit financing. However, collecting and liquidating collateral generates transaction costs, and the amount of collateral available may be limited. The need for costly and limited collateral confines the use of external finance and thus the foreign expansion of firms.

To see how the model works, consider the decision problem of a multinational firm that can invest abroad to serve the foreign market.[7] The firm's alternative investment option is normalized to zero.[8] To set up a foreign affiliate, the firm has to incur a fixed cost of market entry F. Once the firm has decided to set up a foreign affiliate, it has to choose the level of sales.

We follow the recent literature by assuming that firms are heterogeneous, i.e., they differ in their level of productivity. While recent trade literature typically assumes a set up with monopolistic competition and firms producing with constant marginal cost, we consider a scenario that is more related to the financial contracting literature by assuming increasing marginal cost and constant prices. Both setups generate an interior solution for the firm's maximization problem. Our setup is more tractable when focusing on the contracting issues of endogenizing the choice of collateral.

To fix ideas, consider the following variable production cost function, $k(x) = \frac{x^2}{2(1+\beta)}$, where x denotes the quantity produced and sold by the foreign affiliate. The productivity of the parent firm, which also spills over onto the foreign affiliate, is captured by β. The larger the fixed cost of entry and the lower a firm's productivity, the larger are the "real barriers" that a firm faces when

[7] We focus on horizontal FDI. The qualitative implications of our model with regard to the impact of financial constraints would also go through for vertical FDI.

[8] It is straightforward to extend our model and to include an outside option like exports that depends positively on the firm's productivity. As we show in Buch *et al.* (2010), the firm's productivity level matters relatively more for the investment opportunity abroad than for the outside option of exporting. The qualitative results of our model are unchanged.

entering foreign markets.

The firm also faces a "financial barrier" in the form of a cash-in-advance constraint because set up and production cost has to be paid before production starts and before revenues are generated. Revenues that can be generated on the foreign market are uncertain. Serving the foreign market yields positive revenues px with probability q and zero revenues with probability $(1-q)$, where p is the foreign price level.[9]

Benchmark case without liquidity constraints

Before we describe the impact of financial constraints on investment decisions, consider as a benchmark the first-best situation where the firm is not liquidity constrained. The firm can finance both the fixed cost of entry and the variable cost of production from internal funds L . Thus, it maximizes the following profit function:

$$\pi = qpx - k(x) - F = qpx - \frac{x^2}{2(1+\beta)} - F \tag{1}$$

Taking the first-order condition, solving for the optimal sales of the affiliate $x_{\mathrm{FB}} = (1+\beta)qp$ and inserting it back into the profit function (1) yields the following profits under the first-best solution (FB)

$$\pi_{\mathrm{FB}} = \frac{1}{2}q^2p^2(1+\beta) - F \tag{1a}$$

Thus, if liquidity is not an issue, the investment takes place if and only if $\pi_{\mathrm{FB}} \geq 0$, i.e., if net profits of the investment are positive. Not surprisingly, profits depend positively on the firm's productivity β , i.e., less productive firms are less likely to be able to cover the fixed cost of market entry.

Foreign expansion with liquidity constraints

Consider now the situation where the firm is liquidity constrained, which we define as a situation in which its liquid assets L are not sufficient to cover the cost associated with market entry and production. Thus, the firm needs external finance. We assume that external finance is raised in the form of debt finance and, specifically, credits from banks. Firms can obtain credits from domestic or foreign banks. We do not model this choice explicitly and hence do not impose restrictions with regard to the degree of integration of financial markets. However, domestic and foreign banks may differ with regard to their ability to enforce contracts. For instance, if domestic banks maintain affiliates in the foreign country, too, they are in a better position than banks operating abroad solely to monitor the affiliates and collect collateral. This adds to the comparative advantage that they

[9] We abstract from exchange rate changes, i.e., revenues generated on the foreign market can be remitted 1:1 into domestic currency. Russ (2007) and Russ (2012) develop a model in which endogenous adjustment of exchange rates affects firms' entry decisions.

already have in terms of knowledge about the domestic parent. The focus on external debt finance reflects the fact that external equity finance plays a limited role for German firms (Bayraktar *et al.*, 2005). Also, theoretical considerations suggest a "pecking order" of external finance according to which external equity finance and portfolio capital are dominated by bank lending.

Let D denote the credit necessary to finance the fixed and variable cost of entry for a production level x, given the available liquid funds L , i.e., $D = k(x) + F - L$. Furthermore, let $(1+r)D$ denote the repayment of principal plus interest payment that the firm is supposed to pay. Like Manova (2013) and others, we assume that credit repayment is possible only if the revenues from foreign sales are positive. In particular, we rule out the possibility that the parent firm steps in and repays the affiliate's credit if the affiliate is not able to do so. This implies also that the credit repayment $(1 + r)D$ cannot exceed the revenues px, i.e., $(1 + r)D \leq px$. Banks are assumed to operate competitively and to determine the interest rate such as to just break even in expected terms.

To capture enforcement problems in financial contracts, we assume that credit repayment cannot be enforced with certainty, even if revenues are positive, but only with probability μ, with $0 \leq \mu \leq 1$. The enforcement parameter μ has two interpretations. On the one hand, it can reflect different institutional quality across countries. Legal systems may, for instance, differ with regard to the degree of creditor friendliness and the enforceability of contracts.[10] On the other hand, it could reflect a greater presence of home-country multinational banks in the host country. These banks may be able to acquire useful information on the host-country environment and be able to monitor firms more closely through their affiliates abroad. This reduces informational asymmetries and makes it more likely that credit enforcement is successful. Note that, in the context of FDI, the enforcement parameter refers to conditions in the host country of enforcement. In Manova (2013), who considers a firm's export decision, this enforcement parameter captures the financial conditions in the firm's home country.

The firm can collateralize (part) of its credit with assets from two potential sources. First, the firm can pledge its fixed cost investment in the foreign affiliate, F, as collateral. Second, the firm can use an exogenously given collateral, $\overline{C}$, provided by the parent company, to secure the credit. Let $C \leq \overline{C} + F$ denote the collateral actually chosen to secure the credit, the exact value of which is determined endogenously below. If the credit is not repaid, the creditor can seize the collateral to cover her losses. However, she can realize only a fraction θ of the collateral when liquidating it.[11] Thus, liquidating the collateral involves a dead weight loss of $(1 - \theta)C$.

There are two situations where liquidation of collateral (potentially) becomes an issue. One is when there are no revenues. In this case, liquidation of the collateral cannot be avoided. The other is when the affiliate has positive revenues but the creditor fails to be able to enforce the repayment.

[10] Harrison *et al.* (2004) report that financial development lowers financial constraints.

[11] Without loss of generality, we assume that the efficiency loss is the same for both kinds of collateral goods.

In this case the bank has the option to liquidate the collateral but it would be inefficient to do so, due to the dead weight loss of liquidation. We assume that efficient renegotiation will make the firm pay θC, i.e., the amount that the bank can realize from liquidating the collateral, to avoid inefficient liquidation, and the bank will accept this offer.[12]

Now, consider the zero profit condition for banks which determines the interest rate for a given choice of C:

$$\mu q(1+r)D + (1-\mu q)\theta C = D \tag{2}$$

Banks obtain the promised credit repayment $(1+r)D$ only if credit repayment can be enforced. In all other cases, they obtain the liquidation value of the collateral, θC, either because this is what the firm pays voluntarily, after renegotiation, or this is what they receive from actually liquidating the collateral. Solving for $(1+r)D$, we find that banks charge a risk premium over and above the risk-free rate which is declining in the probability of success of the project q and in the efficiency of the liquidation procedure, θ

$$(1+r)D = \frac{D-(1-\mu q)\theta C}{\mu q} \tag{3}$$

Recall from above that the maximum repayment cannot exceed revenues, requiring

$$(1+r)D = \frac{D-(1-\mu q)\theta C}{\mu q} \leq px \tag{4}$$

Note that the smaller μ, the more important it is to pledge a collateral for this condition to be satisfied. However, due to the dead weight loss in case the collateral is actually liquidated, which happens with positive probability, the firm limits the collateral pledged to the minimum required to obtain the desired credit.[13] Inserting $D = k(x) + F - L$ and solving for C yields the minimum collateral needed to finance the fixed cost of market entry and a given level of affiliate sales x taking into account that the collateral has to be non-negative:

$$C^*(x) = \max\left\{0, \frac{[k(x)+F-L]-\mu qpx}{(1-\mu q)\theta}\right\} \tag{5}$$

The larger the required credit, the larger is the minimum collateral needed. Note, however, that the collateral cannot exceed the upper bound specified above, $\overline{C}+F$.

Suppose for a moment that the collateral constraint is not binding. Then, for a given level of affiliate sales x and collateral C, the firm expects the following profits:

[12] This assumes that the firm can hold the bank down to its outside option of liquidating the collateral. It would be straightforward to modify this assumption and let the two parties split the gains from not liquidating the collateral. However, given our assumption of a perfectly competitive banking market, the first assumption seems to be the most convincing one.

[13] Endogenizing the optimal size of collateral is not considered by previous models, as they do not consider liquidation costs and, hence, pledging the maximum collateral is innocuous.

$$\pi = qpx - \mu q(1+r)D - (1-\mu)q\theta C - (1-q)C - [k(x)+F] + D \tag{6}$$

The first term reflects the expected revenues, the second term the debt repayment that can be enforced with probability μ if revenues are positive, which happens with probability q. If credit repayment cannot be enforced, the firm voluntarily pays what the bank would be able to collect in the event of liquidation, θC, to avoid costly liquidation, as discussed above. If revenues are not positive, however, the collateral will be liquidated, as captured by the fourth term. The last terms capture the cost of market entry and production and the credit obtained by the firm to finance this cost, respectively.

The firm maximizes its profits by choosing the optimal sales of the affiliate x taking into account the collateral needed to finance market entry and production, $C^*(x)$.

Using $D = k(x) + F - L$ and the equations (3) and (5) for $(1+r)D$ and $C^*(x)$ we obtain:

$$\pi = qpx - k(x) - F - (1-q)(1-\theta)\max\left\{0, \frac{[k(x)+F-L-\mu qpx]}{(1-\mu q)\theta}\right\} \tag{6a}$$

Note that if $C^*(x) = 0$, i.e., if no collateral is needed to secure the credit, financing cost does not bias the investment decision and the first best sales level can be implemented.

If collateral is needed, however, expected profits are lowered by the expected liquidation cost, $(1-q)(1-\theta)C^*(x)$. Maximization of (6a) yields $x^* = \frac{1+\mu z}{1+z}(1+\beta)qp < x_{\text{FB}}$ as the optimal sales level, with $z = \frac{(1-q)(1-\theta)}{(1-\mu q)\theta}$.

Consider next the case where the collateral constraint is binding for the optimal sales level determined above, $x = x^*$, i.e.,

$$\overline{C} + F < C^*(x^*) = \left\{0; \frac{[k(x^*)+F-L] - \mu qpx^*}{(1-\mu q)\theta}\right\} \tag{7}$$

In this case, x^* cannot be implemented because the credit constraint becomes binding. Instead, production settles at a smaller level $\overline{x}$ that is determined by the maximum available exogenous collateral:

$$\overline{C} + F = \frac{[k(\overline{x})+F-L] - \mu qp\overline{x}}{(1-\mu q)\theta} \tag{8}$$

Solving this equation for $\overline{x}$ and inserting it into the firm's profit function yields the constrained optimal level of sales choices and profits.

The following proposition characterizes the solutions of the firm's maximization problem for binding and non-binding collateral constraints.

Proposition 1*:*

The maximum profit the firm can attain is given by

$$\begin{aligned}
\pi^* = &\quad \tfrac{1}{2}(1+\beta)q^2p^2 - F = \pi_{\text{FB}}, && \text{for } C^*(x^*) = 0 \\
\pi^* = &\quad \tfrac{(1+\mu z)}{(1+z)}\tfrac{1}{2}(1+\beta)q^2p^2 - z(F-L) - F \leq \pi_{\text{FB}}, && \text{for } 0 < C^*(x^*) \leq \overline{C} - F \\
\overline{\pi} = &\quad qp\overline{x} - [k(\overline{x}) + F] - (1-q)(1-\theta)[\overline{C} + F] \leq \pi^* && \text{for } C^*(x^*) \geq \overline{C} - F \\
&\quad \text{with} \quad z = \tfrac{(1-q)(1-\theta)}{(1-\mu q)\theta}
\end{aligned}$$

Proof: See Appendix

Note that if $\theta = 1$, then $z = 0$, and the profit level is the same as in the first-best case. Thus, only if the use of a collateral is costly does it affect the marginal cost of financing the production and profits fall short of first-best profits.

Of course, the firm will engage in FDI only if the maximum profits from investment are non-negative. The following proposition characterizes the comparative statics.

Proposition 2*: **Comparative statics***

The following comparative static results characterize the extensive margins of FDI, summarizing which parameters are more or less likely to ensure non-negative profits:

$$\frac{d\pi}{d\beta} > 0, \frac{d\pi}{dp} > 0, \frac{d\pi}{d\theta} > 0, \frac{d\pi}{d\mu} > 0, \frac{d\pi}{dF} < 0, \frac{d\pi}{dL} > 0,$$

for both $\pi = \pi^*$ and $\pi = \overline{\pi}$ and

$$\frac{d\pi}{d\overline{C}} > (=)0 \text{ if the collateral constraint is binding } (\pi = \overline{\pi}) \text{ (non-binding } (\pi = \pi^*)).$$

Furthermore,

$$\frac{d^2\overline{\pi}}{d\overline{C}d\beta} > 0, \frac{d^2\overline{\pi}}{dLd\beta} > 0$$

Proof: See Appendix

Firm's profits increase in the firm's productivity and in the lucrativeness of foreign markets. Furthermore, better contract enforcement in the host country has a positive effect on profits because it lowers the requirement to use costly collateral, and improving the efficiency of liquidating collateral reduces cost.[14] Higher fixed cost lowers expected profits not only directly but also indirectly. The higher fixed costs are, the less liquid funds are left for financing the investment. Less liquid funds,

[14]This is robust to allowing for larger multinational companies with internal capital markets, as the contractual environment of the host country affects the functioning of internal capital markets as well.

in turn, mean greater need for using costly collateral. Hence, there is an indirect negative effect of fixed cost over and above the direct effect. The maximum collateral, in turn, affects profits only if it imposes a binding constraint. It would be straightforward to generalize our set up and consider a more continuous distribution of collateral cost, instead of distinguishing only binding and non-binding collateral constraints.

We also find that the financial status of a firm as captured by liquid funds and the collateral available has a larger marginal effect on more productive firms.[15] In the absence of financial constraints, more productive firms would be the ones more likely to invest abroad. Hence, more productive firms are more likely to be hampered by financial constraints in their international expansion strategy.

The model has rich implications for the determinants of firms' extensive margins of foreign activities. Higher productivity, more efficient liquidation of collateral, better contract enforcement, and more lucrative foreign markets always increase expected profits. Higher fixed cost decreases and higher internal funds increase activities. The impact of the size of the collateral depends on the scenario considered. The lower the collateral, i.e., the more financially constrained firms are, the more it should matter. Finally, our model predicts that financial constraints matter more for larger, more productive firms, since these firms are more likely to be interested in foreign expansions.

The predictions of our model will be tested in two steps. In a first step, we use information on all firms active in Germany, both domestic and multinational firms, to explore the determinants of FDI. We analyze the importance of real and financial frictions at the firm-level as well as the country-specific determinants of firms' FDI decision. In a second step, we study the determinants of complex internationalization strategies by asking how many affiliates firms actually hold. Because every additional investment involves fixed costs, complex internationalization strategies are likely to be affected by financing constraints.

3. What determines the foreign investment decision?

3.1. Empirical model

We begin our empirical analysis by analyzing the decision of firms to enter a given foreign market, i.e., the extensive margin of their investment decision, using the following regression model:

$$\Pr(\text{FDI})_{i,k,t} = \alpha_0 + \alpha_1 Z_{i,t-1} + \alpha_2 Z_{k,t} + \alpha_3 T + \epsilon_{i,t} \tag{9}$$

where $\Pr(\text{FDI})_{i,k,t}$ indicates whether a firm i has invested abroad in year t in country k. $Z_{i,t-1}$ ($Z_{k,t}$) are vectors of firm-level (country-level) control variables.[16] Firm-level regressors are lagged by

[15] Note that this result is robust to alternative specifications of the cost function, in particular to assuming constant marginal costs of production like in a standard monopolistic competition model.

[16] The model is estimated using an instrumental variable regression model. Estimates using a simple OLS or probit model are qualitatively similar and are available upon request.

one period to account for simultaneity of the explanatory variables. We include time (T) dummies capturing common macroeconomic effects. Country dummies are included in most models. Note, however, that our data have a very short time strings. Hence, variation is driven mostly by the cross-section, and the effects of (largely time-invariant) institutional characteristics of countries cannot be identified in a model with country fixed effects.

The dependent variable, as will be explained in more detail below, captures the possibilities of all German firms to invest in all foreign countries. If this investment actually takes place, then the observations is assigned a "one", if a given firm is not present in a particular market, we assign a "zero". Because of the large number of possible combinations between firms and countries, we do not include all "zeros" in our model, as will be explained in the Section 3.2. Thus, we end up with a sample of over 1 million firm-country-year observations. We use an unbalanced panel covering a maximum of 5 years (2002 - 2006). The main regressions are estimated on a sample which covers 4 years (2003 - 2006) because we lag the explanatory variables by one year.

To estimate the above equation, we combine data from three sources (see Table 6 in the appendix for details). The first dataset, Dafne, provides parent-level information included in the vector $Z_{i,t-1}$, in particular parent-level financial constraints and productivity. Dafne is a commercial database, the German equivalent to the European firm-level database Amadeus. Bayraktar *et al.* (2005) also use the German data from Amadeus for an analysis of firm-level domestic investment behavior. The second dataset, MiDi (Microdatabase Direct Investment) by the Deutsche Bundesbank provides information on German firms' foreign affiliates and their location. Firms are required by law to report information on their investments abroad and on the financial characteristics of their foreign affiliates if the balance sheet total of the affiliate and the ownership share are above a certain threshold (Lipponer, 2006). This dataset is used to construct the dependent variable $\Pr(FDI)_{i,k,t}$. The third dataset contains country-level information on host market characteristics from various sources (See Table 6 in the appendix).

3.2. Dependent variable

The dependent variable is a dummy variable which models the decision of a particular firm to invest in a particular country. Rather than defining firms' choices as "invest / do not invest", we define firms' choices as "invest in a given country/ do not invest in a given country". Because we have over 87,000 firms in the Dafne database and because German firms maintain foreign affiliates in more than 120 countries worldwide, allowing for all possible combinations between firms and countries would lead to a dataset with 87,000 * 120 observations. Most of these are zeros, either because a firm is not internally active at all or because it does not invest in a particular country. Therefore, we restrict the number of foreign countries to OECD countries and the largest emerging markets, which leaves us with 48 countries in total. Table 6 in the appendix provides a list of these countries. Also, we only include a random sample of 10 % of all purely national firms. This leaves us with a regression sample size of around 1 million firm-country-year observations.

Our final dataset used contains between 634 (2002) and 1,084 (2005) parent companies and 3,803 (2002) to 5,706 (2005) affiliates. Our coverage of German firms' foreign affiliates is quite complete: For the 48 countries included, we capture 79% of all affiliates held by German firms between 2002 and 2006. The average time string for individual firms is relatively short (about 2.5 years), which implies that we essentially exploit the cross-sectional variation in the data.

Overall, 5,5% of the firms in our sample have foreign affiliates, and 10% of the firms export. With regard to exports, this share might seem low, given that about one quarter of all manufacturing German firms are exporters. This difference is due to the fact that our dataset contains many services sector firms (65%), and that the share of exporters of services is much lower than in manufacturing. The share of exporting manufacturing firms is indeed quite similar to other datasets for Germany, but only 3% of the service sector firms also sell their products abroad.

3.3. Explanatory variables

Our parent-level explanatory variables are drawn from Dafne, our country-level variables from the World Bank (2008) (see also Table 6 for data definitions and sources). They are defined as follows:

Productivity: Our main measure of a productivity is the size of a parent, and the expected sign is positive. Because size may capture factors unrelated to productivity, we also use cost efficiency as a second firm-level measure of productivity. Cost efficiency is given by sales over total cost, i.e., labor cost plus the cost of other inputs. A higher value reflects higher cost efficiency or higher mark-ups, hence we expect a positive sign.[17] In unreported regressions, we have used two alternative measures of productivity (a residual of a fixed effects regression of sales on labor, capital, and financial constraints; labor productivity defined as sales over total employment). Both measures are insignificant.

Fixed cost: Fixed costs at the parent level are proxied by the ratio of fixed over total assets. We expect a negative impact of the fixed asset share. In previous work, the ratio of fixed over total assets has also been used as a proxy for the availability of collateral (see, e.g., Manova (2013)). The expected sign would be positive because a greater availability of collateral lowers the costs of external finance.[18] Our results suggest that the interpretation of the fixed asset share in terms of fixed costs is more plausibel for our dataset.

[17] Our dataset does not allow using more structural measures of productivity such as the methods developed by Olley and Pakes (1996) and Levinsohn and Petrin (2003). We cannot follow Olley and Pakes because first, we do not know why firms may leave our dataset, i.e., whether exit occurs for economic or other reasons. Second, because of financial constraints, investment might no longer be strictly increasing in the productivity shock. We do not use the method of Levinsohn and Petrin (2003), because we do not observe intermediate inputs.

[18] Note that in contrast to Manova (2013), who studies export decisions, we consider the case of FDI where the firm has to build a plant in a foreign country. If the parent company has a high share of property, plant and equipment, this also translates into higher fixed costs of market entry, because the affiliate will most likely also have to have a higher share of property, plant and equipment.

Internal funds: We distinguish liquid funds from less liquid collateral as two determinants of financial constraints. Log cash flow of the parent is used to measure the internal funds available for financing a particular investment project. This variable should have a positive impact.[19]

Debt ratio: The impact of the parent's debt ratio is ambiguous a priori. On the one hand, the debt ratio measures leverage. Firms which are more highly leveraged ex ante have, ceteris paribus, fewer assets available that can serve as collateral for new credits. Hence, the expected sign for the debt ratio is negative if the collateral constraint is binding. On the other hand, firms may also report a high leverage ratio precisely because they have taken out a loan in order to finance FDI. If this were the correct interpretation, we should expect a positive sign.

Foreign market size: In our theoretical model, we have described the attractiveness of the foreign market in terms of the price that firms can fetch abroad for their product. In our empirical model, we distinguish two aspects of foreign market size. The first is the size of the market measured through GDP. The second is the state of development of a foreign market measured through GDP per capita. We expect positive signs for both variables. We have also experimented with price variables capturing inflation but these were generally insignificant while leaving the main results unaffected.

Contract enforcement: Because we have information on the location of the foreign affiliate, we can test the prediction of our model that the degree of contract enforcement or, more generally, the severity of contractual imperfections, affect firms' foreign activities. The variable *(weak) contract enforcement* gives the number of procedures required to enforce contracts, and the expected impact is negative.

To prepare the data for our analysis, we clean the data and eliminate outliers. We drop firms with negative values for key variables such as sales and total assets. Because we need information on cash flow and sales, we eliminate observations for firms which do not report an income statement. As detailed in Table 6 in the appendix, we additionally truncate several variables at the 1^{st} and 99^{th} percentile. Technically, we do this by replacing outliers with missing values, i.e., the underlying structure of the remaining variables does not change. Possible merger-induced outliers are eliminated by dropping firms with large changes in sales or in the number of employees (i.e., annual growth rates by a factor of 10 or drop to 1/10 or less). We have compared the structure of the sample with and without outlier correction in terms of the industry structure, and the patterns in the data are very similar. Descriptive statistics of our variables of interest are presented in Table 1.

Place Table 1 here

[19]Following Kaplan and Zingales (1997), there has been a lively debate on the usefulness of investment-cash flow sensitivities as a measure for financial constraints. The focus of the discussion have been endogeneity issues as well as issues of adequately taking into account access to external finance. See also Brown *et al.* (2009) for an overview of this discussion.

Before going into the details of our empirical analysis, we simply plot different firm-level variables to detect differences between German MNEs and domestic firms in terms of the key variables of our theoretical model (Figures 1a-1e). Figure 1a confirms previous literature in that MNEs are larger than purely domestic firms (Mayer and Ottaviano (2008)). Unreported one-sided t-tests on the equality of the means between the two sub-samples show that this difference is statistically significant. MNEs also exhibit a somewhat lower share of fixed assets (Figure 1e). Differences between the two types of firms in terms of cost efficiency are small and, in fact, not significant (Figure 1e). Hence, while the dividing line between multinationals and non-multinationals is not as clear-cut as might have been expected on the basis of the cost efficiency of these firms, the dividing line is clear for measures of financial status: multinationals have significantly higher cash flow (Figure 1c) and lower debt ratios (Figure 1d). Prima facie, these figures suggest that heterogeneity with regard to the openness and international orientation of firms could be driven by financial just as by real factors.

Place figure 1 here

3.4. Endogeneity of financial constraints

Endogeneity of the variables measuring financial constraints with regard to the internationalization is an issue in our empirical model: firms may have weaker financial constraints because they have access to international (financial) markets or because they can pledge export receipts as collateral. We use the following variables to instrument the debt ratio and the cash flow of firms.

First, we use the financial constraints of a firm's competitors as instruments. As competitors, we define the firms active in the same sector. The general idea is similar to the measure proposed by Rajan and Zingales (1998): Firms in a given sector face similar financial needs and constraints. At the same time, the financial constraints of a firm's competitors are exogenous to the decision of a specific firm to invest abroad. Hence, we use the mean cash flow and the mean debt ratio in the firm's industry where the means exclude the specific firm under consideration.

A potential concern could be group effects as discussed in Manski (1993): The supply of finance to firms in a given sector could be driven by common factors (correlated effects), and firms may also use the financing patterns in an industry as a guideline for their own demand for external finance (endogenous effects). In fact, the existence and detection of group effects relies on two prerequisites: (i) that it is known how firms form reference groups and (ii) that the group mean behavior can be correctly perceived by the individual firms (Manski, 1993). Because coordination among the firms in our sample is not possible and because information about the other firms' balance sheets is not available to the individual firm, these types of group effects are unlikely to be present in our model.

Note that we cannot use industry dummies when we use competitors' financial constraints as instruments. The reason is the following: The instrument is the mean of the variable over all firms in the sector minus the value of the variable for the firm itself. If we were to use sector dummies,

we would then basically control for the mean of the variable over all firms, thus the information left in our instrument would be basically (minus) the value of the variable for the firm itself - which is of course not a good instrument.

Second, we include a dummy for listed firms among our instruments. A priori, we expect financial frictions to be less important for the listed firms with access to market-based sources of finance. At the same time, whether or not a firm is listed on the stock exchange should not determine its decision to invest abroad except through providing access to finance.

Third, we account for the fact that access to financial markets depends on a firm's age by including an interaction between age and a manufacturing dummy. Our first stage regressions in Table 2 show that the impact of firm age on the debt ratio differs across sectors services and manufacturing.

Finally, we include a dummy for firms from East Germany, acknowledging structural differences in the funding structure of East and West German firms. On average, firms in East Germany have higher leverage and a higher share of funding from public sources.

First stage regressions are reported in Table 2. They show that all variables have a highly significant impact on firms' debt ratio and cash flow, and the signs confirm theoretical priors: older firms and listed firms are less financially dependent, and firms' financial conditions are positively correlated with the sector means.

Place Table 2 here

To check the robustness of our results, we also estimate our model using a method which has been proposed by Lewbel (2010). He suggests using regressors that are uncorrelated with the product of heteroskedasctic errors and thus exploiting heteroscedasticity for identification. In unreported regressions, which are available upon request, we confirm the qualitative results of our model using standard instrumentation strategies.

Another way to address causality of financial constraints and foreign investment is to compare first-time investors and old investors. In Table 3, we show the mean of our explanatory variables one year prior to the investment decision for domestic firms, for previously existing MNEs, and for first-time investors. A first-time investor is defined as a parent company that, in a given year, invests in a country in which it has invested never before. Regarding financial constraints, cash flow (in logs) is highest for those firms who will be first-time investors in the following year, followed by previously existing MNEs and, finally, by domestic firms. Also, the debt ratio is smallest for those firms who will be first-time investors in the next year, followed by previously existing MNEs and domestic firms. Our theoretical model implies that firms with a high fixed asset share have to overcome higher fixed costs when entering a foreign market, especially if it is for the first time. In fact, MNEs have significantly lower fixed asset shares than national firms, with the share for first-time investors being even slightly lower than for previously existing MNEs. Regarding our productivity measures, size seems to be the better measure than cost efficiency, at least if we

believe that the most productive firms go abroad: First-time investors are larger than previously existing MNEs and these are again much larger than purely domestic firms one year before their investment decision, while if we consider cost efficiency, domestic firms are more cost efficient than MNEs. Unfortunately, due to the small number of first-time investors, including a dummy variable in the regression does not yield significant effects.

Place Table 3 here

3.5. What determines firms' foreign investment decisions?

Table 4 shows the determinants of firms' foreign investment decisions. In addition to the results for the full sample which includes firms that have no foreign affiliate so far (columns 1-3), we estimate the model separately for firms that have at least one foreign affiliate ("multinational firms", column 4), and we estimate the sub-samples services and manufacturing firms separately (columns 5 and 6).

Place Table 4 here

The most important finding is that financial constraints measured through the debt ratio have a negative impact on the extensive margin, consistent with the prediction of the model for binding collateral constraints. These point estimates are higher for the multinational firms and thus for the firms that are large compared to the full sample. This is consistent with the prediction of our model that financial constraints should matter the more, the more productive the firm and hence the more interested it is in expanding abroad. The point estimates are also higher for manufacturing firms compared to service sectors firms. This result is not due to the manufacturing firms being larger. In fact, manufacturing and services firms in our sample have a similar (mean) size. The debt ratio is significant only at the 10% level for service sector firms. For the manufacturing firms, a similar explanation could hold because manufacturing firms have higher fixed costs and are more likely to venture abroad than services firms. Hence, the probability that financial constraints are binding for these firms is, ceteris paribus, higher.

The finding that financial constraints matter only for certain firms is also consistent with Chaney (2005), who distinguishes three classes of firms, with low, intermediate and high productivity. He predicts that firms with low productivity are not affected by financial constraints. The reason is that investing abroad is not a viable option for these firms, even if they were not facing financial constraints. More productive firms, instead, are hampered by financial constraints in their foreign expansions. Financial constraints, in other words, do not impede the foreign expansion of small firms because these firms are not productive enough to invest abroad in the first place.

Our other proxies for financial constraints, cash flow and fixed assets share are significant as well and have the expected positive and negative signs, respectively. Our result suggests that an interpretation of the fixed assets in terms of a proxy for the cost of market entry is more plausible

than an interpretation in terms of asset tangibility and hence as collateral available. In contrast to the results for the debt ratio, the two other proxies for financial constraints matter only for the services sector firms and the firms in the full sample including firms with no foreign affiliates yet. They are insignificant for the subsample of firms with at least one foreign affiliate and the manufacturing firms.

Interestingly, size is insignificant. This is consistent with the finding of Berman and Héricourt (2010) who observe that productivity has no effect on a firm's export decision if the firm faces financial constraints. This result depends on the instrumentation strategy though: re-estimating the model simply as an OLS or a probit model gives the expected positive effect of firm size (Results are available upon request).

Cost efficiency has an (unexpected) negative effect: firms with higher costs are more likely to invest abroad. This may indicate mis-measurement of cost efficiency, it may, however, also reflect the fact that international expansions in and of themselves are costly. Another reason might be that firms are driven abroad by cost reduction considerations. Most importantly though, in- and excluding cost efficiency has no impact on the other variables of interest (Results are available upon request).

The country-level variables are significant and have the expected sign: GDP is positive and significant. GDP per capita is positive and significant for the full sample and for most of the sample splits. This confirms that market size matters. We also include variables measuring the controls on inward FDI and the ease of contract enforcement. The variable measuring controls on inward FDI has kindly been provided by Michael Klein ((Klein, 2012)) who has updated the data used in (Schindler, 2009). Both variables vary little over time, which explains why they are insignificant in the model including a full set of country fixed effects. When omitting the country fixed effects, as is done in Column (4), they have the expected negative signs: Greater difficulties with contract enforcement lower the probability that a given German firm enters a particular country. This result is in line with the observation made by Javorcik and Wei (2009) that corruption in the host country reduces inward FDI. Also, countries with controls on the inflow of FDI attract less FDI from abroad.

3.6. What determines the number of foreign affiliates?

The internationalization patterns of firms differ not only with regard to the presence in foreign markets per se or the locational choice. Firms also differ widely with regard to the number of foreign affiliates that they maintain abroad and thus the complexity of their internationalization strategies. Given the total number of 1,084 parents and 5,706 affiliates in 2005, the average number of affiliates is 5.3. One third of the multinational firms have only one foreign affiliate, and a fraction of the multinational firms (7%) has more than 10 foreign affiliates. What drives these differences across firms? Productivity and the business model certainly matter. But opening an additional (foreign) affiliate also involves fixed costs, and financially constrained firms may avoid such extra cost.

To analyze the impact of financial constraints on the complexity of cross-border expansions of

firms, we employ a count model. In this model, the dependent variable is the number of foreign affiliates that a given parent holds. The set of explanatory variables is the same as before but, naturally, we omit the country-level variables from these regressions.

Count data models differ in their assumptions regarding the moments of the distribution and the presence of unobserved individual heterogeneity. These models, therefore, allow controlling for the large share of zeros in our data to a differing degree.[20] The basic count data model is the Poisson model which is quite restrictive in assuming that the conditional mean of the dependent variable equals the conditional variance. The Negative Binomial model allows for unobserved individual heterogeneity and for overdispersion. It is thus a better fit than the Poisson model because the equidispersion assumption is strongly rejected for our data. Our preferred model is the zero-inflated model which assigns an even higher weight to the probability of observing a zero in the dependent variable (Table 5, column 3). We find that results using the Negative Binomial (column 2) and the Poisson (column 1) are quite similar. Larger, less indebted parents, firms with a lower share of fixed assets, and firms with higher cash flow are more active internationally. There results are largely in line with the results obtained in the preceding section. We also find that manufacturing firms are more affected by financial constraints than service firms.

Place Table 5 here

4. Conclusions

In this paper, we develop a model of multinational firms facing real and financial barriers to foreign direct investment (FDI), and analyze their impact on the FDI decision. The model shows that it is the most productive firms for which financial constraints hamper foreign entry most. Intuitively speaking, firms which are not very productive and thus far away from the critical level of productivity necessary to cross the threshold for foreign entry, do not feel the negative impact of financial constraints. Productive firms, that are likely to venture abroad, do.

We take this implication of the model to the data by analyzing for German firms whether financial constraints matter for foreign expansions. They do in the sense that firms with higher leverage, higher fixed costs, and weaker cash flow are less likely to invest abroad. These firms also have fewer foreign affiliates. Consistent with the theoretical model, we find that financial constraints have a stronger impact on the decisions of larger firms, and firms considering expanding foreign investment.

Our results suggest that high productivity may be a necessary, but not a sufficient precondition for foreign expansion. Lowering financial constraints might be just as important, as even large and productive firms are hampered in their internationalization strategy by financial constraints.

[20] For a detailed description of count data models, see, for example, Jones *et al.* (2007).

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References

Alvarez, R. and Lopez, R. (2013). Financial development, exporting and firm heterogeneity in chile. *Review of World Economics/Weltwirtschaftliches Archiv*, **149** (2), 183–207.

Antras, P., Desai, M. and Foley, C. F. (2009). Multinational firms, FDI flows, and imperfect capital markets. *The Quarterly Journal of Economics*, **124(3)**, 1171–1219.

Bayraktar, N., Sakellaris, P. and Vermeulen, P. (2005). Real versus financial frictions to capital investment. *(ECB Working Paper 566). Frankfurt: European Central Bank.*

Bellone, F., Musso, P., Nesta, L. and Schiavo, S. (2010). Financial constraints and firm export behaviour. *The World Economy*, **33** (3), 347–373.

Berman, N. and Héricourt, J. (2010). Financial factors and the margins of trade: Evidence from cross-country firm-level data. *Journal of Development Economics*, **93** (2), 206–217.

Bernard, A., Eaton, J., Jensen, J. and Kortum, S. (2003). Plants and productivity in international trade. *American Economic Review*, **93** (4), 1268–1290.

Bernard, A. B. and Jensen, J. B. (2004). Why some firms export. *The Review of Economics and Statistics*, **86(2)** (2), 561–569.

Brown, J. R., Fazzari, S. M. and Petersen, B. C. (2009). Financing innovation and growth: Cash flow, external equity and the 1990 r&d boom. *Journal of Finance*, **64** (1), 151–185.

Buch, C. M., Kesternich, I., Lipponer, A. and Schnitzer, M. (2010). Exports versus FDI revisited: Does finance matter? *(CEPR Discussion Paper 7839). London: Centre for Economic Policy Research.*

Carluccio, J. and Fally, T. (2012). Global sourcing under imperfect capital markets. *The Review of Economics and Statistics*, **94(3)**, 1–30.

Chaney, T. (2005). Liquidity constrained exporters, (NBER Working Paper 19170). Cambridge, MA: National Bureau of Economic Research.

Deutscher Industrie- und Handelskammertag (2009). Auslandsinvestitionen in der Industrie 2009, Berlin and Brussels .

Forlani, E. (2010). Liquidity constraints and firm's export activity. *(Development Working Papers 291). University of Milano: Centro Studi Luca d'Agliano.*

Greenaway, D., Guariglia, A. and Kneller, R. (2007). Financial factors and exporting decisions. *Journal of International Economics*, **73** (2), 377–395.

Harrison, A. E., Love, I. and McMillan, M. S. (2004). Global capital flows and financing constraints. *Journal of Development Economics*, **75** (1), 269–301.

Helpman, E., Melitz, M. J. and Yeaple, S. R. (2004). Export versus FDI. *American Economic Review*, **94** (1), 300–316.

Javorcik, B. S. and Wei, S.-J. (2009). Corruption and cross-border investment in emerging markets: Firm-level evidence. *University of Oxford: mimeo*.

Jones, A. M., Rice, N., d'Uva, T. B. and Balia, S. (2007). *Applied Health Economics*. Routledge, Oxfordshire.

Kaplan, S. N. and Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financial constraints? *The Quarterly Journal of Economics*, **112** (1), 169–215.

Klein, M. (2012). Capital control: Gates and walls. *Brookings Papers on Economic Activity*, (2), 317–367.

Levinsohn, J. and Petrin, A. (2003). Estimating production functions using inputs to control for unobservables. *Review of Economic Studies*, **70** (2), 317–342.

Lewbel, A. (2010). Using heteroskedasticity to identify and estimate mismeasurement and endogenous regressor models. *Journal of Business and Economic Statistics*, **30** (1), 67–80.

Lipponer, A. (2006). *Microdatabase direct investment- MiDi. A brief guide*. Bundesbank Working Paper, Frankfurt.

Manova, K. (2013). Credit constraints, heterogeneous firms, and international trade. *Review of Economic Studies*, **80** (2), 711–744.

Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *Review of Economic Studies*, **60** (3), 531–542.

Markusen, J. (2002). *Multinational Firms and the Theory of International Trade*. MIT Press, Cambridge, MA.

Mayer, T. and Ottaviano, G. I. (2008). The happy few: The internationalisation of European firms. *Intereconomics: Review of European Economic Policy*, **43** (3), 135–148.

Melitz, M. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, **71** (6), 1695–1725.

Muendler, M.-A. and Becker, S. (2010). Margins of multinational labor substitution. *American Economic Review*, **100(5)**, 1999–2030.

Olley, S. and Pakes, A. (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica*, **64** (6), 1263–97.

Rajan, R. and Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, **88** (3), 559–586.

Russ, K. (2007). The endogeneity of the exchange rate as a determinant of FDI: A model of money, entry, and multinational firms. *Journal of International Economics*, **71** (2), 267–526.

— (2012). Exchange rate volatility and first-time entry by multinational firms. *Review of World Economics/Weltwirtschaftliches Archiv*, **148** (2), 269–295.

Schindler, M. (2009). Measuring financial integration: A new data set. *IMF Staff Paper*, **56** (1), 222–238.

Stiebale, J. (2011). Do financial constraints matter for foreign market entry? A firm-level examination. *The World Economy*, **34** (1), 123–153.

Wagner, J. (2012). International trade and firm performance: a survey of empirical studies since 2006. *Review of World Economics/Weltwirtschaftliches Archiv*, **148** (2), 235–267.

World Bank (2008). *World Development Indicators and Doing Business Database.*

Tables and Figures

Table 1: Descriptive Statistics

This Table provides summary statistics for the regressions reported in Table 3 (Probit model) and Table 4 (Count Model). GDP per capita is in €1,000. Negative values in ln(GDP per capita) hence come from countries with a GDP per capita of less than €1,000.

a) Probit model

	count	mean	sd	min	max
log Cash flow	1,035,696	6.05	2.03	0.69	10.65
Cost efficiency	1,035,696	1.33	0.41	0.39	4.75
Debt ratio	1,035,696	0.57	0.26	0.00	1.00
Exporter dummy	1,035,696	0.10	0.31	0.00	1.00
FDI dummy	1,035,696	0.05	0.22	0.00	1.00
Fixed / total assets	1,035,696	0.30	0.27	0.00	0.97
log Size	1,035,696	8.71	2.07	1.79	16.26
(Weak) Contract enforcement (number of procedures)	865,603	34.21	5.68	21.00	47.00
log GDP	1,023,571	5.23	1.45	2.14	9.26
log GDP per capita	1,023,571	1.82	1.20	-0.82	3.53
Observations	1,035,696				

b) Count model

	count	mean	sd	min	max
log Cash flow	64,500	6.01	2.03	0.69	10.65
Cost efficiency	66,363	1.34	0.40	0.38	4.75
Debt ratio	68,441	0.56	0.26	0.00	1.00
Exporter dummy	68,485	0.10	0.30	0.00	1.00
FDI dummy	68,485	0.05	0.22	0.00	1.00
Fixed / total assets	68,265	0.29	0.27	0.00	0.97
log Size	68,485	8.58	2.10	1.10	16.42
Number of affiliates	68,485	0.43	2.42	0.00	37.00
Observations	68,485				

Table 2: First Stage Regressions

This table reports results of regressions testing the quality of potential instruments for financial constraints (debt ratio and cash flow). Age is the founding year of each firm. Mean cash flow and debt ratio are the industry means, excluding the respective firm. Listed is a dummy for listed firms. Year fixed effects are included. Standard errors are reported in parentheses. Macroeconomic variables and constants are included but suppressed. ***, **, * = significant at the level of 1, 5, and 10 %, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Debt ratio			Dependent variable: Cash flow		
	All firms	Manufacturing	Service	All firms	Manufacturing	Service
Log size *t*-1	-0.0181***	-0.0335***	-0.0138*s**	0.813***	0.898***	0.793***
	(0.00144)	(0.00268)	(0.00188)	(0.00614)	(0.00890)	(0.00855)
Cost efficiency *t*-1	-0.00515	-0.139***	0.0166**	0.234***	0.569***	0.187***
	(0.00690)	(0.0190)	(0.00823)	(0.0278)	(0.0639)	(0.0328)
Fixed asset share *t*-1	0.104***	0.145***	0.103***	0.634***	1.120***	0.463***
	(0.0116)	(0.0237)	(0.0147)	(0.0492)	(0.0845)	(0.0651)
Manufacturing firm (0/1)	-0.00140			0.202***		
	(0.00833)			(0.0306)		
Age * manufacturing dummy (0/1)	-0.000395*	-0.000801***		0.00211***	0.000323	
	(0.000207)	(0.000174)		(0.000681)	(0.000526)	
Mean industry-level cash flow	0.0174***	0.0250	0.0497***	0.132***	0.0999	-0.143**
	(0.00623)	(0.0215)	(0.0179)	(0.0211)	(0.0731)	(0.0677)
Mean industry-level debt ratio	0.664***	0.577**	0.486***	1.583***	0.337	2.447***
	(0.0592)	(0.227)	(0.0848)	(0.216)	(0.742)	(0.308)
Mean industry-level tangibility	-0.257***	0.103	-0.503***	0.635***	-0.797*	2.281***
	(0.0419)	(0.128)	(0.0766)	(0.152)	(0.441)	(0.288)
East German firms (0/1)	-0.0304***	-0.0276**	-0.0391***	-0.171***	-0.0891**	-0.178***
	(0.00635)	(0.0120)	(0.00932)	(0.0232)	(0.0384)	(0.0351)
Age	-0.000490***		-0.000420***	-0.00177***		-0.00190***
	(0.000125)		(0.000148)	(0.000482)		(0.000568)
Listed firm (0/1)	-0.124***	-0.0650**	-0.150***	0.410***	0.193**	0.498***
	(0.0198)	(0.0271)	(0.0288)	(0.0739)	(0.0953)	(0.107)
Exporter (0/1)	-0.0472***	-0.0297***	-0.0450***	0.205***	0.0731*	0.296***
	(0.00874)	(0.0104)	(0.0161)	(0.0337)	(0.0385)	(0.0645)
Observations	882,230	241,083	493,145	816,524	225,077	453,435
R^2	0.107	0.135	0.090	0.770	0.805	0.732

Table 3: Descriptive Statistics for Domestic Firms, New, and Old MNEs

	Number of Observations	Mean of cost efficiency (*t*-1)	Mean of log cash flow (*t*-1)	Mean of the debt ratio (*t*-1)	Mean of fixed / total assets (*t*-1)	Mean of log (size) (*t*-1)
Domestic firms	112,292	1.33	5.36	0.57	0.28	7.85
MNE (previously existing investor)	2,261	1.30 ***	8.33 ***	0.43 ***	0.17 ***	11.69 ***
MNE (primo investor)	552	1.30	8.62 ***	0.41 **	0.16 *	12.20 ***

All variables are lagged by one period. Significance levels are for one-sided t-tests between the respective value and the value in the row above

***, **, * = significant at the level of 1, 5, and 10 %, respectively.

Table 4: Probability of Owning Affiliates Abroad

This table reports results of instrumental variable probit regressions using a 0/1 dummy variable of owning foreign affiliates as the dependent variable. The variables debt ratio and cash flow are instrumented using industry-level means, a dummy for being listed / unlisted on the stock exchange, an interaction term between age and a dummy for manufacturing firms, and a dummy for East German firms. All explanatory variables are at the parent level. Sample splits are at the sample median. Year and country fixed effects are included (except column 3). Constants are included but suppressed. Standard errors are reported in parentheses. ***, **, * = significant at the level of 1, 5, and 10 %, respectively.

	(1) Baseline	(2) Country-level variables	(3) No country dummies	(4) Multinational firms	(5) Manufacturing	(6) Services
Log size *t*-1	-0.00269	-0.00264	-0.00264	0.00076	-0.01268	-0.00126
	(0.002)	(0.002)	(0.002)	(0.011)	(0.015)	(0.001)
Cost efficiency *t*-1	-0.00101	-0.00093	-0.00093	-0.01846**	-0.02618*	-0.00020
	(0.001)	(0.001)	(0.001)	(0.008)	(0.014)	(0.000)
Fixed asset share *t*-1	-0.01356***	-0.01353***	-0.01353***	-0.05294	-0.00092	-0.00889***
	(0.001)	(0.001)	(0.001)	(0.038)	(0.018)	(0.001)
Log cash flow *t*-1	0.00587***	0.00585***	0.00585***	0.01702	0.01387	0.00361***
	(0.003)	(0.002)	(0.002)	(0.014)	(0.016)	(0.001)
Debt ratio *t*-1	-0.00961***	-0.00871***	-0.00871***	-0.14647***	-0.14809***	-0.00530*
	(0.003)	(0.003)	(0.003)	(0.050)	(0.046)	(0.003)
Age	0.00003**	0.00003***	0.00003***	0.00004	-0.00006	0.00001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exporter (0/1)	0.00190*	0.00209**	0.00209**	-0.00786	-0.00484*	0.00237*
	(0.001)	(0.001)	(0.001)	(0.005)	(0.003)	(0.001)
Manufacturing firm (0/1)	0.00147**	0.00126*	0.00126*	-0.00125		
	(0.001)	(0.001)	(0.001)	(0.005)		
Log GDP		0.00214**	0.00197***	0.03110**	0.00795**	-0.00000
		(0.001)	(0.000)	(0.014)	(0.003)	(0.001)
Log GDP per capita		0.00613	-0.00014*	0.09358**	0.02887***	-0.00171
		(0.004)	(0.000)	(0.045)	(0.011)	(0.004)
Controls on FDI inflows (0/1)		0.00021	-0.00205***	0.00301	0.00053	0.00011
		(0.000)	(0.000)	(0.003)	(0.001)	(0.000)
(Weak) contract enforcement		0.00007	-0.00007***	0.00098	0.00039	-0.00002
		(0.000)	(0.000)	(0.002)	(0.000)	(0.000)
Observations	1,035,696	824,088	824,088	60,396	228,236	458,684
R^2	0.008	0.008	0.005	0.068	-0.175	0.006

Table 5: Determinants of the Number of Foreign Affiliates

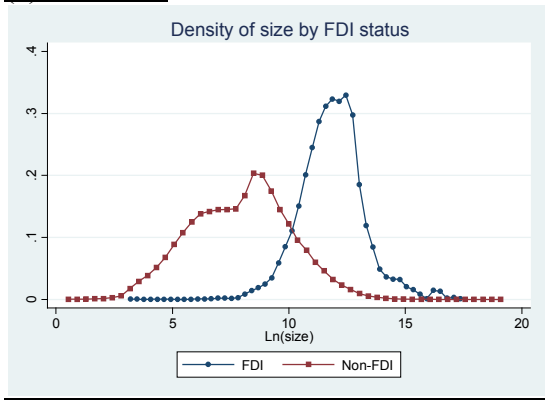
This table reports results of regressions using the number of a firm's foreign affiliates as the dependent variable. Columns (3)-(6) show the Zero Inflated Poisson (ZIP) model. All explanatory variables are at the parent level. Year fixed effects are included. Standard errors are reported in parentheses. ***, **, * = significant at the level of 1, 5, and 10 %, respectively.

	(1) Poisson	(2) NegBin	(3) ZIP	(4) Manufacturing	(5) Services	(6) Large firms
Log size *t*-1	0.00856***	0.00422***	0.01265***	0.03558***	0.01045***	0.05108***
	(0.001)	(0.001)	(0.002)	(0.007)	(0.002)	(0.008)
Cost efficiency *t*-1	-0.00382**	-0.00006	-0.00492	-0.01113	-0.00410	-0.02046
	(0.002)	(0.001)	(0.003)	(0.014)	(0.003)	(0.014)
Fixed asset share *t*-1	-0.04676***	-0.01786***	-0.06389***	-0.12996***	-0.05133***	-0.29346***
	(0.009)	(0.003)	(0.013)	(0.039)	(0.013)	(0.048)
Debt ratio *t*-1	-0.01332***	-0.00045	-0.02289***	-0.08138***	-0.01105*	-0.09562***
	(0.004)	(0.001)	(0.007)	(0.023)	(0.006)	(0.027)
Log cash flow *t*-1	0.00602***	0.00153***	0.00942***	0.02231***	0.00759***	0.03903***
	(0.001)	(0.000)	(0.002)	(0.006)	(0.002)	(0.007)
Age	0.00000	0.00001	-0.00001	-0.00006	0.00007	-0.00004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exporter (0/1)	0.00467**	0.00326***	0.00434	0.00962	0.00274	0.01579
	(0.002)	(0.001)	(0.003)	(0.008)	(0.004)	(0.011)
Manufacturing firm (0/1)	0.00975***	0.00249***	0.00749**			0.03211**
	(0.003)	(0.001)	(0.003)			(0.013)
East German firms (0/1)	-0.01500***	-0.00321***	-0.02910***	-0.09673***	-0.01336	-0.11594***
	(0.003)	(0.001)	(0.006)	(0.016)	(0.009)	(0.024)
Observations	68,485	68,485	68,485	18,712	38,169	37,714
Pseudo R^2	0.705	.	0.314	0.363	0.246	.

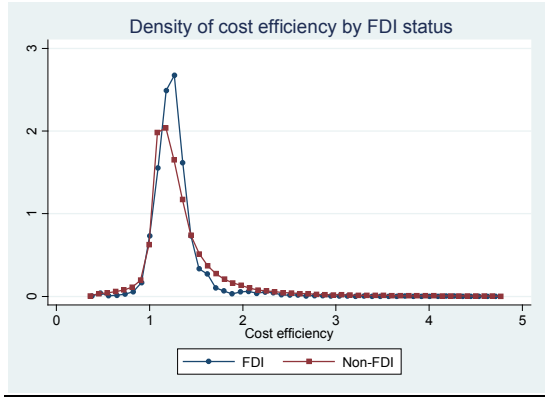
Figure 1: Firm Characteristics by Multinational Status

These graphs show kernel density plots of the respective variables for German firms engaged in FDI versus firms not engaged in FDI. Source: Dafne (Bureau van Dijk) and MiDi (Deutsche Bundesbank).

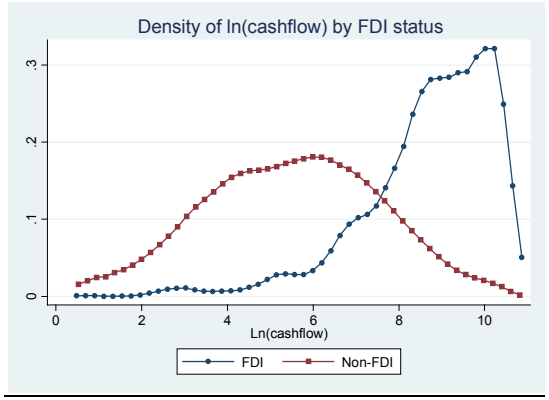
(a) Firm size



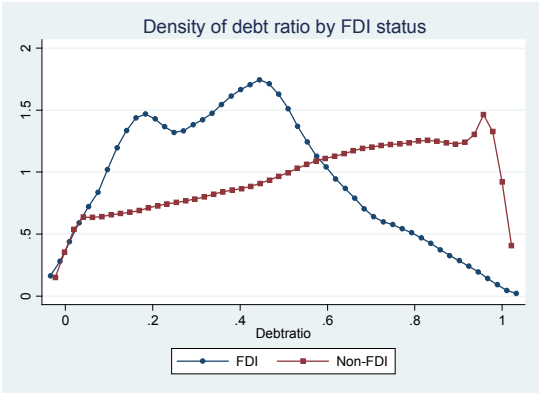
(b) Cost efficiency



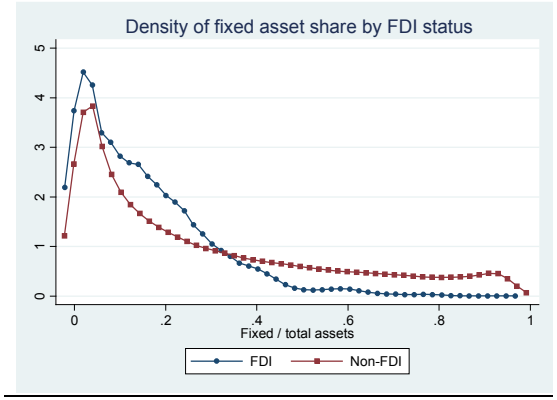
(c) Cash flow



(d) Debt ratio



(e) Fixed asset share



Appendix

Table 6: Data Definitions and Sources

Unless otherwise indicated, parent-level information comes from Dafne (Bureau van Dijk), affiliate level information comes from MiDi (Microdatabase Direct Investment, Deutsche Bundesbank). Country-level information comes from the World Bank's World Development Indicators (http://data.worldbank.org/products/data-books/WDI-2008). All values in €1,000 (unless otherwise indicated). Countract enforcement comes from the Word Bank's "Doing business" database (http://www.doingbusiness.org/). Cash flow and cost efficiency are corrected for outliers by truncating the data at the 1st and 99th percentile. Fixed asset share, the debt ratio, and sales are corrected for outliers by truncating the data at the 99th percentile.

Variable	Definition
	Parent-level data
Cash flow	Cash flow from operations
Cost efficiency	Sales / total cost (cost of materials + labor cost)
Debt ratio	Total debt / total assets
Firms with foreign affiliate	0/1 dummy for firms with foreign affiliates from Dafne-MiDi-merge
Fixed asset share	Fixed assets / total assets
Number of foreign affiliates	Count of total number of affiliates worldwide obtained from MiDi
Sector definitions	We use two definition of sectors: (i) A broad definition of 28 sectoral groups is used for sample splits (see also Table 5), (ii) a narrow definition of about 64 sectors at the 2-digit level is used to generate sector-level dummy variables
Sales	Turnover
State dummies	Dummy variables for the 16 German states
	Country-level data
(Weak) contract enforcement	From the World Bank's "Doing business" database we use the variable "Enforcing contracts / Procedures (number)"
Controls on FDI inflows	Dummy = 1 if country has inflow controls, 0 otherwise. Data was kindly provided by Klein (2012) whose measure is based on Schindler (2009)
GDP	Host country GDP per capita in constant USD, converted into €bn, World Bank, World Development Indicators (2008)
GDP per capita	Host country GDP per capita per capita in constant USD, converted into €1,000, World Bank World Development Indicators (2008)
	List of countries
Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Croatia, the Czech Republic, Denmark, Ecuador, Estonia, Finland, France, Greece, Hong Kong, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Korea (Republic), Latvia, Malaysia, Mexico, New Zealand, Norway, Pakistan, Panama, the Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovakia, South Africa, Spain, Sri Lanka, Sweden, Thailand, Turkey, the United Kingdom, the United States	

Mathematical appendix

Proof of Proposition 1

Consider first the case where the collateral is not binding. We obtain x^* by taking the first-order condition from (6) or (6a) respectively, setting it equal to zero and solving for the optimal x^*. To see that $x^* \leq x_{\text{FB}}$, note that $\frac{1+\mu z}{1+z} < 1$ if $\mu < 1$, which is required for a positive collateral to be needed. $\pi^* \leq \pi_{\text{FB}}$ follows directly from $x^* \leq x_{\text{FB}}$ and can be shown analytically by checking that $\pi_{\text{FB}} > \pi^*$ whenever $C > 0$.

Consider next the case if the collateral is binding. We find the constrained optimal choice of $\overline{x}$ by solving the collateral constraint:

$$\overline{C} + F = \frac{[k(\overline{x}) + F - L] - \mu qp\overline{x}}{(1-\mu q)\theta} \tag{10}$$

for $\overline{x}$. This gives us a quadratic function of $\overline{x}$ which has the following solutions:

$$\overline{x}_{1/2} = (1+\beta)\mu qp \pm \sqrt{(1+\beta)^2\mu^2q^2p^2 - 2(1+\beta)[F - L - (1-\mu q)\theta(\overline{C}+F)]} \tag{11}$$

Since we are looking at constrained levels of sales that fall short of the second-best level of sales x^*, the solution for the investor is to choose the larger of the two levels of sales.

Q.E.D.

Proof of Proposition 2

Consider first the profits if the collateral is not binding. It is straightforward to see

$$\frac{d\pi^*}{d\beta} > 0, \frac{d\pi^*}{dp} > 0, \frac{d\pi^*}{dF} < 0, \frac{d\pi^*}{dL} > 0, \ \frac{d\pi^*}{d\overline{C}} = 0. \tag{12}$$

To see that $\frac{d\pi^*}{d\theta} > 0$ and $\frac{d\pi^*}{d\mu} > 0$, we show that $\frac{dx^*}{d\theta} > 0$ and $\frac{dx^*}{d\mu} > 0$. Using a revealed preference argument, it follows that the profit has to be increasing in these parameters as well.

We evaluate first:

$$\frac{dz}{d\theta} = \frac{-(1-q)(1-\mu q)\theta - (1-q)(1-\theta)(1-\mu q)}{(1-\mu q)^2\theta^2} = -\frac{(1-q)}{(1-\mu q)\theta^2} = -\frac{z}{\theta(1-\theta)} < 0 \tag{13}$$

and

$$\frac{dz}{d\mu} = \frac{(1-q)(1-\theta)q}{(1-\mu q)^2\theta} = \frac{zq}{(1-\mu q)} > 0 \tag{14}$$

Using these derivatives, we obtain:

$$\frac{dx^*}{d\theta} = (1+\beta)qp\frac{(1+z)\mu\frac{dz}{d\theta} - (1+\mu z)\frac{dz}{d\theta}}{(1+z)^2} = -(1+\beta)qp\frac{(1-\mu)\overbrace{\frac{dz}{d\theta}}^{(-)}}{(1+z)^2} > 0 \tag{15}$$

and

$$\frac{dx^*}{d\mu} = (1+\beta)qp\frac{(1+z)[\mu\frac{dz}{d\mu}+z]-(1+\mu z)\frac{dz}{d\mu}}{(1+z)^2} \tag{16}$$

$$= (1+\beta)qp\frac{(1+z)z-(1-\mu)\frac{dz}{d\mu}}{(1+z)^2} = (1+\beta)qp\frac{z}{(1+z)^2}[1+z-\underbrace{\frac{(1-\mu)q}{(1-\mu q)}}_{<1}] > 0 \tag{17}$$

Consider next the case where the collateral is binding.

Consider first $\overline{x}$. It is straightforward to see that: $\frac{d\overline{x}}{d\beta} > 0$, $\frac{d\overline{x}}{dp} > 0$, $\frac{d\overline{x}}{dF} < 0$.$\frac{d\overline{x}}{dL} > 0$, $\frac{d\overline{x}}{d\overline{C}} > 0$, $\frac{d\overline{x}}{d\theta} > 0$

Finally, note that $\frac{d\overline{x}}{d\mu} > 0$, because increasing μ relaxes the collateral constraint. To see this, note that the right-hand side of:

$$\overline{C} + F \geq \frac{[k(\overline{x})+F-L]-\mu qp\overline{x}}{(1-\mu q)\theta} \tag{18}$$

decreases in μ, for a given $\overline{x}$. To see this, note that:

$$\frac{d[\frac{[k(\overline{x})+F-L]-\mu qp\overline{x}}{(1-\mu q)\theta}]}{d\mu} = \tag{19}$$

$$\frac{(1-\mu q)\theta(-qp\overline{x})-(F+k(\overline{x})-L-\mu qp\overline{x})(-q\theta)}{(1-\mu q)^2\theta^2} = \tag{20}$$

$$-q\theta\frac{p\overline{x}-(F+k(\overline{x})-L)}{(1-\mu q)^2\theta^2} < 0 \tag{21}$$

To see the comparative statics for $\overline{\pi}$ note that they have the same signs as the comparative statics for $\overline{x}$ because they follow from relaxing (or tightening) the constraints on the constrained choice of $\overline{x}$.

Q.E.D.