Credit Market Institutions and Firm Imports of Capital Goods: Evidence from Developing Countries

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Abstract

Using firm-level data across seven developing countries, this paper studies the interaction between a firm's wealth and a country's credit market institutions on machinery & equipment imports (=capital imports). A firm's wealth approximates unobserved credit constraints and is inversely measured by a firm's leverage (total debt over assets). The analysis suggests that credit constraints have a negative impact on the probability to import capital at all (extensive margin) but not on the capital import value (intensive margin) and intermediate imports. However, the results also indicate that institutions such as creditor rights, an efficient debt enforcement and accounting standards improve access to external finance and reduce credit constraints with regard to capital imports. Innovative firms and first-time capital importers particularly benefit from a country's institutional reform.

Keywords: international trade, capital imports, machinery & equipment, financial development, credit constraints

JEL classification: F10, F12, F14, G20

1 Introduction

Firms from developing countries can increase their productivity by adopting an advanced technology embodied in imported capital and intermediate goods, as recent evidence shows.[1] In this process developing countries benefit from capital goods imports through the diffusion of superior technologies. Eaton and Kortum (2001) document that the vast majority of machinery and equipment imports worldwide stem from a small number of rich R&D intensive countries, but also that capital goods purchases in developing countries still exhibit a strong home bias.[2] We hypothesize that limited access to external finance prevents many firms from importing better technology and provides a possible explanation of this stylized fact. Furthermore, the institutional environment that should facilitate financial contracting and enforcement is weak in poorer countries and may act as a barrier to financing capital goods imports (IFC, 2010). World Bank data shows that about 35 percent of firms located in middle and low income countries complain about poor access to finance as a major investment constraint compared to only 15 percent for high-income OECD countries (World Bank Enterprise Surveys 2006-2009).[3]

Building on Bustos (2011), this paper develops a simple model of the decision to import capital goods in which only more productive firms invest in foreign technology because of higher fixed adoption costs. Financial frictions are introduced into the framework that depend on a country's strength of credit market institutions. As a result, a subset of firms would import capital goods if credit markets were perfect, but do not receive the required external finance due to financial frictions. They are credit constrained. The model yields a testable prediction on the relationship between a firm's wealth or assets and a country's credit market institutions: A firm's wealth becomes a stronger determinant of the import propensity in countries with weaker institutions. Put differently, for investors a higher amount of collateralizable firm assets may substitute for weak institutions in a country. We test this hypothesis using cross-country data at the firm-level from the 2002 to 2005 waves of the World Bank Enterprise Surveys (WBES).

To our knowledge, there are two papers addressing similar questions. Bas and Berthou

[1] See for instance Amiti and Konings (2007) for an assessment of the impact of cutting intermediate import tariffs on firm productivity in a sample of Indonesian firms and Kasahara and Rodrigue (2008) for an estimated effect of imported intermediates on firm productivity for Chilean firms.

[2] We use the terms capital goods and machinery & equipment interchangeably.

[3] The share of firms reporting finance as a problem is significantly higher in Africa and Latin America, namely about 45 to 50 percent, compared to East and South Asia, where the share ranges from 25 to 30 percent (see also WB, 2008).

(2011a) study a panel of Indian firms and find evidence that a better financial position increases the probability of importing capital goods. Using the same Indian dataset, Bas and Berthou (2011b) show that more liquid firms are more likely to import capital goods, in particular if they are located in financially developed regions measured by the credit volume over GDP of the region. In contrast, our theoretical formulation and results suggest a negative interaction between a firm's financial position and the quality of credit market institutions, which is more in line with the evidence from Love (2003) for firm investments. A further distinction of our paper is that it not only exploits financial development proxied by the credit volume over GDP, but also its institutional determinants. These institutional determinants are of additional interest because they can be directly affected by a country's policymakers as opposed to the lending activities of financial institutions.[4] In related work examining industry-level trade data from 1980 to 1997, Alfaro and Hammel (2007) suggest that stock market liberalizations leading to a lower cost of capital promote the import of machinery and equipment in poorer countries. However,due to the authors' use of industry-level data, they cannot determine whether the positive impact is caused by a higher profitability of the projects or reduced credit constraints at the firm-level.

To our knowledge, this is the first paper to provide firm-level evidence that creditor rights, an efficient legal enforcement of debt contracts and accounting standards lower credit constraints for introducing a foreign technology embodied in capital imports. The reduction of unobserved credit constraints is inferred from the lower sensitivity of the capital import propensity to the firm leverage observed in countries with stronger institutions. For example, in a country with few creditor rights like Brazil (creditor rights index of 1), a standard deviation increase of the leverage decreases the import propensity of the average firm by 9%, whereas the same change in the firm's leverage has no effect in a country with more creditor rights such as Thailand (creditor rights index of 2). First-time and R&D intensive importers particularly benefit from institutional development and firms in financially developed countries allocate a higher share of capital goods expenses to imports. We do not find that credit constraints matter for intermediate imports. The empirical findings are robust to various specifications and estimation techniques and are not driven by a particular country.

[4]However, institutional determinants vary only across countries which poses additional empirical challenges.

2 Related Literature

This section aims to justify the theoretically derived methodology to detect firm-level credit constraints and the set of credit market institutions used in the empirical analysis.

2.1 Inference of credit constraints

As mentioned in the introduction, access to finance seems to be problematic for firms located in the developing world, according to WBES surveys. Some skeptics may however feel uncomfortable drawing conclusions about the prevalence of credit constraints from survey data because firms may justifiably be denied credit for the lack of project profitability. As a consequence, the comprehensive literature dealing with the relationship between real investments and financial frictions infers the presence of unobserved credit constraints theoretically grounded in Modigliani and Miller (1958) but in a indirect way: A firm's wealth or financial position and institutional indicators of a country's credit market should have no effect on real economic outcomes if credit constraints are absent (see also Hubbard, 1998 for a survey of this literature, Love, 2003 and Rajan and Zingales, 1998). In line with this literature, the theoretical model outlined in Section 3 reaches the same conclusion. In econometric terms, the theory predicts a negative interaction term between a firm's financial position and the level of financial institutional development.

2.2 Institutional determinants of external finance

La Porta et al. (1997, 1998) initiated a strand of literature that emphasizes the importance of institutional determinants for the development of debt and equity markets. La Porta et al. (1997) provide evidence in a sample of 49 countries that both legal rules protecting creditors and shareholders and the quality of law enforcement raise the size of capital markets and extend its reach to more firms within a country. Put differently, their results suggest that establishing legal creditor protection and an efficient law enforcement facilitates a broader access to financial markets. Rajan and Zingales (1998) show that countries that have higher accounting standards grow faster in sectors that rely heavily on financial resources. Related to the availability of external finance, Svaleryd and Vlachos (2005) and Manova (2008) find that higher accounting standards improve the export performance and increase specialization in financially dependent sectors. Djankov et al. (2007) investigate

in a panel sample of 129 countries over 25 years the institutional factors that increase the volume of private credit over GDP. They suggest that better legal protection of creditors is associated with higher ratios of private credit to GDP, especially in richer countries. In addition, their analysis shows that credit markets in poorer countries particularly benefit from the presence of credit registries that offer information about a firm's credit history, while creditor rights seem to matter less. Examining WBES data, Beck et al. (2006) conclude that firms located in countries with higher levels of institutional development, measured by a composite indicator that accounts for the effectiveness of law enforcement, are less likely to report credit constraints even after controlling for other country characteristics such as private credit over GDP. Acemoglu and Johnson (2005) emphasize the primacy of securing property rights against state expropriation over contracting institutions for financial development. More generally, the importance of these contractual, enforcement, information-sharing and property rights institutions for facilitating access to finance has been recognized by the more policy-oriented literature from international institutions such as the World Bank, the International Finance Corporation and the G-20 (IFC, 2010; WB, 2008, 2009).[5]

Based on these findings from previous research, we test in a regression framework whether stronger legal creditor protection in the case of non-loan repayment and faster legal debt enforcement improve access to external finance in order to import capital goods. The time duration to resolve a debt dispute before court is used as a proxy for the efficiency of legal debt enforcement. In addition, we examine the importance of institutions aimed at reducing informational asymmetries between lenders and borrowers, such as accounting standards and the presence of credit information registries. These information sharing institutions should make firms more transparent and may thus enhance the lenders' willingness to grant credit.[6] [7]

[5]For instance, a World Bank research report that summarizes the findings from academic research and reviews the different policy options to improve financial access acknowledges that reforming the aforementioned institutions in developing countries is a fundamental prerequisite for a well-functioning credit market (WB, 2008). Given that reforming institutions is an overwhelmingly long-term task, with the notable exception of introducing credit information registries, one may ask whether there are effective short-term actions to improve access to finance. Apart from some improvements in the payment and settlement systems to reduce transaction costs, there seems to be a consensus backed by a large body of evidence that direct government interventions into the credit market through, for example, state-owned banks, taxes or subsidies are in many cases not desirable because of its inefficiencies and unintended consequences (WB, 2008, 2009).

[6]In a robustness check, an additional rule of law indicator will be included that accounts for the positive effect of property rights institutions on the availability of external finance found by Acemoglu and Johnson (2005).

[7]Some researchers have argued that the decline of trade finance practices and poor credit conditions

In sum, we employ a set of credit market institutions in the analysis that has been shown in previous academic research to be beneficial to the availability of external finance and whose importance has been recognized by policy institutions and practitioners. As a result, improving these institutions may help importers of capital goods overcome potential financing obstacles at the extensive and intensive capital import margin.

3 Theoretical Framework

This section develops a simple monopolistic competition model of domestic production to show that a firm's adoption of a more efficient foreign technology can be constrained by the scarce availability of credit in an economy. The model is similar to Bustos (2011) except that credit constraints can arise and firms produce only for the domestic market.[8] Firms within a country differ in their ex ante productivities φ and wealth ω, along the lines of Melitz (2003) and Chaney (2005). Firms that want to import capital goods must incur an additional technology adoption cost f_h in addition to the fixed production cost f, as in Yeaple (2005). As a consequence, only more productive firms find it profitable to import capital goods. Due to imperfect capital markets stemming from the limited pledgeability of future (expected) operating profits, profitability alone is not a sufficient condition to upgrade technology and a firm's credit constraint condition must be overcome as well. In this second dimension, wealthier and more productive firms should be less credit constrained. The model also implies that the importance of credit constraints is negatively related to institutional characteristics of the credit market, such as the existence of creditor rights, the efficiency of debt contract enforcement or the availability of reliable information

during the recent financial crises had severe deteriorating effects on trade flows (Auboin, 2009; Chor and Manova, 2012). In addition, the problem seems to persist in particular for import financing in poorer countries (Auboin, 2010). Since the outburst of the crisis, policy programs by regional development banks, the International Finance Corporation and local export credit agencies have supported trade finance by basically co-financing trade finance with banks and by implementing credit guarantee schemes (Auboin, 2009, 2010). Antras and Foley (2011), however, provide evidence that improvements in contractual institutions in the country of the importer may result in a higher value of imports financed on more favorable open account terms without bank involvement, while importers in countries with poorer institutions have to resort to cash in advance or to more costly letters of credit provided by bank intermediation. Given that a large part of trade transactions do occur without bank intermediation on open account terms, according to survey evidence by the International Chamber of Commerce (ICC, 2010), improving the contractual and enforcement environment in poorer countries may be complementary to the policy actions taken and is likely to make international trade more resilient to future crises.

[8] See Bas and Berthou (2011a) for a similar theoretical derivation of the decision to import capital goods when credit constraints are present.

of a firm's balance sheet and credit history.

Demand Side

Consumers consume a variety of the differentiated goods $q(i)$. They have Dixit & Stiglitz preferences over the differentiated goods, with a constant elasticity of substitution, $\sigma = 1/(1-\rho) > 1$, between any two varieties i within and across industries. Therefore, preferences of the representative consumer are of the form:

$$U = \left(\int_0^N q(i)^\rho di \right)^{\frac{1}{\rho}} \tag{1}$$

Preferences (1) deliver the following revenue function $r(i) = EP^{\sigma-1}p(i)^{1-\sigma}$ for each variety i supplied to the domestic market, where $p(i)$ is the price of variety i in the domestic market, $P = \left[\int_0^N p(i)di\right]^{\frac{1}{1-\sigma}}$ represents the (ideal) price index dual to (1), N corresponds to the number of existing varieties and E denotes aggregate spending for the differentiated goods.

Supply Side

Labor is the only factor of production. Labor is assumed to be supplied elastically and wages are treated as numeraire and thus normalized to one. In addition, a single firm is considered to be in a continuum of firms that produces a differentiated good under increasing return to scale. The production technology for every variety i, manufactured each by a single firm, involves a constant marginal cost $1/(\gamma_j\varphi)$ that depends on the ex ante firm productivity φ, a productivity-shifter γ_j related to the technology choice, where $j = \{l, h\}$ denotes either the low domestic technology l or the high imported technology h, and a fixed production cost f. If a firm adopts a more efficient foreign technology, it has to cover an additional cost f_h, but marginal production costs decline as indicated by $\gamma_h > \gamma_l = 1$.[9] The total costs in terms of required labor to produce $q(\varphi)$ units of variety i

[9]Two intertwined assumptions are made. The fixed costs of importing machinery and equipment is higher than for buying domestic machinery and the foreign technology is more advanced, which is reflected in their lower marginal production costs, $\gamma_h > \gamma_l = 1$. On the one hand, fixed costs increase because importing machinery involves collecting information about a potential foreign supplier and technology, establishing and maintaining a relationship with a foreign firm, as highlighted in Bas and Berthou (2011a). Although no information about the quality of foreign capital or its source country is available, we nonetheless assume that imported machinery and equipment is technologically more advanced than domestic capital goods in our developing countries sample. As argued in Eaton and Kortum (2001), world production of capital equipment is concentrated among a small number of R&D intensive countries. Furthermore, trade figures from the UN Comtrade database conveys that 75% to 97% of machinery & equipment imports (in 2000) come from high-income OECD countries in our sample of developing coun-

are as follows:

$$TC_l(\varphi) = f + \frac{q(\varphi)}{\gamma_l \varphi}, \qquad j = l \tag{2}$$

$$TC_h(\varphi) = f + f_h + \frac{q(\varphi)}{\gamma_h \varphi}, \qquad j = h \tag{3}$$

From (2) and (3), note that the low technology l firms feature lower fixed costs, but exhibit higher marginal costs compared to firms employing the advanced foreign technology h.

Optimal Pricing, Revenues and Profits

Given CES preferences (1) for the differentiated good, the optimal price is a constant markup over marginal costs. A firm with productivity φ hence charges the price

$$p_j(\varphi) = \frac{1}{\rho \gamma_j \varphi}, \qquad j = \{l, h\} \tag{4}$$

Thus, the optimal price is lower for firms using the more productive ($\gamma_h > \gamma_l = 1$) imported technology. Firm revenues and profits can then be written as

$$r_j(\varphi) = EP^{\sigma-1}(\rho \gamma_j \varphi)^{\sigma-1}, \qquad j = \{l, h\} \tag{5}$$

$$\pi_l(\varphi) = \frac{1}{\sigma} r_l(\varphi) - f, \quad j = l \qquad \pi_h(\varphi) = \frac{1}{\sigma} r_h(\varphi) - f - f_h, \quad j = h \tag{6}$$

The revenue and operating profit equations (5) and (6) make clear that revenues are unambiguously higher for high technology firms since the demand elasticity σ is greater than one, whereas the effect of technology on profits depends on the ex ante productivity φ, the efficiency gap between the two technologies, $\gamma_h - \gamma_l$, and the fixed technology adoption cost f_h, as we see in more detail below.

Import Decision under Perfect Credit Market Institutions

A potential producer will enter the domestic market if it earns nonnegative profits using the less productive domestic technology l. More formally, the minimum required ex ante productivity draw φ^* for market entry must be such that the zero profit condition $\pi_l(\varphi^*) = 0$ is met. In this case, the operating profits of a low technology firm l cover exactly the

tries. As a result, the adoption of foreign capital equipment requires the workforce, management and the organization as a whole to adapt to the more advanced technology which further increases fixed costs by f_h.

fixed production cost: $\frac{1}{\sigma} r_l(\varphi^*) = f$ and $\varphi^* = \frac{1}{P\rho}\left(\frac{\sigma f}{E}\right)^{\frac{1}{\sigma-1}}$. Next, it is only profitable for a fraction of more productive firms to adopt the more efficient foreign technology because it involves incurring an additional fixed cost f_h that outweighs the efficiency gains, $\gamma_h > 1$, for unproductive firms.[10] As a result, firms will only install the foreign technology if the increase in operating profits compensates for the higher fixed costs. This leads to the following profitability condition:

$$\pi_h(\varphi_h^*) = \pi_l(\varphi_h^*) \Longleftrightarrow (\gamma_h^{\sigma-1} - 1)\frac{1}{\sigma} r_l(\varphi_h^*) = f_h, \tag{7}$$

while φ_h^* denotes the threshold productivity to employ the foreign technology. The benefit of using the advanced technology embodied in the imported capital goods (LHS of 7) is increasing in firm productivity φ because more efficient firms are better at exploiting the foreign technology in terms of generating operating profits (see also equation 5). This is why firms above the productivity level φ_h^* self-select into importing capital goods. We get the closed-form solution for the threshold productivity φ_h^* by solving the equation (7) for firm productivity:

$$\varphi_h^* = \frac{1}{P\rho}\left(\frac{\sigma f_h}{E(\gamma_h^{\sigma-1} - 1)}\right)^{\frac{1}{\sigma-1}}. \tag{8}$$

The higher the additional fixed cost f_h and the less pronounced the efficiency gap, $\gamma_h^{\sigma-1} - 1$, between the two technologies is, the higher the initial productivity of the firm must be to gain an advantage by using the imported technology.

Credit Constraints

Credit constraints are introduced in a simple manner that capture the essence of a poor financial contracting and enforcement, as in Matsuyama (2005). As a consequence of imperfect credit market institutions, a firm can only credibly pledge up to a fraction, $\theta \in [0, 1]$, of the operating profits generated from selling differentiated goods. The weaker the credit market institutions are, the lower the fraction θ is. The fraction θ of operating profits also corresponds to the maximum amount the firm can borrow for financing the fixed costs, f and f_h.

Matsuyama (2005) points out that several agency costs explanations can justify the assumption of limited profit pledgeability, $\theta \in [0, 1]$. For instance, in the moral hazard

[10] More precisely, the result that only a fraction of the domestic firms adopt the foreign technology holds if the parameter restriction $\frac{f_h}{f} > \gamma_h^{\sigma-1} - 1$ is introduced. This also corresponds to the empirically relevant scenario according to Bustos (2011).

approach, as laid out in Tirole (2006) and Egger and Keuschnigg (2009), a high enough profit stake must be given to a borrower in order to avoid the entrepreneur's appropriation of private benefits from the investment. Assuming that the scope for private benefits is positively related to the level of (expected) operating profits would then naturally lead to a pledgeability of future operating profits of less than one in order to meet the firm's incentive compatibility constraint. Credit market institutions, such as creditor rights, the efficiency of legal contract enforcement and accounting standards, capture θ. These credit market institutions are intended to restrain the ability of entrepreneurs to extract private benefits (θ goes up) by directly empowering creditors or by lowering information asymmetries between lenders and borrowers and thus should increase the availability of external funds (see also Section 2.2).

Import Decision under Imperfect Credit Market Institutions

Because of imperfect credit market institutions, firms cannot entirely pledge their (expected) operating profits of an innovation. Therefore, the profitability of introducing the advanced technology does not suffice to evaluate whether a firm can finance a foreign technology upgrade. In this imperfect institutional environment, a second credit constraint condition and with it the firm's wealth ω become relevant. As a result, only firms that meet the following profitability (9) and credit constraint condition (10) will become importers of more advanced capital goods:

$$(\gamma_h^{\sigma-1} - 1)\frac{1}{\sigma} r_l(\varphi_h^*) \geq f_h \tag{9}$$

$$\theta \left[\frac{1}{\sigma} r_h(\varphi)\right] \geq f + f_h - \omega \tag{10}$$

The equation (9) states the profitability condition already explained above. In addition, the new credit constraint condition expressed in (10) says that pledgeable operating profits (LHS of 10) must be higher than demanded or collateral-adjusted credit (RHS of 10) to obtain credit. Demanded credit equals the difference between the fixed production and technology adoption cost, $f + f_h$, and the firm's wealth ω. As opposed to the environment with perfect credit market institutions, a firm's wealth ω becomes important since it lowers demanded credit and also increases the share of credit backed by collateral. Next, solving the credit constraint condition (10) for productivity φ yields the minimum productivity

$\bar{\varphi}_h$ to be granted credit for importing capital goods.

$$\overline{\varphi}_h(\omega,\theta) = \frac{1}{P\gamma_h\rho}\left(\frac{\sigma(f+f_h-\omega)}{\theta E}\right)^{\frac{1}{\sigma-1}} \tag{11}$$

Firms having a productivity $\varphi \geq max\left[\varphi_h^*, \bar{\varphi}_h(\omega,\theta)\right]$ can profitably adopt the foreign technology and access the necessary external finance.[11] But more interestingly, there may exist a subset of credit constrained firms in the productivity range $\overline{\varphi}_h(\omega,\theta) > \varphi \geq \varphi_h^*$ that are prevented from profitably upgrading technology only because they lack the required external finance. The following proposition ensures that this subset of firms is non-empty:

Proposition: *If* $\frac{\gamma_h^{\sigma-1}-1}{\gamma_h^{\sigma-1}}\left(\frac{f}{f_h}+1\right) > \theta$ *holds, then there exists a subset of credit constrained firms in a specific country that could profitably import capital goods, but do not obtain the required external finance.*

(See the Appendix 9.1 for a simple derivation of this proposition.)

In the following, we assume that this proposition holds and some firms have no access to the local credit market. Ultimately, this is the empirical question this paper examines, namely whether credit constraints matter for the decision to import capital goods. To derive the testable hypothesis, we rewrite the credit constraint condition (10) as the probability that a firm overcomes potential credit constraints. This probability is formulated as a linear expectation given firm i's productivity φ_i , wealth ω_i, and the state of credit market institutions θ_c in country c as follows:

$$E(\frac{1}{\sigma}r_h(\varphi_i) \geq \frac{1}{\theta_c}(f+f_h-\omega_i) \mid \varphi_i,\omega_i) = \frac{1}{\sigma}r_h(\varphi_i) + \frac{1}{\theta_c}(\omega_i - f - f_h) \tag{12}$$

In light of equation (12), a higher firm productivity φ_i reduces credit constraints directly through higher profits. In the model setup, the firm's wealth ω_i is exogenous and lowers the probability of a binding credit constraint condition if credit market institutions are imperfect. In perfect credit markets, a firm's wealth ω should not be a significant determinant of importing capital goods. As a consequence, the firm's wealth ω is predicted to be particularly relevant for firms located in countries with poor credit market institutions

[11] The corresponding minimum productivity to secure finance for the domestic market entry using the low technology l is obtained by solving the condition $\theta\left[\frac{1}{\sigma}r_l(\varphi)\right] = f - \omega$ for productivity φ: $\overline{\varphi}(\omega,\theta) = \frac{1}{P\rho}\left(\frac{\sigma(f-w)}{\theta E}\right)^{\frac{1}{\sigma-1}}$. It is clear that $\overline{\varphi}_h > \overline{\varphi}$ for all ω as long as $\frac{f_h}{f} > \gamma_h^{\sigma-1} - 1$ holds. In words, this means that credit constraints are tighter for potential innovators than for firms serving the home market with the low technology l.

(low θ_c), as can be observed from the interaction between wealth and institutions in (12), $\frac{1}{\theta_c}\omega_i$. In a more formal way, the interaction effect between a firm's wealth ω_i and the institutional quality θ_c is given by

$$\frac{\partial^2 E(\frac{1}{\sigma} r_h(\varphi_i) \geq \frac{1}{\theta_c}(f + f_h - \omega_i))}{\partial \omega_i \partial \theta_c} = -\frac{1}{\theta_c^2} \leq 0, \quad \theta \in [0, 1] \tag{13}$$

The cross-partial derivative (13) implies that the the positive impact of an increase in the firm's wealth ω on overcoming the credit constraint condition (13) is higher in countries with underdeveloped credit market institutions. The lower the profit pledgeability θ_c, the more important the firm's wealth ω becomes because it substitutes for a poor institutional setting.

Hypothesis 1: *The positive effect of a marginal increase in the firm's wealth on the likelihood of importing capital goods is greater in countries with weaker credit market institutions.*

Hypothesis 1 summarizes the theoretical discussion. Weaker credit market institutions translate into a lower profit pledgeability θ_c, which increases the need for firm collateral to access external finance or for internal funds that replace loans. Hence, a firm's wealth becomes a more important determinant of the decision to import capital goods when institutions are weak. A firm's wealth is inversely related to its leverage. A less levered firm can provide more collateral, which matters more where investors are less protected and corporate governance is weaker. On the other hand, the firm's wealth can also be interpreted as internal funds that substitute for the limited availability of external finance.

4 Data

4.1 Firm-level database

This paper employs the standardized firm level data compiled by the World Bank's Enterprise Surveys in the 2002 to 2005 waves.[12] The surveys use a stratified sampling methodology in order to create a representative sample of a country's sectoral composition. In addition, firm size and geographic locations within countries are used as complementary

[12]The covered survey years differ across countries in the data sample.

stratifying variables.[13] Within each strata, the firms are picked randomly. The data contains the needed information to construct the firms' wealth indicators and other firm characteristics included as control variables and the dependent variables. Firms that report an inconsistent current over total assets ratio above one are deleted from the sample. Furthermore, we also restrict the sample in most specifications to solvent firms with non-negative equity.[14] The motivation behind this decision is that we believe that the domain of the theory applies primarily to solvent firms and that insolvent firms are entirely excluded from formal credit markets.[15] Applying these selection rules and considering only firms with information about capital goods imports leaves us with a sample of 3405 firms from 7 developing countries.[16]

4.2 Dependent variable

The dependent variable is an indicator equalling one for a firm that imported new machinery and equipment in a specific year. In other specifications, the dependent variable changes and is defined as the share of capital imports to total capital goods expenses to investigate whether firms tend to switch to imported machinery when credit constraints become less binding. Finally, we also study the impact of credit constraints on the intensive import margin, that is the imported value of capital goods.

4.3 Independent variables

As the empirical counterpart of the firm's wealth ω, *Leverage* calculated as total debt over total assets is used. More indebted firms have a lower equity stake, can provide less collateral and have a higher risk of bankruptcy. Hence, highly levered firms are less likely to obtain external finance. *Liquidity ratio,* defined as current assets over total assets, is employed as an alternative proxy for firm-level credit constraints. It measures the availability of internal funds required in the case of limited access to external finance. In further robustness tests, the *Property ratio* and *Log firm age* are included as credit constraints variables.

[13] Consequently, the sampling methodology leads to an oversampling of larger firms.

[14] Non-negative equity means a total debt over total assets ratio of lower than or equal to 1.

[15] In the robustness section, we relax this assumption and test how sensitive the results are to this selection rule.

[16] The sample used in the regressions with the probability of importing intermediate goods as a dependent variable is larger (see Table 5).

In the Melitz-type framework presented in Section 3, more productive firms set lower prices resulting in higher operating profits; therefore, they are less likely to be credit constrained. We measure firm productivity by the log value added per worker, *Log productivity.* Another important firm characteristic in this framework is the firm size defined as the log number of employees, *Log employment.* To control for the possibility that more capital intensive firms are more likely to import capital and intermediate goods, *Log capital intensity,* measured by the logarithm of total assets per worker, is employed. The dummy variable *Foreign*, which equals one for foreign-owned firms and zero otherwise, is also included in all specifications. Foreign-owned firms may be less prone to credit constraints and have a higher likelihood of importing capital goods.

In robustness checks, we add firm characteristics related to the skill-level of the production workers and the educational background of the employees and the management. This is potentially important because a certain threshold level of human capital is probably required to fully exploit an advanced technology. Lastly, we also control for the share of foreign in total inputs (*Foreign input share*) and include a dummy that equals one if a firm has a *ISO certification*, which may also capture firm aspects linked to organizational and productive efficiency.

4.4 Credit market institutions

The paper considers several indicators intended as proxies for the institutional development of a country's credit market. For instance, we employ *Creditor rights* drawn from Djankov et al. (2007). It is an index ranging from 0 (weak creditor rights) to 4 (strong creditor rights) and is meant to capture the investor protection dimension of the credit market institutions.[17] More specifically, it can be interpreted as a measure of a creditor's legal power to recoup his investment in a firm on the verge of bankruptcy. The variable *Enforcement days* also comes from Djankov et al. (2007) and is defined by the log number of days it takes to enforce an unhonored debt contract worth 50% of the country's GDP per capita. This measure was constructed as of January 2003. It reflects the important legal enforcement dimension of the financial infrastructure. Even in economies with strong creditor rights, investors may be reluctant to lend money because of slow contract enforcement in the case of a firm default. A further institutional variable employed is the widely used *Accounting Standards* indicator from the Center for International Financial Analysis

[17]Both indicators *Private credit* and *Creditor rights* are averaged over the period 1999-2003.

and Research (CIFAR) and taken from Bushman et al. (2004) for the year 1995 (see also La Porta et al., 1998).[18] It is a measure for the transparency of a firm's financial disclosure in a country, or more generally for a country's corporate governance standards. In other words, the reduction of informational asymmetries between investors and borrowers as a result of better accounting standards should increase the likelihood of obtaining credit. Finally, the conventional outcome based measure *Private credit,* which is taken from Beck et al. (2009) and defined as the credit volume from banks and other financial institutions extended to the domestic sector over GDP, is also used in some specifications.

(For a more detailed description of the independent variables, credit market institutions, country characteristics and their data sources see the Appendix 9.2)

[18]This accounting standards indicator is highly correlated over time, as shown by Rajan and Zingales (1998) and Manova (2008), so that the country ranking in this indicator is unlikely to be different for the sample period that begins later. In addition, this accounting standards indicator is of high quality and accurate as confirmed in Hope (2003) and is the only indicator that is available for six out of the seven countries in the sample.

Table 1: Country sample and credit market institutions

			Credit market institutions			
Country	No. of firms	% tot. firms	Creditor rights	Enforcement days	Accounting std.	Private credit
Brazil	773	22.70	1	6.34	56	0.30
India	155	4.55	2	6.05	61	0.28
Indonesia	521	15.30	2	6.35		0.21
Philippines	201	5.90	1	5.94	64	0.40
South Africa	246	7.22	3	5.63	79	1.24
Sri Lanka	360	10.57	2	6.09	74	0.27
Thailand	1149	33.74	2	5.97	66	1.10
Total	3405	100				
Mean			1.86	6.05	66.67	0.54

5 Descriptive Statistics and Empirical Specification

This section offers a descriptive statistical overview of the the country- and firm-level data employed later in the regression analysis. In addition, the baseline empirical specification of the regression equation is presented.

5.1 Descriptive statistics

Table 1 shows the country distribution of the firms included in the study. The sample covers 3405 firms unevenly distributed across 7 developing countries.[19] For instance, firms from Brazil and Thailand together make up more than 50% of the sample. Consequently, we must check that the results are not affected by overrepresented countries in the sample - this is performed in the robustness Section 7.4. In addition, the values and averages of our main four institutional variables across countries are presented.

Table 2 displays the descriptive statistics of all the lagged firm characteristics. In line with the firm-level empirical literature on the import and export determinants, importers are larger, employ a better educated workforce and CEO, have more skilled production workers and are more likely to be foreign-owned (Bernard et al., 2007). Capital importers also use a higher share of foreign inputs and are more likely to be an ISO certified company. Interestingly, productivity, capital and R&D intensity do not differ significantly by capital importer status in these preliminary statistics.[20] With regard to leverage, importers have on

[19]Only countries with at least 100 firms were selected.

[20]Value added per worker is, however, an arguably imperfect proxy for productivity

average a statistically significant lower leverage than non-importers, whereas non-capital importers seem to be, a bit surprisingly, more liquid than capital importers.[21] Finally, importers are on average older, but non-capital importers own more property.

5.2 Empirical Specification

We estimate the following regression equation in the empirical section:

$$\begin{aligned} Import_{ickt} = \alpha + \beta Z_{it-1} + (\gamma_1 + \gamma_2 Credit\ Market\ Institutions_c) \times \omega_{it-1} \\ + \lambda_c + \nu_k + \mu_{ck} + \eta_t, \end{aligned} \tag{14}$$

where $Import_{ickt}$ is a dummy that equals one if a firm i in sector k from country c imports machinery and equipment (capital goods) in the period t.[22] ω_{it-1} is the one year lag of the firm's wealth. *Leverage(t-1)* and *Liquidity ratio(t-1)* proxy for ω_{it-1}. We conjecture that less leveraged and more liquid firms are less credit constrained, as explained in Section 3. We thus expect the following coefficient signs: negative for leverage, $\gamma_1 < 0$, and positive for the liquidity ratio, $\gamma_1 > 0$. However, the importance of the firm's financial position should be higher when the country's institutions governing financial contracting and enforcement are non-existent or underdeveloped. This implies that the coefficient of the leverage interaction should be positive[23], $\gamma_2 > 0$, and that of the liquidity interaction negative[24], $\gamma_2 < 0$. Z_{it-1} is a lagged vector of firm characteristics controlling for differences in productivity, size, ownership and physical and human capital. It is expected that larger and more productive firms have a higher import propensity. Foreign-owned firms, as well as those that are skill or capital intensive, may also be more inclined to employ technologically advanced capital goods from abroad.

We first estimate equation (14) as a pooled Probit model including interactions between a country and a sector μ_{ck} and their main effects $\lambda_c,\ \nu_k$. The country dummy λ_c soaks up the main effects of differences in credit market institutions and other country characteristics affecting the capital import probability; for instance, the distance to capital good producers, the amount of human capital in a country or exchange rate changes affecting import prices. The sectoral dummy ν_k captures the differential impact of sectoral characteristics

[21] Despite using lagged values, reverse causality may be a reason for this finding.
[22] The analysis contains 36 sectoral dummies at the three- and four-digit ISIC level.
[23] Except for the Interaction *Leverage(t-1) x Enforcement* days, which is predicted to be negative.
[24] Except for the Interaction *Liquidity ratio(t-1) x Enforcement* days, which is predicted to be positive.

Table 2: Mean equality tests of firm characteristics

	Non-Capital Importer	Capital Importer	Mean equality t-test
Number of firms (n=3405)	2212	1193	
Credit constraints proxies:			
Leverage	0.50	0.44	5.61[a]
	(0.29)	(0.30)	
Liquidity ratio	0.54	0.52	3.02[a]
	(0.28)	(0.25)	
Property ratio	0.19	0.14	4.22[a]
	(0.20)	(0.14)	
Log firm age	2.65	2.76	-3.83[a]
	(0.77)	(0.76)	
Firm characteristics:			
Log productivity	1.94	1.93	0.12
	(1.29)	(1.58)	
Log employment	4.48	5.40	-17.02[a]
	(1.35)	(1.59)	
Log capital intensity	2.19	2.26	-1.22
	(1.42)	(1.73)	
Foreign	0.09	0.23	-11.25[a]
	(0.29)	(0.42)	
share workforce with university degree	15.06	25.67	-11.66[a]
	(18.45)	(32.44)	
Log R&D spending/sales	-5.37	-5.55	1.22
	(1.87)	(2.22)	
CEO graduate degree	0.10	0.17	-5.60[a]
	(0.30)	(0.38)	
skilled share of production workers	0.35	0.49	-10.32[a]
	(0.35)	(0.39)	
Foreign input share	15.24	36.47	-15.85[a]
	(28.14)	(37.20)	
ISO certification	0.32	0.41	-4.74[a]
	(0.47)	(0.49)	

Notes: Mean values of credit constraints proxies and firm characteristics are reported by capital import status and the t-statistics of the mean equality test. Significance levels: [a]1%, [b]5%, [c]10%.
Standard deviations in parentheses.

such as capital, skill or R&D intensity, whereas the country-sector dummy μ_{ck} is intended to pick up determinants at the country and sector level, such as the import tariff structure and prices, other non-tariff protectionist measures for capital goods, sectoral exchange rate pass-through rates, the size of the market for domestic second-hand capital goods, industrial policies and the differential impact of a country's institutions across industries. The time fixed effect μ_t absorbs changes in the global economic environment that affect all firms similarly in the sample, such as the world business cycle.

Apart from (pooled) Probit estimations, we also estimate (14) by a linear probability model with fixed effects to account for unobserved heterogeneity at the firm-level, for example, heterogenous managerial ability and corporate strategies that may result in different technology choices. A further linear probability model is estimated by 2SLS to control for the possibility of omitted firm characteristics that may confound the consistent estimation of the coefficients of interest γ_1, γ_2.[25] We also estimate dynamic specifications to check whether firms with a past experience of importing are more likely to be capital importers in the present.

[25]The set of instruments used is described in detail in Section 7.1, where the 2SLS results are presented.

6 Results

6.1 The effect of credit market institutions on the capital import probability

Table 3 presents the results concerning our main hypothesis about the interaction between credit market institutions and the firm's financial position. The coefficients of the traditional firm determinants of exporting and importing goods all display the expected signs in line with Bernard et al. (2007): Larger, more productive and capital intensive firms have a higher probability of importing capital goods, albeit productivity surprisingly does not enter the regression significantly in the specifications 1 to 4 and 7. However, value added per worker may only capture part of firm productivity. Foreign-owned firms also have a significantly higher capital import propensity. This probably indicates reduced credit constraints because of the foreign owner's co-financing of investments (see also Manova et al., 2009) or the use of more advanced production technologies of foreign-owned firms.

The estimations show a consistent picture with respect to a firm's leverage and its interactions with the credit market institutions. A more levered firm has a lower capital import probability, but its marginal effect is decreasing in the quality of a country's financial contracting and enforcement, which is in line with hypothesis 1 (see columns 1 to 4). In countries with more creditor rights, faster enforcement of debt contracts and higher accounting standards, the negative impact of a firm's leverage on the decision to adopt a more advanced foreign technology is sharply diminished. This suggests that a firm's leverage plays a less harmful role in access to external finance in countries with more developed credit market institutions. Interestingly, the presence of private and public credit registries for potential lenders does not reduce the importance of a firm's debt situation. In contrast, public registries seem to have a detrimental effect on the capital import propensity (see the interaction in column 4). This counterintuitive result may capture some peculiarity in the small country sample and will be further explored in Section 6.2.

In columns 5 to 8, the leverage variable is replaced with the liquidity ratio as our second proxy for firm-level credit constraints. This set of estimations with the firm's liquidity ratio and its interactions with the institutional measures are mostly statistically insignificant.[26] One possible explanation is that the costs related to the decision to import capital goods

[26] In the columns 5 and 7, a firm's liquidity unexpectedly displays a larger negative effect on the capital import propensity in countries with weaker credit market institutions.

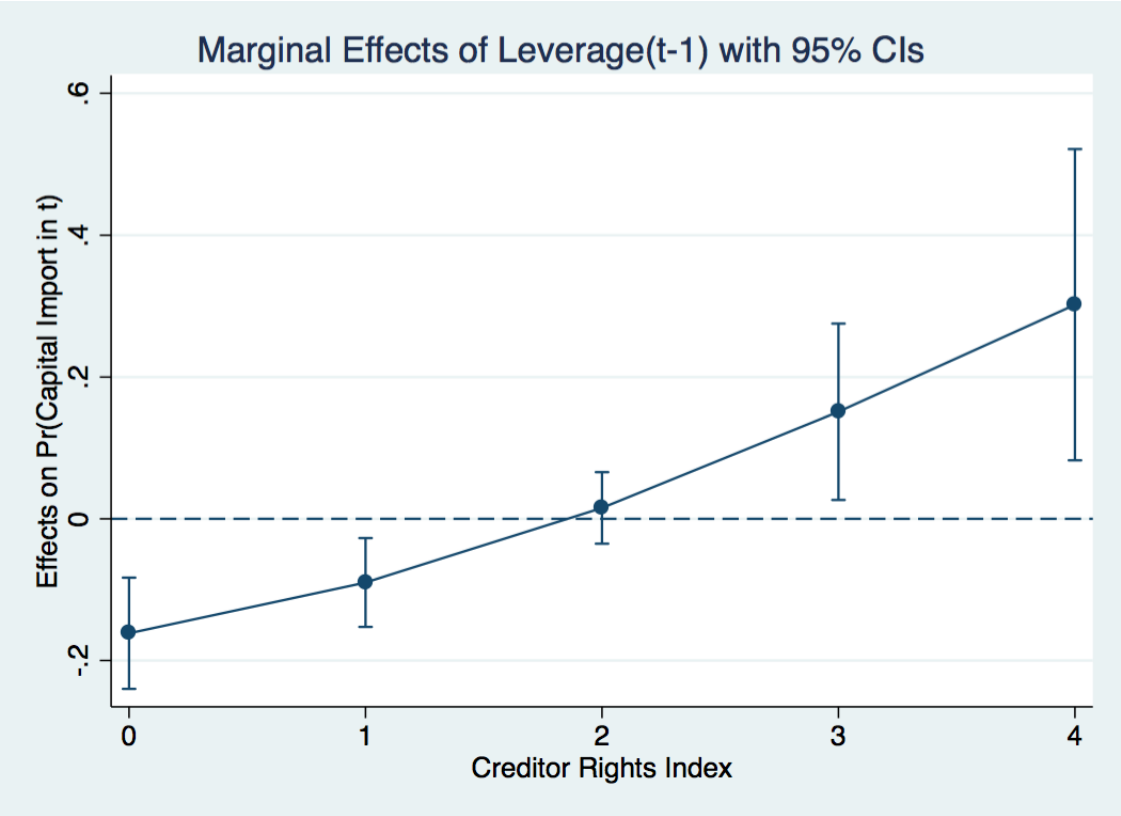
Table 3: Credit market institutions, the firm's financial position and the capital import probability

Dependent variable	Dummy=1 if firm imports capital goods in t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log productivity(t-1)	0.014	0.017	0.013	0.016	0.018[c]	0.018[c]	0.016[c]	0.018[c]
	(0.011)	(0.011)	(0.009)	(0.011)	(0.011)	(0.011)	(0.009)	(0.010)
Log employment(t-1)	0.082[a]	0.082[a]	0.075[a]	0.082[a]	0.081[a]	0.080[a]	0.074[a]	0.081[a]
	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)
Log capital intensity(t-1)	0.030[a]	0.028[a]	0.032[a]	0.029[a]	0.027[a]	0.027[a]	0.029[a]	0.027[a]
	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.010)	(0.009)	(0.010)
Foreign	0.095[a]	0.096[a]	0.086[a]	0.095[a]	0.094[a]	0.095[a]	0.083[a]	0.095[a]
	(0.030)	(0.030)	(0.027)	(0.030)	(0.030)	(0.030)	(0.027)	(0.030)
Leverage(t-1)	-0.283[a]	3.278[a]	-0.792[a]	0.007				
	(0.096)	(0.882)	(0.259)	(0.046)				
Liquidity ratio(t-1)					-0.323[a]	0.908	-0.807[a]	-0.056
					(0.110)	(1.040)	(0.303)	(0.053)
Leverage(t-1) x Creditor rights	0.151[a]							
	(0.050)							
Leverage(t-1) x Enforcement days		-0.545[a]						
		(0.146)						
Leverage(t-1) x Accounting standards			0.012[a]					
			(0.004)					
Leverage(t-1) x Private bureau				0.064				
				(0.067)				
Leverage(t-1) x Public registry				-0.236[a]				
				(0.077)				
Liquidity ratio(t-1) x Creditor rights					0.130[b]			
					(0.059)			
Liquidity ratio(t-1) x Enforcement Days						-0.167		
						(0.172)		
Liquidity ratio(t-1) x Accounting standards							0.011[b]	
							(0.005)	
Liquidity ratio(t-1) x Private bureau								-0.001
								(0.079)
Liquidity ratio(t-1) x Public registry								-0.159[c]
								(0.089)
Observations	5,128	5,128	4,871	5,128	5,128	5,128	4,871	5,128
Pseudo-R-squared	0.264	0.265	0.188	0.264	0.264	0.263	0.189	0.264

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and heteroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

are substantial. As a consequence, the level of external financing required would be high irrespective of the level of available internal finance. This would make the capital import probability insensitive to a change in the firm's liquidity. Put differently, collateral measures such as the firm's leverage are more appropriate to approximate credit constraints if firm financing must rely to a large extent on external finance.

Figure 1: The marginal effect of a unit-increase in the firm's leverage



Based on the baseline specification in the first column of Table 18, we assess the economic importance of our results. Figure 1 depicts the marginal effect of a unit-increase in the firm's leverage on the capital import probability as a function of the Creditor Rights Index. In accordance with hypothesis 1, Figure 1 shows that a higher firm leverage reduces the probability of importing capital goods, particularly for firms located in countries with weak creditor rights. To arrive at a more meaningful interpretation of the quantitative impact, the depicted marginal effects are multiplied by a sample standard deviation in the firm's leverage equal to 0.29. Then, a standard deviation increase in the leverage decreases the capital import probability by about 5 percentage points for firms in countries with a creditor rights index of zero. Given an average import probability of 0.27, this corresponds to 17% lower capital import probability. Furthermore, in countries with no creditor rights (index value= 0), a 10% decrease in the leverage has about the same effect as a 10%-increase in the firm size, namely a rise of about 3% in the average import propensity. In countries with a creditor rights index of 1, like Brazil or the Philippines, the negative marginal effect gets smaller to slightly over minus 2 percentage points or to a 9% lower

capital import probability for the average firm. There is no effect of leverage on importing technology in countries with an index value of 2 (for instance Thailand, Sri Lanka or Indonesia). Consequently, the firm's financial position becomes less important in countries with stronger financial institutions confirming hypothesis 1. The marginal effect of leverage then unexpectedly turns positive for firms operating in countries with strong creditor rights (index of 3 or 4). One possible explanation is that potential investors interpret the firm's leverage as a signal of the ability to generate future profits in countries with strong financial institutions as these firms have enjoyed the faith of other investors - at least in the past. More generally, this quantification shows that higher creditor rights are associated with lower credit constraints inferred from the substantially smaller negative impact of a firm's leverage in financially more developed countries.

6.2 Which credit market institutions matter most?

It is relevant to determine which credit market institutions may have the highest leverage to reduce firm-level credit constraints, in particular from a policy perspective. To start, it is important to bear in mind that two intertwined features of the data make a statistical horse race of the country-level credit market institutions difficult to accomplish: Several indicators are highly correlated and the number of countries included in the estimation sample is fairly small. Nonetheless, this section sheds some light on this question by entering the institutions two by two and simultaneously in order to see which institutions retain a significant effect.

We are primarily interested in the interaction terms of Table 4. In the first column one can note that an efficient legal enforcement of debt contracts seems to dominate the provision of *de jure* creditor rights in the environment of a developing country. The enforcement days interaction (see column 1) enters significantly and almost unchanged compared to its equivalent in Table 3 as opposed to the insignificant creditor rights interaction. Although the interaction terms in the second column are imprecisely estimated, the results suggest that creditor rights and accounting standards may be both important in a similar manner. In the third column almost perfect collinearity prevents us from drawing conclusions on the importance of legal debt enforcement compared to accounting standards. The availability of bank credit matters as can be seen from the estimated coefficients of the firm's leverage and its private credit interaction in column 4. When we control for private credit over GDP in columns 5 and 6, creditor rights still exerts a positive but insignificant influence

Table 4: The importance of different credit market institutions

Dependent variable	Dummy=1 if firm imports capital goods in t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log productivity(t-1)	0.016	0.013	0.014	0.015	0.015	0.017	0.015	0.017
	(0.010)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)
Log employment(t-1)	0.082^{a}	0.075^{a}	0.076^{a}	0.082^{a}	0.082^{a}	0.082^{a}	0.082^{a}	0.082^{a}
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Log capital intensity(t-1)	0.028^{a}	0.031^{a}	0.030^{a}	0.028^{a}	0.029^{a}	0.028^{a}	0.029^{a}	0.028^{a}
	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Foreign	0.096^{a}	0.085^{a}	0.086^{a}	0.094^{a}	0.094^{a}	0.096^{a}	0.095^{a}	0.097^{a}
	(0.030)	(0.027)	(0.027)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Leverage(t-1)	2.942^{c}	-0.492	1.746	-0.156^{b}	-0.272^{a}	3.376^{b}	-0.203	3.221^{b}
	(1.595)	(0.403)	(1.750)	(0.062)	(0.097)	(1.431)	(0.144)	(1.568)
Leverage(t-1) x Creditor rights	0.022	0.094			0.110		0.102	
	(0.084)	(0.095)			(0.071)		(0.066)	
Leverage(t-1) x Enforcement days	-0.496^{b}		-0.337			-0.560^{b}		-0.539^{b}
	(0.244)		(0.228)			(0.226)		(0.263)
Leverage(t-1) x Accounting standards		0.005	0.004					
		(0.008)	(0.007)					
Leverage(t-1) x Private credit/GDP				0.201^{a}	0.090	-0.010		
				(0.073)	(0.105)	(0.113)		
Leverage(t-1) x Public registry							-0.151	-0.016
							(0.098)	(0.135)
Leverage(t-1) x Private bureau							0.077	0.042
							(0.067)	(0.068)
Observations	5,128	4,871	4,871	5,128	5,128	5,128	5,128	5,128
Pseudo-R-squared	0.265	0.188	0.188	0.263	0.264	0.265	0.264	0.265

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: ^{a}1%, ^{b}5%, ^{c}10%. Firm-level cluster- and heteroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

on firm-level credit constraints (see column 5), while enforcement days remains highly significant with an almost unchanged magnitude in column 6. In the last two columns, 7 and 8, we check whether the presence of public and private credit registries reduces the negative impact of a firm's debt position on obtaining credit for importing capital goods. Somewhat surprisingly, this cannot be confirmed from the estimations in columns 7 and 8 in which we control for creditor rights and the time it takes to enforce a debt contract. This finding is consistent with the estimations of Table 3 (column 4), but contrasts with the results from Djankov et al. (2007). It may be reasonable to conclude that the number of countries is too small to test the effect of an institution that enters the regression as a dummy variable.

Although the results of this section must be interpreted with caution, the importance of the legal enforcement of debt contracts clearly emerges from the analysis. One possible interpretation is that creditor rights matter, but the weak legal enforcement in many developing countries is complementary and constitutes the binding firm constraint for access to external finance and the subsequent technology upgrade.

6.3 Do credit market institutions also play a role for intermediate imports?

Limited access to specialized inputs is an important characterization of the business environment of poorer countries. In addition, those inputs are often only available at an extra cost from abroad, as Tybout (2000) argued.[27] This extra cost certainly involves shipping and tariff expenses on a regular basis, but also an additional fixed cost related to quality upgrading, such as the adaption of the production process, learning how to use the new input and the like (Kugler and Verhoogen, 2012). An important part of this fixed cost accrues shortly before or at the time the firm starts importing intermediate goods. Thus, credit constraints could also matter for intermediate imports.

Table 5 reports the marginal effects regarding the relationship between the probability of importing intermediate goods and the interaction between the firm's financial position and the credit market institutions. Firstly, firms with a higher lagged productivity, which employ more people and are more capital intensive, have a significantly higher probability to import intermediate goods in all specifications (see columns 1 to 8). This supports the recent idea that more efficient firms may self-select into importing inputs, as asserted by Kugler and Verhoogen (2009), although the direction of causality is admittedly difficult to establish. Not surprisingly, foreign-owned firms are much more likely to source their inputs from abroad.

The estimations in Table 5 show that neither a firm's liquidity ratio or leverage nor their associated interactions with the financial institutions are determinants of the probability of importing intermediates. The results suggest that credit constraints for imported inputs play a minor role and are in line with the results from Bas and Berthou (2011a) for India. This evidence is probably explained partly by a lower fixed cost of importing inputs than for the adoption of a foreign production technology. Another explanation is that supplier credit or even more informal short-term lending, which are pervasive in countries with weak financial institutions, substitute for a lack of formal credit (IFC, 2010; Fisman and Love, 2003).

It is important to point out that the data only allowed us to determine whether a firm imported inputs at a specific point in time, but does not contain a history about imported

[27] Recent firm-level evidence also suggests that imported intermediate goods on average are of higher quality than domestic inputs for firms located in developing countries (Kugler and Verhoogen, 2009).

Table 5: Credit market institutions and the probability to import intermediate goods

Dependent variable	Dummy=1 if firm imports intermediate goods in t					
	(1)	(2)	(3)	(4)	(5)	(6)
Log productivity(t-1)	0.050[a]	0.051[a]	0.049[a]	0.048[a]	0.048[a]	0.047[a]
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)
Log employment(t-1)	0.113[a]	0.114[a]	0.113[a]	0.115[a]	0.115[a]	0.115[a]
	(0.012)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)
Log capital intensity(t-1)	0.043[a]	0.042[a]	0.045[a]	0.045[a]	0.044[a]	0.046[a]
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Foreign	0.231[a]	0.232[a]	0.239[a]	0.230[a]	0.231[a]	0.238[a]
	(0.043)	(0.043)	(0.043)	(0.042)	(0.042)	(0.043)
Leverage(t-1)	0.030	0.761	0.140[c]			
	(0.087)	(0.532)	(0.073)			
Liquidity ratio(t-1)				-0.037	0.892	0.137
				(0.104)	(0.637)	(0.099)
Leverage(t-1) x Creditor rights	0.027					
	(0.044)					
Leverage(t-1) x Enforcement days		-0.113				
		(0.086)				
Leverage(t-1) x Private credit/GDP			-0.117			
			(0.090)			
Liquidity ratio(t-1) x Creditor rights				0.072		
				(0.050)		
Liquidity ratio(t-1) x Enforcement Days					-0.133	
					(0.106)	
Liquidity ratio(t-1) x Private credit/GDP						-0.111
						(0.132)
Observations	4,150	4,150	3,996	4,150	4,150	3,996
Pseudo-R-squared	0.245	0.245	0.249	0.245	0.245	0.249

Notes: Estimation: Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies. Error correction for correlation at the country-industry level.

inputs.[28] We are therefore not able to detect import starters with a potentially higher fixed or sunk cost that are more likely to be subject to financing constraints. This data limitation must be taken into account when reading our empirical evidence.

[28]Furthermore, the database does not contain any information about the inputs origins.

6.4 The impact of credit market institutions on the intensive import margin

In this section we assess the importance of the firm's leverage and financial institutions on the intensive import margin, which we define as the value of imported capital goods over the total expenses on capital goods as a percentage number (*Capital import share* in columns 1 and 2). In columns 3 to 6 we use the log value of capital goods imports as our dependent variable (*Log(Capital import value)*). This issue deserves attention particularly from a policy point of view. Theoretically, credit constraints may matter less for the intensive import margin. The reason is that at least part of the associated fixed costs have already been borne and financed once a firm is already importing a positive amount of capital. In turn, if firms are credit constrained with respect to the intensive import margin, firms also have problems financing the variable trade costs associated with importing capital goods, and government interventions promoting trade finance also may be appropriate.

Table 6 presents the results of the intensive import margins. In columns 1 and 2 we estimate a two-limit tobit model including a lagged dependent variable that allows for dependence on past behavior stemming, for instance, from established linkages with capital exporters.[29] Indeed, the lagged capital import variable is highly significant. Turning next to financial factors, a lower leverage increases the capital import share, which suggests that financial constraints influence the import of capital goods, but affect domestic capital purchases less strongly. Domestic capital goods might be better known and less risky from the viewpoint of domestic investors. The estimations in columns 1 and 2 indicate that firms substitute capital imports for domestic capital goods when credit constraints become less severe.

The evidence in favor of a significant effect of financial factors and institutions does not, however, carry over to columns 3 to 6 in which the capital import share is replaced with the log value of capital imports as the dependent variable. This model is first estimated by OLS in columns 3 and 4 and afterwards by the Heckman two-step procedure to account for non-random selection into importing capital goods. In the Heckman model the excluded variable is a dummy variable that equals one for firms that have a ISO certification and zero otherwise.[30] The fairly significant Heckman's lambda in columns 5 and 6 provides

[29] A dynamic specification including a lagged dependent variable does not invalidate consistent estimation of the pooled tobit model (Wooldridge, 2002).

[30] The assumption is thus that an ISO certification affects the decision to import capital goods, but it should not have a significant effect on the imported value of capital goods. Indeed, this is what preliminary intensive and extensive margin regressions and the first-stage results confirm, which are available upon request.

Table 6: Credit market institutions and the intensive import margin: capital import share and value

Dependent variable	Capital import share		Log(Capital import value)			
	(1)	(2)	(3)	(4)	(5)	(6)
Capital import share(t-1)	3.054[a]	3.044[a]				
	(0.022)	(0.022)				
Log productivity(t-1)	-2.433[a]	-1.740[b]	0.314[a]	0.308[a]	0.336[a]	0.329[a]
	(0.729)	(0.734)	(0.088)	(0.089)	(0.079)	(0.077)
Log employment(t-1)	18.949[a]	19.542[a]	0.863[a]	0.854[a]	1.011[a]	0.979[a]
	(0.411)	(0.411)	(0.060)	(0.061)	(0.095)	(0.095)
Log capital intensity(t-1)	8.130[a]	7.679[a]	0.422[a]	0.425[a]	0.491[a]	0.485[a]
	(0.677)	(0.678)	(0.111)	(0.111)	(0.077)	(0.075)
Foreign	21.400[a]	21.875[a]	0.336	0.338	0.595[b]	0.560[b]
	(2.055)	(2.048)	(0.252)	(0.253)	(0.234)	(0.231)
Leverage(t-1)	-31.352[a]	1,010.506[a]	-0.568	-4.356	-1.063	-0.859
	(3.491)	(3.499)	(0.910)	(6.480)	(0.925)	(7.786)
Leverage(t-1) x Creditor rights	13.847[a]		0.463		0.676	
	(1.782)		(0.474)		(0.503)	
Leverage(t-1) x Enforcement days		-167.777[a]		0.746		0.160
		(0.579)		(1.069)		(1.265)
Heckman's lambda					1.194[b]	1.015[c]
					(0.540)	(0.535)
Estimation	Two-limit Tobit		OLS		Heckman Model	
Observations	4,702	4,702	681	681	2,135	2,135
Excluded variable					ISO certification	
R-squared			0.579	0.579		

Notes: Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies. Error correction for correlation at the country-industry level and for firm-level cluster correlation in the pooled tobit estimations. First-stage Probit estimates in the Heckman Model are not reported, but can be made available upon request.

some evidence for selection into capital importing. However, the financial variables are not significant throughout columns 3 to 6, which casts doubt on the idea that credit constraints also are important for the intensive capital import margin.

More generally, the results presented in Table 6 are ambiguous with regard to financial variables, whereas the size, capital intensity and productivity proxies have mostly a significant positive impact on the intensive import margin. This implies that the amount invested in imported capital goods may depend more on efficiency or profitability of the foreign technology adoption than on credit constraints. From a policy perspective, cutting import tariffs for more advanced capital goods may be a better option than extending trade finance when the goal is to increase the imported value of capital goods. On the other hand, credit constraints and the quality of financial institutions strongly matter for the decision to import capital goods in the first place. This suggests that fixed costs of technology adoption play a decisive role in this case.

7 Robustness Checks and Additional Results

7.1 Panel specifications, instrumental variables and subsample estimations

Using various tests, this section aims to check the robustness of the evidence regarding the importance of finance for the decision to import capital goods. For this purpose, columns 1 and 2 of Table 7 report the estimations of a panel specified as a linear probability model with fixed effects. The employed unbalanced panel only consists of two time periods; nonetheless, the available degrees of freedom allow us to include firm fixed effects to control for unobserved heterogeneity at the firm level. Interestingly, the fixed effects capture the entire effect of productivity, size and capital intensity as the corresponding variables in columns 1 and 2 are not significant anymore. In contrast, leverage has a significant negative marginal effect on the capital import probability, but providing more creditor rights weakens this adverse relationship between leverage and import propensity substantially, as column 1 displays. Similar results are obtained in column 2 - in which one can read that faster legal enforcement may reduce the negative impact of firm leverage on capital imports through credit constraints. The leverage and the related interaction with the enforcement variable are at the margin of the 10%-significance level, which is remarkable given that the other firm characteristics are far from being significant. It should be noted that we also control for the firm's liquidity ratio and the associated interactions in these panel specifications. In sum, in the first two columns the panel models show that the significance and magnitudes of the estimated coefficients of the financial variables are comparable to the pooled Probits (see columns 1 and 2 of Table 3), strengthening the case for a positive effect of strong credit market institutions on access to finance.

We employ instrumental variable estimations in the linear probability model of the columns 3 and 4 to further mitigate the concern that our results are driven by omitted third factors. The lagged leverage variable and its interaction with *Creditor rights* (in column 3) and *Enforcement days* (in column 4) are instrumented by the two period lag of the current period leverage and the *Leverage(t-2) x Creditor rights* interaction. Furthermore, we also use the log age of the firm and a dummy that equals one for a firm that employs an external auditor to review its financial statements as additional instruments. The null of valid instruments in the overidentifying restriction test cannot be rejected as indicated by the heteroskedastic and clustered errors consistent Hansen J statistic and the p-value. In

Table 7: Robustness checks: panel specifications, 2SLS and R&D intensity

Dependent variable	Dummy=1 if firm imports capital goods in t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R&D Intensity					*Low*	*High*	*Low*	*High*
Log productivity(t-1)	0.003	0.004	0.008	0.010	0.017	0.010	0.020	0.011
	(0.013)	(0.013)	(0.008)	(0.008)	(0.014)	(0.016)	(0.014)	(0.016)
Log employment(t-1)	0.013	0.013	0.059[a]	0.061[a]	0.077[a]	0.089[a]	0.078[a]	0.089[a]
	(0.032)	(0.032)	(0.009)	(0.009)	(0.009)	(0.011)	(0.009)	(0.011)
Log capital intensity(t-1)	-0.029	-0.029	0.022[a]	0.021[a]	0.023[c]	0.046[a]	0.021	0.044[a]
	(0.020)	(0.020)	(0.007)	(0.007)	(0.013)	(0.015)	(0.013)	(0.015)
Foreign			0.085[a]	0.086[a]	0.084[c]	0.072[b]	0.088[c]	0.073[b]
			(0.026)	(0.025)	(0.051)	(0.034)	(0.051)	(0.034)
Liquidity ratio(t-1)	0.137	-0.049						
	(0.136)	(1.314)						
Leverage(t-1)	-0.420[b]	2.964	-0.225[b]	3.058[b]	-0.220[c]	-0.444[a]	3.133[a]	3.784[a]
	(0.180)	(1.879)	(0.102)	(1.420)	(0.122)	(0.152)	(1.185)	(1.296)
Liquidity ratio(t-1) x Creditor rights	0.010							
	(0.070)							
Liquidity ratio(t-1) x Enforcement Days		0.034						
		(0.218)						
Leverage(t-1) x Creditor rights	0.226[b]		0.112[c]		0.119[c]	0.226[a]		
	(0.104)		(0.057)		(0.066)	(0.076)		
Leverage(t-1) x Enforcement days		-0.493		-0.506[b]			-0.519[a]	-0.633[a]
		(0.310)		(0.232)			(0.196)	(0.216)
Estimation	Within		2SLS		Pooled Probit			
Observations	5,305	5,305	2,681	2,681	3,220	1,908	3,220	1,908
Firm fixed effects	yes	yes	no	no	no	no	no	no
R-squared / Pseudo-R-squared (Probit)	0.009	0.008	0.391	0.392				
Hansen J statistic			0.809	0.862				
Hansen J p-value			0.667	0.6499				
Kleinbergen-Paap (KP) statistic			1303.043	81.341				
Critical KP statistic value (5%)			11.04	11.04				

Notes: Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Robust standard errors in parentheses. Leverage (t-1), its interaction with Creditor rights and Enforcement days are instrumented by Leverage (t-2), a second lag of Leverage x Creditor rights, an external auditor dummy and the log age of the firm. 2SLS and pooled Probit specifications include country-industry, country, industry and year dummies. The linear probability panel model (column 1 and 2) contains firm fixed effects and year dummies. Error correction for correlation at the country-industry level and firm-level clustering. Critical KP statistic value (5%) indicate the threshold for rejecting weak identification (H_0) allowing for 5% relative 2SLS bias.

addition, the reported Kleinbergen-Paap statistic, which is a robust F-statistic of the first-stage regression, confirms that weak identification is not a problem. This suggests that our chosen set of instruments is adequate. Using 2SLS estimations, we obtain the estimated coefficients of the instrumented financial variables in columns 3 and 4. The results are encouraging and in line with hypothesis 1 because their magnitudes are almost the same as the corresponding marginal effects in the baseline regressions of Table 3, despite their higher standard errors from 2SLS estimations.

The following identification of the unobservable firm credit constraints relies upon the higher riskiness of investments in firms belonging to R&D intensive industries. Egger and Keuschnigg (2010) point out that R&D intensive firms use more intangible and not collateralizable assets such as human capital and specialized equipment. In terms of the theoretical model in Section 3, these firm characteristics increase agency problems and thus reduce the fraction θ of operating profits lenders accept as credibly pledgeable (see also Matsuyama, 2005). Empirically, one should therefore observe a greater importance of a firm's balance sheet conditions and a country's credit market institutions for firms operating in R&D intensive sectors. This expectation is met by the data presented in columns 5 to 8 of Table 7 in which we divide the sample according to the sample median of the R&D intensity variable (R&D spending over sales) from Kroszner et al. (2007). The firm's financial situation, which is proxied by leverage, and the financial interaction terms exert a larger and more significant effect on the capital import probability in sectors with a high R&D intensity as opposed to less innovative sectors (compare columns 6 to 5 and 8 to 7). As a consequence, more R&D intensive firms seem to particularly benefit from the development of credit market institutions.

7.2 The importance of sunk importing costs

Firms that import capital goods for the first time are likely to incur higher fixed (sunk) costs compared to incumbent capital importers. First-time importers must first find an adequate foreign supplier, negotiate a contract, adapt the production process to the new foreign technology, learn to use the new technology efficiently and so on. Follow-up purchases of capital goods may involve lower fixed costs as incumbents already have experience with upgrading technology along with lower costs due to established relations with foreign suppliers. As a result, credit constraints may be more severe for first-time capital importers. This is what we test in this section and is presented in Table 8.

For this purpose, we include the lagged importer status in all specifications. Indeed, in all specifications having been a capital importer in the previous year significantly increases the probability of capital imports a year later (columns 1 to 8). The inclusion of the lagged importer status halves the size of the effects of the financial variables in the first two columns compared to the corresponding results. In addition, significance reduces remarkably. In the next step, the financial variables are interacted with the lagged importer status. The results are displayed in columns 3 to 5. Although relatively imprecisely estimated, the results suggest that improved financial conditions at the firm- and country-level matter most for firms that are new importers of specific capital goods. Consequently, this evidence supports the idea that credit constraints are more prevalent among new capital importers implying that institutional development is especially beneficial for this subset of firms.

Columns 6 and 7 show Arellano-Bond GMM estimations of the dynamic specification that includes the lagged importer status and, importantly, also allows for firm fixed effects. The instrument vector for the first-differenced regressors contains the second order lags of current regressors, as customary for this GMM framework. The appropriate overidentifying restriction tests are implemented and the null hypothesis, which states that the moment conditions are correct, cannot be rejected. Unfortunately, we cannot test the no second order error autocorrelation condition needed for consistent estimates due to limited sample periods. Taking this into account, the point estimates of the financial variables remain consistent with hypothesis 1 despite being non-significant like all of the other regressors, except the lagged importer status. This strengthens the robustness of our results since in this framework we control for unobserved heterogeneity and endogeneity of all regressors

Table 8: Controlling for past capital importer status

Dependent variable	Dummy=1 if firm imports capital goods in t						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Importer(t-1)	0.705[a]	0.705[a]	0.730[a]	0.728[a]	0.723[a]	0.218[b]	0.217[b]
	(0.017)	(0.017)	(0.033)	(0.034)	(0.035)	(0.917)	(0.910)
Log productivity(t-1)	0.000	0.001	-0.001	0.002	-0.000	-0.005	-0.006
	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.018)	(0.018)
Log employment(t-1)	0.049[a]	0.049[a]	0.049[a]	0.049[a]	0.050[a]	-0.025	-0.025
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.042)	(0.042)
Log capital intensity(t-1)	0.019[b]	0.019[b]	0.022[a]	0.018[b]	0.019[b]	-0.027	-0.027
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.030)	(0.030)
Foreign	0.038	0.039[c]	0.040	0.040[c]	0.037		
	(0.024)	(0.024)	(0.025)	(0.024)	(0.025)		
Leverage(t-1)	-0.153[c]	1.471[c]	-0.211[b]	1.086	-0.108	-0.308	1.571
	(0.088)	(0.875)	(0.107)	(0.939)	(0.074)	(0.287)	(3.116)
Leverage(t-1) x Importer(t-1)			0.073	0.764	0.175		
			(0.133)	(1.000)	(0.107)		
Leverage(t-1) x Creditor rights	0.088[c]		0.121[b]			0.177	
	(0.047)		(0.055)			(0.173)	
Leverage(t-1) x Creditor rights x Importer(t-1)			-0.065				
			(0.056)				
Leverage(t-1) x Enforcement days		-0.242[c]		-0.175			-0.258
		(0.145)		(0.156)			(0.512)
Leverage(t-1) x Enforcement days x Importer(t-1)				-0.136			
				(0.166)			
Leverage(t-1) x Private credit/GDP					0.154[b]		
					(0.078)		
Leverage(t-1) x Private credit/GDP x Importer(t-1)					-0.275[a]		
					(0.088)		
Estimation	Pooled Probit					Dynamic GMM	
Observations	4,566	4566	4,667	4,566	4,566	1,954	1,954
Firm fixed effects	no	no	no	no	no	yes	yes
Pseudo-R-squared	0.538	0.538	0.552	0.538	0.540	.	.

Notes: Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and heteroskedastic-robust standard errors in parentheses. Pooled Probit specifications include country-industry, country, industry and year dummies. Dynamic GMM estimations (Arellano-Bond) employ second order lags of regressors to instrument for first-differences of all regressors and the lagged importer status denoted by Importer(t-1) and also contain year dummies.

and past importer experience.[31]

7.3 Additional credit constraints proxies and firm characteristics

Table 9 presents a set of results using two additional credit constraints proxies; *Property ratio* defined as the share of land and property of total assets and the *Log firm age.* Property is arguably the best collateral a firm can offer to a potential lender, so firms owning more property should be less credit constrained. Similarly, older firms have had time to build up a reputation and to establish relationships with investors, which arguably leads to better access to external finance. While firms owning more property seem to be less constrained by credit markets, particularly in countries with weaker institutions, the imprecisely estimated results do not convincingly support the view of a relationship between firm age, financing and capital import probability.[32]

Next, we test the sensitivity of our results to the inclusion of additional firm characteristics. In particular, we include characteristics related to the level of human capital embodied in the production workers and management as well as the ISO certification dummy and the foreign input share. Importantly, Table 10 shows that the main conclusions drawn previously in the paper are not altered by the additional firm characteristics. The estimated coefficients of the finance variables remain almost unaffected in size and significance. Somewhat surprisingly, the human capital variables do not have a significant influence on the capital import probability, whereas ISO certified firms and firms with a higher share of foreign inputs are more likely to source capital goods from abroad.

[31]Furthermore, unreported results show that *Leverage(t-1)* and the *Leverage(t-1) x Creditor rights* interaction are the only regressors (except the lagged importer status) that achieve significance at the 10%-level if the regressors are not instrumented and thus are more accurately estimated.

[32]Nonetheless, the log firm age variable and their institutional interactions display the expected coefficients signs.

Table 9: Alternative credit constraints proxies and the capital import probability

Dependent variable	Dummy=1 if firm imports capital goods in t					
	(1)	(2)	(3)	(4)	(5)	(6)
Log productivity(t-1)	-0.012	-0.014	-0.013	0.014	0.014	0.012
	(0.018)	(0.018)	(0.018)	(0.011)	(0.011)	(0.009)
Log employment(t-1)	0.085[a]	0.085[a]	0.085[a]	0.080[a]	0.080[a]	0.074[a]
	(0.012)	(0.012)	(0.012)	(0.008)	(0.008)	(0.007)
Log capital intensity(t-1)	0.038[b]	0.036[b]	0.037[b]	0.029[a]	0.029[a]	0.030[a]
	(0.018)	(0.017)	(0.017)	(0.010)	(0.010)	(0.009)
Foreign	0.157[a]	0.157[a]	0.156[a]	0.097[a]	0.096[a]	0.088[a]
	(0.045)	(0.045)	(0.045)	(0.030)	(0.030)	(0.028)
Property ratio(t-1)	0.995[a]	-10.663[b]	3.913[b]			
	(0.324)	(5.032)	(1.543)			
Log firm age				0.025	-0.154	0.168[c]
				(0.033)	(0.299)	(0.087)
Property ratio(t-1) x Creditor rights	-0.545[a]					
	(0.165)					
Property ratio(t-1) x Enforcement days		1.796[b]				
		(0.848)				
Property ratio(t-1) x Accounting standards			-0.059[b]			
			(0.023)			
Log firm age x Creditor rights				-0.016		
				(0.017)		
Log firm age x Enforcement days					0.025	
					(0.049)	
Log firm age x Accounting standards						-0.003[b]
						(0.001)
Observations	1,894	1,894	1,891	5,125	5,125	4,870
Pseudo-R-squared	0.186	0.181	0.181	0.261	0.261	0.186

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and heteroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

Table 10: Additional firm characteristics and the capital import probability

Dependent variable	Dummy=1 if firm imports capital goods in t			
	(1)	(2)	(3)	(4)
Log productivity(t-1)	0.009	0.009	0.009	0.008
	(0.011)	(0.011)	(0.011)	(0.011)
Log employment(t-1)	0.058[a]	0.058[a]	0.058[a]	0.058[a]
	(0.008)	(0.008)	(0.008)	(0.008)
Log capital intensity(t-1)	0.020[b]	0.020[b]	0.020**	0.021[b]
	(0.010)	(0.010)	(0.010)	(0.010)
Foreign	0.077[b]	0.077[b]	0.078[b]	0.076[b]
	(0.032)	(0.032)	(0.032)	(0.032)
Leverage(t-1)	-0.290[a]	2.754[a]	-0.964[a]	-0.188[b]
	(0.091)	(0.796)	(0.278)	(0.073)
Leverage(t-1) x Creditor rights	0.165[a]			
	(0.048)			
Leverage(t-1) x Enforcement days		-0.454[a]		
		(0.132)		
Leverage(t-1) x Accounting standards			0.015[a]	
			(0.004)	
Leverage(t-1) x Private credit/GDP				0.228[a]
				(0.078)
Liquidity ratio(t-1)	-0.097[a]	-0.097[a]	-0.099[a]	-0.093[a]
	(0.036)	(0.036)	(0.036)	(0.036)
share workforce with university degree	-0.001[b]	-0.001[b]	-0.001[b]	-0.001[a]
	(0.001)	(0.001)	(0.001)	(0.001)
CEO graduate degree	-0.003	-0.003	-0.003	-0.004
	(0.028)	(0.028)	(0.028)	(0.028)
skilled share of production workers	-0.015	-0.014	-0.015	-0.012
	(0.027)	(0.027)	(0.027)	(0.027)
ISO certification	0.085[a]	0.085[a]	0.085[a]	0.086[a]
	(0.022)	(0.022)	(0.022)	(0.022)
Foreign input share	0.001[a]	0.001[a]	0.001[a]	0.001[a]
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	3,433	3,433	3,433	3,433
Pseudo-R-squared	0.177	0.177	0.177	0.176

Notes: Estimation: Pooled Probit. Marginal effects at means are reported.

Significance levels: [a]1%, [b]5%, [c]10%.

Firm-level cluster- and heteroskedastic-robust standard errors in parentheses.

All specifications include country-industry, country, industry and year dummies.

7.4 Further robustness checks

In this section we conduct further robustness checks along various dimensions. The corresponding Tables can be found in the Appendix 9.3.

In Table 11 we shed some light on whether foreign ownership affects financial constraints along the lines of Manova et al. (2009) and whether larger firms have better access to financial resources. Although the coefficients of the variables of interest enter the regressions with the expected signs, they are not statistically significant.

We also check whether the results depend on the inclusion of a specific country. Consequently, in every regression we successively excluded one country. Table 12 is reassuring because the size and significance of the displayed coefficients are not driven by a particular country. Even dropping overrepresented countries such as Thailand or Brazil does not substantially affect the estimates, which remain remarkably similar to the benchmark results.

In the next robustness check, displayed in Table 13, further interactions terms between country characteristics - which are likely to be correlated with credit market institutions - and firm leverage are added to the estimating equation. Specifically, in these additional interaction terms we control for the rule of law, the average years of schooling and for proxies related to the level of economic development and performance, such as GNI per capita, GDP per capita growth and the average inflation rate. Although the coefficients of the leverage variables in the regressions with creditor rights in columns 1 to 4 become expectedly less precise, the coefficient signs stay unaffected. Furthermore, aside from column 2, in which the schooling level does indeed somewhat reduce the impact of creditor rights on credit constraints, the magnitudes of the *Leverage(t-1) x Creditor rights* coefficients are not affected much. The results in columns 5 to 8 with *Leverage(t-1) x Enforcement days* are even more convincing as the significance and size of the coefficients of interests do not considerably change.

Table 14 presents the probit regressions including the effectively applied MFN import tariffs for machinery & equipment in every country taken from the UNCTAD-TRAINS database. Controlling for capital import tariffs is potentially important since lower import tariffs may coincide with strong institutions within a country and thus bias the institutions' effect on credit constraints upward. This hypothesis, however, is not supported by the estimations shown in Table 14. The coefficients of the interaction terms are only slightly affected by

adding import tariffs.[33]

Next, all firm characteristics are interacted with the credit market institutions simultaneously. Nonetheless, the size and significance of the leverage interaction remain unchanged, while in the vast majority of cases the other interactions are insignificant (see Tables 15 and 16). This indicates that credit constraints are mainly driven by firm leverage in our baseline specification, as theoretically derived.

Table 17 shows sample sensitivity tests with regard to the liquidity ratio and leverage. In the first column the full sample is used, which also contains insolvent firms and firms with inconsistent liquidity ratios above one. As a result, the importance of finance and institutional variables is dramatically reduced, but they still exert a significant effect on the capital import propensity. Restricting the sample to firms with liquidity ratios under one does not alter the picture, as one can note from the second column. Despite also using observations with liquidity ratios above one, column 3 employs only solvent firms[34] and column 4 a weighting scheme inversely related to the leverage for insolvent firms. Importantly, these regressions convey that the magnitude of the leverage coefficients crucially depend on the exclusion of still operating but insolvent firms. This is intuitively appealing in the sense that there is no reason that the leverage and financial institutions should affect credit constraints or the probability of obtaining credit for already insolvent firms. In the next regressions, displayed in columns 5 to 7, *Creditor rights* is replaced by *Enforcement days*, but the key insight that marginal changes of a firm's financial situation and of interactions with institutions may only play a role within certain value ranges still holds.

Next, the additional control variable *Size of second-hand market* is added to control for the availability of used capital goods within a country and sector. As expected, the main results remain unaffected because the principal variation of this factor at the sectoral level within a country is already picked up by the time-invariant country-sector dummies (see Table 18).

Finally, we use another set of fixed effects. Specifically, we add a time dimension to country-industry fixed effects in the pooled probit regressions. This controls for sharp changes in exchange rates that are not entirely captured by the previous set of fixed effects employed in the baseline specification. However, the results are not influenced by these additional dummy variables, as can be inferred from Table 19.

[33] As stated in Section 5.2, the main effect of capital import tariffs on the capital import probability is taken into account by the country-sector dummies.

[34] This substantially reduces the sample by about 10%.

8 Conclusions

The results indicate that a country's institutional development of the credit market matters mainly for the extensive import margin, i.e. for the decision to import capital goods. In particular, first-time capital importers seem to benefit from stronger credit market institutions, which suggests that fixed and sunk costs of capital imports are considerable. Similarly, credit constraints are found to be more severe among firms belonging to R&D intensive sectors. In turn, this means again that reforming credit market institutions improves access to external finance, especially for this subset of innovative firms. This finding corroborates the view that our financial variables capture credit constraints and the (potential) availability of funding. This is because R&D intensive firms should be more sensitive to the firm leverage and the quality of institutions as a result of higher agency costs. The extensive margin results are impervious to various robustness tests, such as 2SLS estimation, controlling for unobserved firm heterogeneity, past importer status and additional country characteristics among others. In addition, the results are not driven by a particular country. Furthermore, there is no one institution that clearly emerges as the most important, but the analysis suggests that legal investor protection and the efficiency of debt enforcement before court complement each other to be fully effective at reducing credit constraints.

This paper is the first to empirically support the argument that providing legal investor protection, a more efficient enforcement of debt contracts and higher accounting standards reduce firm-level credit constraints for adopting a foreign technology embodied in capital goods imports. This is an important policy finding because importing advanced foreign machinery and equipment is likely to increase the productivity of firms located in developing countries. Moreover, development countries may also benefit from positive externalities stemming from the adoption of more advanced foreign technologies

Concerning the intensive import margin, the results are more ambiguous. While financial limitations are not found to play an important role for the absolute amount invested in capital imports, the regressions show that firms located in countries with stronger credit market institutions devote a higher share of their capital spendings to imports. This subtle finding may also point to the importance of the additional fixed costs involved with sourcing capital goods from abroad, which prevents firms from entry into foreign markets for machinery and equipment. Next, this paper does not find an effect of finance on the import propensity of intermediate goods whose fixed costs of importing are assumed to

be lower. This implies that cutting import tariffs is a more appropriate policy measure to increase intermediate and capital goods imports, while institutional development of the credit market allows firms to finance the fixed costs of technology upgrade associated with capital goods imports.

The robustness check regarding the sample selection sensitivity suggests that the relationship between credit constraints, institutional development and innovation activities may be nonlinear and dependent on the level of financial and institutional variables at the firm- and country-level. This could be a fruitful area for theoretical research. However, in future empirical research the precise estimation of such nonlinear effects would require larger samples with more firms and countries; especially to increase the variation of the institutional indicators at the country-level.

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9 Appendix

9.1 Credit constrained innovators

Proposition: *If* $\frac{\gamma_h^{\sigma-1}-1}{\gamma_h^{\sigma-1}}\left(\frac{f}{f_h}+1\right)>\theta$ *holds, then there exists a subset of credit constrained firms (denoted by* Ω*) in a specific country, that could profitably import capital goods, but do not obtain the required external finance.*

Proof. *This proposition is proved by substituting equation (11) into the left-hand side of inequality* $\overline{\varphi}_h(\theta,\omega)>\varphi_h^*=\frac{1}{P\rho}\left(\frac{\sigma f_h}{E(\gamma^{\sigma-1}-1)}\right)^{\frac{1}{\sigma-1}}$ *and setting firms' wealth* ω *to zero.* $\overline{\varphi}_h(\theta,\omega=0)>\varphi_h^*$ *is a necessary and sufficient condition for* Ω *to be non-empty and will hold if the above condition in the proposition is met.*

It is assumed that these conditions are satisfied.

9.2 Data

Variable	Description
Credit constraints proxies:	
Liquidity ratio	Current assets over total assets.
Leverage	Total debt over total assets.
Property ratio	Share of land and property of total assets.
Log firm age	Logarithm of the firm age.
Firm characteristics:	
Log productivity	Logarithm of value added per employee.
Log employment	Logarithm of the number of employees.
Log capital intensity	Logarithm of total assets per employee.
Foreign	A dummy variable that equals one if at least 50% of the firm is owned by foreigners and zero otherwise.
share workforce with university degree	percentage share of the workforce with a university degree.
Log R&D spending/sales	Logarithm of R&D spending over total sales.
CEO graduate degree	A dummy variable that equals one if the CEO of the firm obtained a post graduate degree (PhD, Masters) and zero otherwise.
skilled share of production workers	share of production workers reported as skilled to total production workers.
Foreign input share	percentage share of the use of foreign inputs to total inputs.
ISO certification	A dummy variable that equals one if the firm has a ISO certification and zero otherwise.
	Source of firm-level variables: World Bank Enterprise Surveys (2002-2005).
Credit market Institutions:	
Creditor rights	An index ranging from 0 (weak creditor rights) to 4 (strong creditor rights). A score of one is given if the following rights are legally adopted by a country: *(I)* There are restrictions, such as creditor consent or minimum dividends, to file for bankruptcy. *(II)* Secured creditors are able to seize their collateral if a firm reorganization is approved (no automatic stay or asset freeze). *(III)* Secured creditors are the first to be paid out of the liquidated assets of a bankrupt firm. *(IV)* If the debtor does not retain the management of the firm during the reorganization. Data is averaged over the period from 1999 to 2003. *Source:* Djankov et al. (2007).

(continued)

Variable	Description
Enforcement days	The logarithm number of days it takes to enforce a debt contract worth 50% of a country's GDP per capita before court, constructed as of January 2003. *Source:* Djankov et al. (2007).
Accounting standards	Index from 1 to 90 created by the Center for International Financial Analysis and Research (CIFAR), constructed by rating a cross-section of a country's firms' 1995 annual reports on the inclusion and omission of 90 items that fall into 7 categories such as general information, income statement, balance sheets, funds flow statement, accounting standards, stock data and special items. *Source:* Bushman et al. (2004).
Private credit	Private credit volume from banks and other financial institutions extended to the domestic sector over the country's GDP. Data is averaged over the period from 1999 to 2003. *Source:* Beck et al. (2009).
Private bureau	A dummy variable that equals one if a private credit bureau operates in a country and zero otherwise. The credit bureau provides information about a firm's credit history and its current financial situation. *Source:* Djankov et al. (2007).
Public registry	A dummy variable that equals one if a public credit registry operates in a country and zero otherwise. The credit registry ran by public authorities provides information about a firm's credit history and its current financial situation. *Source:* Djankov et al. (2007).
Country characteristics:	
Rule of law	A composite index from -2.5 to +2.5 that captures perceptions of the extent to which citizens have confidence in a country's rule of law, in particular the efficiency of contract enforcement, property rights enforcement, the police, the courts, as well as the probability of crime and violence. Average from the biannual data from 1998 to 2002. *Source:* Government IV database (1996-2002) from the World Bank (Kaufmann et al., 2003).

(continued)

Variable	Description
Average years of schooling	Average years of schooling of people older than 25 within a country for the year 2000. *Source:* Barro and Lee (2001).
Log average GNP per capita	The logarithm of the gross national product averaged from 2001 to 2003. *Source:* World Development Indicators.
Mean GDP per capita growth	Average growth rate of the gross domestic product per capita from 1999 to 2003. *Source:* World Development Indicators.
Average inflation rate	Average inflation rate over the period from 1999 to 2003. *Source:* World Development Indicators.
Sectoral characteristics:	
capital import tariffs	The effectively applied most favored nation (MFN) import tariffs for the machinery and other equipment sector in a country (SITC Rev. 3 code 7). *Source:* UNCTAD-TRAINS database.
Size of second-hand market	Total sectoral expenses on domestic second-hand capital goods over sectoral revenues of a country's sector. It is a proxy for the availability of used domestic capital goods and the size of the sectoral second-hand market for capital goods within a country. *Source:* World Bank Enterprise Surveys (2002-2005).

9.3 Tables

Table 11: Foreign ownership, employment and the capital import probability

Dependent variable	Dummy=1 if firm imports capital goods in t					
	(1)	(2)	(3)	(4)	(5)	(6)
Log productivity(t-1)	0.014	0.014	0.012	0.013	0.014	0.011
	(0.011)	(0.011)	(0.009)	(0.010)	(0.011)	(0.009)
Log employment(t-1)	0.080[a]	0.081[a]	0.074[a]	0.108[a]	-0.076	0.208[a]
	(0.007)	(0.007)	(0.006)	(0.022)	(0.219)	(0.063)
Log capital intensity(t-1)	0.030[a]	0.030[a]	0.032[a]	0.030[a]	0.030[a]	0.031[a]
	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.009)
Foreign	0.172[c]	0.081	0.472[c]	0.096[a]	0.097[a]	0.089[a]
	(0.094)	(0.864)	(0.286)	(0.030)	(0.030)	(0.027)
Leverage(t-1)	-0.017	-0.017	-0.010	-0.019	-0.020	-0.013
	(0.031)	(0.031)	(0.028)	(0.031)	(0.031)	(0.028)
Foreign x Creditor rights	-0.035					
	(0.041)					
Foreign x Enforcement days		0.002				
		(0.130)				
Foreign x Accounting standards			-0.004			
			(0.003)			
Log employment(t-1) x Creditor rights				-0.015		
				(0.012)		
Log employment(t-1) x Enforcement days					0.026	
					(0.036)	
Log employment(t-1) x Accounting standards						-0.002[b]
						(0.001)
Observations	5,128	5,128	4,871	5,128	5,128	4,871
Pseudo-R-squared	0.262	0.261	0.185	0.262	0.262	0.187

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and heteroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

Table 12: Dropping countries one by one

Dependent Variable	Dummy=1 if firm imports capital goods in t							
	full sample	W/O THA	W/0 BRA	W/O IND	W/O IDN	W/O PHI	W/O RSA	W/O SRI
(1) Leverage(t-1)	-0.283[a]	-0.303[a]	-0.225	-0.281[a]	-0.260[a]	-0.351[a]	-0.222[c]	-0.278[a]
	(0.096)	(0.111)	(0.154)	(0.095)	(0.086)	(0.104)	(0.116)	(0.094)
Leverage(t-1) x Creditor rights	0.151[a]	0.170[a]	0.126[c]	0.150[a]	0.143[a]	0.179[a]	0.107	0.153[a]
	(0.050)	(0.060)	(0.074)	(0.050)	(0.045)	(0.053)	(0.067)	(0.050)
(2) Leverage(t-1)	3.278[a]	3.715[a]	3.962[a]	3.245[a]	2.749[a]	3.303[a]	3.022[b]	3.284[a]
	(0.882)	(1.072)	(1.429)	(0.876)	(0.807)	(0.863)	(1.195)	(0.874)
Leverage(t-1) x Enforcement days	-0.545[a]	-0.614[a]	-0.660[a]	-0.539[a]	-0.457[a]	-0.548[a]	-0.504[b]	-0.546[a]
	(0.146)	(0.176)	(0.240)	(0.145)	(0.134)	(0.143)	(0.196)	(0.145)
(3) Leverage(t-1)	-0.792[a]	-0.882[a]	-0.654	-0.789[a]	-0.792[a]	-0.777[a]	-0.599[c]	-0.983[a]
	(0.259)	(0.299)	(0.436)	(0.257)	(0.259)	(0.246)	(0.314)	(0.277)
Leverage(t-1) x Accounting Standards	0.012[a]	0.013[a]	0.010	0.012[a]	0.012[a]	0.012[a]	0.009[c]	0.015[a]
	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)

Notes: Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Robust standard errors in parentheses. Specifications (1) to (3) are pooled probit estimations including firm characteristics (Log productivity, Log employment, Log capital intensity and Foreign) but suppressed in the Table. All specifications include country-industry, country, industry and year dummies. Error correction for firm-level cluster correlation. W/O= without, THA=Thailand, BRA=Brazil, IND=India, IDN=Indonesia, PHI=Philippines, RSA= Republic of South Africa SRI=Sri Lanka.

Table 13: Additional country characteristics

Dependent variable	Dummy=1 if firm imports capital goods in t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log productivity(t-1)	0.015	0.016	0.014	0.015	0.017	0.017	0.017	0.017
	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.010)
Log employment(t-1)	0.082[a]	0.082[a]	0.082[a]	0.082[a]	0.083[a]	0.082[a]	0.082[a]	0.082[a]
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Log capital intensity(t-1)	0.030[a]	0.029[a]	0.030[a]	0.029[a]	0.028[a]	0.028[a]	0.028[a]	0.028[a]
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Foreign	0.094[a]	0.096[a]	0.095[a]	0.095[a]	0.095[a]	0.096[a]	0.096[a]	0.097[a]
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Leverage(t-1)	-0.191	-0.565[a]	-0.302[b]	-0.076	2.719[b]	4.378	3.234[a]	3.455[a]
	(0.121)	(0.180)	(0.129)	(0.186)	(1.102)	(2.771)	(0.893)	(0.986)
Leverage(t-1) x Creditor rights	0.101	0.089	0.150[a]	0.167[a]				
	(0.065)	(0.063)	(0.050)	(0.055)				
Leverage(t-1) x Enforcement days					-0.452[b]	-0.695[c]	-0.543[a]	-0.568[a]
					(0.182)	(0.387)	(0.146)	(0.164)
Leverage(t-1) x Rule of law	0.197				0.131			
	(0.165)				(0.156)			
Leverage(t-1) x Average years of schooling		0.065[c]				-0.032		
		(0.037)				(0.077)		
Leverage(t-1) x Log average GNI per capita (01-03)			0.000				0.000	
			(0.000)				(0.000)	
Leverage(t-1) x Mean GDP p. cap. growth (99- 03)				-0.056				-0.012
				(0.046)				(0.044)
Leverage(t-1) x Average inflation rate (1999-03)				-0.019				-0.001
				(0.015)				(0.015)
Observations	5,128	5,128	5,128	5,128	5,128	5,128	5,128	5,128
Pseudo-R-squared	0.264	0.264	0.264	0.264	0.265	0.265	0.265	0.265

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and heteroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

Table 14: Controlling for import tariffs

Dependent variable	Dummy=1 if firm imports capital goods in t		
	(1)	(2)	(3)
Log productivity(t-1)	0.015	0.016	0.013
	(0.011)	(0.010)	(0.009)
Log employment(t-1)	0.082[a]	0.082[a]	0.075[a]
	(0.007)	(0.007)	(0.006)
Log capital intensity(t-1)	0.029[a]	0.028[a]	0.031[a]
	(0.010)	(0.010)	(0.009)
Foreign	0.095[a]	0.096[a]	0.086[a]
	(0.030)	(0.030)	(0.027)
Leverage(t-1)	-0.196	3.755[a]	-0.764[c]
	(0.147)	(1.070)	(0.402)
Leverage(t-1)x Capital import tariffs	-0.008	0.009	-0.001
	(0.010)	(0.012)	(0.011)
Leverage(t-1) x Creditor rights	0.138[a]		
	(0.053)		
Leverage(t-1) x Enforcement days		-0.636[a]	
		(0.187)	
Leverage(t-1) x Accounting standards			0.012[b]
			(0.005)
Observations	5,125	5,125	4,871
Pseudo-R-squared	0.263	0.264	0.188

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and hetoroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

Table 15: Firm characteristics interactions with Creditor rights and Enforcement days

Dependent Variable	Dummy=1 if firm imports capital goods in t		
	(1)		(2)
Independent Variables		*Independent Variables*	
Log productivity(t-1)	0.044	Log productivity(t-1)	-0.510[c]
	(0.032)		(0.302)
Log employment(t-1)	0.115[a]	Log employment(t-1)	-0.157
	(0.023)		(0.226)
Log capital intensity(t-1)	-0.021	Log capital intensity(t-1)	0.377
	(0.028)		(0.274)
Foreign	0.132	Foreign	0.367
	(0.096)		(0.957)
Leverage(t-1)	-0.246[b]	Leverage(t-1)	3.366[a]
	(0.098)		(0.900)
Liquidity ratio(t-1)	-0.284[b]	Liquidity ratio(t-1)	0.445
	(0.114)		(1.063)
Liquidity ratio(t-1) x Creditor rights	0.110[c]	Liquidity ratio(t-1) x Enforcement Days	-0.090
	(0.061)		(0.176)
Leverage(t-1) x Creditor rights	0.133[a]	Leverage(t-1) x Enforcement days	-0.559[a]
	(0.051)		(0.149)
Log productivity(t-1) x Creditor rights	-0.016	Log productivity(t-1) x Enforcement days	0.087[c]
	(0.017)		(0.050)
Log employment(t-1) x Creditor rights	-0.018	Log employment(t-1) x Enforcement days	0.040
	(0.012)		(0.038)
Log capital intensity(t-1) x Creditor rights	0.030[c]	Log capital intensity(t-1) x Enforcement days	-0.058
	(0.015)		(0.045)
Foreign x Creditor rights	-0.021	Foreign x Enforcement days	-0.037
	(0.042)		(0.131)
Observations	5,128		5,128
Pseudo-R-squared	0.268		0.268

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and hetoroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

Table 16: Firm characteristics interactions with Accounting standards

Dependent variable	Dummy=1 if firm imports capital goods in t
	(1)
Log productivity(t-1)	0.108
	(0.082)
Log employment(t-1)	0.230[a]
	(0.064)
Log capital intensity(t-1)	-0.144[c]
	(0.075)
Foreign	0.388
	(0.311)
Leverage(t-1)	-0.774[a]
	(0.260)
Liquidity ratio(t-1)	-0.739[b]
	(0.312)
Liquidity ratio(t-1) x Accounting standards	0.010[b]
	(0.005)
Leverage(t-1) x Accounting standards	0.012[a]
	(0.004)
Log productivity(t-1) x Accounting standards	-0.001
	(0.001)
Log employment(t-1) x Accounting standards	-0.002[b]
	(0.001)
Log capital intensity(t-1) x Accounting standards	0.003[b]
	(0.001)
Foreign x Accounting standards	-0.003
	(0.003)
Observations	4,871
Pseudo-R-squared	0.195

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and hetoroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

Table 17: Sample selection sensitivity tests

Dependent variable	Dummy=1 if firm imports capital goods in t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log productivity(t-1)	0.014	0.013	0.017	0.014	0.014	0.014	0.014	0.018^{c}
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Log employment(t-1)	0.083^{a}	0.079^{a}	0.084^{a}	0.079^{a}	0.083^{a}	0.083^{a}	0.079^{a}	0.085^{a}
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Log capital intensity(t-1)	0.034^{a}	0.034^{a}	0.029^{a}	0.033^{a}	0.033^{a}	0.034^{a}	0.033^{a}	0.028^{a}
	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.010)
Foreign	0.090^{a}	0.086^{a}	0.095^{a}	0.091^{a}	0.094^{a}	0.090^{a}	0.086^{a}	0.096^{a}
	(0.026)	(0.027)	(0.029)	(0.027)	(0.027)	(0.026)	(0.027)	(0.029)
Leverage(t-1)	-0.074^{b}	-0.084^{b}	-0.240^{a}	-0.116^{b}	-0.106^{b}	0.357^{b}	0.477^{b}	3.229^{a}
	(0.032)	(0.035)	(0.092)	(0.046)	(0.045)	(0.163)	(0.201)	(0.821)
Leverage(t-1) x Creditor rights	0.024^{b}	0.027^{b}	0.128^{a}	0.043^{a}	0.040^{b}			
	(0.011)	(0.012)	(0.048)	(0.016)	(0.016)			
Leverage(t-1) x Enforcement days						-0.066^{b}	-0.085^{b}	-0.537^{a}
						(0.029)	(0.036)	(0.136)
Sample selection rule	No	Liquid <=1	Leverage<=1	Weights & Liquid<=1	Weights	No	Liquid <=1	Leverage<=1
Observations	6,171	5,896	5,516	5,896	6,171	6,171	5,896	5,516
Pseudo-R-squared	0.273	0.263	0.272	0.260	0.271	0.273	0.263	0.274

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Weights correspond to 1 for observations with non-negative equity and (1/ Leverage(t-1)) for observations with negative equity defined as Leverage(t-1)>1, Liquid=Liquidity ratio (t-1) variable.
Significance levels: ^{a}1%, ^{b}5%, ^{c}10%. Robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies. Error correction for firm-level cluster correlation.

Table 18: Controlling for the size of the second-hand capital goods market

Dependent variable	Dummy=1 if firm imports capital goods in t		
	(1)	(2)	(3)
Log productivity(t-1)	0.015	0.017	0.013
	(0.011)	(0.011)	(0.009)
Log employment(t-1)	0.082 [a]	0.083[a]	0.075[a]
	(0.007)	(0.007)	(0.006)
Log capital intensity(t-1)	0.029[a]	0.028[a]	0.031[a]
	(0.010)	(0.010)	(0.009)
Foreign	0.095[a]	0.096[a]	0.086[a]
	(0.030)	(0.030)	(0.027)
Size of second-hand market	0.003[b]	0.003[b]	0.002[b]
	(0.001)	(0.001)	(0.001)
Leverage(t-1)	-0.283[a]	3.281[a]	-0.792[a]
	(0.096)	(0.883)	(0.259)
Leverage(t-1) x Creditor rights	0.151[a]		
	(0.050)		
Leverage(t-1) x Enforcement days		-0.545[a]	
		(0.146)	
Leverage(t-1) x Accounting standards			0.012[a]
			(0.004)
Observations	5,128	5,128	4,871
Pseudo-R-squared	0.264	0.265	0.188

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and hetoroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.

Table 19: Adding country-industry-year dummies

Dependent variable	Dummy=1 if firm imports capital goods in t			
	(1)	(2)	(3)	(4)
Log productivity(t-1)	0.013	0.015	0.012	0.014
	(0.011)	(0.011)	(0.009)	(0.011)
Log employment(t-1)	0.081***	0.082***	0.075***	0.082***
	(0.007)	(0.007)	(0.006)	(0.007)
Log capital intensity(t-1)	0.030***	0.028***	0.032***	0.029***
	(0.010)	(0.010)	(0.009)	(0.010)
Foreign	0.096***	0.098***	0.087***	0.096***
	(0.030)	(0.030)	(0.028)	(0.030)
Leverage(t-1)	-0.263***	3.071***	-0.745***	-0.152**
	(0.097)	(0.897)	(0.262)	(0.062)
Leverage(t-1) x Creditor rights	0.137***			
	(0.051)			
Leverage(t-1) x Enforcement days		-0.511***		
		(0.149)		
Leverage(t-1) x Accounting standards			0.011***	
			(0.004)	
Leverage(t-1) x Private credit/GDP				0.189**
				(0.074)
Observations	5,095	5,095	4,841	5,095
Pseudo-R-squared	0.264	0.265	0.189	0.264

Notes: Estimation: Pooled Probit. Marginal effects at means are reported. Significance levels: [a]1%, [b]5%, [c]10%. Firm-level cluster- and hetoroskedastic-robust standard errors in parentheses. All specifications include country-industry, country, industry and year dummies.