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The Decision to Import Capital Goods in India: Firms' Financial Factors Matter

Maria Bas Antoine Berthou

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NON-TECHNICAL SUMMARY

Globalization is characterized by a significant increase in world imports of capital goods and intermediate inputs. In developing countries, a number of firms rely on capital goods and inputs from abroad since they are more efficient, sophisticated, and advanced in terms of technology relative to the domestic goods. Imports of foreign capital goods are expected to promote technological catch-up, increase productivity and economic growth.

The objective of this article is to study how financial constraints in developing countries affect the decision of firms to import foreign technology embedded in capital goods. The use of foreign technology requires the payment of an important up-front cost, due to the screening process of potential foreign suppliers, the cost of the technology itself, and the cost associated with the adaptation of the production process. Given the large size of this investment, which usually requires external financial resources, financial constraints may hamper the adoption of foreign technology. The objective of this study is to rationalize the theoretical mechanisms through which financial constraints can affect the import of foreign technology. The empirical analysis is performed on a panel of firms located in India.

The first part of the study presents the theoretical model, which is used to derive the empirical prediction. With financial constraints, borrowings are closely related to the firm's initial wealth and independent of the return of the investment. It follows that some firms, though productive enough, are not be able to finance the up-front cost associated with the adoption of the foreign technology, and do not import capital goods.

The second part of the study presents the empirical investigation of the link between financial constraints, and the adoption of foreign technology. Estimations are performed using a panel of Indian firms (Prowess) over the period 1996-2006. This database details for each firm all the balance-sheet information that is used to compute financial indicators and the type of goods that are imported by the firm (capital goods, intermediates etc.). The empirical strategy allows identifying the link between the balance-sheet of a firm, such as the liquidity and leverage ratios, and its decision to import capital goods.

Our results confirm that financial factors play an important role on the decision of firms to import foreign capital goods. Quantitatively, an improvement of the liquidity or leverage ratio by 10% increases the probability of importing capital goods by 3% to 5% respectively, independently of productivity. The

role of financial factors is independent of trade reforms over the period that started in 1991. The decision to source foreign intermediates, however, is not affected by financial factors independently of the decision to source foreign capital goods. Our results are robust to alternative empirical specifications taking into account the potential effect of technology adoption on financial factors. Finally, the effect of financial constraints is found to be concentrated in sectors that rely more on the use of external finance.

ABSTRACT

Are financial constraints preventing firms from importing capital goods? Sourcing capital goods from foreign countries is costly and requires internal or external financial resources. A simple model of foreign technology adoption shows that credit constraints act as a barrier to importing capital goods under imperfect financial markets. In our study, we investigate this prediction using detailed balance-sheet data from a sample of about 5,500 Indian manufacturing firms per year, having reported information on financial statements and imports by type of good over the period 1996-2006. Our empirical findings shed new light on the micro determinants of firms' choice to import capital goods. Baseline estimation results show that firms with a lower leverage and higher liquidity are more likely to source their capital goods from foreign countries. Quantitatively, an improvement of the liquidity or leverage ratio by 10% increases the probability of importing capital goods by 3% to 5% respectively, independently of productivity. These findings are robust to alternative measures of foreign technology. The effect of leverage is also robust with respect to specifications dealing directly with reverse causality.

JEL Classification: F10, F14, D24 and D92.
Keywords: Access to finance, foreign technology and firm panel data.

LA DÉCISION D'IMPORTATION DE BIENS D'EQUIPEMENTS EN INDE: LE RÔLE DES CONTRAINTES DE FINANCEMENT

Maria Bas Antoine Berthou

RÉSUME NON TECHNIQUE

Les échanges de biens intermédiaires et de biens d'équipement occupent une place de plus en plus importante dans le commerce mondial. Dans les économies émergentes, l'importation de biens intermédiaires ou de biens d'équipement, en provenance de pays riches notamment, revient à importer de la technologie étrangère. Ces importations doivent favoriser le rattrapage technologique, et permettre de réaliser des gains importants en termes de productivité et de revenu par habitant.

L'objectif de cet article est d'étudier dans quelle mesure les contraintes de financement, auxquelles sont soumises les entreprises localisées dans un pays en développement, affectent leur décision d'importer de la technologie étrangère incorporée dans les biens d'équipements importés. L'adoption d'une technologie étrangère nécessite en effet un investissement initial important, lié à la recherche d'un fournisseur pour cette technologie, à son coût d'achat, et aux frais associés à sa mise en œuvre. Dans un environnement financier caractérisé par des contraintes de crédit importantes, les difficultés d'accès à des sources de financement externes doivent réduire la capacité des entreprises domestiques à importer des équipements étrangers, et à réaliser un saut technologique. Notre objectif est de rationaliser ce mécanisme sur le plan théorique, et de tester empiriquement le lien entre adoption de technologie étrangère et contraintes de financement à partir d'un panel d'entreprises indiennes.

Dans la première partie de notre étude, nous présentons le modèle théorique qui rationalise les principaux mécanismes à travers lesquels l'accès au crédit affecte la décision d'adopter une technologie étrangère, et qui nous permet d'obtenir une prédiction empirique. En présence de contraintes de crédit, le montant que peut emprunter la firme domestique dépend essentiellement de sa richesse initiale. Il en découle que certaines firmes sont forcées de renoncer à l'adoption de technologie étrangère, alors même que cet investissement se révèlerait rentable en l'absence de contraintes de financement.

La seconde partie de l'étude vise à tester empiriquement l'effet des contraintes de financement sur la décision d'adopter une technologie étrangère, à partir d'un panel d'entreprises indiennes (Prowess) pour la période 1996-2006. Cette base de données regroupe pour chaque entreprise du panel des informations sur son bilan, ainsi que le détail des biens importés (notamment les biens d'équipement et biens intermédiaires). Cette information, nous permet de calculer différents indicateurs financiers, comme le ratio de liquidité et l'endettement de chaque entreprise. Notre stratégie empirique permet d'identifier le rôle des contraintes de financement sur l'adoption de technologie étrangère, au travers de la relation

entre ces ratios financiers et la décision d'importation de biens d'équipements.

Nos résultats mettent en lumière un effet très important de la santé financière des entreprises indiennes sur leur décision d'importer des équipements étrangers. Nos estimations montrent qu'une augmentation de 10% du ratio de liquidité, ou une diminution équivalente du ratio d'endettement, augmentent la probabilité d'une firme indienne d'adopter de la technologie étrangère de 3% à 5%, indépendamment de sa productivité. Le rôle des contraintes de financement dans nos estimations est indépendant des réformes commerciales qui sont intervenues en Inde à partir de l'année 1991, et ne semblent pas affecter la décision s'importer des biens intermédiaires indépendamment des importations de biens d'équipement. Nos résultats sont également robustes à différents tests prenant en compte l'effet possible de l'adoption de technologie étrangère sur la santé financière des entreprises. Enfin, nous montrons que l'effet des contraintes financières est davantage concentré dans les secteurs très dépendants de la finance externe.

RÉSUMÉ COURT

Les contraintes financières sont-elles un obstacle à l'adoption de technologie étrangère ? L'importation d'une technologie étrangère, au travers de biens d'équipement, requiert un investissement initial important, et requiert généralement l'utilisation de ressources financières externes à la firme. Dans un contexte des marchés financiers imparfaits, les contraintes de crédit peuvent agir comme une barrière a l'adoption des technologies étrangères. Nous étudions cette prédiction théorique à partir de l'exploitation d'un panel de 5,500 entreprises indiennes, reportant pour la période 1996-2006 des informations de bilan ainsi que le type de biens importés. Nos résultats empiriques mettent en lumière les déterminants micro-économiques de la décision d'importer des biens d'équipement. La liquidité de la firme, et son endettement, se révèlent être des facteurs essentiels de la décision d'importer des équipements étrangers. Nos estimations montrent qu'une augmentation de 10% du ratio de liquidité, ou une diminution équivalente du ratio d'endettement, augmentent la probabilité d'une firme indienne d'adopter de la technologie étrangère de 3% à 5%, indépendamment de sa productivité. Ces résultats sont robustes aux différentes spécifications économétriques mises en œuvre, et à l'utilisation de mesures alternatives de technologie étrangère utilisée par la firme. Notre stratégie permet aussi de mettre en évidence un lien de causalité entre les ratios financiers et la décision d'importer une technologie étrangère.

Classification JEL : F10, F14, D24 and D92.
Mots clés : Access to finance, foreign technology and firm panel data.

THE DECISION TO IMPORT CAPITAL GOODS IN INDIA: FIRMS' FINANCIAL FACTORS MATTER [1]

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1. INTRODUCTION

Globalization is characterized by a significant increase in world imports of capital goods and intermediate inputs. In developing countries, a number of firms rely on capital goods and inputs from abroad since they are more efficient, sophisticated, and advanced in terms of technology relative to the domestic goods (Goldberg et al., 2010; Kugler and Verhoogen, 2009; Halpern et al., 2009; Kasahara and Rodrigue, 2008). The literature on endogenous growth provides theoretical grounds for the role of foreign technology on enhancing efficiency gains and economic growth (Ethier, 1982; Markusen, 1989; Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991). Given their predominant role in international trade, the study of the micro-determinants of firms' investment decisions in imported capital goods has thus become crucial in the understanding of these aggregate trade patterns.

The idea that imports of foreign inputs improves aggregate productivity has motivated recent empirical research on the barriers that firms face when sourcing their goods from abroad. In a context of an intense policy debate over the impact of trade policy in developing economies, this research has focused its attention on the effect of tariff reductions on firms' productivity. [2] Importing foreign capital goods implies incurring fixed costs associated with gathering information on foreign markets and establishing linkages with foreign suppliers, which requires

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2. A major finding is that lower tariffs on imports of intermediate goods improves productivity within firms (Schor, 2004; Amiti and Konings, 2007) and increases the range of products manufactured by domestic firms (Goldberg et al., 2010).

external financing. [1] In our study, we argue that financial constraints might also represent an important barrier to firms' imports of capital goods, thereby limiting their opportunities to benefit from technological spillovers in foreign countries. Surprisingly, this issue has received little attention.

The purpose of this paper is to fill this gap by investigating how firms' financial factors affect their decisions of investing in foreign capital goods. We first present a simple theoretical framework to rationalize the main mechanisms through which financial access affects firms' foreign technology choice. In this framework, using foreign capital goods increases the efficiency to produce final goods, but requires paying an additional fixed cost. In the presence of financial constraints wealthier firms have a better access to external finance and are more likely to use the foreign technology by importing capital goods. We then test this relationship between firms' financial statements and their decision to import capital goods using a detailed Indian firm-level dataset, Prowess. This data was collected by the Centre for Monitoring the Indian Economy (CMIE) for the period 1996-2006. [2] This dataset provides information on financial characteristics of firms as well as imports distinguished by type of goods (capital equipment, intermediate goods, or final goods). This information allows us to compute the liquidity and leverage ratios that are used throughout the paper to measure firms' financial factors. These balance sheet statements are expected to be positively related to the borrowing capacity in the presence of financial constraints. Our empirical strategy demonstrates the impact of the liquidity and leverage ratios of the firm on the decision to invest in foreign capital goods.

Our empirical findings confirm the theoretical prediction that those firms that are ex-ante more liquid and less leveraged are more likely to import capital goods. In our baseline estimations, a 10 percentage point increase in the liquidity ratio or an equivalent decrease in the leverage ratio for the average firm increases the likelihood of importing capital goods by almost 3% and by more than 5%, respectively. [3]. This result focuses on imports of capital goods whereas the decision to source intermediate goods from abroad does not appear to be affected by firms' financial factors. We also carry out different tests that demonstrate that our results are not influenced by omitted variable bias related to India's trade liberalization.

1. See Eaton and Kortum (2001) for a discussion on the sources of costs of trading capital equipment across countries. They quantify that about 25 percent of cross-country productivity differences can be explained by the relative price of equipment, half of it being due to barriers to trade in equipment.
2. We focus on the period 1996-2006 in order to maximize the number of firms each year.
3. These results are reported in columns (2) and (5) of Table 2.

We provide a series of robustness tests to account for the possibility that using foreign capital goods may improve financial factors of firms ex-post. First, we use a measure of foreign royalties on technical know-how paid by the firms as an alternative proxy to the use of foreign technology. Given that the frequency of payment of foreign royalties is low (firms using foreign technology report a payment on foreign royalties only once during the sample period), this reduces the possibility of reverse causality. Second, we focus on the sample of firms that have started importing foreign capital goods, by considering in the empirical analysis only those firms that did not import capital goods in the previous two to four years. Third, we estimate a two-stage least square (2SLS) linear probability model where the liquidity ratio, the leverage ratio, and the capital intensity are instrumented with lagged values (four to five years) and the mean capital intensity of the industry. Fourth, we use the measure of external dependence proposed by Rajan and Zingales (1998) to identify an exogenous effect of financial constraints on import decision across different industries. These results confirm that the leverage of the firm has a strong negative effect on the probability of importing foreign equipments. The effect of firms' liquidity ratio is less robust in these alternative estimations, indicating that importing capital goods also improves financial statements of the firm.

This paper is based on previous results in the litterature that connects financial factors and firms' investment decision. In the presence of information asymmetries, uncollateralized external financing becomes more costly than internal financing, thus introducing a positive relation between a firm's net worth and its investment decision. This link has been empirically observed for a number of countries (Hubbard, 1998). These studies (Fazzari et al., 1988; Whited, 1992; Bond and Meghir, 1994; Bond et al., 2003) use firms' financial indicators such as the cash flow, the debt to assets ratio, or the liquidity ratio, as proxies for firms' net worth or collateral. Most of these papers rely on data for OECD economies and show that wealthier firms invest more. Similar evidence is found for Ecuador (Haramillo et al., 1996) and Ivory Coast (Harrison and McMillan, 2003). In a different setting, Gorodnichenko and Schnitzer (2010) use a survey of firms in Eastern European Countries and show that financial constraints decrease investment in innovation by domestic firms. Aghion et al. (2008) alternatively use measures of firms' payment incidents for France to analyze the relation between credit constraints and research and development along the business cycle. We build on this literature and provide new evidence that financial constraints are preventing firms located in India to invest in foreign capital equipment.

Our work also relates to previous empirical studies showing evidence of the existence of financial constraints on export decisions for the United Kingdom (Greenaway et al., 2007) and

developing economies (Berman and Héricourt, 2010). The negative effect of financial constraints on export decisions is observed for the sample of developing countries, but not in the case of the UK. [1] These studies, however, elude the question of financial constraints as a determinant of foreign technology adoption through the imports of foreign capital goods. This is the focus of our study.

Lastly, our paper can be seen as complementary to the literature on the role of foreign intermediate inputs and firm performance in developing countries. Using specific firm-product level data from Colombia, Kugler and Verhoogen (2009) and Kugler and Verhoogen (2010) show that larger firms produce high quality goods by relying on high-quality inputs imported from abroad. Along the same line, Kasahara and Rodrigue (2008); Halpern et al. (2009); Schor (2004); Amiti and Konings (2007) find robust empirical evidence on the use of foreign intermediate goods that enhances firms' total factor productivity. Goldberg et al. (2010) show that access to new input varieties from abroad enables the creation of new varieties in the domestic market. Since the use of foreign technology increases firm efficiency, the study of the financial determinants of firms' decisions to upgrade foreign technology then becomes crucial. Relative to the previous literature, our study identifies empirically how the access to external finance determines firms' decision to import capital goods using detailed firm-level data for a developing country.

In the next section, we present a simple theoretical framework of import decision and credit constraints. Section III describes the data and introduces the estimation strategy. In Section IV we present the baseline empirical results. Section V presents several robustness checks. In the last section, we present our conclusion.

2. THEORETICAL MOTIVATION

The aim of this section is to motivate our empirical analysis by introducing a simple model of endogenous adoption of foreign technology. The theory rationalizes the mechanisms through which credit constraints affect firms' decision to upgrade foreign technology. The model is based on firm heterogeneity in terms of productivity à la Melitz (2003). Firms are also characterized by their initial wealth as in Chaney (2005). [2] They use this wealth as a collateral to

1. Previous papers have focused on the effects of the aggregate development of financial institutions on exports and the patterns of specialization (Beck, 2002; Chaney, 2005; Manova, 2008)

2. Previous models of heterogeneous firms and credit constraints have also used this framework to explain the determinants of export decision. See Manova (2008) and Muûls (2008).

get external finance in the presence of financial constraints. The representative household allocates consumption from among the range of domestic goods (j) produced using domestic-low technology (Ω_d) and those produced using foreign-high technology (Ω_f). [1]

2.1. Production

There is a continuum of firms, which are all different in terms of their initial productivity (φ). This productivity draw is derived from a common distribution density $g(\varphi)$, after firms decide to enter the market. Each firm produces its own variety in a monopolistic competition market structure. In order to produce the final good (y), firms need to combine two inputs: labor (l) and physical capital (k). There are two types of capital equipment goods: domestic (z) and imported (m). [2] However, only those firms that are productive enough to adopt the foreign technology are able to produce with imported capital goods. Heterogeneous firms in terms of different productivity levels (φ) are introduced. Technology is represented by the following Cobb-Douglas production function that combines labor (l) and capital goods (k) to produce output with factor shares η and $1-\eta$:

$$y_i = \varphi\gamma_i \left(\frac{k_i}{\eta}\right)^{\eta} \left(\frac{l_i}{1-\eta}\right)^{1-\eta} \qquad i = \{d, f\} \tag{1}$$

The subscript d corresponds to firms producing with domestic technology and f to those producing with foreign technology embodied in imported capital goods. The coefficient γ represents the efficiency of imported capital goods relative to domestic ones. Firms using only domestic capital goods ($i = d$) have $\gamma = 1$ and $k_d = z$. Firms producing with foreign technology ($i = f$) combine both types of capital goods by a Cobb-Douglas function: $k_f = \left(\frac{z}{\alpha}\right)^{\alpha}\left(\frac{m}{1-\alpha}\right)^{1-\alpha}$. Firms that decide to adopt foreign technology increase their productivity level by a factor $\gamma > 1$. To access imported capital goods firms must pay a fixed foreign technology acquisition cost (F_T).

1. The standard CES utility function (C) represents the consumer preferences $C^{\frac{\phi-1}{\phi}} = \int_{j\in\Omega_d} C_{dj}^{\frac{\phi-1}{\phi}} dj + \int_{j\in\Omega_f} C_{fj}^{\frac{\phi-1}{\phi}} dj$. The elasticity of substitution between both types of goods is given by $\phi > 1$. The optimal relative demand functions are: $C_i = \left(\frac{P}{p_i}\right)^{\phi} C$, where P represents the price index, C the global consumption and p_i the price set by a firm.

2. To keep the model simple, we assume that one unit of domestic capital good is produced using one unit of labor, which is elastically supplied and the wage is normalized to one.

The first-order condition of monopolistic firms is such that prices reflect a constant mark-up, $\rho = \left(\frac{\phi-1}{\phi}\right)$, over marginal costs: $p_i = \frac{c_i}{\rho\varphi}$. c_i represents the per unit cost of production which is different among firms depending on whether or not they have adopted the foreign imported technology: $c_d = p_z^{\eta}$ and $c_f = \frac{(p_z)^{\alpha\eta}(\tau_m p_z)^{(1-\alpha)\eta}}{\gamma}$. The price of domestic capital good is p_z and the price of imported capital takes into account transport costs and tariffs (τ_m): $p_m = \tau_m p_z$. The relative per unit cost is equal to $\frac{c_f}{c_d} = \frac{\tau_m^{\eta(1-\alpha)}}{\gamma}$. We assume that the efficiency parameter of imported capital goods (γ) is higher than its additional variable cost (τ_m) relative to domestic ones. [1]

Combining the demand faced by each firm, $q_i(\varphi) = \left(\frac{P}{p_i(\varphi)}\right)^{\phi} C$, and the price function, $p_i(\varphi) = \frac{c_i}{\rho A_i}$, revenues are given by $r_i(\varphi) = q_i(\varphi)p_i(\varphi) = \left(\frac{P}{p_i}\right)^{\phi-1} R$, where $R = PC$ is the aggregate revenue of the industry exogenous to the firm. Firm profit is then $\pi_i = \frac{r_i}{\phi} - F$,

where F is the fixed production cost.

2.2. Firm's Decisions under Perfect Financial Market Conditions

Only those firms with enough profits to afford the fixed production (F) cost will be able to survive and produce. Profits of the marginal firm are equal to zero. The zero cutoff condition is given by: $\frac{r_d(\varphi_d^*)}{\phi} = F$. The value φ_d^* represents the productivity cutoff to produce in the domestic market.

Once a firm has received its productivity draw, it may also decide to adopt a foreign technology to reduce its marginal costs on the basis of its profitability. Only a subset of the most productive firms will switch to foreign technology since the fixed importing cost is higher than the fixed production cost. The condition to acquire the foreign technology is given by: $\pi_f(\varphi_f^*) = 0$. The value φ_f^* represents the productivity cutoff to import foreign goods: $\frac{r_f(\varphi_f^*)}{\phi} = F + F_T$.

1. Note that the relative per unit cost is a function of tariffs on capital goods and the efficiency parameter . A reduction of import tariffs on capital goods reduces the relative per unit costs of foreign technology. Similar results hold in the case of an increase in the efficiency parameter of foreign technology (γ).

2.3. Financial Access and Import Decision under Imperfect Financial market Conditions

Importing technology embodied in foreign capital goods implies a sunk cost of investment (F_T). In the presence of financial constraints, firms cannot use their future expected revenues $r_f(\varphi)$ to get external finance ex-ante. In this context, firms can make use of two sources of cash to finance the extra fixed cost F_T. First, firms are able to borrow up to $r_d(\varphi)$, which corresponds to the sales of the final good for firms using the domestic technology. [1] Second, firms can use their exogenous wealth A as a collateral to borrow additional liquidity λA, where λ corresponds to the credit multiplier and is inversely related to the extent of credit constraints in the economy, as in Aghion et al. (1999).

We assume that the productivity and the exogenous collateral distributions are independent. The total liquidity that is available to the firm is equal to $\pi_d(\varphi) + \lambda A$. Importing foreign capital goods relates to the liquidity constraint condition (LCC) given by:

$$\pi_d(\varphi) + \lambda A \geq F_T \tag{2}$$

We can define the lowest productivity level below which firms with an exogenous wealth A, $\overline{\varphi}(A)$, are liquidity constrained. $\overline{\varphi}(A)$ is given by: $\pi_d(\overline{\varphi}(A)) + \lambda A = F_T$. Firms that face liquidity constraints have a productivity level below $\overline{\varphi}(A)$. They are not able to import capital goods due to financial constraints.

Following Chaney (2008) we set $\varphi_d^* = g(F)$ and use the zero cutoff profit conditions and the liquidity constraint condition, equation (2), to define two productivity cutoffs [2]:

$$\varphi_f^* = \left(\frac{F + F_T}{F}\right)^{\frac{1}{\phi-1}} \left(\frac{\tau_m^{\eta(1-\alpha)}}{\gamma}\right) \varphi_d^*; \qquad \overline{\varphi}(A) = \left(\frac{F_T + F - \lambda A}{F}\right)^{\frac{1}{\phi-1}} \varphi_d^*$$

All the firms with a productivity level between $max\{\varphi_f^*, \overline{\varphi}(A)\} > \varphi > \varphi_d^*$ produce with domestic technology. Only those firms with a productivity $\varphi > max\{\varphi_f^*, \overline{\varphi}(A)\}$ are able to

1. Financial intermediaries have perfect information about firms' profitability in the case where they produce with the domestic technology, and will be willing to provide cash in advance up to $r_d(\varphi)$.

2. For tractability purposes we assume, as in Chaney (2005), that the price index only depends on local firms' prices. In our framework we focus on the determinants of firms' import decision. Since firms in our economy only sell in the domestic market, and countries are symmetric, there are no foreign final goods sold at home. In a relatively closed economy, it is a reasonable approximation, which allows for the model to be solved. In the Appendix we define the price index approximation.

finance the fixed technological cost of importing and thus they use both types of capital goods.

Which are the firms that face credit constraints to import capital goods? There is a subset of firms that are profitable enough to be viable importers, but prevented from accessing foreign capital goods because of liquidity constraints. Firms that have a productivity level φ below $\overline{\varphi}(A)$ are liquidity constrained, and are not able to source imported inputs from abroad no matter how profitable they could be by importing more efficient foreign capital goods. All firms with a productivity level above φ_f^* could profitably import, if they had sufficient liquidity. Hence, there is a subset of liquidity constrained firms with a productivity level above φ_f^*, but below $\overline{\varphi}(A)$. In the appendix we demonstrate the existence of liquidity constrained importers.

2.4. Testable Prediction

Firms' import decision is determined by domestic revenues and by the exogenous collateral. These two sources of finance allow firms to afford the fixed technology cost of importing. Using equation (2) we can define the probability that a firm *i* imports capital goods at time *t*:

$$\Pr(\pi_d + \lambda A - F_T > 0) = \Pr(\varphi^{\phi-1}\frac{1}{\phi}\left(\frac{\rho}{c_d}\right)^{\phi-1} RP^{\phi-1} + \lambda A - F - F_T) > 0 \qquad (3)$$

The probability of importing is directly determined by the two sources of finance. On the one hand, in this monopolistic competition framework with heterogeneous firms, the most productive firms set lower prices and have larger domestic revenues to finance the fixed importing cost. On the other hand the higher the exogenous collateral, the greater the financial resources of the firm to afford the fixed foreign technology cost.

Testable prediction: *In the presence of financial constraints, ex-ante wealthier firms are more likely to import foreign equipment and upgrade foreign technology.*

3. Data and Empirical Methodology

3.1. Data

The Indian firm-level dataset is compiled from the Prowess database by the Centre for Monitoring the Indian Economy (CMIE). This database contains information from the income statements and balance sheets of listed companies comprising more than 70 percent of the economic activity in the organized industrial sector of India. Collectively, the companies covered in Prowess account for 75 percent of all corporate taxes collected by the Government of

India. The database is thus representative of large and medium-sized Indian firms. This dataset was already used in several studies on the performance of Indian firms. [1]

The dataset covers the period 1996-2006 and the information varies by year. It provides quantitative information on sales, capital stock, income from financial and non financial sources, consumption of raw material and energy, compensation to employees and on ownership group, location of industrial plants factories and incorporation year.

The Prowess database provides detailed information on imports by category of goods: finished goods, intermediate goods and capital goods. In our main empirical specification, we use imports of capital goods (machinery and equipment) as a proxy of foreign technology. Then we carry out a robustness checks using alternative measures of technology such as foreign spending in royalties and research and development investments. The dataset contains also comprehensive information about the financial statements of firms such as total assets, current assets, total debt and liabilities. We construct two financial variables: (1) the leverage ratio and (2) the liquidity ratio. Leverage is the ratio of borrowings over total assets and liquidity ratio is measured by the ratio of current assets over total liabilities of the firm. [2]

The Appendix Table provides summary statistics on the main firm and industry level variables used in our econometric analysis. Our sample contains information for about 5,500 firms each year in organized industrial activities from manufacturing sector. On average 1,650 firms import capital goods in a year. Firms are categorized by industry according to the 4-digit 1998 NIC code (116 industries).

3.2. Empirical Methodology

A unique feature of our database is that firms report imports of finished goods, capital goods and intermediate goods. Keeping in line with our theoretical framework, the baseline econometric analysis is therefore performed on capital goods. The rationale for this is that importing capital goods implies incurring fixed costs associated with gathering information on foreign markets and establishing linkages with foreign suppliers. The choice of importing capital goods in a developing country could be associated with firms' foreign technology adoption decision. This decision is related with a discrete choice of a fixed investment cost that firms

1. See Khandelwal and Topalova (2009), Topalova (2004), Goldberg et al. (2010), (Goldberg et al., 2009) Alfaro and Chari (2009).

2. This financial ratios are used by several works studying the impact of access to external finance on export participation (Greenaway et al., 2007; Berman and Héricourt, 2010; Manova et al., 2009).

made once they start producing or when they renew their machinery. Since India is a developing country dependent on foreign technology, firms pay a fixed technology costs when they decide to import capital goods from abroad.

We test the impact of financial factors on firms' investment decision in imported capital goods by estimating the probability that a firm *i* imports capital goods from abroad in year *t*. Our preferred specification estimates the following equation using a Conditional Logit estimator. For this estimation, we therefore rely on a sample of firms that change their import status at least once over the period:

$$Importer_{(is)(t)} = \beta_0 + \beta_1 Finance_{(i)(t-1)} + \beta_2 Z_{(i)(t-1)} + \beta_3 X_{(s)(t)} + \upsilon_t + \mu_i + \nu_{it} \qquad \text{(I)}$$

Where $Importer_{(is)(t)}$ is a dummy variable equal to one if the firm *i* producing in 2-digit NIC code industry *s*, has positive imports of capital goods in year *t* and zero otherwise. Finance measures firm's financial statements. The financial variables of interest that we use to proxy the financial factors (the empirical counterpart of the exogenous collateral in the model) are the liquidity ratio and the leverage ratio. The liquidity ratio is the share of firms' current assets over total liabilities. The liquidity ratio is related to the firm's ability to pay off its short-terms debts obligations. The leverage ratio indicates the proportion of borrowing over total assets of the firm. A higher level of leverage decreases, everything else equals, the net worth of the firm. According to the model's predictions, an improvement of the firm's wealth (measured by a higher liquidity ratio or a lower leverage), increases the access to external finance. Since the access to external finance determines the decision to source capital goods from abroad, we expect a positive coefficient for the liquidity ratio and a negative coefficient for the leverage ratio.

Unobserved firm characteristics could lead to inconsistent estimates. For this reason, all estimations include firm-level fixed effects (μ_i). The introduction of firm fixed effects is important to control for unobservable firm characteristics that do not vary over time. Our specification shows how an improvement in firms' financial factors over time affects firms' decision to participate in the import market.

Estimates also include controls for firm and industry characteristics that vary over time. First, we introduce a set of firm level variables $(Z_{(i)(t-1)})$ expressed in logarithm in year (t-1) that control for observable firm characteristics that might affect firms' import choices. Similar to the decision to participate in the export market, only a subset of larger firms import goods. Several empirical works show evidence of a positive impact of firms' size and productivity on

its import decision. [1] Unfortunately, there is no information available in the Prowess dataset on the number of employees. We then use the wage-bill to measure firms' size. Bigger firms tend to be more skilled intensive and to pay higher wages. [2] Since we focus on the import decision of capital equipment goods, we also control for the past capital intensity of the firm measured as total capital stock over the wage-bill. We expect a positive coefficient of capital intensity. The more firms rely on capital goods in the production process; the more likely they are to import capital goods from abroad.

Second, we introduce a set of industry level variables $X_{(st)}$ that control for observable industry characteristics at the NIC 2-digit level that might affect firms' import choices of capital goods. Several studies show that competition might enhance firm efficiency and create incentives for firms to invest in R&D activities and in foreign technology. This is the theoretical mechanism highlighted by Aghion et al. (2005) of an inverted U shape relationship between competition and R&D investments. We constructed a Herfindahl index at the 2-digit NIC industry level to control for competition in the domestic market. We also control for foreign competition pressures associated to the trade liberalization process experienced by India at the beginning of the 1990s. We include the average import tariff for final goods at the 2-digit NIC industry level. Finally, we include the import propensity of the 2-digit NIC industry level measured by the mean of total imports within the industry. Technical differences across industries could be associated to different requirements of foreign capital goods in the production process. Firms belonging to industries that have a higher import propensity might have a positive bias towards importing goods from abroad.

All explanatory variables are expressed in logarithm and they are lagged of one and two periods to control for potential endogeneity issues. Moreover, in the last section we deal explicitly with the potential reverse causality between financial factors and firms' investment decision in imported capital goods. We also introduce year fixed effects to control for macroeconomic shocks (υ_t). This is an important control since India was affected by the Asian financial crisis in 1997-1998. The introduction of year fixed effects allows us to control for the effects of this crisis on both financial statements of firms and their import decisions.

As an alternative specification, we estimate equation (II) with a logit estimator, controlling

1. See Kasahara and Lapham (2007), Bernard et al. (2009), Muûls and Pisu (2009) Bas (2009).

2. In alternative specifications, available upon request, we use firm total factor productivity (TFP) computed using Levinsohn and Petrin (2003) methodology. However, since our dataset does not contain the number of workers, we use the wage-bill to estimate firm TFP as Khandelwal and Topalova (2009) and Goldberg et al. (2010). Thus, our most reliable proxy of firm size is the wage-bill used in all specifications.

for additional firms characteristics, 2-digit NIC industry fixed effects and region fixed effects.

$$Importer_{(is)(t)} = \beta_0 + \beta_1 Finance_{(i)(t-1)} + \beta_2 Z_{(i)(t-1)} + \beta_3 V_i + \beta_4 X_{(s)(t)} + \upsilon_t + \mu_k + \mu_r + \nu_{it} \quad \text{(II)}$$

V_i is a vector of firm-level controls that are time-invariant such as the age and foreign status of the firm. μ_k and μ_r are respectively the industry and region dummies. Unlike the specification presented in Equation (I), this specification exploits the variation between firms of the same industry and located in the same region in India. It also uses the within-firm heterogeneity over time (as in equation (I)). The identification therefore relies on the comparison of the characteristics of firms that import capital goods at a given point in time, versus those who do not import. In order to rely on a sample of firms in the "treatment" and "control" groups that are comparable, estimations of equation (II) are performed on the sample of firms that import at least once capital goods over the sample period.

4. Estimation Results

4.1. Baseline Results: Are Financial Factors Related to Firms' Decision of Sourcing Foreign Capital Goods?

In this section we present the results of the main estimations of the impact of financial access on the probability of importing capital goods.

Table 1 reports marginal effects evaluated at the mean values from a Conditional Logit estimation of equation (I) with firm and year fixed effects. Column (1) shows the effect of the leverage ratio lagged of one period on firms' decision to import capital goods. The coefficient is negative and significant at the 1% level: firms having a higher ratio of borrowing over total assets are less likely to import their capital goods from the foreign market. Next we include firm level variables to control for firm characteristics that vary over time and that could be picking up the effect of firms' financial variables. Moreover, firms producing in industries growing faster might be less credit constrained. Then, changes in firms' financial statements might be capturing the effects of industry characteristics. We address these issues by introducing in column (2) additional controls at the firm and 2-digit NIC industry level. Column (2) shows the effect of firms' size and capital intensity on the decision to source capital goods from a foreign country. As expected bigger and capital intensive firms are more likely to import capital goods from abroad. Concerning the time variant industry characteristics, both coefficients of output tariff and Herfindhal index are non significant. Not surprisingly, firms producing

in industries that are more intensive in the use of foreign goods, have a higher probability of sourcing their goods from abroad. The negative effect of leverage on firms' foreign technology decision remains stable and robust to the inclusion of this set of firm and industry controls.

In the next column (3), we include the leverage ratio lagged of two periods. The negative effect of financial constraints on the probability of importing is still significant at the 1% level. The estimated coefficients imply that a 10 percentage point fall in the leverage ratio leads to 4.5% to 5.3% increase in the likelihood of importing capital goods. One standard deviation reduction of the leverage ratio, corresponding to a decrease of the leverage of the average firm by 32%, increases the import probability of capital goods by 15%.

In columns (4) to (6) we test how a firm's liquidity ratio affects its probability to upgrade foreign technology embodied in imported capital goods. The liquidity ratio is subsequently introduced with one or two lags. Once we control for firm and industry characteristics, the coefficient is positive and significant at the 1% level in both cases, indicating that more liquid firms are more likely to import their capital goods from abroad. The estimated coefficients imply that a 10 percentage point increase in the liquidity ratio leads to a 2% to 2.9% increase in the likelihood of importing capital goods. One standard deviation increase of the liquidity ratio, corresponding to an increase of the liquidity of the average firm by 17%, increases the import probability by almost 5%.

Columns (1) to (6) correspond to equation (I) where we exploit only the within-firm variance. In the last two columns, we estimate equation (II) with the logit estimator, controlling for industry and region dummies. We rely on the sample of firms importing capital goods at least once over the period. In a given year, firms that import foreign capital goods are therefore compared to firms that do not import those goods. Moreover, this specification additionally controls for the age and the foreign status of firms. [1] In the previous specifications these characteristics where captured by the firm fixe effects. Columns (7) and (8) show that firms' age has not a direct effect on firms' decision to import foreign capital goods, but when we include the square of the age the effect turns out negative and significant. This result is in line with previous research showing that younger firms are more innovative and have larger productivity growth than mature firms (Huergo and Jaumandreu, 2002, 2004).

Our results show that foreign firms have a higher probability of using imported capital goods

1. Prowess dataset reports the foreign origin of firms. This characteristic however does not change in the data over time.

relative to domestic firms. This result is in line with previous studies on multinational firms showing that foreign firms in developing countries tend to use more advanced technologies and be more productive relative to domestic firms (Javorcik, 2004). One reason may be that foreign multinationals have a better access to finance, and are more likely to source capital goods. Javorcik and Spatareanu (2009) show for instance that the suppliers of multinationals in Czech Republic are less credit constrained. [1] Our coefficients of interest on financial variables remain, though, robust to the inclusion of these controls.

Table 1 about here

Are Imports of Intermediate Inputs also Affected by Financial Constraints ?

In order to disentangle the mechanisms through which financial access affect firms' foreign technology upgrading, we consider separately the special case of intermediate goods imports, to determine whether financial factors affect differently this type of good relative to capital goods.

First, we estimate equation (I) for the subsample of firms using foreign intermediate goods. Table 2 reports the marginal effects evaluated at the mean values after a Conditional Logit estimation. Column (1) shows that once we control for firm and industry characteristics, the leverage ratio has a negative but non significant effect on firms' import decision to use foreign intermediate goods. These findings indicate that credit constraints are not crucial for importing foreign inputs. In column (2) we include the liquidity ratio. The effect is positive an significant at the 5% confidence level. The higher the current assets over total liabilities ratio of the firm, the more likely firms import their inputs from abroad.

Table 2 about here

Next, we investigate whether the decision to import intermediate goods is associated to the decision of upgrading foreign technology embodied in capital goods. If such a complementarity exists, the effect of financial factors on imports of intermediates may arise because of its effect through capital goods. To isolate the effect of capital goods decision from foreign

1. Manova et al. (2009) also show that in the case of China, multinationals have a better propensity to export in sectors where firms are typically more financially vulnerable.

input decision, we restrict our sample to firms that have never imported capital goods in the period. Column (3) reports the marginal effects after Conditional Logit estimations. The financial variables have no longer a significant effect on the decision to import foreign inputs conditional to have never imported capital goods (columns (3) and (4)).

To summarize, these findings emphasize that credit constraints do not matter for firms that start importing intermediate goods and never import capital goods during the period. One plausible explanation is related to the higher amount of fixed importing costs for capital goods relative to intermediate goods.

Financial Constraints Versus Tariffs on Capital Goods

In a context of trade liberalization, firms could upgrade foreign technology easily thanks to the removal of import barriers on capital equipment goods. Thereby, the effect of better financial access on foreign technology adoption might just be picking up the effects of lower tariffs on capital equipment goods.

In the previous specifications, we include tariff on final goods at the 2 digit induatry level to capture the impact of India's trade liberalization that took place at the beginning of the nineties. We now explore the robustness of our results when we take into account tariff reductions on capital goods over the period. The average yearly reduction of import tariffs on machinery and equipment goods is 2.3 percent during the period. Since trade liberalization in India in the early 90s consisted in a unilateral trade reform, we use most-favored-nation (MFN) tariffs set by India to the rest of the world for the period 1996 to 2006. To do that we match the firm level data with the average import tariff data of products corresponding to hs6 codes between 840000 and 859999 (machinery and mechanical appliances) from TRAINS dataset from United Nations.

Table 3 presents the results including the variation of the average import tariffs on capital equipment goods on the previous specifications. As expected, a reduction of import barriers on capital goods increases the likelihood of firms to upgrade foreign technology. More interesting, our results remain unaffected by the introduction of import tariffs on capital goods. Once we take into account directly the effects of trade reform, a reduction of leverage ratio and an increase in the liquidity of the firm have both a positive impact of the probability of adopting a foreign technology.

Table 3 about here

4.2. Robustness Checks

One of the challenges of investigating the relationship between the access to external finance and firms' technology adoption decisions is the potential reverse causality from firms' import patterns to their financial factors. In the medium or long run, importing foreign capital goods is expected to increase the profitability of the firm and therefore its financial statements (reduce the leverage or increase the liquidity ratio). This mechanism would result in a positive bias in the relation between imports and financial factors of the firm. In the short run, the cost associated with the imports of a new technology is expected to increase the leverage of the firm, or decrease its liquidity. This mechanism would result in a negative bias. We perform several robustness checks to address this potential reverse causality issue.

Alternative Measures of Technology

To test the causality link between firms' access to finance and foreign technology upgrading, we use alternative measures of foreign technology which the average firm made only once during the period of analysis. First, we use foreign royalties and technical know how expenditures. Columns (1) to (4) of Table 4 report marginal effects evaluated at the mean values from Conditional Logit estimations of equation (I) using as a dependent variable a dummy equal to one if the firm i reports positive expenditures on foreign royalties and technical know how in year t. As firms' leverage decreases or firms' liquidity increases, the likelihood of upgrading foreign technology improves (column (1) to (4)). Columns (5) to (8) confirm these results when total royalties are used as the dependent variable.

In Table 5 we use as a dependent variable a dummy variable equal to one if the firm i reports positive R&D expenditures in year t. These results confirm that financial constraints are an important determinant of the decision to invest in research and development within the firm. This result is in line with previous findings in the literature (see (Hall and Lerner, 2009) for a survey on this topic).

Table 4 about here

Table 5 about here

Decision to Start Importing Capital Goods

We explore the robustness of our baseline specification when we restrict our sample to firms that have not imported capital goods in the previous years. We investigate whether an increase in the access to external finance is associated to the decision to start sourcing capital goods from abroad. By focusing on firms that have not imported capital goods in the previous period, this specification deals with the possible endogeneity issues between financial access and foreign technology adoption that the previous specifications might suffer.

Table 6 about here

Columns (1) to (2) of Table 6 report the marginal effects evaluated at the mean values after Conditional Logit estimation of equation (I) with firm and year fixed effects for the restricted sample of firms that have not imported capital goods in the last two years. A reduction in the leverage ratio as well as an increase in the liquidity ratio, increases the probability of importing capital goods from abroad. A 10 percentage point reduction of the leverage ratio increases the probability to start importing capital goods by 4.2 percent (column (1)). Similarly, a 10 percentage point increase in the amount of liquidity increases the probability to upgrade foreign technology for the first time by almost 2 percent (column (2)). When we restrict our sample to firms that have not imported capital goods in the last four years, the effect of the leverage ratio is still negative and significant, while the liquidity ratio is no longer significant (columns (3) and (4)). We use as an alternative econometric specification, a Logit estimation with industry, region and year fixed effects, which exploits the variation between firms within the same industry and region. The results reported in columns (5) and (6) show that both a reduction of the leverage or an expansion of firm liquidity have a positive effect on the decision to upgrade foreign technology for firms that have not imported in the last four years. These findings confirm the importance of financial access to start sourcing capital goods from abroad.

Instrumental Variables Estimations

We carry out an additional test to verify whether there is a causal relationship of financial access on foreign technology upgrading. We proceed to Instrumental Variable estimations using a Two-Stage least squares estimator. The endogenous variables are the capital intensity, the liquidity ratio and the leverage ratio. Excluded instruments include the leverage ratios with four and five lags, the capital intensity with four lags, and the average capital intensity within the industry (defined at NIC 2-digits level). Given that standard econometric packages do not

allow to instrument endogenous variables with a logit or conditional fixed-effect logit estimators, a linear probability model is estimated. We proceed therefore to the estimation of a linear probability model, using industry and region fixed effects, or firm fixed effects. For each strategy, we estimate a benchmark OLS or within-fixed effect equation, before the two-stage least square is implemented. The validity of the instruments is tested using the Hansen test for overidentifying restrictions.

Estimation results are reported in Table 7. The dependent variable is the decision to import capital goods (extensive margin). Columns (1) and (2), and (5) and (6) correspond respectively to the benchmark estimations with OLS and within fixed effect estimators. Columns (3) and (4) correspond to the 2SLS estimations including industry, region and year fixed effects. Columns (7) and (8) report estimation coefficients for the 2SLS estimations with firm and year fixed effects.

Results of the OLS and within fixed-effect estimations confirm previous results that firms that are ex-ante more leveraged or less liquid are less likely to import capital goods. This result is confirmed when the leverage and capital intensity are instrumented (columns 3 and 7). However, intrumenting the liquidity ratio and capital intensity (columns 4 and 8) reveals that the coefficient on the liquidity ratio in previous estimations was biased upwards. When the liquidity ratio is instrumented by its four and five lags, the coefficient turns out unsignificant. Importantly, the p-value of the Hansen Statistic is above 10% in most cases (with the exception of column 8), which indicates that the null of exogeneity of the instruments cannot be rejected.

These results imply that the leverage ratio of the firm is indeed preventing her of importing capital goods. The evidence for the liquidity ratio is not robust, which suggest that firms importing capital goods become more liquid in subsequent years.

Table 7 about here

Dependence with Respect to External Finance

As a final exercise, we use the measure of firms' dependence on external finance ("external dependence"), proposed by Rajan and Zingales (1998) and updated by Braun (2002) and Braun and Larrain (2005), to identify an exogenous effect of financial constraints on capital goods imports across different industries. In the presence of financial constraints, the borrowing

capacity of a firm is closely related to its financial statement. Financial constraints are therefore expected to affect more the investment decision in sectors where firms rely more on the use of external finance.

Table 8 about here

The empirical strategy proposed by Rajan and Zingales (1998) is adapted to the context of our study. [1] The measure of external dependence at the 2-digit industry level updated by Braun (2002) and Braun and Larrain (2005) is interacted with our measures of firms' financial statements. The baseline empirical specification is then augmented with the *Leverage(i)(t-1)× Ext. Dep.(s)* and *Liquidity ratio (i)(t-1)× Ext. Dep.(s)* variables. The coefficient on the interaction variable between the leverage of the firm and the external dependence of the industry is expected to be negative, and the coefficient on the interaction between the liquidity ratio of the firm and the degree of external dependence is expected to be positive: in the presence of financial constraints, the liquidity ratio and leverage of the firm are expected to be more closely related to the imports of foreign capital goods for firms that rely more on the use of external finance.

Table 8 reports estimation results. We estimate a linear probability model so that the coefficient on the interaction variable can be interpreted. [2] Column (1) reports estimation results from a linear OLS regression with industry, region and time fixed effects. The leverage ratio is interacted with the external dependence variable. The coefficient on the interaction variable reports a negative sign, confirming that the negative impact of the leverage of the firm, on its probability to import foreign capital goods, is higher in sectors where firms require more external finance. Column (2) replicates this estimation, and includes as well an interaction between the leverage of the firm and the capital intensity of the industry. The capital intensity of the industry is provided by Braun (2002), and is sector-specific. This new variable allows to control for the possibility that importing capital goods is more likely to affect firms' financial factors in sectors where firms are typically more capital intensive. Since the external dependence of the firm and the capital intensity are positively related, reverse causality would bias

1. Rajan and Zingales (1998) propose to identify the effect of financial development on economic growth, using an interaction term between the country's financial development and the industry level of external dependence. The degree of dependence on external finance is a technology parameter (measured using Compustat data for the United States), and is independent of countries' characteristics. The coefficient on the interaction term is therefore expected to be unrelated to countries' characteristics, and unaffected by future economic growth.

2. See Ai and Norton (2003) for a discussion about the use of interaction terms in logit and probit models, the computation of marginal effects, and their interpretation.

the coefficient on the Leverage(i)(t-1)× Ext. Dep.(s) variable. Estimation results in column (2) though confirm that the coefficient on the Leverage(i)(t-1)× Ext. Dep.(s) variable is negative and very significant, as well as the coefficient on the Leverage(i)(t-1)× Cap.Int.(s) interaction term. Changes in firms' financial statements affect more the probability of importing capital goods, in capital-intensive industries as well as in industries where firms typically rely more on external finance. In column (3), the estimation using a within fixed effect estimator confirms previous findings.

Columns (4), (5) and (6) provide similar analysis where the Liquidity ratio is interacted with the sectoral external dependence and the sectoral capital intensity. In OLS estimations, the coefficient on the Liquidity ratio(i)(t-1)× Ext. Dep.(s) is never significantly different from zero, whereas it is positive in the within fixed-effect estimation in column (6). This test therefore only provide a weak verification that the liquidity of the firm is affecting the import decision of capital goods.

5. CONCLUDING REMARKS

Adopting foreign technology is costly and requires using internal and external financial resources. This paper investigates the influence of firms' financial factors on their decision to source foreign capital goods. The empirical analysis is performed using a detailed database reporting balance sheet information from a sample of about 5,500 firms each year over the period from 1996 to 2006. We test whether firms that experience an improvement in their financial statements have a higher probability to upgrade foreign technology embodied in imported capital goods. We find strong evidence that this is the case. Firms with a lower leverage and a higher liquidity have a higher probability of upgrading foreign technology. We address the potential reverse causality issues between financial factors and foreign technology adoption. Our results are robust with respect to alternative measures of foreign technology and to different econometric specifications.

Our findings suggest that financial market imperfections have a negative effect on purchases of foreign technology. This is an important issue for aggregate productivity growth in developing countries, like India, that rely heavily on foreign technology in their production process. One important policy implication of our findings is that the success of trade reforms is closely related to the capacity of the financial intermediaries to provide fundings to domestic firms.

REFERENCES

Aghion, P., Askenazy, P., Berman, N., Cette, G., and Eymard, L. (2008). Credit constraints and the cyclicality of r&d investment: Evidence from france. PSE Working Papers 2008-26.

Aghion, P., Banerjee, A., and Piketty, T. (1999). Dualism and macroeconomic volatility. *Quarterly journal of economics*, 114:1359–1397.

Aghion, P., Bloom, N., Blundell, Griffith, R., and Howitt, P. (2005). Competition and innovation: An inverted u relationship. *Quarterly journal of economics*, 120:701–728.

Ai, C. and Norton, E. (2003). Interaction terms in logit and probit models. *Economics Letters*, 80(1):123–129.

Alfaro, L. and Chari, A. (2009). India transformed? insights from the firm level 1988-2005. NBER Working Papers 15448.

Amiti, M. and Konings, J. (2007). Trade liberalization, intermediate inputs, and productivity: Evidence from indonesia. *American Economic Review*, 97(5):1611–1638.

Bas (2009). Trade, foreign inputs and firms' decisions: Theory and evidence. Working Paper CEPII.

Beck, T. (2002). Financial development and international trade: Is there a link? *Journal of International Economics*, 57(1):107–131.

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

Bernard, A. B., Jensen, J. B., and Schott, P. K. (2009). Importers, exporters and multinationals: A portrait of firms in the u.s. that trade goods. In *Producer Dynamics: New Evidence from Micro Data*, NBER Chapters. National Bureau of Economic Research, Inc.

Bond, S., Elston, J., Mairesse, J., and Mulkay, B. (2003). Financial factors and investment in belgium, france, german and the uk: A comparison using company panel data. *Review of Economics and Statistics*, 85:153–165.

Bond, S. and Meghir, C. (1994). Dynamic investment models and the firm's financial policy. *Review of Economic Studies*, 61(2):197–222.

Braun, M. (2002). Financial contractibility and asset hardness. Mimeo.

Braun, M. and Larrain, B. (2005). Finance and the business cycle: International, inter-industry evidence. *Journal of Finance*, 60(3):1097–1128.

Chaney, T. (2005). Liquidity constrained exporters. mimeo Chicago University.

Eaton, J. and Kortum, S. (2001). Trade in capital goods. *European Economic Review*, 45(7):1195–1235.

Ethier, W. (1982). National and international returns to scale in the modern teory of international trade. *American Economic Review*, 72(3):389–405.

Fazzari, S. M., Hubbard, R. G., and Petersen, B. C. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, 19(1988-1):141–206.

Goldberg, P., Khandelwal, A., Pavcnik, N., and Topalova, P. (2009). Trade liberalization and new imported inputs. *American Economic Review Papers and Proceedings*, 99(2):494–500.

Goldberg, P. K., Khandelwal, A. K., Pavcnik, N., and Topalova, P. (2010). Imported intermediate inputs and domestic product growth: Evidence from india. *The Quarterly Journal of Economics*, 125(4):1727–1767.

Gorodnichenko, Y. and Schnitzer, M. (2010). Financial constraints and innovation: Why poor countries don't catch up. NBER Working Paper No. 15792.

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

Grossman, G. and Helpman, E. (1991). Innovation and growth in the global economy. *Cambridge, MA: MIT*.

Hall and Lerner (2009). The financing of r & d and innovation. NBER Working Paper No. w15325.

Halpern, Koren, and Szeidl (2009). Imported inputs and productivity. CEPR N. 5139.

Haramillo, F., Schiantarelli, F., and Weiss, A. (1996). Capital market imperfections before and after financial liberalization: An euler equation approach to panel data for ecuadorian firms. *Journal of Development Economics*, 51(2):367–386.

Harrison, A. E. and McMillan, M. S. (2003). Does direct foreign investment affect domestic credit constraints? *Journal of International Economics*, 61(1):73–100.

Hubbard, R. G. (1998). Capital-market imperfections and investment. *Journal of Economic Literatture*, 36(1):193–225.

Huergo, E. and Jaumandreu, J. (2002). How does probability of innovation change with firm age? mimeo.

Huergo, E. and Jaumandreu, J. (2004). Firms' age, process innovation and productivity growth. *International Journal of Industrial Organization*, 22(4):541–559.

Javorcik, B. S. (2004). Does foreign direct investment increase the productivity of domestic firms? in search of spillovers through backward linkages. *American Economic Review*, 94(3):605–627.

Javorcik, B. S. and Spatareanu, M. (2009). Liquidity constraints and firms' linkages with multinationals. *World Bank Economic Review*, 23(2):323–346.

Kasahara and Lapham (2007). Productivity and the decision to import and export: Theory and evidence. No CESifo Working Paper No. 2240.

Kasahara and Rodrigue (2008). Does the use of imported intermediates increase productivity? plant-level evidence. *Journal of Development Economics*, 87:106–118.

Khandelwal, A. and Topalova, P. (2009). Trade liberalization and firm productivity: The case of india. Forthcoming The Review of Economics and Statistics.

Kugler, M. and Verhoogen, E. (2009). Plants and imported inputs: New facts and an interpretation. *American Economic Review Papers and Proceedings*, 99(2):501–507.

Kugler, M. and Verhoogen, E. (2010). Prices, plant size, and product quality. Mimeo.

Levinsohn, J. and Petrin, A. (2003). Estimating production functions using inputs to control for unobservables. *Review of Economic Studies*, 70(2):317–341.

Manova, K. (2008). Credit constraints, heterogeneous firms and international trade. NBER Working Paper 14531.

Manova, K., Wei, S.-J., and Zhang, Z. (2009). Firm exports and multinational activity under credit constraints. mimeo Stanford University.

Markusen, J. (1989). Trade in producer services and in other specialized intermediate inputs. *American Economic Review*, 79(1):85–95.

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

Muûls, M. (2008). Exporters and credit constraints. a firm-level approach. National Bank of Belgium Working Paper, 2008-09-22.

Muûls, M. and Pisu, M. (2009). Imports and exports at the level of the firm: Evidence from belgium. *World Economy*, 32(5):692–734.

Rajan, R. and Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, 3:559–86.

Rivera-Batiz, L. and Romer, P. (1991). International trade with endogenous technological change. *European Economic Review*, 35(4):971–1001.

Schor (2004). Heterogeneous productivity response to tariff reduction: evidence from brazilian manufacturing firms. *Journal of Development Economics*, 75:373–396.

Topalova, P. (2004). Overview of the indian corporate sector: 1989-2002. IMF Working Papers 04/64.

Whited, T. M. (1992). Debt, liquidity constraints, and corporate investment: Evidence from panel data. *Journal of Finance*, 47(4):1425–60.

Table 1 – Access to external finance and import of capital goods decision (1996-2006)

Dependent variable	Dummy equal one if firm(i) imports capital goods in t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage(i)(t-1)	-0.217***	-0.528***					-0.308***	
	(0.057)	(0.053)					(0.019)	
Leverage(i)(t-2)			-0.457***					
			(0.077)					
Liquidity ratio (i)(t-1)				0.490***	0.289***			0.052**
				(0.067)	(0.070)			(0.026)
Liquidity ratio(i)(t-2)						0.197***		
						(0.056)		
Log wage bill (i)(t-1)		0.155***	0.156***		0.108***	0.083***	0.167***	0.164***
		(0.018)	(0.019)		(0.027)	(0.024)	(0.004)	(0.004)
Capital intensity(i)(t-1)		0.024**	0.003		0.032***	0.014*	0.041***	0.038***
		(0.011)	(0.013)		(0.011)	(0.008)	(0.004)	(0.005)
Output Tariff(s)(t-1)		-0.123	-0.188		-0.113	-0.111	-0.044	-0.058
		(0.184)	(0.199)		(0.149)	(0.123)	(0.125)	(0.124)
Herfindhal index(s)(t-1)		0.003	0.000		0.001	-0.000	0.005	0.005
		(0.007)	(0.007)		(0.005)	(0.004)	(0.005)	(0.005)
Import propensity(s)(t)		0.111***	0.118***		0.084***	0.066***	0.076***	0.078***
		(0.035)	(0.030)		(0.020)	(0.016)	(0.024)	(0.024)
Age(i)							0.011	-0.003
							(0.031)	(0.030)
Age^2(i)							-0.018***	-0.014***
							(0.005)	(0.005)
Foreign status(i)							0.123***	0.154***
							(0.014)	(0.013)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Industry (2 digit) fixed effects	No	No	No	No	No	No	Yes	Yes
Region fixed effects	No	No	No	No	No	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,109	15,042	13,474	21,114	15,046	13,482	21,372	21,376
pseudo R-squared	0.0712	0.0574	0.0533	0.0560	0.0471	0.0462	0.166	0.156
Log likelihood	-7766	-5650	-5086	-7895	-5715	-5128	-12345	-12497

Notes: The table reports marginal effects evaluated at the mean values from conditional logit estimations of Equation (I) in columns (1) to (6) and of Logit estimations with industry and region fixed effects in columns (7) to (8). We focus on the subsample of switchers (firms that change their import status). The dependent variable is a dummy equal to one if the firm i imports capital goods in t. All explanatory variables are lag of one period to control for potential endogeneity issues. Firms' capital intensity is the ratio of capital over the wage-bill. The financial variables that we use are leverage(i) and liquidity ratio(i). Leverage(i) is the ratio of borrowings over total assets and liquidity ratio(i) is the ratio of current assets over total liabilities of the firm. The output tariff and the Herfindhal index are at the 2-digit NIC industry level. Import propensity industry is calculated as the mean of imports for all firms with available information in the 2 digit NIC industry. In parentheses we report heteroskedasticity-robust standards errors. Disturbances are corrected for clustering at the firm level. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 2 – Decision to import intermediates conditional to have never imported capital goods

Dependent variable	Dummy equal one if firm(i) imports intermediates in t			
	(1)	(2)	(3)	(4)
	Full sample		Never imported capital goods	
Leverage(i)(t-1)	-0.088		-0.041	
	(0.052)		(0.044)	
Liquidity ratio (i)(t-1)		0.111**		0.063
		(0.050)		(0.044)
Log wage bill (i)(t-1)	0.208***	0.111**	0.094	0.036
	(0.065)	(0.049)	(0.058)	(0.044)
Capital intensity(i)(t-1)	0.104***	0.059**	0.044*	0.018
	(0.031)	(0.025)	(0.026)	(0.013)
Output Tariff(s)(t-1)	0.073	0.035	0.277**	0.108*
	(0.142)	(0.075)	(0.125)	(0.058)
Herfindhal index(s)(t-1)	0.004	0.002	0.001	0.000
	(0.005)	(0.003)	(0.004)	(0.002)
Import propensity (s)(t)	0.058***	0.030**	0.044**	0.016*
	(0.021)	(0.013)	(0.020)	(0.009)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	11216	11216	5458	5458
pseudo R^2	0.0925	0.0941	0.0800	0.0850
Log likelihood	-3987	-3981	-1970	-1960

Notes: The table reports marginal effects evaluated at the mean values from conditional logit estimations. We focus on the subsample of switchers (firms that change their import status). The dependent variable is a dummy equal to one if the firm i imports intermediate goods in t. Columns (3) to (5) restrict the sample to firms that never imported capital goods. All explanatory variables are lag of one period to control for potential endogeneity issues. Firms' capital intensity is the ratio of capital over the wage-bill. The financial variables that we use are leverage(i) and liquidity ratio(i). Leverage(i) is the ratio of borrowing over total assets and liquidity ratio(i) is the ratio of current assets over total liabilities of the firm. The output tariff and the Herfindhal index are at the 2-digit NIC industry level. Import propensity industry is calculated as the mean of imports for all firms with available information in the 2 digit NIC industry. In parentheses we report heteroskedasticity-robust standards errors. Disturbances are corrected for clustering at the firm level. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 3 – Trade liberalization and imports of capital goods

Dependent variable	Dummy equal one if firm(i) imports of capital goods				
	(1)	(2)	(3)	(4)	(5)
Tariffs capital goods	-0.626***	-0.671***	-0.264*	-0.501***	-0.084*
	(0.115)	(0.134)	(0.144)	(0.099)	(0.049)
Leverage(i)(t-1)		-0.555***	-0.564***		
		(0.038)	(0.069)		
Liquidity ratio (i)(t-1)				0.353***	0.156***
				(0.021)	(0.026)
Log wage-bill(i)(t-1)		0.091***	0.083***	0.065***	0.026***
		(0.014)	(0.014)	(0.009)	(0.006)
Capital intensity(i)(t-1)		0.013	0.015	0.028***	0.013***
		(0.010)	(0.010)	(0.007)	(0.004)
Herfindhal index(s)(t-1)			-0.007		-0.002
			(0.007)		(0.002)
Import propensity(s)			0.128***		0.041***
			(0.016)		(0.005)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	20165	15061	15061	15065	15065
pseudo R^2	0.00173	0.0308	0.0346	0.0181	0.0223
Log likelihood	-7980	-5819	-5796	-5898	-5873

Notes: The table reports marginal effects evaluated at the mean values from conditional logit estimations. The dependent variable is a dummy equal to one if the firm i imports capital goods in t. Δ *tariffs capital goods* represents the variation in the average tariffs of capital equipments goods computed using hs6 product level data of MFN tariffs applied by India from TRAINS. All explanatory variables are lag of one period to control for potential endogeneity issues. Firms' capital intensity is the ratio of capital over sales. The financial variables that we use are leverage(i) and liquidity ratio(i). Leverage(i) is the ratio of borrowings over total assets and liquidity ratio(i) is the ratio of current assets over total liabilities of the firm. Import propensity industry is calculated as the mean of imports for all firms with available information in the 2 digit NIC industry. In parentheses we report heteroskedasticity-robust standards errors. Disturbances are corrected for clustering at the firm level. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 4 – Alternative technology measures (1996-2006): Royalties and Know How

Dependent variable	Dummy=1 if firm pays foreign royalties				Dummy=1 if firm pays royalties (domestic or foreign)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage(i)(t-1)	-0.203***	-0.140***			-0.124***	-0.079**		
	(0.024)	(0.053)			(0.022)	(0.040)		
Liquidity ratio (i)(t-1)			0.166***	0.150*			0.234***	0.112*
			(0.062)	(0.091)			(0.044)	(0.068)
Log Wage-bill(i)(t-1)		0.084***		0.100***		0.079***		0.084***
		(0.028)		(0.025)		(0.016)		(0.014)
Capital intensity(i)(t-1)		0.023*		0.034**		-0.003		0.003
		(0.012)		(0.015)		(0.010)		(0.011)
Industry control variables:								
Output Tariff(s)(t-1)	No	Yes	No	Yes	No	Yes	No	Yes
Herfindhal index(s)(t-1)	No	Yes	No	Yes	No	Yes	No	Yes
Import propensity(s)	No	Yes	No	Yes	No	Yes	No	Yes
Firm and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10170	7561	10176	7566	14574	10473	14580	10478
pseudo R^2	0.0604	0.0537	0.0544	0.0525	0.00972	0.0107	0.00937	0.0105
Log likelihood	-3715	-2791	-3741	-2796	-5782	-4169	-5787	-4171

Notes: The table reports marginal effects evaluated at the mean values from conditional logit estimations of Equation (I). The dependent variable in columns (1) to (4) is a dummy equal to one if the firm i reports positive expenditures on foreign royalties and technical know how in t, in columns (5) to (8) is a dummy equal to one if the firm i reports positive expenditures on total royalties. We use the same control variables as in Table1. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 5 – Alternative technology measures (1996-2006): Research and Development

Dependent variable	Dummy=1 if firm does R&D			
	(1)	(2)	(3)	(4)
Leverage(i)(t-1)	-0.221**	-0.312***		
	(0.092)	(0.051)		
Liquidity ratio (i)(t-1)			0.285***	0.260***
			(0.015)	(0.066)
Wage-bill(i)(t-1)		0.222***		0.183***
		(0.019)		(0.034)
Capital intensity(i)(t-1)		0.009		0.020*
		(0.012)		(0.011)
Industry control variables:				
Output Tariff(s)(t-1)	No	Yes	No	Yes
Herfindhal index(s)(t-1)	No	Yes	No	Yes
Import propensity(s)	No	Yes	No	Yes
Firm and year fixed effects	Yes	Yes	Yes	Yes
Observations	7938	9331	12376	9331
pseudo R^2	0.0316	0.0617	0.0289	0.0589
Log likelihood	-2955	-3395	-4701	-3405

Notes: The table reports marginal effects evaluated at the mean values from conditional logit estimations of Equation (I). The dependent variable is a dummy equal to one if the firm i reports positive expenditures on R&D in *t*. We use the same control variables as in Table1. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 6 – Decision to start importing capital goods

Dependent variable	dummy==1 if firm imports capital goods$_{it}$= 1					
	Firms that do not import capital goods in the previous					
	two years		four years		four years	
	(1)	(2)	(3)	(4)	(5)	(6)
Leverage(i)(t-1)	-0.417***		-0.546***		-0.121***	
	(0.137)		(0.203)		(0.018)	
Liquidity ratio (i)(t-1)		0.174*		0.099		0.124***
		(0.092)		(0.080)		(0.024)
Log wage-bill(i)(t-1)	0.154***	0.076*	0.239***	0.086	0.036***	0.037***
	(0.042)	(0.042)	(0.071)	(0.072)	(0.004)	(0.004)
Capital intensity(i)(t-1)	0.096***	0.056*	0.115***	0.047	0.014***	0.019***
	(0.028)	(0.029)	(0.038)	(0.037)	(0.005)	(0.005)
Output Tariff(s)(t-1)	-0.290	-0.200	-0.372	-0.173	0.018	0.006
	(0.338)	(0.215)	(0.484)	(0.246)	(0.131)	(0.133)
Herfindhal index(s)(t-1)	-0.012	-0.005	-0.008	-0.003	-0.006	-0.007
	(0.012)	(0.007)	(0.016)	(0.006)	(0.006)	(0.006)
Import propensity(s)(t)	0.047	0.031	0.077	0.032	0.037	0.042
	(0.052)	(0.022)	(0.067)	(0.024)	(0.025)	(0.026)
Age(i)					-0.071**	-0.088***
					(0.028)	(0.028)
Age^2(i)					0.006	0.009*
					(0.005)	(0.005)
Foreign status(i)					0.045*	0.056**
					(0.024)	(0.025)
Firm fixed effects	Yes	Yes	Yes	Yes	No	No
Industry (2 digit) fixed effects	No	No	No	No	Yes	Yes
Region fixed effects	No	No	No	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,373	4,374	2,989	2,989	5,882	5,882
pseudo R-squared	0.0738	0.0650	0.165	0.151	0.0581	0.0539
Log likelihood	-1320	-1333	-788.1	-801.2	-2374	-2385

Notes: Columns (1) to (4) report marginal effects evaluated at the mean values from conditional logit estimations with firm and year fixed effects and columns (5) to (6) report marginal effects from a Logit estimation with industry, region and year fixed effects. We focus on the subsample of switchers (firms that change their import status). The dependent variable is a dummy equal to one if the firm i imports capital goods in t and have not imported in the previous four years. We use the same control variables as in Table1. ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 7 – Imports of capital goods - Instrumental Variables estimations

Dependent variable	dummy=1 if firm imports capital goods$_{it}$= 1							
Estimation	Benchmark		IV		Benchmark		IV	
Estimator	OLS	OLS	2SLS	2SLS	Within	Within	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage(i)(t-1)	-0.210***		-0.175***		-0.096***		-0.237**	
	(0.016)		(0.021)		(0.019)		(0.112)	
Liquidity ratio (i)(t-1)		0.143***		0.041		0.122***		0.102
		(0.023)		(0.032)		(0.033)		(0.328)
Log wage(i)(t-1)	0.145***	0.147***	0.143***	0.144***	0.069***	0.074***	0.057***	0.074***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.007)	(0.007)	(0.012)	(0.011)
Capital intensity(i)(t-1)	0.082***	0.090***	0.073***	0.069***	0.037***	0.044***	0.028***	0.044***
	(0.004)	(0.004)	(0.006)	(0.007)	(0.006)	(0.006)	(0.009)	(0.006)
Output tariff(s)(t-1)	0.103	0.078	0.099	0.075	-0.013	-0.021	0.012	-0.022
	(0.152)	(0.152)	(0.151)	(0.152)	(0.097)	(0.097)	(0.100)	(0.100)
Herfindhal index(s)(t-1)	0.005	0.004	0.005	0.004	0.000	0.000	0.001	0.000
	(0.005)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)
Import propensity(s)(t)	0.054*	0.051*	0.053*	0.052*	0.052***	0.050***	0.054***	0.050***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.019)	(0.019)	(0.019)	(0.019)
Age(i)	0.012	0.003	0.016	0.022				
	(0.042)	(0.043)	(0.042)	(0.043)				
Age^2(i)	-0.009	-0.007	-0.010	-0.011				
	(0.007)	(0.007)	(0.007)	(0.007)				
Foreign status(i)	0.106***	0.127***	0.110***	0.130***				
	(0.013)	(0.013)	(0.013)	(0.013)				
Firm fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Industry (2 digit) FE	Yes	Yes	Yes	Yes	No	No	No	No
Region fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,817	12,817	12,817	12,817	17,263	17,263	17,263	17,263
R-squared	0.258	0.249	0.258	0.247	0.020	0.019	0.016	0.019
Hansen statistic			3.017	1.487			5.136	8.610
p-value of Hansen			0.221	0.475			0.162	0.0350

Notes: ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively. Columns (1) and (2), and (5) and (6) correspond respectively to the benchmark estimations with OLS and within fixed effect estimators. Columns (3) and (4) correspond to the IV estimations including industry, region and year fixed effects. Columns (7) and (8) report estimation coefficients for the IV estimation with firm and year fixed effects. Endogenous variables the leverage ratio and the capital intensity of the firm, or the liquidity ratio and the capital intensity. Instruments include the leverage ratio or the liquidity ratio with 4 and 5 lags, the capital intensity with 4 lags, and the mean capital intensity within the industry.

Table 8 – Imports of capital goods - depedence on external finance in the industry

Dependent variable	dummy=1 if firm imports capital goods$_{it}$= 1					
Estimator	OLS		Within	OLS		Within
	(1)	(2)	(3)	(4)	(5)	(6)
Leverage(i)(t-1)	-0.112***	0.016	-0.019			
	(0.020)	(0.044)	(0.045)			
Leverage(i)(t-1)×Ext.Dep.(s)	-0.172***	-0.191***	-0.146**			
	(0.056)	(0.058)	(0.074)			
Leverage(i)(t-1)×Cap.Int.(s)		-1.600***	-0.408			
		(0.485)	(0.515)			
Liquidity ratio (i)(t-1)				0.129***	0.021	-0.002
				(0.028)	(0.058)	(0.074)
Liquidity ratio (i)(t-1)×Ext.Dep.(s)				-0.079	-0.069	0.291***
				(0.064)	(0.064)	(0.089)
Liquidity ratio (i)(t-1)×Cap.Int.(s)					1.379**	0.587
					(0.646)	(0.862)
Log wage(i)(t-1)	0.143***	0.143***	0.058***	0.146***	0.146***	0.063***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
Capital intensity(i)(t-1)	0.086***	0.087***	0.039***	0.093***	0.094***	0.046***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)
Output tariff(s)(t-1)	0.287***	0.290***	-0.002	0.267***	0.266***	-0.006
	(0.089)	(0.089)	(0.074)	(0.090)	(0.090)	(0.074)
Herfindhal index(s)(t-1)	0.005	0.005	0.001	0.005	0.005	0.001
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Import propensity(s)(t)	0.008	0.008	0.042***	0.007	0.007	0.044***
	(0.009)	(0.009)	(0.013)	(0.009)	(0.009)	(0.013)
Age(i)	-0.015	-0.015	-0.113**	-0.030	-0.028	-0.108*
	(0.024)	(0.024)	(0.057)	(0.024)	(0.024)	(0.057)
Age(i)^2	-0.005	-0.005	0.061***	-0.002	-0.002	0.053***
	(0.004)	(0.004)	(0.020)	(0.004)	(0.004)	(0.020)
Foreign Status (i)	0.110***	0.110***		0.127***	0.126***	
	(0.010)	(0.010)		(0.011)	(0.011)	
Firm fixed effects	No	No	Yes	No	No	Yes
ISIC Industry fixed effects	Yes	Yes	No	Yes	Yes	No
Region fixed effects	Yes	Yes	No	Yes	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,523	20,523	33,701	20,527	20,527	33,705
R-squared	0.233	0.233	0.025	0.226	0.226	0.024
Log likelihood	-12174	-12170	-4336	-12271	-12268	-4355

Notes: ***,**, and * indicate significance at the 1, 5 and 10 percent levels respectively. Columns (1), (2), (4) and (5) report the estimation results using OLS estimator. Columns (3) and (6) report the estimation results using the within fixed effect estimator. Leverage(i)(t-1)×Ext.Dep. is the interaction variable between the Leverage ratio and the variable external dependence provided by Braun (2002) and Braun and Larrain (2005). Leverage(i)(t-1)×Cap.Int. is the interaction of the leverage ratio with the capital intensity of the industry, also provided by Braun (2002). External dependence and capital intensity are sector-specific, with ISIC rev.2 3-digits classification.

APPENDIX

6. THEORETICAL APPENDIX

A. Price index approximation

Following Chaney (2005), we assume that the price index only depends on local firms'prices and that foreign firms do not face any liquidity constraints. The price index approximation is:

$$P \approx \left(\int_{\varphi \geq \varphi_d^*} p_d(\varphi)^{1-\phi} L dF_\varphi(\varphi) \right)^{\frac{1}{1-\phi}}$$

We define a function $g(.)$ in the following way:

$$g(.): \ \varphi^{*\phi-1} = \left(\frac{\phi}{\mu} \int_{\varphi \geq \varphi^*} \varphi^{\phi-1} dF_\varphi(\varphi) \right) \times F \Leftrightarrow \varphi^* = g(F)$$

B. Credit constrained firms

A sufficient condition for the existence of liquidity constraints importers is $\frac{c_f}{c_d} < 1$. This is the assumption that we introduce concerning the relative per unit cost is then equal to $\frac{c_f}{c_d} = \frac{\tau_m^{\eta(1-\alpha)}}{\gamma} < 1$. This condition implies that the efficiency parameter of imported capital goods is higher than its additional variable cost relative to domestic ones ($\gamma > \tau_m^{\eta(1-\alpha)}$).

Proposition 1: *Under the assumption that $\chi < 1$, there is a subset of firms (denoted Φ) subject to liquidity constraints with a productivity level between $\varphi_f^* < \varphi < \overline{\varphi}(A)$.*

Proof. In order to prove that Φ is not empty we investigate whether $\overline{\varphi}(0) > \varphi_f^*$:

$$\left(\frac{F + F_T - \lambda A}{F} \right)^{\frac{1}{\phi-1}} \varphi_d^* \ > \ \left(\frac{F + F_T}{F} \right)^{\frac{1}{\phi-1}} \left(\frac{c_f}{c_d} \right) \varphi_d^*$$

7. EMPIRICAL APPENDIX

Appendix Table : Descriptive statistics

	Mean	**Std. Dev.**
Financial variables		
Liquidity ratio	0.50	0.23
Leverage ratio	0.45	0.53
Foreign technology measures		
Imports of capital goods	1.20	1
Imports of intermediate goods	8.39	11
Total royalties and technical Know How	1.56	37
Foreign royalties and technical Know How	0.37	7
R&D	0.61	10
Firm level characteristics		
Wage bill	6	39
Capital intensity (capital stock over wage bill)	7.15	180
Industry level controls (NIC 2 digit)		
Tariff	0.31	0.07
Herfindhal index	0.89	0.84
Import propensity	10	7.67

Notes: Mean values and standard errors in parentheses are reported. Leverage(i) is the ratio of borrowings over total assets and liquidity ratio(i) is the ratio of current assets over total liabilities of the firm.