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Credit Constraints, Technology Choice and Exports: A Firm-Level Study for Latin American Countries*

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Abstract

In this paper, constraints on technology choice and credit access are introduced into a firm-level trade model in a dynamic setting in order to explain factors that limit benefits to a firm from trade liberalization. Theoretical analysis shows that firms face credit constraints depending on their initial productivity and the cost of credit. As a result, credit-constrained firms may not be able to cross the minimum productivity threshold needed to enter and compete in a foreign market. Empirical analysis using firm-level panel data for six Latin American countries confirms that financial constraints negatively influence firms' export and investment decisions.

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1. Introduction

Access to firm-level trade data has stimulated research on productivity variation across firms and their decision to produce for domestic or foreign markets, with studies identifying some unique features: for example, Clerides *et al*. (1998) find that exporters have higher productivity than non-exporters. An explanation for such an empirical observation was almost non-existent until Melitz (2003) developed a model where firms only enter foreign markets if their productivity is above a certain threshold. The underlying idea is that with higher productivity under economies of scale, firms face declining long run average costs. Based on their higher productivity, exporters make enough profits to cover the fixed costs incurred in establishing foreign market operations. Firms operating below the cut-off threshold of productivity are forced to exit, trade liberalization diverting factors of production towards the most productive firms in the market.

Melitz assumes that all firms use the same production technology, but are heterogeneous in their productivity levels supported through a productivity draw from an exogenous distribution. This affects a firm's production decision: it either produces for the domestic market alone, it produces for the foreign market as well, or it exits the industry. In addition, firms are not credit-constrained in their investment decisions regarding fixed costs of market entry. However, realities on the ground in developing countries do not support these assumptions: firms produce using various types of technologies, and may require credit to finance acquisition of frontier-level technology. Trade liberalization, therefore, may not result in diversion of resources towards the most productive enterprises.

Access to financial credit is a significant issue for firms in developing countries where equity markets are underdeveloped. The associated information asymmetries and contract enforcement problems make external credit an imperfect substitute for firm's retained earnings.

Firms with limited or no access to credit, therefore, cannot undertake potentially profitable projects without incurring the extra cost of capital. Thus access to new technology is also adversely affected, firms being constrained in their investment decisions.

The decision to make initial and ongoing investment is contingent on a firm's perception that future benefits will outweigh costs. As a consequence, the solution to a firm's profit maximization problem subject to technology costs leads to an optimal investment decision in a dynamic two-period setting. In this paper, firms are assumed to be able to opt between low, intermediate and high levels of technology, their decision being constrained by the limitations of retained earnings and availability of external credit.

Two key findings are reported in this paper: first, at the firm-level, arriving at the optimal investment decision is critical for a profit maximizing firm. A firm having already invested in a specific technology knows its productivity and profits. Using these it can decide on optimal investments to upgrade its production technology. The theoretical model leads to the interesting conclusion that credit demand of a firm is positively related to the size of an economy gauged by aggregate expenditure but is negatively related to the cost of credit. It is also found that a firm's demand for credit is positively related to its initial productivity. Second, at the policy-level, marginal firms can be identified who if supplied with essential credit can cross the productivity threshold and enter foreign markets.

The significance of credit constraints on investment and export decisions of firms is also examined empirically using a panel data set for firms from Latin America. The econometric results suggest that credit availability is significant for the decision to export (the extensive margin), but not in determining the volume of exports (the intensive margin). In addition, the

empirical results indicate that a firm's decision to invest in capital goods depends on its access to credit, and investment in capital goods has a positive effect on its export decision.

2. Literature Review

Melitz (2003) introduced productivity differences between firms into Krugman's (1980) model of intra-industry trade. On the demand side, a constant elasticity of substitution (CES) utility function allows consumption of substitutable varieties of a product. On the supply side, market structure is characterized by monopolistic competition and firm productivity is random. Firms face a constant marginal cost and fixed cost production technology with a single input (labor). A firm has to pay a fixed cost of entry and only after that does it obtain its productivity draw from a known distribution. After observing its productivity, a firm decides whether to produce or exit the market.

The innovative element in Melitz is the representation of firm heterogeneity using idiosyncratic productivity of each firm. However, this feature has been adapted with respect to technology and the impact of credit constraints. Schmidt (2010) allows firms to choose between three alternative technologies. The most basic technology is analogous to the firm's own technological frontier. The other two technologies go beyond the firm's own technological frontier. Firms deciding to upgrade technology may aim at technology from countries within the world technological frontier, or from the world leaders in research and development (R&D). The choice of technology affects the firm's exporting behavior: those with higher technological status are more likely to enter the export market.

Other researchers have evaluated the effect of credit constraints on trade. For example, Manova (2013) has shown that there is a negative effect of credit constraints on the intensive margin of trade at both the industry and country level. Thus, firms belonging to sectors that

depend on outside financing and having less collateral are the most affected. Manova et al. (2015, forthcoming) also show that credit constraints have a negative impact on both the intensive and extensive margins of trade. Analysis of French firm-level data by Mayneris (2011) shows that financial constraints have a negative impact on a firm's probability of becoming an exporter but do not affect the quantities exported by the firm. While Berman and Hericourt (2010) show that in the case of developing economies, access to finance has a positive effect on the foreign market entry decision of firms, but a firm's financial health does not increase the extent of exports. Overall, the available empirical evidence shows that the impact of financial constraints on the intensive margin of trade is mixed (Wagner, 2014).

3. Model

Consider two symmetric countries, home *h* and foreign *f* with similar wages, i.e., a firm incurs the same marginal cost in any specific industry. The investment decision of a firm in *h* is conditioned on its decision to produce either for the home market, for both home and foreign markets, or to increase the volume of its exports. Following Schmidt (2010), firms choose between three alternative technologies: *L* (primitive), *M* (intermediate), and *H* (latest). Also, drawing on Manova (2013), the decision by firms to invest in technology is subject to credit constraints.

Firms invest at time t_0 based on their production decision at time t_1, the only input being labor. As noted above, a three-tier technology choice is adopted where the top level has the highest initial fixed cost but the lowest marginal cost of production. Based on a firm's initial technology type, associated productivity, fixed and marginal costs of production, and profits for each period are derived. The initial choice of technology is exercised by a firm at time t_0. Retained earnings and available external credit decide a firm's investment decision and hence its

profits at time t_1. It is assumed that a firm may experience a positive change in its productivity arising out of R&D producing the technical change and which is not accounted for by the typical inputs (labor, capital, and intermediate goods). Given this, the investment decision of the firm is modeled, pinning down its relevant credit requirements. Its productivity is, therefore, dependent on the underlying technology of production, subject to its ability to finance this choice.

Consider two time periods, t_0 and t_1, the firm's productivity φ_t^T being indexed on subscript *t* the time period, and *T* refers to the technology of production. A firm at time t_0 draws initial productivity φ_0^T from a distribution $G\left(\varphi_0^T\right)$, with support [0, ∞]. At the same time, the firm also decides about technology innovation depending on its production decision at time t_1. Of the possible situations at t_0, focus is limited to the following two cases: first, a firm with technology *L* finds its productivity is just sufficient to survive in the domestic market and it decides to enhance its productivity by investing in technological innovation, and hence entering the export market (the extensive margin); second, a firm's technology is *M* and its productivity is such that it can undertake some export activity which can be further enhanced, both in terms of quantities and destinations, by switching to technology *H* (the intensive margin).

It is assumed that a firm can commit t_0 profits and the balance of investment is financed through external credit. The cost of the technology upgrade is incurred at time t_0 and the productivity enhancement is achieved at time t_1.

Model Setup

A representative consumer with CES preferences characterizes the demand-side. The good *q* is produced over a continuum with total available varieties *N*, indexed over *ω*, with the following utility function:

$$U = \left[\int_0^N q(\omega)^{\rho} \, d\omega \right]^{\frac{1}{\rho}}, \tag{1}$$

where varieties of good q are imperfect substitutes, implying $0 < \rho < 1$ and the elasticity of substitution σ between any two goods is given by $\sigma = \frac{1}{(\rho - 1)} > 1$.

Firms are heterogeneous, producing substitutable varieties of good *q*, the market being monopolistically competitive. A firm's technology choices *T=L, M* and *H* have increasing fixed costs and decreasing marginal costs across these choices. A firm starting with technology *L* at t_0 may opt for technology *M* or *H*. As the latter requires firms to incur a higher fixed cost, the firm has to invest to benefit from a lower marginal cost of production. Under monopolistic competition each firm faces a residual demand curve, charging a markup over marginal cost. Wages are the same for all technology types and are normalized to one - otherwise with low technology, a firm will employ low paid, less skilled labor that has low productivity, thereby resulting in higher marginal cost.

Firms with technology *T* produce with constant marginal cost $\left(1/\varphi^T\right)$ and multiples of fixed cost *f*. The fixed cost multiple is η_T such that for the three technology options $\eta_H > \eta_M > \eta_L = 1$. The total cost (*TC*) under each technology irrespective of time period is given as:

$$TC_T = \eta_T f + \frac{q}{\varphi^T} \ . \tag{2}$$

In order to enter an industry a firm first has to incur a technology-specific sunk cost. The firm knows its productivity level only after that. As in Melitz, until its productivity is drawn the firm is not aware of whether it will remain in the market or will be forced to exit. As a result, firms do not know their productivity unless they incur the fixed cost of entering the market. A

rational firm picks the technology with the lowest fixed cost in order that it incurs minimum losses in case it is forced to exit. Although a firm's productivity is positively related to its technology, gains in productivity from more expensive technologies are assumed to be diminishing. In every period there is a probability ∂ that a firm is hit by a bad shock, forcing it to exit. It is assumed that with technology choice *L*, the productivity level φ^L crosses the threshold level required to make non-negative profits in the home market. For the three technology types the corresponding firm productivity ranges follow the increasing order $\varphi^H > \varphi^M > \varphi^L$ and $\tilde{\varphi}^T$ represents the mean productivity of the group of firms using technology *T*.

Firms' profits and productivity associated with technologies *L* and *M* are shown in Figure 1. The vertical intercepts give the fixed costs associated with each technology and the fixed costs of exporting $f_{x.}$. Technology *L* has a fixed cost of f and zero-cutoff productivity $\hat{\varphi}^L$ such that any firm with productivity below is forced to exit. For the marginal firm the productivity cutoff condition is $\pi_h(\hat{\varphi}_0^L) = 0.$ The mean productivity of technology *L* is $\tilde{\varphi}^L$, where the technology-specific mean productivity is used to determine the equilibrium conditions.

INSERT Figure 1 here

In the case of technology *M*, if the firm produces for the home market alone the fixed cost is $\eta_1 f (\eta_1 \in \eta_M)$ and if it produces for the foreign market the total fixed cost is $\eta_1 f + f_x$ as shown in Figure 1. $\tilde{\varphi}^M$ is the zero cutoff productivity level for technology *M*. For the marginal firm switching from optimal productivity $\tilde{\varphi}^L$ under technology *L*, the following condition holds:

$$\pi_h\left(\hat{\varphi}^{M(h)}\right) = \pi_h\left(\tilde{\varphi}^L\right) . \tag{3}$$

At this productivity, when the firm switches from technology *L* to technology *M* and produces for the home country, it can profitably cover the higher fixed cost $\eta_1 f$ and earn higher profits. If the firm also decides to produce for the foreign market, it meets the condition:

$$\pi_{h+f}\left(\hat{\varphi}^{M(h+f)}\right)=\pi_h\left(\tilde{\varphi}^L\right), \tag{4}$$

i.e., a firm whose productivity with technology *L* permits it to opt for an investment decision will acquire technology *M.* In terms of Figure 1, (3) and (4) are the intersection points indicated by the dotted lines. Similar equilibrium conditions exist for switching from technology *M* to *H*.

Technology Choice and Investment Decisions by Firms with Technology L

It is assumed that a firm with technology *L* has productivity that is just feasible for producing for *h*, i.e., the home market only. In t_0 the firm maximizes the following profit function:

$$\pi_h\left(\varphi_0^L\right)=p_h\left(\varphi_0^L\right)q_h\left(\varphi_0^L\right)-\frac{q_h\left(\varphi_0^L\right)}{\varphi_0^L}-f, \tag{5}$$

where in the home market, p_h is price and q_h is quantity a firm produces. Now let the firm decide on upgrading to either technology *M* or *H*, which implies a need for external financing through credit $C(.)$ measured in terms of labor. In t_1 a firm has to pay back, $R(.)C(.)$, where $R(.)\geq 1$ is the principal plus interest rate charged by the creditor. The credit amount and the rate of interest charged by a financial institution are a function of several factors including a firm's productivity in t_0, the collateral it can offer, its profit earning trend, and its affiliation with either a domestic or foreign business group, and expected profits in t_1. Due to information asymmetries the opportunity cost of external financing is greater than internal financing which is normalized to one. By adopting improved technology, a firm will produce for both the home and foreign markets such that it earns positive profits from both in t_1. However, the firm has to pay the

additional trade costs, which includes the fixed cost $f_x > 0$, variable iceberg transport costs and the cost of credit. The firm, therefore, maximizes the following:

$$\Pi(\varphi_1^{M/H}) = \pi'_f(\varphi_1^{M/H}) + \pi'_h(\varphi_1^{M/H}) - R(.)C(.), \tag{6}$$

where $\pi'_f\left(\varphi_1^{M/H}\right)$ and $\pi'_h\left(\varphi_1^{M/H}\right)$ are the present value of firm profits from foreign and home markets respectively with either technology *M* or *H* in t_1, $\pi' = (1/d)\pi$ is discounted future profit. To determine the profit maximizing credit amount under no uncertainty, the first order condition is applied to the above equation with respect to $C(.)$:

$$\frac{\delta\left\{\Pi\left(\varphi_1^{M/H}\right)\right\}}{\delta\left\{C(.)\right\}} = \frac{\delta\pi'_f}{\delta\left\{C(.)\right\}} + \frac{\delta\pi'_h}{\delta\left\{C(.)\right\}} - \frac{\delta[R(.)C(.)]}{\delta\left\{C(.)\right\}} = 0. \tag{7}$$

Simply, this shows that at t_0 the feasible credit should be such that in equilibrium at t_1 a firm's marginal rate of return from the investment is equal to the marginal cost of the credit. If a firm produces for both the home and foreign markets then the profits are given as:

$$\pi_h\left(\varphi_1^M\right) + \pi_f\left(\varphi_1^M\right) = \frac{\left(1+\tau^{1-\sigma}\right)}{\rho} E\left(P\rho\right)^{\sigma-1}\left(\varphi_1^M\right)^{\sigma-1} - \eta_M f - f_x. \tag{8}$$

Assuming that productivity has a diminishing return to investment and considering that the entire investment is financed by credit, the relationship between the two period productivities and the investment is given by:

$$\varphi_1^{M/H} = \left[C\left(\varphi_0^L, .\right)\right]^{\alpha} \varphi_0^L, \tag{9}$$

where $0 < \alpha < 1$. The credit is to acquire higher level technology *M* or *H*. Using the relation above, the optimal investment for this case is as follows,

$$C\left(\varphi_0^L,.\right)=\left(E\alpha\right)^{\frac{1}{\beta}}\left[\frac{\sigma\text{-}1}{\sigma}\right]^{\frac{\sigma}{\beta}}\left[P\varphi_0^L\right]^{\frac{\sigma\text{-}1}{\beta}}\left[\frac{\delta}{1+\tau^{1\text{-}\sigma}}\right]^{\frac{1}{\beta}}\left[\frac{1}{R\left(\varphi_0^L,.\right)}\right]^{\frac{1}{\beta}}, \quad (10)$$

where $\beta=1-\alpha\left(\sigma-1\right)$, and $\beta\neq 0$ to ensure the investment function converges.

Some intuition is useful at this point. The firm's investment decision is determined endogenously in the model. Credit demand is a decreasing function of its price so the higher the price of credit, the higher will be the level of credit constraint faced by the firm. Also investment financed by credit is positively related to a firm's initial productivity such that more productive firms demand larger loans.

4. Empirical Implementation

Considering the fixed costs in (5) and (8), a firm may face credit constraints for either the market entry or export decision or both. Consequently, the following testable hypotheses can be stated:

(i) Credit availability increases the likelihood of export by a firm (extensive margin)

(ii) A firm's volume of exports is more likely to increase with credit (intensive margin)

(iii) The likelihood of a firm investing in capital goods increases with access to credit

(iv) The likelihood of a firm exporting increases with its investment in capital goods.

Data

Data were collected from the World Bank Enterprise Surveys for Latin American countries, conducted in 2006 and 2010 covering Argentina, Bolivia, Chile, Colombia, Mexico and Peru. The surveys contain detailed quantitative and qualitative questions about firm's access to finance, production, innovation, labor employment and business related infrastructure and market information. The main piece of survey information used in this paper relates to credit access, exports as a percentage of sales and investment in capital goods. The use of panel data in the analysis provides controls for unobservable variables such as differences in business practices

across firms; or variables that change over time but not across entities, i.e., national policies, federal regulations, international agreements, etc. That is, use of panel data enables us to account for individual firm heterogeneity.

A comparison of Tables 1 and 2 confirms that the number of firms reporting high interest rates as a reason for not applying for credit was rising in Argentina and falling in Peru. The evidence presented in the tables also shows that many Mexican firms do not have a bank account of their own, which confirms the presence of an informal channel of financing.

INSERT Tables 1 and 2 here

Sample Selection

The industry selection in the dataset is broad-based and firm selection is random to ensure that they are true representatives of the population. The degree of heterogeneity in the sample reduces as the firms share the following: they are small or medium in size, privately owned urban-based and relate to the manufacturing sector. The country and industry wise descriptive statistics of the firms are given in Tables 2 and 3.

INSERT Table 3 here

Variables of Interest

To examine the effect of credit availability on export and investment decisions made by firms, three dependent variables are defined: first *Export* is equal to one if the firm undertakes direct exports and zero otherwise; second, *Export-Share* is defined as the logarithm of the direct export share of the total sales of an exporting firm; third, *Invest* is defined as being equal to one if a firm invests in capital goods, and zero otherwise. The variable central to this study is *Credit* which equals one if a firm has an outside line of credit from a private commercial bank or a financial institution and zero otherwise. To control for several firm characteristics, the logarithm of the

number of both skilled labor employees, *Skilled Labor*, and support labor employees, *Support Staff*, are used. In addition, a firm's affiliation with a business group or foreign investment in its stock is depicted by a binary variable *Affiliate*. Finally, to capture the effect of unobservable characteristics, dummy variables based on a firm's location (six countries) and industry (19 categories) have been used.

Empirical Methodology

The theoretical model outlined suggests that credit constraints negatively affect a firm's decision to invest in new technology and pay off the fixed costs of entering a foreign market.

Hypothesis (i) deals with a binary discrete choice which depends on whether the firm is exporting or not; specifically the following probit model is used to test the probability of export by firm *i*:

$$prob\left(Export=1\right)=prob\left(\alpha+\ \beta_c Credit_i+\kappa Z_i+\mu_i>0\right)\ , \tag{11}$$

where *Z* are control variables. The error term μ_i has a standard normal distribution relating to unobserved firm attributes and other unaccounted factors that may influence the dependent variable. The expected sign of the *Credit* coefficient is positive, $\beta_c>0$.

For hypothesis (ii), the dependent variable in (11) is replaced with the logarithm of direct export share in total sales:

$$ExportShare=\alpha+\beta_c Credit_i+\kappa Z_i+\varepsilon_i\ . \tag{12}$$

As only exporting firms are being considered, the export share is always greater than zero. The expected direction of the *Credit* coefficient based on the available literature is ambiguous as this parameter determines the significance of the fixed or marginal costs of trading.

For hypothesis (iii), reported access to credit is regressed on a firm's decision to invest in capital goods, using the following probit model:

$$prob\left(Invest=1\right)=prob\left(\alpha+\beta_c Credit_i+\kappa Z_i+\mu_i>0\right), \tag{13}$$

where μ_i is a normally distributed random error term.

Hypothesis (iv), tests the likelihood of export increases with a firm's investment in capital goods:

$$prob\left(Export=1\right)=prob\left(\alpha+\beta_i Invest_i+\kappa Z_i+\mu_i>0\right). \tag{14}$$

Exogeneity Test and Instruments

Establishing a causal relation between either a firm's export and credit availability or a firm's investment in technology and credit availability is likely to suffer from endogeneity. First, firms with high productivity and large exports earn higher profits and are more likely to have easy access to a supply of credit. Second, inefficient firms answering the survey may report problematic access to finance in order to cover up their poor performance.

To confirm exogeneity of the *Credit* variable we pick either the Smith-Blundell or Durbin-Wu-Hausman tests depending on their relevance to the base model of the particular hypothesis being tested. Rejection of the null hypothesis at the 5 percent significance level implies that the *Credit* variable is endogenous. Consequently, an instrumental variables (IV) approach is used, and based on a Two-Stage Least Squares (IV/2SLS) panel regression exogeneity is confirmed through the Davidson-Mackinnon test.

In the case of hypothesis (iii), reverse causality is very likely. A firm investing in capital goods is more likely to have access to external finance compared with one that does not purchase these items.

Robustness Checks-Instrumental Variables Approach

In order to handle the endogeneity problem, further analysis also follows an IV/2SLS approach. One of the instruments selected for this is *OverDraft* which equals one if a firm enjoys an

overdraft facility and zero otherwise. An overdraft line of credit arising from an agreement between a firm and a bank is based on an evaluation of its credit worthiness. This type of finance is usually short term, with a limited amount and a higher interest rate as compared to a regular loan. The second instrument is *Audit* which reflects whether a firm had its financial statements audited independently or otherwise. The requirement for an independent audit is usually imposed by a regulator and is not correlated with the export status of a firm.

As there are two instruments for one endogenous variable in each model, the over-identification restrictions can be checked using Sargan's test. For each model the test statistics show that the instrumental variables are uncorrelated to the residuals and are therefore valid.

Regression Results

A fixed effects model that takes into account the impact of unobservable firm-specific characteristics is considered the most appropriate choice for econometric estimation. However, due to the latter not identifying the effect of time-invariant regressors, both 2SLS pooled and fixed effects panel data regression models are used. The pooled data model is estimated with a full set of industry and country dummies to capture the country-industry fixed effects. The coefficient estimates reported in Tables 4 and 5 relate to the pooled and panel data regressions, using instrumental variables to handle the endogeneity of the key explanatory variable, *Credit.*

While pooling observations increases the precision of estimation, the likely correlation between regressors and the error term may yield inconsistent coefficients. Moreover, such a model typically over-estimates the precision gains leading to under-estimated standard errors. In the current framework, the pooled data estimator is likely to be inconsistent due to the correlation between firm-specific heterogeneity and the main explanatory variable *Credit*. Consequently, we have added country and industry dummies to capture some of the inherent heterogeneity in the

model. Also, based on the Hausman test, we conclude that a fixed effects model is the appropriate choice and treat the estimated coefficients as the unbiased and consistent marginal effects.

The results of the 2SLS pooled and fixed effects panel regression for hypotheses (i) to (iii) are given in Table 4. For hypothesis (i) columns 1 and 2 give the coefficients for the pooled (2SLS) and panel data models (IV-FE) respectively. Both sets of results show that the impact of credit availability on a firm's decision to export is positive and statistically significant. Specifically, the estimated coefficient from the panel model shows that with access to *Credit* the probability of a firm exporting increases on average by about 19 percentage points. From the pooled data model, we find that in terms of country, firms located in Argentina and in terms of industry, firms in the textile, garment manufacturing, machinery, and plastic and rubber sectors are more likely to enter the export market.

INSERT Table 4 here

For hypothesis (ii) which allows a test relating to the intensive margin of trade, the dependent variable is defined as the logarithm of share of direct exports in the total sales of the firm. This is regressed against the same explanatory and control variables as for hypothesis (i). Columns (3) and (4) of Table 4 show the results for the pooled and panel data models respectively. In both models the *Credit* variable has a negative coefficient, although it is statistically insignificant. A possible explanation for this result is that credit availability in the economy causes diversion of resources towards more productive but financially vulnerable sectors and thus the intensive margin of trade of firms already in the export market gets shallow. It can be concluded that once a firm has incurred the fixed costs of entry to the export market, they are not credit-constrained in terms of increasing the volume of their exports.

Hypothesis (iii) is used to test the significance of credit in a firm's decision to invest in capital goods. The results are shown in columns (5) and (6) of Table 4. Irrespective of the model, credit is statistically significant in a firm's investment decision. The panel data estimator indicates that a change of *Credit* from zero to one, i.e., a firm has access to credit, results on average in a 68 percentage point increase in the probability that investment by a firm occurs.

Hypothesis (iv) is defined to test how investment in capital goods is likely to affect the export decision of a firm. The results reported in Table 5 indicate that, after controlling for endogeneity, the effect of investment is positive and statistically significant for both the pooled and panel estimates. The results for the panel model show that the movement of *Invest* from zero to one leads on average to a 14.4 percentage point increase in the probability that exporting by a firm will occur. Thus the main theoretical finding that investment in capital goods is vital for foreign market participation is supported by the results.

INSERT Table 5 here

A review of the results indicates that for hypotheses (i), (iii) and (iv), both the pooled and panel data estimates support the significance of the main explanatory variables. For hypotheses (iii) and (iv), the panel data model generates better estimates of the impact of credit and investment variables with a much better global fit. The other explanatory/control variables, *Skilled Labor*, *Support Staff,* and a firm's corporate status and affiliation, *Affiliate*, are positive and significant in the pooled regression with country and industry fixed effects captured through dummy variables. However, after controlling for individual heterogeneity in the panel regression, the level and significance of the main explanatory variable is improved while the remaining variables lose their significance. The results are similar for hypothesis (iv), as shown in Table 5.

5. Summary and Conclusions

According to Melitz (2003), selection of firms in export markets depends on their exogenously determined productivity. However, it is important to examine the underlying assumptions of this popular model to determine actual selection of firms in export markets, especially in developing countries. The premise of the research presented in this paper was to find out if credit is significant for firms seeking to undertake direct exports and for investing in capital goods.

The extant research shows that firms can influence their productivity draw by investing in R&D and undergoing technical change. Such an investment decision is however constrained by the level of the development of financial markets and ease of access to credit. In the case of developing countries, financial markets are either non-existent or incomplete such that firms have access to limited amounts of credit, often with a high price tag. Firms, therefore, need to assess the feasibility of external borrowing before they decide to invest in R&D or capital goods. The theoretical model developed in this paper considers three different technological choices where, as firms move towards the frontier, the fixed cost component increases but the marginal cost component decreases. Apart from the exogenous probability of exit, there is no other uncertainty, firms being able to assess the profitability of the investment decisions.

The theoretical and empirical results suggest that firms need credit to undertake either process or product innovation, or to meet the fixed cost of entering export markets. The empirical findings indicate that Latin American firms are credit constrained only to the extent of the impact on the extensive margin of trade, the results showing that access to credit has no significant impact on the volume of exports. Also credit has a positive and significant on the capital investment decision. Finally the empirical results confirm the main hypothesis of this paper: firms investing in capital goods are more likely to enter export markets. All of these

results lead to the conclusion that firms need finance beyond their retained earnings to meet the fixed costs of enter the export.

Viewing these results in the context of global trade liberalization involving developed and developing partners, it can be argued that incompleteness or imperfection of financial markets in developing countries acts as a restriction on exports, resulting in net social loss. Firms unable to acquire frontier-level technologies have a mean productivity level that is always below the cutoff threshold necessary to enter the export market. When aggregated, this results in a lack of industry-level competiveness and ultimately the country is unable to secure a share of international markets. Policy instruments aimed at the correction of credit market failure can lower such barriers to trade and hence the possibility of adverse selection. Potential exporters can be identified on the basis of their initial productivity which if provided with the requisite financing can cross the productivity required for foreign market entry. Extending credit to such firms for introducing innovations or establishing foreign market networks can feasibly replace trade related subsidies to existing exporters.

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Country	No Need / Sufficient Capital	Application Procedure Complex	High Interest Rate		Collateral Required	Total Firms
			2006	2010		
Argentina	218	45	44 (7.63)	62 (9)	29	594
Bolivia	129	10	14 (3.57)	9 (0.86)	16	132
Chile	162	14	0 (5.25)	8 (3.25)	3	388
Colombia	126	7	8 (7.25)	11 (3)	6	368
Mexico	228	18	17 (7.0)	13 (4.5)	14	314
Peru	69	6	11 (4.5)	8 (3.0)	6	238

Source: World Bank Enterprise Surveys (2007, 2012). Average interest rates reported in parenthesis

Table 1: Reasons Firms Did Not Apply for Credit

Country	Total Reporting Firms	Firms with Bank Account	Firms with Over Draft	Firms with Credit	Firms with Credit from Commercial Bank	Firms with Credit State Owned Bank	Firms with Credit from Other Sources
Argentina	786	775	591	389	313	68	8
Bolivia	358	341	172	195	175	3	17
Chile	550	535	479	420	409	9	2
Colombia	554	548	500	410	386	7	17
Mexico	420	255	90	141	137	1	3
Peru	334	316	239	260	254	0	6

Source: World Bank Enterprise Surveys (2007, 2012)

Table 2: Firm Financial Characteristics

Industry	No of Firms	Percent
Food	502	24.68
Textiles	236	11.6
Garments	334	16.32
Chemicals	350	17.21
Plastics & rubber	46	2.26
Non-metallic products	62	3.05
Basic metals	6	0.29
Fabricated Metal products	126	6.19
Machinery and equipment	174	8.55
Electronics	50	2.46
Others	148	7.28
Total	**2034**	**100**

Source: World Bank Enterprise Surveys (2007, 2012). Number of reporting firms varies from table 2 as only manufacturing sector data are used for empirical analysis.

Table 3: Firm-Industry Statistics

Dependent Variable	*Export*		*Export-Share*		*Invest*	
Model	2SLS Pooled	IV-FE Panel	2SLS Pooled	IV-FE Panel	2SLS Pooled	IV-FE Panel
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Credit	0.273***	0.192*	-1.80	-0.420	0.353***	0.685***
	(0.055)	(0.105)	(1.422)	(0.28)	(0.129)	(0.224)
Skilled Labor	0.050***	0.010	0.183**	-0.0019	0.037***	0.031
	(0.010)	(0.014)	(0.061)	(0.098)	(0.014)	(0.022)
Support Staff	0.057***	0.019	-0.058	-0.067	0.037*	0.016
	(0.017)	(0.022)	(0.105)	(0.161)	(0.014)	(0.039)
Affiliate	0.064*	0.013	-0.054	-0.208*	0.065	0.018
	(0.036)	(0.038)	(0.120)	(0.070)	(0.043)	(0.059)
Observations	1933	1933	591	591	1933	1933
R-squared	0.205	0.012	0.08	0.056	0.148	0.16
Country /Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Sargan Stat (P-val)	0.514	0.15	0.674	0.464	0.18	0.334

Notes: *Significant at 10% level, **significant at 5% level, and *** significant at 1% level, Robust standard errors in parenthesis, clustered on industry.

Table 4: Regression Results-Hypotheses (i)-(iii)

Dependent Variable	*Export*	
Model	2SLS Pooled	IV-FE Panel
Variable	(1)	(2)
Invest	0.0543***	0.144**
	(-0.0172)	(-0.0645)
Skilled Labor	0.0789***	-0.0749
	(-0.0179)	(-0.0664)
Support Staff	0.119***	0.043
	(0.011)	(0.040)
Affiliate	0.0942***	-0.0401
	(-0.0365)	(-0.0553)
Observations	1253	1253
R-squared	0.043	0.281
Country/Ind FE	Yes	Yes
Sargan Test Stat.	0.646	0.152

Notes: * Significant at 10% level, **significant at 5% level, and *** significant at 1% level. Robust standard errors in parenthesis, clustered on industry.

Table 5: Regression Results-Hypothesis (iv)

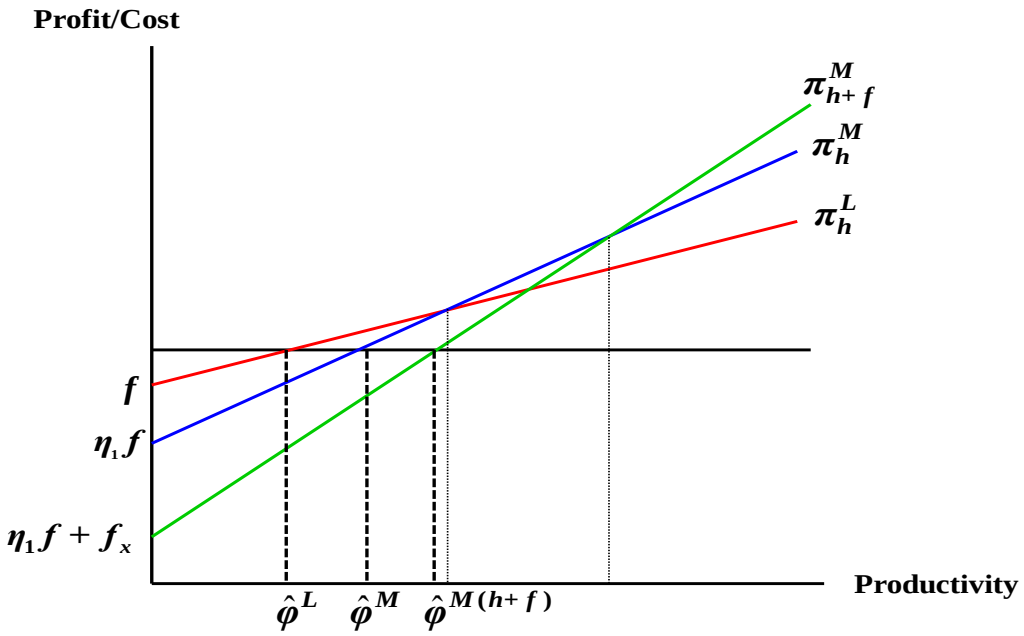

Figure 1: Profits and Productivity Level for Firm