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# Does Bank Competition Alleviate Credit Constraints in Developing Countries?

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## Abstract

Whether competition helps or hinders firms' access to finance is in itself a much debated question in the economic literature and in policy circles, especially in the developing world. This paper considers the consequences of bank competition on credit constraints using firm level data covering 70 developing and emerging countries. In addition to the classical concentration measure, competition is assessed by computing three non-structural measures (Lerner index, Boone indicator, and H-statistic). The results show that bank competition alleviates credit constraints, while bank concentration measure is not a robust predictor of a firm's access to finance. Findings highlight that bank competition not only leads to less severe loan approval decisions but also reduces borrowers' discouragement. In addition, a secondary result of this paper documents that banking competition enhances credit availability more by reducing prices than by increasing relationship lending.

*Keywords:* Bank competition, access to credit, developing countries, discouraged borrower

*JEL classification:* G20, L1

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# 1 Introduction

Limited access to bank credit is viewed by many policy makers and academics as a major growth constraint for developing economies, in particular for small- and medium-sized enterprises (Beck and Demirguc-Kunt, 2006). As a result, many resources have been devoted to improving credit availability around the world. Competition in the banking sector is often advanced as an important driver of access to credit. The traditional *market power view* argues that market power is detrimental in banking as well as in other industries. Fiercer competition leads to lower costs and better access to finance (Besanko and Thakor, 1992; Guzman, 2000). In the presence of information asymmetries and agency costs, however, competition can reduce access by depriving banks of the incentive to build lending relationship (Petersen and Rajan, 1995).<sup>1</sup> Other contributions document that the quality of screening (Broecker, 1990; Marquez, 2002) and banks' incentives to invest in information acquisition technologies (Hauswald and Marquez, 2006) are higher in less competitive markets. Therefore, the *information hypothesis* argues that access to credit for opaque borrowers can be reduced when competition is harsher.

Which of these views best describes the implications of competition in terms of access to credit is ultimately an empirical issue. Despite the policy relevance of this issue, empirical evidence on the effect of interbank competition on access to finance in developing countries is inconclusive. Using data from 74 developed and developing countries, Beck et al. (2004) show that bank concentration increases the probability that firms report finance as a major obstacle to growth, in line with the *market power view*. Chong et al. (2013) confirm the *market power view* documenting that credit availability is restrained in concentrated markets in China. Adopting a similar approach on data from Philippines, Tacneng (2014) provides support for the opposite view. Local concentrated banking markets are generally associated with an increase in credit accessibility. González and González (2008) also find results in line with the *information hypothesis*. A major concern with these studies refers to the proxy of competition used. The degree of competition is assessed by market concentration. Several contributions have cast doubt on the consistency and robustness

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<sup>1</sup>Boot and Thakor (2000), however, document that the role exerted by competition on bank relationships is somewhat inconclusive.

of the structural approach as a good indicator of competition in banking (Degryse et al., 2009). Carbó-Valverde et al. (2009b) document that this issue is not only a technical problem insofar as conclusions may be sensitive to the measure of competition employed. A recent wave of works has tried to overcome this issue by employing non-structural measures of competition. Claessens and Laeven (2005) examine the influence of banking competition on economic growth in 16 countries, using the Panzar-Rosse H-statistic as a non-structural approach to indicate market competition. They find that sectors heavily dependent on bank financing grow faster in countries where there is fierce bank competition. Liu and Mirzaei (2013) confirm the *market power view* by employing the sensitivity of market share to relative costs to proxy competition. Fernández de Guevara and Maudos (2011) measure competition by employing both the Lerner index and the Panzar-Rosse H-statistic and find opposite evidence that the exercise of market power enhances economic growth. Hoxha (2013) reaches similar conclusions in favor of *information hypothesis* using the Panzar-Rosse H-statistic. Recent papers directly investigate the relationship between the use of credit and bank competition. Using a panel data analysis on 53 developing countries and the Lerner index as proxy for competition, Love and Martinez Peria (2012) show that the use of bank loan is lower in more competitive markets, giving support for the *market power view*. However, in a sample of 33 countries, Mudd (2013) obtains a more complex relationship between bank competition and a firm's probability of having a line of credit. Competition (measured by the Panzar-Rosse H-statistics) has a positive but declining effect on a firm's use of bank financing, turning to a negative impact for competitive markets above the mean level. As a result, the evidence is mixed and results are sensitive to sample and measures of competition and credit availability employed.

This paper tests the *information hypothesis* versus the *market power hypothesis* in the context of developing countries using different measures of competition. Econometric analysis considers almost 30,000 firms from 70 developing countries across four continents. Firm-level variables are extracted from the World Bank Enterprises Surveys (WBESs) and country-level variables are taken from diverse sources. Following Popov and Udell (2012), firms those that were either discouraged from applying for a loan or were rejected when they applied are classified as credit constrained. Information on bank competition is

extracted from the Global Financial Development Database. Competition in the banking industry is assessed by the degree of market concentration (share of assets held by the three largest banks) and by three non-structural measures (the Lerner index, Boone indicator, and Panzar-Rosse H-statistic).

The results show that financing constraints are alleviated in countries where banking markets are more competitive, irrespective of whether competition is measured by the Boone indicator or the Panzar-Rosse H-statistic, supporting the *market power hypothesis*. Employing the Lerner index to proxy market power suggests a similar conclusion, while the results are not robust. The degree of concentration has no impact on credit availability. The empirical set-up allows us not only to test the *information hypothesis* versus the *market power hypothesis* but also to investigate the channels by which competition affects credit availability. In particular, we investigate the determinants of a firm's decision to apply for a credit and a bank's decision to approve or reject the request. The results show that competition not only leads to less severe loan approval decisions but that is also reduces borrower discouragement. An additional result of this paper documents that banking competition enhances credit availability more by reducing prices than by increasing relationship lending.

This paper makes important contributions to the literature on the relationship between bank competition and credit availability in developing countries by addressing a number of issues that have not yet been resolved. First, this paper is the first that considers three different non-structural measures of competition to investigate the implications of competition on credit availability. There is no consensus regarding the best measure by which to gauge competition. As shown by [Carbó-Valverde et al. \(2009b\)](#), the choice of a particular indicator may influence conclusions regarding the implications of competition. By confronting the findings from several non-structural measures, this paper gives a more complete picture of the role of competition on credit availability. In particular, it is the first work to use the Boone indicator to study the relationship between competition and access to credit. Second, the identification of financially constrained firms remains a challenge. Existing studies measure credit constraints by a firm's perception of finance as an obstacle to growth ([Beck et al., 2004](#)) or the mix of internal and external funds ([Carbó-Valverde et al., 2009b](#); [Ryan et al., 2014](#)). The survey measures are subject to

perception bias (Ergungor, 2004) and the mix of funds requires data on firms' balance sheets, rarely available for SMEs in developing countries. Recent works proxy credit constraints by the use of credit (Love and Martinez Peria, 2012; Mudd, 2013). The fact that few firms obtain credit is, however, not sufficient to prove constraints, since certain firms may not have a demand for credit. This hypothesis is far from anecdotal in developing countries: our data document that more than half of firms had no demand for credit. A comprehensive definition of credit constraints should measure the demand for credit that is unfulfilled by the existing supply of credit due to market imperfections. In this paper, we classify a firm as constrained if its demand is not fulfilled by the supply of funds due to market frictions. Third, this work not only tests the *market power hypothesis* vs. the *information hypothesis* but also tries to shed lights on the channels by which competition affects credit availability (impact on lenders or on borrowers; price channel or relationship channel). The final contribution involves to country coverage. The sample considers 70 developing countries including many countries from low-income countries rarely considered in previous studies.

In addition to its contributions to the literature regarding the impact of bank competition on credit availability in developing countries, this work also adds to the empirical literature on borrower discouragement and approval/denial decisions in developing countries. Empirical studies are generally focused on the U.S. (Cole, 1998; Cavalluzzo et al., 2002; Han et al., 2009). Recent contributions have begun to investigate these issues in the case of developing countries (Bigsten et al., 2003; Brown et al., 2011; Chakravarty and Xiang, 2013) but often analyze the characteristics of firms or managers to explain a firm's discouragement or a bank's rejection decision. Brown et al. (2011) underline that country characteristics play a significant role in borrower discouragement and in bank decisions to deny in Eastern Europe. Taking advantage of the large country coverage, we investigate a large set of country characteristics, including bank competition. The findings shed light on the important role played by country characteristics to explain borrower discouragement and bank decisions.

The rest of the paper is organized as follows. Section 2 presents the data and describes the construction of variables and the empirical methodology. The baseline results are discussed in Section 3. Section 4 presents some tests in order to understand how competition

affects credit availability and the final section concludes.

## 2 Data, variables and method

### 2.1 Data

The database used in this paper combines firm- and country-level data from various sources. The firm-level data come from the World Bank Enterprises Surveys (WBES). The dataset is supplemented with country-level data from diverse sources such as the World Development Indicators, the Global Financial Development Database, and the Doing Business databases. Some filtering rules are applied. Firms for which information about credit market experience was not available and for whom at least one of the firm- and country-level control variables were not available have been dropped. We then excluded observations when the interviewer did not believe that the responses were reliable (question a16). Finally, firms with more than 5,000 employees that can access equity markets have been excluded. The final sample includes 28,952 firms from 70 low-income and middle-income countries spanning four continents (Africa, Latin America, Europe and Asia). Two fifths of the firms were surveyed in 2006 and one third in 2009. Others were surveyed in 2007, 2008 and 2011. The sample considered has the advantage of grouping together economies with heterogenous characteristics.

### 2.2 Measuring credit constraints

Among other topics, the WBES address questions about access to finance. To identify credit constrained firms, we refer to a number of questions regarding the credit experience of the firm in the year previous to the survey. The first question is whether or not the firm applied for a loan (*k.16: In last year, did this establishment apply for loans or lines of credit?*). In order to distinguish between discouraged borrowers and non-borrowers among non-applicants, we turned to the subsequent question (question k.17) which asks the main reason for not applying. Firms are considered as non-borrowers if they declared that they did not apply because they did not need a loan and are considered as discouraged borrowers if they declared another reason. Among the applicants (firms that answered

”yes” in question k16), a distinction is made between approved and denied applicants. A firm is declared as approved if at least one request was not turned down.

From this classification and following [Popov and Udell \(2012\)](#), firms those that were either discouraged from applying for a loan or were rejected when they applied are classified as credit constrained. This measure allows us to identify firms expressing a demand for formal funds that was not fulfilled by supply. Contrary to measures based on firms’ use of formal loans ([Love and Martinez Peria, 2012](#); [Mudd, 2013](#)), we are able to discriminate between constrained firms and firms that have expressed no demand for loans. According to the definition proposed, two thirds of firms are not credit constrained (see the descriptive statistics in the Appendix). Sixty-three percent of firms reported a need for external funds but only 58% of these firms applied. Among the applicants, a large number obtained at least one loan (85%). As documented in [Table 1](#), the credit market experiences differ greatly across developing countries. More than 3 out of 4 firms are credit constrained in the Democratic Republic of Congo, Angola, Ivory Coast, Mali or Mozambique, but this ratio is below 10% in Hungary and Slovenia.

At this stage, it is important to discuss a caveat in the data. The paper considers credit as uniform but it is not. In the paper, we merely consider a firm as financially rationed if the firm has a need for funds but does not use credit. However, a firm with a loan may be considered as constrained if the loan requested differs from the loan granted ([Chong et al., 2013](#)). For example, a firm may apply for a long-term loan and get a short-term credit or may obtain only a share of the total amount desired. We do not believe that this issue alters our results. The measure built in this paper allows us to detect the most financially constrained firms (firms that did not receive credit at all). One may expect that this proxy of strong credit rationing is closely related to partial credit rationing.

*[Insert here Table 1]*

## **2.3 Measuring bank competition**

The purpose of this essay is to investigate the implications of bank competition on credit availability. The choice of the appropriate proxy for bank competition is therefore crucial. All measures of bank competition are based on bank-level information. The Bankscope



database, which covers a large range of banks in the world, is employed to extract balance sheet and income statement information on banks. Computations of indicators of competition are made by World Bank’s staff and reported in the Global Financial Development Database.

Despite some limitations with the structural approach, the share of assets held by the three largest banks is used as a proxy of the impact of market concentration. We complement the information on market structure that imperfectly captures bank conduct by using three indicators of competition based on the New Empirical Industrial Organization (NEIO) approach: the Lerner index, the Panzar-Rosse H-statistic, and the Boone indicator. These different measures do not provide the same information about competition, and thus catch different aspects of competition (Degryse et al., 2009).

The Lerner index is often used in empirical works. It captures the extent to which banks can maintain a price level above their own marginal costs. For each individual bank, average revenues proxy price and marginal costs are obtained from the estimation of cost function with three inputs: labor, physical capital and deposits (more details can be found in Love and Martinez Peria, 2012). The Lerner index for country  $c$  is the weighted (by bank size) average of individual Lerner indices of all banks in country  $c$  as follows:

$$L_c = \sum_{i \in c} s_{ic} L_{ic} \quad (1)$$

where  $s_{ic}$  is the market share of bank  $i$  in country  $c$  and  $L_{ic}$  the value of the Lerner index for this bank. Greater values of the Lerner index are associated with greater levels of market power. Although it is widely-used in the literature, the Lerner index may be not the most relevant measure of competition. Boone et al. (2013) show that the Lerner index at the country level consistently has problems picking up increasing competition due to more aggressive conduct of incumbent firms. Furthermore, price cost margins are sensitive to the macroeconomic conditions (Carbó-Valverde et al., 2009a). In addition, in our paper the value of the Lerner index is available for only 51 countries.

Another measure of competition often used in the empirical papers is the Panzar-Rosse H-statistic. This indicator catches the transmission of input prices, and thus marginal costs, on firms’ revenues. Panzar and Rosse (1987) showed that under certain assumptions, the transmission of input price variation differs according to the degree of competition in

the market. The elasticity of bank revenues relative to input prices, also called the H-statistic, therefore assess the degree of competition. In a market where banks collude, the value of the H-statistic is less than or equals to zero. The H-statistic equals to one in a competitive market and lies between 0 and 1 if banks operate under monopolistic competition. The value of the H-statistic is calculated in two steps. First, the logarithm of total revenues is regressed against the logarithm of input prices for each country and other control variables as follows (more details can be found in [Schaeck et al., 2009](#)):

$$\ln(\text{Rev}_{it}) = \alpha + \sum_{l=1}^L \beta_l \ln(w_{l,it}) + \sum_{k=1}^K \gamma_k Z_{k,it} + \mu_i + \varepsilon_{it} \quad (2)$$

where subscripts  $i, t$  refers respectively to bank and year. Three inputs ( $w_{l,it}$ ) are considered: labor, physical capital and deposits. The model is run by country over the period 1990-2010 and includes bank fixed effects ( $\mu_i$ ) and control variables ( $Z_{k,it}$ ). Adding the estimated coefficients for each input price in the second step allows us to obtain the value of the H-statistic:

$$H = \sum_{l=1}^3 \beta_l$$

[Claessens and Laeven \(2004\)](#) point out that the Panzar-Rosse model is well-suited to compare competition between markets. An important pitfall, however, concerns identification. The interpretation of the values of the H-statistic requires respecting many assumptions regarding the market equilibrium, demand elasticity, cost structure or exogeneity of input prices ([Bikker et al., 2012](#)). Finally, in this work, an additional limitation comes from data availability. The H-statistic is available for only 35 countries which reduce the sample by half.

[Boone \(2008\)](#) has recently developed a new indicator based on the idea that efficient firms are more rewarded in more competitive markets. The basic intuition underlying this indicator is that more efficient firms achieve superior performance in the sense of higher profits, and that this effect is stronger the heavier the competition is. The Boone indicator can be calculated as the elasticity of profits to marginal costs. To calculate this elasticity, the log of return on assets is regressed against a log measure of marginal costs.

$$\ln(\pi_i) = \alpha + \beta \ln(MC_i) + \varepsilon_i \quad (3)$$

where  $\pi_i$  stands for profit and  $MC_i$  a measure of marginal cost. Marginal costs are obtained from an estimated translog cost function with three inputs. The more negative the  $\beta$ -coefficient is, the higher the level of competition is in the market. The Boone indicator has two major advantages. On the one hand, it is based on strong theoretical foundations and catches competition due both to a fall in entry barriers and to more aggressive behavior on the part of incumbents. On the other hand, it captures the dynamics and non-price strategy in the market, while the Panzar-Rosse model and the Lerner index are based on static price competition. These advantages come with shortcomings. The Boone indicator approach focuses on one important relationship, affected by competition, thereby disregarding other aspects. Efficient gains may not be translated into higher profits in the short-term.

The different indicators employed here catch different aspects of competition. The Lerner index measures the static pricing market power, the Panzar-Rosse H-statistic the transmission of input price changes to revenues, and the Boone indicator the dynamics of markets.

## 2.4 Empirical methodology

The objective of this essay is to evaluate the net impact of bank competition on firms' credit availability. The dependent variable is a dummy variable taking the value one if firm  $f$  in country  $c$  is not subject to credit rationing (has access to credit) and 0 otherwise. Given the nature of the dependent variable, a binary model is required. In addition, it could be important to control for unobservable heterogeneity across countries insofar as the interest variable is country-specific. As a result, a random effects probit model is used to take into account unobserved country heterogeneity. The basic econometric specification estimation through the random effect probit estimator is as follows:

$$Pr(Credit_{fc} = 1) = \Phi(\alpha + \beta Competition_c + \Theta \mathbf{F}_{fc} + \Gamma \mathbf{C}_c) \quad (4)$$

where subscripts  $f$  and  $c$  refer to firm and country respectively.  $Credit_{fc}$  is a dummy variable equal to 1 if firm  $f$  in country  $c$  is not credit constrained;  $\mathbf{F}_{fc}$  is the matrix of firm characteristics and  $\mathbf{C}_c$  the matrix of country characteristics.  $Competition_c$  is the indicator of bank competition (concentration ratio, Lerner index, H-statistic or Boone

indicator). The net impact of bank competition on credit availability is given by the sign of coefficient  $\beta$ .<sup>2</sup> If  $\beta > 0$  more competition induces less financing constraints in line with the *market power hypothesis*. By contrast,  $\beta < 0$  confirms the *information hypothesis* arguing that competition hinders access to finance.

The firm-level variables control for observable firm-level heterogeneity. They include the size and age of the firm, the top manager's years of experience in the firm's sector, and the share of assets held by the largest owner. They also consider dummy variables capturing whether the firm is an exporter, foreign-owned, or government-owned and if the firm was audited in the past year, belongs to a larger firm, is privately held or is listed. Industry dummies are included to control for unobservable characteristics shared by firms in the same sector.

A crucial issue concerns the identification of the net impact of competition. To avoid the omitted variable issue, country-level characteristics correlated with credit availability and bank competition are included as control variables.<sup>3</sup> The level of economic and financial development are taken into account by adding the logarithm of real GDP per capita and the ratio of domestic credit to GDP. The macroeconomic conditions are captured by the real growth and the inflation rate. The measure of institutional development developed by Kaufmann et al. (2010) is added. Furthermore, the depth of credit information and the strength of legal rights are often advanced to explain differences in both access to finance and competition. We employ the measure of creditors' protection and depth of credit information calculated by Doing Business for each country to control for both. Finally, for judging the potential impact of the current financial crisis, a dummy variable taking value 1 if the survey was implemented between 2009 and 2011 is added. All country-level variables (competition measures included) are measured with one lag. All variables and summary statistics are presented in the Appendix.

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<sup>2</sup>To facilitate the reading of the results, the inverse of the concentration ratio, the Lerner index, and the Boone indicator are used. Thus an increase of the value of the indices is associated with an increase in the level of competition.

<sup>3</sup>Among the potential sources of endogeneity (measurement error, reverse causation or the omitted variable), the omitted variable issue is certainly the most likely in our case. As a result, we focus our attention on this issue. Another way to solve this issue consist of using instrumental approach. Unfortunately, it is uneasy to find relevant instruments that are available for a large set of countries.

## 3 Results

### 3.1 Baseline results

This section presents the results of the empirical test of the link between competition and credit availability. Four different proxies of competition are used: the share of assets held by the three largest banks, the Lerner index, the Panzar-Rosse H-statistic, and the Boone indicator. Table 2 presents the baseline results using a random effect probit estimator. The first column reports the results of estimation including only firm-level variables. The second column provides the results for a regression without banking sector competition variables. In the following columns, the four different proxies for competition (CR3, Lerner index, Panzar-Rosse H-statistic, and Boone indicator) are included sequentially. The Wald tests show the presence of unobservable country heterogeneity.

*[Insert here Table 2]*

Results document that banking competition enhances the financing of firms in developing countries. The coefficient associated to the Lerner index is positive but not significant at the usual thresholds (it is significant if the threshold is extended to 15%). Despite the fact that studies often employ it, the Lerner index is not the best measure of competition, as discussed above. We therefore also test the relationship between competition and credit availability by considering two other non-structural measures of competition: the Panzar-Rosse H-statistic and the Boone indicator. The coefficients associated to both proxies of competition are positive and significantly different from zero, indicating that firms face lower credit rationing in countries with more competitive markets. It should be noted that the structure of the market does not explain the access to credit. The coefficient associated to the concentration ratio is not different from zero. The economic impact of competition is also significant. A one-standard deviation change in the level of competition (Lerner index, Boone indicator or H-statistic) results in a reduction of 2 percentage points in the probability of being rationed. While this may appear to be a small impact, in comparison with other country- and firm-level variables the effect

of competition is not insignificant.<sup>4</sup> These results confirm the relevance of the *market power hypothesis* in developing countries and are in line with previous studies (Love and Martinez Peria, 2012; Chong et al., 2013).

The results for control variables are consistent with expectations. Firms which are larger, foreign-owned, members of a group (subsidiary), audited, and privately held are less likely to suffer from credit rationing. The crisis dummy has a negative coefficient and its economic impact is important insofar as the probability of having credit constraints increases by 5 percentage points following 2009. At the country-level, credit binding is related to the economic environment in which firms operate. Credit rationing is more likely in less economically developed countries and in countries with unstable economic environment (high inflation). The coefficient associated to financial development is positive but not always significant. In particular, when unobservable country characteristics are controlled for, it becomes statistically insignificant.

### 3.2 Robustness checks

Before investigating the channels by which competition affects credit availability, it is useful to test the robustness of the results. Although we control for many country-level variables and use different proxies for competition, other explanations might justify the positive relationship between competition and credit availability.<sup>5</sup>

In developing countries, the intensification of competition has been accompanied by the globalization process and the expansion of foreign-ownership of banks. Internationalization of banking systems can exert an impact on credit availability. Some papers document that foreign bank presence is associated with higher access to loans for SMEs, while other papers show that foreign banks tend to finance only larger, established and more profitable firms (see: Claessens and Van Horen, 2013b). Different degrees of competition may merely capture the differences in ownership structure of the banking industry. To test this hypothesis, we include as controls the share of banking assets owned by foreigners. We

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<sup>4</sup>By comparison, a one standard deviation change in the inflation rate induces a similar change. The fact that a firm is foreign-owned, privately held or has 5 additional employees increases its probability of being constrained by 4 percentage points.

<sup>5</sup>To save space, the results are not reported but are available upon request.

use the dataset built by [Claessens and Van Horen \(2013a\)](#) to proxy the share of banking assets held by foreigners. This variable is only available for 59 out of 70 countries of our sample. The results are robust insofar as coefficients associated to competition remain stable in terms of size and significance. The presence of foreign banks tends to play no role on credit availability.<sup>6</sup>

The positive link between competition and access to credit can be explained by financial regulation. Less government interference in the banking system, especially less restrictions on bank activities, may alleviate credit constraints. For instance, in less regulated markets, banks can propose new products more suitable for SME financing. Insofar as competition and financial regulations are correlated, the positive coefficient associated to competition can merely reflect the relationship between financial restrictions and credit availability. To control for this possibility, we include a measure of financial freedom built by the Heritage Foundation. Results highlight that the coefficients associated to competition remain positive and significant.<sup>7</sup>

Another potential drawback concerns the measures of competition used. The proxies of competition are computed at the country level, while firms borrow locally. This may mask subnational differences which may be important for larger countries. In developing countries, the degree of competition tends to reflect the competitive pressure in economic capitals but not the level of competition in remote cities. We test the relevance of our results for firms located outside the economic centers. The surveys do not provide information about cities where firms are located. However, surveys do give the administrative district in which firms operate. We select a sub-sample of firms located in districts outside economic centers for each country and rerun the model on the sub-sample of firms in remote areas. The main findings are confirmed.

Finally, we also run additional robustness checks changing the sample (excluding outliers and limiting the sample to the 35 countries for which the H-statistic is available) and the

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<sup>6</sup>We also computed the share of foreign banks from the database provided by [Barth et al. \(2005\)](#). Results regarding the competition are similar, while the coefficients associated to both foreign and government ownership are negative and statistically significant (results are available upon request).

<sup>7</sup>Including activity restrictions or barriers to entry based on the World Bank Survey of Bank Regulation and Supervision database ([Barth et al., 2005](#)) instead of the financial freedom variable does not alter the conclusions.

econometric method (employing pooled probit model) without altering conclusions. Both the coefficients associated to the H-statistic and the Boone indicator remain positive and significant.

## 4 How does competition affect credit availability?

The baseline set-up shows that competition alleviates credit constraints in developing countries, which is in line with the *market power hypothesis*. In this section, we try to go one step further by investigating by which channels competition plays a role in facilitating access to finance.

### 4.1 Disentangling the impact on borrowers and lenders

Recent works on developing countries have shown that the low use of formal credit is mainly explained by borrower discouragement rather than banks' denial decisions (Bigsten et al., 2003; Brown et al., 2011). Our data confirm this feature: 42% of firms with a need for external funds refused to apply, although only 15% of requests were turned down. An advantage of the database is the possibility of investigating to what extent the low incidence of bank credit in developing countries is the result of low credit demand and/or supply-side constraints and factors influencing both.

#### 4.1.1 Impact of bank competition on a firm's decision to apply

Borrower discouragement can be explained by many economic and non-economic factors. Interbank competition can exert an effect on the borrower's decision to apply for a loan. Recent contributions show that in a dual system with formal and informal finance, poor borrowers are more likely to access the formal sector when bank competition increases (Madestam, 2014). In addition, competition can affect the demand for loans by reducing the costs of credit through its impact on interest rates or on other elements of loan contracts such as collateral requirements (Hainz et al., 2013). We thus analyze whether competition affects the borrowers' decision to apply for a loan.

To investigate the determinants of the decision of a given firm to apply, it is important to control for firms who do not need external financing. A simple probit model is no longer



valid due to the sample selection issue. The probit with sample selection (PSS) model proposed by [Van de Ven and Van Praag \(1981\)](#) is thus employed. The PSS estimate two probit equations (selection and outcome equations) where error terms follow a bivariate normal distribution. The selection equation is completely observed but we have only a selected sample for the outcome equation. The PSS model is only available for pooled estimation (without controlling for country heterogeneity). The relevance of the sample selection problem is tested through a Wald test. Under the null hypothesis, the PSS model does not give more information than the simple pooled probit model. Finally to allow correlation across the error terms within a specific country, the standard errors are clustered at the country level for each model.

Relevant exclusion variables have to affect the needs for external funds but not directly impact a firm's decision to apply or a bank's willingness to finance. Two variables are used to proxy the need for funds. The proportion of the value of sales paid after the delivery by the customers in the previous year is considered. This variable catches the need of funds for financing working capital. We also add a dummy variable equal to one if the firm submitted an application to obtain a construction permit over the prior two years, approximating the willingness to invest.

*[Insert here Table 3]*

Results show that the likelihood of applying for a loan increases with the level of competition. Table 3 presents the determinants of the decision for a given firm with a need for credit to apply or not. Coefficients associated to the Boone indicator and H-statistic are positive and significant. As in the previous section, the coefficients associated to the share of assets held by the three largest banks (CR3) and the Lerner index are not significant at the usual thresholds. Firms in more competitive markets may be less reluctant to apply for a loan. An increase in the Boone indicator or Panzar-Rosse H-statistic by one standard deviation will result in between a 2.3 (Boone) and 3.2 (H-statistic) percentage points rise in the probability of applying. By comparison, an increase of one standard deviation in the level of financial development will induce an increase of 7 percentage points. The positive impact of competition on a firm's decision to apply could be justified by different channels such as lower credit costs, less procedural requirements, well-designed products

and services, better access to bank branches or a higher probability of being financed. Control variables give some other interesting insights. Larger, audited, privately held firms and exporters, as well as firms in which the managers have less experience, are less subject to discouragement. The levels of financial and economic development are strongly correlated with a firm's probability of applying for a loan.

#### **4.1.2 Impact of bank competition on a bank's approval decision**

If competitive pressure reduces borrower discouragement, competition can also affect the probability of applicants being financed. Insofar as a bank's final decision is only available for applicants, the pooled PSS model is used. A good exclusion variable must impact the likelihood that a firm will apply but should not be observed or taken into account by banks. According to the standard theory, physical capital and labor are, at least partially, related (substitutes or complements). The demand for loans is therefore related to the severity of the obstacles in the labor market perceived by the firm. At the same time, it would be surprising if a lender based its decision on this information (if we suppose that a bank could obtain it). The obstacles in the labor market are measured through a firm's assessment of the severity induced by an inadequately educated workforce on the firm's growth.

*[Insert here Table 4]*

Results, reported in Table 4 indicate that the probability of being rejected is lower in countries with more competitive banking markets. The coefficients associated with the Boone indicator and H-statistic are positive and significant at the usual thresholds. The coefficient associated to the Lerner index is positive and significant at 15 percent. Bank concentration is, however, unrelated to the likelihood of applicants being satisfied. Harsher competition leads to softer loan approval decisions but market structure plays no role. The economic impact of competition is also significant. An increase of competition by one-standard deviation will raise the probability of being satisfied by one percentage point (for the three non-structural measures of competition). By comparison, an increase of two points in depth information index and legal rights (about one standard deviation) implies an increase in probability of between 1.5 and 2.5 percentage points. The positive effect

of competition on a bank's decision to approve or deny is relatively easy to understand. In countries with low levels of competition, a bank can easily turn down an application without cost. By contrast, in competitive markets, the choice to deny implies the risk of losing long-term relationship benefits. Indeed, a denied borrower will contact a rival if it believes that its project is viable. The borrower and rival bank may enter into a long-term relationship and it could be impossible or very costly for outside banks to subsequently attract the firm.

Results regarding the control variables are in line with expectations. Banks are more willing to finance transparent firms (larger, older, exporter) or firms linked with a larger one. Following the crisis, banks are more reluctant to finance firms. The probability of obtaining a loan has been reduced by 3 percentage points in the wake of the crisis. Information sharing mechanisms and creditors protection, despite the lack of net impact on credit availability, have a positive effect on the probability of applicants being financed. In other words, uncertainty and opacity play a significant role in explaining a bank's decision to approve or turn down credit requests.

## 4.2 Relationship lending versus price effect

The previous results document the positive effect of competition on credit availability through its impact on borrowers and lenders. As stated by [Chong et al. \(2013\)](#), banking competition can enhance credit availability through increasing relationship lending and/or lowering the interest rate (transaction-based lending technologies). In this sub-section, we try to give some insights about this debate.

If banking competition increases credit availability through expanding relationship lending, [Chong et al. \(2013\)](#) argue that opaque (small and young) firms will be impacted by competition more than their counterparts. We therefore analyze the implications of competition on different sub-groups of firms, classifying them according to their size and age. Results, reported in Table 5 (Panel A), suggest that smaller firms are not more (or less) affected by competition than larger ones.<sup>8</sup> However, results reported in Panel B show that competition is beneficial mainly for older firms. Both the coefficients associated to

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<sup>8</sup>Large firms tend to benefit less than SMEs from competition. A possible explanation is the fact that larger firms already have access to finance.

the Panzar-Rosse H-statistic and the Boone indicator show that the youngest firms (less than five years of operations) do not take advantage of fiercer competition. On the contrary, firms established for more than five years benefit more from harsher competition. This suggests that the beneficial effect of competition is larger for well-established than for newly-established firms. These findings are in line with the price channel hypothesis. Older firms are more sensitive to change in prices than to increase in relationships. They are more transparent having more assets and a longer credit history.

*[Insert here Tables 5 & 6]*

In order to provide more insight, we investigate in detail the reasons for the refusal to apply. Under the price effect channel, competitive pressure should increase the loan demand for firms reporting high interest rates, collateral requirements or the necessity to make informal payments to justify their decision. By contrast, the demand for loans for firms reporting another reason (satisfaction probability, procedures, etc.) should be less affected by the degree of competition. We divide discouraged borrowers into firms that justify their choice by price factors and other firms. We investigate the determinants of applications on each sub-sample using the PSS model. The first dependent variable is a dummy taken the value of one if the firm applied for a loan and 0 if the firm refused to apply because it considered that the loan terms to be unsatisfactory (other discouraged firms are excluded). The second dependent variable takes the value 0 if the firm refused to apply because they expected to be denied or the procedures were complex. The results are reported in Table 6. The coefficient associated to the Boone indicator is always positive. By contrast, the coefficient associated to the H-statistic is only positive when applicants are compared to discouraged firms that report price factors as a barrier to applying. In other words, this finding shows that competitive pressure mainly increases the likelihood of a firm applying by reducing the direct (interest rates) or indirect (collateral requirements or informal payments) costs of credit. This finding tends to confirm the price channel in line with previous findings on China (Chong et al., 2013).

## 5 Conclusion

Whether competition helps or hinders small firms' access to finance is in itself a much debated question in the economic literature and in policy circles. Despite the policy relevance of this issue, empirical evidence on the effect of interbank competition on access to finance in developing countries is scarce and inconclusive. Using surveys on firms in developing economies, this article sheds a new light on this debate. A firm is classified as financially constrained only if it expressed a demand for formal funds that was not fulfilled by supply. Furthermore, contrary to existing research, this paper employs several non-structural measures of competition (Lerner index, Boone indicator, or H-statistic) in addition to the market structure. By confronting the findings from several measures, this paper gives a more complete picture of the role of competition on credit availability.

Our findings supports the *market power hypothesis* in the case of developing countries. Findings, from a sample of almost 30,000 firms in 70 developing countries, show a positive impact of bank competition on credit availability, while bank concentration has no effect. This work also provides some insights about the channels by which competition affects credit availability. In particular, this essay documents that competitive pressure not only leads to less severe loan approval decisions but that it also reduces borrower discouragement. This conclusion is far from anecdotal insofar as the low use of bank credit in developing economies is mainly explained by low demand rather than by high rates of rejection. In addition, the findings tend to show that competition affects credit availability through price effect (lower interest rates) rather than relationship effect (banks invest more in relationship in competitive markets).

The policy implications are threefold. First, a direct policy implication is to promote competition in credit markets. This may be materialized by developing a large range of pro-competitive measures. The most direct reforms concern the regulation of financial systems by removing existing barriers. This preliminary reforms can be complemented by other measures. For example, developing a pro-competitive environment through the installment of information sharing mechanisms could spur contestability. In addition, governments can shape competition by ensuring customers' access to information and financial literacy or by facilitating the definition, detection and sanction of uncompetitive

behaviors. Many of these reforms can be hardly implemented at the national level in developing countries due to the limited size of local markets and lack of skilled staff. For instance, installation of anti-trust agencies or effective credit bureaus induces high fixed costs that cannot be recouped in small markets. Reinforcing regional integration can be a way to overcome some obstacles in the smallest markets. Second, competition policy is not the be-all and end-all of financial development policies. A secondary result of this paper documents that banking competition enhances credit availability more by reducing prices than by increasing relationship lending. Consequently, competition in banking is usefulness for the most opaque firms or sectors. Additional reforms should be implemented including certainly more interventionist policies such as credit guarantee programs or dedicated financial institutions. However, the recent history of developing countries has underlined the adverse impact of too much interventionism in finance. The benefits and costs of each government intervention should be evaluated. Third, policymakers should also be aware that the low use of credit is mainly driven by borrower discouragement. The evidence suggests that a significant portion of discouraged firms would be successful in obtaining credit if only they would apply. Acting on the demand-side is thus crucial if policymakers expect to raise the share of financing of firms by formal financial institutions. Better understanding discouragement in credit markets could be useful in explaining the success and failure of some reforms in these markets. Works investigating the behavior of borrowers in the developing countries are therefore crucial.

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## 6 Tables

Table 1: Access to finance and interbank competition

Country	% of firms			Interbank competition			
	Rationed	Disc.	Denied	CR3	Lerner	Boone	H-st.
<i>Africa (25 countries)</i>							
Angola	0.81	0.83	0.75	74.60	0.44	-0.14	
Botswana	0.25	0.81	0.23	74.39	0.25	-0.07	
Burundi	0.58	0.73	0.33	100.00		0.05	
Congo	0.52	0.83	0.33	100.00	0.14		
D.R. Congo	0.84	0.88	0.71	61.59		-0.20	
Gabon	0.39	0.86	0.27	96.62		-0.01	
Gambia	0.57	0.86	0.32	90.42		0.02	
Ghana	0.66	0.76	0.36	79.26	0.22	-0.19	
Ivory Coast	0.78	0.86	0.32	59.63	0.24	-0.05	
Lesotho	0.31	0.68	0.30	100.00		0.00	
Liberia	0.44	0.77	0.06	100.00		0.00	
Madagascar	0.39	0.76	0.13	89.72		0.00	
Mali	0.76	0.73	0.66	70.03	0.32	-0.11	
Mauritania	0.76	0.76	0.62	66.89	0.36	0.02	
Mauritius	0.19	0.73	0.19	50.56	0.29	-0.14	
Mozambique	0.72	0.84	0.41	95.62	0.24	-0.04	
Namibia	0.19	0.79	0.31	88.70		0.00	
Rwanda	0.47	0.67	0.22	87.01		-0.06	
Senegal	0.68	0.77	0.47	67.24		-0.07	0.38
Sierra Leone	0.56	0.72	0.18	60.79	0.14	-0.33	
South Africa	0.28	0.78	0.12	70.94	0.29	-0.05	0.87
Swaziland	0.27	0.80	0.16	67.67		-0.23	
Tanzania	0.63	0.78	0.21	55.50	0.28	-0.09	
Uganda	0.56	0.80	0.15	62.99		-0.04	
Zambia	0.43	0.78	0.19	51.92	0.35	-0.10	0.18
<i>Latin America and the Caribbean (16 countries)</i>							
Argentina	0.34	0.66	0.10	43.21	0.29	-0.22	0.49
Bolivia	0.28	0.61	0.08	50.25	0.17	-0.14	0.65
Brazil	0.23	0.46	0.18	49.89	0.36	-0.05	0.75
Chile	0.11	0.41	0.03	54.90	0.30	-0.05	
Colombia	0.16	0.39	0.06	41.39	0.27	-0.02	0.78
Ecuador	0.13	0.44	0.04	48.10		-0.75	0.95
El Salvador	0.20	0.57	0.08	67.50	0.33	-0.07	0.99
Guatemala	0.18	0.69	0.08	48.03	0.19	-0.07	
Honduras	0.23	0.58	0.09	40.75	0.19	-0.05	0.88
Mexico	0.27	0.90	0.16	59.03	0.19	-0.13	
Nicaragua	0.24	0.64	0.09	84.00	0.37	-1.59	
Panama	0.12	0.71	0.02	48.84	0.31	-0.04	0.57
Paraguay	0.23	0.62	0.05	47.77	0.12	-0.11	0.86
Peru	0.16	0.37	0.03	76.51	0.32	-0.09	0.62
Uruguay	0.34	0.71	0.09	57.57	0.24	0.54	0.78
<i>Europe and Central Asia (26 countries)</i>							
Albania	0.14	0.72	0.01	88.34	0.26	-0.01	
Armenia	0.21	0.58	0.09	43.32	0.31	-0.14	0.76
Azerbaijan	0.44	0.83	0.39	59.70	0.28	-0.08	0.60
Belarus	0.21	0.42	0.09	82.56	0.29	-0.11	0.81
Bosnia	0.27	0.42	0.15	49.32	0.18	-0.04	
Bulgaria	0.25	0.78	0.13	38.73	0.28	-0.51	0.30
Croatia	0.25	0.52	0.18	56.05	0.18	-0.06	0.41
CzechRep	0.15	0.58	0.11	58.69	0.22	-0.09	0.73

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Country	% of firms			Interbank competition			
	Rationed	Disc.	Denied	CR3	Lerner	Boone	H-st.
Estonia	0.11	0.54	0.12	92.52	0.16	0.04	
Macedonia	0.27	0.62	0.19	70.18	0.21	-0.06	-0.02
Georgia	0.23	0.54	0.13	70.64	0.24	-0.17	0.61
Hungary	0.10	0.69	0.07	53.51	0.19	-0.08	0.66
Kazakhstan	0.28	0.62	0.18	56.00	0.31	0.17	0.57
Latvia	0.22	0.58	0.19	57.60	0.28	0.09	0.90
Lithuania	0.13	0.49	0.10	72.71	0.18	0.15	0.79
Moldova	0.29	0.49	0.19	45.50	0.24	-0.10	0.42
Mongolia	0.35	0.41	0.22	96.93		-0.05	
Montenegro	0.37	0.53	0.14	79.41		-0.09	
Poland	0.20	0.63	0.13	48.68	0.24	-0.09	0.81
Romania	0.17	0.53	0.10	64.37	0.20	-0.10	0.91
Russia	0.27	0.49	0.18	38.84	0.25	-0.04	0.67
Serbia	0.26	0.40	0.19	33.47	0.17	-0.20	0.63
Slovak Rep.	0.16	0.63	0.10	66.02	0.21	0.03	0.59
Slovenia	0.09	0.40	0.09	51.72	0.15	-0.03	0.55
Tajikistan	0.31	0.63	0.17	100.00		0.11	
Turkey	0.15	0.43	0.16	43.94	0.21	-0.02	0.61
Ukraine	0.33	0.62	0.12	26.08	0.22	-0.12	0.69
<i>Others (3 countries)</i>							
Iraq	0.58	0.85	0.49	57.41		0.00	
Laos	0.31	0.88	0.00	88.29		0.17	
SriLanka	0.51	0.77	0.05	54.64		-0.11	

Table 2: Interbank competition and credit availability

	Measure of competition					
	None	None	CR3	Lerner	Boone	H-stat
<i>Firm-level variables</i>						
ln(Firm size)	0.0586*** (17.64)	0.0531*** (18.15)	0.0532*** (18.15)	0.0491*** (15.92)	0.0530*** (18.21)	0.0519*** (15.29)
ln(Age)	0.0070† (1.53)	0.0060† (1.48)	0.0061† (1.48)	0.0065† (1.49)	0.0060† (1.47)	0.0036 (0.73)
ln(Exp)	-0.0013 (-0.28)	-0.0015 (-0.37)	-0.0015 (-0.36)	-0.0027 (-0.58)	-0.0015 (-0.37)	-0.0068 (-1.30)
Largest ow.	-0.0000 (-0.38)	-0.0000 (-0.43)	-0.0000 (-0.43)	-0.0001 (-1.06)	-0.0001 (-0.49)	-0.0002† (-1.60)
For.-owned	0.0393*** (3.85)	0.0367*** (4.00)	0.0366*** (3.98)	0.0354*** (3.48)	0.0365*** (4.00)	0.0202* (1.67)
Gov.-owned	-0.0576† (-1.47)	-0.0497 (-1.40)	-0.0500 (-1.41)	-0.0469 (-1.23)	-0.0466 (-1.32)	-0.0666† (-1.49)
Exporter	0.0104 (1.12)	0.0087 (1.04)	0.0088 (1.05)	0.0119 (1.39)	0.0088 (1.05)	0.0147† (1.60)
Subsidiary	0.0499*** (5.56)	0.0449*** (5.56)	0.0449*** (5.55)	0.0439*** (5.10)	0.0444*** (5.52)	0.0398*** (4.06)
Audited	0.0530*** (7.90)	0.0476*** (7.88)	0.0477*** (7.87)	0.0382*** (5.95)	0.0474*** (7.87)	0.0279*** (3.85)
Publicly listed	0.0057 (0.37)	0.0055 (0.40)	0.0056 (0.41)	0.0040 (0.28)	0.0059 (0.43)	0.0047 (0.29)
Privately held	0.0429*** (5.59)	0.0384*** (5.50)	0.0386*** (5.51)	0.0329*** (4.49)	0.0382*** (5.49)	0.0274*** (3.23)
Crisis	-0.0501* (-1.80)	-0.0565** (-2.43)	-0.0586** (2.47)	-0.0788*** (-3.03)	-0.0487** (-2.10)	-0.0258* (-1.74)
<i>Country-level variables</i>						
<b>Competition</b>			<b>-0.0003</b> <b>(-0.51)</b>	<b>0.3043†</b> <b>(1.48)</b>	<b>0.0967*</b> <b>(1.86)</b>	<b>0.1197*</b> <b>(1.86)</b>
Fin. Dev.		0.0005 (0.74)	0.0006 (0.76)	0.0005 (0.67)	0.0005 (0.69)	0.0001 (0.15)
ln(GDPpc)		0.0768*** (3.91)	0.0799*** (3.89)	0.0714*** (3.21)	0.0797*** (4.12)	0.0407† (1.46)
Growth		0.0007 (0.23)	0.0008 (0.23)	-0.0049 (-1.05)	0.0012 (0.37)	0.0000 (0.00)
Inflation		-0.0022* (-1.88)	-0.0022* (-1.90)	-0.0019 (-1.61)	-0.0023** (-1.99)	-0.0062** (-2.17)
Legal Rights		0.0052 (0.83)	0.0059 (0.92)	0.0114* (1.75)	0.0042 (0.68)	0.0057 (0.81)
Credit Info		0.0041 (0.49)	0.0045 (0.53)	0.0109 (1.22)	0.0012 (0.15)	0.0047 (0.51)
Inst. Dev.		0.0007 (0.02)	-0.0037 (-0.10)	-0.0138 (-0.38)	0.0087 (0.25)	-0.0207 (-0.38)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
# firms	28949	28949	28949	23550	28929	17755
# Countries	70	70	70	51	69	35
LR test	2517.08***	1095.28***	1093.27***	740.62***	1025.29***	338.15***

The dependent variable is a dummy equals to 1 if the firm is not subject to financing rationing. Inverse of CR3, Lerner index and Boone indicator are used in the table. The LR test compares the pooled estimator (probit) with the panel estimator. Under null hypothesis, the panel estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. †, \*, \*\*, and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.

Table 3: Interbank competition and loan applications

	Measure of competition					
	None	None	CR3	Lerner	Boone	Hstat
<i>Firm-level variables</i>						
ln(Firm size)	0.0814*** (12.49)	0.0782*** (12.69)	0.0782*** (12.66)	0.0742*** (10.42)	0.0781*** (12.76)	0.0786*** (18.08)
ln(Age)	-0.0035 (-0.42)	-0.0120† (-1.62)	-0.0120† (-1.64)	-0.0091 (-1.14)	-0.0134* (-1.89)	-0.0207*** (-2.64)
ln(Exp)	0.0365*** (3.84)	0.0151** (2.13)	0.0151** (2.11)	0.0115* (1.77)	0.0131* (1.91)	0.0036 (0.57)
Largest ow.	-0.0002 (-0.61)	-0.0002 (-0.72)	-0.0002 (-0.74)	-0.0002 (-1.00)	-0.0002 (-0.95)	-0.0003† (-1.48)
For.-owned	-0.0544*** (-3.33)	-0.0131 (-1.27)	-0.0126 (-1.21)	-0.0100 (-0.84)	-0.0145 (-1.39)	-0.0096 (-0.81)
Gov.-owned	-0.1076 (-1.40)	-0.0625 (-0.99)	-0.0614 (-0.97)	-0.0527 (-0.70)	-0.0584 (-0.92)	-0.0561 (-0.70)
Exporter	0.0654*** (3.94)	0.0484 (3.36)	0.0483*** (3.36)	0.0471*** (3.39)	0.0476*** (3.30)	0.0460*** (3.79)
Subsidiary	-0.0042 (-0.33)	-0.0063 (-0.45)	-0.0065 (-0.47)	-0.0064 (-0.45)	-0.0048 (-0.35)	-0.0073 (-0.47)
Audited	0.0717*** (4.42)	0.0641*** (4.25)	0.0640*** (4.15)	0.0554*** (3.31)	0.0655*** (4.32)	0.0463*** (4.28)
Publicly listed	0.0734** (2.45)	0.0412† (1.57)	0.0410† (1.56)	0.0049 (0.21)	0.0411† (1.61)	-0.0029 (-0.11)
Privately held	0.1305*** (5.21)	0.0783*** (4.23)	0.0780*** (4.21)	0.0557*** (3.72)	0.0777*** (4.44)	0.0441*** (3.05)
Crisis	0.0328 (0.95)	-0.0084 (-0.26)	-0.0087 (-0.26)	0.0210 (0.66)	0.0006 (0.02)	0.0907*** (2.74)
<i>Country-level variables</i>						
<b>Competition</b>			<b>0.0001 (0.08)</b>	<b>0.0794 (0.38)</b>	<b>0.0974** (2.08)</b>	<b>0.1441** (2.32)</b>
Fin. Dev.		0.0033*** (2.65)	0.0033*** (2.65)	0.0025** (2.16)	0.0032*** (2.66)	0.0009 (0.86)
ln(GDPpc)		0.0504** (2.22)	0.0499** (2.11)	0.0464* (1.72)	0.0543** (2.30)	0.0613* (1.72)
Growth		-0.0004 (-0.09)	-0.0004 (-0.08)	-0.0066 (-1.03)	0.0002 (0.04)	-0.0028 (-0.35)
Inflation		-0.0011 (-1.24)	-0.0011 (-1.21)	-0.0012 (-1.44)	-0.0012 (-1.50)	-0.0116*** (-4.36)
Legal Rights		-0.0077 (-1.08)	-0.0080 (-1.02)	-0.0076 (1.02)	-0.0091 (-1.31)	0.0051 (0.57)
Credit Info		0.0038 (0.44)	0.0040 (0.46)	0.0015 (0.17)	0.0004 (0.05)	-0.0083 (-1.32)
Inst. Dev.		-0.0251 (-0.68)	-0.0242 (-0.61)	-0.0252 (-0.57)	-0.0135 (-0.40)	-0.1499** (-1.93)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
# firms	18238	18238	18238	14572	18225	10978
# Countries	70	70	70	51	69	35
Wald test ( $\rho = 0$ )	162.71***	70.92***	74.49***	0.57	69.27**	20.75***

The dependent variable is a dummy equals to 1 if the firm with a need for funds applied. Inverse of CR3, Lerner index and Boone indicator are used in the table. Probit with sample selection (PSS) issue is used. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. †, \*, \*\* and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.

Table 4: Interbank competition and loan rejection/acceptation

	Measure of competition					
	None	None	CR3	Lerner	Boone	Hstat
<i>Firm-level variables</i>						
ln(Firm size)	0.0089*** (3.31)	0.0091*** (3.54)	0.0091*** (3.56)	0.0091*** (3.86)	0.0093*** (3.68)	0.0091** (2.04)
ln(Age)	0.0208*** (5.59)	0.0197*** (5.71)	0.0198*** (5.69)	0.0182*** (4.89)	0.0188*** (5.67)	0.0162*** (3.44)
ln(Exp)	0.0064 <sup>†</sup> (1.47)	0.0009 (0.22)	0.0012 (0.28)	0.0019 (0.48)	0.0003 (0.08)	-0.0069 (-1.23)
Largest ow.	-0.0000 (-0.13)	0.0000 (0.19)	0.0000 (0.15)	0.0001 (0.76)	0.0000 (.08)	-0.0000 (-0.37)
For.-owned	0.0107 (1.16)	0.0197** (2.02)	0.0192** (2.07)	0.0121 (1.17)	0.0190* (1.95)	0.0057 (0.51)
Gov.-owned	-0.0090 (-0.33)	0.0066 (0.29)	0.0054 (0.24)	0.0030 (0.14)	0.0074 (0.33)	-0.0313 (-1.33)
Exporter	-0.0099 (-1.14)	-0.0156* (-1.85)	-0.0156* (-1.85)	-0.0138* (-1.75)	-0.0158* (-1.87)	-0.0098 (-1.32)
Subsidiary	0.0203*** (2.66)	0.0202*** (2.83)	0.0200*** (2.80)	0.0205*** (3.05)	0.0197*** (2.79)	0.0169** (2.42)
Audited	0.0027 (0.38)	-0.0009 (-0.14)	-0.0013 (-0.19)	-0.0079 (-1.21)	-0.0004 (-0.06)	-0.0088 (-1.20)
Publicly listed	0.0146 (1.17)	0.0080 (0.60)	0.0086 (0.64)	0.0182 <sup>†</sup> (1.48)	0.0074 (0.55)	0.0165 (1.31)
Privately held	0.0333*** (3.00)	0.0173** (2.07)	0.0180** (2.10)	0.0209*** (2.73)	0.0174** (2.12)	0.0052 (0.67)
Crisis	-0.0342** (-2.43)	-0.0464*** (-3.37)	-0.0467*** (-3.38)	-0.0630*** (-5.12)	-0.0434*** (-3.14)	-0.0421*** (-3.01)
<i>Country-level variables</i>						
<b>Competition</b>			<b>-0.0002 (-0.50)</b>	<b>0.1242<sup>†</sup> (1.51)</b>	<b>0.0323** (2.30)</b>	<b>0.0442** (2.04)</b>
Fin. Dev.		0.0002 (0.63)	0.0002 (0.63)	0.0002 (0.60)	0.0002 (0.59)	0.0009* (1.79)
ln(GDPpc)		0.0047 (0.46)	0.0065 (0.54)	0.0035 (0.32)	0.0055 (0.53)	-0.0036 (-0.32)
Growth		0.0001 (0.06)	0.0001 (0.04)	-0.0022 (-0.83)	0.0003 (0.13)	0.0051* (1.79)
Inflation		-0.0007 (-1.20)	-0.0007 (-1.20)	-0.0002 (-0.56)	-0.0007 (-1.32)	-0.0032** (-1.98)
Legal Rights		0.0078*** (2.58)	0.0081** (2.31)	0.0097*** (3.04)	0.0074** (2.46)	0.0066** (1.98)
Credit Info		0.0116*** (3.59)	0.0116*** (3.53)	0.0141*** (4.26)	0.0108*** (3.18)	0.0128*** (4.21)
Inst. Dev.		-0.0101 (-0.59)	-0.0128 (-0.64)	-0.0095 (-0.63)	-0.0071 (-0.41)	-0.0351 (-1.22)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
# firms	10597	10597	10597	9027	10592	7461
# Countries	70	70	70	51	69	35
Wald test ( $\rho = 0$ )	2.71*	6.42**	5.89**	12.45***	7.76***	1.93

The dependent variable is a dummy equals to 1 if the applicant received a loan (and 0 otherwise). Inverse of CR3, Lerner index and Boone indicator are used in the table. Probit with sample selection (PSS) issue is used. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. <sup>†</sup>, \*, \*\* and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.

Table 5: Interbank competition and credit availability, by firm size and age

<i>Panel A: Firm size</i>						
	Boone indicator			H-statistic		
	Small	Medium	Large	Small	Medium	Large
Competition	0.1143* (1.88)	0.1053* (1.94)	0.0533 <sup>†</sup> (1.41)	0.1267* (1.65)	0.1176* (1.92)	0.0878* (1.86)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	15513	5981	7435	8430	3969	5356
# Countries	69	69	69	35	35	35
LR test	616.27***	141.83***	88.51***	204.53***	30.33***	25.90***

  

<i>Panel B: Firm age</i>						
	Boone indicator			H-statistic		
	Young	Medium	Old	Young	Medium	Old
Competition	0.0758 (1.06)	0.1057* (1.91)	0.1088** (2.43)	0.1087 (1.24)	0.1007* (1.64)	0.1130* (1.78)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes	Yes	Yes
# firms	4772	12795	11362	2405	7914	7436
# Countries	69	69	69	35	35	35
LR test	175.80***	363.01***	274.83***	38.96***	83.51***	111.30***

The dependent variable is a dummy equals to 1 if the firm is not subject to financing rationing. Small-sized firms are less than 20 employees, medium-sized have more than 20 employees but less than 50 and large firms, and large firms have more than 50 employees. Young firms assemble firms operate for less than five years and old firms are firms with more than 15 years of operations. Inverse of Boone indicator is used in the table. The LR test compares the pooled estimator (probit) with the panel estimator. Under null hypothesis, the panel estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. <sup>†</sup>, \*, \*\* and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.



Table 6: Interbank competition and loan applications, by reasons

	Boone indicator		H-statistic	
	Price	Other	Price	Other
Competition	0.0540*	0.0458**	0.1308***	.0138
	(1.66)	(2.22)	(3.43)	(0.39)
Firm controls				
Industry FE				
Country controls				
# firms	15487	13330	9729	8710
# Countries	69	69	35	35
Wald test ( $\rho = 0$ )	66.30***	37.04***	38.74***	7.72***

The *Price* variable is a dummy equals to 1 if the applicant received a loan and 0 if the firm refused to apply owing to contract term consideration (e.g. interest rates or collateral requirements). The *Other* variable is a dummy equals to 1 if the applicant received a loan and 0 if the firm refused to apply due to other consideration (e.g. expected that demand will be turned down). Inverse of Boone indicator is used in the table. Probit with sample selection (PSS) issue is used. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. \*, \*\*, and \*\*\* and indicate significance at the 10%, 5% and 1% respectively.

Table 7: Variables description and data source

Variable	Description	Source
<i>Dependent variables</i>		
Credit	Dummy variable equals to 0 if the firm is classified as <i>Discouraged</i> or as <i>Denied</i> and 1 otherwise	WBES <sup>a</sup>
Need	Dummy variable equals to 1 if the firm needed external funds in the last year	WBES
Apply	Dummy variable equals to 1 if the firm needed external funds and applied for loans and 0 if the firm did not apply	WBES
Accepted	Dummy variable equals to 1 if the firm applied for loans and received at least one line of credit and 0 if the firm applied but did not receive a line of credit	WBES
<i>Independent variables</i>		
<i>Interbank competition</i>		
CR3	Share of banking system assets held by the three largest banks	GFDD <sup>b</sup>
Lerner	Value of the Lerner index	GFDD
Boone	Value of the Boone index	GFDD
H-stats	Value of the H-statistics	GFDD
<i>Firm-level control variables</i>		
Firm size	Number of permanent full-time employees	WBES
Age	Age of the firms (in years)	WBES
Exporter	Dummy variable equals to 1 if 10% or more of sales are exported	WBES
Foreign-owned	Dummy variable equals to 1 if 50% or more of the firm is owned by foreign organization	WBES
Government-owned	Dummy variable equals to 1 if 50% or more of the firm is owned by the government	WBES
Experience	Experience in this sector that the top manager has (in years)	WBES
Largest owner	Share of assets held by the largest owner	WBES
Audited	Dummy variable equals to 1 if the firm have its annual financial statement checked and certified by an external auditor	WBES
Subsidiary	Dummy variable equals to 1 if the firm is part of larger firm	WBES
Publicly listed	Dummy variable equals to 1 if the firms is a publicly listed company	WBES
Privately held	Dummy variable equals to 1 if the firms is a limited liability company	WBES
<i>Country-level control variables</i>		
Financial Development	Domestic credit to the private sector to GDP	GFDD
GDPpc	GDP per capita (Constant USD)	WDI <sup>c</sup>
Inflation	Annual change in the GDP deflator	WDI
Growth	Real growth of the GDP	WDI
Credit information	Depth of credit information index is a measure of the coverage, scope and accessibility of credit information available through either a public credit registry or a private credit bureau (0-6)	DB <sup>d</sup>
Legal Rights	The strength of legal rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders (0-10)	DB
Institution Dev. Crisis	Composite index of institutional development Dummy variable equals to 1 if year $\geq$ 2009	WGI <sup>e</sup>
<i>Selection variables</i>		
WK	Proportion of goods or services paid for after the delivery	WBES
Construction	Dummy variable equals to 1 if the firm submit an application to obtain a construction-related permit over the last two years	WBES
Obstacles	Firm's assessment of growth obstacle induced by an inadequately educated workforce (ranges from 0 (no obstacle) to 4)	WBES

<sup>a</sup>WBES: World Bank Enterprises Surveys; <sup>b</sup> GFDD: Global Financial Development Database; <sup>c</sup> WDI: World Development Indicators <sup>d</sup> DB: Doing Business; <sup>e</sup> WGI: World Governance Indicators

Table 8: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
<i>Independent variables</i>					
Credit	28952	0.6813	0.4660	0	1
Need	28952	0.6300	0.4828	0	1
Apply	18238	0.5810	0.4934	0	1
Accepted	10598	0.8504	0.3567	0	1
<i>Dependent variables</i>					
<i>Firm-level variables</i>					
Firm size	28952	77.9750	237.524	0	5000
Age	28952	16.9504	14.9103	0	108
Experience	28952	17.2560	11.1765	0	75
Largest owner	28952	78.2017	26.7016	0	100
Foreign-owned	28952	0.1001	0.3001	0	1
Gov.-owned	28952	0.0057	0.0757	0	1
Exporter	28952	0.1390	0.3460	0	1
Subsidiary	28952	0.1286	0.3348	0	1
Audited	28952	0.4753	0.4993	0	1
Publicly listed	28952	0.0515	0.2211	0	1
Privately held	28952	0.5847	0.4928	0	1
Construction	28952	0.1606	0.3671	0	1
WK	28952	48.5730	39.9079	0	100
Obstacles	28952	1.5163	1.3590	0	4
<i>Country-level variables</i>					
CR3	70	65.4999	19.1019	26.08	100
Lerner	51	0.2482	0.0691	0.12	0.44
Boone	69	-0.0900	0.2376	-1.59	0.54
H-stat	35	0.6500	0.2203	-0.02	0.99
Fin. Dev.	70	30.6170	23.0935	1.56	95.97
GDPpc	70	2647.21	2701.75	92.37	13836
Growth	70	5.7105	3.9012	-4.24	21.71
Inflation	70	10.4114	10.7748	-1.74	80.75
Legal rights	70	5.1285	2.3089	1	10
Credit Info	70	3.1745	2.1629	0	6
Institution Dev.	70	-0.2309	0.6217	-1.61	1.14