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Credit Crunch or Loan Demand Shortage: What Is the Problem with the SMEs' Financing?

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Abstract

The aim of this paper is to study the determinants of bank loan applications and financial access of small and medium enterprises from 2013 to 2015. We applied binary and ordered logit models to a sample of 27.811 firms from 37 countries from the Survey on the Access to Finance of Enterprises (SAFE). We provided evidence that larger firms and those belonging to the industry sector are more likely to apply for and obtain bank loans. A puzzling result was found regarding the matter of innovation. It is relevant for both application and access to bank loans, but in opposite ways: innovation boosts external finance applications but hampers actual financial access. Furthermore, the use of retained earnings enhances financial application and the effective financial access. This could indicate that internal funds are complementary, rather than substitutes in the firms' financial structure. The results of the study are relevant to improve policies of SMEs access to finance in the European context.

1. Introduction

It is well known that Small and Medium Enterprises (SMEs) play an important role in the economic system, especially as employment generators, thus contributing to GDP growth. Difficulties of accessing financial loans could limit the growth and development of SMEs. Consequently, it is relevant to study the determinants of financial access in this type of firms.

The capital structure theory studies this kind of problem, detecting different reasons arising from either the supply or the demand side.

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There are several competing theories that explain financial decisions, such as the Trade-off Theory (Modigliani & Miller, 1958; 1963), the Pecking Order Theory (Myers, 1984; Myers & Majluf, 1984), and the Financial Growth Cycle Theory (Berger & Udell, 1998), among others. Other authors prefer to analyze jointly both sides of the market (Kon & Storey 2003; Beck, 2013; Mina et al., 2013; Cole & Sokolykb, 2016). In this sense, Beck (2013) detected two problems: (i) self-exclusion, and (ii) barriers related to regulation and loan characteristics (e.g. collateral and interest rates). This author considered that policy reforms and interventions have uneven impacts on SMEs, depending on the entrepreneur's characteristics.

Since the European Central Bank has started the Survey on the Access of Finance of Enterprises (SAFE) in 2009, we believed it is appropriate to empirically analyze this topic for European SMEs. SAFE constitutes a state-of-the-art survey on the financial conditions for SMEs in European (and some associated) countries. It is conducted biannually and comprises the largest database on this subject in Europe.

The aim of this paper is to analyze the determinants of bank loan applications and financial access from this dual perspective: from the demand and supply sides. We performed a specific study of SMEs characteristics profile, such as size, sector, age, use of retained earnings, and innovation activities. Firstly, we set a model to analyze the determinants of bank loan applications. This analysis was able to detect the willingness or unwillingness of SMEs to request a loan, according to their needs and depending on their characteristics. Secondly, once firms had already applied for a loan, we established a model to analyze the characteristics related to the effective financial access (success). Thirdly, we further examined the financial access, using an ordered logit model to uncover the different levels of access to bank loans, considering the relative size of access.

Our study provides new evidence on firms' characteristics leading to both financial application and effective financial access, using a comprehensive European database, which is conducted regularly and systematically by the European Central Bank. Even though there are previous studies that also use the SAFE database, our paper examined SMEs financing difficulties in greater detail. We analyzed different levels of external financing considering SMEs' needs and their actual financial success. In addition, we enhanced the financial success analysis by studying the relative size of the credit obtained.

We contribute to the existing literature by assessing whether the restrictions arise from the supply side (financial institutions) or from the demand side (SMEs). This approach plays a key role on the possible actions to tackle the financing problem. If there is a supply side obstacle (i.e. firms apply for funding, but do not get access to them), it would be necessary to study whether the bank scoring system is too restrictive, causing adverse selection problems. If there is a demand side problem (i.e. firms do not request a bank loan), it would be necessary to study which are the underlying motivations for such financial self-exclusions.

This paper is organized as follows. Section 2 presents a brief review of the main theories of SME's capital structure, and distinctive characteristics of European SMEs. Section 3 and 4 describes the data and methodology used in this paper. Section 5 presents the results of the empirical study. Section 6 discusses the main findings. Finally, Section 7 shows the main conclusions.

2. Literature Review

2.1 SMEs' Capital Structure According to Different Theories

SMEs' access to finance has been frequently studied in the literature, given the relevance of this kind of firms in job creation, investment, innovation, and economic growth. Financing sources used by SMEs vary from internal funds (such as retained earnings and equity) to external funds. The latter is provided either by banks or other such as financial institutions as well as capital markets.

Theories about a company's capital structure began with the seminal paper by Modigliani and Miller (1958), who considered, under certain assumptions, that the cost of capital and the value of the company are independent from the company's financial structure. That is, they denied the existence of an Optimal Capital Structure and implicitly assumed that financing decisions do not affect the value of the firm. Soon after, Modigliani and Miller (1963) studied the effects of taxes on the capital structure, concluding that debt has a tax advantage for the company, produced by the deduction of interests in the calculation of the tax on corporate earnings. Therefore, once taxes are taking into account, an optimal capital structure arises.

In this framework, the Trade-off Theory considers the effects of several variables (taxes, bankruptcy costs, and agency problems) and predicts an optimal structure, weighting the costs and benefits of each component of the financial structure. Leverage is regarded as advantageous (under certain conditions) and firm managers prefer to use debt, even if internal funds are available. For these reasons, this theory proposes to avoid the extreme use of leverage and limit the debt to an equity ratio (Brealey et al., 2006).

Miller (1977) improved previous models by considering the investor's income tax. This tax is levied either on the income from shares (dividends and capital gains) or on interest, in addition to income tax. Consequently, the fiscal advantage of debt is cancelled when both types of taxes are taken into account, recalling the thesis of the irrelevance of the capital structure on the value of a firm.

Myers (1984) and Myers and Majulf (1984) proposed an alternative approach, denominated the Pecking Order Theory, which recognizes an order of preferences in the sources of financing chosen by companies. According to this theory, companies prefer, in the first place, their retained earnings (internal equity); in the second place, short-term debt; and in the third place, further own capital (external equity capital). This order reflects the preference of entrepreneurs to stay in control of the company and avoid the costs of external financing. It takes place in contexts of asymmetrical information, where managers have more information than external investors do about the expectations, risks, and value of the company (Ferrer & Tresiera Tanaka, 2009). Diamond (1991) proposed a different type of ordering of finance preferences, based on the cost of different types of debt. In this model, firms increase their access to different sources of financing when they earn market reputation.

Some literature incorporates the stages of growth of companies as a condition to access finance. In this line, Ang (1991) stated that SMEs go through several stages in the path traveled to be a large company, so it is possible that a single theory could be unable to explain the capital structure previously adopted. Berger and Udell (1998) also considered that firms can substitute and complement different forms of

financing, which vary over the business life cycle. These authors presented a theory of financial growth cycle and confirmed that younger and smaller businesses face more difficulties and are prone to use internal financing and external funds more often. This model explains that capital financial decisions are linked to the firm's characteristics such as size, age, and information availability. In this sense, as the firm grows and establishes in its sector, it begins to gain access to more formal financial sources.

Briozzo et al. (2016) indicated that the manager's individual objectives, such as attitude towards debt and experience with external financing (according to risk aversion), level of education, and the socioeconomic and emotional costs of bankruptcy affect the demand for funds. According to the business life cycle and to this approach, some of the characteristics of the firms and those of the owners-managers could simultaneously affect the demand for external funds as well as its success.

Credit constraints are not only limited to the access to external funds. Theories presented above show that financing restrictions may come from either the demand or supply side. The presence of moral hazard and adverse selection produce credit constraints to small businesses, by increasing the cost of loans and the required collateral. Generally, SMEs have significant information gaps, causing some problems to access external funds, and diverting the supply of loans to larger firms. Many papers on this topic (Stiglitz & Weiss, 1981; Ang, 1991) analyze specifically SMEs financing problems under the presence of asymmetric information. Generally, this information issue is more frequent in emerging markets than in developed countries.

Boot and Thakor (1994) assumed that SMEs do not have enough collateral and, hence, face difficulties in borrowing funds, even at an expensive cost. Furthermore, financial globalization brings fierce competition toward funds, making credit conditions even worse for SMEs.

2.2 SMEs' Financial Access

Ferrando and Mulier (2015) investigated the role of firm's characteristics on financial constraints during the financial crisis, using a bivariate probit model. They measured the financial constraints through firms' self-assessment with respect to the access to finance, as their most pressing problem. They also compared the firm's actual applications for external financing. Their results suggest that firms that are more profitable are less likely to face external financing constraints. Additionally, they found that firms that rely heavily on short-term debt are more likely to have a negative perception towards the access to finance. These authors also observed that firm age, but surprisingly not size, is negatively related to the access to external finance.

Lawless et al. (2015) studied credit bank constraints faced by European SMEs and the use of financial sources by means of a multinomial logit and a Poisson regression. They found that firms adjust fund sources in response to requirement changes or according to the different types of available sources. The authors highlighted that firms' characteristics, such size and age, are more evident than cross-country variation. Smaller and younger firms are significantly more limited to

financial options than older and larger firms are. Similar results are found by Bauer (2004), using data of the Czech Republic. These results are in concordance with the Life-cycle Theory, where financing options for firms are limited until an established track record of performance and adequate collateral are reached.

In a similar vein and using the SAFE database, Ferrando and Mulier (2015) observed that firms with lower profit margins and lower return on equity have higher probabilities of facing actual financing constraints. Furthermore, they affirmed that the firm age is important in explaining both the perceived and the actual financial limitations. Using the same database, Mc Namara et al. (2020) analyzed the effect of the lending infrastructure on SMEs credit rationing. They found that there are less rationed SMEs in countries with highly efficient judicial systems, less efficient bankruptcy systems, and with greater levels of trust. Likewise, firms' age and size show a negative relationship with respect to credit rationing. García Posada (2019) identified that credit constraints have important negative effects over investment in fixed assets, inventories, and other working capitals and firm growth. Moreover, regarding the marginal effect for different types of firms, the author remarked that micro firms are largely unaffected by credit constraints considering that this kind of firms use internal funds more frequently.

Russo and Parlapiano (2018) analyzed the hypotheses of the companies' balance sheets according to their characteristics and the risk profile in the transmission of monetary policy in the framework of the sovereign crisis and the successive changes in interest rates. They identified that the characteristics of borrowers and the changes in their financial conditions are determinants in the reduction of interest rates applied to companies after the financial crisis. Bremus and Neugebauer (2018) found different channels through which credit market fragmentation affects the financing constraints of SMEs, and affirmed that in those economies with the strongest reductions in international credit, the probability of facing higher loan rates is greater than in countries with the most favourable evolution of international credit.

Dedu et al. (2019) studied the situation and challenges faced by the European SMEs related to funding access and financial inclusion considering the SAFE database. They analyzed six European countries and tried to answer if internal macroeconomic factors are similar or more important than business sector factors. The authors examined the correlations between them and how they influence the access to finance for SMEs. They found that Spanish and Portuguese SMEs faced the most difficulties in the access to finance. Moreover, the Spanish and French SMEs have suffered mainly from credit history decline in bank loans availability for companies (excluding overdraft and credit lines) and most of the SMEs believe that financing costs have increased markedly during the last period. Wagner (2019) studied SMEs from industry or services belonging to 25 European countries and tested for links between credit restrictions and export activities of firms. He found a rarely significant negative relationship between more severe problems in access to finance and exports.

Mc Namara et al. (2020) analyzed the effect of nine countries' lending infrastructure on SMEs capital structure, during the period 2005 to 2011, and observed that SMEs environment affects their capital decisions. SMEs debt is higher

in countries with more efficient bankruptcy procedures (in terms of debt recovery), and in countries with less severe regulatory laws and lower capital regulatory requests for banks.

Martinez et al. (2020) conducted a comprehensive meta-analysis of the papers using SAFE database as main source of information. They detected that there are still several gaps in the literature, probably due to the lack of empirical data. Their review systematizes the methodology and contributions of the papers using this relative new database. In general, all of them consider SMEs' characteristics of different sets of European countries and evaluate the 2008 financial crisis effect over the economies.

Bonanno et al. (2020) analyzed the relationship between firms' profit efficiency, access to finance, and innovation activities. They identified that credit constrained firms present an incentive to improve their efficiency in order to increase profitability. Moreover, they noted that high-tech firms are able to turn innovation and knowledge into productivity gains, while low technology and innovation do not produce leverage on revenues.

3. Data and Variables Description

This study uses microdata from the Survey on the Access to Finance of Enterprises (SAFE), conducted biannually by the European Commission and European Central Bank since 2009. As its name indicates, the survey is well suited for our research goal. More precisely, we used the following waves: 9 (April to September 2013), 11 (April to September 2014), 13 (April to September 2015), which include data from 27811 companies in 37 European countries. We employed the selected waves jointly, as a cross section analysis. In this line, we followed the path of previous papers such as Örtürk and Mrkaic (2014), Ferrando et al. (2017), Dedu et al. (2019), and Guercio et al. (2019).

The main reason for this selection is that these waves do not include the financial crisis period. In this way, we avoided the interference of such events in our results. As mentioned in Section 1, the financial crisis severely affected lending conditions, producing an important impact on European SMEs' financial access. Therefore, we focused our study on SMEs determinants of bank loan applications and approval after the crisis.

The survey contains information related to SMEs demographic characteristics, such as size (proxied by the turnover), sector, firm age, and ownership. Additionally, it informs if the firm is involved into product and/or process enhancement/innovation. More importantly, SAFE includes information on the requests of financial resources (loans, bank overdraft, etc.), and the degree of success in requests of bank loans (total or partial requested amount granted).

The variables were selected following the Financial Growth Cycle Theory (Berger & Udell, 1998) that explains capital financial decisions through the firm's characteristics profile.

Table 1 summarizes the description of the dependent and independent variables selected for our study. The empirical research was structured in three steps, each of them with different dependent variables. In the first step, the dependent variable represents those firms that had applied for a bank loan (*need*). In the second step, the dependent variable represents those firms that were effectively granted a

bank loan (*success*), which corresponds to a subset of the dependent variable of the previous step (*need*). Finally, in the third step, the dependent variable is the percentage of credit actually obtained, labelled as relative loan size (*relsize*).

The independent variables analyzed in this study are those which, according to the previous literature, influence SMEs financial access or affect their capital structure. The signs presented in Table 1 are those previously identified in the literature.

We considered:

a. Three variables related to firm size (*micro, small, medium*), using the last one as the base category for size.
b. Four variables to classify firms into economic sectors (*service, trade, construction, industry*), using industry as the base category for sector.
c. Three variables to segregate firms according to their age (*age5, age5_10, age10*), being firms older than ten years as the base category.
d. One variable to indicate if the firm has recently been involved in innovation activities.
e. One variable to signal if the firm uses retained earnings in its financial structure.

Table 2 displays descriptive data of the variables under analysis. As can be observed, only 26.2% of the sample reported to the survey at least one bank loan application within six previous months (need). Among these firms that had already applied for a loan, 78.8% got them approved (success). However, their success in loan application is not always perfect. In fact, considering the firms that received a positive answer from their credit officer, 80.4% obtained the entire requested amount, whereas 9.7% obtained between 75% and 99% of the demanded amount, and 9.9% got less than the 75% of the application amount (relsize).

Regarding the independent variables, we observe that more than a half of the sample includes micro firms (59.1%), followed by small (26.9%), and medium firms (14%). In relation to the sector, service firms are the most frequent in the sample. Moreover, it could be appreciated that 76.5% of the SMEs in the sample are older than ten years, approximately half of the firms engage in innovative activities, and almost 20% use retained earnings in their finance structure.

Table 1 Selected Variables Description

Dependent Variables	*Description*		
need	Dichotomous variable that takes on the value 1 if the firm applied for bank loans in the past six months, and 0 if it did not apply for it. This variable shows the demand for bank loans, according to its needs.		
success	Dichotomous variable that takes on the value 1 if the firm obtained a bank loan in the past six months, and 0 otherwise. This variable shows the success in bank loan application.		
relsize	Categorical variable that takes on values according to different degrees of loan approval. It takes on the value 1 if the firm received 100% of the requested amount, 2 if the firm received between 75% and 99% of the requested amount, and 3 if the firm received between 1% and 75% of the requested amount.		
Independent Variables	*Description*	*Expected sign*	
		Need	*Success*
micro	Dichotomous variable that takes on the value 1 if the firm's turnover is up to 2 million euros, and 0 otherwise.	–	–
small	Dichotomous variable that takes on the value 1 if the firm's turnover is between 2 and 10 million euros, and 0 otherwise.	–	–
medium	Dichotomous variable that takes on the value 1 if the firm's turnover is between 10 and 50 million euros, and 0 otherwise.	Base category	
service	Dichotomous variable that takes on the value 1 if the firm is in the service sector, and 0 otherwise	–	–
trade	Dichotomous variable that takes on the value is 1 if the firm is in the trade sector, and 0 otherwise.	–	–
construction	Dichotomous variable that takes on the value 1 if the firm is in the construction sector, and 0 otherwise.	–	–
industry	Dichotomous variable that takes on the value 1 if the firm is in the industrial sector, and 0 otherwise.	Base category	
age5	Dichotomous variable that takes on the value 1 if the firm's age is up to five years old, and 0 otherwise.	Base category	
age5_10	Dichotomous variable that takes on the value 1 if the firm's age is between five and ten years old, and 0 otherwise.	+	+
age10	Dichotomous variable that takes on the value 1 if the firm's age is more than ten years old, and 0 otherwise.	+	+
innova	Dichotomous variable that takes on the value 1 if the firm has introduced or significantly improved a product or service to the market; or significantly improved production, a process, or method, in the previous 12 months; and 0 otherwise.	+	–
retained	Dichotomous variable that takes on the value 1 if the firm uses retained earnings or sales assets to finance business operations or specific projects or investments, and 0 otherwise.	+	+

Notes: Own elaboration

Table 2 Data Description

Variables	*Mean (%)*	*N*	*SD*
Dependent			
need	26.2%	27811	0.440
success	78.8%	7205	0.409
relsize =1	80.4%	4563	
relsize =2	9.7%	549	0.637
relsize =3	9.9%	563	
Independent			
micro	59.1%	27811	0.490
small	26.9%	27811	0.431
medium	14%	27811	0.329
industry	25.1%	27811	0.419
Service	34.8%	27811	0.482
Trade	28%	27811	0.449
construction	12.1%	27811	0.329
age5	8.9%	27458	0.285
age5_10	14.6%	27458	0.359
age10	76.5%	27458	0.428
innova	46.2%	27651	0.496

Notes: Own elaboration based on data from SAFE

4. Methodology

4.1 Binary Logit Models

Binary logit models are used to estimate the outcome of a dichotomous variable, due to a latent variable. The latent variable y^* is a linear function of the explanatory variables, using the following equation (Long & Freese, 2006):

$$y^* = x_i\beta + \mu \tag{1}$$

The higher the value of y^*, the greater the probability of occurrence of the event. The observed variable y_i is related to the latent variable y^* in the following way:

$$y_i = \begin{cases} 1 & if\ y_i^* > 0 \\ 0 & if\ y_i^* \leq 0 \end{cases} \tag{2}$$

Thus, the event probability is defined as:

$$Pr\,(y_i = 1|x_i) = F(x_i\beta + \mu) = F(x_i\beta) \tag{3}$$

In our case, the events are the application for a bank loan and the approval of a previous requested loan. Thus, we made two estimations, each one with a different dependent variable:

$$\Pr(need = 1|\mathrm{x}_i) = F(\mathrm{x}_i\beta) \tag{4}$$

The number of firms included in each category is presented in Table 3.

Table 3 Number of Firms in Each Category

		Number	*Percentage*
Variable "need"	Total	27811	100%
	Loan not requested (*need* =0)	20510	73.7%
	Loan requested (*need*=1)	7301	26.2%
Variable "success"	Total	7305	100%
	Loan rejection (*success*=0)	1530	21.2%
	Loan approval (*success*=1)	5675	78.8%

Notes: Own elaboration based on data from SAFE

4.2 Ordered Logit Models

In addition to the traditional logit or probit models, regression models for ordered responses are very useful when the dependent variable is explained by several arbitrarily scaled independent variables. The multiple probit model was originally proposed by Aitchison and Silvey (1957) for biometrical purposes. Subsequently, Theil (1969) developed a multinomial logit model. Since then, it has become an extensively used technique in econometrics. Barhnart and Sampson (1994) described several multinomial logit models and their estimation methods. We refer to Boes and Winkelmann (2006) for a detailed description of ordered response models.

Sometimes, firms get their loans approved for less than requested due to insufficient collateral, bank risk aversion, or other causes. Microdata in the SAFE survey provide more precise information on the percentage of the loan that was effectively approved.

In our case, *relsize* is a dependent variable that can be ordered according to the percentage of the loan approved with respect to the amount that the firm had already requested. As has been commented in Table 1, *relsize* can take three different values. Table 4 displays the number of firms that were granted a loan, classified according to the percentage of the approved amount. Ordered logit models are useful when dependent variables are measured on an ordinal scale.

The estimation of an ordered logit model is similar to an ordinary one. The aim is to evaluate the probability of belonging to different groups, *vis-à-vis* the probability of not belonging to them. Following Williams (2019), we estimate

$$y_i = \sum_{k=1}^{K} \beta_k X_{ki} + \varepsilon_i. \quad (5)$$

In each model, we conducted robustness analysis by controlling for possible autocorrelations between firms of each country.

Table 4 Firms Classified by Type of Bank Relative Access

		Number	*Percentage*
	Total	*5675*	*100%*
relsize =1	Received 100% of the requested amount	4563	80.4%
relsize =2	Received between 75% and 99% of the requested amount	549	9.7%
relsize =3	Received between 1% and 74% of the requested amount	563	9.9%

Notes: Own elaboration based on data from SAFE

5. Results

5.1 Determinants of Bank Loan Applications

Table 5 presents the coefficient estimations of two models, considering *need* as the dependent variable. The difference between each model is the presence or absence of retained earnings as an explanatory variable.

Table 5 Estimation of Logit Models for the Dependent Variable "need" for Bank Loans

Variable	*Model_1*	*Model_2*
micro	-0.6206*** (0.0556)	-0.6021*** (0.0571)
small	-0.1731*** (0.0538)	-0.1778*** (0.0532)
services	-0.1632*** (0.0389)	-0.1565*** (0.0372)
trade	-0.1823*** (0.0324)	-0.1691*** (0.0348)
construction	-0.0165 (0.0568)	-0.0100 (0.0603)
age5_10	0.1046 (0.0850)	0.1090 (0.0838)
age10	0.1125* (0.0932)	0.0991 (0.0903)
innova	0.2703*** (0.0316)	0.2679*** (0.0334)
retained		0.3020*** (0.0432)
constant	-0.7725*** (0.1448)	-0.8425*** (0.1447)
N	27299	26725
Wald chi2(8)	556	641
Pseudo_R2	0.0179	0.0210
AIC	30919	30168
BIC	30993	30249

Notes: Own estimations using SAFE data. * p<0.1; ** p<0.05; *** p<0.01

Even though both models show consistent results, the pseudo R^2 (i.e., goodness of fit) is greater in Model_2.

We detected that smaller firms (*micro* and *small*) exhibit a lower likelihood of applying for a bank loan *vis-à-vis* medium size firms (base category). The respective firm sector is also a relevant variable. Belonging to the *services* or *trade* sectors decreases the likelihood of a loan application with respect to the *industry* sector (base category).

Another interesting result is the fact that those firms that had introduced a new or significantly improved product or process/method (*innova*) increases the likelihood of a loan application.

The same reasoning applies to the use of retained earnings (*retained*). This is a noteworthy result because it provides evidence that external and internal funds are not substitutes, but rather complementary sources.

5.2 Determinants of Bank Loan Access (Success)

In this section, we estimate a binary logit model, whose dependent variable is *success*. Results are presented in Table 6. We observe that the model with better goodness of fit is Model_2. In order to compare these results with the previous analysis, we discuss this model in detail.

Table 6 Estimation of the Logit Models of the "success" of the Loan

Variable	*Model_1*	*Model_2*
micro	-0.8477*** (0.0950)	-0.8483*** (0.0891)
small	-0.3084** (0.1001)	-0.3072** (0.0951)
services	-0.1960* (0.0908)	-0.2008* (0.0811)
trade	-0.3025*** (0.1003)	-0.2860*** (0.0823)
construction	-0.2300* (0.0768)	-0.2230* (0.1055)
age5_10	0.2814* (0.1132)	0.2901* (0.1233)
age10	0.4509*** (0.1183)	0.4420*** (0.1049)
innova	-0.1630** (0.0893)	-0.1719** (0.0610)
retained		0.1560* (0.0732)
constant	1.0710*** (0.1658)	1.0675*** (0.1438)
N	7088	6935
Wald chi2(8)	201	211
Pseudo_R2	0.0289	0.0305
AIC	7142	6990
BIC	7205	7059

Notes: Own estimations using SAFE data. * p<0.1; ** p<0.05; *** p<0.01

According to Model_2, firm size significantly influences the effective *success* to external financing, in agreement with the theory of corporate finance. That is, smaller firms have lower probabilities to access bank financing.

The sector where a company develops its activity is another significant variable, which presents the expected sign. Firms in the s*ervices*, *trade,* and *construction* sectors are less likely to access bank financing compared to firms in the *industry* sector. This result could be explained by the larger amount of assets that industrial companies could offer as loan collateral.

Our results, in line with the financial theory, support that the firms' age influences the likelihood of effective financial access. This situation could be due to the fact that older companies have smaller information asymmetries than younger companies, favoring the loan approval.

The variable *innova* shows a negative sign, meaning that firms engaged in innovative activities face harder limitations in the access to bank financing.

Innovation activities carried out by companies increase the information asymmetries due to the uncertainty in the outcome of the innovation process. Frequently, it is difficult for a third party to control and understand technologically complex projects (Guercio et al., 2016). This situation sometimes makes investors and financial institutions reluctant to do business with innovative firms.

Last but not least important, companies using retained earnings are more likely to access bank financing. This result is worth noting because it reflects that firms investing their own resources provide a positive signal to the banking sector, improving their likelihood of accessing external funding.

5.3 Degree of Bank Loan Access

In this section, we present the results of the ordinal logit models, where the dependent variable *relsize* is equal to one if the firms received the entire requested amount, equal to 2 if the firms received 75% or more of the requested amount, and equal to 3 if the firms received between 1% and 74% of the requested amount. Results are presented in Table 7. The ordered logit model indicates that the model is good specified[1] and we observe that the model with better goodness of fit is Model_2.

The results show that the probability of receiving 100% of the requested credit for micro firms is lower than for medium firms. The sector where companies develop their activity is another significant variable. Firms in the *trade* sector are more likely to obtain the total amount than *industry* sector firms are. However, *construction* sector firms are less likely to receive the total amount requested.

The probability of obtaining the total bank loan requested is lower for innovative firms than for non-innovative ones. With respect to retained earnings, firms that used internal funds are less likely of receiving the total amount requested.

[1] The rejection of the null hypothesis on the parallel regression assumption (tests of the parallel regression assumption). See the Appendix.

Table 7 Degree of Bank Loan Access (relsize)

Variable	*Model_1*	*Model_2*
micro	-0.3431***	-0.3191***
	(0.0904)	(0.0924)
small	0.1006	0.0854
	(0.0942)	(0.0953)
services	-0.0117	-0.0062
	(0.0907)	(0.0921)
trade	0.1602*	0.1621*
	(0.0907)	(0.0921)
construction	-0.2534**	-0.2757*
	(0.1124)	(0.1132)
age5_10	0.1011	0.0740
	(0.1576)	(0.1592)
age10	-0.0719	-0.0884
	(0.1376)	(0.1390)
innova	-0.2101***	-0.2116***
	(0.0688)	(0.0698)
retained		-0.1455*
		(0.0816)
constant1	1.7336***	1.6755***
	(0.1656)	(0.1691)
constant2	2.5294***	2.4614***
	(0.1684)	(0.1719)
Statistics		
N	5580	5455
LR chi2(8)	40.77	43.96
Prob > chi2	0.0000	0.0000
Pseudo_r2	0.0057	0.0064

Notes: Own estimations using SAFE database. * p<0.1; ** p<0.05; *** p<0.01

6. Discussion

In this section we summarize the results of the estimations of loan application (need), loan access (success), and access type (relsize), considering Model 2, to highlight the relevance of the results and identify policy implications (see Table 8). It could be observed that the company size is negatively related to the application and access. Moreover, if firms get their loans approved, they are less likely to obtain the total amount requested.

Similarly, the firm sector affects, in general, both the likelihood of loan application and loan approval. Companies that belong to the *services* and *trade* sectors apply for and access loans to a lesser extent than companies in *industry* sector do.

Companies in the *construction* sector have no statistical difference with companies in the *industry* sector regarding loan application, but they exhibit a lower likelihood of getting their loans approved. In relation to the type of access, our results reveal that *trade (construction)* firms exhibit a greater (lower) likelihood of obtaining the entire amount requested from the bank than *industry* firms.

Table 8 Summary of Results

Variable	Need	Success	Relsize
micro	S (−)	S (−)	S (−)
small	S (−)	S (−)	NS
services	S (−)	S (−)	NS
trade	S (−)	S (−)	S (+)
construction	NS	S (−)	S (−)
age5_10	NS	S (+)	NS
age10	NS	S (+)	NS
innova	S (+)	S (−)	S (−)
retained	S (+)	S (+)	S (−)

Notes: Own elaboration

The firms' age does not explain differences regarding the likelihood of loan applications, but reflects a greater likelihood of older companies to get their loans approved. This result indicates that firms apply for loans independently of their business cycle, but older firms present a higher likelihood of obtaining effective financial access than younger firms.

A distinct fact is the results regarding innovative companies. Innovative firms have greater probabilities of applying for bank loans than non-innovative ones. However, they have lower probabilities of effective financial access (success). These results could indicate that there is a pool of innovative firms that have unfulfilled financing needs. This situation sheds light on the great difficulty that innovative firms have in accessing bank financing. Consequently, it could preclude some innovative projects to be carried out. This result may be due to the fact that innovative firms need higher loans than non-innovative firms (as a proportion of their equity), appearing as riskier borrowers. Additionally, innovations may be also opaque for banks, making them reluctant to provide enough funding for the firms' projects.

Our results show that firms that use retained earnings exhibit greater willingness to apply for loans, and a greater likelihood of loan approval than firms that do not use this internal source of capital. Strikingly, firms using internal resources obtain, in general, less than the requested resources. This could indicate that internal funds are complementary, rather than substitutes, in the firms' finance. The effect of the complementarity is a positive signal towards financial institutions to decide on the firms' loan applications.

We found that the size limits the application and effective access to bank loans, probably because of adverse selection and moral hazard problems. Similarly, the age also constrains financial access, making younger firms less likely to obtain loan approvals than older firms. In this sense, policy makers could favor this market segment by enacting bank's incentives to finance small and young firms. Such stimulus could include the establishment of public collaterals to SMEs loans. This measure could produce better outcomes than the traditional interest rate subsidy policy. The reason is that the interest rate subsidy reduces the cost of financing for a selected group of firms that have already had financing. However, the interest rate subsidy does not reach firms which have already decided not to apply for a loan,

probably due to the lack of enough collateral. Therefore, the existence of a state-backed market for collaterals could enhance the financial access of these firms. In the case of innovative firms, results confirm that they have more needs of financing, but less probabilities of effective financial access, possibly due to large amounts requested and the risk associated with the projects. Therefore, the design of policies must take into account these considerations and adapt the programs or promote other instruments, based on the right incentives for the demand and supply sides to avoid that some sectors are left behind in the financing queue.

7. Conclusions

The literature on access to finance is divided into two main streams. On the supply side, there are studies arguing that problems in the financial access are due to the financial institutions' behavior. On the demand side, other studies consider that financial decisions are solely determined by firms. Supply side problems arise from information asymmetries that are the main drivers of financial access restrictions. Demand side problems result from the intrinsic characteristics of the firms.

This paper sheds light on both literature streams. We not only studied the characteristics of the firm, but also the characteristics succeeding the access to the requested financing. We also classified the access to finance according to the percentage of the obtained amount, compared to the requested amount.

We found that the likelihood to apply for and to obtain bank loans increases with the firm's size. Moreover, firms in the industry sector exhibit stronger willingness in the use of external financing, and effective access to bank loans. Another important result is that the firm's age influences the effective access to bank loans, but not the application likelihood. Furthermore, the use of retained earnings enhances financial application and the effective financial access, which could indicate that internal funds are complementary, rather than substitutes in the firms' financial structure.

A puzzling result was found regarding innovation. It is relevant for both application and access to bank loans, but in opposite ways: innovation boosts external finance applications, but hampers actual financial access. This result induces to think that firms that innovate have stronger needs of bank financial resources, but, at the same time, face greater difficulties in getting their applications approved. Consequently, it seems that credit scoring is, in some sense, behaving against this kind of firms. Even though the available data do not allow us to deepen the analysis, we believe it would be interesting to evaluate and rethink the role of the banking system as a provider of financial resources for small and innovative firms.

Our results offer additional insight and some policy implications. Innovative firms, because of their nature, rely heavily upon human capital, which is not included in the financial statements. Moreover, they could include intangible assets in their financial statements, whose valuation could be difficult. Consequently, these firms are in disadvantaged position *vis-à-vis* more traditional factory-based firms when applying for a bank loan. In sum, greater financing needs and stronger asymmetric information could hamper the access of innovative firms to bank loans.

Thus, it could be useful to set public policies to overcome such difficulties. One of such policies could be interest rate subsidies. However, this measure will only

benefit those firms that get their loans approved, denying firms with weaker financial statements access to the market for loans. Then, a better policy measure could be the establishment of a state-sponsored market for collaterals. This effort could be a positive signal to the financial market. It creates more flexible conditions for SMEs and facilitates the approval of bank loans for this type of firms, while keeping risk controlled for financial institutions.

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APPENDIX

Tests of the Parallel Regression Assumption

These tests compare an ordered logit model with the fully generalized ordered logit model, which relaxes the parallel regression assumption on all explanatory variables.

	Chi2	*Df*	*P>Chi2*
Wolfe Gould	5.918	8	0.656
Brant	5.542	8	0.698
score	5.332	8	0.722
likelihood ratio	5.58	8	0.694
Wald	5.331	8	0.722

A significant test statistic provides evidence that the parallel regression assumption has been violated. For more detail, see Long and Freese (2006).