MDPI

Article

SME Steeplechase: When Obtaining Money Is Harder Than Innovating

M. Belén Guercio[1,2], Lisana B. Martinez[1,2], and Aurelio F. Bariviera[3,*]

[1] Instituto de Investigaciones Económicas y Sociales del Sur (IIESS), CONICET- UNS, Argentina ; mbguercio@iiess-conicet.gob.ar, lbmartinez@iiess-conicet.gob.ar
[2] Universidad Provincial del Sudoeste, Argentina
[3] Department of Business, Universitat Rovira i Virgili, Spain
* Correspondence: aurelio.fernandez@urv.cat ; Tel.: +34-977759833

Version February 25, 2019 submitted to Int. J. Financial Stud.

Abstract: In this paper, we analyze the main characteristics of European SMEs, related to the demand for and access to external financial resources. We use microdata from an extensive database, elaborated by the European Central Bank and the European Commission: the Survey on the Access to Finance of Enterprises. Firstly, we consider a set of variables as determinants to the decision to apply for different financial instruments. Secondly, we use the same set of variables to analyze the actual access to these instruments. For each regression, several SMEs profiles were created, in order to detect SMEs archetypes according to their decisions. The results are thought-provoking, and highlight that differences in firms characteristics (size, innovative activities, etc.), influence not only the access to, but also the demand for external finance.

Keywords: Financial Decisions; Innovative Firms; EU; SME

JEL Classification: G21, G28, O3, O52

1. Introduction

The Small and Medium Enterprises (SMEs) are commonly known as the backbone of the real economy. They represent 99.8% of all European business, which generate around 58% of the gross value added of the corporate sector in Europe. Furthermore, they are responsible for almost 67% of private sector employment, which represents 86.8 million people (Kaya (2014)).

This concern highlights the importance of SMEs growth and their needs for external financing and the problems they have to face to solve market barriers.

In this sense, SMEs financial structure and its determinant is a wide subject of study that has changed over time and according to the set of SMEs analyzed, given that many factors affect their financial decisions. As it is commonly known, the SMEs financial access is restricted due to large information asymmetries, agency risk, scarce physical collaterals, and specific activities and firm's characteristics (Berger and Udell (1998); Briozzo et al. (2016)). In light of the 2008 financial crisis, many European markets suffered credit constrained problems. Ferrando et al. (2017) mention that investor confidence dropped in the banking sectors of those countries more affected by the turmoil, given that their banks tended to assign large portfolios to the debt securities issued by domestic sovereigns. Consequently, bank funding increased. Mc Namara et al. (2017) suggest that countries lending infrastructure influences SMEs capital structure due to the fact that SMEs debt is higher in countries with more efficient insolvency environments in terms of debt rescue and in countries with less rigorous regulatory laws because of the lower capital regulatory requirements for banks.

Nonetheless, Kaya (2014) supports that SMEs in the countries that are the hardest hit by the recession and unemployment problems are those less favorable to get loans given the high level of lending rates.

Wehinger (2014) analyses the European SMEs and the credit crunch since the 2008 financial crisis and highlights that since that event, bank's perception of growing macro and micro risks have played an increasing role in the contraction of business credit standards and have reduced availability of external financing, despite countries particularities.

It is true, that the relationship between innovativeness and the probability to get financed has been previously studied. This study investigates if the SMEs financial access depends on the specific instrument demanded or on a set of variables that condition SMEs' profile to decide to apply for some specific financial instruments. Moreover, we deepen this aspect by considering the current access to the financial line regarding the same set of variables recognized as key determinants of SMEs capital structure. However, to the best of our knowledge, there are no others papers that split the financial aid application willingness from the financial aid application success. Precisely, this is the main contribution of this paper.

We conducted the empirical study on two homogeneous groups of countries: euro and non-euro EU countries.

Our results are consistent and contribute to the literature in different ways: first, there are no similar works that analyze this issue considering such a huge set of European countries, distinguishing the dependent variable between applying and accessing, and the different financial instruments. Second, the innovation variable is considered given the importance of its characteristic to SMEs decisions in line to their needs for external financial access. Third, SMEs profiles have been created in order to detect which kind of SMEs is more fortunate to access to specific financial instruments.

This paper is organized as follows: Section 2 presents the literature review of the main SMEs capital structure theories and a revision of SMEs' empirical works related to their capital structure decisions. Section 3 describes the data and section 4, the methodology applied for the study. Section 5 presents the results of the study and discusses the main findings. Finally, Section 6 provides an analysis regarding the main conclusions of the work.

2. Literature Review

2.1. SMEs financial structure.

Previous literature studies the sundry traditions usually considered by SMEs in financing their activities. Since 1950, capital structure has developed into a controversial research area in the field of corporate finance (Forte et al. (2013)).

One of the traditional debates on this concern comes from Modigliani and Miller (1958), who considered that the market value of each enterprise is independent of its capital structure. Some years later, Modigliani and Miller (1963) studied the possibility to dismiss the original assumptions of perfect competition markets and admit that indebtedness has a tax advantage given that interests are deductible from the income tax. Even so, it does not mean that companies must at all times try to use debt. The authors highlight the existence of other relevant factors in the financing decisions that are not considered within the context of the equilibrium static models.

In this context, the Trade-off theory raises, and considers the effects of the entire industry (taxes, bankruptcy costs and agency problems) and predicts an optimal structure as a result of balancing costs and the benefits of issuing debt and capital. In this framework, leverage is considered advantageous (under certain conditions) and managers choose to use debt even if there are internal funds available. This theory assumes that the optimal capital structure is the result of equalizing the benefits of leverage (mainly tax savings) and the costs of financial difficulties. It also proposes to avoid the extreme use of leverage and rationalize the indebtedness indexes (Brealey et al. (2006)).

On the other side, Myers (1984) and Myers and Majluf (1984) propose the Pecking Order Theory, that describes a hierarchy in financing choices and has as central axis the asymmetric information

between lenders and borrowers. Due to the fact that companies have more information on their future than lenders, the need for control increases borrowing costs, which encourage companies to be financed with internal funds in the first place. In this line, companies prefer the reinvestment of profits, in order to avoid adverse selection problems. When these funds have been exhausted, companies are financed with bank debt, and lastly, in the stock market. The proponents of the Pecking Order Hypothesis explain that this hierarchical order is the result of greater flexibility and lower transaction costs of internal versus external resources. In this stream, the leverage is considered to be disadvantageous compared to the use of internal sources (Briozzo et al. (2016); Martinez et al. (2017)).

The last financial crisis that burst in 2008 and its consequences and collateral effects spread to many European economies and sometime later affected strongly the interbank market. This crucial source of liquidity for banks in Europe brought changes in corporate lending, leading to a credit crunch in several Eurozone countries (Drehmann and Nikolaou (2013); Iyer et al. (2014)). Many works analyze the effects and consequences of the last financial crisis on SMEs development, considering that the financial system has been altered, and consequently the financial access of such firms changed (Armstrong et al. (2013); Cowling et al. (2012); Lee et al. (2015)).

Many works have studied the SMEs capital structure during different periods of time, and find that, according to different samples of firms, some of them finance their activities in accordance with the pecking order (Yazdanfar and Öhman (2015);Balios et al. (2016)). Others highlight the importance of the trade-off theory to explain the financial behavior of SMEs (Rossi et al. (2015); Banga and Gupta (2017)) and some others argue that theories are complementary (Serrasqueiro and Nunes (2012); Serrasqueiro and Caetano (2015); Mc Namara et al. (2017)).

2.2. Innovative SMEs.

The differences between innovative SMEs and traditional SMEs which intensify the problems of access to external financing of the former, have promoted several studies that test the results of capital structure theories in innovative SMEs. These empirical works have found coincidences and dissidence when evaluating whether the traditional theories explain the capital structure of innovative SMEs. Cassia and Minola (2012), find that companies follow the financial hierarchy theory in the first years of life, but then prioritize the capital increase instead of bank indebtedness. The same results are found by Minola et al. (2013) and Hogan and Hutson (2005). These last authors, highlight that this financial structure not only comes from financial constraints (on the supply side), but is a consequence of the preferences of the SMEs owners of innovators that, unlike traditional SMEs, they do not have a deep-rooted desire for independence, and as a consequence, they prefer to share the company's ownership instead of borrowing in the financial system.

Hogan et al. (2017), find that venture capitalists and angel investors are in second place, after domestic financing. Guercio et al. (2016) considering a group of innovative Argentine SMEs, find that first SMEs use internal resources and then finance their activities with current liabilities, mainly suppliers, and finally, loans from financial institutions. Ullah and Taylor (2007) find that funds from personal savings are listed as the main source of financing, followed by capital risk, and mortgage loans. On the other hand, Giudici and Paleari (2000) and Guercio et al. (2017), find that innovative firms use short term debt and commercial credit lines only in case that internal resources are not their sufficient to fund the investment projects. Pierrakis and Saridakis (2017) study the interaction between venture capitalists and other players of the innovation ecosystem, in order to overcome information asymmetries. In the course of the business life, firms can get access to other types of financing such as debt or capital increase. It is specially sensitive the financial constraints faced by innovative SMEs. Innovation is intrinsically a risky activity since it is concerned with the introduction of a new product, method, or device with an uncertain outcome. This situation turns financial decision riskier Coad and Rao (2008). Moreover, asymmetric information can preclude innovative unexperienced firms from external financial resources (Sullivan (2014)). In fact, credit scoring for micro-entrepeneurs relies heavily on information that is not easily available to the financial institution, in case of newly

established firms/individuals, as reported in Lanzarini et al. (2015 2017) and Jimbo Santana et al. (2018 2017). It is also critical the lack of hard collateral in most innovative firms, whose main assets could be intangible, and sometimes unuseful outside the firm itself (Mina et al. (2013)). Moritz et al. (2016) comment that innovative SMEs are more financially constrained given the huge risk of innovations, the informational opaqueness of the projects for external capital providers, and the low diversifications of SMEs possibilities (Ang (1992)). Takalo and Tanayama (2010) find that public Research and Development subsidies help to reduce the financing constraints of technology-based entrepreneurial firms in a double way: (i) reducing the financial amount requested to the banks, and (ii) signaling firms with promising projects.

3. Data

To pursue our research objective, we use microdata from the European Commission and European Central Bank, collected on the Survey on Access to Finance of SMEs (SAFE survey). This survey contains information of reliable financial sources of SMEs financing, since 2009.

The survey is conducted biannually on a given set of questions. Each round is of a different type of survey. The more comprehensive one is done on all EU countries plus some neighboring countries. The limited survey is run on a limited number of euro area countries. Considering that the aim of this paper is to study SME financial constraints across time, we used the more comprehensive survey, in order to consider more countries. The years under analysis are 2009, 2011, 2013, 2014 and 2015.

Moreover, the questionnaire includes the key question regarding the innovation done during the last twelve months for the firms, considering if they have introduced a new or significantly improved product or service to the market, or process or method, a new organization of management or a new way of sales. The whole sample includes data of around 40.000 companies in 28 European countries. See Table 1, in order to get detailed information on countries included.

Table 1. Countries included in the sample

EURO AREA COUNTRIES		OTHER EU MEMBER STATES	
AT	Austria	BG	Bulgaria
BE	Belgium	HR	Croatia
CY	Cyprus	CZ	Czech Republic
EE	Estonia	DK	Denmark
FI	Finland	HU	Hungary
FR	France	PL	Poland
DE	Germany	RO	Romania
GR	Greece	SE	Sweden
IE	Ireland	UK	United Kingdom
IT	Italy		
LT	Lithuania		
LV	Latvia		
LU	Luxembourg		
MT	Malta		
NL	Netherlands		
PT	Portugal		
SK	Slovakia		
SI	Slovenia		
ES	Spain		

Moreover, the survey encloses information related to SMEs characteristics such as size (the number of employers and turnover), sector, firm age, ownership, the fact that the firm is involved or not in product and/or process enhancement/innovation, and their recent financial sources requests. In addition, it contains information on the different financial instruments used by firms. Several works used this database previously (Öztürk, Bahar; Mrkaic (2014); Ferrando and Mulier (2015); Lawless et al.

(2015); Moritz et al. (2016)). For a detailed methodological information on this survey see European Central Bank (2017).

The variables selected and their descriptions are represented in Tables 2 and 3. The variables considered in this work are those which, according to previous literature, influence SMEs financial access or affect their capital structure.

Tables 4 and 5 show the percentage of firms that applied and accessed to a given financial instrument, at global and country level.

Table 2. : Selected dependent variables description

Dependent Variables	Description
Apply_cl	Binary variable that takes 1 if the firm applied for credit line, bank overdraft or credit card overdraft in the past 6 months and 0 if it did not apply. This dependent variable shows the demand of credit line.
Apply_bl	Binary variable that takes 1 if the firm applied for bank loans in the past 6 months and 0 if it did not apply. This dependent variable shows the demand of bank loans.
Apply_tc	Binary dichotomous variable that takes 1 if the firm applied for trade credit in the past 6 months and 0 if it did not apply. This dependent variable shows the demand of trade credit.
Apply_of	Binary variable that takes 1 if the firm applied to other external financing in the past 6 months and 0 if it did not apply. This dependent variable shows the demand of other external financing as loans from a related company, shareholders or family and friends, leasing, factoring, grants, subordinated debt instruments, participating loans, peer-to-peer lending, crowdfunding, and issuance of equity and debt securities
Access_cl	Success in obtaining short term bank financing. It is a dichotomous variable that takes 1 if the firm obtained all credit line, bank overdraft or credit card overdraft that has applied in the past 6 months and 0 otherwise. This dependent variable shows the access of short term bank financing
Access_bl	Success in obtaining loans. It is a dichotomous variable that takes 1 if the firm obtained 100% of the bank loan which has applied in the past six months, and 0 otherwise. This dependent variable shows the access of long term bank financing
Access_tc	Success in obtaining trade credit. It is a dichotomous variable that takes 1 if the firm obtained all trade credit requested in the past six months, and 0 otherwise.
Access_of	Success in obtaining other external financing. It is a dichotomous variable that takes 1 if the firm obtained 100% of all other external financing requested in the past six months, and 0 otherwise.

4. Methodology

In this work, we use regression models for binary outcomes, given that the dependent variables are binary. We estimate two models, one of them to analyze the decision to apply for different financial instruments and the other one, to analyze the access to these financial instruments. The objective of this paper is to detect if the independent variables effect over the applied probability to some financial instruments and over the access probability are similar in both models.

Binary logit models are used to estimate the outcome of the dichotomous variable, given a latent variable. The latent variable y^* is a linear function of the explanatory variables, using equation 1:

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

Table 3. Selected independent variables description

Independent Variables	
Turnover_micro	It is a dummy that takes 1 if the firm's turnover is up to 2 million euros; and 0 in another case
Turnover_small	It is a dummy that takes 1 if the firm's turnover is between 2 million euros and up to 10 million euros; and 0 in another case.
Turnover_medium	It is a dummy that takes 1 if the firm's turnover is between 10 million euros and up to 50 million euros; and 0 in another case. (Base)
Industry	It is a dummy that takes 1 if the firms belong to the industry sector; and 0 in another case (Base).
Services	It is a dummy that takes 1 if the firms belong to the service sector; and 0 in another case.
Trade	It is a dummy that takes 1 if the firms belong to the trade sector; and 0 in another case.
Construction	It is a dummy that takes 1 if the firms belong to the construction sector; and 0 in another case.
Age5	It is a dummy that takes 1 if the firm's age is up five years old and 0 in another case.
Age5_10	It is a dummy that takes 1 if the firm's age is between five and 10 years old and 0 in another case.
Age10	It is a dummy that takes 1 if the firm's age is more than ten years old, and 0 in another case.
Innova	Dummy variable that reflects that the enterprise has introduced a new or significantly improved product or service to the market or a new or significantly improved production process or method in the last 12 months. It takes 1 if the answer is positive and 0 otherwise.
Innova_micro	Interaction binary variable between firm size and innova. It takes 1 if the firm is innovative and micro, and 0 otherwise.
Innova_young	Interaction binary variable between firm age and innova. It takes 1 if the firm is innovative and up to five years old, and 0 otherwise.
Zone	Dummy variable that classify countries. It takes 1 if the firm is in the Euro area, and 0 if it is in a non-euro EU country.
ownership	Dummy variable that takes 1 if the firm's ownership is a family, and 0 otherwise.
Reatined	Dummy variable that takes 1 if retained earnings or sale of assets are relevant sources of finance of the firm, and 0 otherwise.
tc	Dummy variable that takes 1 if trade credit is a relevant source of finance of the firm, and 0 otherwise.
bl	Dummy variable that takes 1 if bank loan is a relevant source of finance of the firm.
cl	Dummy variable that takes 1 if credit line is a relevant source of finance of the firm, and 0 otherwise.

Table 4. Descriptive statistics of selected dependent variables, for the whole database.

Zone	apply_cl	apply_bl	apply_tc	apply_of	access_cl	access_bl	access_tc	access_of
Euro area	26%	28%	20%	14%	58%	62%	60%	69%
Non-euro area	24%	19%	19%	14%	70%	64%	69%	70%
Total	25%	25%	19%	14%	62%	63%	63%	70%

Table 5. Descriptive statistics of selected dependent variables by country. Shaded cells highlight the greatest and lowest value of each dependent variable.

Area	Country	apply_cl	apply_bl	apply_tc	apply_of	access_cl	access_bl	access_tc	access_of
euro area	AT	27%	24%	11%	13%	72%	77%	77%	83%
	BE	20%	29%	13%	11%	62%	73%	64%	73%
	CY	20%	20%	25%	5%	31%	51%	41%	44%
	DE	22%	24%	9%	16%	74%	76%	81%	91%
	EE	10%	15%	7%	10%	53%	59%	40%	62%
	ES	35%	35%	33%	17%	53%	53%	57%	57%
	FI	11%	20%	15%	13%	74%	81%	84%	73%
	FR	32%	35%	11%	16%	60%	74%	63%	77%
	GR	13%	28%	27%	7%	22%	33%	35%	31%
	IE	23%	18%	32%	13%	48%	44%	61%	50%
	IT	36%	33%	27%	11%	56%	60%	68%	67%
	LT	27%	26%	18%	15%	47%	51%	48%	48%
	LU	31%	24%	7%	12%	77%	84%	83%	97%
	LV	18%	13%	8%	15%	58%	42%	50%	69%
	NL	17%	18%	14%	14%	35%	35%	42%	56%
	PT	22%	20%	19%	9%	55%	59%	64%	63%
	SI	38%	34%	9%	14%	58%	66%	63%	64%
	SK	31%	20%	13%	15%	73%	61%	60%	72%
Mean euro area		26%	28%	20%	14%	58%	62%	60%	69%
non-euro area	BG	23%	17%	12%	10%	69%	57%	64%	54%
	CZ	23%	22%	12%	14%	77%	70%	63%	75%
	DK	23%	12%	8%	11%	64%	61%	69%	74%
	HR	29%	30%	18%	23%	72%	63%	59%	80%
	HU	25%	18%	8%	13%	70%	68%	61%	76%
	MT	25%	20%	18%	6%	67%	64%	53%	29%
	PL	29%	22%	30%	20%	79%	69%	72%	75%
	RO	27%	20%	17%	10%	66%	56%	57%	59%
	SE	8%	20%	8%	10%	60%	71%	72%	70%
	UK	21%	15%	31%	16%	64%	65%	76%	70%
Mean non-euro area		24%	19%	19%	14%	70%	64%	69%	70%
Mean all countries		25%	25%	19%	14%	62%	63%	63%	70%
Max all countries		38%	35%	33%	23%	79%	84%	84%	97%
Min all countries		8%	12%	7%	5%	22%	33%	35%	29%

The higher the value of y*, the greater the probability of occurrence of the event. In our case, the events are the probability of applying for a bank loan and the probability to get the application approved. The observed variable is related to the latent variable y^* in the following way:

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

So, the event probability is defined as:

$$\begin{aligned} Pr(y_i = 1|x) =& Pr(x, \beta + \mu) \\ =& F(x\beta) \end{aligned} \tag{3}$$

Where F is the cumulative distribution function for the logistic distribution with variance $\pi^2/3$. The binary regression model is nonlinear. The independent variable effect over the dependent variable depends on its own value and on the whole variables included in the model. Therefore, it is not possible to obtain only one coefficient for each independent variable. Consequently, the interpretation of relationship between independent and dependent variable is not valid. Then, in this work, we interpreted the results with predicted probabilities. Given that, all independent variables are categorical. Furthermore, we use the profile estimation probabilities. Different profiles are created considering the main interesting firms' features for this research. In this sense, different values for the independent variables are fixed. Consequently, the change in the predicted probabilities related to each profile can be observed.

5. Empirical Analysis and Results

Table 6 presents the descriptive statistics of the interaction of variables reflecting financial application or access and innovation. It can be observed that innovative firms (independently of size, age or other characteristics) apply more for financial aid than non-innovative firms. These proportions are statistically different at 1% significance level. However, it can be observed that innovative firms are less successful regarding effective financial access than non-innovative firms. These proportions are statistically different at 1% and 5% signficance level, depending on the financial instrument.

Table 6. Descriptive statistics of selected financial application and financial access dependent variables, interacting with innovation characteristics of the firms.

Application					Access				
Financial instrument	Innovation				Financial instrument	Innovation			
apply_cl	Innova=0	Innova =1	Total	N	**access_cl**	Innova=0	Innova =1	Total	N
0	77.44	71.25	74.67	22716	0	36.10	39.47	37.81	2816
1	22.56	28.75	25.33	7674	1	63.90	60.53	62.19	4595
Total	100.00	100.00	100.00	30390	Total	100.00	100.00	100.00	7411
	Pearson chi2 = 123.8560; p-value= 0.000					Pearson chi2= 4.1734; p-value= 0.041			
apply_bl					**access_bl**				
0	78.26	72.58	75.74	30050	0	34.64	39.53	37.09	3501
1	21.74	27.42	24.26	9625	1	65.36	60.47	62.91	5962
Total	100.00	100.00	100.00	39675	Total	100.00	100.00	100.00	9463
	Pearson chi2= 140.2956; p-value= 0.000					Pearson chi2= 11.8621; p-value=0.001			
apply_tc					**access_tc**				
0	82.24	77.19	80.02	24710	0	34.93	37.38	36.16	2172
1	17.76	22.81	19.98	6178	1	65.07	62.62	63.84	3862
Total	100.00	100.00	100.00	30888	Total	100.00	100.00	100.00	6034
	Pearson chi2= 109.7303; p-value = 0.000					Pearson chi2= 4.1123; p-value=0.043			
apply_of					**access_of**				
0	88.15	83.30	85.99	29767	0	28.04	31.02	29.63	1436
1	11.85	16.70	14.01	4846	1	71.96	68.98	70.37	3351
Total	100.00	100.00	100.00	34613	Total	100.00	100.00	100.00	4787
	Pearson chi2= 133.2070; p-value = 0.000					Pearson chi2 = 4.1546; p-value=0.042			

Table 7 presents the obtained results of the logit model for the different financial instruments: credit line, bank loan, trade credit and other financial instruments, and the independent variables detailed in Table 3.

Our results detect that micro firms have a negative significant coefficient, meaning that being a micro firm affect negatively the probability to apply for the different financial instruments. With respect to small firms, this characteristic affects more the effective financial access rather than the application for external financial aid.

The firms' age variable is significant for those firms that have more than five years. Older firms (5 or more years old) ask less for trade credit lines or other financial resources. However, they are better at effectively securing any kind of external financial resources. In other words, for firms that present a wide seniority in the markets, the probability to demand a trade credit and other external financial instrument decreases, but their effective financial access increases.

The fact that firms have innovated in a process, product or service affects positively the probability to demand financial sources. The same result is obtained if the firms use internal sources.

Respect to the sector that the firms belong to, and considering the industrial sector as categorical base, the probability to demand bank financing, regarding short term instruments (credit lines) and medium and large terms (bank loan) sources and finance through trade credit diminish if the firms belong to the service sector.

The firms that belong to the trade sector affect negatively the probability to demand a bank loan and other external financial instruments. The construction sector affects positively the probability to demand credit lines and trade credit.

According to these results, if the firms are family businesses, they have higher probabilities to apply to trade credit. Respect to the other financial instruments, this variable is not significant.

Table 7 also presents the results of the probability estimation of SMEs that have accessed to the financial source demanded previously. In the same line as the probability estimation of demand, the firms' size is significant for all the instruments considered. Therefore, micro and small firms diminish the probabilities to access to external finance, such as the theory of the capital structure predicts.

Moreover, if we consider the productive sector of the firms, belonging to the trade and construction sectors diminishes the probability in accessing a bank loan or a trade credit with respect to the industrial sector. Also, belonging to the construction sector affects negatively to the access to credit lines.

The firms age is positively correlated with the probability of access. Firms that are between 5 years old or more present higher probabilities in accessing credit lines, bank loans or trade credit than those that are less than 5 years old (base category). Moreover, the probability related to the access to other financial resources is higher for firms that are 10 or more years old than those that have less seniority.

The probability in accessing a credit line, a bank loan or trade credit diminishes if the firms innovate. However, innovative firms are better at accessing other financial resources. In general, we observe that innovative firms have higher probabilities to demand financial instruments but fewer probabilities in accessing them. These results could indicate that innovative firms present higher needs of external financial, but their access is limited.

In order to analyze the goodness of fit, the likelihood of the model (with and without the intercept), the McFadden R2 and the probability of success (Count) are calculated. The results show that in all estimates the Log-likelihood Model is greater than the Log-likelihood Intercept-only. The p-value of LR (dif=10) indicates that the null hypothesis is rejected. The model is explained only by the constant. The McFadden and the McFadden (adjusted) indicate the goodness of fit of the model for the data is based on the comparison of the likelihood of the model only with the constant, with the likelihood of the model with all the estimated parameters. Finally, the Count compares the values observed in the sample with those predicted in the model. In all cases, the Count Index is high (above 0.5), indicating that there are a high number of cases in which the prediction derived from the regression model achieves what is observed in the sample.

Table 7. Logit model with dependent variables Apply and Access to the different financial instruments.

Variable	apply_cl	apply_bl	apply_tc	apply_of	access_cl	access_bl	access_tc	access_of
turnover_micro	**-0.0492***	**-0.5090*****	**-0.3813*****	**-0.4243*****	**-0.4697*****	**-0.5635*****	**-0.1935*****	**-0.5669*****
turnover_small	0.111***	**-0.1419****	0.0000	0.0285	**-0.1977****	**-0.1603*****	**-0.1477*****	-0.1341
services	**-0.1430*****	**-0.1241*****	**-0.4777*****	0.0344	-0.0671	-0.0982	-0.0470	0.1142
trade	-0.0477	**-0.1172*****	0.00000	**-0.3830*****	-0.1039011	**-0.0926****	**-0.1595****	0.0015
construction	**0.1239*****	0.0025	**0.0825****	-0.0452	**-0.1955****	**-0.1837***	**-0.2995****	0.0482
age5_10	0.0811	0.0016	**-0.1594***	**-0.1174***	**0.3329*****	**0.3043***	**0.1972***	0.0756
age10	-0.0610	-0.0164	**-0.1781*****	**-0.2384****	**0.3088*****	**0.2811*****	**0.3165****	**0.2713****
innova	**0.2853*****	**0.2653****	**0.2321****	**0.3151*****	**-0.1913*****	**-0.0468****	**-0.1532*****	**0.1416****
ownfe	-0.011	-0.043	**0.3051 ***	0.0244	0.0479	0.0482	**0.1286***	0.0964
zonaeuro	**0.1567*****	**-0.4945*****	0.0000	0.0204	**0.5576*****	**0.5589*****	**0.4353*****	0.0725
retained	**0.9712*****	**0.2133*****	**0.2827*****	**0.2471*****	**sig (+)*****	0.1001	**0.1468*****	0.0265
cl	**.**	**0.2133*****	**0.5057*****	**0.3871*****	.	0.3602	**-0.1204*****	-0.0428
bl	**0.2741*****	**.**	**0.42502*****	**0.3951*****	**sig (+)*****	.	**0.1291*****	**0.1959*****
tc	**0.2741*****	**0.2927*****	.	**0.2614*****	**sig (-)*****	-0.2480	.	**-0.2980*****
Statistics								
N	30697	39675	30888	34613	7411	9463	6034	4787
ll_0	-17,392,319	-22,032,052	-15,531,546	-14,068,061	-49,198,196	-6,239,248	-39,465,984	-29,207,251
ll	-16481	-20846859	-14728661	-13506	-47819828	-6107242	-38925855	-28642493
chi2	17,935,252	22,758,842	15,305,323	11,305,754	26,135,698	25,665,082	10,355,111	11,025,484
r2_p	0.0524	0.0538	0.0517	0.0400	0.0280	0.0212	0.0137	0.0193
aic	32,990,199	41,721,718	29,485,322	27,041,999	95,919,657	12,242,484	7,813,171	57,584,986
bic	33,106,846	41,841,957	29,602,055	27,168,779	96,887,158	12,342,656	79,070,433	58,556,034

We created different firm profiles, according to size and engagement into innovation activities. These profiles present the same characteristics respect to the sector (all of them belong to the industrial area), use of internal source to finance their activities, the firms are not family businesses, and they belong to the euro area.

The aim of the profile analysis is to evaluate the change in the probability to apply different instruments according to size and innovation. Consequently, we could determine the archetype firm, which is more or less affected in financial application and access. The different firms' profiles are presented in Table 8.

Table 8. Firms' profiles

Profile	Characteristics
1	Micro innovative firm
2	Small innovative firm
3	Medium innovative firm
4	Micro not innovative firm
5	Small not innovative firm
6	Medium not innovative firm

Considering the profiles created, the probability of firms demand for each instrument has been created. The aim of this result is to show a compact vision of each profile result and the financial instruments. The probabilities obtained are presented in Table 9, in decreasing order for each financial instrument. For example, regarding financial application, Profile 2 has a probability of 0.5559. This means that among all the firms within profile 2 (Small=1, Innova=1), there is a probability equal to 0.5559 to apply for credit line. At the same time, firms within Profile 2, which actually applied for a credit line, have a probability of 0.5491 to really access to the credit line they have requested. The probability to access a given financial instrument was computed only with the firms that actually applied for such instrument. We can observe that, in general innovative firms (Profiles 2 and 3) show greater probability to demand external financial aid. However, non-innovative firms reach the highest positions regarding the effective access to financial instruments (Profiles 5 and 6). If we look at firm size, micro firms (Profiles 1 and 4), irrespective of innovation activities) demand less and access less external finance. If we focus simultaneously on firm size and innovation, micro innovative firms (Profile 1)

have one of the lowes application probability and the lowest financial access in all instruments. It is observed that medium firms (profiles 3 and 6) present higher probability in accessing any instruments than micro firms (profiles 1 and 4), as the financial theories predict.

Table 9. Predicted probability of financial application and access

Financial Application							
Credit line		Bank loan		Trade credit		Other finance	
Profile 2	0.5559	Profile 3	0.5863	Profile 3	0.4624	Profile 2	0.3755
Profile 3	0.5284	Profile 2	0.5516	Profile 2	0.4498	Profile 3	0.3688
Profile 5	0.4848	Profile 6	0.5209	Profile 6	0.4055	Profile 1	0.3152
Profile 6	0.4572	Profile 5	0.4855	Profile 5	0.3932	Profile 5	0.3049
Profile 4	0.4450	Profile 1	0.4600	Profile 1	0.3701	Profile 6	0.2989
Profile 1	0.2876	Profile 4	0.3952	Profile 4	0.3178	Profile 4	0.2181
Financial Access							
Credit line		Bank loan		Trade credit		Other finance	
Profile 6	0.6425	Profile 6	0.6563	Profile 6	0.6284	Profile 6	0.7364
Profile 3	0.5975	Profile 5	0.6193	Profile 5	0.5934	Profile 5	0.7095
Profile 5	0.5959	Profile 3	0.5998	Profile 3	0.5920	Profile 3	0.7080
Profile 2	0.5491	Profile 2	0.5608	Profile 4	0.5822	Profile 2	0.6795
Profile 4	0.5292	Profile 4	0.5209	Profile 2	0.5559	Profile 4	0.6131
Profile 1	0.3932	Profile 1	0.4604	Profile 1	0.5445	Profile 1	0.5329

6. Conclusions

SMEs are the engine of the economies. Their share in gross domestic product and employment creation is highly relevant. The financial structure of this type of firms has been frequently studied in the economy literature. Asymmetric information produces serious problems, which preclude several SMEs from easily accessing external resources. This paper explores not only the variables related to the financial current access, but also the variables that affect the application for financial resources.

We found several interesting results. First, firm size affects both the demand and the effective access to finance. In this sense, the smallest firms have fewer probabilities in applying for and accessing to the all-financial instruments considered in this work. Second, we observe that innovative firms have higher probabilities in demanding financial instruments but fewer probabilities in accessing them. These results indicate that innovative firms present higher needs of external financial, but their access is more limited. Among the problems cited in the literature that magnifies the access to finance in this kind of firms are the uncertainty regarding the innovation process, long times to delivering the products, intangibility of the main assets of the firms, and the difficulty of reproduction of the processes, outside the original firms. This paper detects that the demand for external finance in this kind of firms is greater than non-innovative firms, widening the gap between financial supply and demand.

Since the seminal paper by Schumpeter (1942), economists know that innovation is a key economic development driver. Enhancement in productivity, and gross domestic product growth is only the visible part of the whole iceberg, known as “innovation”. In fact, innovation produces a deep spillover effect on society, improving employment quality, and diversity and quality in products and services.

Consequently, economic policies should be oriented to ease the financial access to SMEs. Even though European countries have been developing joint efforts towards it, this paper uncovers that such efforts have not been sufficient in order to improve the intermediation mechanisms between the financial sector and innovative firms. Therefore, a greater effort and a closer involvement of policy makers with SMEs are considered necessary.

Author Contributions: methodology, M.B.G. and L.B.M.; software, M.B.G.; ; formal analysis, M.B.G., L.B.M. and A.F.B.; investigation,M.B.G. and L.B.M.; data curation, M.B.G. and L.B.M.; writing review and editing, M.B.G., L.B.M. and A.F.B.

Funding: This research was partially funded by MINCYT Milstein Grant, Ministerio de Ciencia e Innovación Productiva, Argentina (MINCyT 279/16).

Acknowledgments: The authors would like to thank the European Central Bank (ECB) for the generous provision of SAFE microdata.

Conflicts of Interest: The authors declare no conflict of interest.

MDPI	Multidisciplinary Digital Publishing Institute
DOAJ	Directory of open access journals
TLA	Three letter acronym
LD	linear dichroism

References

Ang, James S.. 1992. On the theory of finance for privately held firms. *The Journal of Entrepreneurial Finance 1*(3), 185–203.

Armstrong, Angus, E. Phillip Davis, Iiana Liadze, and Cinzia Rienzo. 2013. Evaluating changes in bank lending to uk smes over 2001-12 - ongoing tight credit? NIESR Discussion Paper.

Balios, D., N. Daskalakis, N. Eriotis, and D. Vasiliou. 2016. SMEs capital structure determinants during severe economic crisis: The case of Greece. *Cogent Economics and Finance 4*(1), 0–11. doi:10.1080/23322039.2016.1145535.

Banga, Charu and Amitabh Gupta. 2017. Effect of Firm Characteristics on Capital Structure Decisions of Indian SMEs. *International Journal of Applied Business and Economic Research 15*(10), 281–201.

Berger, Allen N. and Gregory F. Udell. 1998, aug. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance 22*(6-8), 613–673. doi:10.1016/S0378-4266(98)00038-7.

Brealey, Richard A., Franklin Allen, and Stewart C. Myers. 2006. *Corporate finance* (8th ed. ed.). Boston [etc.] :: McGraw-Hill Irwin.

Briozzo, Anahí, Hernán Vigier, and Lisana B. Martinez. 2016. Firm-Level Determinants of the Financing Decisions of Small and Medium Enterprises: Evidence from Argentina. *Latin American Business Review 17*(3), 245–268. doi:10.1080/10978526.2016.1209081.

Cassia, L. and T Minola. 2012. Hyper-growth of smes: toward a reconciliation of entrepreneurial orientation and strategic resources. *International Journal of Entrepreneurial Behavior and Research 18*(2), 179–197.

Coad, Alex and Rekha Rao. 2008, may. Innovation and firm growth in high-tech sectors: A quantile regression approach. *Research Policy 37*(4), 633–648. doi:10.1016/J.RESPOL.2008.01.003.

Cowling, Marc, Weixi Liu, and Andrew Ledger. 2012. Small business financing in the UK before and during the current financial crisis. *International Small Business Journal 30*(7), 778–800. doi:10.1177/0266242611435516.

Drehmann, Mathias and Kleopatra Nikolaou. 2013. Funding liquidity risk: Definition and measurement. *Journal of Banking and Finance 37*(7), 2173–2182. doi:10.1016/j.jbankfin.2012.01.002.

European Central Bank. 2017. Survey on the access to finance of enterprises. Methodological information on the survey and user guide for the anonymised micro dataset. Technical report, European Central Bank. doi:10.2866/80371.

Ferrando, Annalisa and Klaas Mulier. 2015. Firms' financing constraints: Do perceptions match the actual situation? *Economic and Social Review 46*(1), 87–117. doi:doi-not-found.

Ferrando, Annalisa, Alexander Popov, and Gregory F. Udell. 2017. Sovereign stress and SMEs' access to finance: Evidence from the ECB's SAFE survey. *Journal of Banking and Finance 81*, 65–80. doi:10.1016/j.jbankfin.2017.04.012.

Forte, Denis, Lucas Ayres Barros, and Wilson Toshiro Nakamura. 2013, sep. Determinants of the capital structure of small and medium sized brazilian enterprises. *BAR - Brazilian Administration Review 10*(3), 347–369. doi:10.1590/S1807-76922013000300007.

Giudici, G and S Paleari. 2000. The provision of finance to innovation: A survey conducted among italian technology-based small firms. *Small Business Economics 14*(1), 37–53.

Guercio, M. Belén, Lisana B. Martinez, and Hernán Vigier. 2017, jan. Las limitaciones al financiamiento bancario de las Pymes de alta tecnología. *Estudios Gerenciales 33*(142), 3–12. doi:10.1016/J.ESTGER.2017.02.001.

Guercio, M. B., H. P. Vigier, A. E. Briozzo, and L. B. Martínez. 2016. El financiamiento de las pymes del sector de software y servicios informáticos en argentina. *Cuadernos de Economía 35*(69), 615–635.

Hogan, Teresa and Elaine Hutson. 2005. Capital structure in new technology-based firms: Evidence from the irish software sector. *Global Finance Journal 15*(3), 369–387.

Hogan, Teresa, Elaine Hutson, and Paul Drnevich. 2017. Drivers of external equity funding in small high-tech ventures. *Journal of Small Business Management 55*(2), 236–253. doi:10.1111/jsbm.12270.

Iyer, Rajkamal, José-Luis Peydró, Samuel Da-Rocha-Lopes, and Antoinette Schoar. 2014, jan. Interbank Liquidity Crunch and the Firm Credit Crunch: Evidence from the 2007-2009 Crisis. *The Review of Financial Studies 27*(1), 347–372.

Jimbo Santana, Patricia, Laura Lanzarini, and Aurelio F Bariviera. 2018. Extraction of Knowledge with Population-Based Metaheuristics Fuzzy Rules Applied to Credit Risk. In Y. Tan, Y. Shi, and Q. Tang (Eds.), *Advances in Swarm Intelligence*, pp. 153–163. Cham: Springer International Publishing. doi:10.1007/978-3-319-93818-9_15.

Jimbo Santana, Patricia, Augusto Villa Monte, Enzo Rucci, Laura Lanzarini, and Aurelio F. Bariviera. 2017. Analysis of Methods for Generating Classification Rules Applicable to Credit Risk. *Journal of Computer Science and Technology (JCS&T) 17*(1), 20–28.

Kaya, Orcun. 2014. SME financing in the euro area. Deutsche Bank Research.

Lanzarini, Laura, Augusto Villa Monte, Aurelio F. Bariviera, and Patricia Jimbo Santana. 2015. Obtaining Classification Rules Using LVQ+PSO: An Application to Credit Risk. In *Scientific Methods for the Treatment of Uncertainty in Social Sciences*, Volume 377, pp. 383–391. Springer International Publishing. doi:10.1007/978-3-319-19704-3.

Lanzarini, Laura Cristina, Augusto Villa Monte, Aurelio F. Bariviera, and Patricia Jimbo Santana. 2017, feb. Simplifying credit scoring rules using LVQ + PSO. *Kybernetes 46*(1), 8–16. doi:10.1108/K-06-2016-0158.

Lawless, Martina, Brian O'Connell, and Conor O'Toole. 2015. Financial structure and diversification of European firms. *Applied Economics 47*(23), 2379–2398. doi:10.1080/00036846.2015.1005829.

Lee, Neil, Hiba Sameen, and Marc Cowling. 2015. Access to finance for innovative SMEs since the financial crisis. *Research Policy 44*(2), 370–380. doi:10.1016/j.respol.2014.09.008.

Martinez, Lisana B., María Belén Guercio, Lilia J. Corzo, and Hernán Vigier. 2017. Determinantes del financiamiento externo de las PyMEs del MERCOSUR. *Revista Venezolana de Gerencia 22*(80), 672–692.

Mc Namara, Andrea, Pierluigi Murro, and Sheila O'Donohoe. 2017. Countries lending infrastructure and capital structure determination: The case of European SMEs. *Journal of Corporate Finance 43*, 122–138. doi:10.1016/j.jcorpfin.2016.12.008.

Mina, A., H. Lahr, and A Hughes. 2013. The demand and supply of external finance for innovative firms. *Industrial and Corporate Change 22*(4), 869–901.

Minola, Tommaso, Lucio Cassia, and Giuseppe Criaco. 2013. Financing patterns in new technology-based firms: An extension of the pecking order theory. *International Journal of Entrepreneurship and Small Business 19*(2), 212–233.

Modigliani, Franco and Merton H Miller. 1958. he cost of capital, corporation finance and the theory of investment. *The American Economic Review 48*(3), 261–297.

Modigliani, Franco and Merton H Miller. 1963. Corporate income taxes and the cost of capital: A correction. *The American Economic Review 53*(3), 433–443.

Moritz, Alexandra, Joern H. Block, and Andreas Heinz. 2016, apr. Financing patterns of European SMEs – an empirical taxonomy. *Venture Capital 18*(2), 115–148. doi:10.1080/13691066.2016.1145900.

Myers, Stewart C.. 1984, jul. The Capital Structure Puzzle. *The Journal of Finance 39*(3), 574–592. doi:10.1111/j.1540-6261.1984.tb03646.x.

Myers, Stewart C. and Nicholas S. Majluf. 1984, jun. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics 13*(2), 187–221. doi:10.1016/0304-405X(84)90023-0.

Öztürk, Bahar; Mrkaic, Mico. 2014, nov. SMEs' Access to Finance in the Euro Area: What Helps or Hampers? *IMF Working Paper WP/14/78*, 1–30.

Pierrakis, Yannis and George Saridakis. 2017, Sep. The role of venture capitalists in the regional innovation ecosystem: a comparison of networking patterns between private and publicly backed venture capital funds. *The Journal of Technology Transfer*, 1–24. doi:10.1007/s10961-017-9622-8.

Rossi, Matteo, Rosa Lombardi, Fabio Nappo, and Raffaele Trequattrini. 2015. The capital structure choices of agro-food firms: evidence from italian smes. *International Journal of Management Practice 8*(3), 172. doi:10.1504/IJMP.2015.072768.

Schumpeter, Joseph A.. 1942. *Capitalism, socialism and democracy*. New York :: Harper & Brothers,.

Serrasqueiro, Zélia and Ana Caetano. 2015, mar. Trade-Off Theory versus Pecking Order Theory: capital structure decisions in a peripheral region of Portugal. *Journal of Business Economics and Management 16*(2), 445–466. doi:10.3846/16111699.2012.744344.

Serrasqueiro, Zélia and Paulo Maçãs Nunes. 2012, jul. Is Age a Determinant of SMEs' Financing Decisions? Empirical Evidence Using Panel Data Models. *Entrepreneurship Theory and Practice 36*(4), 627–654. doi:10.1111/j.1540-6520.2010.00433.x.

Sullivan, Mary O. 2014, jan. Finance and Innovation. In J. Fagerberg and D. C. Mowery (Eds.), *Oxford Handbooks Online*, Number July, pp. 1–19. Oxford University Press. doi:10.1093/oxfordhb/9780199286805.003.0009.

Takalo, Tuomas and Tanja Tanayama. 2010. Adverse selection and financing of innovation: is there a need for r&d subsidies? *The Journal of Technology Transfer 35*(1), 16–41.

Ullah, F. and P. J. Taylor. 2007. Are uk technology-based small firms still finance constrained? *The International Entrepreneurship and Management Journal 3*(2), 189–203.

Wehinger, Gert. 2014. SMEs and the credit crunch: Current financing difficulties , policy measures and a review of literature. *OECD Journal: Financial Market Trends 13/2*, 1–34. doi:doi:10.1787/19952872.

Yazdanfar, Darush and Peter Öhman. 2015, jan. Debt financing and firm performance: an empirical study based on Swedish data. *The Journal of Risk Finance 16*(1), 102–118. doi:10.1108/JRF-06-2014-0085.