Access to Credit for the Small and Medium-Sized Enterprises in Senegal

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Abstract

While they represent more than 80% of Senegal's industrial fabric, and against a backdrop of excess bank liquidity, only less than 18% of small- and medium-sized enterprises (SMEs) in the country have access to credit. This study sets out to identify the causes of their difficulty in accessing credit. The study is based on data from the World Bank's *Enterprise Survey* for Senegal, and it uses a methodological approach based on logistic regression to identify the determinants of access to credit for SMEs. It found that having annual financial statements audited, being an innovating SME, being an exporting SME, having a high sales turnover, having fixed assets, and having a manager with long experience were the most important factors. The study also found that enterprises in the formal sector and those owned by women were more likely to have access to credit.

Keywords: Access to credit, SMEs, Senegal.

1. Introduction

The Subprime Crisis (2007-2009) compounded the difficulty in having access to credit, at a time when small and medium-size enterprises (SMEs and business people were suffering from a double shock: a drastic fall in the demand for goods and services, and a credit crunch (OECD,[1] 2009). This state of affairs, which did not spare industrialized countries, rendered low-income countries even more vulnerable. It is against this backdrop that Collier (2009) stated that "While African banks had just started to turn to SMEs, the global crisis came to reverse this trend and the SMEs were faced with the risk of seeing their access to credit suddenly deteriorate". A number of studies have shown that access to credit has remained a challenge for the bulk of SMEs (Jasor, 1998; Bannock and Morgan, 1998; Mbaye and Golub, 2002; World Bank, 2005).

The deterioration indeed came to pass in West Africa, in particular in Senegal where SMEs became more and more excluded from the banking system despite the large number of banks in the country (25 banks and four banking establishments) and against a backdrop of excess bank liquidity. According to the World Bank, Senegal was among the most stable countries in Africa in 2014, which ought to have been an added advantage for a business climate conducive to entrepreneurship. Yet, in Senegal, SMEs not only represent the foundation on which all economic growth is based but also a powerful lever for the private sector, which has considerable impact on the country's economic development. They fully contribute to the creation of wealth and employment and the training of the labour force. Government departments and public and private institutions, such as the National Statistics and Population Board (*ANSD*), have carried out a number of macroeconomic and sectoral studies that have brought to light the indicators related to the contribution of SMEs to the national economy. The weight and role of these SMEs can be measured at three levels: overall development, economic growth, and social level.

Regarding overall development, and according to *ANSD* (2014)*,* the share of SMEs in wealth creation is estimated at 33% of GDP. The industrial SMEs achieve the highest turnover (CFAF 1.3 billion on average). They are followed by enterprises in the public works and buildings sector (CFAF 1 billion on average), and by those in the trade sector (CFAF 800 million). These figures represent more than 40% of the total turnover of modern companies. Their contribution to total national turnover is estimated at 36%, and they contribute around 30% of the national value added.

Regarding economic growth, SMEs represent about 90% of all the enterprises in the country and in the key growth sectors such as public works and buildings sector, trade, industry and services (*DPEE*, 2014). And on the social front, SMEs play a vital role

in absorbing economic crises, since they are an important factor in social integration and a powerful lever for fighting poverty. In this connection, they have created 42% of all the jobs in the modern sector (*DPME,* 2013).

In spite of their weight in economic activity and of them being a driver of economic development, SMEs in Senegal are increasingly excluded from the banking and financial system (DPME, 2010). Only less than 14% of them have access to credit from a financial institution World Bank (2014), Entreprises Survey . Moreover, according to the *DPEE* (2014), out of the five loan applications addressed to banks (whether private or state-owned), four get rejected because of the poor quality of the funding proposal submitted (31%), and lack of loan guarantees (51%).

On average, in the countries that are signatory to *OHADA* (Organization for the Harmonization of Business Law in Africa), 64% of enterprises have reported access to credit to be a major obstacle to economic activity World Bank (2013), Doing Business Report. Moreover, according to several studies (e.g. Aryeetey, 1998; IMF, 2004; World Bank, 2006), more than 80% of SMEs in Sub-Saharan Africa are faced with huge financial constraints, which remain the main obstacle to their development.

Despite the changes made to the Senegalese financial sector through the reorganization of the banking system in the 1980s and changes related to the 1994 CFAF devaluation, SMEs in Senegal still suffer from limited access to bank financing.

This study seeks to understand why some SMEs manage to have access to credit while others do not. In other words, it will address the question: What are the determinants of a loan application being successful?

It thus becomes necessary to grasp how the bank credit market functions. From this grasp could arise a definition of public policies that would enable a better access to financial resources. This improved access would in turn foster a better process of private capital accumulation, a widening of the domestic industrial base with an increase in the production scale, the creation of new enterprises and the lengthening of life for others, a creation of employment and wealth for the populations that will see their living conditions improve and, finally, more generally, the promotion of economic growth.

Based on data from the World Bank's Enterprise Survey involving 601 Senegalese enterprises (including 553 SMEs), this study uses a logistic regression methodology (Logit model), which makes it possible to identify the characteristics of SMEs which make their access to bank financing more difficult and the specific problems which hinder their development.

The remainder of this paper is structured as follows: Section 2 describes the background to the study. Section 3 is a brief review of the literature. Section 4 describes the methodology. Section 5 is a presentation of the data and a descriptive analysis. Section 6 presents and discusses the results of the estimation. Section 7 is the conclusion.

2. Background to the Study

The importance of SMEs[2] in the Senegalese economy is well established. According to the *ANSD* (2014), SMEs contribute up to 33% of the country's GDP. They belong either to the informal sector, which is vital to the country's economy to the extent that it offers employment to most of the unemployed (though under precarious working conditions), or to the formal sector, thus with guaranteed, secure, well-paying jobs under good working conditions. Those enterprises can be categorized according to three sectors of activity: the primary sector, which accounts for 15.3% of GDP; the secondary sector, accounting for 19.9%; and the tertiary sector, which is the most dynamic and the one that really drives the country's economic growth, accounting for about 54% of its GDP (*RGE*, 2016).

Senegal's economic and industrial fabric is perceived to be one of the most important in the *UEMOA* area (West African Monetary and Economic Union). Such a fabric owes its development to the private sector, which consists mainly of small and medium-sized enterprises. The dynamism of these SMEs is attributable mainly to the investment they make, the income they distribute and the jobs they create. Up to 2013, the investments made by SMEs had reached CFAF 87 billion, and almost 47% of this amount was stable between 2010 and 2011 (*DPME*, 2013). With the change in political leadership in Senegal between 2011 and 2012, this rate fell by about 10%. But since the new regime took over, this worrying situation for the Senegalese economy has led to consultations among economic players, bringing together the private sector and the decision-makers to address the question of how to improve the investment levels. In terms of employment, SMEs have created 42% of all the jobs created in the modern sector because of the heavy investment made by entrepreneurs to meet the demands of globalization in a context of economic and financial crisis.

The Senegalese financial sector is made up of five main segments (the banking system, microfinance institutions (MFIs), insurance, remittances, and the stock market) resulting from a long process of reform since the colonial period. With a banking network limited to only five banks at its independence, Senegal, like most other African countries, inherited a colonial financial system. In the 1970s, this system was accused of being interventionist because of the instrumentalization of public companies by the government, which unfortunately was one of the main reasons, at the end of the 1970s, for the crisis in the financial system as a whole and in the banking system in particular. Therefore, to overcome its failed policies, in 1989 the government adopted market economy policies but these did not produce the expected effects on economic growth. It was not until the January 1994 CFAF devaluation, which was accompanied by a relatively generalized wave of growth in the global economy, that financial and macroeconomic equilibrium in the country was restored.

In the recent years, the Senegalese banking landscape has become much denser with establishment of new foreign banks. In 2019, the country had 29 credit institutions (including 25 banks and four financial institutions) against 23 in 2015 and 26 in 2016. In the *BCEAO*'s ranking of the *UEMOA* member states in terms of financing of the economies, Senegal has the most dynamic banking system after Côte d'Ivoire.

The weight of the banking system in financing the economy is appraised through the loans granted to the private sector. According to statistics from the Ministry of the Economy, Finance, and Planning (MEFP), in collaboration with the Directorate of Currency and Trade (*DMC*), between 2011 and 2014, the loans granted to the private sector increased in a less than proportional manner each year. These loans were estimated at CFAF 1,956 billion in 2011 against CFAF 2,133 billion in 2012; a 9% increase. In 2013, they stood at CFAF 2,412.39 billion, which is an 11% increase between 2012 and 2013. Despite this increase in the credit granted to the private sector since 2011, there is still much to be done to improve access to corporate credit, which remains low.

According to World Bank (2014) *Enterprise Survey*, on average, the loans granted to the large enterprises received from private commercial banks were estimated at about CFAF 11 billion, compared to about CFAF 284 million granted to the medium-sized enterprises and CFAF 19 million to the small enterprises. The participation of state-owned banks and government agencies and the Micro-Finance Institutions (MFIs) in the financial inclusion of the surveyed units was very low; of the 100 loans granted to enterprises, 83% were granted by private banks, while state-owned banks granted only 4%.

3. Literature Review

There is abundant theoretical and empirical literature on the issue of small- and medium-sized enterprises having access to credit. In particular, there is a large amount of literature on the debate about SMEs' access to financial institutions. This study focuses only on two theoretical aspects of corporate finance, which lead to credit rationing: information asymmetry and the pecking order theory.

The determinants of the difficulties enterprises encounter in having access to credit are often associated with information asymmetry issues. Hidden information often pushes banks to be suspicious of or sometimes extremely cautious about lending to businesses. When only the enterprises have information about their internal management, performance and reliability, that may be a reason for banks to ration their credit to them. Credit rationing is a situation where enterprises have profitable investment projects but cannot find financing. In concrete terms, when the demand for credit is greater than the supply of it and the banks do not want to raise interest rates to achieve market equilibrium, that is a situation of credit rationing. In theory, credit rationing can be caused by the presence of asymmetric information, the existence of a statutory usury rate, a fee for corporate failure that is unfavourable to creditors, and insufficient competition between banking institutions.

According to Stiglitz and Weiss (1981), in the presence of information asymmetry, funders will choose to either withhold their funding or ration it. The authors describe two situations when credit rationing occurs: the first is when one of two apparently identical groups of loan applicants gets it and the other does not; the second is when there are identifiable groups in the population who are unable to obtain credit or can only obtain it at a much higher price. The authors also show that regardless of the interest rate that the loan-applying enterprises agree to pay, they will not be granted the credit if the profitability expected by the lending banks is low.

Adair and Hamad (2004) have a similar argument; when there is no profitability on the relatively small loans which are applied for by the SMEs or very small enterprises, banks are not motivated to grant the loans because of the high transaction costs involved. In the banks' opinion, the SMEs presenting the highest risk of defaulting on their loan repayment will be excluded from the credit market. Stiglitz and Weiss (1981) refer to them as being "redlined". In the credit-rationing model, the risks characterizing the "redlined" enterprises are not easily identifiable by the banks. This may lead the latter to over-estimate the likelihood of the enterprises defaulting and thus exclude them from the credit market. It follows from this kind of argument that the most opaque or non-transparent SMEs are likely to be the first ones to be excluded from access to credit.

Credit rationing also occurs when banks realize that there are economies of scale that are related to fixed transaction costs such as information gathering, loan appraisal and monitoring. These costs can be higher if SMEs are not sufficiently transparent (Berger and Udell, 2006) and if the quality of the financial information they provide to the financial institution is limited (Cull et al., 2006). For Pandula (2011), credit rationing by banks and financial institutions exists because of adverse selection, moral hazard, and issues related to contract observance. Information asymmetry is more pronounced among small enterprises than among their larger counterparts (Tucker et al., 2003). When the enterprise is "opaque" (i.e. no reliable financial information comes from it), credit institutions will not take the risk of satisfying its loan application. In the same vein, Giannetti et al. (2011) argue that when an enterprise is granted a loan, this reveals information about it that is favourable in the eyes of other lenders. Murro et al. (2019) argue that if enterprises raise their level of opacity, asymmetric information problems can be mitigated with beneficial effects on credit availability for them.

Theoretically, these difficulties related to asymmetric information can be mitigated if the enterprise is able to pledge collateral or offer assets (financial or real estate), which the lender can seize in case of non-repayment, because a credit agreement with collateral will reduce the probability that the borrower will not repay the loan. Giannetti et al. (2011) argue that the enterprises that have placed a lien on their assets to obtain bank loans are more likely to obtain these, and that in the event of default on loan repayment, creditors will have the right to seize inputs and other assets from the enterprises concerned.

These findings are in line with Xu's (2018) hypothesis that better legislation allowing for collateral security makes it easier for businesses to get bank loans. Beck et al. (2018) found that fixed assets had a positive and significant effect on access to bank loans. However, the role of the guarantee in alleviating the problems related to anti-selection and moral hazard has been disputed by Stiglitz and Weiss (1981; 1987). These authors show that those problems are positively related to guarantees. All in all, the SMEs suffer from problems related to information asymmetry, such as adverse selection and moral hazard. In this regard, they are affected by the typical issues addressed in the pecking order theory.

The pecking order theory was first put forward by Donaldson in 1961 and was popularized by Myers and Majluf in 1984. The "pecking order theory" was born out of the information asymmetry existing on the financial markets. It postulates that the cost of financing increases with information asymmetry. Myers and Majluf suggest that enterprises have a particular order of preference for the capital used to finance their activities. For these authors, when SMEs have a project to be financed, they can have recourse to three sources of funding: self-financing (i.e. internal financing), bank loan, and commercial loan.[3] The enterprises start by exploiting the least expensive source, and then when this is no longer available, they move to the next (which is a little more expensive) provided that the marginal cost remains lower than the internal rate of return on marginal investment. In other words, the enterprises start with sources of

finance that are less affected by the least risky costs of information and supply. Then they consider the short-term debt, which is classified as low risk. Finally, they consider the long-term debt, which carries with it the highest information costs (Donaldson, 1961; Myers and Majluf, 1984). The authors suggest that the structure of the optimal capital is not well defined.

From these theoretical studies was born a series of empirical validation attempts. Enterprises are required to present annual financial statements that reflect current financial transactions related to their activities. In this regard, it is necessary to use an accounting and auditing firm whose mission is to certify that the financial statements are truthful. However, most small businesses do not place a high value on this critical element of their operations, the most plausible explanation for this being that in most cases the business is owned and run by the entrepreneur himself/herself, who is not always in possession of the required financial information.

Tucker and Lean (2003) have shown that small businesses are not financially sophisticated because they sometimes lack the records showing financial inflows and outflows. Yet, audited financial statements are highly appreciated by financial institutions, as these require them prior to granting the credit. Allee (2007) asserts that enterprises with audited financial statements are more likely to obtain credit than those without them. In their study of 16 emerging European countries, Popov and Udell (2012) have shown that enterprises choose to have their financial statements audited (that is, they are willing to pay for transparency) when considering to apply for a bank loan, because that will increase their chances of securing the loan.

These results, which show how audited financial statements are a determining factor in enterprises having access to bank loans, vary according to the structure of the economy considered. For example, in the case of Vietnam, a study by Le (2012) found that the audit was not a key determinant of an SME having access to a bank loan. This finding corroborates that made by Uchida (2011), which suggests that Japanese banks do not attach any importance to the informative nature of financial statements (whether these are audited or not).

The enterprise-size criterion is one of the important determinants of access to credit. This is true in both developed and developing countries. Carpenter and Petersen (2002) argue that small- and medium-sized enterprises are financially more constrained than larger ones. This credit restriction against small enterprises is, according to Schiffer and Weder (2001), the result of the high risk of failure associated with them. Beck et al. (2005) consider that the size of an enterprise is a key variable in analysing financial constraints. In the particular case of African enterprises, Bigsten and Soderbom (2006) found that a large proportion of small enterprises were subject to credit constraints. Aterido et al. (2011) also found that small enterprises had less access to finance than larger ones.

Small and sole proprietorships are subject to credit constraints the most, which is an indication that they potentially have a weaker ability to take advantage of their alternative capital markets (Popov and Udell, 2012). This is a conclusion made by Faisal and Edward (2013). It was found that being a medium-sized enterprise (compared to

being a small-sized one) increased the probability of having access to credit by 19%. Being a large enterprise (compared to being a small-sized one) increased it by between 50% and 51%. Like Faisal and Edward, Fowowe (2017) also found that large enterprises faced the fewest constraints in terms of having access to credit and, as a result, they received the highest amount of funding. Conversely, small enterprises faced the most constraints and, as a result, they received the lowest amount of funding. In the same vein, Murro and Peruzzi (2019) have shown that the smaller the enterprise, the more credit-related restrictions it is likely to face.

The size of an enterprise can also be appraised by the volume of its sales (turnover) or by the acquisition of real estate assets (fixed assets). This is what Bigsten et al.'s (2000) study on credit constraints facing manufacturing firms in Africa has shown; increased sales and profits are associated with better access to credit. The results of Le's (2012) study seem to go in the same direction, but are mixed concerning SMEs' sales; a high level of sales on the domestic market rendered Vietnamese SMEs more likely to obtain credit from banks, while a high level of indirect export sales had no effect on the banks' decision to grant loans to the enterprises concerned. Ownership of machinery, vehicles, and equipment played an important role in the availability of credit for SMEs. For their part, Faisal and Edward (2013) found that a 1% increase in sales increased the enterprise's probability of having access to credit by 0.08%. The authors validated this finding by using a two-step approach where demand for and supply of credit were estimated simultaneously; they observed that a 1% increase in the level of sales led to a 0.7% increase in the amount of credit granted.

Opinion is divided regarding the effect of the manager's experience on his/her enterprise having access to bank financing. While Kung'u (2011) found that this experience had a positive effect on access to credit for SMEs in Kenya, Thouraya and Gajigo (2012) found the opposite. In fact, the latter found that credit constraints increased with the manager's experience. However, they noted a relaxation of these obstacles to financing from a certain threshold. For their part, Faisal and Edward (2013) found that the manager's number of years of experience had no effect on the probability of the enterprise obtaining a bank loan.

In relation to the gender variable, many studies have found that when an enterprise is owned or managed by a woman, it is likely to face obstacles in terms of it having access to credit. On this issue, Kabeer's (2001) and Agier and Szafarz (2013) observations are mixed; even though access to credit does not hinge on gender differences, women are still more likely to encounter difficulties in securing a loan than men. Lee et al. (2015) concluded that female-owned businesses were more likely to not get all the funding they needed for their activities. In the same wake Beck et al. (2018) state that female-owned businesses are more willing to use trade credit but less likely to obtain it. They also found that when the owner of an enterprise was female, this reduced the probability of applying for a bank loan by 2.6% of its total sales.

In some cases, banks are reluctant to lend, taking into account the characteristics of the borrowing enterprises and the context (i.e. structure) of the economy. A number of studies have highlighted the issue of granting credit to innovating enterprises. The

results offer a mixed picture depending on the angle from which they are analysed, the measure of innovation, the size of the enterprise and its sector of activity. While some studies such as Canepa and Stoneman (2007) and Czarnitzki (2006) suggest that funding is more likely to hinder innovation in small-sized enterprises and high-tech industries, others such as Freel (2007) and Mina et al. (2013) suggest that innovating enterprises are more likely than others to get funding.

Revest and Sapio (2010), who studied the financing of enterprises operating in the new technology sector, found a contrary result and concluded that financing could be a problem for innovating enterprises. Mueller and Reize (2010) made the same observation and concluded that innovating enterprises were more likely to see their loan application rejected because of their more dispersed distribution of returns. However, they were better able to cope with a loan refusal because they were still able to find other sources of financing if their returns were attractive.

Many empirical studies have shown that the relationship between the export status of an enterprise and its probability of having access to credit can go in both directions. Greenaway et al. (2007) reminded empirical trade economists that exporters were always aware that credit constraints could hinder or even prevent exports. An enterprise's exporter status significantly influences the likelihood of it having access to credit. "Banks lend to businesses that have higher growth prospects," stated Popov and Udell (2012), who demonstrate that enterprises that export part of their production face fewer credit constraints. In his analysis, Le (2012) showed that enterprises involved in export activities could use more credit technology to obtain bank loans than those operating only on the domestic market. The author states that exporting enterprises are more likely to increase the probability of having access to bank loans. In addition to bank loans, they have more internal capital than the non-exporting ones and are more likely to have access to credit through another channel, while the non-exporting enterprises have limited options in terms of financial channels. Compared to the case of a non-exporting enterprise, the probability of having access to credit for an exporting one increases by about 14 percentage points (Faisal et al., 2013).

Kumarasamy et al. (2018) suggest that enhancing access to finance and expanding the banking sector enable the enterprises operating from outside capital cities or large cities to have easy access to export markets. Sibanda et al. (2018) conclude that access to finance has a positive impact on SMEs' export behaviour. Pietrovito and Pozzolo (2019) report having strong evidence of a statistically and economically significant negative effect of financial constraints on the likelihood of an enterprise exporting (the extensive margin of exports) and on the share of exports on total sales (the intensive margin of exports). Only rarely is there a statistically significant negative relationship between more serious problems of access to finance and exports (Joachim, 2019). An enterprise's exporter status also increases the likelihood of credit restrictions (Murro and Peruzzi, 2019).

When a business is formal, it has more opportunities to have access to formal credit, from banks, for example. This is the thesis that is generally defended in the literature. Some studies such as Tiryaki's (2008) report that informal businesses do not have access to credit markets. According to the author, in high-income countries, businesses generally do not operate solely in the formal or the informal sector, but rather operate on both markets. It follows, therefore, that they are more likely to have access to credit than on the formal markets than the businesses operating in the informal sector in developing countries.

A study conducted by the IFC (2013) considers access to formal financial services to be an incentive for a business to become formal. But this definitely remains a big challenge. According to the same study, this challenge is most acute in countries where small enterprises operating in the formal sector have very limited access to finance. But even if the informal businesses were to become formal, this could create an opaque scenario, as their prospects for access to capital are low. Beck et al. (2018) note that formal enterprises, that is those that are registered with the relevant government bodies, engage in more transparent transactions, which the formal lenders (financial institutions) prefer.

In light of the above, the question to ask is the following: Why do some enterprises in Senegal manage to have access to credit while others do not? In other words, what are the determinants of a high probability for an SME succeeding in obtaining a bank loan?

To answer this question, three hypotheses can be formulated:

-   *Hypothesis 1*: Banks respond favourably to an enterprise's loan application if the enterprise is transparent. In other words, if the SME makes available information on its audited financial statements, it increases its chances of getting a bank loan. To verify this hypothesis, the study will test the effect of the audit on the probability of obtaining a bank loan.

-   *Hypothesis 2:* Financial institutions attach particular importance to the extent to which an SME is a fully-fledged one.
    This second hypothesis relates to the positive link that could exist between an enterprise's being granted a bank loan and its activities. To verify it, the study will test the effect of innovation, of whether the enterprise is an exporting one, and of its revenues on the probability of it having access to credit.

-   *Hypothesis 3*: The fact that an SME has invested in fixed assets increases its chances of obtaining a bank loan.
    To verify this hypothesis, the study will test the effect of investment in fixed assets on the probability of having access to financing.

To those variables of interest will be added other variables needed to control for the other characteristics related to the management of an enterprise, such as the gender of the owner of the enterprise, the latter's formal or informal status, and the experience of its manager. It is expected that, except for the gender variable, which should have a negative effect, these control variables will have a positive effect on the probability of an enterprise having access to credit.

4. Methodology

This section discusses and justifies the choice of the empirical model used in this study. Following Bebczuk (2004), Fatoki et al. (2010) and Le (2012), the methodological approach used is based on logistic (logit) regression[4] to identify the explanatory factors in an enterprise's access to credit.

This model does not apply to a quantitative variable associated with the occurrence of an event (i.e. the granted loan, in the present case), but to the probability of occurrence of that event, depending on exogenous variables. Since the dependent variable (i.e. access to credit) in this study is dichotomous type, it can only take two values: **0** and **1**. According to Bourbonnais (2005), the probabilities, the proportions of variables, and the error terms are between **0** and **1**, and thus follow a discrete law. This means that simple regression would not be appropriate, for two reasons: it does not consider the maximum or the minimum, and it assumes the normality of the error terms (Pampel, 2000). It is, therefore, more appropriate to use a binary-choice model, which will enable us to estimate the probability associated with an event. As suggested in Equation 1, it is a question of modelling the probability **P** $(Y_i=1)$ that an enterprise i will be granted a loan.

$$Pr\ (Yi\ = 1)\ where\ Yi = \begin{cases} 1 & = \ if\ access\ to\ credit \\ 0 & = \ if\ not \end{cases} \tag{1}$$

This nonlinear probability model (logit) responds to some specificities, hence the importance of identifying its distribution function given by Equation 2. Suppose **Φ (.)** is the distribution function of the logistic law whose manifestations must be between **0** and **1**.

Let us suppose here that: $Y_i = \Phi\ (\alpha + \beta x_i) + \varepsilon_i$ with:

$$\Phi(\alpha + \beta X_i) = \frac{\exp^{\alpha + \beta X_i}}{1 + \exp^{\alpha + \beta X_i}} \tag{2}$$

Then our logistic regression model becomes:

$$y_i = \beta_0 + \beta_i x_i + \epsilon_i y_i = \beta_0 + \beta_i x_i + \epsilon_i \tag{3}$$

where:

Yi represents the variable to be explained in our model (i.e. access to credit) and is binary;

X_i in equation (3) represents the model's explanatory variables; they are either discrete or continuous;

β_0 represents the model's constantβ_0 represents the model's constant;

β_i represents the coefficient associated with the explanatory variables;

β_i represents the coefficient associated with the explanatory variables;

ε_i represents the error term for the regression, which follows a logistic law;

Y_i is the state of satisfaction of the demand for credit (1 if the SME has access to credit, 0 if not).

The observation of access to credit is supposed to be guided by an underlying, unobservable, latent phenomenon Yi^*, as shown in Equation 4. It can be interpreted as a propensity to generate an event of type $Yi= 1$. Effective access to credit is then observed when this latent phenomenon exceeds a certain critical threshold normalized to zero, as shown by Equation 5.

$$y_i^* = \beta_0 + \beta_i x_i + \epsilon_i \tag{4}$$

Where one would observe $y_i = 1$ if this propensity exceeded a certain threshold (γ).

$$\begin{cases} y_i = 0 \Leftrightarrow y_i{}^* = \beta_0 + \beta_i x_i + \varepsilon_i < \gamma \\ y_i = 1 \Leftrightarrow y_i{}^* = \beta_0 + \beta_i x_i + \varepsilon_i > \gamma \end{cases} \tag{5}$$

The empirical exercise then amounts to modelling the behaviour of these phenomena and the factors that contribute to their values being above the thresholds, meaning that the enterprise has access to credit. It is assumed that similar mechanisms, albeit to varying degrees, are the cause of enterprises' propensity to use external financing and to succeed in gaining access to it. These mechanisms are represented by the explanatory variables Xi, which essentially captures the characteristics of the demand for credit and of the supply of it. In addition, in this type of model, the numerical value of the estimated parameters is not of much interest in itself, in so far as they correspond to the parameters of the latent variable equation only to a multiplicative constant. The relevant information in this model is therefore the sign of the parameters, which indicates whether the variable associated with the influence of the probability is increasing or decreasing.

5. Data and Descriptive Statistics

The data used in this study came from a survey conducted in Senegal by the World Bank.[5] The survey was conducted between May 2014 and February 2015, and concerned 601 Senegalese enterprises of all sizes, operating from four regions of Senegal: Dakar (the economic capital, where nearly two-thirds of the enterprises surveyed are based), Saint-Louis, Thiès, and Kaolack. The enterprises in question operate mainly in three sectors of activity: manufacturing (41.4%), trade (25.0%), and services (33.6%). The SMEs, which by definition employ less than 100 workers, constitute the overwhelming majority (92%). Since large enterprises are outside the scope of this study, the sample was reduced to 553 enterprises (70% of which small-sized and 22% medium-sized). In the end, the analysis is based on a sample of 322 SMEs, after excluding no-response cases. The sample was weighted to generalize the conclusions to all the SMEs in Senegal.

For the Enterprise Survey for Senegal, stratified random sampling was used, for various reasons. There was need to obtain unbiased estimates for different strata of the population with a certain known level of precision, but also to obtain unbiased estimates for the entire population. The questionnaires provided diversified information about the characteristics of the enterprises surveyed, their sectors of activity, the financing of their operations, the loan conditions, etc. In addition to the activities of those enterprises, the study takes a particular interest in their innovation dimension. Detailed information about their formal or informal status, their capacity and how they were financed was collected during the survey. The questions that were asked of the owners and senior managers of the enterprises were the following: whether the enterprise had applied for a loan and, if not, what the specific reasons were for not doing so; to which financial institution (state-owned bank, private commercial bank, microfinance institution) was the application addressed; whether the application had been successful and, if not, what the specific reasons were for its rejection; what was the exact amount of the loan; did the loan require a guarantee; what kind of guarantee (land, machinery or equipment) was required, etc.

Table 1 provides some descriptive statistics of the variables in this study's model, and the definition of each is given in Appendix Table A3. Table 1 reveals a poor access to credit for SMEs. On average, only one out of every six small- and medium-sized enterprises surveyed was granted a loan. In accordance with the regulations in force in Senegal, each enterprise is required to provide certified annual financial statements. In spite of this law, only 25.5% of those surveyed had their annual financial statements audited and certified by an external auditor. In addition, almost all the SMEs surveyed (82.3%) were owned by men. And almost all of them were formal (84.5%) and were

run by senior managers with 20 years' experience in the sector, on average. Only one in five SMEs had acquired fixed assets (machinery, vehicles, equipment, land, and buildings). Although not too many of the SMEs (only 6.2%) were identified as being exporters of goods or services, more than half of them (55%) used new or significantly enhanced logistical equipment and products and services. These small- and medium-sized enterprises achieved a turnover of nearly CFAF 2.5 billion per year on average.

Table 1: Descriptive statistics

Variables	No. of observations	Frequencies/ average
Access to credit (%)	322	17.08
Audit (%)	322	25.46
Assets (%)	322	20.18
Formal sector (%)	322	84.47
Female-managed (%)	322	17.70
Innovation (%)	322	55.00
Exports (%)	322	06.21
Manager's experience (years)	322	20.00
Sales turnover (CFAF billion)	322	02.43

Source: Compiled by the author based on World Bank (2014) data from the Enterprise Survey

6. Results and Discussion

It should be recalled that the methodological approach used in the this study is based on the logit model. This method consists in detecting values that will enable a maximization of the probability of obtaining the observed data by maximizing the likelihood logarithm. According to Bourbonnais (2005) and Crépon and Nicolas (2010), logit model parameters are estimated using the maximization algorithms of a likelihood function. Moreover, it was necessary to carry out tests of correlation, robustness and validity of the model. Appendix Table A1 shows that the explained variables are strongly correlated with the explanatory variable of the model, and the explanatory variables are weakly correlated between themselves. They can thus be kept in the model. In addition, Appendix Figure 1 gives the ROC curve and indicates that the model is globally well specified because it displays an "Area under ROC curve" that is between 0.8 and 1. The results obtained with the probit model (Appendix Table A2) show a certain degree of robustness.

Table 2 gives the results of the logistic estimation; their interpretation takes into account the sign and the degree of significance of the regression coefficients. A positive sign indicates that the exogenous (or explanatory) variable has a positive effect on the probability of occurrence of an event (i.e., access to credit, in the present case), while a negative sign indicates that it has a negative effect (Bourbonnais, 2005).

As can be expected from the theory, when there is asymmetric information the borrowing enterprises face more credit constraints. When an enterprise has got audited financial statements, that significantly influences its access to credit. This confirms this study's first hypothesis and corroborates the observations made by Allee (2007) and Popov and Udell (2012). One of the benefits of audited financial statements is the reduction of informational opacity, which means that the enterprises that are willing to pay for transparency have a potentially higher probability of obtaining credit. The results suggest that enterprises that have financial statements that have been audited and certified by an external auditor are at least twice as likely to obtain credit as those that do not.

Innovation, exports, and revenues were found to have a positive effect on the probability of an enterprise having access to credit, which supports this study's hypothesis 2. Firstly, the study found that the innovating enterprises were three times more likely to have access to bank credit. This positive result runs contrary to the theory that suggests that such enterprises have a higher probability of being refused a loan because of the risk associated with innovation. This divergence could be attributed to the different approaches used to measure innovation. It should

be remembered that this study used the acquisition of new or enhanced logistical equipment, products and services to represent innovation. Based on this, the study's results corroborate those of Mueller and Reize (2010) and Mina et al. (2013). The research and development activity, considered a measure of innovation, does not always lead to a marketable product and implies a higher level of risk (Mueller and Reize, 2010). Besides, it may not constitute a useful guarantee outside the enterprise itself (Mina et al., 2013).

Secondly, the study found that enterprises that exported their production had a high probability of having their loan application accepted. It further found that exporting enterprises had twice more chances of having access to credit than innovating ones, which suggests that banks are more inclined to lend to enterprises offering better prospects for growth. Finally, it found that the chances of having access to credit increased with the enterprise's turnover, but the same chances decreased over time. In fact, they ceased to increase when the turnover reached about CFAF 335 million a year, a level of sales beyond which there was an inverse relationship between the two variables. This could mean that banks give special importance to enterprises that sell their products very easily, but that at a certain point in time, when an enterprise is capable of realizing sufficiently large annual sales, it gradually reduces its demand for credit since it can finance itself.

The study's third hypothesis was also verified. Investment in fixed assets was found to have a significant and positive effect on the decision to grant a loan. In other words, enterprises that had acquired machinery, equipment, vehicles, land and buildings were more likely to obtain financing. The study's results show that the SMEs that had invested in fixed assets were at least three times more likely to obtain a bank loan. This could mean that banks attach particular importance to the assets that borrowers have, which may be used as collateral in the event of non-repayment of the loan.

Contrary to what previous empirical analysis suggests, this study found that the gender of an enterprise's owner had a positive effect on the probability of it having access to credit. In fact, it found that obtaining a bank loan was more likely when the enterprise's owner was a woman. This finding, which is contrary to expectations, could be associated with the dynamism and reputation of women entrepreneurs in Senegal when it comes to repaying loans.

As expected, and although the coefficient was found to be significant only at the 10% threshold, the formal status of enterprises was found to have a positive effect on the probability of them obtaining a bank loan. This suggests that informal enterprises are less likely to get bank financing not only because they are more exposed to fluctuations in economic activity, but also, and more importantly, because of their high risk. This observation is in agreement with the previous literature which suggests that the small size of the enterprises in the informal sector prevents them from having access to credit markets.

Table 2: Probability of obtaining a bank loan

Variables	Access	Odds ratios	Marginal effects
Formal	0.372*	1.450*	0.0299*
	(0.216)	(0.313)	(0.016)
Female	0.374**	1.454**	0.0363**
	(0.147)	(0.214)	(0.015)
Audited statements	0.824***	2.281***	0.0795***
	(0.147)	(0.336)	(0.015)
Assets	1.328***	3.775***	0.166***
	(0.153)	(0.578)	(0.024)
Manager's experience	0.244***	1.276***	0.0218***
	(0.030)	(0.0383)	(0.002)
Experience2	-0.00422***	0.996***	-0.000379***
	(0.0005)	(0.0005)	(4.66e-05)
Exports	1.940***	6.957***	0.308***
	(0.205)	(1.425)	(0.046)
Innovation	1.206***	3.340***	0.104***
	(0.157)	(0.525)	(0.013)
Sales	3.007***	20.23***	0.270***
	(0.434)	(8.783)	(0.036)
Sales2	-0.0766***	0.926***	-0.00686***
	(0.011)	(0.010)	(0.001)
Constant	-35.83***	0***	
	(4.345)	0	

Observations = 322
Likelihood Log= -802
Pseudo R^2= 0.239

Note: Access to credit is the dependent variable. It is assigned the value 1 if the access is real, and 0 if not. The standard deviations appear between parentheses. * indicates significance at the 10% threshold, ** at the 5% threshold, and *** at the 1% threshold.

As had been predicted, the study found that the probability of having access to credit increased with the manager's number of years of experience, but this probability declined over time. In fact, it stopped increasing at the 29-year experience level. Thouraya and Gajigo (2012) had hoped to arrive at the same conclusion, but they unexpectedly found a contrary result, and a threshold that was established at the level of 30 years of experience. It should be noted that the managers considered in this study are those with 20 years in their sector of activity, on overage. Therefore, if at the end of 29 years of experience their enterprises began to face credit constraints, this could be attributed to the fact that the managers were getting closer to the retirement age which, until December 2014, was set at 55.

7. Conclusion

All in all, what can be concluded about access to credit for small- and medium-sized enterprises in Senegal?

First of all, although the number of financial institutions has increased significantly in the recent years in Senegal, enterprises generally continue to face enormous difficulties before they have been granted a loan or a line of credit. It is against this backdrop that this study chose to analyse the determinants of the probability of Senegalese SMEs having access to credit. Based on survey data from the World Bank, this paper has developed a methodological approach based on logistic regression to identify the determinants of access to credit. From the discussion above, almost all of the study's hypotheses have been confirmed, which means that the explanatory variables seem to explain the SMEs' access to credit. Indeed, the study's results clearly show that audit, innovation, exports, sales, fixed assets and experience are the most important factors. Thus, in summary, the SMEs are more likely to obtain credit from banks if: (i) they have truthful financial statements validated by external auditors; (ii) they acquire new or significantly enhanced logistical equipment and products and services; (iii) they export their production outside Senegal; (iv) they achieve a high sales turnover; (v) they invest in economic assets; and (vi) they are led by a manager with a significant number of years of experience in the sector.

However, the study's results are meaningful only if the study's limitations are taken into account. This is because if some variables that are not represented in the database used for the study and, therefore, not represented in the study's model (such as interest rate and amount of the loan granted), had been included, they could have given a relatively more complete picture. That is why it is necessary to deepen the research on the issue of the Senegalese SMEs having access to credit.

Notes

1   Organization for Economic Cooperation and Development

2   Senegalese law defines a small-sized enterprise (SE) as any natural person
    or legal entity occupied in a professional, civil, trading, craft, agricultural, in-
    dustrial, or service employment and whose annual turnover, excluding taxes,
    is higher than CFAF 100 million and lower than or equal to CFAF 500 mil-
    lion. For its part, a medium-sized enterprise (ME) is one that has a turnover
    of between CFAF 500 million and 2 billion. SMEs must keep accounts either
    internally, by a chartered accountant or by a chartered management centre,
    or other similar approved structure.

3   Trade loans are a short-term source of funding used to finance a firm's
    operating cycle. Their collateral consists of the terms of payment granted to
    customers. Petersen and Rajan (1994) have shown that this source of funding
    is extremely expensive.

4   The logistical model was developed and introduced in 1994 by Joseph Berk-
    son (1899-1982).

5   Enterprise Surveys (*http://www.enterprisesurveys.org*), the World Bank.

References

Adair P. and Hamad Y. 2004. Le microcrédit : Une solution au financement de la microentreprise au Maghreb. Communication présentée au 6e symposium du réseau d'analyse et de développement économique, tenu à Marrakech en mars 2004.

Agier, I. and Szafarz, A. 2013. "Microfinance and gender: Is there a glass ceiling on loan size?" *World Development*, 42: 165-181.

Allee. K D. 2007. The demand for financial statements in an unregulated environment: An examination of the production and use of financial statements. Privately-held small businesses, http://ssrn.com/abstract=647721.

Aryeetey, E. 1998. Informal finance for private sector development in Africa, Economic Research Papers, Banque Africaine de Développement n°41

Aterido, R., Hallward-Driemeier, M. and Pages, C. 2011. Big constraints to small firms' growth? Business environment and employment growth across firms. *Economic Development and Cultural Change, University of Chicago Press, vol.* 59(3): 609-647.

Bannock, G. and Morgan, V.E. 1998. *Banks and small business: An international perspective*. London: The Forum of Private Business.

Bebczuk, R.N. 2004. What determines the access to credit by smes in argentina? *Department of Economics Universidad Nacional de La Plata Argentina.*

Beck, T., Demirgüç-Kunt, A. and Maksimovic, V. 2005. 'Financial and legal constraints to growth: does firm size matter?', *The Journal of Finance*, 60(1), 137–177.

Beck, T. H. L., Hoseini, M. and Uras, B. 2018. Trade credit and access to finance of retailers in Ethiopia. DFID Working Paper. Tilburg: Tilburg University.

Berger A.N. and Udell G.F. 2006. "A more complete conceptual framework for SME finance", *Journal of Banking and Finance,* 30(11): 2945-2966.

Berkson, J.1944. Application to the logistic function to bio-assay. *Journal of the American Statistical Association*, 39(227), 357. doi:10.2307/2280041

Bigsten, A., Collier, P., Dercon, S., Fafchamps, M., Gauthier,B., Gunning, J.W., Oduro, A., Oostendorp, R., Pathillo, C., Söderbom, M., Teal, F., and Zeufack, A. 2000. "Credit constraints in manufacturing enterprises in africa", *CSAE Working Paper, WPS* 2000.24..

Bigsten, A. and Soderbom, M. 2006. "What have we learned from a decade of manufacturing enterprise surveys in Africa". *World Bank Research Observer*, 21 (2): 241-265.

Bourbonnais, R. 2005. « *Econométrie: cours et exercices corrigés* », *6è édition, éd. DUNOD, Paris*, 368 p.

Canepa, A. and P. Stoneman. 2007. "Financial constraints to innovation in the UK: Evidence from CIS2 and CIS3". *Oxford Economic Papers* 60(4):711-30.

Carpenter, R. E. and Petersen, B.C. 2002. "Is the growth of small firms constrained by internal finance?" *Review of Economics and Statistics*, 84(2): 298-309.

Collier. 2009. Repenser le financement des petites entreprises en Afrique. *Revue de Proparco*, Issue No. 1, May 2009.

Crépon, B. and Nicolas J., 2010. *Économétrie: Méthode et applications*. Brussels: Groupe de Boeck.

Cull R., Davis L.E., Lamoreaux N.R. and Rosenthal J.L. 2006. "Historical financing of small and medium-size enterprises". *Journal of Banking and Finance*, 30(11): 3017-3042.

Czarnitzki, D. 2006. "Research and development in small and medium-sized enterprises: The role of financial constraints and public funding". *Scottish Journal of Political Economy,* 53(3): 335-57.

Donaldson, G. 1961. Corporate debt capacity: a study of corporate debt policy and the determination of corporate debt capacity. *Boston, division of research, graduate school of business administration, harvard university.*

DPEE (Direction générale de la planification et des politiques économiques) 2014. Le financement de l'économie sénégalaise. Working Document, September 2014.

DPME (Direction des Petites et Moyennes Entreprises). 2010. Étude sur l'offre et la demande de financement des PME au Sénégal » Final Report by Cabinet Va Conseils.

DPME (Direction des Petites et Moyennes Entreprises). 2013. Rapport de l'Enquête Nationale sur les Petites et Moyennes Entreprises. April 2014.

Faisal B. and Edward B. 2013. "Access to credit and the effect of credit constraints on the performance of manufacturing firms in the East African region: Micro analysis". *International Journal of Economics and Finance*, Vol. 5(10).

Fatoki, O., et Odeyemi, A. 2010. Quelles nouvelles petites et moyennes entreprises en Afrique du Sud ont accès au crédit bancaire? *International Journal of Business and Management*, 5 (10). doi: 10.5539 / ijbm.v5n10p128

Fowowe B. 2017. "Access to finance and firm performance: Evidence from African countries". *Review of Development Finance,* 7: 6-17.

Freel, M. S. 2007. 'Are small innovators credit rationed?', *Small Business Economics*, 28(1), 23–35.

Giannetti, M., Burkart, M. and Ellingsen, T. 2011. "What you sell is what you lend? Explaining trade credit contracts". *Review of Financial Studies,* 24(4): 1261-1298.

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

IFC. 2013. *Closing the credit gap for formal and informal micro, small, and medium enterprises*. World Bank Group, 94911.

IMF. 2004. Republic of Mozambique: financial system stability assessment including report on the observance of standards and codes on the following topics. Banking supervision, payment systems, and anti-money laundering and combating the financing of terrorism, *IMF Country Report* n°04/52.

Jasor, M. 1998. Amélioration des relations entre banques et PME. *Les Echos* 16-17, January 1998.

Joachim W. 2019. "Access to finance and exports: Comparable evidence for small and medium enterprises from industry and services in 25 European countries". *Open Economies Review*. https://doi.org/10.1007/s11079-019-09534-w

Kabeer, N. 2001. "Conflicts over credit: Re-evaluating the empowerment potential of loans to

women in rural Bangladesh". *World Development*, 29: 63-84.

Kumarasamy D. and Singh P. 2018. "Access to finance, financial development and firm ability to export: Experience from Asia-Pacific countries". *Asian Economic Journal,* 32(1): 15-38.

Kung'u G. A. 2011. Factors influencing SMEs access to finance: A case study of Westland Division, Kenya. MPRA Paper No. 66633.

Le, P. 2012. "What determines the access to credit by SMEs?" *Journal of Management Research*. Vol. 4(4).

Lee, N., Sameen, H., & Cowling, M. 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..

Lee, Neil, Sameen, Hiba and Cowling, Marc. 2015. "Access to finance for innovative SMEs since the financial crisis". *Research Policy*, 44 (2): 370-380.

Mbaye, A. A. and S. Golub. 2002. Convergence en productivité: Le Sénégal, la sous-région et l'économie internationale. Ministère de l'Economie et des Finances, Unité de Politique Economique.

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.

Mueller E. and Reize F. 2010. Loan availability and investment: Can innovative companies better cope with loan denials? ZEW Discussion Papers, No. 10-025.

Murro, P. and Peruzzi, V. 2019. "Family firms and access to credit. Is family ownership beneficial?" *Journal of Banking and Finance.* doi: https://doi.org/10.1016/j.jbankfin.2019.02.006.

Myers S. and Majluf. 1984. "Corporate financing and investment decisions when firms have information that investors do not have". *Journal of Financial Economics,* 13(2): 187-221.

OECD. 2009. L'impact de la crise mondiale sur le financement des PME et de l'entrepreneuriat et les réponses en termes d'action des pouvoirs publics. *Revue Bel Canto* – Boulogne (F92100).

Pampel, Fred C. 2000. "Logistic regression: A primer". In Michael S. and Lewis-Beck, eds, *Series on Quantitative Applications in the Social Sciences*. Thousand Oaks: Sage Publications.

Pandula, G. 2011. An empirical investigation of small and medium enterprise access to bank finance: The case of emerging economy. ASBBS Annual Conference, Vol. 18, No. 1.

Petersen M. A. and Rajan, R. 1994. "The benefits of lending relationships: Evidence from small business data". *The Journal of Finance*, 49(1): 3-37.

Pietrovito F. and Pozzolo A.F. 2019. Credit constraints and firm exports: Evidence from SMEs in emerging and developing countries. Centro Studi Luca D'Agliano Development Studies. Working Paper No. 441.

Popov. A. and Udell. G.F. 2012. "Cross-border banking, credit access, and the financial crisis". *Journal of International Economics*, 87(1): 147-161.

Revest, V. and A. Sapio. 2010. "Financing technology-based small firms in Europe: What do we know?" *Small Business Economics* 39(1): 179-205.

RGE (Recensement Général des Entreprises). 2016. Ministere de l'economie, des finances et du plan. Rapport global-05-07-2017.

Schiffer, M & Weder, B .2001. Firm size and the business environment: worldwide survey results, *IFC Discussion Paper* 43.

Sibanda K., Hove-Sibanda P. and Shava H. 2018. "The impact of SME access to finance and performance on exporting behaviour at firm level: A case of furniture manufacturing SMEs

in Zimbabwe". *Acta Commercii Independent Research Journal in the Management Sciences* 18(1): 1-13.

Stiglitz J. E. and Weiss A. 1981. "Credit rationing in markets with imperfect information". *American Economic Review*, 71(3): 393-410.

Stiglitz J. E. and Weiss A. 1987. "Credit rationing: Reply". *American Economic Review*, 77(1): 228-231.

Thouraya T. and Gajigo O. 2012. Credit bureaus and registries and access to finance: New evidence from 42 African countries. Working Paper Series No. 154. Tunis: African Development Bank.

Tiryaki G. F. 2008. "The informal economy and business cycles". *Journal of Applied Economics.* 11(1): 91-117.

Tucker, J. and Lean, J. 2003. "Small firm finance and public policy". *Journal of Small Business and Enterprise Development,* 10(1): 50-61.

Uchida, H. 2011. "What do banks evaluate when they screen borrowers? Soft information, hard information and collateral". *Journal of Financial Services Research*, 40(1-2): 29-48.

World Bank. 2005. Sénégal: Une évaluation du climat des investissements. Washington DC.

Xu, B. 2018. "Permissible collateral and access to finance: Evidence from a quasi-natural experiment". *China Economic Review.* S1043-951X(18)30167-6.

World Bank. 2013. Smart regulations for small and medium businesses. *International Bank for Reconstruction and Development* / 10th edition Doing Business..
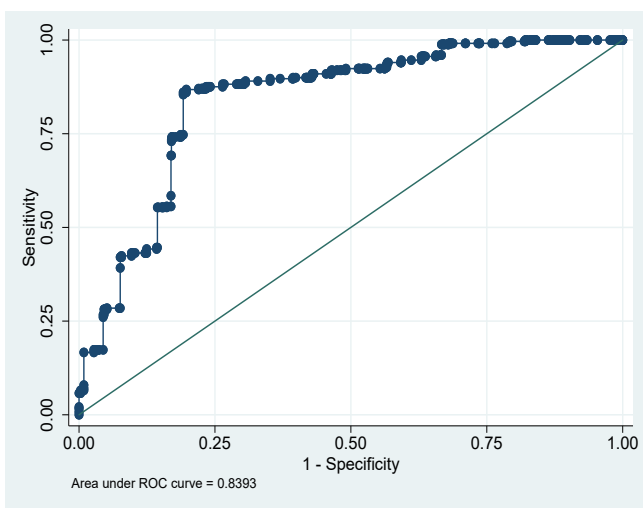
Appendix

Appendix Figure 1: Specification of the logit model

Logistic model for access to credit
Number of observations = 322
Area under ROC curve = 0.8393

Source: Compiled by the author based on World Bank (2014) data from the Enterprise Survey

Appendix Table A1: Paired correlations between the variables of interest in the study's model of access to credit

	Access to credit	Audited statements	Fixed assets	Exports	Innovation	Revenues
Access	1.0000					
Audit	0.1325	1.0000				
Fixed assets	0.3063	0.0967	1.0000			
Exports	0.1909	0.1745	0.0309	1.0000		
Innovation	0.1457	0.1422	0.1131	0.1036	1.0000	
Revenues	0.2084	0.3235	0.1442	0.2789	0.1228	1.0000

Source: Compiled by the author based on World Bank (2014) data from the Enterprise Survey

Appendix Table A2: Summary of the results of the logit and probit estimation of the access-to-credit model

Variable	Logit	Probit
Statut	.3719*	.2043*
Genre	.3742**	.1974**
Audit	.8245***	.4388***
Immobilisa~s	1.328***	.8189***
Expérience	.2437***	.1315***
Expérience2	-.0042***	-.0023***
Exportation	1.94***	1.136***
Innovation	1.206***	.6584***
Recettes	3.007***	1.737***
Recettes2	-.0766***	-.0443***
_cons	-35.83***	-20.53***
N	322	322
ll	-802.3	-797.5

legend: * p<.1; ** p<.05; *** p<.01

NB: *statut*: status; *immobilisa*: fixed assets; *recettes:* revenues

Appendix Table A3: Definitions of the variables

Variables	Definitions
Access	1 = If the SME has access to a line of credit or a bank loan. 0 = If not.
Audited	1 = If the SME has its annual financial statements audited and certified by an external auditor. 0 = If not.
Gender	1 = If the owner of the SME is female. 0 = If not.
Status	1 = If the SME is formal. 0 = If not.
Innovation	1 = If the SME has acquired logistical equipment, products and services that are new or significantly enhanced. 0 = If not.
Fixed assets	1 = If the SME has got fixed assets such as machines, land and buildings. 0 = If not.

Exports	1 = If the SME is an exporting one. 0 = If not.
Revenues	log (the SME's total annual sales for all its products and services)
Revenues2	Revenues squared
Manager's experience	The manager's number of years of experience in the sector
Experience2	Experience squared

Source: Compiled by the author based on World Bank (2014) data from the Enterprise Survey

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