



## Determinants of Bank Funding for Tunisian SMEs in the Context of Information Asymmetry

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### Abstract

This paper explores the determinants of access to finance for small and medium enterprises (SMEs) in the context of asymmetric information. The sample consists of 250 Tunisian SMEs financed by the Arab International Bank of Tunisia, broken down by sector according to activity, size and region. The results of multiple linear regressions showed that size, interest rate, trade credits and profitability have a significant influence on the total volume of credit. The bank considers the size of commercial and industrial SMEs, and those located in the District of Tunis and the Central East, as a positive signal when considering a loan. The bank also considers high interest rates when considering giving loans to commercial SMEs, micro-enterprises and SMEs located in the District of Tunis. As far as innovation is concerned, the results showed that service SMEs, micro-enterprises and SMEs located in the District of Tunis and in the Central East find it difficult to get credit. It is interesting to note that the bank neglects liquidity issues and the net worth of the SME in its financing decision, which contradicts the theoretical assumptions. Finally, it is concluded that bank's financing of Tunisian SMEs is characterized by conditions dominated by the problem of asymmetric information.

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*Small  
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## 1. Introduction

For more than twenty years, a large amount of research has been conducted on a very specific category of firms: small and medium-sized enterprises (SMEs). This category of enterprises receives increasing attention not only from the scientific world, but also from the public authorities and the banking and financial sectors. SMEs play a fundamental role in the economic sectors of several countries around the world. They represent a continuous source of economic dynamism, accounting for three quarters of all jobs. They differ from large enterprises in their management methods, their relationships with customers, their integration into their environment and also in their financing methods. Today, SMEs are the main pillars of the modern economy.

The relationship between banks and SMEs is a topical issue insofar as these two actors play a very important role in the production system of a country. In Tunisia, the issue of the relationship between banks and SMEs has consistently been raised. Moreover, these relationships were, are and will be the subject of several debates and roundtables focusing on the importance of one for the other.

In addition, the prospects of economic recovery have given new relevance to the issue of SME financing. The bank and the enterprise are both partners in the development of the project, and their relationship is based on mutual trust and a desire to find the best solution together to ensure the success of the project.

However, the internal resources of small and medium-sized enterprises are insufficient, so to meet investment needs, an enterprise must rely on external resources. The SMEs that can meet the conditions of access to resources will receive the specific resources on terms that best suit their performance. Thus, bank credits constitute the essential share of SME financing if the need arises.

However, SMEs face difficulties in meeting their financial needs given the mismatch between their original innovative qualities and the quantitative and qualitative rationing imposed on them by the traditional financial system. One of the main difficulties encountered by SMEs is the reluctance of certain donors to grant them financial assistance because they have not yet proven their worth. These uncertainties lead banks to adopt a cautious attitude, which often results in young innovative firms being pushed out of the financing circuit. This caution can be explained by the poverty and opacity of the information structure of SMEs, by the high average risk that they present (Bank Commission, 1998), by their particularly opaque information system (Ang, 1991), and by their exposure to the phenomenon of rationing that can develop in the credit market (Yan, 1996). Bankers are, therefore, particularly exposed to the phenomena of adverse selection, moral hazard and opportunism.

Thus, our study aims to investigate the determinants of bank financing for SMEs in an asymmetric information context. We endeavor to identify the most important implications of bank financing decisions in the context of asymmetric information by analyzing the following three dimensions: The problem of asymmetric information in economic theory, the impact of asymmetric information on banks' financing decisions with respect to SMEs, and the determinants of bank financing for SMEs in the context of asymmetric information based on the case of the BIAT (Banque Internationale Arabe de Tunisie, or Arab International Bank of Tunisia).

The aim is to highlight the depth of the bank–company relationship and the need to analyze information asymmetry before a payment failure occurs. This will allow us to understand how the implementation of regular bank financing, which we will call relationship banking finance since it is part of both the duration and the multiplicity of exchanges between the parties, can allow SMEs to overcome their difficulties in obtaining financial resources. More precisely, we seek to evaluate the impact of such a contractual configuration on the financing conditions of these structures, which are particularly subject to difficulties associated with information asymmetry.

This paper is organized as follows: Section 2 comprises a review of the theoretical literature, Section 3 describes the research methodology, Section 4 presents the empirical results, and Section 5 contains the conclusion.

## **2. Theoretical Literature Review**

The idea of developing bank–company relations has been the subject of numerous empirical and theoretical studies aimed at specifying the place of bank financing in relation to the financial market and the debt structure of enterprises, especially those of SMEs. Uncertainty is central to the funding relationship. It relates not only to the conditions of the future world, but also to the behavior of the other party in the future. Credit is, in effect, pledged on an activity of the enterprise that has not yet taken place; there is no objective product on which to evaluate the transaction. If a firm is, a priori, in a less risky situation, it nevertheless has to demonstrate its ability to repay to the community of lenders and to earn the trust placed in it in order to renew its credit.

This section examines the empirical literature on the financing conditions experienced by SMEs. To do so, we will proceed in stages. First, we adopt a broad perspective in order to identify the main characteristics of their funding supply. We will also place particular emphasis on the opaque nature of these enterprises, i.e., the high degree of information asymmetry in which their potential financiers find themselves and the difficulties that this situation generates. Then, in a more precise manner, we review the work that specifically deals with the effect of the establishment of a banking finance relationship with the enterprises benefiting from it.

### *2.1. Opacity and Financing Difficulty*

The financial literature agrees that SME financing is mainly characterized by limited access to different sources of funds due to their opacity (Ang, 1992). Opacity is defined as the inability of potential external funders to fully understand the risk characteristics of firms, potentially due to poor business history or lack of complete and reliable financial information. Berger and Udell (1998) proposed a study of different forms of financing used by SMEs in the USA according to different levels of opacity based on the age and size of the firms. The results point to the primacy of internal financing, which is less subject to information asymmetry, with an average in the sample of two thirds of the equity and one third of the debt coming directly from the main owner. Bank debt, on the other hand, appears to be the primary source of external financing, just before supplier credit.

## *2.2. Benefits of the Bank–Corporate Client Relationship*

Numerous empirical studies have sought to identify the effects of establishing a relationship between the banking finance system and the financing conditions of enterprises. The vast majority of these studies show a reduction in the difficulties linked to information asymmetry associated with this type of contract. These studies can be broken down into two main categories. The first is based on the event study method, which consists of measuring the presence of abnormal returns on the securities of firms when announcements are made in relation to the concept being tested, in this case, the presence of relationship banking. These contributions follow the article by James (1987) and concern essentially large companies, since they are listed. The second is based on the analysis of contract data, which assesses the measures of the conditions of credit granted to firms, the availability of financing (fewer rationing problems), the cost and required collateral and, in light of indications of relationship banking, the duration of the relationship between the bank and the firm, its degree of exclusivity, and its scope.

## *2.3. Financing Conditions and Credit Rationing*

The bank can undertake a number of actions and require certain conditions when drafting a credit agreement contract, such as collateral requirements, interest rate, and credit rationing. Theoretical literature (Chan & Thakor, 1987) found that real guarantees can limit the problems of moral hazard and adverse selection in credit agreements. The bank sees these guarantees as the best solution to the asymmetric information problems that arise between the firm and the bank. The bank requires greater collateral and continuously controls the collateral rate (Rajan & Winton, 1995) in order to reduce the risk of loan default and to persuade the borrower to meet his commitments. Nevertheless, the longer the credit partnership lasts, the lower the collateral requirements become (Berger & Udell, 1995).

The bank also considers the interest rate as a means of protection against credit default. The bank sets the interest rate depending on the volume of credit granted, the borrower's situation, the nature of the relationship established with the borrower, etc. However, Cowling and Westhead (1996) stated that the interest rate is used as a compensatory means for the bank to take on additional risk. Banks may charge higher interest rates when establishing a credit relationship with a new customer because they consider specific information about the borrower to be an important part of their relationship (Rajan, 1992). On a practical level, strong credit relationships are generally associated with lower interest rates (Berger & Udell, 1995). The borrower is required to pay interest on the debt at fixed intervals to ensure repayment of the credit. Credit rationing cannot be ruled out, and the bank may find it impossible to verify exactly what the firm's intentions are due to a lack of information. In this way, the risk of moral hazard is present. It particularly arises in the event of misappropriation of the funds lent by the creditors for purposes that are riskier than expected, with a minimization of the value of the investment at the expense of the risk. The bank may also be subject to misappropriation of a portion of the gains from the investment due to information asymmetry. As a result, in the event of credit repayment difficulty, it often has to check whether this situation stems from a bad economic situation or from opportunistic behavior by the SME (Williamson, 1988). All of these phenomena may lead lenders to plan adjustments through borrower rationing, which is particularly important in the SME credit market. Credit selection and evaluation mechanisms are very important in the process of bank credit approval. However, as a result of technological development, banks can invest in information technology that allows for a proper review of credit applications, monitoring of projects, reduction of credit default risks, and debt rationing (Watanabe, 2004). Generally speaking, rationing refers to the refusal of the banking sector to lend to enterprises at the requested quantity rates. This phenomenon occurs when banks are no longer able to discriminate between bad (non-creditworthy) and good (creditworthy) borrowers. From this point of view, information asymmetry can transform the way firms are financed, and in general, the financing structure of an economy.

## **3. Research Methodology**

After studying the first two aspects focusing on the problem of information asymmetry in economic theory and the related problems that hamper SME financing opportunities, we attempt to apply these concepts to the reality of SME financing by taking the case of the BIAT. We study the financing granted by the BIAT and its relationship with certain variables, and we try to determine the extent to which the implications of this relationship influence the bank's financing decisions. We present the hypotheses of our research, the methodology used to collect data, the variables, and the chosen model. For this research, we considered a database composed of variables that were chosen based on recent studies on the financing of SMEs by banks.

### *3.1. Research Hypotheses*

Based on the studies that have examined the financing structure of SMEs, we have derived some hypotheses related to the choice of variables.

*Liquidity Crisis:* According to Alexandre and Buisson-Stéphan (2014), a liquidity crisis in an SME can generate significant losses, pushing it to increase its loan demand as long as it has not reconstituted a sufficient level of equity. In addition, SMEs are affected by the fact that a major part of their activity is

destined for large companies for which they have a supplier role. However, these large companies have significantly reduced their orders. These SMEs will thus have more opportunity to obtain a loan. Mialocq (2018) found that an SME liquidity crisis has a positive impact on its access to bank financing. By taking the case of French unlisted medium-sized companies, Mialocq has shown that the bank does not care about a liquidity crisis when granting a loan to this type of SME because it performs a preliminary check on the duration of the crisis to determine if it is temporary or structural. This result was confirmed by Mazeri and Mohammed (2019) on Algerian banks. We therefore state our first hypothesis as follows:

*H1: A liquidity crisis is positively correlated with access to finance for SMEs.*

*Net Position:* According to the results of the studies conducted by Colot and Croquet (2007) and Mazeri and Mohammed (2019), the net position of an SME is negatively related to the decision to grant a loan. These authors concluded that whenever there is a negative liquidity position within an SME, there is a reservation in lending. Hence, the second hypothesis is as follows:

*H2: Net worth is negatively correlated with access to finance for SMEs.*

*Firm Size:* Previous empirical studies have used firm size as an indicator of better credit quality and have shown that it can have a positive effect on access to credit (Cenni, Monferrà, Salotti, Sangiorgi, & Torluccio, 2015; Hernandez-Canovas & Martinez-Solano, 2007). As a firm grows, it may acquire more tangible assets that can be useful to the bank when assessing a firm's credit risk (Gompers, 1995). At the same time, larger firms can acquire more bargaining power and they can negotiate with the bank on credit terms that can facilitate loans with fewer restrictions and larger loan amounts (Cenni et al., 2015). Brancati (2015) showed that microenterprises in the Italian market are more credit constrained than SMEs, as information opacity is even more stringent for microenterprises. It is clear that microenterprises have a lower level of asset tangibility and it is difficult to assess their future growth rate. Similarly, large firms can more easily show better transparency of information to banks by producing audited financial statements (Berger & Udell, 2002; Ortiz-Molina & Penas, 2008). Overall, research shows that lower information opacity of large firms and reduced information asymmetry can have a positive effect on SMEs' access to bank financing. Therefore, we expect firm size to be positively related to access to finance. Based on this, we propose the following hypothesis:

*H3: Size is positively correlated with access to finance for SMEs.*

*Firm Age:* Research shows that younger firms are more vulnerable to restricted access to bank financing because information transparency is lower. It also asserts that younger firms have a lower level of asset intensity and, as a result, are credit rationed (Ferri & Murro, 2015). Similarly, banks are reluctant to lend money to younger firms because survival rates are lower than those of older firms (Dierkes, Erner, Langer, & Norden, 2013). In his study, Kirschenmann (2016) found that young firms are more likely to be credit rationed since they received no previous loans from banks and, therefore, it is difficult for banks to judge their repayment ability. Moreover, access to credit also depends on the survival analysis of firms, and in this context (Shumway, 2001) has shown that default rates for younger firms are higher than those of older firms. From the perspective of the bank–borrower relationship, older firms can establish a long-term relationship with banks, which is less likely for younger firms. Thus, based on the banking relationship, older firms may receive more credit from banks (Cenni et al., 2015; Comeig, Fernández-Blanco, & Ramírez, 2015). Given the above literature, we formulate the following hypothesis:

*H4: Age is positively correlated with access to finance for SMEs.*

*Innovation:* Recent research shows that innovation is very important for the long-term growth of firms seeking to attract new customers. By innovating, a firm can create an advantage over its competitors, which helps generate an additional profit margin (Baregheh, Rowley, & Sambrook, 2009). Previous studies have shown that European SMEs are more likely to rely on bank loans to support their innovative ideas, as they cannot raise funds from the external financial market (Lee, Sameen, & Cowling, 2015). However, the lack of support from commercial banks negatively affects firms' ability to innovate (Mohnen & Röller, 2005). Investments in innovative activities are generally risky because investment returns are uncertain (Hall, 2002). In the UK context, Lee et al. (2015) showed that innovative firms seek more external sources of finance than non-innovative firms. They also showed that innovative firms are more likely to be credit rationed than non-innovative firms. Similarly, Pederzoli, Thoma, and Torricelli (2013) showed that default rates for innovative firms are higher than for non-innovative firms. They argued that, in most cases, R&D investments for SMEs are not profitable, and innovative SMEs suffer more payment defaults. Brancati (2015) studied the financing opportunities for innovative firms in the Italian market and found that high-tech firms are more rationed by banks than non-tech or non-innovative firms. The author argued that commercial banks cannot assess the growth prospects of innovative firms and that this may result in a lack of financing. Because of the uncertainties associated with innovative SMEs, the latter are perceived as risky investments by banks and, therefore, innovative SMEs are more likely to receive fewer bank loans. Therefore, we assume that there may be a negative relationship between firm innovation and access to finance.

*H5: Innovation is negatively correlated with access to finance for SMEs.*

*Interest Rate:* In their study of Portuguese SMEs, Farinha and Félix (2015) found that banks offering lower interest rates received more loan applications than those offering higher interest rates. According to

Neuberger and R athke-D oppner (2015) and Stefani and Vacca (2015), there are several factors that can affect interest rates on loan contracts, such as the availability of collateral, concentration and competition in the credit market, the size and type of ownership of the bank, the characteristics of the SME and the bank, and the maturity of the loan. Hernandez-Canovas and Martinez-Solano (2007) stated that borrowers are discouraged from obtaining loans from banks when the cost is too high, causing their debt burden to increase, negatively affecting firm value. Thus, we predict a negative correlation between access to finance and interest rates as high borrowing costs may discourage borrowers from taking large loans from the bank. Hence, the following hypothesis is proposed:

*H6: Interest rate is negatively related to access to finance for SMEs.*

*Information Asymmetry:* In the bank debt relationship, information asymmetry is present throughout the execution of the contract. This leads to problems of adverse selection, moral hazard and opportunism, which explains the particular nature of the bank financing relationship. Lenders are forced to exclude firms deemed to maximize information asymmetry, such as SMEs. This results in a rationing equilibrium (Stiglitz & Weiss, 1981). To reduce information asymmetry, some studies recommend a signaling strategy (Harris & Raviv, 1990; Leland & Pyle, 1977). Thus, a high amount of trade credit is a good indicator of a firm's solvency vis- vis its partners, which encourages banks to grant it credit. Diamond (1984); Haubrich (1989) and Sharpe (1990) showed that a firm's good reputation positively influences its relations with creditors. Banks therefore refer to trade credits as an indicator of reliability and a lower risk of payment default. Profitability is also a good signal of a firm's financial reliability, which increases the supply of bank loans (Coleman & Carsky, 1999; Panno, 2003). Profitability can be understood in terms of return on assets (ROA), which is the ratio of net profit to total assets (Kremp, Stoss, & Gerdesmeier, 1999). Based on the above, our hypotheses are as follows:

*H7: A firm's good reputation with its business partners is positively related to access to finance.*

*H8: Financial profitability is positively related to access to financing.*

### *3.2. Sample and Data*

Our sample is composed of 250 Tunisian SMEs financed by BIAT, broken down by sector of activity, size,<sup>1</sup> and region. The database is a collection of accounting data and selected information related to loan granting. These data were collected from the SME Credit Risk and Retail Clients Department and Superior Credit Committee of the BIAT.

### *3.3. Definition of Variables*

At the empirical level, the objective of the research is to highlight certain criteria used by the BIAT in the decision to grant credit to SMEs. This is related to the specification of the variables and their corresponding retained measures. Our database includes one endogenous variable and eight explanatory variables.

#### *3.3.1. The Variable to be Explained*

Theoretical models of customer relationships in banking are almost all models of asymmetric information (Diamond, 1984; Sharpe, 1990). Once information imperfection is taken into account, it becomes impossible for the lender to determine the quality of the borrower, or impossible or very costly to monitor the actions of an agent (Psillaki, 1995). Thus, the information imperfection faced by lenders has a considerable influence on the assessment of the quality of potential borrowers in the credit market, which is in line with the approach developed by Akerlof (1970). By exploiting this literature and applying it to the Tunisian context, the dependent variable is measured by the amount of credit requested by the SME, and not the amount actually granted by the bank.

#### *3.3.2. Explanatory Variables*

Given the difficulty of obtaining variables that measure the problem of information asymmetry in the field of information economics, we resorted to approximate variables that can mitigate these difficulties and be broken down into three groups. Referring to the study by Mazeri and Mohammed (2019), we found it appropriate to classify these variables into three groups: variables measuring information symmetry, variables that mitigate the problem of information asymmetry, and variables that reinforce the problem of information asymmetry. Table 1 defines the different variables selected in our study, presents their measures and the phenomena they describe, and specifies the expected signs.

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<sup>1</sup> In Tunisia, the criteria used differ according to the legislative or regulatory provisions of the SME aid schemes. The National Directory of Enterprises (RNE) maintained by the National Institute of Statistics (INS) has adopted, for statistical purposes, the following definitions: Microenterprises are units employing fewer than six workers, small enterprises are units employing between six and 49 workers, and medium enterprises are units employing between 50 and 199 workers.

Table 1. Definition of variables and expected signs.

Variable	Measure	Phenomenon	Expected sign
Variables under symmetric information.			
Liquidity crisis (LC)	Gross operating surplus - financial expenses/turnover	Support cost	+
Net situation (NS)	Total assets/Total indebtedness	Potentialities of recovery	-
Variables under asymmetric information: Variables that will mitigate the problem of information asymmetry.			
Size of the SME (SIZE)	Ln (Turnover)	Existence of asymmetric information	+
Age of the SME (AGE)	Number of years the firm has been operational	Existence of asymmetric information	+
Innovation (INNOV)	Dummy variable equal to 1 if the SME has launched new products or services in the last three years, and 0 otherwise	Existence of asymmetric information	-
Trade credits (TC)	Trade payables and related accounts/equity	Existence of asymmetric information	+
Profitability (ROA)	Net profit/total assets	Existence of asymmetric information	+
Variable under asymmetric information: Variable that reinforces the problem of asymmetric information			
Interest rate (INTEREST)	Appropriate interest rate charged on the loan	Asset substitution risk	-

Measure	Phenomenon	Expected sign
Gross operating surplus - financial expenses/turnover	Support cost	+
Total assets/total indebtedness	Potentialities of recovery	-
Ln (Turnover)	Existence of asymmetric information	+
Number of years the firm has been operational	Existence of asymmetric information	+
Dummy variable equal to 1 if the SME has launched new products or services in the last three years, and 0 otherwise	Existence of asymmetric information	-
Trade payables and related accounts/equity	Existence of asymmetric information	+
Net profit/total assets	Existence of asymmetric information	+
Appropriate interest rate charged on the loan	Asset substitution risk	-

### 3.4. Empirical Estimation Methodology

To estimate the proposed model, it is necessary to choose the appropriate methodology. In line with the existing literature, we proceed with a multiple linear regression (see Equation 1). The choice of function type has been studied, namely by Short (1979), and the results show that a linear analysis produces results that are "as good as with any other type of function". This model works as follows:

$$CREDIT_i = c + \sum_{j=1}^n \alpha_j x_i^j + \varepsilon_i \quad (1)$$

$CREDIT_i$  represents the loan amount requested by the SME "i",  $c$  is a constant,  $x_i^j$  are the independent variables described above, et  $\varepsilon_i$  represents the error. The model chosen in our study is largely inspired by

Ashiqur, Rahman, and Belas (2017), and is expressed as follows:

$$Ln(CREDIT) = c + \alpha_1 LC + \alpha_2 NS + \alpha_3 SIZE + \alpha_4 AGE + \alpha_5 INNOV + \alpha_6 TC + \alpha_7 ROA + \alpha_8 INTEREST + \varepsilon \quad (2)$$

In Equation 2, we regress the variables chosen in a linear regression model using EViews. The dependent variable is measured by the natural logarithm of the amount of the loan requested by the SME and not the amount granted by the bank, which is a proxy for access to finance. To test the hypotheses, we considered variables that could affect the credit granting decision of the commercial bank. The size of the SME (SIZE) is measured by the Napierian logarithm of sales. It is more likely that larger firms (high turnover) have more bargaining power and can acquire more assets, showing better credit quality. Firm age (AGE) is measured by the number of years the SME has been operational. We believe that the older a firm is, the more it can prove its creditworthiness to the bank by presenting its business history, and the more it can establish a long-term relationship with the bank. INNOV is a dummy variable equal to 1 if the SME has launched new products or services in the last three years, and 0 otherwise. It is widely accepted that the returns on innovation and R&D activities are uncertain, and therefore SMEs with innovative activities suffer from a lack of funding from banks. The interest rate variable (INTEREST) is the appropriate interest rate charged on the loan. Research assumes a negative relationship between the interest rate and the loan amount because a high rate will discourage borrowers from applying for large loans from the bank. Liquidity crisis (LC) is measured by the difference between the gross operating surplus of the SME and the financial charges related to its turnover. The net situation (NS) is measured by the ratio between the SME's total assets and its debts. Profitability is the return on assets (ROA) measured by the ratio of the net profit to the total assets of the SME. Finally, the trade credits (TC) variable represents trade credits measured by the ratio between trade payables and related accounts and the SME's own funds. A multiple linear regression using the ordinary least squares (OLS) method was implemented to explain the financing decisions through the previously determined variables.

#### 4. Interpretation of Results

Before presenting our econometric estimates, a descriptive analysis of the data that brings together the observations of the different SMEs is essential. This first exploratory step ensures the understanding of the results from the regressions and proposes the characteristics and the econometric methods that correspond to the phenomena revealed by descriptive statistics.

##### 4.1. Descriptive Statistics

Table 2 presents the discrepancies between the average values of the explanatory variables and the variable to be explained and their standard deviations for the different SMEs in the sample.

Table 2. Descriptive statistics of the SMEs.

Variable	CREDIT	SIZE	AGE	LC	INNOV	NS	INTEREST	TC	ROA
Observations	250	250	250	250	250	250	250	250	250
Mean	5.824	6.636	2.484	0.162	0.170	1.492	0.085	1.172	0.049
Standard deviation	0.443	0.555	0.588	0.391	0.377	0.706	0.008	1.408	0.0428
Skewness	-0.309	-0.248	-0.267	5.753	1.757	0.111	-0.894	0.324	0.142
Kurtosis	3.262	3.009	2.735	47.33	4.087	2.952	19.460	2.536	3.518
Jarque–Bera	1.888	1.030	1.486	8742	56.37	0.215	19.460	1.487	1.419

The results in Table 2 show that the average amount of credit granted by the BIAT to Tunisian SMEs is around 5,824 with a fairly high average interest rate of 8.5%, and that the average age of the firms is two and a half years. It also emerged that only 17% of firms have launched new products or services in the last three years, showing that these SMEs do not have a strong orientation toward innovative activities. The Kurtosis coefficient (distribution coefficient) for most of the variables implies a high probability of extreme points and series with thicker tails than the normal distribution. In addition, the Skewness coefficient, which measures the skewness of the distribution, is non-zero, indicating the presence of asymmetry. Finally, the Jarque–Bera test statistic has a high value, which confirms the non-normality of the data studied.

Table 3. Correlation matrix for SMEs.

Variable	CREDIT	SIZE	AGE	LC	INNOV	NS	INTEREST	TC	ROA
CREDIT	1.000								
SIZE	0.564*	1.000							
AGE	0.226	0.358*	1.000						
LC	-0.052	-0.115	-0.071	1.000					
INNOV	-0.128	-0.116	-0.248*	0.202	1.000				
NS	0.142	0.131	0.158	0.012	-0.075	1.000			
INTEREST	0.282*	0.154	0.042	-0.217	-0.024	0.040	1.000		
TC	0.213*	0.034	0.053*	0.067	0.165	0.037	0.041*	1.000	
ROA	0.317*	0.004	0.001	0.054*	0.072	0.165*	0.002	0.043	1.000

Note: \* indicates statistical significance at 5%.

In order to detect a possible relationship between the different variables, Table 3 presents the different correlation coefficients. This matrix takes into account the observed relationship between the different explanatory variables. Thus, the correlation coefficient is an indicator that gives us an idea about the activity of the linear relationship between two variables. As shown in this table, the correlation coefficients between the different explanatory variables are low. Thus, no variable will be excluded from the model.

To study the stationarity of the variables, we used the augmented Dickey–Fuller (ADF) test. We will accept the hypothesis of the existence of a unit root, i.e., a non-stationary process, when the empirical value of the ADF test is greater than that of the t-statistic. Table 4 presents the results of the ADF tests applied to each of the variables. The comparison of the ADF test values with the t-statistics values (MacKinnon's statistic) shows that all the variables are stationary at first difference since the ADF statistics are lower than the critical value at the 5% threshold.

Table 4. Summary of the augmented Dickey–Fuller (ADF) stationarity test.

Variable	ADF test value	Critical value at 5%	Integration order
CREDIT (-1)	-9.493490	-2.890926	I(1)
AGE (-1)	-10.35662	-2.890926	I(1)
LC (-1)	-9.894688	-2.890926	I(1)
NS (-1)	-8.634633	-2.890926	I(1)
SIZE (-1)	-8.454663	-2.890926	I(1)
INTEREST (-1)	-8.722648	-2.890926	I(1)
TC (-1)	-9.564267	-2.890926	I(1)
ROA (-1)	-9.529012	-2.890926	I(1)

#### 4.2. Empirical Results

In the following, we present the results of the estimates according to the firms' sector of activity, size and region.

##### 4.2.1. Based on the Firms' Sector

Table 5 displays the empirical results by considering all SMEs and then disaggregating them by their sector of activity. The Fisher test indicates that the model is globally significant up to the 1% threshold (Prob > F = 0.0000). The goodness of fit is acceptable since the model explains 44.55% of the total variance. The coefficient of multiple determination of the model (R<sup>2</sup>) is equal to 0.445, and the adjusted coefficient of multiple determination is equal to 0.403, showing that the model variables explain 40% of the dependent variable. The remaining 60% is attributed to the influence of factors not recorded or not taken into account in this study.

Table 5. Regression results by sector of activity of the SME.

Variable	Total firms log (CREDIT)	Industrial firms log (CREDIT)	Commercial firms log (CREDIT)	Service firms log (CREDIT)
SIZE	0.29885 (4.40387)***	0.32444 (3.06967)***	0.48507 (3.61477)***	0.05960 (0.80721)
LC	0.054990 (0.565194)	0.06259 (0.565833)	0.85687 (2.953534)***	0.01806 (0.098615)
INNOV	-0.08743 (-0.76790)	-0.19858 (-1.38041)	0.36607 (2.25628)***	-0.36940 (-3.45725)***
NS	0.03020 (0.600491)	0.12464 (2.026752)**	-0.05510 (-0.874114)	-0.23168 (-1.329673)
INTEREST	8.72613 (2.090263)**	4.15750 (0.592694)	12.8842 (2.312683)**	6.62050 (0.668445)
AGE	0.00479 (0.681397)	0.00094 (0.110266)	0.00917 (1.236648)	0.00261 (0.549423)
TC	0.03265 (1.54623)**	0.01487 (0.36512)**	0.28712 (0.36912)**	0.00451 (0.04198)**
ROA	0.00986 (1.62809)*	0.03167 (1.52768)	0.11276 (0.04167)**	0.17865 (0.45612)
_CONS	2.67242 (5.333217)	2.65039 (4.046244)***	0.89126 (0.939844)	4.98854 (4.191634)***
Number of firms	250	109	86	55
R-squared	0.445565	0.503212	0.633021	0.756543
Adjusted R-squared	0.403379	0.420414	0.530266	0.601616
Log-likelihood	- 30.55162	-15.35129	-3.473318	9.265211
F statistic	10.56208	6.077589	6.160532	0.010021
Prob (F statistic)	0.000000	0.000062	0.000295	0.000021

Note: ( ) Student's t-distribution; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Table 5 shows that SME size, interest rate, trade credits and profitability are the four statistically significant variables. The SIZE variable is positively and significantly correlated at the 1% threshold with the volume of credit granted by the BIAT. This result confirms those found by Cenni et al. (2015) and Hernandez-Canovas and Martinez-Solano (2007) and shows that the larger the firm becomes, the more bank financing it can acquire. We can explain this result by the fact that larger firms have a lower risk of bankruptcy than smaller firms and this is due to a greater diversification of activities. Thus, by reducing the volatility of cash flows, this diversity also reduces the probability of bankruptcy and, consequently, increases the attractiveness of debt. Hypothesis H3 is therefore accepted. Also, it is interesting to note that the SIZE variable is positively and significantly correlated at the 1% threshold with the volume of loans granted to industrial and commercial SMEs. This result shows that the BIAT considers the size of these two types of SME as a positive signal when considering granting a loan. This can be explained by the high transparency of information of industrial and commercial SMEs, which facilitates the possibility of obtaining a bank loan (Bolton, Freixas, Gambacorta, & Mistrulli, 2016; Ferri & Murro, 2015) in contrast to service SMEs.

The INTEREST variable is positively and significantly correlated at the 5% threshold with access to finance for SMEs. This result corroborates the result found by Ashiqur et al. (2017). It shows that the loan amount increases with an increase in the interest rate. In other words, the higher the loan amount, the higher the risk. Therefore, banks may charge a higher interest rate as the loan amount increases. Moreover, a large loan amount may increase the moral hazard problem, causing banks to charge sufficiently high interest rates to receive their compensation in a relatively short period of time. Hypothesis H6 is therefore rejected. We also note that there is a positive and significant correlation at the 5% threshold between the INTEREST variable and the volume of credit granted to commercial SMEs. This result shows that the BIAT considers high interest rates when planning to grant credit to commercial SMEs. However, we did not find significant results for the other two sectors of activity.

Trade credits (TC) are positive and significant at the 5% threshold. This supports the important role played by the reputation effects of the SME with its business partners regarding its access to bank credits. This result confirms hypothesis H7, which posits that the role of trade credit as a signaling tool facilitates SMEs' access to bank credit. This positive relationship can be explained by the signaling theory. The preponderance of trade credits is a good indicator of a firm's ability to honor its commitments, which encourages banks to finance them. Several authors have shown that taking into account a firm's reputation positively influences its relations with its creditors (Diamond, 1984; Haubrich, 1989; Sharpe, 1990). The role of the signal attributed to trade credits is confirmed by the estimates for the three sectors of activity identified. Banks refer to trade credits as an indicator of good payment reliability, regardless of the activity.

The link between return on assets (ROA) and the volume of credit granted differs between manufacturers and service providers, and manufacturers and traders. On the one hand profitability encourages manufacturers and service providers to reduce their debt. On the other hand, profitability encourages traders to obtain bank loans. These results can be explained by the nature of commercial activity, which is difficult to assess for banks. The wealth created by trading firms cannot be measured by indicators such as value added. Moreover, their assets are mainly current assets consisting of inventories. Banks are more sensitive to the performance of firms, and profitability is therefore a good signal of reliability. We therefore confirm hypothesis H8.

The AGE variable is positively correlated with loan size but is statistically insignificant regardless of the SME's sector of activity. This result corroborates those obtained by Comeig et al. (2015) and Cenni et al. (2015) and contradicts the results of Petersen and Rajan (2002). It shows that older and more mature firms need a relatively higher amount of debt from financial institutions to have more liquidity for investment. In addition, the older the SME is, the better relationship it can form with banks (Brancati, 2015; Neuberger, R athke, & Schacht, 2006). Hypothesis H4 is therefore accepted.

The INNOV variable is negatively and significantly correlated at the 1% threshold with the size of the loan granted to SMEs in the service sector. This result shows that innovative service SMEs represent risky investments for banks. It confirms the finding of Brancati (2015) that high-tech firms are more rationed by banks than non-tech or non-innovative firms and that banks cannot assess the growth prospects of innovative firms, hence the lack of financing. Hypothesis H5 is therefore accepted.

The liquidity crisis (LC) variable is positively and significantly correlated at the 1% threshold with the loan amount for commercial SMEs. This result confirms the one found by Mazeri and Mohammed (2019) for Algerian banks. It appears that the bank does not care about the problem of a liquidity crisis when granting the loan to this type of SME, since it performs a preliminary study on the duration of the crisis to determine if it is temporary or structural. Therefore, hypothesis H1 is accepted.

For the net situation (NS) variable, the results of the estimate show a positive and significant correlation at the 5% threshold with the amount of credit for industrial SMEs. This result is in contrast to those found by Colot and Croquet (2007) and Mazeri and Mohammed (2019). We can conclude that the positive liquidity position of industrial SMEs encourages banks to finance them, and hypothesis H2 is therefore rejected.

#### *4.2.2. Based on the Size of the Firm*

The results of the regression model estimates by SME size are shown in Table 6. It shows that the SIZE variable is positively and significantly correlated at the 5% threshold with the total volume of credit granted

by the bank, regardless of the size of the SME (micro, small or medium). This result shows that banks grant credit independently of the size of the SME.

The INNOV variable is negatively and significantly associated at the 5% threshold with the dependent variable for microenterprises. In other words, the more a microenterprise innovates, the less it could benefit from bank financing. This may be due to poor growth prospects for microenterprises in the market. However, a positive relationship between the INNOV variable and total credit volume was detected for medium-sized SMEs. We can deduce that these firms are not penalized by the BIAT; on the contrary, the BIAT values the innovation activities of medium-sized firms by providing them with financial support.

The INTEREST variable is positively and significantly correlated at the 10% threshold with the volume of credit granted by the bank, particularly for microenterprises. This result shows that the BIAT considers high interest rates when it plans to grant loans to microenterprises, given that the latter are substantially risky. Interbank competition may affect a bank's decision to extend credit to high-risk borrowers, and a high interest rate represents an incentive for the bank to increase its profit margin.

Trade credits (TC) and ROA present a positive and significant signal at the 10% threshold for all SMEs regardless of size. This relationship supports the important role played by the reputation of the SME with its commercial partners in its access to bank credits. Profitability is also signal of the financial reliability of the firm. These results confirm the roles of trade credit and profitability in facilitating SMEs' access to bank credit.

The AGE variable is negatively and non-significantly correlated with the dependent variable for micro and small firms. The negative sign of this relationship can be explained by the fact that an older firm may have succeeded in accumulating a significant amount of equity through self-financing and, consequently, needs less financing. In contrast, this variable is positively related to the volume of credit for medium-sized firms. This result corroborates the findings of Dietsch (2003), who pointed out that SMEs need to be able to build long-term relationships with banks in order to strengthen their confidence and thus facilitate their access to credit. This positive impact can be explained by the intensification of the trust between medium-sized SMEs and the BIAT over time.

**Table 6.** Regression results by SME size.

Variable	Micro firms log (CREDIT)	Small firms log (CREDIT)	Medium firms log (CREDIT)
SIZE	0.66299 (3.429663)**	0.31309 (2.199317)**	0.27813 (2.454463)**
LC	1.21741 (3.574812)**	0.05610 (0.456642)	0.29424 (0.914981)
INNOV	-0.41309 (-2.49166)**	-0.27223 (-1.33018)	0.10049 (0.61705)
NS	-0.29312 (-1.47071)	0.06190 (0.81837)	-0.09377 (-1.14414)
INTEREST	12.5451 (1.930750)*	8.91197 (0.826225)	7.78776 (1.035794)
AGE	-0.00441 (-0.360256)	-0.00136 (-0.164489)	0.00719 (1.013244)
TC	0.41543 (1.55817)*	0.09126 (1.34254)*	0.17231 (0.02654)*
ROA	0.00943 (0.17698)*	0.05413 (0.091253)*	0.01128 (0.106215)*
_CONS	-0.10295 (-0.08670)	2.41359 (1.79535)	3.07877 (3.09030)**
Number of firms	33	75	142
R-squared	0.779498	0.426322	0.410714
Adjusted R-squared	0.669248	0.282902	0.292857
Log-likelihood	1.182925	-10.43956	-9.461714
F statistic	7.070228	2.972548	3.484850
Prob (F statistic)	0.001005	0.018388	0.006143

Note: ( ) Student's t-distribution; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Finally, we can highlight the positive and significant relationship at the 5% threshold between the LC variable and the amount of the loan for microenterprises, showing that the bank is not concerned about a liquidity crisis when granting loans, especially for this type of SME.

## 4.2.3. Based on the Region of the Firm

In this third step, we present the results of the estimation of the regression models according to the region of the SME. The estimation results in Table 7 show that the size of the SME is positively and significantly correlated at the 5% threshold with the dependent variable, namely for SMEs located in the District of Tunis and in the Central East.

This shows that the BIAT is more active with these SMEs, which receive more support than those located in the Northeast. This result can be explained by the fact that the BIAT has a higher number of branches in these regions, which, in 2020, accounted for more than a third of the industrial fabric (35.1% in the District of Tunis and 24.2% in the Central East).

The INNOV variable is negatively and significantly related at the 5% threshold with the volume of credit granted to SMEs located in the District of Tunis and the Central East. This result is explained by the fact that innovative firms located in these regions are generally risky because the returns on their investments are uncertain; they are also likely to be rationed in terms of credit. Thus, innovative SMEs are more likely to receive fewer loans from the BIAT, which would not be able to assess their growth prospects.

The AGE variable is positively and significantly related at the 10% threshold with the dependent variable for SMEs located in the District of Tunis, but negatively and significantly related at the 5% threshold for SMEs located in the Northeast and Central East.

Table 7. Regression results by SME region.

Variable	District of Tunis log (CREDIT)	Northeast log (CREDIT)	Central east log (CREDIT)
SIZE	0.546432 (3.79866)**	0.319876 (2.76490)	0.128975 (2.17954)**
LC	1.376651 (3.52678)	0.547424 (0.28065)	0.154643 (0.75491)
INNOV	-0.312765 (-2.48749)**	-0.165743 (-1.94571)	-0.111765 (-0.19053)**
NS	0.298564 (1.26479)	0.004123 (0.18934)	0.852764 (1.19561)
INTEREST	11.54364 (1.85743)*	7.324567 (0.12645)	6.128756 (1.98301)
AGE	0.231456 (0.22543)*	-0.067578 (-0.13854)**	-0.023451 (-1.23185)**
TC	0.12753 (1.08278)**	0.05287 (0.06442)**	1.42698 (1.65497)**
ROA	0.06575 (0.04167)***	0.14723 (0.03653)***	0.00512 (0.01278)***
_CONS	-0.235342 (-0.01275)	2.318765 (1.18724)	3.624865 (3.68123)**
Number of firms	112	85	53
R-squared	0.64894	0.517865	0.365464
Adjusted R-squared	0.52687	0.384654	0.197869
Log-likelihood	1.12167	-9.65464	-8.546475
F statistic	7.18943	3.657437	2.657427
Prob (F statistic)	0.00000	0.000012	0.000015

Note: () Student's t-distribution; \*\*\* significance at 1%, \*\* significant at 5%, \* significant at 10%.

This result can be explained by the fact that SMEs located in the District of Tunis are older and more mature and can thus establish a long-term relationship with the bank by benefiting from more credit. This is less likely for younger firms located in the Northeast and Central East, which are more vulnerable to restricted access to bank financing because the transparency of information is lower.

The profitability variable is positively and significantly correlated at the 1% threshold with the dependent variable for all SMEs regardless of region. This result shows that the most profitable firms have easier access to bank financing than the least profitable firms. The more profitable the firm, the easier it is to negotiate a loan contract. This is because they have a low risk of financial default.

Finally, the trade credit (TC) variable plays a positive and significant role at the 5% threshold, regardless of region. Moreover, this positive impact confirms that bank financing increases with the reputation effects of the SME with its business partners.

## 5. Conclusion

Tunisian SMEs are often neglected in empirical studies on the problem of bank financing in the context of asymmetric information. After reviewing the existing literature on the subject, we wished to carry out an econometric study to understand what role certain variables specific to SMEs could play, which we classified into three categories: variables measuring the symmetry of information, variables which attenuate the problem of the asymmetry of information, and variables that reinforce the problem of information asymmetry. This was done in order to determine the extent to which the implications of the bank–SME relationship contribute to influencing the bank's financing decisions. The sample consisted of 250 Tunisian SMEs financed by the BIAT, broken down by sector of activity, size and region.

Of the eight variables considered in our model, size, interest rate, trade credits and profitability have a statistically significant influence on the total volume of credit requested by SMEs. We also found that the BIAT considers the size of commercial and industrial SMEs, and those located in the District of Tunis and the Central East, as a positive signal when considering a loan; this can be explained by the high transparency of information of these companies, although it grants a credit regardless of the size of the SME.

The BIAT also considers high interest rates when considering offering loans to commercial SMEs, microenterprises and SMEs located in the District of Tunis, as these are substantially risky. As far as innovation is concerned, the results showed that service SMEs, microenterprises and SMEs located in the District of Tunis and in the Central East find it difficult to get a credit from the BIAT, which is reluctant to finance them, since these innovative SMEs represent risky investments. However, the bank values the innovative activities of medium-sized companies by providing them with financial support. We can also underline that the bank is not concerned about a liquidity crisis when granting loans, especially for microenterprises.

Finally, this study highlights the important role played by the SME's reputation with its business partners regarding access to bank credit, regardless of size, sector of activity or region. Similarly, the results confirm the role of profitability as a signaling device that facilitates SMEs' access to bank credit, especially for commercial SMEs.

It is interesting to note that the BIAT neglects liquidity issues and the net worth of the SME in its financing decision, which contradicts the theoretical assumptions. In fact, the bank's financing of newly created institutions accentuates the problem of information asymmetry.

Finally, we conclude that the BIAT's financing of Tunisian SMEs is characterized by conditions dominated by the problem of asymmetric information. It is then necessary to adjust the behavior of the bank and the SMEs in order to improve their access to financing, thus reinforcing the confidence in the bank–SME relationship.

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