Examining Collateral Prerequisites for Small and Medium-Sized Business Loans

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Abstracts: This paper examines the factors that affect loan collateral specifically for SMEs in Lebanon, which is a country with a small, open emerging market economy. Collateral should secure the bank loan, but in practice it is adjusted according to other socio-economic criteria of the firms. This is especially true for SMEs and even more so for emerging countries. We propose in this research to illustrate the signals mobilized by banks when granting secured loans. The data on these variables come from the Lebanese Central Bank and the World Bank. They contain observations for two samples - 532 firms for 2019 and 561 firms for 2013. A set of factors influence the level of collateral required: those related to firm characteristics (relevant variables: age, size, audit of financial statements, provision of training to workers, private shareholder ownership, quality recognition, experiencing at least one bribe request, female manager), manufacturing (reflects economic sector), interest rate (reveals loan characteristics), and location in the capital (reveals loan market characteristics). The logistic regression estimates suggest that collateral required by older firms is higher even that SMEs have financial statement revised annually by external auditors. Size and interest rate contribute to lower collateral requirements. The consistency of results in the combined panel, 2013, and 2019 shows the reliability of the Lebanese Banking Sector norms and policies.

Keywords: Financing, SMEs, Collateral, Credit Risk, Regression Analysis, Lebanon.

1. INTRODUCTION

Recent decades many scholars focus their research on the troubles the small and medium-sized enterprises (SMEs) face to acquire financing. These troubles are considered as financial constraints (Rahman, et al., 2017, p.650). The interest in this topic is motivated by the importance of SMEs for the overall economic landscape of each country, whether in developed or emerging countries. SMEs have main contribution to the growth of economy and the number of jobs (Ayyagari, et al., 2007). In emerging countries as Lebanon, whole economic sectors are dominated by small and medium-sized enterprises. Impediments to the development of SME's affect the other sectors of the economy and can hinder the country's economic growth. Collateral restrictions are cited as a key funding barrier by 16 percent of businesses that seek external loans, according to the World Business Environment Survey (WBES). Similarly, Beck et al. (2006) indicate that collateral requirements are the third most critical hurdle among the 12 financing difficulties they investigated, based on the WBES. High collateral requirements are the fourth most important reason why firms do not apply for external loans, according to the Business Environment and Enterprise Performance Surveys (BEEPS) of firms in Eastern Europe and Central Asia, ranking just behind the complexity of application processes and high interest rates. As a result, collateralization looks to be a critical component of a company's access to external funding, which can decide a company's downfall or survival. A large literature in banking micro-economics and micro-econometrics, documents the fact that SMEs have more difficulties to acquire financing than large firms (Beck et al., 2006; Rahman, et al., 2017). The small size often is a reason for banks to suspect the credibility of firms and raise the guarantees required for returning the amounts they have lent. Small firms are commonly expected to provide poor information and usually not producing audited financial statements that would cause difficulties for banks to evaluate the credit quality of the borrowers (Berger & Udell, 2002). They are suspected to benefit from generating information asymmetry. Banks are compelled to establish long-term relations with small firms to overcome this informational problem (Carter et al., 2004; Berger & Udell 2006). It is typical for the Japanese model of banking but in other cases it would make the process of financing more expensive (Beck & Torre 2007). As a result, SMEs could not be enough competitive to attract external financing desired. Commercial banks impose requirements with respect to the credibility of the firms applying for loans. Their prior intention is to prevent credit defaults and assure successful collecting the loan provided. The riskier the loan, the more restrictive the terms and the higher the collateral requirements are. In this sense, considering the SMEs as riskier borrowers suggest these firms would hold a larger share of the total number of collateralized loans. Reviewing the literature on the topic, Rahman, et al., (2017, p.651) pointed that collateral can alleviate adverse selection and moral hazard problems in a loan contract because collateral can act as a signaling

device for banks to sort out quality borrowers from risky ones (Bester 1985; Chan & Kanatas 1985; Besanko & Thakor 1987; Boot et al. 1991). However, collateral requirement itself is considered among the most important obstacles for the SMEs to acquire external loans (Beck et al., 2006; Rahman, et al., 2017. The empirical section is intended to contribute to the existing evidence on this topic by focusing on Lebanon's credit market. Data on these variables have been derived from the Lebanese Central Bank and the World Bank. It contains observations for two samples – 532 firms for 2019 and 561 firms for 2013. The empirical study is based on correlation and logistic regression methodology. The emphasis will be put on the impact of firm characteristics, loan characteristics and market characteristics on the requirement for collateral. Moreover, the country is situated in Asia, in the region of the Near East whose credit market differs from these ones of Europe and the United States. This factor will increase the potential of having new outcomes. The structure of the paper contains the following sections: first one provides theoretical background and review of the empirical evidence on factors affecting collateral (collateral determinants). Second section describes the method of empirical analysis, variables chosen, data, and its descriptive statistics. The third section performs logistic regressions for the pooled data and then with an annual dummy variable that reveals the effect of the year and discusses the results. The last section concludes.

Research problem

Many Lebanese SMEs are vulnerable to problems such as restricted access to loans due to the perception that their ability to provide transparent information is relatively weak. It is often assumed that relatively young firms are risky borrowers and therefore subject to credit rationing. This paper addresses the following research questions:

- What are the variables that affect the increase/ decrease of collateral needs?
- Does the size and age of the firm affect its ability to access finance in the Lebanese market?
- What is the effect of interest rate changes on the firm's ability to access loans?
- Is there consistency between the 2013 and 2019 results? If so, what does this reveal?

2. THEORETICAL BACKGROUND AND REVIEW OF THE LITERATURE ON COLLATERAL'S DETERMINANTS IN SMEs COLLATERAL-BASED LENDING

2.1. Theoretical Reasoning on Collateral-Based Lending

The importance of collateral seems particularly relevant for small and medium-sized enterprises (SMEs). What could be added for the case of Lebanon is that the existence of a guarantee is an essential element in obtaining loan approval, regardless of the SME's internal micro data. Empirical research in this area can be categorized into two research streams. In the first, collateral is studied as a solution to information asymmetries between borrower and lender. In the second line of research, collateral is studied as a means of increasing the supply of bank debt and directly reducing the probability of being rationed. The collateral keeps the high-risk firm from moving from a low-risk project to a higher-risk project after the loan is granted or from making less effort to complete the proposed project (Boot et al., 1991). Collateral can be indirectly seen as a solution to credit rationing through its ability to reduce informational opacity. At the same time, collateral is seen as a tool that directly reduces the probability of being credit rationed by increasing the supply of bank debt. Collateral can be considered as a determinant of the supply function of bank debt (Ogawa and Suzuki, 2000; Shen, 2002; Atanasova and Wilson, 2004). Greater availability of collateral is expected to increase the supply of bank debt because collateral can mitigate informational asymmetries between the borrower and the lender. Nowadays, including collateral clauses in the contracts is a standard way for overcoming information opacity and synchronizing the interests of borrowers and banks (Rahman, et al., 2017; Boot et al. 1991). Relaxing monetary policy will increase the supply of credit by commercial banks. Inversely, tightening of monetary policy is expected to reduce the supply of money and credit and thus increase the requirements imposed by the banks in applying for bank loans (Aiyar, Sh., et al., 2016). The collateral requirements would be directly determined by monetary policy which – on other hand – is determined by the macroeconomic dynamics and the phase of business cycle (Kashyap, et al., 1993; Kashyap, et al., 1994; Disyatat, 2008). Small and medium enterprises (SMEs) in Lebanon face greater challenges in obtaining financing than large corporations. A review of recent empirical studies on collateral and credit rationing will be presented in Table 5- appendix A as a

guide for typical research.

2.2. Collateral's Determinants in SMEs Lending

2.2.1. Size/ Age of Firm

Economists often use business size and age as proxies for information asymmetry in SME financing, finding that increased information transparency reduces collateral requirements (Rahman et al., 2017, p.654). Smaller and younger firms typically provide more collateral to demonstrate project quality when lenders are unfamiliar (Chan and Kanatas, 1985). Additionally, smaller firms may need more collateral due to their elevated risk of bankruptcy (Altman et al., 1977). Recent research by Ang et al. (1995) and Avery et al. (1998) has also been influential. According to Avery et al. (1998), larger companies, having more business assets that can be used as collateral, tend to face lower lender costs. In contrast, smaller firms often require more personal obligations. Furthermore, when larger companies seek corporate loans, their size can serve as a proxy for their past performance, leading to fewer personal commitments from lenders (Ang et al., 1995). Empirical studies consistently highlight the significance of a company's size, age, and capital in securing bank loans. Company size's impact on access is well-documented (Beck, Demirgüç-Kunt, and Maksimovic, 2005). Business age also plays a vital role in SME financing access, as older businesses often possess stronger reputations valued by lenders (Abor & Biekpe, 2007; Chittenden, Hall, & Hutchinson, 1996; Quartey, 2003). Furthermore, capital is crucial in enhancing access, as it assures lenders of protection against asset value loss. Consequently, firms with higher capital ratios are more likely to obtain credit than those with lower ratios.

H1: Collateral needs are negatively related to the firm's size and age.

2.2.2. External Audit of Annual Financial Statement/ Operating in Manufacturing Sector

Older and larger companies enjoy an advantage in the loan market due to their longer credit history and higher balance-sheet asset values, making them appear as better-credit-quality borrowers (Knyazeva & Knyazeva, 2012; Grunert & Norden, 2012; Menkhoff et al., 2006; Rahman et al., 2017). This advantage often results in these companies being required to provide less collateral for obtaining bank loans. The same advantage is associated with businesses that have greater financial transparency, often due to financial statement audits and the presence of tangible assets (Berger & Udell, 2002; Chakraborty & Hu, 2006; Ferri & Murro, 2015; Rahman et al., 2017). Moreover, businesses in the manufacturing sector tend to have a higher proportion of physical assets on their balance sheets, which enhances their trustworthiness in the eyes of lenders. SMEs following international accounting standards and employing external auditors for transaction documentation tend to secure external funding for their fixed-asset growth and working capital needs. Those adhering to international standards often rely on foreign-owned bank loans, while those with external auditors typically seek local loans (Barth et al., 2011). This supports the notion that transparent businesses face fewer financial constraints. Additionally, the presence of a controlling shareholder in an SME can further enhance the capacity of financial transparency to reduce financing limitations, particularly in less developed nations with weaker institutional frameworks (Hope, Thomas, and Vyas, 2009). Lenders often encounter significant challenges when SMEs, to which they have extended loans, fail. The informal nature of most SMEs makes it difficult to recover the funds provided. Smaller businesses also have lower survival rates compared to larger corporations, with manufacturing businesses employing fewer than 20 employees being particularly susceptible to failure (Storey, 1994).

H2: An audited yearly financial statement and a business working in the manufacturing sector have a beneficial impact on collateral requirements.

2.2.3. Shareholder Ownership

Ownership concentration plays a significant role in determining the level of collateral required when seeking a bank loan. Agency theory, as suggested by Rahman et al. (2017), predicts that as collateral requirements decrease, ownership tends to become more concentrated. While state-owned companies typically benefit from easier access to bank loans due to a "crowding-out effect," the impact of private ownership on collateral pledge is less clear. Steijvers et al. (2009) emphasize that various factors, including the loan amount, total assets, and whether a firm is family-owned or not, are key determinants of the collateralization decision, considering different types of credit, such as letters of credit (L/C) and personal versus business collateral. In contrast, Hanedar et al. (2014a) find that businesses with multiple owners are more likely to offer collateral, especially in developing markets where the enforcement procedure may be less effective. They also observe that sole proprietorship SMEs are less inclined to provide collateral. Rahman et al. (2017) presents another perspective, suggesting that SMEs with concentrated ownership are more likely to offer collateral.

H3: Private shareholder ownership of a firm decreases the requirement for collateral.

2.2.4. Female Top manager/ Experiencing Bribery Incidence

Borrower experience and gender are significant factors in collateral-based lending, as noted by Rahman et al. (2017). Research by Carter & Rosa (1998), Garwe & Fatoki (2012), and Rahman et al. (2017) underscores the influence of sexual stereotyping on commercial bank loan conditions. Borrower risk assessment, as indicated by Jimenez et al. (2006), Hanedar et al. (2014), and Rahman et al. (2017), considers proxies such as loan default, liquidity risk, past-due payments, criminal history, and bribery incidents. Baliamoune-Lutz and Lutz (2017) find that female-owned businesses in Middle Eastern and African economies secure more debt funding and exhibit larger management beliefs than other businesses, highlighting existing funding limitations faced by female-owned businesses in these regions. Effective contract enforcement, well-functioning property registration systems, and reliable credit rating systems are crucial prerequisites for mitigating the detrimental impact of information asymmetry on SMEs' access to external capital (Okura, 2007; Maurer, 2008). SMEs, especially in emerging economies, are particularly exposed to institutional underdevelopment due to their limited knowledge (Beck and Demirguc-Kunt, 2006). SMEs report fewer funding restrictions in countries with established economies, modern financial systems, and lower corruption (Beck, Demirguc-Kunt, and Maksimovic, 2005).

H4: Both the borrower's gender and the incidence of bribery influence collateral requirements.

2.2.5. International Recognized Quality/ Workforce Trainings

Holding globally recognized quality certification and maintaining the quality of the staff employed may help a company's image. SME personnel in developing countries frequently have lower levels of education than those in large corporations (Nichter and Goldmark, 2009). Collateral is viewed as a messaging method for banks to learn about the quality of the borrowers, and therefore pledging collateral can lower the credit risk of the loans by boosting access to the credits. On the other hand, disadvantaged borrowers may be required to furnish greater collateral due to capital restrictions and credit rationing from other sources (Gama and Duarte, 2015). Innovative training techniques are more likely to produce greater financial results than rivals who do not have such training (Noe, 2002). Training also assists SMEs in dealing with the most up-to-date accounting systems, information technology, management ideas, and manufacturing processes (Jones, 2004). According to Hanedar et al. (2014a), having a globally recognized quality certification (such as ISO 9000, 9002, or 14000) is an indication of greater borrower quality. Furthermore, Minard (2016) claims that while acquiring high-quality certifications is expensive, possessing one might minimize information asymmetry and signify higher borrower quality. According to Duarte et al. (2017), companies with a globally recognized quality certification are less likely to offer collateral for bank loans.

H5: Having an internationally recognized quality besides training the existing workforce negatively affects the collateral requirement.

2.2.6. Interest Rate

Banks analyze both collateral requirements and interest rates at the same time to screen investors' riskiness, which encourages the adoption of various contract terms as a self-selection mechanism to identify borrowers of varying risk levels. When borrowers know their credit quality, but lenders don't, collateral indicates good credit quality; borrowers with a higher risk of default instead choose a contract with a higher interest rate and less collateral. Rahman et al. (2017, p.657) predict a positive relationship between collateral and interest rates based on the observed risk hypothesis. According to their argument, borrowers may give greater collateral to get loans with lower interest rates, and therefore collateral serves as a substitute for lower interest rates. In emerging economies, inadequate market rules contribute to more concentration in the banking industry. Banks with more market power can charge higher interest rates, control the availability of money (Barth et al., 2011), and act selectively. A highly established banking industry offers more cash to SMEs, as well as longer-term and lower-interest loans (Barth et al., 2011).

H6: A loan contract with a high interest rate will almost certainly need less collateral.

2.2.7. Location in the Capital Town of Lebanon

The location of a business in the capital city is a good indicator for the concentration and growth of the lending market in an emerging-market economy. The conventional economic wisdom predicts that the market and income-levels are bigger in the capital town in comparison with the countryside. There, the competition among the banks is more intensive and the formal requirements could be expected to be laxer. Borrowers who are closer to their bank's location are required to provide less collateral. Due to information opacity, Hainz et al. (2013) found that SMEs located closer to banks are financed by screening, whereas distant borrowers must pledge collateral. According to Agarwal and Hauswald (2010), a shorter distance may boost bank efficiency in the loan screening process since the credit officer may visit the business more frequently and obtain firm-specific soft information.

H7: A firm's location in a capital city minimizes the requirement for high collateral.

3. EMPIRICAL METHODOLOGY AND DATA

3.1. Method and Variables

Logistic regression is used since the nature of the dependent variable is *Collateral* that has two possible cases: exist or no.

$$Coll_i = \alpha + \beta_{j1} * FC_{ji} + \beta_2 * Man_i + \beta_3 * IR_i + \beta_4 * CC_i + \epsilon_i$$

Where:

- C_i is a binary variable that takes value of one in each case of collateralized loan.
- FC_i is a set of variables representing the firm’s characteristics.
- Man_i shows belonging to the manufacturing sector of economy.
- IR_i is the most representative loan characteristics: interest rate.
- CC_i is a proxy for development of credit market that is location of a firm in the capital town.
- The parameter α is the constant value in the equation and $\beta_{1,2,3,4}$ are regression coefficients.
- The component of ε_i expresses the error term of the regression.

3.2. Data

The data have been derived from the database of the World Bank, Enterprise Surveys, What Businesses Experience. The raw data in this section of the World Bank's database have been accumulated through interviewing business owners and top managers between May 2019 and April 2020. These data include polls filled in by the representatives of 532 firms. Estimates will be run on data for second sample of firms. These data have been collected between April 2013 and September 2014. In this survey, owners, and top managers of 561 firms are interviewed. Thus, all these 532 and 561 cases are taken to fill in the observations of the variables in both the samples of empirical study of the present work. Firms of all the sizes have been included in the process of interviewing. Firms with 5-19 employees are defined as small firms. Firm hired between 20 and 99 are defined as medium-sized ones. Those having 100 and more employees are considered as large firms. Firms from all the regions of Lebanon have been interviewed. These regions are Mount Lebanon, Beirut, South Lebanon, Bekaa Valley, North Lebanon, and Nabatieh. Variables considered in the analysis are described in the table 1.

Table 1. Definitions and sources of the variables in regression model

Variable	Definition	Source
Collateral (COLL)	Dependent variable: Binary variable which takes value 1 if a firm has pledged collateral to receive an external loan	World Bank
Size (SZ)	Size of firm, measured as the average number of full-time employees	World Bank
Age (AG)	Age of firm, measured as the average number of the years of existence	World Bank
Audit (AUD)	Binary variable which takes value 1 if the firm's annual financial statement is audited by external auditors	World Bank
Ownership (OWN)	Binary variable which takes value 1 if a firm is owned by private shareholders	World Bank
Female (FM)	Binary variable which takes value 1 if a firm's top manager is female	World Bank
Quality (QUA)	Binary variable which takes value 1 if a firm has an internationally recognized quality certification	World Bank
Workforce training (WFT)	Equal 1 if the firm offer trainings to its workers	World Bank
Bribery Incidence (BI)	Equal 1 if firms experiencing at least one bribe payment request	World Bank
Manufacturing (MAN)	Binary variable which takes value 1 if a firm operates in the manufacturing sector	World Bank
Interest rate (IR)	Average value of the basic interest rate owed on a bank loan	Lebanese Central bank
Capital city (CC)	Binary variable which takes value 1 if a firm is in the capital town of Lebanon.	World Bank

4. EMPIRICAL ESTIMATION AND REGRESSION RESULTS

4.1. Variable Importance

The filter method is used to assess the importance of each variable. The weights of the variables help to rank the independent variables from the one that has the most influence on the dependent variable to the one that has the least influence. Age, size, and interest rate are the three most important variables respectively. The incidence of bribery, workforce training and external audit are the next three significant variables respectively (Figure 1).

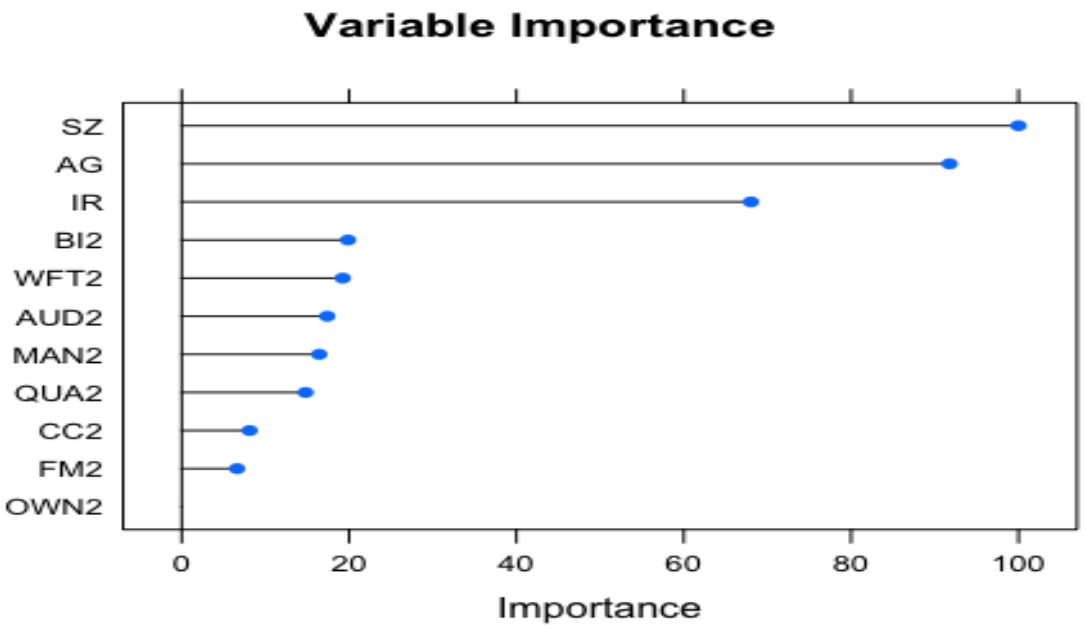

Figure 1. Collateral Variable Importance

4.2. Logistic Regression

A logistic regression is fitted to estimate the relationship between SMEs' need for collateral and the variables collected in the business survey. Size, age, and interest rate are included in the model as they give relatively higher significant scores than the other variables. In attempt to add suitable independent variables that increase the accuracy of the model, the AIC is evaluated. The desired result is to have the lowest possible AIC for our model. Conversely, adding unsuitable variables to a model increases its complexity, which increases the AIC. Table 2 shows the AIC and residual deviance obtained by introducing each of the additional variables separately into the model.

Table 2. AIC evaluation

	SZ + AG+ IR	+ BI	+ WFT	+ AUD	+ MAN	+ QUA	+ CC	+ FM	+ OWN
AIC	115.15	116.46	115.79	114.7	117.12	117.14	115.41	116.32	116.2
%Change		1.14	0.56	-0.39	1.71	1.73	0.23	1.02	0.91
Residual Deviance	107.15	106.46	105.79	104.7	107.12	107.14	105.41	106.32	106.2

The variable (AUD) representing the external audit led to a reduction in the AIC and the residual deviance value. Therefore, in addition to size, age, and interest rates, the only variable that improves the model is AUD. Table 3 below shows the logistic regression results.

Table 3. Logistic Regression Results- Pooled Model

```
Call:
glm(formula = COLL ~ SZ + AG + IR + AUD, family = "binomial",
    data = na.omit(data3))
```

```
Deviance Residuals:
   Min      1Q  Median      3Q     Max
-1.5547  -0.8920  -0.7319   1.2041   2.1258

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.704142   2.423166   0.703    0.482
SZ          -0.003943   0.002775  -1.421    0.155
AG           0.018158   0.011691   1.553    0.120
IR          -0.449573   0.396468  -1.134    0.257
AUD          1.243371   0.811899   1.531    0.126

(Dispersion parameter for binomial family taken to be 1)
    Null deviance: 111.56  on 87  degrees of freedom
Residual deviance: 104.70  on 83  degrees of freedom
AIC: 114.7

Number of Fisher Scoring iterations: 4
Confusion Matrix and Statistics
          Reference
Prediction  1  2
         1  5  6
         2 54 23
 Accuracy : 0.3182
            95% CI : (0.2229, 0.4261)
   No Information Rate : 0.6705
   P-Value [Acc > NIR] : 1
             Kappa : -0.086
Mcnemar's Test P-Value : 1.298e-09
          Sensitivity : 0.08475
          Specificity : 0.79310
       Pos Pred Value : 0.45455
       Neg Pred Value : 0.29870
           Prevalence : 0.67045
       Detection Rate : 0.05682
  Detection Prevalence : 0.12500
     Balanced Accuracy : 0.43892
 'Positive' Class : 1
```

The logistic pooled model becomes:

$$Coll_i = 1.704 - 0.004 * SZ + 0.018 * AG - 0.45 * IR + 1.243 * AUD + \epsilon_i$$

Outcomes are presented in the form of conclusions for the above hypotheses:

- **Finding H1**

As seen, the **size** of a company is a factor that inspires confidence in lending institutions. Thus, the larger the company, the lower the collateral required. SMEs that are larger than others should provide low value collateral, as they tend to have larger assets, which allows lenders to easily recover their money in case of default. This result could also be understood in the perspective of Beck et al (2006) that SMEs have more financing difficulties than large firms. Therefore, we can argue that reducing information asymmetry by showing convincing and more than modest SME sizes can increase SMEs' financing options in the loan market.

The **age** of a business is associated with higher collateral requirements. When lending to older SMEs or companies that have been in existence for a long time, collateral needs to be considered excessively as they are established companies, which makes them fall into the category of "doubtful clients", riskier than others. Conversely, for younger SMEs, lenders are less strict in requiring collateral because they see them as new entrepreneurs starting

up recent businesses with sufficient market research: a feature of the developed economy in its growth phase.

- **Finding H2**

Result shows that firms whose **annual financial statements** are reviewed by external auditors are those whose loans require higher collateral. The coefficient has a positive sign. Secured loan applications often require an annual statement audited by an external auditor. It is obvious that the presence of an audited annual financial statement is a necessary document for any credit application. An "externally audited annual financial statement" is a part of the company's identity that must exist without the SME being exempted from a collateral request against the granting of a bank loan. This also could be the result of the lack of strict financial regulation in Lebanon which makes financial statements an unreliable document as it could be non-transparent and biased.

- **Finding H6**

An increase in the value of the **interest rate** will lead to a proportional decrease in the collateral needed. This is because the risk of lending to SMEs is compensated not only by the collateral, but also by the high revenues that banks earn from interest rates. It is difficult for SMEs to demonstrate their creditworthiness; therefore, banks ration their loans (Berger and Udell, 2002; Petersen and Rajan, 2002). Due to the ambiguous nature of credit scoring models and the information asymmetry between banks and SMEs, banks may impose not only higher interest rates, but also non-price limitations on lending to SMEs, such as collateral requirements: information opacity is compensated by either the interest rate or the collateral. This explains the significant negative correlation between the interest rate and collateral.
The effects of the predictor variables on the collateral requirements are presented graphically (figure 2) as follows:

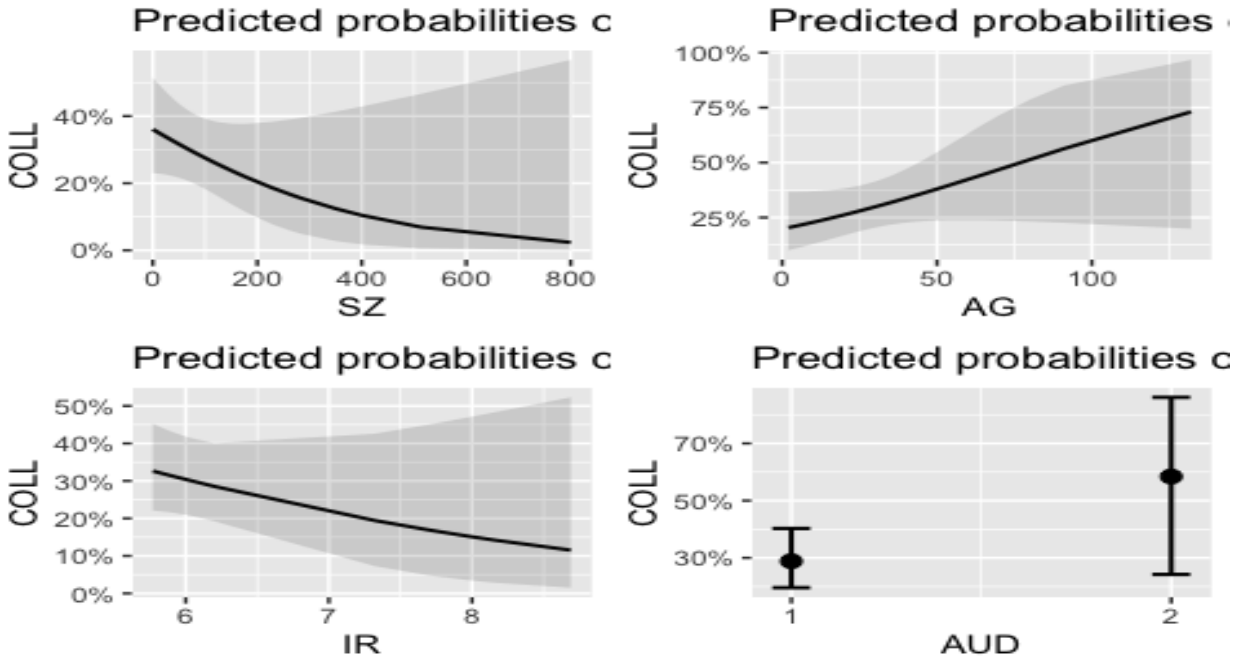

Figure 2. Collateral Prediction

The probability of being asked for collateral on loans is reduced as SME becomes larger but increases for older firms. The probability for collateral on loans reduces as interest rates increase. SMEs that are audited externally also show a higher probability for collateral requirements. To check if there is a consistency between pooled data

results, and the ones with annual dummy variable (2013 and 2019), an additional regression will be conducted in the following section.

4.3. Panel Data Analysis- Year effect

Having run regressions for the pooled data (2013 and 2019), a binary variable is now introduced to control for the year. It is time to allow the role of economic fluctuations to reveal themselves, which is precisely what the annual dummy variable captures. The panel data analysis allows to identify and quantify variabilities that may exist solely due to the difference in the year of the survey. Comparing the pooled logistic model with the panel logistic regression model, we find that the performance metric increases minimally, panel and year have no effect (Random effects variance = 0). The model coefficients and summary statistics are presented below (table 4):

Table 4. Panel Logistic Regression Model- Year Effect

```
[glmerMod]
Family: binomial  ( logit )
Formula:
COLL ~ SZ + AG + IR + AUD + (1 | panel) + (1 | year) + (1 |
   panel:year)
  Data: na.omit(data3)

    AIC      BIC   logLik deviance df.resid
  122.1    144.4    -52.1    104.1       79

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.5623 -0.6917 -0.5298  1.0470  2.7762

Random effects:
 Groups    Name        Variance Std.Dev.
 panel:year (Intercept) 0        0
 panel     (Intercept) 0        0
 year      (Intercept) 0        0
Number of obs: 88, groups:  panel:year, 4; panel, 3; year, 2

Fixed effects:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.185166   2.535156   0.467    0.640
SZ          -0.003866   0.002761  -1.400    0.161
AG           0.017034   0.011752   1.449    0.147
IR          -0.434517   0.399067  -1.089    0.276
AUD          1.216774   0.815259   1.492    0.136
Correlation of Fixed Effects:
    (Intr) SZ     AG     IR
SZ  -0.075
AG  -0.027 -0.520
IR  -0.960  0.059 -0.040
AUD  0.350  0.126 -0.011 -0.403
optimizer (Nelder_Mead) convergence code: 0 (OK)
boundary (singular) fit: see? isSingular
```

In short, from an econometric point of view, there is consistency in the market as SMEs have been treated in the same way across different years and panels.

5. CONCLUSIONS

The availability of bank loans is a major concern for both SMEs and financial institutions. Collateral-based lending is a common practice of commercial banks to minimize the risk associated with the amounts lent to borrowers of various kinds. There are lots of factors that influence the existence of collateral under a loan contract. Economists have summarized these factors into three groups - firm characteristics, loan characteristics, and credit market specifics. This paper provides estimates in terms of samples of two different years – 2013 and 2019. The data were pooled then classified into panels in objective to assess whether the model parameters are significantly different from each other. The logistic regression estimates suggest that age and having annual financial statements reviewed by external auditors contributed to higher collateral requirements. Lower collateral is required for firms with higher size. Lower interest rates lead to stricter collateral requirements for loans. Higher interest rates have been imposed where the availability of collateral is low. Inevitably, credit risk is mitigated either by high interest rates or by collateral requirements. The converging results between 2019 and 2013 reflect the consistency of policies in the Lebanese banking sector. In general, this study has supported the hypothesis that, in Lebanon, a specific style of SME is preferred by banks in terms of creditor clients.

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Appendix A

Table 5. Summary of empirical studies on collateral and credit rationing

Study	Sample	Method	Key variables	Key findings
Leeth and Scott (1989)	National Federation Independent Business Survey 1980 and 1982	Probit regression Dependent variable: collateralization decision	Firm characteristic Loan characteristic Legal environment	1-Older firms are less likely to be required to put up collateral 2-The chance of pledging collateral reduces while getting a loan for a lesser sum or with a shorter duration 3-The establishment of interest rate restrictions and changes to the Bankruptcy Code increased the usage of collateral.
Berger and Udell (1995)	NSSBF lines of credit (L/C) 1988	Logit regression- Dependent variables: Collateral-pledging accounts receivable-inventory collateral	Relationship Governance characteristic Financial characteristic	1-Collateral pledging is more likely in larger companies 2-Older businesses are less likely to be required to put up collateral- 3-Higher leveraged companies tend to pose a greater risk to lenders, increasing the likelihood of collateral pledging 4-Firms that have had a longer connection with their lender benefit from a lower chance of collateral pledging.
Ang et al. (1995)	NSSBF 1988	Descriptive analysis of incidence of personal commitments business lending	Organizational form Firm size Leverage Profitability	1-Personal commitments are important in small business lending. 2-Firm size, profitability and leverage are inversely related to the incidence of personal commitments. 3-Partnerships have the lowest incidence of personal commitments. 4-There is a lack of separation of business and personal risks among small businesses
Harhoff and Körting (1998)	German SMEs on their L/C obtained 1997	Probit regression Dependent variable: collateralization	Relationship Financial characteristics Firm characteristics Governance	1-Firms that were in distress at some point during the five years prior to the survey are more likely to pledge collateral for their L/Cs. 2-Relationship lending appears to be beneficial to the SMEs: longer lasting lending relationships profit from reduced collateral requirements while

			characteristics	firms that engage in more lending relationships face more collateral requirements
Machauer and Weber (1998)	Credit files of five large German banks Period 1992–1996 on their L/C	Ordinary least squares regression Estimation of unsecured percentage	Relationship Loan variable Risk variable Governance variable	1-Housebank borrowers provide a higher amount of collateral. 2-There is no significant relation between collateralization and borrower risk. 3-A guarantee obtained from a parent company does not seem to solve the collateral need of the bank: it increases the amount of collateral that the firm has to pledge
Avery et al. (1998)	NSSBF 1987 and 1993. Survey of Consumer Finances 1989, 1992, 1995	Logit regression Dependent variables distinguishing between L/C and non-L/C: (1) the collateralization decision and (2) personal commitment decision	Firm characteristic Lender characteristic Loan characteristic	1-Few robust relationships are found between personal commitment use and firm or owner characteristics. For L/C 2-Older firms appear to pledge more often business collateral but less often personal collateral 3-For L/C, personal and business collateral appear to be substitutes. 4-Firms with few assets tend to depend more on personal commitments.
Cowling (1999)	survey data from UK SMEs 1991	Logit regression Dependent variable: collateralization decision	Bank- firm relationship Loan characteristics	1-While loan size and loan duration exert positive effects on the probability of loan collateralization, firm age has a negative effect. 2-Lending from a local branch bank increases the likelihood of collateralized loans. 3-Where the firm owner perceives that the bank had good information on the firm and its owner, the incidence of collateralization was reduced
Degryse and Van Cayseele (2000)	Credit files of a large Belgian bank Period 1995–1997	Logit regression Dependent variable: collateralization decision	Relationship Loan and firm characteristics	1-Smaller and younger firms more often have to pledge collateral. 2-When obtaining loans from the main bank, the probability of collateral pledging increases. 3-Loans of a larger size or a longer maturity more often require collateral pledging

Cressy and Toivanen (2001)	Individual loans from large UK bank Period 1987–1990	Two-stage least squares (2SLS) To estimate system of equations consisting of three equations- Dependent variables: pledging of collateral, interest rate and loan amount	Interest rate Loan amount Collateral requirements Risk degree Duration of the project	4-Only loan duration seems to have a positive impact on the probability of pledging collateral. 5-No relationship is found between risk and collateral pledging
Lehmann and Neuberger (2001)	survey of bank loan managers of German banks- data on SME loan applications 1997	Two-limit Tobit regression To determine the amount of collateralization varying from 0% to 100%	Relationship Firm, loan, and risk characteristics	1-High-risk borrowers seem to pledge less collateral. 2-Larger and older firms provide less collateral. 3-When obtaining loans from a housebank, more collateral has to be provided
Hanley (2002)	Credit files of a UK retail bank Period 1998–2000	Logistic and Tobit regression Dependent variables: collateralization decision and amount of collateral pledged	Loan, firm, owner, and risk characteristics	Compared to start-ups and firms that transferred from another bank, existing businesses more often have to pledge a higher level of collateral.
Hanley and Crook (2005)	Credit applications from business start-ups to a major UK bank Period 1998–1999	Logistic regression Dependent variable: probability of application rejection	Relationship characteristics Collateral availability Aim of the loan Credit history	An increase in the amount of available collateral increases the likelihood that a loan will be granted

Menkhoff et al. (2006)	Credit files of a Thai bank Period 1992–1996	Probit and Tobit regression Dependent variables: the incidence and amount of collateral pledged	Risk Relationship Firm characteristics	Collateral is used to reduce the higher credit risks of small and rather young firms
Hernández-Cánovas and Martínez- (2006)	Survey data from Spanish SMEs Period 1999–2000	Probit regression Dependent variable: decision to pledge personal guarantees	Relationship Risk Firm characteristics	1-Larger and older firms incur a lower probability of having to provide personal guarantees. 2-Firms with a higher risk degree (higher indebtedness), more often have to provide personal guarantees. 3-Firms engaging in a long-term relationship or maintaining an exclusive relationship with a lender are subject to the information monopoly of the lender, which is translated in a higher probability of providing personal guarantees
Voordeckers and Steijvers (2006)	Credit files of large Belgian bank Period 2000–2003	Ordered probit and continuation ratio logit estimation Dependent variables: collateralization decision and the type of collateral decision	Relationship Loan, firm, lender characteristics	1-Differences in determinants of the collateralization decision and determinants of the type of collateral. 2-Larger and older firms more often must pledge collateral, while for older firm business collateral is sufficient. 3-Collateral requirements decrease in the length of the bank–borrower relationship 4-Introducing competition between banks for a credit request decreases the likelihood of having to offer collateral. 5-If a bank operates as a main banker, the firm is more likely to offer any kind of collateral while this variable has no effect on the type of collateral that must be provided
Chakraborty and Hu (2006)	NSSBF 1993	Probit regression Dependent variable: collateralization decision as a	Relationship and firm characteristics Key financial indicators	1-There is a necessity to distinguish between L/C and non-L/C. 2-The likelihood of pledging collateral for L/C decreases with the relationship length. 3-For non-L/C, collateral is less often required when the number of bank services used increases.

				4-For both kinds of loans, firms with a higher availability of collateral as well as a higher financial risk more often pledge collateral
Brick and Palia (2007)	NSSBF, L/C 1993	Simultaneous equation estimation (2SLS) consisting of three equations Dependent variables: loan rate premium, business, and personal collateral as	Loan characteristic Firm characteristic Relationship characteristics	1-Collateral pledging has a significant impact on loan interest rates suggesting a jointness in debt terms. 2-There is a significant positive correlation between the observable firm risk and the pledging of collateral. 3-The economic impact of posting personal collateral appears to be greater than posting business collateral
Steijvers et al. (2008)	NSSBF 1998	Decision tree analyses Dependent variables: collateralization decision and the type of collateral decision	Relationship characteristics Family ownership	The most important determinants of the collateralization decision as well as of the personal versus business collateral decision are loan amount, total assets, and the family versus non-family firm distinction. Relationship characteristics appear to be minor in importance

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