

Firm characteristics and credit constraints among SMEs in the Philippines

Características de la empresa y restricciones crediticias de las PYMEs en Filipinas

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Abstract

Access to finance is critical to support the growth of small and medium-sized enterprises (SMEs). However, lack of access to adequate financing is one of the biggest obstacles that SMEs face. This paper analyzed the relationship between firm characteristics and credit constraints among SMEs in the Philippines. We determined which firm characteristics are correlated to the predicted probability of being credit-constrained or "quasi-constrained" — i.e., able to borrow from informal sources. Estimates of marginal effects at the means (MEMs) from logistic regressions provide some suggestive evidence that increased firm size, previous purchase of fixed assets, and increased use of digital technologies for accounting and financial management are associated with a lower predicted probability of being credit-constrained. The use of digital technologies in accounting and financial management is also associated with a lower probability of credit constraint in informal financial markets.

Keywords: credit constraints; firm characteristics; SMEs; Philippines; informal financing

JEL Classification: E26; G21; G28; O17

Resumen

El acceso a la financiación es fundamental para apoyar el crecimiento de las pequeñas y medianas empresas (PYMEs). Sin embargo, la falta de acceso a una financiación adecuada es uno de los mayores obstáculos a los que se enfrentan las PYMEs. En este trabajo se analiza la relación entre las características de las empresas y las restricciones crediticias en las PYMEs de Filipinas. Determinamos qué características de las empresas están correlacionadas con la probabilidad de tener restricciones crediticias o "cuasi-restricciones" -- es decir, de poder obtener préstamos de entidades financieras no oficiales. Las estimaciones de los efectos marginales en las medias (MEMs) de las regresiones logísticas proporcionan algunas pruebas de que el aumento del tamaño de la empresa, la adquisición de activos fijos y el mayor empleo de nuevas tecnologías de información para la gestión contable y financiera, están asociados con una menor probabilidad prevista de tener restricciones de crédito. El uso de dichas tecnologías en la gestión contable y financiera también se asocia con una menor probabilidad de restricción crediticia en los mercados financieros alternativos.

Palabras clave: restricciones crediticias; características de la empresa; PYMEs; Filipinas; mercados financieros alternativos

Clasificación JEL: E26; G21; G28; O17

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1. Introduction

The development of small and medium enterprises (SMEs) is an essential contributor to economic and social growth in developing economies (Samawi et al., 2016). However, having limited access to finance impedes firm success. The lack of access to financing is one of the most critical obstacles affecting SME performance, competitiveness, and growth (Aldaba, 2011). Lack of access to financing hinders an SME from innovating and acquiring assets to expand its operations. Access to finance is essential to support small businesses' growth (Angeles et al., 2019) by enabling innovation, facilitating investment and expansion to new markets, improving efficiency, and providing employment (Innovations for Poverty Action (IPA), 2015). When financing is maximized, the growth of small businesses is improved (Angeles et al., 2019). Additional capital increases SMEs' opportunities to boost productivity (Krishnaswamy, 2007), while the lack of capital limits small firms' growth opportunities (Angeles et al., 2019). Lack of capital due to credit constraints is the primary obstacle that hinders SMEs from reaching their full potential (Fowowe, 2017). Thus, financial institutions' willingness to support SMEs through financing is critical in overcoming small firms' growth constraints (Khandker et al., 2013; Kuzilwa, 2005).

Although several studies have analyzed the relationship between firm characteristics and access to finance, a research gap our paper intends to address is whether access to finance through formal channels has different determinants than informal channels. This is important because, like other developing countries, informal financing is a substantial credit provider in the Philippines. Over 38% of borrowers in the Philippines rely on informal sources of credit, despite the associated risks (World Bank Group, 2015).

This paper studied the relationship between firm characteristics and access to finance among SMEs in the Philippines. We examined which firm characteristics were correlated to the predicted probability of being credit-constrained or "quasi-constrained"—i.e., able to borrow from informal sources. Further, we analyzed whether the firm characteristics that were significant in accessing finance solely through formal channels such as banks were also significant when considering informal financing sources such as private moneylenders, family, or friends.

This study used data from 480 SMEs in the Philippines, gathered during the second and third quarters of 2018. Logistic regressions were performed and the marginal effects at the means (MEMs) provided an estimate of the relationship between firm characteristics and the predicted probability that the average SME in the sample is credit-constrained or quasi-constrained. In this paper, we focused on firm size, the previous purchase of fixed assets, and the use of digital accounting and financial management technologies. We studied the relationship between these firm characteristics and access to finance both through formal and informal markets because increased firm size and the previous purchase of fixed assets are typically associated with less credit constraint in the literature, while the digital transformation of accounting and financial management has improved the operation efficiency, productivity, and performance of SMEs (Hoang & Le Dinh, 2019).

The Philippines provides relevant context to develop our study because micro, small, or medium enterprises account for over 99% of all firms, about two-thirds of employment, and a third of gross value added (GVA), serving as the backbone of the economy. Furthermore, our estimates in this paper suggest that 42% of small and 33% of medium enterprises are credit-constrained. In comparison, 47% of both small and medium enterprises are quasi-constrained¹ from a sample of 480 SMEs in the National Capital Region (NCR) and Calabarzon region. By identifying which factors enable access to finance in both formal and informal markets, we can evaluate policy options to make financing more inclusive. Alternative financing sources that support projects typically considered too small or risky by traditional banks have experienced rapid growth (World Economic Forum, 2015) in recent years. Many financial technology (fintech) companies enter the market to address the increasing demand for inclusive, fully digital, remotely accessible, and affordable financial services. This is particularly favorable to small businesses and firms operating in remote areas that encounter difficulties accessing traditional financing (OECD, 2018). Digital technologies enable SMEs' access to credit (Lukonga, 2020) by allowing small businesses to take advantage of innovative digital financial services (OECD, 2018). However, despite the benefits of digital finance that give small businesses greater access to loans, the use of fintech solutions remains limited compared to traditional finance due to the digital and financial literacy requirements to access fintech (Nemoto & Koreen, 2019). Thus, policies that democratize financial services through inclusive finance and financial technologies (fintech) should be promoted to enable the growth of SMEs.

2. Literature Review and Hypotheses

2.1 Access to Formal Finance

Macroeconomic factors do not entirely drive firms' inability to access external financing. Firm characteristics and other institutional variables also determine their capability to access finance, and many firms have

characteristics that may hinder them from receiving external financing (Peñaloza, 2015). Building on the reviewed literature, we propose several hypotheses on the relationship between firm characteristics of SMEs and access to finance through both formal and informal markets in the Philippines.

Ease of access to finance is typically correlated with firm size, which means smaller companies find it more difficult to access financing. This is due to fewer collateral options, a higher perceived risk profile, lower accounting and financial management capacity, and higher informality rates among smaller firms (OECD et al., 2019). In this sense, among firm characteristics, the most common determinants of credit constraints studied in the literature include firm size, firm age, and ownership type. Several empirical studies, such as Beck et al. (2006) and Canton et al. (2013), indicated firm size and firm age as determinants, while Quartey et al. (2017) identified firm size, ownership type, and credit information. Using data from a sample of over 10,000 firms covering 80 countries, Beck et al. (2006) found that larger, older, and foreign-owned firms encountered fewer barriers in accessing finance. In addition, Canton et al. (2013) found that the youngest and smallest SMEs had the worst perceptions regarding bank loan access. Using firm data from SMEs across West Africa, Quartey et al. (2017) found that larger firms were more likely to gain access to finance because of adequate collateral, a more established bank history, and perceived creditworthiness compared to smaller firms.

H1: Among SMEs, firm size has a negative relationship with the probability of being credit constrained in formal financial markets.

The availability of collateral has been cited as a key determinant of access to finance, especially in developing economies. In a study that analyzed the credit constraints faced by new SMEs in South Africa, Fatoki and van Aardt Smit (2011) identified collateral availability as a key factor in determining an SME's access to credit. In addition, Kira (2013) identified collateral availability as a key factor that influenced access to finance in a study that used data from SMEs in Tanzania. Fixed assets, such as land, buildings, and equipment, are typically eligible as collateral. Some studies (Okura, 2008; Le, 2012) identified fixed assets as a creditworthiness characteristic. Moreover, a history of fixed asset purchases makes an SME more attractive to creditors. Bougheas et al. (2006) asserted that collateral is an important factor for SMEs to access debt finance since collateral reduces a loan's riskiness by giving the lending financial institution a claim on a tangible asset without compromising its claim on the outstanding debt (Kira, 2013). In addition, some studies (Coco, 2000) regarded collateral as the lender's second line of defense (Kira, 2013).

H2: Previous purchase of fixed assets reduces the likelihood that an SME is credit constrained in formal financial channels.

SMEs with more developed financial management practices are more attractive to financial service providers (OECD et al., 2019), enabling them to have greater access to finance through formal channels. The use of digital accounting and financial management tools allows firms to organize their records and examine their financial condition. Digitizing the accounting and financial management operations of SMEs has improved their productivity, performance, and overall efficiency (Hoang & Le Dinh, 2019). Although the relationship between the adoption of digital technologies in firm operations and their access to finance has been studied in the literature, the role of the digital transformation of accounting and financial management in enabling greater access to finance has yet to be investigated extensively.

Several studies provide empirical evidence linking credit constraints with a firm's ability to adopt new technologies and innovate. In addition to firm size, Peñaloza (2015) identified the firm's technological capacity as a key factor in determining a firm's access to credit markets primarily because of competitive advantages brought about by increased use of technology. Using data from a survey of 4,220 firms across Russia, Bircan and de Haas (2015) showed the channels by which firms' technological adoption was affected by credit constraints. In particular, Bircan and de Haas (2015) provided empirical evidence that access to finance helps firms adopt new technologies, although they found no evidence that bank credit stimulated firm innovation through in-house research and development (R&D). By analyzing the relationship between bank credit and innovation in more than 19,000 firms across 47 developing economies, Ayyagari et al. (2011) found a positive association between using external finance and increased firm innovation. Using data from 6,422 small firms across 22 emerging economies, Qi and Ongena (2020) provided empirical evidence that lack of access to finance restrains a firm from adopting technologies. Wignaraja and Jinjark (2015) examined firm-level determinants of SME finance using World Bank Enterprise Survey data, covering 8,080 firms in several Asian countries. Numerous aspects of access to finance, including credit, lender type, bank borrowing, line of credit availability, and collateral, were found to be correlated with firm characteristics (Wignaraja & Jinjark, 2015).

H3: A higher level of technology adoption in accounting and financial management has a negative association with credit constraint in formal financial channels.

2.2 Access to Informal Finance

Difficulties in accessing external finance are common for SMEs in developing countries. Empirical evidence from studies in other developing countries such as Ethiopia (Fanta, 2015) and Kenya (Mungiru & Njeru, 2014) indicated that SME owners that faced obstacles in accessing finance actively resorted to informal channels to circumvent credit constraint. On the one hand, informal financing sources may have dampened the negative impacts of credit constraints on an SME's operations and growth (Fanta, 2015). However, while some informal channels such as group loans and loans from family and friends may have benefited a credit-constrained SME, others such as loan sharks that charged high interest rates with more stringent terms and conditions may have done more harm than good (Mungiru & Njeru, 2014).

Informal credit may be the only viable financing option for some borrowers deemed ineligible for formal financial services, such as smaller firms with little to no collateral and borrowers in rural areas. Financial transactions unregulated by the government and outside traditional financial institutions are referred to as informal finance. Various informal credit sources include peer-to-peer networks, family, friends, informal credit unions, savings collectors, moneylenders, and loan sharks (Hanedar et al., 2014). Typically, interest rates in informal markets are more volatile compared to traditional markets. Informal moneylenders can charge high and unfair interest rates, while loans from family and friends commonly have lower interest due to altruism concerns, making it more attractive to borrowers (Hanedar et al., 2014).

Determinants of access to finance through formal channels may differ from those in informal channels. Since informal financing works in an environment where social networks are typically used in conducting business (Allen et al., 2018), firm characteristics such as firm size and history of asset purchases may not be as relevant in determining access to informal credit. However, the use of digital financial management may improve SME's access to informal finance.

The adoption of digital technologies facilitates SMEs' access to finance (Lukonga, 2020). Digital lending platforms that connect borrowers to lenders directly, such as peer-to-peer networks, are increasingly utilized as an informal lending channel and alternative funding source for small businesses (Lukonga, 2020). Although not as stringent in terms of requirements compared to formal financial institutions, digital peer-to-peer lending networks still require financial data from firms. Thus, alternative financing options in informal channels such as peer-to-peer lending networks are more accessible to firms that use digital technologies to organize and manage their financial data. Digitalization improves access to and diversifies the supply of financing for SMEs (Disse & Sommer, 2020). The emergence of new financing options in the market that capitalize on digitalization, reduced transaction costs, and a wider network mitigates several of the challenges in SME finance (Disse & Sommer, 2020). Many of these options, such as peer-to-peer lending networks that match borrowers to lenders online, are part of informal financing channels, some of which have emerged from small informal banks (Deer et al., 2015). Digital financial management improves the access of small businesses to digital finance in informal channels. The adoption of digital technologies in accounting and financial management reduces asymmetric information between borrowers and lenders in both formal and informal financing channels. Digital financial management organizes and enhances the availability of SME's financial data. This improves screening and credit assessment, enabling greater access to finance for SMEs, even in informal channels (Disse & Sommer, 2020). Moreover, digital financial management can lower risk and default for financial service providers (Disse & Sommer, 2020).

H4. Greater use of digital accounting and financial management technology decreases the probability of being credit constrained in informal financial channels.

3. Method

3.1 Data

This study used data from the 2018 Asian Institute of Management RSN Policy Center for Competitiveness (AIM RSN-PCC) Survey on Small and Medium Enterprise (SME) Competitiveness. The survey, which was conducted during the second and third quarters of 2018, included 480 SMEs in National Capital Region (NCR²) and the neighboring Calabarzon³ region in the Philippines. The sampled firms were drawn using a combination of multi-stage and systematic random sampling.

In the first stage, 12 cities in Metro Manila were selected in addition to one city from each of the five provinces in the Calabarzon region, where the probability of a city being selected was proportional to the actual number of firms in each city. In addition, the number of sampled SMEs per region and sector⁴ also followed the actual sectoral distribution of SMEs in the region that a city belonged to.

In the second stage, *barangays*⁵ were randomly selected from each of the cities that were drawn. Then followed by the third stage, where the respondents were selected. A randomly determined location in every drawn *barangay* was selected, and every third establishment was invited for an interview. The respondents

were owners or managers⁶ of the firm. If the firm was not an SME or declined to be interviewed, the subsequent establishment was then selected. If needed, the enumerator proceeded to the next village. This process was repeated until the quota was reached.

The survey questionnaire included 96 items that covered information about SMEs and the factors that affected their development and competitiveness. All variables used in our analysis were from the 2018 AIM RSN-PCC SME Competitiveness dataset.

3.2 Variables

To test our hypotheses, we identified *credit-constrained* and *quasi-constrained* as the model's dependent variables. *Firm size*, *previous purchase of fixed assets*, and a *high use of digital technologies for accounting and financial management* are the independent variables. The following firm characteristics: *profit growth*, *employment size*, *ownership type*, *sector*, *firm age*, *gender of owner*, *percentage of employees with a college degree*, and *NCR* (whether the firm operates at the National Capital Region) are control variables.

Firm size was measured according to the total assets of the firm excluding land. Firms that had assets greater than Php three million (€ 53,000) up to Php 15 million (€ 260,000) were classified as small enterprises, while firms with assets greater than Php 15 million (€ 260,000) up to Php 100 million to (€ 1,750,000) were classified as medium sized enterprises. *Previous purchase of fixed assets* is measured by the firm's history of fixed assets purchases in the past two years. Firms that were able to acquire new equipment or fixed assets in the past two years were assigned the dummy variable value of one. Firms in the sample were also classified according to their use of digital processes and software in accounting and financial management. SMEs that had a moderate to extensive use of digital processes in accounting and financial management were assigned a dummy variable value of one. *Profit growth* measures the percent change in the firm's profit over the past two years. *Employment size* measures the number of employees in a firm. *Ownership type* identifies the ownership structure of an SME, whether they are registered as a *sole proprietorship*, *partnership*, or *corporation*. In the dataset used for this study, SMEs belonged to either the *manufacturing or services* sectors. Firms that belonged to the *services* sector were assigned a dummy variable value of one. *Firm age* denotes how many years the SME has been in operations. *Gender of owner* designates the gender of the firm's owner while *percentage of employees with a college degree* measures the education level of employees in the firm. *NCR* indicates whether the SME operates at the National Capital Region of the Philippines. The dependent variables are discussed in the succeeding sections.

Defining Credit Constraint

A typical way of measuring credit constraint in the SME literature generally looks at credit usage (instead of access to) or perceived and self-reported obstacles (instead of empirical data). For our analysis, we patterned our definition on Kuntchev et al. (2013), whose measurement of firm credit constraint was primarily based on the firm's usage and ability to obtain new credit. Although we closely followed the general credit constraint definition of Kuntchev et al. (2013), we extended their definition by including informal sources of credit to fit the context of SMEs in developing countries such as the Philippines.

Kuntchev et al. (2013) categorized firm credit constraint into four groups as Fully Credit Constrained; Partially Credit Constrained; Maybe Credit Constrained, and Non-Credit Constrained. Fully Credit Constrained firms did not have external loans because:

1. loan applications were rejected, or
2. the firm did not apply for a loan even if they needed additional capital.

On the other hand, Partially Credit Constrained firms were only partially credit-constrained because they were able to find sources of external finance other than bank finance. For purposes of this analysis, we focus on Fully Credit Constrained and Partially Credit Constrained.

Strictly Credit Constrained (SCC)

Initially, we defined an SME as Strictly Credit Constrained (SCC) if the SME attempted to take out a loan but could not get a loan, or the SME was able to take out a loan the loan amount was less than the desired amount. This SCC definition applies the most rigid conditions for being credit-constrained because no assumption is made about the motivation behind a firm's inaction in forgoing a loan application. Theoretically, this is the most straightforward definition of credit constraint.

However, given our data, we were left with minimal observations when we applied this definition. Only 17 out of the 480 or 3.5% of SMEs in our sample would have been classified as credit constrained following this definition. Considering the empirical evidence from developing countries that access to finance is a major obstacle for SMEs (Beck et al., 2006), our initial definition that resulted in an estimate where only 3.5% of

SMEs are credit-constrained may need to be revised. In this light, we modified our definition of credit constraint to take into consideration underlying attitudes and motivations for deciding whether or not to get a loan, as well as alternative sources of credit outside formal channels.

Kuntchev et al. (2013) argued that firms that did not apply for a loan due to reasons other than having enough capital for the firm's needs may also be considered credit constrained. These firms may have been rationed out of the market, as some characteristics of the potential loan's terms and conditions could have deterred these firms from applying for a loan. We adhered to this assertion and patterned our modified definition with Kuntchev et al. (2013).

The survey data we used in our analysis contained information on the reasons for not borrowing or getting a loan, whereby respondents rated to what degree⁷ each possible reason provided was important to them in their decision not to borrow or get a loan⁸. We used this additional information to categorize firms according to the type of credit constraint based on our modified definitions.

Credit-Constrained

For our analyses, we used the following definitions to identify whether an SME was credit-constrained, quasi-constrained, or neither. We characterized an SME to be credit-constrained if:

1. The SME attempted to take out a loan but was not able to get a loan, or
2. The SME was able to take out a loan, but the loan amount was not enough, or
3. The SME did not apply for a loan; and "did not need to borrow" was at most a "moderate reason" for not borrowing; and "did not need to borrow" was not the biggest reason for not applying.

Condition 3 suggests that only SMEs that explicitly expressed they did not need additional credit are considered not credit-constrained. On the other hand, even if an SME did not apply for a loan, but their motive for not applying was anything other than not needing additional capital, they are considered credit-constrained. Just because a firm did not apply for a loan does not mean that they do not need additional credit. Condition 3 aims to distinguish between firms that did not apply for a loan based on their reason for not doing so.

Quasi-Constrained

Some firms were able to obtain loans, but from informal sources, such as the business owner, family members and friends of the business owner, or moneylenders. An SME is defined to be quasi-constrained if:

1. The SME attempted to take out a loan but was not able to get a loan, or
2. The SME was able to take out a loan, but the loan amount was not enough, or
3. The SME did not apply for a loan; and "did not need to borrow" was at most a "moderate reason" for not borrowing; and "did not need to borrow" was not the biggest reason for not applying; and
4. The SME obtained a loan from informal sources

3.3 Summary Statistics

Table 1 below shows the proportions of SMEs in the sample that are credit-constrained and quasi-constrained based on certain firm characteristics. Firms with total assets, excluding land, greater than three million up to 15 million Philippine pesos (roughly € 53,000 to € 260,000) are classified as small enterprises. In contrast, firms with total assets, excluding land, greater than 15 million pesos up to 100 million Philippine pesos (roughly € 260,000 to € 1,750,000) are classified as medium enterprises. A larger proportion (42%) of small enterprises were found to be credit-constrained, compared to medium enterprises (33%). On the other hand, an equal proportion of small and medium firms were found to be quasi-constrained at 47%.

Table 1. What proportion of small and medium firms are credit-constrained?

	Credit-constrained	Quasi-constrained
Small enterprises	42%	47%
Medium enterprises	33%	47%
n = 414 (small); 66 (medium)		
Services	58%	48%
Industry	33%	41%
Female-owned	38%	45%
n = 480		

Source: Own elaboration

More than half (58%) of all SMEs in the services sector were credit-constrained, while only one-third (33%) of SMEs in industry were credit-constrained. There was a slightly larger proportion of SMEs in services (48%) than industry (41%) that were quasi-constrained.

The summary statistics of the dependent variables (credit-constrained and quasi-constrained) and independent, and control variables are presented in Table 2 below. The summary statistics of firm characteristics provide a general profile of the SMEs in the sample. Our coverage was limited to the National Capital Region (NCR), where 73% of the SMEs surveyed came from, and the Calabarzon region, which made up the remaining 27%. Both dependent variables in our analysis were binary, taking on a value equal to 1 if an SME is credit-constrained or if it is quasi-constrained. Appendix (Table 4) shows the pairwise correlation of variables.

Table 2. Summary Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Dependent variables					
<i>Access to finance</i>					
credit-constrained	480	0.404	0.491	0	1
quasi-constrained	480	0.467	0.499	0	1
Independent variables					
<i>Firm characteristics</i>					
medium sized (assets)	480	0.138	0.345	0	1
profit growth rate: past 2 years	480	20.12	22.97	-50	100
employment size	480	24.35	29.89	10	192
sole proprietorship	480	0.646	0.479	0	1
corporation	480	0.188	0.391	0	1
services	480	0.804	0.397	0	1
firm age	480	13.68	13.18	2	83
female owner	480	0.444	0.497	0	1
NCR	480	0.725	0.447	0	1
% of employees with college degree	480	40.43	29.46	0	100
fixed assets purchase	480	0.642	0.480	0	1
digital accounting and financial management use	480	0.717	0.451	0	1

Source: Own elaboration

The average profit growth rate⁹ of SMEs in our sample was about 20%, and the average employment size is about 24. Most of the SMEs in our sample are sole proprietorships (about 64%), the remaining 19% being corporations and 17% being partnerships. The average SME in our sample has been operating for a little less than 14 years. On average, about two-fifths (40%) of employees have a college degree.

In terms of asset size, 86.25% of SMEs in the sample are small, while the remaining 13.75% are medium-sized. A larger proportion (72.5%) of SMEs are located in the National Capital Region (NCR), while the remaining 27.5% are in the Calabarzon region. The majority (about 80%) of SMEs in the sample are in the services sector, while less than 20% are in industry. About 44% of SMEs in the sample have a female as the majority owner. About 64% of SMEs in our sample purchased fixed assets in the past two years, while the remaining 36% did not. More SMEs in our sample have a moderate to high use of digital software for accounting and financial management operations (about 72%), relative to SMEs that do not use, or at most have limited use of digital software for accounting and financial management (around 28%).

4. Results and Discussion

As a preliminary analysis, we ran a binary logistic regression to estimate the relationship between firm characteristics, firm technology, and the probability that an SME i is credit-constrained (1) or quasi-constrained (2). The results of the logistic regressions are presented in Appendix (Table 5) and Average Marginal Effects in Appendix (Table 6). We used the following equations in the logistic regressions:

$$Prob(credconst_i = 1) = \alpha_i + \beta_i \times firmchar + \varepsilon_i \quad (1)$$

$$Prob(quasiconst_i = 1) = \alpha_i + \beta_i \times firmchar + \varepsilon_i \quad (2)$$

where β is a vector of coefficients of **firmchar**, a vector of firm characteristics that include firm size, profit growth rate, employment size, ownership type, industry, firm age, female ownership, administrative region where the firm was located, percentage of employees with a college degree, purchase of fixed assets in the

past two years, and the firm's use of digital technologies for accounting and financial management operations; and ε is the error term.

Absolute values of the estimated logit coefficients (Appendix (Table 5) do not directly express the magnitude of economic impact. Thus, we also present our estimates of Average Marginal Effects (AMEs) in Appendix (Table 6). Marginal effects are one of the more widely-used means of providing an intuitive and meaningful interpretation of the impact of variables in nonlinear models (Williams, 2012) and are especially useful for categorical and binary independent variables. They are also often reported with logistic regression analyses to communicate and quantify how a change in outcome is related to changes in a particular covariate (credit constraint factors) (Cameron & Trivedi, 2010). AMEs use the actual observed values for the variables, making it attractive for some researchers since all the data and not just the means are used in the analysis (Williams, 2012).

Aside from the magnitude, we were also interested in approximating the amount of change in the predicted probability that the average SME in our sample is credit-constrained or quasi-constrained, given a change in a dependent variable such as firm characteristics and firm technology. To this end, we present estimates of Marginal Effects at the Means (MEMs) in Table 3.

MEMs use the means when computing predicted values (Williams, 2012). Use of AMEs over MEMs, and vice-versa are subject to preference, and both allow for meaningful interpretations of coefficient estimates, albeit from different reference points. An argument for preferring MEMs over AEMs is that MEMs can be more representative in analyzing the effects on the average observation (in our case, the average SME) in the sample.

Equation (3) shows the marginal effect of increasing the level of digital software use for accounting and financial management on the predicted probability that an SME i is credit-constrained (3) or quasi-constrained (4). We compute the MEMs using the following equations:

$$MEM_{digiAFM_i} = Pr(credconst_i = 1|X, digiAFM_i = 1) - Pr(credconst_i = 1|X, digiAFM_i = 0) \quad (3)$$

$$MEM_{digiAFM_i} = Pr(quasiconst_i = 1|X, digiAFM_i = 1) - Pr(quasiconst_i = 1|X, digiAFM_i = 0) \quad (4)$$

where *credconst* is a binary variable equal to 1 for credit-constrained SMEs, and 0 otherwise; *quasi-const* is a binary variable equal to 1 for quasi-constrained SMEs, and 0 otherwise; \mathbf{X} is a vector of covariates in the model that include all other firm characteristics held constant at their means, and *digiAFM* is equal to 1 if the SME i has a moderate to high use of digital software for accounting and financial management, and 0 if the SME does not, or at most has limited use of digital software for accounting and financial management.

To find the relationship of changes in firm characteristics on the predicted probability that the average SME in our sample is credit-constrained or quasi-constrained, we report the marginal effects at the means (MEMs). Our analysis of MEMs allowed us to quantify the impact of changes in the covariates on the predicted probability that the average SME in our sample is credit-constrained. We identified the average SME in our sample by holding all firm characteristics at their mean values. The covariates we focused on were firm characteristics and the SME's adoption of digital technologies for accounting and financial management. For our analysis of MEMs, the estimated marginal effects show how the predicted probabilities of being credit-constrained or quasi-constrained change as the covariates change. We are particularly interested in the marginal effect of an SME's increased use of digital software in accounting and financial management operations.

The estimated marginal effects coefficients allowed us to determine how the predicted probability of being credit-constrained or quasi-constrained changes for the average SME in our sample as it increases its use of digital technologies for accounting and financial management operations, holding firm characteristics at their mean values. Compared to SMEs that are credit-constrained, respondents were classified as quasi-constrained if they obtained loans from informal sources. For purposes of this analysis, we defined informal sources as any of the following: the business owner or one of the owners, family or relative of the business owner/one of the owners, moneylenders ("five-six loan sharks"¹⁰), and other sources apart from banks or financial institutions such as cooperatives, savings, and loan associations and lending companies.

We present the marginal effects at the mean estimation results in Table 3 below. There are two major findings from the results. First, firm characteristics (asset size and fixed assets purchase) that matter in accessing finance through formal channels are not significant when accounting for informal sources. In other words, the factors that affect an SME's predicted probability of being credit-constrained may be different from the factors that affect the probability of being quasi-constrained. Second, the increased use of digital software for accounting and financial management operations is associated with a lower predicted probability of being credit-constrained and quasi-constrained.

Table 3. Marginal Effects at the Mean

Marginal effects at the means	(1)	(2)
	Credit-constrained	Quasi-constrained
Firm size (by assets)	-0.116*	-0.0440
	(0.0678)	(0.0735)
Profit growth rate (%)	7.54e-05	0.000366
	(0.00103)	(0.00104)
Employment size	0.00114	0.00132
	(0.000881)	(0.000918)
Sole proprietorship	-0.0974	-0.106
	(0.0665)	(0.0664)
Corporation	0.0287	0.0145
	(0.0801)	(0.0790)
Services sector	0.0844	0.0675
	(0.0569)	(0.0591)
Firm age	0.000178	0.00127
	(0.00186)	(0.00192)
Female-owned	-0.0425	-0.0178
	(0.0487)	(0.0496)
Located in the NCR (National Capital Region)	-0.00682	0.0450
	(0.0550)	(0.0553)
Employees with college degree (%)	-0.000974	-0.00108
	(0.000833)	(0.000847)
Previous purchase of fixed assets	-0.0812*	-0.0488
	(0.0488)	(0.0495)
Moderate to high use of digital accounting and financial management	-0.156***	-0.124**
	(0.0553)	(0.0552)
Observations	480	480
Pseudo R-squared	0.0371	0.0285

Source: Own elaboration

Standard errors in parentheses, (***) $p < 0.01$, (**) $p < 0.05$, (*) $p < 0.1$

Column 1 in Table 3 shows that the predicted probability of being credit-constrained is 11.6 percentage points lower for medium-sized enterprises, relative to small enterprises, holding firm characteristics at their means. This result is consistent with Aldaba (2011), whose study finds that smaller SMEs in the Philippines had a more challenging experience accessing external financing, primarily due to having limited records, collateral, and inadequate financial statements. An enterprise's ability to access finance is typically correlated with firm size. Smaller companies generally encounter more difficulties accessing finance. Smaller firms usually have fewer collateral options, a riskier profile, lower accounting and financial management capacity, and higher informality rates (OECD et al., 2019). Besides having less access to external finance, SMEs face higher risk premiums and higher transaction costs than larger firms (Beck & Demircug-Kunt, 2006). Cross-country studies show that as firm size increases, the probability of being credit constrained decreases (Kuntchev et al., 2013). In the Philippines, SMEs, especially the smaller firms, have faced difficulties accessing credit due to limited acceptable collateral, inadequate financial statements, and incomplete financial records (Aldaba, 2011).

Also consistent with Aldaba (2011), we find that having purchased fixed assets, which can be used as collateral and is also a positive signal of creditworthiness to creditors, has an inverse association with the probability of being credit-constrained. Particularly, the predicted probability of being credit-constrained is about 8.1 percentage points lower for SMEs that have purchased fixed assets in the past two years, relative to those that did not purchase fixed assets. Previous asset purchase records have also been linked to increased access to finance. A firm's prior acquisition of assets can be indicative of its credit history. Quartey et al. (2017) identified a firm's credit information as a determinant of access to finance. To reduce asymmetric information and assess their clients' ability to repay loans, banks and other formal financial institutions typically require collateral (Love et al., 2013). While firms have traditionally used fixed assets as collateral, moveable assets such as equipment have recently been gaining increased use as a form of collateral, especially for small businesses that lack fixed assets. Love et al. (2013) found that introducing movable collateral registries increases firms' access to bank finance, especially for smaller firms. Nonetheless, the recent acquisition of assets, whether fixed or moveable, may increase the likelihood that a firm can access finance from formal institutions.

Also, we find that an SME's increased adoption of technology, represented by its level of digital software use for accounting and financial management operations, is inversely associated with the predicted probability that an SME is credit-constrained and quasi-constrained. For average SMEs in our sample, those with moderate to high use of digital accounting and financial management software are 15.6 percentage points less likely to be credit-constrained and 12.4 percentage points less likely to be quasi-constrained than those with limited or no use of digital software for accounting and financial management. This result is also consistent with Aldaba (2011), which identified having inadequate financial statements as one of the barriers to accessing finance. Using digital software for accounting and financial management may make it easier to oversee and generate reports on a firm's finances. Increased use of digital processes also improves a firm's ability to organize its records, such as financial statements. Thus, having a higher level of digital accounting and financial management use could make the firm more attractive to external creditors, especially if the creditor requires the firm's financial statements, as do most banks and other lending institutions in the formal sector. A firm's adoption of new technologies, particularly in accounting and financial management, is also a determinant of its ability to access formal credit markets. Increased digital technologies adoption has an inverse association with the predicted probability of being credit constrained. In addition to firm size, Peñaloza (2015) identified the firm's technological capacity as a key factor in determining a firm's access to credit markets primarily because of competitive advantages brought about by increased use of technology. Using digital software for accounting and financial management also streamlines firms' record-keeping process, enabling them to meet the requirement of records to access credit from formal financial institutions.

Comparing column 1 with column 2 in Table 3, the estimation results indicate that some of the firm characteristics that affect the probability of being credit-constrained may not significantly affect the probability of being quasi-constrained. Firm size, past purchase of fixed assets, and a moderate to high level of digital software use for accounting and financial management operations each have a statistically significant inverse relationship with the predicted probability that an SME is credit-constrained. Among the firm characteristics that were significant in determining access to formal finance, only the use of digital software for accounting and financial management has a statistically significant inverse relationship with the predicted probability that an SME is quasi-constrained in informal channels. For the average SME in our sample, higher use of digital accounting and financial management software is associated with a lower predicted probability of being credit-constrained and quasi-constrained.

In short, access to informal finance may have different determinants than formal finance, although the results of our estimates show that the use of digital technologies in accounting and financial management are both significantly correlated to less credit constraint in both formal and informal markets.

5. Conclusion

Access to finance is essential in enabling and maximizing small businesses' growth (Angeles et al., 2019). Having additional capital allows entrepreneurs to innovate, expand to new markets, improve efficiency, and provide employment (Innovations for Poverty Action (IPA), 2015). While the lack of capital limits small firms' growth opportunities (Angeles et al., 2019), additional capital increases small businesses' potential to boost productivity (Krishnaswamy, 2007).

The lack of capital due to credit constraints is the primary obstacle that hinders SMEs from reaching their full potential (Fowowe, 2017). Thus, financial institutions' willingness to support SMEs through financing is critical to overcoming small firms' growth constraints (Khandker et al., 2013; Kuzilwa, 2005).

Our study contributes to the literature on SME finance by distinguishing between the types of credit constraints small businesses face - whether they cannot obtain loans from formal sources (credit-constrained) or can obtain loans but only from informal channels (quasi-constrained). This distinction is especially relevant for SMEs in developing countries where informal channels are an important source of financing for small businesses. Moreover, our study also shows that access to finance in formal channels has different determinants than informal channels, although the use of digital technologies for accounting and financial management is positively associated with increased access to finance in both formal and informal markets. This result is important because although access to finance in formal channels has different determinants than informal channels, the use of digital technologies for financial management may help mitigate credit constraints for SMEs in both formal and informal markets.

In this paper, we defined credit constraints and identified the characteristics of credit-constrained and quasi-constrained SMEs in the Philippines using data from a sample of 480 firms in the NCR and Calabarzon regions. We were particularly interested in the relationship between firm characteristics, including its level of technology use in accounting and financial management operations and the probability of being credit-constrained and quasi-constrained.

We distinguished between being credit-constrained and quasi-constrained, where SMEs that obtained loans from informal sources are considered quasi-constrained. Comparing the estimates of marginal effects at the

means from logistic regressions, we show that while firm size and past purchase of fixed assets are associated with a lower predicted probability of being credit-constrained, they have no statistically significant relationship with the probability of being quasi-constrained when involving informal sources. In addition, our estimates also revealed that high use of digital software for accounting and financial management has a statistically significant inverse relationship with the predicted probability of being credit-constrained or quasi-constrained.

Many financial technology (fintech) companies enter the market to address the increasing demand for inclusive, fully digital, remotely accessible, and cheap financial services. This is particularly relevant for small businesses and firms operating in rural and remote areas that find it difficult to access the formal financial sector (OECD, 2018). Digital technologies enable SMEs' access to credit (Lukonga, 2020) by allowing small businesses to take advantage of innovative digital financial services (OECD, 2018). Alternative financing sources have seen rapid growth in both developing and developed economies as they enable investment projects typically considered too small or too risky by traditional banks (World Economic Forum, 2015). Despite the social and economic benefits of fintech in increasing access to finance, innovative digital financial solutions remain limited compared to traditional finance. This is because digital and financial literacy are requirements for SMEs to access fintech and other digital financial solutions that give them greater access to loans (Nemoto & Koreen, 2019). Policies that democratize financial services through inclusive finance and financial technologies (fintech) should be promoted, in addition to digital financial literacy, to enable the growth of SMEs.

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Appendix

Table 4. Pairwise correlation of variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	1.000													
(2)	-0.058	1.000												
(3)	-0.020	0.124	1.000											
(4)	0.036	0.311	-0.046	1.000										
(5)	-0.065	-0.223	-0.067	-0.238	1.000									
(6)	0.030	0.049	0.032	0.126	-0.604	1.000								
(7)	0.050	0.227	0.052	0.171	-0.649	-0.215	1.000							
(8)	0.064	-0.047	0.034	-0.070	0.030	-0.019	-0.018	1.000						
(9)	0.034	0.193	-0.023	0.308	-0.202	0.016	0.232	-0.009	1.000					
(10)	-0.052	-0.174	-0.007	-0.128	0.258	-0.073	-0.246	0.029	-0.133	1.000				
(11)	0.013	-0.079	-0.102	0.173	0.100	-0.075	-0.051	0.119	0.039	0.156	1.000			
(12)	-0.063	0.044	-0.049	0.184	-0.137	0.097	0.076	0.101	-0.018	-0.006	0.114	1.000		
(13)	-0.093	0.084	0.164	0.020	-0.045	0.008	0.047	0.014	0.006	0.038	0.046	0.057	1.000	
(14)	-0.132	0.144	0.073	0.146	-0.263	0.145	0.184	-0.077	0.024	-0.099	-0.128	0.230	0.089	1.000

Source: Own elaboration

The variables in Table 4 are as follows: (1) credit-constrained; (2) asset classification: medium-sized; (3) net profit change in the past two years; (4) employment size; (5) sole proprietorship; (6) partnership; (7) corporation; (8) services sector; (9) firm age; (10) female-owned; (11) located in the National Capital Region; (12) owner education; (13) acquisition of new equipment or fixed assets in the past two years; (14) moderate to high use of digital processes and software in accounting and financial management.

Table 5. Logistic Regressions

	(1)	(2)
Logistic regressions	Credit-constrained	Quasi-constrained
Firm size (by assets)	-0.508 (0.316)	-0.178 (0.300)
Profit growth rate (%)	0.000314 (0.00429)	0.00147 (0.00420)
Employment size	0.00477 (0.00367)	0.00529 (0.00369)
Sole proprietorship	-0.404 (0.272)	-0.426 (0.268)
Corporation	0.115 (0.322)	0.0585 (0.318)
Services sector	0.362 (0.252)	0.274 (0.243)
Firm age	0.000741 (0.00776)	0.00509 (0.00771)
Female-owned	-0.177 (0.204)	-0.0717 (0.199)
Located in the NCR (National Capital Region)	-0.0284 (0.229)	0.182 (0.224)
Employees with a college degree (%)	-0.00406 (0.00348)	-0.00436 (0.00340)
Previous purchase of fixed assets	-0.336* (0.201)	-0.196 (0.199)
Moderate to high use of digital accounting and financial management	-0.641*** (0.227)	-0.497** (0.224)
Constant	0.417 (0.437)	0.261 (0.428)
Observations	480	480
Pseudo R-squared	0.0371	0.0285

Source: Own elaboration

Standard errors in parentheses, (***) $p < 0.01$, (**) $p < 0.05$, (*) $p < 0.1$

Table 6. Average Marginal Effects

Average Marginal Effects	(1)	(2)
	Credit-constrained	Quasi-constrained
Firm size (by assets)	-0.112*	-0.0423
	(0.0655)	(0.0705)
Profit growth rate (%)	7.20e-05	0.000352
	(0.000983)	(0.00100)
Employment size	0.00109	0.00126
	(0.000835)	(0.000875)
Sole proprietorship	-0.0930	-0.102
	(0.0632)	(0.0641)
Corporation	0.0273	0.0141
	(0.0763)	(0.0765)
Services sector	0.0811	0.0651
	(0.0549)	(0.0571)
Firm age	0.000170	0.00122
	(0.00178)	(0.00184)
Female-owned	-0.0406	-0.0172
	(0.0466)	(0.0477)
Located in the NCR (National Capital Region)	-0.00651	0.0434
	(0.0525)	(0.0534)
Employees with a college degree (%)	-0.000930	-0.00104
	(0.000791)	(0.000809)
Previous purchase of fixed assets	-0.0781*	-0.0470
	(0.0470)	(0.0478)
Moderate to high use of digital accounting and financial management	-0.151***	-0.120**
	(0.0534)	(0.0535)
Observations	480	480
Pseudo R-squared	0.0371	0.0285

Source: Own elaboration

Standard errors in parentheses, (***) $p < 0.01$, (**) $p < 0.05$, (*) $p < 0.1$

Footnotes

¹ Quasi-constrained firms are those that can obtain loans from informal sources. A more formal definition of quasi-constrained firms is discussed.

² Composed of 17 cities in Metro Manila.

³ Composed of five provinces, each of which is composed of numerous cities and municipalities.

⁴ agribusiness / industry / services.

⁵ The smallest administrative division of local government in the Philippines.

⁶ Someone who is in charge of the day-to-day operations of the business.

⁷ Not a reason / minor reason/ moderate reason/ major reason/ biggest reason.

⁸ Reasons for not getting a loan: Did not need to borrow/ Did not think loan application would be approved anyway/ Applied for a loan but it was not approved/ The interest was too high/ Lack of acceptable collateral/ Complicated loan application process/ Negative perception of loan or debt/ Too risky/ The owner/s do not want to have debt/ The owner fears that the business won't be able to pay the loan/ Slow processing of loan.

⁹ Over the past 2 years.

¹⁰ Five-six loan sharks are lenders that charge a 20% (or higher) interest rate for loans that are commonly collected on a weekly or daily basis.

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