

Essays on SME Growth and Financing

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ABSTRACT

The growth of small- and medium-sized enterprises (SME) accounts for a disproportionate share of employment, economic growth and prosperity (Adelino et al., 2017). However, it has been argued that SMEs suffer from severe information asymmetry and other types of market frictions and, thus, are more likely subject to credit constraints (Berger and Udell, 1998). This PhD thesis addresses this issue from three different, yet interrelated, perspectives: the relationship between SME growth and credit constraints; the impacts of firm characteristics on the full scope of the SME debt acquisition process; and the effectiveness of a credit guarantee scheme (CGS). The latter is a widely-used form of policy initiative that seeks to address SME credit constraints. Accordingly, this thesis comprises three chapters and draws on empirical analyses of unique datasets from Statistics Canada surveys, conducted from 2011 to 2017.

The first chapter of this dissertation investigates the impacts of demand- and supply-side credit constraints on SME growth. It finds that evidence consistent with the premise that growth-oriented firms that apply and obtain either term loans or trade credit experience higher short-term growth than demand-constrained and supply-constrained firms. In the longer term, growth-oriented firms that apply and obtain term loans experience higher growth in revenues than supply-constrained firms.

The second chapter estimates the three stages of the SME debt acquisition process (i.e., recognizing a need for capital, applying for a loan, and being approved for a loan) using a trivariate probit model that accounts for the correlation among the three stages of the SME debt acquisition process. It finds that while innovators and exporters are relatively more likely to need external financing, they do not face demand- or supply-side constraints. Conversely, firms majority-owned by women and members of visible minority groups are more likely to need credit, are more likely to be demand-constrained and are subject to statistical discrimination when seeking credit. When changing the definition of demand-constrained borrowers to a more narrow definition, innovators are relatively more likely to apply for needed financing, exporters are relatively less likely to do so, and visible minorities are relatively just as likely to apply for needed financing.

The third chapter proposes a new means of assessing the economic impact of the Canadian CGS, the Canada Small Business Financing (CSBF) program. The Canadian CGS is a mechanism by

which the Government of Canada guarantees a specific portion of a loan in the event of default. The new measure improves on an existing measure that seeks to evaluate the performance of CGSs: the incrementality rate (a measure that evaluates the extent to which loans advanced under the CGS program would not otherwise have been approved by lenders—the counterfactual). The new measure developed in this chapter gauges lenders’ moral hazard; that is, the extent to which lenders take excessive risks by betting on overly risky loans because they know that the losses would be covered by the program. This cannot be captured by the incrementality rate. The chapter reports on the evaluation of the CSBF performance based on both measures, the traditional incrementality rate and the new measure of lenders’ excess risk taking. It finds that the CSBF is not incremental, with a low incrementality rate of 5.3 per cent. The findings also suggest that lenders do not engage in excessive risk-taking behavior, as evidenced by an almost zero risk-taking rate. While Canadian banks do not particularly exhibit a willingness to allocate guaranteed loans to women and visible minorities (the groups of firms that are subject to statistical discrimination per Chapter II), they tend to allocate more guaranteed loans to growth-oriented borrowers, consistent with the CSBF’s objective to support the growth of small businesses (ISED Canada, 2016). Finally, the CSBF incrementality rate does not vary significantly between recession (following the 2007-2008 crisis) and post-recession time periods.

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CHAPTER I : BUSINESS GROWTH AND DEMAND- AND SUPPLY-SIDE FINANCIAL CONSTRAINTS

I.1. Introduction

It is well-known that the growth of small and young firms accounts for a disproportionate share of employment growth and the associated economic welfare (Adelino et al., 2017). For example, SMEs accounted for 80 per cent of total employment growth in Europe in 2010. In the United States, SMEs account for half of the country's total private sector jobs and contributed 62 per cent of net new job creation in 2015 (OECD, 2020). Similarly, in Canada, SMEs contributed 87.7 per cent of net employment growth realized during the 2005-2015 period (ISED Canada, 2016).

However, it has been also argued that small firms suffer from severe information asymmetry and other types of market frictions and are therefore more likely subject to credit constraints (Berger and Udell, 1998; Stiglitz and Weiss, 1983). Limited access to financing compromises firm growth, which, in turn, possibly hinders the growth of the entire economy that would otherwise have been realized. While existing studies have empirically examined the relationship between SME growth and financing availability, several crucial research questions remain unaddressed. According to Fraser et al. (2015, p. 82):

“We know comparatively little about the impact of financial constraints on small business growth. . . . Future research needs to examine the impact of funding gaps on growth and how this varies over specific types of finance and across different types of business. There is also a need for more research to better understand (potential) cognitive constraints, including discouragement, on investment/financing decisions and growth.”

This study responds to Fraser et al.'s call. It investigates the growth-constraint relationship in the context of not only bank loans but also trade credit. Trade credit is an important source of financing, as are bank loans (Matias Gama and Van Auken, 2015), especially when credit supply is tightened (Carbo-Valverde et al., 2016). In 2017, the Survey of Financing and Growth of SMEs (SFGSME) reported that bank loans and trade credit were the most important sources of financing for SMEs, with 25.6 per cent of SMEs applying for bank loans and 25.7 per cent of SMEs applying

for trade credit.¹ The impact of trade credit availability on firm growth has not yet been studied and the extent to which SMEs are constrained from accessing bank loans has been widely debated. Therefore, it is important to investigate the availability of financing through these key channels.

Second, in its examination of the impacts on growth of bank and trade credit constraints, this study distinguishes between demand-side constraints from supply-side counterparts. To my knowledge, there is no study that has performed such separate analyses – so our understandings about the impact of demand-side constraints on firms’ growth is limited.² This study argues that such separation is important as different implications—and approached to remediation—hold for different types of constraints, especially for policy makers.

Furthermore, the work focuses on a specific category of businesses – those that are growth-oriented. The general SME population includes many “life-style” businesses and “forced entrepreneurs” (the latter also known as “necessity entrepreneurs”), firms that may not always be focused on growth of their firms. Estimations of growth-constraint relationships that do not distinguish between firms whose owners seek growth from those who do not cannot be relied on to accurately quantify the impacts of financing constraints. This study addresses these gaps in the literature.

This research employs empirical methods to estimate the impact of financial constraints. The approaches employed here have several advantages over previous attempts. First, following Motta (2018), the estimations use direct and reliable measures of credit constraints. Specifically, this study uses whether or not the project proposed by the firm was financed (i.e., the outcomes of the loan/trade credit application) to measure supply-side constraints and whether the firm was discouraged from applying for financing (i.e., the decision to apply for a loan or trade credit) to measure demand-side constraints (as opposed to those based on variables from financial statements and entrepreneurs’ perceptions). Second, the analyses control for the availability of other sources of financing, including internally generated funds, trade credit (for bank loan analyses), bank loans (for trade credit analyses), equity financing, and leasing. Third, the analyses use a two-step

¹ For comparison, the 2017 request rates for lease financing and equity financing were 7.2 and 0.8 per cent respectively.

² Motta (2018) considers both supply- and demand-side constrained borrowers, yet groups them into the same category.

propensity score analyses procedure. The first step estimates the propensity of (1) not applying for credit when needing it (relative to applying); and, (2) having loan requests rejected (relative to having it accepted). The models estimated from step 1 (using weighted probit models) are then used to generate propensity scores for each firm. Step 2 incorporates these scores as weights in a regression model that regresses firm growth on a set of control variables and financial constraint indicators (Guo and Fraser, 2015). Fourth, the impacts of financial constraints on growth are estimated for multiple measures of growth over different time frames.

The results of such analyses are summarized as follows.

First, in the short-term (one year after non-constrained firms (NCFs) receive financing), growth-oriented firms that apply and obtain bank debt or trade credit experience higher growth in employees than growth-oriented firms that were demand constrained. Likewise, in the short-term, (a) growth-oriented firms that apply for and obtain bank debt experience higher growth in assets than growth-oriented firms that were supply constrained; (b) growth-oriented firms that apply for and obtain trade credit experience higher growth in revenues and productivity than growth-oriented firms that were supply constrained.

Second, in the longer-term (two years after receiving financing), growth-oriented firms that apply for and obtain bank debt and trade credit no longer experience higher growth than demand-constrained firms. For trade credit, this result is understandable as this type of financing is almost always for short-term working capital financing. For bank debt, the result may suggest that, in the longer term, demand-constrained firms may start to overcome discouragement (and thus apply for and obtain the financing they need) in the subsequent years. The supply-side constraints, however, are found to be persistent in the longer-term. That is, in the longer-term, growth-oriented firms that apply and obtain bank debt experience higher growth in employees, assets and revenues than growth-oriented firms that were supply constrained, particularly in the second year. These results suggest that supply-side constraints are more persistent, arguably due to the longer time required for supply-side constrained firms to build creditworthiness. They also suggest that it takes a longer time for bank loan financing to be translated into growth in such fundamentals, such as revenues and total assets.

Third, based on an additional examination that splits the bank debt sample into term loan and line of credit sub-samples, the positive relationship between bank debt availability and growth discussed above is mainly driven by the availability of term loans. More specifically, growth-oriented firms that apply for and obtain term loans experience higher employee and asset growth than growth-oriented firms that were either demand or supply constrained. However, growth-oriented firms that apply for and obtain lines of credit do not experience any significant differences in growth compared to growth-oriented firms that were demand or supply constrained. These insignificant differences in growth may be linked to the versatility of proceeds from lines of credit compared to proceeds from term loans. Since funds from lines of credit can often be used for multiple reasons, growth is distributed across several different areas of spending. For example, although both are for working capital financing, trade credit financing is for the purchase of raw materials and other revenue-enhancing costs (e.g., advertisements), whereas lines of credit can be used for paying the current portion of long term debt, deferred taxes, etc. Accordingly, we would expect trade credit to have a stronger association with growth (in particular, revenues and productivity) than lines of credit.³

Table I-1. Summary of results - Demand

<i>Labels</i>	Short-term (1 year) growth	Long-term (2~3 year) growth
Trade credit	Employees	No difference
Bank loans	Employees	No difference
Term loans	Employees, Assets	No difference
Lines of credit	No difference	No difference

Table I-2. Summary of results - Supply

<i>Labels</i>	Short-term (1 year) growth	Long-term (2~3 year) growth
Trade credit	Revenues, Productivity	Productivity

³ Consistent with this argument, Demiroglu, James and Kizilaslan (2012) report that high-growth firms are less likely to have a credit line.

Bank loans	Assets	Employees, Revenues, Productivity
Term loans	Employees, Assets	Employees, Assets, Revenues
Lines of credit	No difference	No difference

Overall, obtaining either term loans or trade credit are found to matter for growth performance. In the short-term, trade credit positively impacts revenue and productivity growth, while term loans impact, positively, asset and employee growth. In the long term, term loans appear to positively influence revenue growth (but trade credit does not have a long term impact on growth, and this is understandable because trade credit is a short-term financing tool). Specifically, term loans impact positively employee, asset, and revenue growth, while trade credit impacts (positively) productivity. These results suggest that it takes longer for the additional resources obtained via term loans to be translated into revenue growth.⁴ Conversely, access to trade credit has a positive impact on growth in revenues and productivity within a shorter time period (one year after receiving it).

To my knowledge, this is among the first studies to investigate the impact of the availability of both trade credit and bank loans on firm growth, while considering different channels of constraints separately and focusing on the impacts for growth-oriented firms. By doing so, it contributes to both the academic literature and to public policy. I believe that these are important points to address, especially since public policy efforts have focused primarily on supply side, rather than demand side, constraints (OECD, 2013). Moreover, a substantive portion of the research literature is devoted to analyses of bank loans despite that trade credit also appears to be an important source of financing for SMEs (Carbo-Valverde et al., 2016; Matias Gama and Van Auklen, 2015). In addition, no previous research has (to my knowledge) examined the extent to which growth outcomes, *fuelled by entrepreneurial growth aspirations*, have been compromised by limited access to financing. This is surprising as existing research has reported that growth-oriented small businesses face even more severe credit constraint than the general SME population (e.g., Binks and Ennew, 1996a; 1996b; Psillaki and Daskalakis, 2009). I believe that the investigation on this point provides a more complete understanding of the growth-financing availability relationship for

⁴ Eventually, in the long term, firms that received bank loans seem to experience growth in revenues, but not productivity.

both academics and policy makers who seek to facilitate economic growth via active entrepreneurial activity.

This paper proceeds with a detailed review of the existing literature on financial constraints and growth, followed by the conceptual framework. Sections four and five present the data and methodology. Section six presents the empirical findings, and section seven concludes.

1.2. Literature review⁵

While financial availability is an important issue also for large firms (Banerjee, Dutta and Zhu, 2020), the research literature has long held that information asymmetry and the consequent limited access to external finance (for example, Stiglitz & Weiss, 1981) negatively impacts growth more severely for SMEs than for established corporations (Ayyagari et al. 2007; Frazer, 2005). This is also partially because small young firms tend to lack internally generated cash flows, that “limited access to external finance undermines the ability of SMEs to invest in their operations due to constraints in the availability of internal finance” (Motta, 2018; p. 3).⁶

The above arguments have motivated researchers to explore the impact of access to external financing on growth, much of which has focused on the context of bank loans. These studies use several different proxy measures for the lack of access to financing, including the entrepreneurs’ perceptions of the level of financial constraints, credit ratings, and loan application outcomes. For example, using data on 4,000 SMEs in 54 countries, Beck et al. (2005) study the effect of firm size, the levels of legal system development and corruption of the country the firm resides, and the firm’s perceived level of the strength of financing obstacles on its growth. They find that smaller firm size, better legal systems, low levels of corruption, and higher perceived level of severity of obstacles to obtain financing all lower the firm’s growth performance, and the impact of the latter

⁵ See Appendix 1 for more detailed review on existing papers on the growth-financial constraint relationship.

⁶ Carpenter and Petersen (2002) detect a greater sensitivity of growth to the availability of internal finance for firms that do not rely on external finance than those who use external equity financing. This finding suggests that inability to access to external financing forces entrepreneurs rely on internal financing, i.e., sensitivity of growth to internal financing can be used as a proxy for constraints of external financing (Carpenter and Petersen, 2002; Fraser et al., 2015). In this context, several papers observe significant sensitivity of growth to internal financing among SMEs (e.g., Elston, 2002; Hutchinson and Xavier, 2006; Fagiolo and Luzzi, 2004), with an increased impact of internal cash flows on growth for smaller firms within the SME category (Wagenvoort, 2003). These studies suggest that SMEs face not only limited availability of internal cash flows but also difficulty in accessing external financing – and this problem is severer for smaller firms.

three are stronger for small firms. Ullah (2019) also uses a proxy for credit constraint similar to that of Beck et al.'s and finds similar results in Eastern European and Central Asian countries. Bottazzi et al. (2014) use credit ratings as a proxy for financial constraint and show both the direct and moderating effects of financial constraint on growth. That is: financial constraints not only reduce growth but also exacerbate the impacts of other firm characteristics (such as size, age, and profitability) on growth. Financial constraints also change the growth patterns, which introduces volatilities in growth shock distributions.

While the contributions of these papers to the literature is significant, these studies rely on either the SME owners' *perceived* level of financial constraint or credit ratings, perceptions that may not reflect an objectively-gauged level of credit constraint. For example, the benchmark for what level of credit tightness is enough to rate themselves as "highly credit-constrained" is different for different firm owners. This shortcoming makes it particularly difficult to quantify the foregone growth by unavailability of credit, the objective of this study, rather than by examining simply whether credit constraints hinder growth.⁷ In addition, Wagenvoort (2003) points out that the subjectively measured (SME owners' perceived level of) credit constraints may be inherently biased upward, as they are incentivised to report themselves as highly constrained to trigger an increase in government financial support programs. Similarly, Hallward-Driemier and Aterido (2009) suggest that subjective survey responses can lead to biased results given the differences in the willingness of firms to report positive or negative responses, the benchmark used by firms when answering the survey question and whether firms view the question narrowly or broadly.

Credit ratings, when used as a proxy for credit constraints, are free from the shortcomings inherent in subjective measured credit constraints, yet neither do they take into account whether the firm needs financing (e.g., a firm with a low rating might not need growth financing), nor do they capture the final decision made by credit suppliers regarding whether the request is to be approved or not (i.e., a firm with a low rating might eventually obtain financing). In addition, Treacy and Carey (2000) highlight "rating assignment and review almost always involve the exercise of human judgment" (p. 168). Because of these characteristics, credit ratings may not be a reliable

⁷ Ullah (2019) estimates the impact of financial constraints on growth using the subjective and objective measures of constraints (of which the latter drawn from firms' financial statement information). While the conclusion drawn from the two measures is the same, the estimated impacts (the coefficients) of constraints are different between the two measures (0.005~0.006 and 0.016~0.044, respectively), yet both are coded in the same way (binomial).

measure of credit constraints in the estimation of the growth-financing availability relationship and the quantification of forgone growth attributable to these constraints. In this regard, as a proxy for financing constraint measures, the actual outcomes of financing applications appear to be the best means of investigating the growth-financing availability relationship, as they do not rely on firms' perceptions (subjective judgements) of the level of constraints, and they incorporate whether a firm needs financing, whether (or not) it applied for financing and whether they obtained financing.⁸

A few studies have considered the outcomes of financing applications and their relationship with growth outcomes. For example, Motta (2018) finds that SMEs without a loan have significantly lower levels of labor productivity than SMEs that obtained a loan. Similarly, Becchetti and Trovato (2002) find that Italian firms with less than 50 employees grew significantly less if they had requested credit but did not receive it compared to counterpart firms that did receive external financing.

However, these studies tend to focus either on supply-side constraints or fail to distinguish them from demand-side constraints, so the impact of the latter is not yet clear (Fraser et al., 2015). Financial constraints can originate from both supply- and demand-side factors (see Figure I-1). While (post-application) growth rates are expected to be lower for both supply-side and demand-side constrained firms than not-constrained firms (i.e., $Growth\ rate_A > Growth\ rate_S$ and $Growth\ rate_A > Growth\ rate_D$), the extent of which each of the demand- and supply-side constraint impact growth is not yet known. The supply side constraint happens when firms' financing applications are rejected, while the demand side constraint occurs when firms that need financing do not apply for it: being self-constrained. This paper argues that it is important to investigate the effects of the two sets of constraints separately, as they have different implications, especially for policy makers who seek government initiatives to facilitate small firm growth via smoother access to financing. It is not yet known how demand-side constraints impact growth and how such impact differs from those of supply-side constraints.

⁸ In addition, this study takes it into consideration whether the firm was subject to the demand-side constraints (i.e., did not apply even though they need financing).

Figure I-1. SME growth financing process

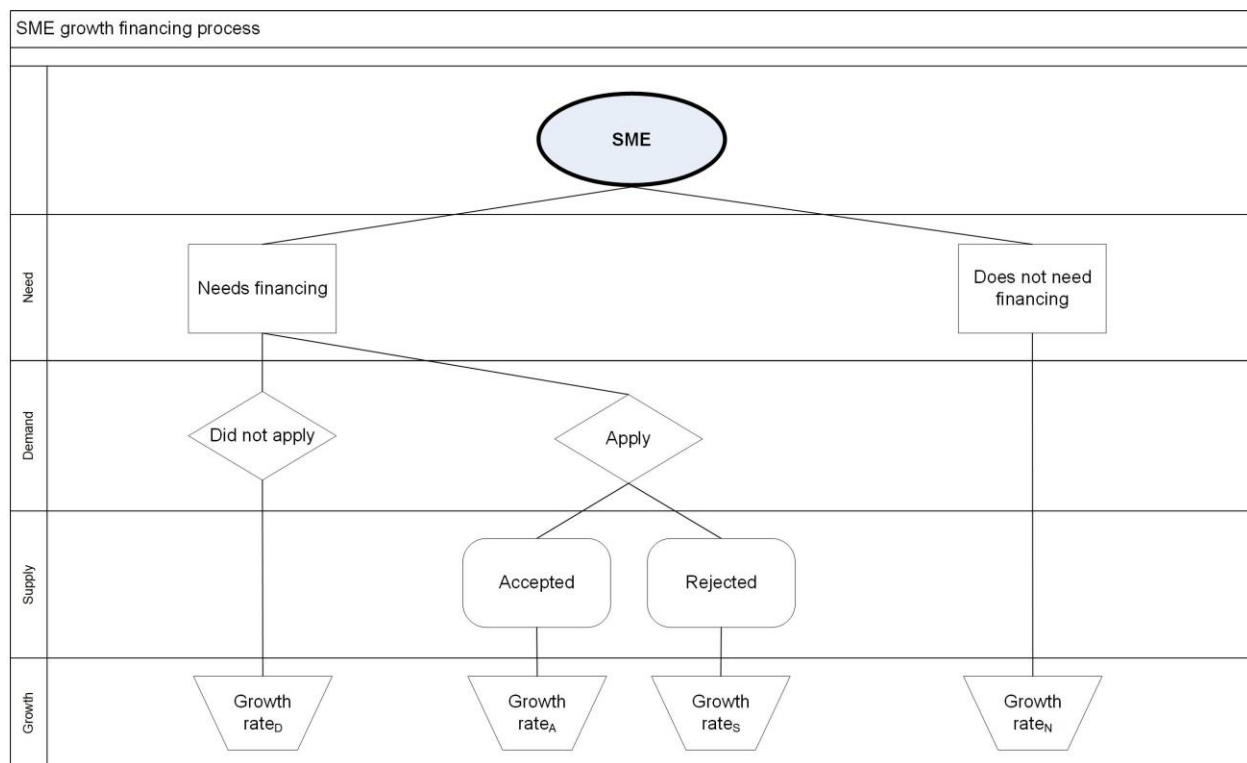


Figure I-1 models the SME growth financing process, one that identifies whether the SME: needs financing; applied for financing; and, obtained financing. The final row of the diagram depicts the growth rate outcomes following each decision.

In addition, research has yet to determine the counterfactual; that is, the quantum of economic benefits that would have been realized by *growth projects* of SMEs; yet which were compromised by financial constraint. Such estimation requires the estimation of the impact of financial constraints on firms looking for finance that intend to grow. Existing studies estimate the impact of financial constraints on growth by assuming implicitly that all firms that seek financing do so for growth purposes, yet such an assumption may not hold. According to Statistics Canada (2006), only 39 percent of firms that applied for bank loans expressed a desire to grow in 2004, implying that more than 60 percent of firms did so for reasons beyond growth purposes. Furthermore, previous studies did not control for the availability of other sources of financing. The estimated growth-financial constraint relationship could be misleading if financial constraints are measured

by loan application outcomes and if firms that were rejected for their loan applications obtained financing from other sources (e.g. trade credit), and vice versa.⁹

In addition, there is a scant literature on the growth-financing availability that focuses on the availability of trade credit (as mentioned, most studies in this literature stream are in the context of bank loans). Trade credit appears to be an important source of financing for SMEs along with bank loans (Matias Gama & Van auken, 2015). For example, according to Statistics Canada, 25.6 per cent of SMEs in the 2017 survey sample applied for bank debt and 25.7 per cent for trade credit, compared to 0.8 and 7.2 per cent for equity and lease financing, respectively.¹⁰ Carbo-Valverde et al. (2016) report that trade credit is used as a substitute of bank loans especially when bank credit supply is tightened.¹¹

Since growth requires not only financing for long-term assets but also for working capital, it is logical that the availability of trade credit can also be expected to facilitate growth. The availability of trade credit is positively associated with profitability (Martínez-Sola, García-Teruel and Martínez-Solano, 2013) and firm survival (García-Teruel and Martínez-Solano, 2007) However, its relationship with firm growth remains unknown.

This study addresses these gaps in the literature. Specifically, it quantifies the impact of credit constraints on growth in the contexts of both bank loans and trade credit, while examining the effect of supply- and demand-side constraints separately and controlling for firms' growth intention and need for credit. It does so by using a reliable measure for credit constraints (credit application outcomes) while controlling for the availability of internally generated funds and other

⁹ The literature has debated on the influence of firm growth intentions on financing availability. For example, Cosh et al. (2009) suggest that growth intention significantly affects the probability of loan applications. While Freel et al. (2012) argue that firms that seek external financing for growth purposes are more likely to receive it (given the positive signal sent by growth intention to lenders that the firm has a profitable project), Binks and Enew (1996a) maintain that growth intentions add more cash flow volatilities, making lenders shy away from firms seeking external capital for growth purposes. Whichever the direction of the impact of firm growth intention, these studies suggest the importance, in empirical research, of focusing on growth-oriented firms and separating the examination of the impact of the demand- and supply-side financial constraint.

¹⁰ The 0.8 request rate for equity includes all equity requests such as crowdfunding, venture capital, angel and/or friends and family requests.

¹¹ Carbo-Valverde, et al. (2016) and Petersen and Rajan (1997) suggest that trade credit is a substitute for bank loans, and other studies (Psillaki, and Eleftheriou, 2015) show a complement feature of these two (availability of trade credit facilitate bank loans). Engemann et al. (2014) argue that trade credit is generally complementary to bank loans but could also act as a substitute for bank loans, and that the substitution effect is stronger for financially constrained exporters.

external sources of finance. By doing so, it aims to shed additional light on the literature of growth and credit constraints.

I.3. Theory and hypotheses

This study develops a conceptual framework based on the theoretical model presented by Rahaman (2011), which relates access to finance and growth for firms.

Rahaman's model starts with the following two assumptions. The first assumption is "in any given period t , firm i receives a productivity shock a_{it} , which is positively correlated across time" (Rahaman, 2011, p.711), as expressed in Equation (I-1):

$$a_{it} = \rho a_{it-1} + \varepsilon_{it} \quad (\text{I-1})$$

where ρ is the correlation coefficient between the past and current productivity and ε is a normally distributed error term with a mean of zero and variance of σ_ε . The second assumption is that in the absence of external financing, profits are either re-invested in the firms (I_{it}) and/or distributed to the stakeholders of the firm (D_{it}), that is:

$$I_{it} = a_{it}II_{it} - D_{it} \quad (\text{I-2})$$

where II_{it} is the gross profit generated by firm i at time t , thus $a_{it}II_{it}$ represents profits.

Substituting (1) to (2) and dividing both sides by I_{it-1} yield the investment growth of the firm:

$$\frac{I_{it}}{I_{it-1}} = \frac{(\rho a_{it-1} + \varepsilon_{it})II_{it}}{I_{it-1}} - \frac{D_{it}}{I_{it-1}} \quad (\text{I-3})$$

Note that from Equation (I-2), $a_{it-1} = \frac{I_{it-1} + D_{it-1}}{II_{it-1}}$. Substitution of this to (3) yields:

$$\frac{I_{it}}{I_{it-1}} = \rho \frac{(I_{it-1} + D_{it-1})}{I_{it-1}} \frac{II_{it}}{II_{it-1}} - \frac{D_{it}}{I_{it-1}} + V_{it} \quad (\text{I-4})$$

where $V_{it} = \frac{I_{it}}{I_{it-1}} \varepsilon_{it}$. From this simplified investment growth model proposed by Rahaman (2011), a model of *net* profit growth follows. First, with algebraic manipulations, a model for *gross* profit can be obtained:

$$\frac{II_{it}}{II_{it-1}} = \left(\frac{I_{it} + D_{it}}{I_{it-1}} - V_{it} \right) \frac{1}{\rho} \frac{I_{it-1}}{(I_{it-1} + D_{it-1})} \quad (\text{I-5})$$

Multiplying both sides with $\frac{a_{it}}{a_{it-1}}$ yields the net profit growth model:

$$\frac{P_{it}}{P_{it-1}} = \left(\frac{I_{it} + D_{it}}{I_{it-1}} + V_{it} \right) \frac{I_{it-1}}{(I_{it-1} + D_{it-1})} + e \quad (\text{I-6})$$

where P_{it} represents net profit generated by firm i at time t , and e is the error term.¹² Equations (I-5) and (I-6) indicate that the growth in (both gross and net) profit depends on the return on invested capital and the portion of profits allocated for reinvestment.¹³ This intuitively makes sense as growth in revenues and profits requires additional investments in tangible and intangible assets as well as in working capital.

Rahaman (2011) also argues that the external sources of capital, E_{it} , is a perfect substitute for internally generated funds, I_{it} , when the cost of the former is identical to that of the latter, $K(E_{it}) = K(I_{it})$. In other words, the total funds available to firm i , Ta_{it} , is equal to the sum of the internally and externally available funds, i.e., $Ia_{it} + Ea_{it}$, if $K(E_{it}) = K(I_{it})$.¹⁴ Conversely, the total funds available to firm i is equal to only the internally generated funds when $K(E_{it}) \neq K(I_{it})$. That is:

$$Ta_{it} = \begin{cases} Ia_{it}, & K(I_{it}) \neq K(E_{it}) \\ Ia_{it} + Ea_{it}, & K(I_{it}) = K(E_{it}) \end{cases} \quad (\text{I-7})$$

¹² $e = \left(\frac{I_{it} + D_{it}}{I_{it-1}} + V_{it} \right) \frac{1}{\rho} \frac{I_{it-1}}{(I_{it-1} + D_{it-1})} \frac{I_{it-1}}{a_{it-1}}$

¹³ The argument resembles Damodaran (2002), which shows the growth in next income is a product of ROE and the retention ratio.

¹⁴ In practice, where chargeable interest rates are often capped, unavailability of external financing more likely takes a form of a rejection of financing request rather than a cost of external financing higher than the cost of internally generated fund.

Now I consider the relationship among total, internally and externally available funds, to firm i at time t (Ta_{it} , Ia_{it} , and Ea_{it} , respectively), total amount invested as well as internal and external funds invested by firm i at time t (T_{it} , I_{it} , and E_{it} , respectively), and the amount of funds necessary to finance growth (N_{it}). When the firm has enough internal funds to finance its growth, ($N_{it} \leq Ia_{it}$), the total amount invested would equal the amount of internal fund invested, which is the amount of funding necessary to execute the growth project ($T_{it} = I_{it} = N_{it}$). However, when $N_{it} > Ia_{it}$, the firm needs to seek external sources of financing. If the external source of financing is available ($K(I_{it}) = K(E_{it})$), the growth opportunity can be fully financed ($T_{it} = (I_{it} + E_{it}) = N_{it}$). However, if it is not available ($K(I_{it}) \neq K(E_{it})$), the project is only partially financed or dismissed ($T_{it} = I_{it}$, and $I_{it} \leq Ia_{it} < N_{it}$), as seen in Equation (I-8).¹⁵ This implies that the positive relationship between firm growth and the availability of external sources of financing is observable only when the firm has insufficient internal funding to invest in its growth. When the internal funding is abundant to sustain growth, the relationship disappears.¹⁶ The other side of the coin would also be true: after controlling for the external fund availability, firm growth is a function of internal funding availability, as Carpenter and Petersen (2002) argue.

¹⁵ In reality, and strictly speaking, perfect substitution of the external fund for the internal fund ($K(E_{it}) = K(I_{it})$) is unlikely, even if the equal expected returns between the two, due to the presence of positive application costs (Kon and Storey 2003). This implies that the following three scenarios can be conceived when the cost of former is said to be greater than that of the latter:

1. Firm i is unable to obtain loans (i.e., its loan applications are denied);
2. The difference in costs of internal and external funds is outside of the acceptable range, so firm i does not apply even if it needs external fund for its growth; and,
3. The difference in costs of internal and external funds is an acceptable range, so firm i use the external fund (firm i applies and obtains the external fund).

Accordingly, the empirical experiment assumes the scenario 3 as being very close to $K(E_{it}) = K(I_{it})$ and regards firm i , not financially constrained in this scenario (note that scenario 1 implies the supply-side financial constraint, and scenario 2 suggests the demand-side financial constraint). Thus, the above argument is consistent with the pecking order hypothesis, i.e., firm owners first choose internally generated funds before seeking external sources of capital (Myers & Majluf, 1984).

¹⁶ This suggests the importance to control for the internal fund availability when the relationship between growth and external fund availability is examined – even in the context of SME financing. It has been believed that almost all SMEs rely on debt financing because: (1) the majority of SMEs require external finance to sustain their growth due to their shortage of internally generated fund; and, (2) bank loans and trade credit are the major sources of external financing for SMEs, yet this may not be always the case. For example, based on a US study (Cole & Wolken, 1995), which reports that almost 60 per cent of small firms have no debt from depository institutions, Carpenter and Petersen (2002) argue that external finance may be a “relatively unimportant source of funds for most firms” (p. 303). In Canada, 43 per cent of Canadian SMEs that were surveyed in 2014 reported that they did not need external financing (Statistics Canada, 2015), and this number increased to 48 per cent in 2017 (Statistics Canada, 2018).

$$T_{it} = \begin{cases} I_{it} = N_{it}, & N_{it} \leq Ia_{it} \\ I_{it} \leq Ia_{it} < N_{it}, & K(I_{it}) \neq K(E_{it}) \cap N_{it} > Ia_{it} \\ (I_{it} + E_{it}) = N_{it}, & K(I_{it}) = K(E_{it}) \cap N_{it} > Ia_{it} \end{cases} \quad (I-8)$$

Accordingly, the above argument, as a whole, leads to the following proposition:

Proposition: Firm growth is positively correlated with the availability of external sources of financing, after controlling for the availability of internally generated funds.

The model and the proposition are thought to be applicable to firms of all sizes, including SMEs. However, in order to develop testable hypotheses from the above proposition, there appear to be a few additional considerations necessary when it is applied to SMEs. The first consideration relates to the entrepreneur's desire to grow the firm. Unlike large publicly listed firms that consistently seek growth projects to satisfy shareholder return, SMEs are subject to their owners' various growth intentions. While some owners seek "higher than average" growth of their firms, others, are comfortable with their current levels of responsibilities and incomes and may prefer the *status quo* (which includes stable real growth rate). The small business population includes "lifestyle businesses" run by owners who, through managing the business, want to achieve or maintain a particular lifestyle, as well as those run by "forced (necessity) entrepreneurs" – people who are forced into entrepreneurship due to declining job opportunities (Hacamo & Kleiner, 2020). These businesses may not seek to grow their firms to be the next "Alphabet Inc." and therefore, even when they seek capital they are more likely to do so for "maintaining the lifestyle" or "survival" purposes rather than for the sake of "higher than the average" growth.¹⁷ Hurst and Pugsley (2011) report similar heterogeneity of growth intentions among SME owners in the United States. They find that most small business owners do not wish to grow their firms; they simply want to hold a firm in order to create and maintain a lifestyle they prefer, such as working for one's self and making their own schedule. For these groups of SME owners, entrepreneurial models such as the above growth model and proposition might be irrelevant (Hurst and Pugsley, 2011). Therefore, it

¹⁷ For example, a firm may make request for financing due to lack of internal funds in order to adapt itself to an anticipated technological change. The investment would not generate additional excess cash flow (i.e., growth) but would sustain the current level of profitability.

is important to constrain the conceptual framework and the proposition to SMEs that *seek growth* when the testable hypotheses are developed.

Another necessary consideration relates the phenomenon, well documented in the SME financing literature, that some firms in need of external capital choose to not apply for it (Jappelli, 1990; Kon and Storey, 2003).¹⁸ These demand-side financially-constrained firms should be distinguished from supply-side financially-constrained counterparts, due to the inherently different implications of the two types. The supply-side constraint is caused by firms' unsuitability to capital suppliers, originating from:

- (1) an information asymmetry problem on the supply side, where the lender knows less about the applicant firm than does the firm itself (e.g. Berger and Udell, 1998; Canales & Nanda, 2012; Uchida et al., 2012; Stiglitz & Weiss, 1981);
- (2) the small size of applicant firms may not justify the costs of due diligence, which tends to escalate with the level of information asymmetry; and,
- (3) regulation, which does not allow financial institutions to charge a higher cost of financing to compensate for high costs of due diligence relative to the size of financing (Stiglitz and Weiss, 1981, 1983). Presence of the supply-side constraints implies imperfect markets and, perhaps, government failure (regulations that do not result in desired outcomes) such that policy interventions and regulatory considerations could be justified.

Conversely, the origins and implications of demand-side constraints are not straightforward. Previous studies document that firms needing external financing may not apply for financing for a variety of reasons, including high cost of financing, collateral requirements, corruption, anticipated rejection (Brown et al., 2011), application costs (financial, in-kind, or psychic, Kon and Storey, 2003) or that applying for a loan is too complicated (Chakravarty and Xiang, 2013).¹⁹ As for its implications, there are two competing arguments associated with this phenomenon. On one hand, Kon and Storey (2003) argues that when good firms that need financing do not apply for fear of rejection ("good" means "creditworthy," that they would have obtained financing if

¹⁸ Note that the literature on the demand side financial constraints (or discouraged borrowers) also tend to focus on bank loans; no study, to my knowledge, has studied it in the context of trade credit.

¹⁹ Brown et al. (2011) define corruption as financial institutions requiring applicants to provide informal payments to obtain financing.

they had applied), it likely stems from demand-side information problems. That is: firms know less about the source of financing than its suppliers, thus *wrongly* believe that they would be rejected (Kon and Storey, 2003). On the other hand, Jappelli (1990) argues that the demand-side constraint is a self-rationing process consistent with market efficiency.

These studies suggest that the implications of demand-side constraints depend on their origins (reasons for firms not to apply) and the creditworthiness of the firm. For example, if the demand-side constraints result from the firm's accurate estimation of a high probability of rejection to its application, this implies that the demand side constraints are consistent with an efficient market and policy intervention is unjustified. On the other hand, if "good" firms refrain from advancing financing applications because of erroneous estimations of the probability of application denial (or their erroneous understanding of financing costs and procedures related to raising capital) the demand-side constraint stems from information asymmetry. However, if the reasons include correct anticipations of high financing costs, stringent collateral requirement, significant application costs, or complicated application process, this may imply frictions on supply side and imperfect markets.

Among demand-side constrained firms, particular attention should be given to firms that would have obtained financing if they had applied. If a significant portion of firms refrain from seeking financing due to misperceptions of the probability of the application outcome or misplaced anticipation of financing costs, collateral requirements, or application process, the costs of these misperceptions, in the form of foregone growth, would be significant. Existing studies report that firms of this type account for a considerable portion of SMEs that need external financing but do not apply. For example, Cowling et al. (2016) estimate that 55.6 per cent of firms, which need financing but did not apply either for fear of rejection or due to the perception that financing was too expensive, would have been approved their loans applications if they had applied. Similarly, Cole and Sokolyk (2016) find that as much as 55.5 per cent of demand-constrained firms due to fear of rejection would have received financing if they had applied. It is crucial to investigate the extent to which growth was compromised by the demand-side financial constraints, separately from the supply-side, in order to consider the implications of the results – in particular, for those who could have been obtained loans if they had applied.

Accordingly, in order to develop testable hypotheses, it is necessary to: (1) limit the proposition to firms that seek growth; and, (2) split the proposition into two testable hypotheses (one on supply, the other on demand-side constraints), as follows:

Hypothesis 1a: Growth-oriented firms that need, apply and successfully obtain financing will exhibit higher growth performance than those that need financing but did not apply (demand-side constrained firms), after controlling for the availability of internally-generated and other sources of financing.

Hypothesis 1b: Growth-oriented firms that need, apply and successfully obtain financing will exhibit higher growth performance than those that need financing but did not apply, but which would have been obtained if they had applied (good demand-side constrained firms), after controlling for the availability of internally-generated and other sources of financing.

Hypothesis 2: Growth-oriented firms that need, apply and are accepted for financing will exhibit higher growth performance than those that needed, applied for but did not get financing, after controlling for the availability of internally-generated and other sources of financing.²⁰

This study tests the above hypotheses in the contexts of both bank loans and trade credit.

I.4. Data

The work takes advantage of a unique set of periodically-conducted survey data, the Surveys of Financing and Growth of Small-and Medium-Enterprises (SFGSME) carried out in 2011, 2014 and 2017.²¹ These data are well-suited to this research for several reasons: they provide information about the business owners' growth intentions, the firms' needs for external financing, its applications for external capital, and the detailed outcomes of such applications (type of

²⁰ Lower growth rates for firms that were unable to obtain bank loans, if observed, could have two alternative explanations. The first one is it is due to the inability to finance the growth projects, as hypothesized above. The second explanation is that the growth projects the firm proposed to the lender is of a lower quality (this is why their loan applications were denied). To control for the second explanation, this study includes as many project-quality related variables as possible in the analyses.

²¹ There is an earlier version of this periodic survey, conducted in 2000, 2004, and 2007: the Survey on Financing of Small-and Medium-Enterprises (SFSME). The datasets based on this previous version were excluded from the analysis due to numerous missing variables and less informative compared to those based on the current version (SFGSME). For example, the 2007 data do not have information on borrowers' need for financing or reason for not applying for credit (i.e., does not allow to investigate demand-side constraint). Similarly, the 2000-2004 data do not have the education and innovation variables.

financing sought, including bank loans, equity financing, trade credit, leasing, approved or not, terms of financing, type of capital suppliers, etc.), during the 12-month period previous to the day on which the interview was conducted (for the sake of brevity, this study refers to this as the “survey period”). The surveys also offer detailed demographic information on the firm and its primary owner(s) (the key respondents). In addition, the data are linked, through Statistics Canada’s linkable file environment, to the tax submissions of each respondent enterprise for years prior to, and years following, the survey. This allows for tracking respondent firms’ financial settings before, and longitudinal growth performance after, they have sought external financing.

Statistics Canada designs questionnaires and conducts surveys on behalf of Industry Science and Economic Development (ISED) Canada and Finance Canada. The population of interest for these surveys was drawn from 1.3 million Canadian enterprises listed on the Business Register maintained by Statistics Canada (an exhaustive collection of all Canadian firms reporting a minimum of \$30,000 CDN in revenues during any 12-month period). Among those, firms eligible to the surveys were for-profit businesses with fewer than 500 full-time-equivalent employees and annual gross revenues of less than \$50 million CDN.²² Data were collected through computer-assisted telephone interviews. The respondent firms were then weighted to best represent the underlying population while ensuring minimum data counts for each cell. The surveys were administered in 2000 (11,015 valid responses), 2004 (13,042), 2007 (15,808), 2011 (9,957), 2014 (10,397), and 2017 (9,115).²³

The surveys minimize the overall effects of non-response and selection biases by high response rates (typically exceeding 50 percent), by creating a large number of strata, and by surveying a large number of firms so that each stratum achieves a coefficient of variance of five per cent.²⁴ Key informant problems are minimal because the survey involves SMEs with a median firm size

²² More specifically, the following enterprises are excluded from the population: (1) firms with 500 or more employees; (2) firms with over \$50 million in gross revenue; (3) non-profit organizations; (4) cooperatives (surveys before 2017) and joint ventures; (5) firms in specific industries, such as: (a) utilities; (b) finance and insurance; (c) management of companies; (d) educational services; (e) public administration; (f) automotive equipment or commercial/industrial machinery/ equipment rental and leasing; (g) health care services; (h) community food and housing; (i) emergency and other relief services.

²³ Each survey is conducted independently with no intention to repeat respondents from survey to survey.

²⁴ The strata variables include region, industry, size (the number of employees) and age of the firm, and participation in the Canada Small Business Financing (CSBF) loan guarantee program.

of less than 4 employees: access to the person who has best detailed knowledge of the firm should not have been an issue.

I.5. Methodology

The two most common sources of financing for SMEs are bank debt and trade credit (for example, in 2017, 25.6 per cent of the sample SMEs in the SFGSME applied for bank debt and 25.7 per cent applied for trade credit, compared to 0.8 and 7.2 per cent for equity and lease financing, respectively (Statistics Canada, 2018)). Accordingly, this study considered the impact of the supply- and demand-side financial constraint on growth in terms of the availability of bank loans and trade credit, separately.²⁵ In order to minimize possible contaminations in the growth-bank loan availability relationship estimations, it excluded non-growth oriented firms and firms that received other sources of external finance (firms that acquired trade credit (for the analyses on bank loan availability), a leasing contract, a venture capital investment, bank loan (for trade credit availability analyses) etc., during the respective survey period). The following section describes the methodology used in this study, using the analyses on bank loan availability as an example (for the sake of brevity, the methodology used for analyses of trade credit parallels that used for bank loan availability and is omitted here).

Dependent variable. The dependent variable was the growth of the firm subsequent to the “survey period” in which the firm specified whether it needed, applied for, and obtained financing. This study calculated growth rates using four different measures (as suggested by Musso and Schiavo (2008) and Neville et al. (2017)), growth in: the number of employees, total assets, total revenues, and productivity (revenues per employee). It also used three different post-survey periods: one-, two- and three-year time spans.²⁶

The previous (conceptual framework) section discussed the importance of restricting the analyses to firms whose primary owners expressed the intention to grow. Accordingly, the sample focused on firms that responded to the survey question “in the next three years, what is the expected average

²⁵ It is important to distinguish between bank loans and trade credit given previous studies’ suggestive evidence on a complimentary relationship between both types of financing. For example, Matias Gama and Van Auker (2015) find that trade credit can be used to finance firms that have lower capacity for accessing bank loans (riskier firms). Similarly, Psillaki and Eleftheriou (2015) show that trade credit can serve as a complementary source of financing to bank loans during financial crises.

²⁶ For 2017, tax data was only available until 2019. Accordingly, the three-year analysis excluded the 2017 sample.

yearly growth of your business’ sales or total revenues?” Growth-oriented firms were those whose owners responded either “1-10 per cent growth” or “more than 10 per cent growth”.

Independent variables. Independent variables comprised the following four binary variables:

1. NCF (“unconstrained firm”): a firm that needed, applied for and obtained bank loans (=1) or not (=0);
2. SCF (“supply-side constrained firm”): a firm that needed and applied for a loan but had their loan applications rejected (=1) or not (=0);
3. DCF (“demand-side constrained firms”): a firm that needed financing but did not apply for a bank loan (=1) or not (=0); and,
4. GDCF (“good demand-side constrained firm”): a firm that needed financing but did not apply for loans, yet which would have been obtained if had applied (=1) or not (=0).

The first three variables are mutually exclusive (e.g., SCF=1 implies NCF=0 and DCF=0), thus NCF is set as reference and suppressed from the regression models. However, GDCF is a subset of DCF, that is: GDCF=1 implies DCF=1, but the opposite is not always the case. Table I-3 exhibits the coding for each variable.

Table I-3. Independent variables

<i>Labels</i>	<i>Variable equals</i> 1	<i>Variable equals</i> 0
SCF	SCF (“supply-side constrained firm”)	NCF (“not constrained firm”)
DCF	DCF (“demand-side constrained firms”)	NCF (“not constrained firm”)
GDCF	GDCF (“good demand-side constrained firm”)	NCF (“not constrained firm”)

The analyses were restricted to firms that need external financing, as the previous section (conceptual framework) discusses the importance to control for this point. For this, the study uses firms’ responses to the survey question “why did your business not request external financing?” Firms that replied to this question as “financing not required” were regarded as those that have no project in which to invest, or have internal funds sufficient to finance the investment projects, thus

were excluded from the analyses.²⁷ To control for differences in the availability of internally generated funds among firms that needed external finance, the vector of control variables included the cash flow/total asset ratio (in the spirit of Carpenter and Petersen (2002), Gambini and Zazzaro (2013), and Wagenvoort (2003)).

This paper used a propensity score weighting technique to model the effects of the three different types of financial constraint (SCF, DCF, GDCF) on firm growth outcomes. More specifically, the impacts of supply-side constraints were estimated through the comparison of growth outcomes between groups 1 (NCFs) and 2 (SCFs), while the impacts of the demand-side constraints were assessed by the comparison between groups 1 and 3 (DCFs) and between groups 1 and 4 (GDCFs). These impacts are estimated for the sample data comprised of pooling the 2011, 2014 and 2017 survey datasets.

The following illustrates the processes in which: (1) firms in group 4 (“good demand-side constrained firms (GDCFs)”) were identified; and, (2) the growth-constraint model were estimated using the propensity score weighting technique. It then defines the control variables and outlines robustness checks.

I.5.1. Impacts of demand-side constraint

I.5.1.1. Identifying good demand-side constrained firms (GDCFs)

In order to identify GDCFs, a weighted logistic regression model (Equation (I-9)) was estimated for borrowers that applied for a loan.

$$\text{Approved: } P^* = Z'\theta + \tau \quad \text{where } P = I(P^* > 0) \quad (\text{I-9})$$

The dependent variable, P , is a binary variable equal to one if the loan application was accepted; or zero if rejected. The vector of explanatory variables, Z , contains the variables summarized in Table I-4. The estimated model was then used to distinguish “good” DCFs and “not good” counterparts among borrowers that needed, but did not apply for, bank loans (identifying GDCFs from the sample of DCFs).

²⁷ Please see section I.5.5 (Robustness checks) for the discussion on the sample selection bias the exclusion of “firms that do not need for external financing” might induce.

I.5.1.2. Estimation of the growth-constraint model for the demand-side

Once good demand-side constrained firms (GDCF) had been identified, a two-step procedure was used for the sub-sample of firms that had expressed a need for financing. Following Guo and Fraser (2015), the first step was to estimate propensity scores using model-predicted probabilities. A weighted probit model was used to predict the propensity of applying for loans (the treatment effect, Equation (I-10)).

$$\text{Applied: } A^* = Y'\delta + \omega \quad \text{where } A = I(A^* > 0) \quad (\text{I-10})$$

The dependent variable, A , is a binary variable equal to one if the firm applied for a loan and zero otherwise. The vector of explanatory variables, Y , contains the variables summarized in Table I-4.

The second step used the predicted probabilities of applying for loans (estimations based on the model estimates from Equation (I-10)), noted $\hat{a}$, the propensity scores for each firm. Then the dependent variable of interest, the firm's growth performance, G , was regressed against the independent variable, λ_1 (applied indicator denoting whether the firm is a DCF (group 3 = 0) or an NCF (group 1 = 1); or whether it is a GDCF (group 4 = 0) or an NCF (group 1 = 1)), along with the set of control variables, Z_1 , while using the inverse of each firm's propensity score, $\frac{1}{\hat{a}}$, as a partial determinant of sample weights.

$$G = \alpha_1 + \lambda_1\gamma_1 + Z_1'\beta_1 + \varepsilon_1 \quad (\text{I-11})$$

Following Ullah (2019), the firm's growth performance, G , is given by $\frac{Emp_{t+h}-Emp_t}{Emp_{t+h}+Emp_t}$ for employee growth, $\frac{Assets_{t+h}-Assets_t}{Assets_{t+h}+Assets_t}$ for asset growth, $\frac{Rev_{t+h}-Rev_t}{Rev_{t+h}+Rev_t}$ for revenue growth, and $\frac{Prod_{t+h}-Prod_t}{Prod_{t+h}+Prod_t}$ (where Prod = revenues/number of employees) for productivity growth, where h equals one, two and three years (G takes a value between -1 and 1 to reduce the impact of outliers on growth rates). Finally, per Guo and Fraser (2015), the p -values associated with the treatment variable was used to test hypothesis 1. Hypothesis 1 predicted a positive and significant coefficient for γ_1 , which suggests that growth-oriented firms that had applied for, and received, a bank loan experienced significantly higher growth than that for growth-oriented yet demand-side constrained counterparts

(or “good” demand-side constrained counterparts). The coefficient value represents the unit change in the firm’s growth rate (percentage).

I.5.2. Impacts of supply-side constraints

The estimation of the effect of rejection of a loan application on firm growth employed a two-step procedure similar to that described in the previous section. The first step employed a weighted probit model to estimate the propensity of the loan application being accepted (the treatment effect).

$$\text{Approved: } P^* = Z'\theta + \tau \quad \text{where } P = I(P^* > 0) \quad (\text{I-12})$$

The dependent variable was identical to that of Equation (I-9), that is: a binary variable equal to one if the loan application was accepted and zero if rejected.

The second step was similar to the second step described in the previous section. That is: it used the predicted probabilities of being accepted, noted $\hat{P}$, obtained from Equation (I-12). The dependent variable, the firm’s growth performance, G , was regressed against the independent variable, λ_2 (accepted indicator signifying whether the firm is a SCF (group 2 = 0) or an NCF (group 1 = 1)), along with the vector of control variables, Z_2 , while using the inverse of each firm’s propensity score, $\frac{1}{\hat{P}}$, as a partial determinant of sample weights. Hypothesis 2 predicted a positive and significant coefficient for γ_2 , which suggests that growth-oriented firms that were successful in acquiring bank loans experienced significantly higher growth than did growth-oriented, but loan application rejected, counterparts.

$$G = \alpha_2 + \lambda_2\gamma_2 + Z_2'\beta_2 + \varepsilon_2 \quad (\text{I-13})$$

I.5.3. Control variables

The vector of control variables for the demand- and supply-side equations (Equations (I-9), (I-10) and (I-12)) was created in a manner consistent with the conventional wisdom regarding finance suppliers’ credit adjudication criteria. Examples include, for example,

- the five-Cs of credit (character, capacity, capital, conditions, and collateral specified in virtually all contemporary finance texts (e.g., Ross, Westerfield & Jordan, 2019);
- variables used as risk measures in previous research (Duchin et al., 2010; Kremp and Sevestre, 2013; and Carbó-Valverde, Rodriquez-Fernandez and Udell, 2013);
- by practitioners (such as Export Development Canada) and, from the findings of previous research regarding the factors that influence finance suppliers' decisions on credit requests and firms' growth performance.

Similarly, the vector of control variables (shown in Table I-4) for the growth equations (Equations (I-11) and (I-13)) was created based on the those included by previous studies of growth as reviewed in section I.2. Finally, in order to avoid endogeneity issues induced by reverse causality, one-year-lagged financial ratio variables were used to measure firms' financial conditions (per Kremp and Sevestre (2013) and Carbo-Valverde et al. (2013)).

Table I-4. Control variables²⁸²⁹

Variable name	Description
<i>Firm characteristics</i>	
Age	Categorical variable measured by years since firm inception: 1) New firm (under 3 years old), 2) Young firm (3 to 10 years old) or 3) Over 10 years old.
Size	Continuous variable measured by the natural logarithm of: (1) revenues; (2) total assets; and, (3) the number of employees. Of those, the one with least missing observations will be chosen.
Size ²	Squared of size. It has been shown to have a positive and significant impact on growth (Fagiolo and Luzzi, 2006; Heshmati, 2001).
Location fixed effect	Categorical variable denoting the location of the firm: Ontario, Québec, East coast or West coast.

²⁸ The final model includes a selection of these variables that maximizes the predictive accuracy of the loan adjudication model, taking multicollinearity problems into consideration (e.g., total debt/capitalization and EBITDA/total Debt are expected to be collinear).

²⁹ In the OLS regression analyses in this chapter, the categorical variables presented in Table I-4 are converted to vectors of dummy variables. For example, the location fixed effect variable is transformed into four dummy variables: (1) Ontario, (2) Québec, (3) East coast and (4) West coast, one of which is excluded from the regression models to avoid perfect multicollinearity, as the base category (in this case, Ontario).

Urban	Dummy variable denoting one if the firm operates in an urban area; zero otherwise.
Industry fixed effect	Categorical variable denoting the firm's industry: 1) Goods (manufacturing and primary sector), 2) Wholesale/retail, 3) Professional services or 4) Other services.
Historical growth	Continuous variable measured by the firm's size growth in the previous period (1-year prior). Positive growth in the previous year has been shown to positively effect the firm's current year growth performance (Rahaman, 2011).
Intended use of loan	Categorical variable for the answer to the survey question "What were the intended uses of this financing?": 1) research & development, debt consolidation, enter new market, and/or other purposes; 2) real assets; 3) working capital.
Exporter	Dummy variable denoting one if over 25 per cent of the firm's revenues originated from exports sales; zero otherwise.
Innovator	Dummy variable equal to one if the firm introduced any of the following innovations: a) a new or significantly improved good or service; b) a new or significantly improved production process or method; c) a new organizational method in your business practices, workplace organization or external relations; or, d) a new way of selling your goods or services
<i>Owner characteristics</i>	
Experience	Categorical variable for the number of years owner has in managing a business: 1) 5 years or less; 2) 6 to 10 years; 3) more than 10 years.
Education	Ordinal variable for the highest level of education: 1) Less than high school diploma; 2) High school diploma; 3) A college/cegep/trade school diploma; 4) A bachelor's degree; 5) A master's degree or above.
Gender	Categorical variable denoting if the firm's ownership is comprised of 1) majority men, 2) 50/50 men-women or 3) majority women. Previous research has suggested that women-owned firms have higher growth performance (Motta, 2018).
Minority status	Dummy variable equal to one denoting that the firm's ownership is majority comprised of aboriginal persons or of persons who are from a visible minority group (other than aboriginal); or zero otherwise.

<i>Loan characteristics</i> ³⁰	
Lender type	Categorical variable denoting if the loan was extended by a 1) Chartered bank, including Alberta Treasury Branches, 2) Credit Union / Caisse Populaire, or 3) Government institution.
Loan type	Dummy variable denoting one if the firm applied for a term loan; zero if the firm applied for a line of credit.
<i>Financial ratios</i> ³¹	
Capacity	Dummy variable equal to one if the ratio of amount of debt sought over total revenues is over one; zero otherwise.
Current ratio	Ratio of current assets over current liabilities. Rahaman (2011) suggests that firms with a lower current ratio exhibit higher growth performance.
ROA	Ratio of net income over total assets.
Profit Margin	Ratio of net income over total revenues.
Gross margin	One minus the ratio of cost of sales over total revenues.
Account payable/Sales	Ratio of account payable over sales, to control for the firm's historical availability of trade credit.
Short term debt /Sales	Ratio of short term debt over sales, to control for the firm's historical availability of operating loans.
Interest coverage ratio	Ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) over interest expenses.
Financial slack	Ratio of tangible assets over total liabilities. Rahaman (2011) suggests that firms with less financial slack exhibit higher growth performance.
Internal financing	Ratio of cash flow over size. Higher levels of internal financing, measured by cash-flow relative to size, has been associated with higher growth performance (Carpenter and Petersen, 2002; Gambini and Zazzaro, 2013; Wagenvoort, 2003 (cash flow/total assets); Hutchinson and Xavier, 2006;

³⁰ Applicable to the analyses of the impact of bank loan availability on growth (observable only for firms that applied for a loan, i.e., NCFs and SCFs).

³¹ Unless specified otherwise, the financial ratio variables are measured using an ordinal variable denoting 1) if the firm's ratio value is equal or lower to the 30th percentile of the distribution; 2) if the firm's ratio value is between the 30th and 60th percentile; 3) if the firm's ratio value is above the 60th percentile.

	Oliveira and Fortunato, 2006 (real cash flow/tangible assets); Fagiolo and Luzzi, 2006 (cash flow/sales)).
Debt capitalization ratio	Ratio of liabilities over total liabilities and shareholder equity, which controls for the firm's proportion of debt used to finance assets. Higher debt capitalization has been associated with higher growth performance (Gambini and Zazzaro, 2013; Rahaman, 2011). It also controls for the firm's historical availability of bank loans.
External/total equity	Ratio of externally raised equity over total shareholder equity, to control for the firm's historical availability of equity fund. It also controls for the owner's enthusiasm and belief about the firm's future success (skin in the game).
Productivity	Ratio of total revenues over employees.
Working capital	Dummy variable equal to 1 if the firm's working capital is over one; zero otherwise.
EBITDA / debt	Ratio of EBITDA over total liabilities.
Sales / working capital	Ratio of total revenues over working capital.

I.5.5. Robustness checks

In order to confirm the validity of the results obtained from the analyses described above, the following robustness checks were performed. First, hit rate tests were performed per Heij et al. (2004) to assess the predictive power of the estimated loan approval model. For each model, a random sample of 100 observations were set aside as a hold-out sample. The estimated models were then used to predict the outcome of observations within the hold-out sample.³²

Second, while previous studies have suggested sample selection biases associated with borrowers that do not apply for financing and those that do not need financing, this may not necessarily be a concern when the goal of the study is model prediction, as is the case in this research. More specifically, the approval model used by banks is based on its sample of applicants (Arca, 2020). Therefore, mirroring their loan approval/rejection model building by using only firms that applied enables this study to estimate a model that should mirror loan application outcomes of the lenders. Also, the choice of model depends on whether the econometrician's goal is descriptive or

³² Model prediction is not the objective of the paper but a necessary step to identify financially constrained borrowers. The hit rate test will be conducted to assess the accuracy of this identification step.

predictive (Heij et al., 2004; p. 454). Since the goal is to estimate a loan adjudication model that provides the best predictive accuracy, omitting the sample selection process might not be an issue. Nevertheless, as a robustness check, a trivariate probit model was also estimated for Equations (I-9) and (I-12) and a bivariate probit model was estimated for Equation (I-10) using the entire sample of SMEs to compare the predictive accuracy of the model estimated here with that of a model that also considers sample selection.³³³⁴

I.6. Empirical findings

I.6.1. Descriptive Statistics

Table I-5 and Table I-6 provide the distributions and profiles of NCFs, DCFs, GDCFs, and SCFs (see page 20 for the definitions) extracted from the pooled sample (that combined 2011, 2014 and 2017 surveys). Both tables provide the distributions and profiles based on: (1) the bank debt sample (the sample of growth-oriented, finance-needing firms, excluding those that received other sources of external finance such as trade credit, a leasing contract, a venture capital investment); and (2) the and trade credit sample (the sample of growth-oriented, finance-needing firms, excluding those that received other sources of external finance such as bank loans, a leasing contract, a venture capital investment).³⁵

Table I-5 describes the profiles of growth-oriented firms that needed financing and successfully obtained financing (NCFs) relative to (1) those that need financing but did not apply for loans

³³ More specifically, the system of equations for the trivariate probit can be summarized as follows:

$$\text{Needs financing (N): } N^* = W'\beta + \varepsilon, \quad \text{where } N = I(N^* > 0) \quad (\text{I-14})$$

$$\text{Applied (A): } A^* = Y'\delta + \omega, \quad \text{where } A = I(A^* > 0) \text{ if } N = 1, \quad (\text{I-15})$$

and is missing otherwise

$$\text{Approved (P): } P^* = Z'\theta + \tau, \quad \text{where } P = I(P^* > 0) \text{ if } A = 1 \text{ and } N = 1, \quad (\text{I-16})$$

and is missing otherwise

The system of equations for the bivariate probit model includes Equation (I-14) and Equation (I-15) only.

³⁴ The growth equations, Equation (I-12) and Equation (I-13), are estimated on the sample of firms that need financing. Accordingly, sample selection biases may be present. However, previous research has shown that propensity score methods mitigate sample selection biases (Imbens and Wooldridge 2009; Karhunen and Huovari 2015; Motta, 2018). Therefore, the current methodology addresses the sample selection bias associated with the growth equation using propensity score weighting.

³⁵ As mentioned above, borrowers that received other types of financing are excluded. Specifically, borrowers that received trade credit, lease financing and/or equity are excluded from the bank debt sample, and borrowers that received bank debt, lease financing and/or equity are excluded from the trade credit sample.

(DCF); and (2) firms that need financing but did not apply for loans yet would have been obtained if had applied (GDCFs).³⁶

Table I-5. Descriptive statistics – Growth-oriented NCFs, DCFs and GDCFs breakdown³⁷

<i>Labels</i>	<i>Bank debt</i>			<i>Trade credit</i>		
	NCF	DCF	GDCF	NCF	DCF	GDCF
Distribution	High (***)	Low	Low	High (***)	Low	Low
Distribution by survey year						
2011	High (***)	Low	Low	High (***)	Low	Low
2014	High (***)	Low	Low	High (***)	Low	Low
2017	High (***)	Low	Low	High (***)	Low	Low
Age						
New firms (<=3yrs)	Low	High	High	Low	High	High
Young firms (3-10yrs)	Low (***)	High	High	Low (***)	High	High
Established firms (>10yrs)	High (***)	Low	Low	High (***)	Low	Low
Size (employees)	High (***)	Low	Low	High (***)	Low	Low
Province						
Atlantic	Low	High	High	High	Low	Low
BC and Territories	Low	High	High	High	Low	Low
Ontario	Low	High	High	High (***)	Low	Low
Prairies	High (***)	Low	Low	High (***)	Low	Low
Quebec	Low	High	High	Low (***)	High	High
Industry						
Goods	High (***)	Low	Low	High (***)	Low	Low
Wholesale/Retail	Low	High	High	High	Low	Low
Professional services	Low	High	High	Low (***)	High	High
Other services	Low (***)	High	High	Low (***)	High	High
Exporter	High	Low	Low	High	Low	Low
Owner experience						
5 years or less	Low	High	High	Low (**)	High	High
5-10 years	High	Low	Low	Low	High	High
More than 10 years	Low	High	High	High (*)	Low	Low
Education						
High school diploma or less	Low	High	High	Low	High	High
A college/cegep/trade school						
diploma	High	Low	Low	High (*)	Low	Low
A bachelor's degree or higher	Low	High	High	Low	High	High
Innovator	High (***)	Low	Low	High (**)	Low	Low
Minority	Low (***)	High	High	Low (***)	High	High

³⁶ GDCFs were identified using Equation I-9 (they represent over 90 per cent of DCFs). Given the almost identical samples of DCFs and GDCFs, the comparative results between NCFs and DCFs and NCFs and GDCFs are almost identical. For more information on the estimation of the loan adjudication model (Equation I-9), see Chapter III.

³⁷ Presentation of the results in this thesis follows Statistics Canada's suppressed output format. See Appendix 2 for more details.

Gender							
	Majority Men	High (***)	Low	Low	High (***)	Low	Low
	50/50	High	High	High	High	Low	Low
	Majority Women	Low (***)	High	High	Low (***)	High	High
Historical growth (1-year past employee growth)		High (***)	Low	Low	High	Low	Low
Debt capitalization ratio							
	30th percentile or less	High (*)	Low	Low	High (***)	Low	Low
	Between 30th and 60th percentile	High (***)	Low	Low	High (***)	Low	Low
	Over 60th percentile	Low (***)	High	High	Low (***)	High	High
Slack (Tangible assets / Total liabilities)							
	30th percentile or less	Low (*)	High	High	Low	High	High
	Between 30th and 60th percentile	High	Low	Low	High	Low	Low
	Over 60th percentile	High	Low	Low	High	Low	Low
Productivity (Revenues / Employees)							
	30th percentile or less	Low (***)	High	High	Low (***)	High	High
	Between 30th and 60th percentile	Low	High	High	High	Low	Low
	Over 60th percentile	High (***)	Low	Low	High (***)	Low	Low
Interest coverage ratio (EBITDA / Total interest expense)							
	30th percentile or less	High (**)	Low	Low	Low	High	High
	Between 30th and 60th percentile	High (***)	Low	Low	High (*)	Low	Low
	Over 60th percentile	Low (***)	High	High	Low	High	High
Gross margin (1 - (Cost of sales / Revenues))							
	30th percentile or less	High	Low	Low	High (**)	Low	Low
	Between 30th and 60th percentile	High	Low	Low	High (***)	Low	Low
	Over 60th percentile	Low	High	High	Low (***)	High	High
Internal funds (Cash / Total assets)							
	30th percentile or less	High (***)	Low	Low	High (**)	Low	Low
	Between 30th and 60th percentile	High	Low	Low	High	Low	Low
	Over 60th percentile	Low (***)	High	High	Low (**)	High	High
Post-survey growth							
Employee growth							
	1-year	High (***)	Low	Low	High (***)	Low	Low
	2-year	High (***)	Low	Low	High (*)	Low	Low
	3-year	High (***)	Low	Low	High (***)	Low	Low

Revenue growth		1-year	High (***)	Low	Low	High (***)	Low	Low
		2-year	High (**)	Low	Low	High	Low	Low
		3-year	High (***)	Low	Low	High (**)	Low	Low
Asset growth		1-year	High	Low	Low	Low	High	High
		2-year	High	Low	Low	Low	High	High
		3-year	High	Low	Low	High	Low	Low
Productivity growth		1-year	High (***)	Low	Low	High (***)	Low	Low
		2-year	High (**)	Low	Low	High	Low	Low
		3-year	High (***)	Low	Low	High (**)	Low	Low
		Observations	4-5k	0-1k	0-1k	3-4k	0-1k	0-1k

The proportion of NCFs is larger than that of DCFs and GDCFs, both for the entire pooled sample and for each survey year.³⁸ Overall, the results are in line with those of Cole and Sokolyk (2016) in that firms that apply for and obtain financing (NCFs) are of higher quality than that of demand-constrained firms. The following summarizes the significant differences between the profiles of NCFs and demand-constrained firms (DCFs and GDCFs).

- Age and Size. NCFs tend to be older and larger compared to those that are demand-constrained (DCFs and GDCFs), as many existing studies have reported (e.g., Brown et al., 2011; Cole and Sokolyk, 2016; Drakos and Giannakopoulos, 2018).
- Location and industry. Both province and industry distributions exhibit slight variations across firm application status, highlighting the importance of controlling for province and industry. For example, and consistent with findings of Cole and Sokolyk (2016), NCFs are more likely to operate in the goods sector relative to demand-constrained firms.
- Owner experience. For trade credit, owners of NCFs tend to have more experience in managing a business than owners of demand-constrained firms. Experienced owners are more likely to have an established relationship with their suppliers, which facilitates obtaining account payable contracts. The insignificant impact of this variable in the bank

³⁸ Rate of successful application (the number of successful applications over the total number of applications) is higher than 85 per cent for each survey year for each financing type (bank loans and trade credits).

loan sample might indicate established relationships with credit suppliers are relatively more important for obtaining trade credit than for bank loans.

- Innovation. NCFs are more likely to be innovators compared to those that are demand constrained (DCFs and GDCFs). This is consistent with the notion that innovators are more likely to apply for the financing they need since they do not, in many cases, have enough of their own internal funds to cover the significant costs of innovation (Brancati, 2015).
- Minority and gender status of owner. Firms that apply for, and obtain, the financing they need are more likely to be majority-owned by men and less likely to be majority-owned by members of visible minority groups compared to demand-constrained firms.³⁹ This is consistent with the majority of previous research reviewed in section II.2.2. that argues that women- and visible minority-owned firms are more likely to be demand-constrained (e.g., Cole and Sokolyk, 2016; Gama et al., 2017; Neville et al., 2017; Rostamkalei et al., 2018).
- Historical growth. NCFs are more likely to have experienced relatively higher historical employee growth (one year growth from the year prior to the survey year – although the difference is significant only for the case of bank loan applications) than demand-constrained firms, consistent with the notion that firms that grow apply for the financing they need to sustain their growth momentum (Rahaman, 2011).
- Debt capitalization. Firms that apply for and obtain the financing they need are less likely demand constrained firms (DCFs and GDCFs) to have a high level of debt capitalization. This is consistent with the notion (per Cole and Sokolyk, 2016) that firms that need credit might make the decision not to apply because they are already too highly leveraged to take on additional debt. This is also consistent with the concept of self-screening, where poor quality borrowers refrain from applying for financing they need because they accurately think that they will be rejected (Jappelli, 1990; Kon and Storey, 2003).⁴⁰
- Productivity. NCFs are more likely to have higher levels of productivity compared to firms that do not apply for needed financing (DCFs and GDCFs). This is consistent with the notion that firms that apply for needed financing are of higher quality than demand-

³⁹ This dissertation refers to a firm of which more than 50 per cent ownership (majority) is held by visible minorities as a minority-owned firm.

⁴⁰ As mentioned above, this chapter examines two types of “demand-constrained” firms. Companies in the first group are firms that do not apply for needed financing for any reason, specified as DCFs. Those in the second group are good borrowers that need financing but do not apply due to fear of rejection. The second group categorization follows Kon and Storey (2003)’s original definition of “discouraged borrowers”.

constrained firms (Cole and Sokolyk, 2016), and the concept of self-screening (Jappelli, 1990; Kon and Storey, 2003).

- Interest coverage ratio and gross margin. NCFs are more likely to have lower interest coverage ratios compared to demand constrained firms (DCFs and GDCFs) for the bank loan sample. Similarly, for trade credit, NCFs are more likely to have low levels of gross margin compared to demand constrained firms (DCFs and GDCFs). The finding that GDCFs have higher levels of interest coverage ratio and gross margin relative to NCFs is not surprising, given that GDCFs are, by definition, good quality borrowers that would have been approved had they applied. Since the majority of DCFs are GDCFs (e.g. most DCFs are good quality borrowers), it is also not surprising that they exhibit higher levels of interest coverage ratio and gross margin compared to NCFs.
- Internal financing. NCFs are more likely to have lower levels of internal funds compared to DCFs and GDCFs. This is consistent with Brown et al. (2011) and Cole and Sokolyk (2016) and may be related to the urgent need of financing for firms with low levels of internal funding, leading them to be more likely to apply for financing.
- Post-survey growth. With the exception of asset growth, firms that applied for and obtained needed financing at time 0 (NCFs) are consistently more likely to experience higher growth in revenues, employees, and productivity during the post-financing periods (from time 0 to time 1 (one year); to time 2 (two years); and to time 3 (three years)), compared to firms that needed but did not apply for financing at time 0 (DCFs and GDCFs).

Table I-6 compares the profiles of SCFs (growth oriented firms that did not obtain financing they needed and applied for) with those of NCFs (growth oriented firms that obtained financing they needed and applied for), along with the distribution of these firms.⁴¹

Table I-6. Descriptive statistics – Growth-oriented NCFs and SCFs breakdown

<i>Labels</i>	Bank debt		Trade credit		
	NCF	SCF	NCF	SCF	
Distribution	High (***)	Low	High (***)	Low	
Distribution by survey year	2011	High (***)	Low	High (***)	Low

⁴¹ Firms that received a loan through the loan guarantee program were excluded from the analysis.

		2014	High (***)	Low	High (***)	Low
		2017	High (***)	Low	High (***)	Low
Age	New firms (<=3yrs)		Low	High	Low	High
	Young firms (3-10yrs)		Low	High	Low	High
	Established firms (>10yrs)		High (*)	Low	High (*)	Low
			High (*)	High	High (*)	Low
Size (employees)						
Province	Atlantic		Low	High	High	Low
	BC and Territories		Low	High	High	Low
	Ontario		Low (*)	High	Low (**)	High
	Prairies		High	Low	High (***)	Low
	Quebec		High (**)	Low	Low	High
Industry	Goods		Low	High	High	Low
	Wholesale/Retail		Low	High	High	Low
	Professional services		High (***)	Low	High	Low
	Other services		Low	High	Low	High
			High (***)	Low	Low	High
Exporter Owner experience						
	5 years or less		Low	High	Low	High
	5-10 years		High	Low	High (*)	Low
	More than 10 years		High	Low	Low	High
Education						
	High school diploma or less		High	Low	High (***)	Low
	A college/cegep/trade school diploma		Low	High	High	Low
	A bachelor's degree or higher		High	Low	Low (**)	High
Innovator			Low	High	Low (**)	High
Minority			Low	High	High	Low
Gender						
	Majority Men		High	Low	Low	High
	50/50		Low	High	High (***)	Low
	Majority Women		High	Low	Low	High
Historical growth (1-year past employee growth)						
			Low	High	Low	High
Debt capitalization ratio						
	30th percentile or less		High (***)	Low	High	Low
	Between 30th and 60th percentile		High	Low	Low	High
	Over 60th percentile		Low (***)	High	Low	High
Slack (Tangible assets / Total liabilities)						
	30th percentile or less		Low	High	Low	High
	Between 30th and 60th percentile		Low	High	Low	High
	Over 60th percentile		High (***)	Low	High (***)	Low
Productivity (Revenues / Employees)						
	30th percentile or less		Low	High	High	Low
	Between 30th and 60th percentile		Low	High	High	Low

Interest coverage ratio (EBITDA / Total interest expense)	Over 60th percentile	High (**)	Low	Low	High
	30th percentile or less	Low	High	Low	High
	Between 30th and 60th percentile	High	Low	Low	High
Gross margin (1 - (Cost of sales / Revenues))	Over 60th percentile	Low	High	High	Low
	30th percentile or less	High	Low	High	Low
	Between 30th and 60th percentile	Low (**)	High	Low (***)	High
Internal funds (Cash / Total assets)	Over 60th percentile	High (*)	Low	High (***)	Low
	30th percentile or less	Low	High	Low	High
	Between 30th and 60th percentile	Low	High	High	Low
Employee growth	Over 60th percentile	High	Low	High	Low
	1-year	High	Low	High	Low
	2-year	High	Low	High	Low
Revenue growth	3-year	Low	High	High	Low
	1-year	High	Low	Low	High
	2-year	Low	High	Low	High
Asset growth	3-year	High	Low	High	Low
	1-year	Low	High	Low	High
	2-year	High	Low	Low	High
Productivity growth	3-year	High (**)	Low	Low (*)	High
	1-year	High	Low	Low	High
	2-year	High	Low	High	Low
	3-year	Low	High	High	Low
Observations		3-4k	0-1k	4-5k	0-1k

NCFs significantly outnumber SCFs for the whole sample, throughout each separate survey year, and for both bank debt and trade credit.⁴² Overall, the results are as expected: that is, rejected applicants are of lower quality than approved applicants. The following summarizes the significant differences between the profiles of borrowers that obtained financing (NCFs) and those that were rejected (SCFs).

⁴² Loan application approval rate is higher than 85 per cent for each survey year.

- Age and size. NCFs are older and larger than SCFs for both bank debt and trade credit. This is consistent with the notion that information asymmetry plays an important role in the loan adjudication process, that is: relatively informationally opaque small and young firms are disadvantaged in accessing loans (Berger and Udell, 1995).
- Location and industry. Both province and industry distributions vary across borrower types (accepted, and rejected), highlighting the importance of controlling for province and industry. For example, approved borrowers are more likely to operate in the professional services sector, consistent with Cole and Sokolyk (2016) who also find that approved borrowers are more likely to operate in the professional services industry.
- Exporter. For bank debt, NCFs are more likely to export relative to SCFs.
- Education. For trade credit, NCFs are less likely to have a bachelor's degree or higher compared to SCFs. Suppliers may prefer lending to those with more practical education.
- Innovator. For trade credit, NCFs are less likely to innovate compared to SCFs. This is consistent with the increased risk of innovation perceived by suppliers (Ughetto 2008; Wang et al., 2015).
- Gender. For trade credit, NCFs are relatively more likely to be equally-owned by men and women relative to SCFs.
- Debt capitalization. SCFs have higher debt capitalization ratios than NCFs for bank debt, highlighting the risk of leverage recognized by lenders, and consistent with Cole and Sokolyk (2016).
- Financial slack. NCFs have higher levels of financial slack compared to SCFs, for both the bank debt and trade credit samples. For bank debt, this is consistent with the importance of tangible assets for lenders given their ability to be pledged as collateral. For trade credit, while it does not require collateral, high financial slack might send suppliers a positive signal of the availability of other sources of financing for the borrower firm, which implies a lower probability of default on the trade credit that they are considering extending to the firm. This is consistent with the hypothesis that trade credits have a complementary relationship with bank loans (Psillaki and Eleftheriou, 2015).
- Productivity. Among bank debt, NCFs have relatively higher levels of revenues per employee compared to SCFs. This is consistent with the notion that higher levels of productivity send positive signals to lenders.

- Gross margin. NCFs are more likely to have higher levels of gross margin relative to SCFs for the bank debt and trade credit samples, consistent with the notion that NCFs are of higher quality than SCFs.
- Post survey growth. For the bank debt sample, NCFs are more likely to experience higher asset growth compared to SCFs. This is as expected since the proceeds of obtained bank loans are supposedly used for asset acquisitions (in the case of term loans). In terms of revenues, productivity, and the number of employees, there is no significant difference between the growth performance between NCFs and SCFs for both the bank debt and trade credit samples.

To investigate whether the differences in growth performance among NCFs, DCFs, GDCFs, and SCFs (observed at the univariate level) persist even after controlling for firm and owner characteristics, multivariate analysis were performed and are reported in the next section.

I.6.2. Multivariate analyses

As stated in Section I.5.1.2., weighted probit models were used, as the first step, to estimate the propensity scores. The selected explanatory variables for each model were variables that were statistically different between the respective control and treatment groups (NCFs and DCFs, NCFs and GDCFs, and NCFs and SCFs) as shown in Table I-5 and Table I-6.⁴³ The second step uses the predicted propensity scores from the first step as probability weights in the OLS estimations of Equation I-11. The explanatory variables selected for Equation I-11 include control variables from Table I-4 (age, size, location, industry, export status, owner experience, education, gender and minority status) and variables that previous studies identified as having a significant impact on growth performance (size squared, past growth, financial slack, internal financing and debt capitalization).⁴⁴ Panel A of Table I-7 presents the treatment effect results of the propensity weighted one-year growth equation for each control-treatment comparison. Panels B and C present the treatment effect results of the propensity weighted two-year growth equation and three-year

⁴³ For more information on the estimation of the propensity models, see Section II.4.2. of Chapter II, which details the estimation procedure used for Equations I-9, Equation I-10 and Equation I-12 in this chapter. The hit rate test (robustness check) is presented in Section III.6.2 of Chapter III.

⁴⁴ The exceptions are variables that were found to be colinear. For example, Ramahan (2011) uses both current ratio and debt capitalization ratio in the growth model. However, this thesis chapter excludes the current ratio variable since it was colinear with debt capitalization and had less available observations.

growth equation, respectively, for each control-treatment comparison. Panel D of Table I-7 presents the propensity weighted growth equation (Equation I-11) estimation results for the explanatory variables.

Table I-7. Propensity weighted growth models

<i>Labels</i>	<i>Bank debt</i>				<i>Trade credit</i>			
	(1) employee growth	(2) asset growth	(3) revenue growth	(4) producti vity growth	(5) employee growth	(6) asset growth	(7) revenue growth	(8) producti vity growth
Panel A – 1-year growth treatment effects								
Financial constraints								
NCF (base = DCF)	++	+	+	-	+++	-	+	+
NCF (base = GDCF)	++	+	+	-	+++	-	+	+
NCF (base = SCF)	+	++	+	+	****	-	+++	+++
Panel B – 2-year growth treatment effects								
Financial constraints								
NCF (base = DCF)	+	+	+	-	+	+	+	+
NCF (base = GDCF)	+	+	+	-	+	+	+	+
NCF (base = SCF)	+++	+++	++	+	-	-	-	****
Panel C – 3-year growth treatment effects								
Financial constraints								
NCF (base = DCF)	++	+	+	-	+	+	+	+
NCF (base = GDCF)	++	+	+	-	+	+	+	+
NCF (base = SCF)	-	+	+	-	-	-	-	****
Panel D – Control variables								
Industry fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Age (Base = New firms)								
Young firms (3-10yrs)	-**	-**	-***	-	+	+	+	-

Established firms (>10yrs)	**-	-	**-	-	-	-	-	-
Size (employees)	+	**-	+	-	****	+	+	+
Size (employees) ^ 2	-	+	-	-	****	-	-	-
Exporter	+	-	+	-	+	***	+	+
Owner experience (Base = <5yrs)								
5-10 years	***	-	+	-	****	-	-	-
More than 10 years	+	-	+	-	-	-	-*	-
Education (Base = High school diploma or less)								
A college/cegep/trade school diploma	-	-	+	+	****	-	+	-
A bachelor's degree or higher	-	-*	-	+	**	+	***	+
Innovator	-	+	+	+	****	+	+	+
Minority	***	+	+	-	****	**	****	+
Gender (Base = Majority Men)								
50/50	-	**-	**-	***	****	****	+	-
Majority Women	+	+	+	-	****	**	****	+
Historical growth (1-year past employee growth)	-	+	+	***	****	+	****	****
Debt capitalization ratio (Base = <=30th perc)								
Between 30th and 60th percentile	-	+	+	+	***	**	+	-
Over 60th percentile	-	-	+	+	+	-	+	-
Slack (Tangible assets / Total liabilities) (Base = <=30th perc)								
Between 30th and 60th percentile	+	-	-	-	***	-	***	+
Over 60th percentile	-	-	-	+	***	-	****	
Internal funds (Cash / Total assets) (Base = <=30th perc)								
Between 30th and 60th percentile	-	-	-*	-	-	-	+	-
Over 60th percentile	+	+	-	-*	-	+	-	-
Constant	+	****	+	+	-	+	-	-
Observations	2-3k	2-3k	2-3k	2-3k	2-3k	2-3k	2-3k	2-3k
R ²	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2

Note: This table reports the estimation results of the propensity score weighted growth models, equation I-11 presented in section II.5.1. The dependent variable *Growth Performance* for columns 1 and 5 is the growth in the number of employees. The dependent variable *Growth Performance* for columns 2 and 6 is the growth in total assets. The dependent variable *Growth Performance* for columns 3 and 7 is the growth in total revenues. The dependent variable *Growth Performance* for column 4 and 8 is the growth in productivity. Panels A, B and C present the estimated treatment effects between each control and treatment groups. Panel A presents the estimated treatment effects between each control and treatment groups on growth between t and $t+1$. Panel B presents the estimated treatment effects between each control and treatment groups on growth between t and $t+2$. Panel C presents the estimated treatment effects between each control and treatment groups on growth between t and $t+3$. Panel D presents the estimation results of the explanatory variables and their effect on one-year growth. Explanatory variables are defined in Table I-4. A previous version of this chapter included three separate tables for each estimation of Equation I-11: (1) NCFs vs. DCFs, (2) NCFs vs. GDCFs, and (3) NCFs vs. SCFs. Given that the estimation results for the explanatory variables were identical across all three tables, the tables were combined into one table. Control variables results for the two- and three-year growth models are presented in Appendix 3. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Age and Size. Among control variables, age has a significantly negative impact on employment, asset, and revenue growth (for bank debt). Similarly, the measure of firm size exhibits a significantly negative association with the firm's growth in assets (for bank debt) and with the firm's growth in employees (for trade credit) after controlling for age. Both results are consistent with Fagiolo and Luzzi (2006) and Rahaman (2011) and the notion that small and young firms experience higher growth rates than large and established firms. However, while growth decreases as size increases, the *rate* of the decrease diminishes as size increases, as evidenced by the significantly positive association between the squared measure of size and the firm's growth in employees (for trade credit), again consistent with Fagiolo and Luzzi (2006).⁴⁵

Owner experience and education. Firms with more experienced owners exhibit relatively more growth in employment for the bank debt models, consistent with Motta (2018). On the other hand, firms with more experienced owners show relatively less growth in employment for the trade credit models. One possible explanation for this result is that more experienced owners manage relatively larger and older firms, leading to relatively lower growth rates.⁴⁶ More educated owners experience relatively less growth in employment yet more growth in assets, revenues and productivity for the trade credit models. This may be indicative of more educated owners realizing more efficient growth. In other words, higher education allows business owners to increase outputs (such as revenues) without incurring additional costs (such as hiring additional employees), therefore increasing productivity.

⁴⁵ The lack of variable significance for each model is likely to due to the small number of constrained borrowers (DCF, GDCF, and SCF). As shown in the descriptive statistics tables (Table I-5 and Table I-6), the sample is highly unbalanced (e.g., the majority of sampled firms are NCFs).

⁴⁶ For example, approximately 97 per cent of firms that were 11 years old or older are owned by entrepreneurs with at least five years of experience (ISED, 2019). Furthermore, a possible explanation as to why there is a significant impact for owner experience for bank loans but not for trade credit may be the difference in estimation samples (bank loans vs. trade credit). Given that: (1) the size of trade credit financing is smaller than that of bank loans (the average financing size for trade credit is five times smaller than the average bank loan size); (2) the bank loan sample excludes those firms that applied for trade credit (and vice versa), the availability of bank loans might be more directly translated into growth than that of trade credit; (3) more experienced owners tend to manage larger firms, which require large amount of financing for growth, bank loan availability (particularly term loans) might be more directly translated into growth than that of trade credit for larger firms with more experienced owners. In other words, when applying for bank loans (particularly term loans), large firms are seeking a larger scale of growth, which is translated into employee growth, than when applying for trade credit. The negative coefficient for the owner experience variable in the trade credit sample likely implies the difficulty in growth for larger firms (percentage-wise, as, for example, it is more difficult to grow the number of employees from five to ten than from one to two, both a 100 per cent growth). This argument is supported by the results for the size variable in the employment growth models: it is negative and significant for the trade credit samples, yet insignificant for the bank loan samples.

Growth strategies and momentum. Exporter firms experience higher growth in employment, assets and revenues (for trade credit financing) compared to those that do not export. Firms that experienced historical growth are more likely to grow in the future, a finding consistent with previous studies and the notion of momentum in growth (Rahaman, 2011).⁴⁷

Gender and minority status. While firms majority-owned by members of visible minority groups experience higher rates of growth in employees for bank debt models, they experience lower rates of growth in employees, assets and revenues for trade credit models.⁴⁸ For trade credit models, women ownership seems to have negative influence on growth in the number of employees and assets, but has a positive impact on growth in revenues and productivity for trade credit models. This might reflect the argument that women are more risk averse (e.g. Georgieva et al., 2021), which leads women entrepreneurs to being more cautious when hiring additional employees and purchasing additional long-term assets (which are difficult decisions to undo). Accordingly, it may take a longer period of time for women to make decisions on acquiring additional human resources and long term assets.⁴⁹

As for the financial variables, most results are in line with Rahaman (2011) and Wagnvoort (2003). For example, firms with higher debt capitalization and financial slack experience higher growth, consistent with Rahaman (2011) and Wagnvoort (2003). One exception is that firms with higher levels of internal financing experience lower growth, however the result is only marginally significant ($p\text{-value} < 0.1$).

Two-year and three-year growth

The growth models were re-estimated with two-year (Panel B) and three-year (Panel C) post survey horizons as dependent variables instead of the one-year growth used in Panel A of Table I-7 to investigate the impacts of financial constraint on growth for longer time periods. It is reasonable to expect that growth might occur over a longer period than one-year after the new

⁴⁷ Innovation, on the other hand, is found to have a negative impact on growth in employees for trade credit. Similar to education, this could be indicative of innovative firms realizing more efficient growth. That is, innovation allows firms to realize their output growth with less inputs (e.g., fewer or no additional employees).

⁴⁸ The impact of minority on employment growth is significantly positive in the bank loan model yet is significantly negative in the trade credit model. One possible explanation for this result could be the very small number of firms that are majority-owned by members of visible minority groups in the trade credit estimation sample. Accordingly, the small portion does not likely represent the population of visible minority-owned firms.

financing injection. For example, it might take more than a year for the firm to grow its revenues and productivity, which may require asset acquisitions and installments, hiring of new personnel to improve customer services, development of better products, improved operating and production systems, or expansion to new markets. Likewise, it might take more than a year for the firm to manage growth in employment. For example, the firm may require assets acquisitions (such as equipment and machinery) before hiring the additional employees required for the assets (e.g. using the equipment and machinery). Subsequently, it also takes time to manage job postings, screen candidates, interview candidates, etc., and finally hire the additional employee(s).

Treatment effects

The impact of finance availability on growth tends to be manifested over a longer time period (two years after financing injections) in the case of bank loans, but it is likely to manifest in a shorter time period (within one year of financing injections) in the case of trade credit. This is to be expected in the case of employee and asset growth because trade credit is for relatively short-term financing of working capital. Conversely, the bank loan sample comprised borrowers who sought term loans, loans that are more likely to be employed in the acquisition of fixed assets. In addition, the difference in growth between NCFs and (G)DCFs tend to become weaker in the second- and third years, while that between NCFs and SCFs are more likely to be sustained. This may be because owners of (G)DCFs may overcome their discouragement and apply for financing in subsequent years. In contrast, supply-side constrained firms are likely to keep being supply-side constrained because of the longer time required to build creditworthiness.

On trade credit:

- Productivity growth is associated with access to trade credit financing. It appears that trade credit allows firms to purchase more and better raw materials, to finance greater quantity and quality of raw materials, to provide attractive discounts etc. to customers, and to financing short-term expenditures for system improvements, etc. Collectively these translate into higher revenues, greater efficiencies (as compared with SCFs) and lower production costs. Obtaining trade credit (as opposed to the denial of trade credit

applications) appears to create significant differences in productivity in the short term, that sustain for the longer term.⁵⁰

- It also appears that receiving trade credit allows firms to hire more employees in the year subsequent to when the firm received it (as compared with DCFs, GDCFs).
- The difference in employee and revenue growth disappears in the two- and three-year time horizon, as trade credit is for short-term working capital financing, and, it appears that the revenue growth realized by the availability of trade credit in the first year may not be large enough to require hire additional personnel.
- There was no significant association between the availability of trade credit and asset growth, as trade credit is for short-term working capital financing. The latter may result in an increase in current assets (and current liabilities); however, growth in total assets attributable to an increase in current assets is likely small compared with asset growth realized by fixed, long term asset acquisitions fueled by term loans.
- It is an enigma that while firms that obtained trade credit (NCFs) exhibit higher employee growth than DCFs and GDCFs, their average one-year employee growth is significantly lower than those who were denied their trade credit requests (SCFs). One speculation relates to productivity in that trade credit allows to generate more revenues with fewer employees (resulting in productivity growth). As a result, firms that receive trade credit (NCFs) grow the number of employees to a lesser extent than SCFs, yet are able to generate more revenues than SCFs (recall that revenue and productivity growth is significantly higher for NCFs than SCFs).

Bank loans:

- Growth realized by the availability of bank loans is more likely to take the form of increases in the number of employees and total assets. This is understandable given that proceeds of bank term loans are generally used for asset acquisitions and working capital financing.
- It is, however, surprising that NCFs' revenue growth is significantly greater only for the 2-year post-survey period, and only in comparison with SCFs (there is no significant difference in revenue growth between NCFs and DCFs/BDCFs), and the significance level

⁵⁰ The significant differences in the longer term growth rates (two- and three-year growth rates) in productivity are mostly driven by the first year growth.

is only marginal. It appears that proceeds of bank loan may not be used for productivity improvement.

Overall, it appears that hypothesis 1a, 1b, and 2 are supported for the case of trade credit. The availability of bank loans appears to have a weaker impact than trade credit availability, but tends to fuel longer-term growth in assets, employment, and revenues in lesser extent. The results show that different sources financing are translated in growth in different forms: it appears that cash flows released from working capital requirements (through obtaining trade credit) are more likely to lead to growth in operational efficiency, while bank loans, of which proceeds allow firms to purchase long term assets (both tangible and intangibles, i.e., human resources), are translated into assets, employees, and eventually revenue growth via expansion. Supply-side constrained firms were unable to realize such growth due to their inability to purchase additional assets (using bank loans) or to release free cash flows (via trade credit).

1.6.3. Robustness checks

1.6.3.1 Hit rate test

The hit rate tests were performed for the propensity weighted models (Heij et al., 2004) to assess the predictive power of the model. Each model exhibited a significant hit rate (p -value<0.05).

1.6.3.2 Term loans vs. lines of credit

Conventional wisdom is that long-term investments are financed by term loans rather than by short-term lines of credit (the latter is being used for shorter term projects/WC financing (Legendre, 2016)). To investigate the difference between the impact on growth of receiving a term loan compared to that of receiving a line of credit, the bank debt samples from Table I-7 were split into two subsamples: a subsample of term loan applications and a subsample of line of credit applications.⁵¹

Table I-8 presents the treatment effects results on one-year growth measures. As expected, the results suggest that the bank debt treatment effects in Table I-7 are largely associated with term loans. While none of the treatment effects for the line of credit models are significant, the demand-

⁵¹ The line of credit sample includes both new line of credit applications and increases in credit limits for existing lines of credit. For the trade credit sample, only new trade credit applications were included in the survey questionnaire.

side and supply-side treatment effects for the term loan models are significant for both employment and asset growth. This lack of significance for lines of credit might be because, unlike term loans, lines of credit tend to be used for multiple purposes that include those unrelated to growth (such as debt consolidation or deferred taxes).

1.6.3.3 Sample selection bias

As mentioned in section I.5.5, a trivariate probit model was estimated for Equations (I-9) and (I-12) and a bivariate probit model for Equation (I-10) on the entire sample of SMEs as the first step of the propensity score weighted estimation to account for the potential bias associated with the exclusion of firms that do not need financing.^{52,53,54} The second step was identical to the second step presented in section I.5. That is, the predicted propensity scores from the first step were used as probability weights in the OLS estimations of Equation I-11. The results for Equation I-11 were identical, supporting the argument that propensity score methods mitigate sample selection biases (Imbens and Wooldridge 2009; Karhunen and Huovari 2015; Motta, 2018).

⁵² See Chapter II for more detailed explanation on the estimated models.

⁵³ More specifically, the system of equations for the trivariate probit can be summarized as follows:

$$\begin{array}{lll} \text{Needs financing (N):} & N^* = W'\beta + \varepsilon, & \text{where } N = I(N^* > 0) \end{array} \quad (\text{I-14})$$

$$\begin{array}{lll} \text{Applied (A):} & A^* = Y'\delta + \omega, & \text{where } A = I(A^* > 0) \text{ if } N = 1, \\ & & \text{and is missing otherwise} \end{array} \quad (\text{I-15})$$

$$\begin{array}{lll} \text{Approved (P):} & P^* = Z'\theta + \tau, & \text{where } P = I(P^* > 0) \text{ if } A = 1 \text{ and } N = 1, \\ & & \text{and is missing otherwise} \end{array} \quad (\text{I-16})$$

The system of equations for the bivariate probit model includes Equation (I-14) and Equation (I-15) only.

⁵⁴ The growth equations, Equation (I-12) and Equation (I-13), are estimated on the sample of firms that need financing. Accordingly, sample selection biases may be present. However, previous research has shown that propensity score methods mitigate sample selection biases (Imbens and Wooldridge 2009; Karhunen and Huovari 2015; Motta, 2018). Therefore, the current methodology addresses the sample selection bias associated with the growth equation using propensity score weighting.

Table I-8. Propensity weighted growth models – term loans and lines of credit

<i>Labels</i>	<i>Term loan</i>				<i>LoC</i>			
	(1) employee growth	(2) asset growth	(3) revenue growth	(4) producti vity growth	(5) employee growth	(6) asset growth	(7) revenue growth	(8) producti vity growth
Panel A – 1-year growth treatment effects								
Financial constraints								
NCF (base = DCF)	+	+	+	-	+	+	-	-
NCF (base = GDCF)	+	+	+	-	+	+	-	-
NCF (base = SCF)	+	+	-	-	+	+	+	+
Panel B – 2-year growth treatment effects								
Financial constraints								
NCF (base = DCF)	+	+	+	+	+	+	-	-
NCF (base = GDCF)	+	+	+	+	+	+	-	-
NCF (base = SCF)	+	+	+	-	+	+	+	+
Panel C – 3-year growth treatment effects								
Financial constraints								
NCF (base = DCF)	+	+	+	-	+	+	-	-
NCF (base = GDCF)	+	+	+	-	+	+	-	-
NCF (base = SCF)	+	-	-	-	-	+	+	-
Observations	1-2k	1-2k	1-2k	1-2k	1-2k	1-2k	1-2k	1-2k
R ²	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2

Note: This table reports the treatment effects estimation results of the propensity score weighted growth models (Equation I-11) presented in section II.5.1. The dependent variable *Growth Performance* for columns 1 and 5 is the growth in the number of employees. The dependent variable *Growth Performance* for columns 2 and 6 is the growth in total assets. The dependent variable *Growth Performance* for columns 3 and 7 is the two-year growth in total revenues. The dependent variable *Growth Performance* for column 4 and 8 is the two-year growth in productivity. Panel A presents the estimated treatment effects between each control and treatment groups on growth between t and t+1. Panel B presents the estimated treatment effects between each control and treatment groups on growth between

t and t+2. Panel C presents the estimated treatment effects between each control and treatment groups on growth between t and t+3. The output is restricted to the estimated treatment effect between each control and treatment groups, since the estimation results of the impacts of the independent variables on one-year growth measures are identical to the estimation results presented in Table I-7. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

I.7. Conclusion

This first chapter quantifies the impact of financial constraints on growth, while (1) considering the availability of both bank loans and trade credit; (2) assessing the effect of supply- and demand-side constraints separately; and, (3) controlling for firms' need for credit, desire to grow, as well as the availability of alternative sources of financing. The findings of these analyses are summarized as follows. First, growth-oriented firms that apply and obtain bank debt and trade credit experience higher growth in employment than growth-oriented firms that were demand constrained in the short-term (one year after receiving financing). Similarly, growth-oriented firms that apply and obtain bank debt experience higher growth in assets than growth-oriented firms that were supply constrained. Growth-oriented firms that apply for and obtain trade credit experience higher growth in revenues and productivity than growth-oriented firms that were supply constrained do.

Second, the difference in growth between growth-oriented firms that apply for and obtain bank debt and trade credit (NCFs) and demand-constrained firms ((G)DCFs) tend to disappear in the longer-term (in the second- and third years after NFCs' financing injection). One possible explanation is that demand-constrained firms may overcome their self-imposed demand-constraints by subsequently applying for and obtained financing. In contrast, the difference in growth between growth-oriented firms that apply and obtain bank debt/trade credit (NCFs) and growth-oriented firms that were supply constrained (SCFs) tends to sustain. One explanation is that supply-side constraints are more persistent, perhaps because the longer time required for supply-side constrained firms to build creditworthiness. Moreover, impacts of financing availability on growth tends to be manifested over a longer time period in the case of bank loans (the second year after financing injections), while it seems likely to show up in a shorter period of time in the case of trade credit (one year subsequent to financing). This is to be expected, especially for the case of employee and asset growth, because trade credit is primarily for financing short-term working capital. The bank loan sample include borrowers who sought term loans.

Third, growth-oriented firms that apply for and obtain *term loans* experience higher growth than growth-oriented firms that were demand- or supply constrained, while growth-oriented firms that

apply for and obtain *lines of credit* do not experience significant differences in growth compared to growth-oriented firms that were demand or supply constrained. This may be due to the versatility of proceeds from lines of credit compared to the proceeds from term loans (that is: the former is more likely to be used for non-growth purposes, such as debt consolidation or deferred taxes, than the latter).

Overall, obtaining term loans or trade credit is found to matter for growth performance. In the short-term, trade credit positively impacts both revenue and productivity growth (recall that the significant differences in the longer term growth rates (two- and three-year) growth rates in productivity are mostly results of the initial-year growth). The additional assets and employees obtained in the first year through term loans are translated into revenue growth in the second year (again, the significant differences in the longer term growth rates in employee and asset growth are mostly results of the initial-year growth). Given that the goal of the firm is to generate cash flows and increase the value of the firm, these results might suggest that recipients of trade credit use this available financing more effectively at increasing the value of the firm (increasing revenues and productivity) than recipients of bank loans (increasing only revenues through additional assets and employees).

Previous research, as well as the findings of this study, suggest the following policy recommendations. First, initiatives that seek to alleviate SME credit constraints to foster growth should target both supply-side and demand-side constraints. Second, new and existing initiatives that seek to alleviate supply-side credit constraints to foster growth should limit their focus to term loans and trade credit, given the lack of positive correlations between access to lines of credit and growth. Third, initiatives that seek to promote growth should also help alleviate demand-side credit constraints, given their negative impacts on short-term growth.

Like most empirical work, this study is not free from limitations, in part because of its reliance on secondary data. First, limitations include differences among questions across different survey years (conducted by Statistics Canada, used exclusively in this study), the availability of variables is not consistent across all survey years. For example, a variable indicative of the demand-side constraint is not available for the 2007 survey, forcing this study to exclude that year when estimating the entire debt acquisition process. Second, the investigation of the growth in other measures directly

related to the value of the firm, such as profitability and cash flows, is left outside of the scope of this chapter. An extension of this research should therefore include the examination of the impact of financial constraints on those two variables (e.g., growth in margins and earnings before interest, taxes, depreciation and amortization (EBITDA) as a proxy for cash flows). Third, future research can also investigate how the relationship between growth and demand-side and supply-side constraints have evolved using more recent data: the 2020 version of the SFGSME data used in this thesis.⁵⁵ In doing so, future research should also address the survivorship bias given the expected higher exit rates due to the 2020 pandemic.⁵⁶ Lastly, given that new firms are more likely to face constraints than older firms, an extension to this research with a larger sample could investigate how the impact of financial constraints differ across different age groups.

Nevertheless, this work uses datasets that provide detailed information on the characteristics of respondent firms, their owners, financing applications and outcomes, as well as comprehensive financial statements and growth performance, associated with each of the 2011, 2014 and 2017 survey years. These data provide a rich set of control variables that allow this chapter to control for differences in growth opportunities faced by different firms when measuring the growth-financing relationships. Using these rich and unique datasets, this study contributes to the academic literature and policy development through the analyses of growth-credit constraint relationships, which distinguishes demand-side constraint from the supply-side counterparts while considering bank term loan, line of credit and trade credit availability. By doing so, this study provides a better understanding of financing SME growth, shedding additional light on the academic literature and public sectors that contemplate means to alleviate difficulties associated with SMEs that attempt to grow.

The policy implications of such analyses are summarized as follows. First, some credit guarantee schemes (CGSs) provide guaranteed financing for working capital, such as the Enterprise Finance Guarantee scheme in the United Kingdom and the Small Business Act (SBA) credit guarantee scheme in the United States. This chapter finds that credit constraints for working capital financing do not have significant impacts on firm growth, suggesting that such policy design efforts may be

⁵⁵ The 2020 version of the SFGSME data is expected to be available in 2023.

⁵⁶ The survivorship bias would be minimal for 2017, 2014, and 2011 due to very low exit rates in the samples.

wasteful of taxpayer dollars compared to CGSs that focus on term loans, such as the Canada Small Business Financing program. Second, this chapter finds that trade credit may be more effective at increasing firm value efficiency (through revenue and productivity growth). Accordingly, policy initiatives that facilitate the availability of trade credit for SMEs might be a good idea. This is of particular importance in developing countries, where SMEs face even more difficulties in accessing trade credit compared to SMEs in developed countries (WTO, 2016). Furthermore, this chapter finds that *both* demand-side and supply-side constraints affect growth at different stages, suggesting that policy efforts that seek to promote firm growth through alleviating supply-side constraints (like CGSs) should also focus on alleviating demand-side constraints.

CHAPTER II : THE ENTIRE DEBT ACQUISITION PROCESS OF SMES

II.1. Introduction

The purpose of this study is to investigate the full SME debt acquisition process. Such an examination is important to identify, more precisely, the nature of financial constraints faced by SMEs at each stage of the debt acquisition process that could possibly hinder the job creation and economic growth. It examines, simultaneously, the three phases involved in such a process, starting from the stage in which owners identify the need for credit, through the step in which they make decisions about whether or not to apply for credit, to the point where they receive the outcome of their credit application.⁵⁷ By drawing on the scope of SME's credit acquisition process, this paper attempts to gain a better understanding of the profile of those SMEs, among the wider SME population, which face even more limited accessibility of debt financing.

Previous studies of access to credit among SMEs often ignore the necessity and demand stages, and the factors at work therein, when estimating "access to credit" models. This could potentially induce estimation biases for two reasons. First, not all SMEs need external financing (Carpenter and Petersen, 2002). Second, firms in need of external capital do not always apply for it (Han et al., 2009; Jappelli, 1990; Kon and Storey, 2003).⁵⁸ These censored firms appear to represent a significant portion of the SME population, sometimes outnumbering the rejected applicants (Cole and Wolken, 1995; Levenson and Williard, 2000). Accordingly, regression estimates of the probability of being credit constrained on the supply side may be biased if these groups of firms

⁵⁷ From here on, this study refers these three stages as "necessity", "application", and "acquisition" stages respectively, which collectively form "the SME debt financing process". It also refers to firms that needed but did not apply for loans as being "demand-side constrained", while those who applied but were rejected their loan applications by financial institutions as being "supply-side constrained". It also considers a particular subgroup within the "demand-side constrained" firms, which consists of firms that needed but did not apply for fear of rejection (following Kon and Storey (2003) definition). Models that estimate factors distinguishing firms that are likely to acquire (apply for, need for) bank loans (as opposed to being not likely) are referred to as the credit supply (demand, necessity) models, respectively.

are ignored. This study seeks to identify the presence of those subgroups of SMEs that face particular difficulty with respect to access to credit while addressing these potential biases.

To my knowledge, the literature has only one study (Drakos and Giannakopoulos, 2018) that investigates the entire SME credit acquisition process while controlling for the correlation among the three stages involved (need of, apply for, and obtain).⁵⁹ However, their data were somewhat limited in terms of firm/loan/credit supplier characteristics variables and time spans. Accordingly, this study: (1) employs Drakos and Giannakopoulos (2018)'s refined methodology, one that makes it possible to derive unbiased estimations of the full SME debt acquisition process estimates; while (2) drawing on a more exhaustive dataset, one that contains a richer set of variables.

By using trivariate probit analyses, analyses that yield unbiased estimations, with a rich set of firm/loan/lender characteristic variables, this study re-examines the impact of entrepreneurial traits that, in previous studies, have been associated with mixed findings or that are understudied. These entrepreneurial traits/firm characteristics include gender and minority status of the owner(s), the owner/entrepreneur growth aspirations and the firm's growth strategies (such as innovation and exporting). For gender and minority status of the owner, the work also examines the source of supply-side credit constraint – whether it stems from statistical or taste-based discrimination. For the latter, it scrutinizes the impacts of growth and its strategies by distinguishing firms' intention from strategies (intention to grow, innovation and export activities). This paper examines the impacts of these variables on credit constraints in the form of not only credit application denial but also in the form of borrowers' refraining from loan applications. By doing so, it attempts to present a more complete picture of the nature of credit constraints faced by SMEs.

The findings of these analyses are summarized as follows. First, while exporters and innovators are more likely to express a need for external financing, they do not face different levels of either demand- or supply-side constraints. These results are consistent with previous studies (e.g., Gama

⁵⁹ Cole and Sokolyk (2016), Cowling et al. (2016) and Cowling et al. (2020) consider the three stages involved in the credit acquisition process ("apply" and "obtain"). However, while their contributions to the literature are significant, the stages are not estimated simultaneously. Cole and Sokolyk's (2016) model for loan necessity is a univariate probit that is independently estimated from their bivariate probit for loan demand and supply. Cowling et al. (2016) and Cowling et al. (2020) model loan supply jointly with loan demand followed by a separate joint model of loan demand and loan necessity.

et al. (2017), Riding et al. (2009)) and suggest that firms and lenders do not consider such growth strategies indicative of lower credit quality.

Second, while firms majority-owned by members of visible minority groups and firms that are majority-owned by women are neither more or less likely to express a need for financing, those that do need credit are less likely to apply for it. Thus, this study confirms previous studies' argument that women are more likely self/demand-constrained (Cole and Sokolyk, 2016; Orser et al., 2006), based on the bias-free estimates.

Third, in the credit supply model estimates, the coefficients of the gender and the minority status variables are insignificant. This implies, among firms that need and apply for financing, no taste-based discrimination against minority-owned or majority women-owned firms.⁶⁰ In other words, these results support the argument that there is no systematic difference in credit supply based on gender nor minority status, once other owner and firm characteristics are controlled for (Cole and Sokolyk, 2016; Coleman, 2000; Eddleston et al., 2016; Orser et al., 2006), rather than the other school of existing studies that claims the presence of such difference (Cole and Mehran, 2009; Eddleston et al., 2016).

However (and fourth), this study finds that such firms are subject to statistical discrimination. That is, the findings suggest differences in loan adjudication criteria that lenders apply, between majority-men and majority-women-owned firms, and between firms owned by members of visible minority groups and those that are not owned by members of visible minority groups. As for the gender difference, it is found that majority women-owned firms are more likely to be approved compared to majority men-owned firms when they are small, but less likely to be approved when they are large firms. This might be because lenders prefer more risk averse ownership for smaller firms (given their higher default likelihood (Nitani and Legendre, 2021)), while preferring more self-confident owners with more ambitious goals for large firms. Regarding the visible minority status of owners, marginally significant evidence of statistical discrimination is detected: among firms that report high gross margins, those owned by minority entrepreneurs are more likely

⁶⁰ This dissertation refers to a firm of which more than 50 per cent ownership (majority) is held by visible minorities as a minority-owned firm.

rejected their loan applications. This might be due to the difference in business reporting standards that could exist between visible minorities and non-minorities (e.g., Neville et al., 2014).

In addition, this chapter investigates how changes in the definition of demand-constrained borrowers affects the profile of such firms. Levenson and Williard (2000) argue that the empirical literature has focused excessively on supply-side constraints regarding SMEs and there remains a need to investigate further demand-side constraints. The demand-side constraints are often associated with the concept of “discouraged borrowers”, yet their profiles drawn by existing studies are inconclusive. One source of this inconsistency may be related to the methodological issue described above. Another possible factor could be different definitions given to the term “discouraged borrowers” across different studies, ranging from a very broad one (e.g., firms that did not apply for credit *for any reason* (Brown et al., 2011)) to a very narrow one (*good* firms that require external capital but choose not to apply specifically *because of fear of rejection* (Kon and Storey, 2003)). This study develops a profile of “discouraged borrowers” as broadly defined (firms that needed but did not apply for loans for any reason, which this study refers to as “demand-side constrained firms”) and a separate profile of “discouraged borrowers” as narrowly defined (firms that needed but did not apply for fear of rejection, which this study defines as “discouraged borrowers”, as described in footnote 1), based on unbiased estimation methods. Through the comparison of profiles of firms that refrain from loan applications for differing reasons, this study attempts to provide keys to reconcile profiles of “discouraged borrowers” that differ across the various studies.

The findings of such changes in definition suggest that the innovator and exporter variables were not significant when the term “discouraged borrower” is broadly defined. However, when it is narrowly defined, innovators are relatively more likely to apply for needed financing and exporters are relatively less likely to apply for needed financing. For innovators, one possible explanation is that innovators may have a more urgent need for financing their innovative activities, therefore they cannot permit themselves to refrain from applying for fear of rejection. For exporters, one possible reason why they are more reluctant to apply due to fear of rejection than non-exported might be that they are aware of the additional risk associated with international trade (Feenstra et al., 2014), which they believe to lead to loan application rejections. As for entrepreneurs of visible

minority groups, they were significantly less likely to apply when the broad definition was used, but are relatively just as likely to apply for needed financing compared to non-minority-owned firms when the strict definition of a discouraged borrower was used. This suggests that minorities are more likely to not apply for needed financing for reasons outside of fear of rejection, which could be the difficulty, lack of necessary knowledge, and complication associated with applying for bank loans that are exacerbated for immigrant entrepreneurs that face knowledge barriers relating to the business environment in their host country (Glover and Sim, 2002; Neville et al., 2014). Lastly, no significant gender effect was detected on the likelihood of being a discouraged borrowers whichever the definition is used.

The availability of capital for small young firms is a vital issue. While their growth is an important source of job creation and economic welfare (Ayyagari et al., 2007; Ayyagari et al., 2014; Criscuolo et al., 2017; de Kok et al., 2011; Haltiwanger et al., 2010; OECD, 2020), such growth is often compromised by financing constraints thought to be caused by severe information asymmetry as well as other market frictions, such as interest rate caps. Accordingly, the findings of this study hold important implications to policy makers and academic literature that seek to promote economic growth through smooth capital flows to young growing firms. First, while this study found no evidence of taste-based discrimination against women and minority business owners, it identified the statistical discriminations against these owners, as well as their higher likelihood of being demand-side constrained. These could have serious consequences to the economy, given the increased presence of these firms and their potential contributions.⁶¹ Second, insignificant impacts of innovation and exporting on the likelihood of supply-side credit constraints suggest that efforts to facilitate supply of credit to innovative and exporting SMEs might not be necessary.

This research also contributes to the literature by addressing the shortcomings associated with debt acquisition models estimated in previous studies. More specifically, this study accounts for the double sample selection biases associated with the debt acquisition process, distinguishes between

⁶¹ For example, the numbers of women- and minority-owned firms are growing – in Canada, Grekou et al. (2018) state that “women-owned enterprises experienced the fastest growth over the period from 2005 to 2013. The number of women-owned enterprises increased to over 300,000 in 2013, from 232,800 in 2005” (p. 4). Similarly, Business Development Canada (BDC) reports that the number of newcomer visible minority entrepreneurs grew from around 210,000 in 2006 to 251,600 in 2018. Chapter 1 suggests that majority-women-owned businesses experienced higher growth in revenues and productivity than majority-men-owned businesses (Table I-7, for trade credit sample).

taste-based and statistical discrimination, distinguishes between demand-side constrained and discouraged borrowers, and controls for a rich set of firms and owner characteristics using a unique dataset on Canadian SMEs. By doing so, it is believed that the empirical observations in this paper provide more conclusive evidence on the impacts of gender, minority status, and growth strategies (innovation and exports) at each step of the debt acquisition process.

The rest of the paper is organized as follows. Section 2 reviews the literature on demand and supply constraints as well as the research questions. Section 3 presents the data and methodology, followed by the empirical results in Section 4. Section 5 concludes.

II.2. Literature review and research questions

II.2.1. The supply-side credit constraints

Stiglitz and Weiss's seminal work of 1981 suggests information asymmetry as the primary source of credit rationing. Since then, the literature has investigated whether small and young businesses (known to be more severely affected by asymmetric information problems) are credit constrained through the estimation of loan supply models.

The literature has also investigated whether there are subgroups within the SME population that are particularly subject to the supply-side financial constraints. It has been suggested that women- and minority-owned businesses, growth-oriented firms, innovative firms, and exporters are subgroups of this type; however, consensus has not yet been achieved as to this point.

Women- and minority-owned businesses. On one hand, studies find that women entrepreneurs do not receive the same amount of financing compared to their men-counterparts (Brush et al., 2001; Buttner and Rosen, 1988), and discrimination persists even when controlling for characteristics such as education, industry, size, age, and past performance (Eddleston et al., 2016). On the other hand, the significant impact of gender (high rejection rates for women) disappears when a richer set of firm characteristics, including age and size, are controlled for (Cole and Mehran, 2009; Coleman, 2000; Fabowale et al., 1995; Orser et al., 2006). Existing research is also inconsistent regarding the impact of minority status. On the one hand, using a bivariate probit model for loan supply and demand, Blanchard et al. (2008) find that minority-owned firms are more likely to be

denied financing, conversely, Mitchell and Pierce (2011) observe, using a similar bivariate probit analysis, report no significant difference in loan acceptance rates between minority owned and non-minority owned firms once loan type is controlled for. Similarly, Cole and Sokolyk (2016) find that only Black owners consistently face severer credit constraints; Asian and Hispanic owners' probabilities of loan approval do not face significantly differ from non-minority owners.

Exporters. As mentioned above, firms involving international trades are thought to be subjects of relatively more severe credit constraints, due mainly to their operational risk and information asymmetry (Riding et al., 2009). The operational risk is associated with the time lag (and attendant need for financing) between production and revenue receipt (Amiti and Weinstein, 2011; Feenstra et al., 2014). According to Djankov et al. (2010). It takes approximately 21 days for a product to be ready for shipping (from the time when it is out from factory), and then another 23 days until it is secured by the importer and payment subsequently follows. During this period the importer could possibly default (to minimize this risk exporters often write insurance); the longer the time, the higher the risk of importers' defaults along with the higher working capital requirements (Feenstra et al., 2014). In addition, the assessment of the importer is difficult due to the information asymmetry exacerbated by distance (Boot, 2000; Elyasiani & Goldberg, 2004; Brevoort & Hannan, 2006).

Another operational risk stems from the additional costs associated with international trade (Manova et al., 2015). Such additional expenses include both fixed costs (such as regulatory compliance, product customization, establishing foreign distribution networks) and variable costs (such as trade insurance, transportation, freight insurance, and duties). These costs are often substantial, of which the fixed portion increases the operating leverage. These additional sources of risk and information asymmetry make it more difficult for lenders to provide exporters with loans. This is especially true for SMEs, which are already riskier than established corporations without international trade being involved, and thus more likely to default on loans.

As for the empirical examination on the above argument, however, only three studies have investigated the impact of exporting on credit constraints, yielding conflicting results. Cowling et al. (2020) find that exporters are significantly less likely to obtain bank loans compared to their non-exporter counterparts. On the other hand, Brown et al. (2011) report that Eastern European

exporters are less likely to be rejected, but this effect disappears when Western European exporters are examined. Similarly, Chakravarty and Xiang (2013) find an insignificant effect of exporting on demand constraints. Riding et al. (2009) find that only growth-oriented exporters are more likely to have their financing applications rejected, while non-growth exporters do not have significantly different likelihoods of rejection than non-growth non-exporters.

Innovative firms. Ughetto (2008) explains that there are three reasons for credit constraints to arise for innovative firms, which are especially pronounced among SMEs. First, there is considerable uncertainty surrounding expected future cash flows of innovation activities. Such investments are better understood by the entrepreneurs than outside investors and lenders, which can lead to moral hazard and adverse selections problems (Jensen and Meckling, 1976; Stiglitz and Weiss, 1981). Second, these projects often suffer from a very low probability of success (Carpenter and Petersen, 2002; Leland and Pyle, 1977). Third, major assets for innovative firms include the entrepreneur's brain (ideas) and intellectual properties, thus they often lack tangible assets to pledge for collateral (Berger and Udell, 1990; Lev, 2001). There are, to my knowledge, only three studies that have investigated the above argument. Ughetto (2008) examines a sample of Italian manufacturing firms from 1998 to 2003 reporting that innovative firms particularly suffer from credit constraints. Wang et al. (2015) report similar results in China. Cowling et al. (2020), on the other hand, find no significant difference in likelihoods of loan approval between innovators and non-innovators in the United Kingdom, using a sample of borrowers from 2011 to 2013.

II.2.2. The demand-side credit constraints

Existing studies suggest that not all firms that need external capital (bank loans) choose to apply for them, constituting a group of demand-side credit constrained firms (as opposed to the supply side constraint). Firms do not apply for credit with a variety of reasons, including anticipated high interest rates and stringent collateral requirements, corruption, anticipated rejection (Brown et al., 2011), application costs (Kon and Storey, 2003), or that applying for a loan is too complicated (Chakravarty and Xiang, 2013).⁶² Consideration of this group of firms (demand-side constrained borrowers) is important not only for the estimation of the credit supply models (ignoring this group

⁶² Brown et al. (2011) define corruption as banks requiring applicants to provide informal payments to obtain financing.

would result in a selection bias), but also because the presence of this group of firms appears to be significant. Levenson and Williard (2000) suggest that these demand-side constrained borrowers can outnumber supply-side constrained counterparts. Moreover, if they are good borrowers (that is: they would have obtained loans if they had applied), the growth opportunities foregone by the demand-side constraints could be significant. Cole and Sokolyk (2016) find that 33 per cent of demand-side constrained firms in the United States would have had their loan applications approved if they had applied.

The existing literature has therefore attempted to identify the characteristics of these demand-constrained firms. However, again, existing studies draw mixed conclusions as to the impacts of gender and minority status on the probability to apply for bank loans, and the associations of growth and innovations with demand-side constraint appear to be understudied (see below).

Women- and minority-owned firms. The majority of previous studies report that firms owned by women are more likely to be demand-side constrained (Cavaluzzo et al., 2002; Chakravarty and Xiang, 2013; Cole and Mehran, 2009; Cole and Sokolyk, 2016; Gama et al., 2017; Orser et al., 2006; Robb and Wolken, 2002; Rostamkalaei et al., 2018; Singh, 2014). However, there are also observations that gender is not a significant determinant of this demand-side constraint (Cole and Mehran, 2009; Freel et al., 2012; Han et al., 2009), that the significance of gender is not always present over time (Coleman and Robb, 2014) and that women are less likely to be demand constrained (Cowling et al., 2020). Similarly, the majority of previous studies find minority-owned businesses to be more likely to be demand-side constrained (Cavaluzzo et al., 2002; Cole and Sokolyk, 2016; Han et al., 2009; Neville et al., 2017), with a few exceptions that report minority status to be not significant in determining demand-side constraints (Chakravarty and Xiang, 2013).

Growth- and innovation-oriented firms. Psillaki and Daskalakis (2009) argue that growth-oriented firms are more likely to seek bank loans because firms with high growth opportunities are more likely to exhaust internal funds. Freel et al. (2012) detect no significant impact of growth intention on demand-side constraint.⁶³ Regarding innovation, to my knowledge, only Cowling et al. (2020)

⁶³ Freel et al. (2012) find that while growth intention does not impact the demand for financing, it has a significantly positive impact on the firm's need for credit.

has investigated their impacts on demand constraints. They find no significant effect of whether the firm is an innovator on loan demand.

Exporters. Brown et al. (2011), Chakravarty and Xiang (2013), and Gama et al. (2017) report the significantly negative impact of international trades on demand-side constraint, as an international trade involves inevitable incremental fixed and working capital financing that drive firms to seek additional capital. However, Cowling et al. (2020) do not find a significant impact of exporting on the firm's need or the firm's demand for a loan.⁶⁴

II.2.3. Methodological consideration and research questions

As reviewed above, existing studies have investigated the profiles of SMEs that are more subject to the supply- (demand-) side constraints by estimating credit supply (demand) models. However, many of these studies fail to address one (or both) of the two selection biases associated with these estimations. The first selection bias occurs because not all firms apply for the financing they need. Jappelli (1990) argues that the self-constrained nature of these firms may lead to lenders adopting different loan adjudication criteria if these firms were to be included in credit supply analysis. The second selection bias occurs when not all firms need financing. In the United States, for example, Cole and Sokoluk (2016) report that approximately half of SMEs do not need credit. Similarly in Canada, the 2017 SFGSME (Survey of Financing and Growth of SMEs) highlights that 57 per cent of SMEs did not express a need for financing (Innovation, Science and Economic Development Canada, 2018). Drakos and Giannakopoulos (2018) identify significant correlations among these three stages of debt acquisition process (need for financing, applying for financing and getting approved for financing), suggesting biased estimations if these correlations are not accounted for. More specifically, estimations of the credit supply models require addressing both the first and second selection biases, and the estimation of the credit demand models requires addressing the second sample selection bias.⁶⁵

⁶⁴ There is a possibility that the level of exporting influences the results. For example, Chakravarty and Xiang (2013) define exporters as those with at least 10 per cent of their revenues originating from exports, while Cowling et al. (2020) regard firms as exporters if over zero per cent of their revenues originated from exports.

⁶⁵ Freel et al. (2012) address the second selection bias by using a bivariate probit model when estimating the credit demand models. They find significant correlation between the “necessity” and “application” stages.

To my knowledge, only Drakos and Giannakopoulos (2018) address these sample selection biases by using a trivariate probit with double selection credit supply model.⁶⁶ However, the data they use are somewhat limited. Accordingly, the impacts of entrepreneurial attributes (such as gender and minority status), firm's growth intention and growth strategies (innovation, exporting, etc.) on necessity, application, and acquisition of bank loans (in an unbiased fashion) are still inconclusive. This study addresses this gap in the literature. Thus, the first research question of this study is:

RQ1: How do entrepreneurs' attributes, their growth intention, and growth strategies influence the firm's necessity of, application for, and acquisition of credit, when they are analysed in an unbiased way?

If gender and minority status are found to face more severe supply-side constrained in the analysis of research question 1, this study also attempts to investigate, for gender and minority status, the mechanism of this supply-side constraint (or discrimination).

There are two types of discrimination suggested by the literature: statistical and taste-based discriminations (Blanchard et al., 2008). Taste-based discrimination suggests that lenders are willing to forego a good borrower due to his or her animus towards members of that group (Becker, 1957; Guryan and Charles, 2013).⁶⁷ For example, if the lender has an animus towards women owners, the lender may reject a loan application from women-owned firms, even if the lender's loan adjudication standards suggest the loan to be approved based on the owner's credit and resources, the firm's credit and financial health, and other objective risk measures (Blanchard et al., 2008). On the other hand, statistical discrimination suggests that lenders may deny loans to people in certain groups in the belief that people in these groups have poor *unobserved* credit qualifications (Blanchard et al., 2008; p. 474). Contrary to taste-based discrimination, lenders apply different lending criteria based on this belief of poor unobservable characteristics rather than

⁶⁶ Brown et al. (2011), Cole and Sokolyk (2016) and Cowling et al. (2016) also considered the "necessity", "application", and "acquisition" stages simultaneously. However, Brown et al. combined the "necessity" and the "application" stages, and all three studies do not control for the cross-correlation among the three stages simultaneously. These studies also suffer from endogeneity concerns due to use of the firm's current year financial variables. For example, a firm in Cole and Sokolyk's 1993 sample reports balance sheet data at year-end for 1993, yet the financing information can be anywhere from 1990-1993. It could be that it is in fact financing activity prior to 1993 that explains the firm's current balance sheet data in 1993 (reverse causality). See Appendix 4 for a detailed summary of the sample selection procedures and variables used by previous studies.

⁶⁷ A social animus, in general, refers to a spiteful or malevolent ill will based on a prejudice.

hatred (animus) towards the group. For example, suppose a lender receives two loan applications, one from a majority women-owned firm and the other from a majority men-owned, but the firms are identical otherwise. The lender believes that there is unobserved poor credit quality associated with the women-owned firms. Accordingly, the lender considers the profit margin of five per cent high enough to approve a loan for men owner, yet the same profit margin not sufficient to approve a loan for women owner. In other words, the lender applies different loan adjudication standards when screening women owners.⁶⁸ Distinguishing between both types of discrimination is key for building effective policies to fight against discrimination, and this study seeks to meet this requirement.

RQ2: Are severer credit constraints faced by subgroups of SMEs due to statistical or taste-based discrimination?

As seen in Section 2.2, existing studies draw inconclusive pictures of demand-side constrained borrowers (firms that require bank loans yet do not apply). One potential reason for this is the bias associated with the credit demand models discussed above. Another possible factor would be differences in definitions across studies. When a firm needs bank loans yet does not apply (i.e., when the firm is demand-side constrained), existing papers often refer to it as a “discouraged borrower”. However, the exact definitions of this term differ across different studies. The differences mainly lie in phrases indicating reasons for not applying. For example, Brown et al. (2011) define this term as firms that did not apply for *any reason* (which include: not needing a loan; application procedures too burdensome, collateral requirements too high, interest rates too high, informal payments are necessary or fear of possible rejection). Drakos and Giannakopoulos’ definition (2018) excludes the case where firms do not need a loan but includes any other reasons. In contrast, Jappelli (1990) refers to discouraged borrowers as firms that require external capital choose not to apply *due to fear of rejection*. Kon and Storey (2003) give an even narrower definition, *good* firms that require external capital choose not to apply *due to fear of rejection*. Their definition requires firms meet the following three conditions in order for them to be

⁶⁸ Some studies attribute high rejection rates for women-owned firms to their characteristics. For example, Fabowale et al. (1995), Coleman (2000), Orser et al. (2006), and Cole and Mehran (2009) reports that women-owned firms tend to be younger and smaller in size, which is often associated with high loan default rate (Nitani and Legendre, 2020). These are consistent with the statistical discrimination models.

recognized as discouraged: (1) need financing; (2) yet do not apply for the reason of an anticipated rejection; and (3) be creditworthy. Since studies use different definitions of discouraged borrowers, it is not surprising that they identify different profiles of “discouraged borrowers”.

This study addresses the above issue through the consideration of two types of firms that needed bank loans yet did not apply, which are most frequently examined by existing studies. The first one includes firms that needed bank loans yet did not apply *for any reason* (they are “discouraged borrowers” when the term is broadly defined by existing studies), which is, in this study, referred to as “demand-side constrained borrowers”. “Any reason” includes fear of rejection; anticipations that applying for financing is too difficult or time consuming, or that cost of financing is too high; or unaware of financing sources (private or government) that are available. The second type is firms that needed bank loans yet did not apply *for fear of rejection* (they are also “discouraged borrowers” when the term is narrowly defined), which is, in this study, referred to as “discouraged borrowers”. Note that “discouraged borrowers” are also “demand-side constrained borrowers”, forming a subgroup within the latter broad group. By defining these two groups, this study attempts to identify how different definitions of discouraged borrowers draw different profiles, thereby – and based on unbiased estimation approach, draw a more comprehensive picture of demand-side constrained and discouraged borrowers.

RQ3: How do the profiles of demand-side constrained borrowers differ depending on the reasons for not applying?

II.3. Data and Methodology

II.3.1. Data

This work takes advantage of unique datasets: the Surveys of Financing and Growth of Small-and Medium-Enterprises (SFGSME) conducted in 2011, 2014 and 2017.⁶⁹ These data are particularly suited to this research for several reasons. First, they collect detailed information about the firms’

⁶⁹ There is an earlier version of this periodic survey, conducted in 2000, 2004, and 2007: the Survey of Financing of Small-and Medium-Enterprises (SFSME). The datasets based on this previous version were excluded from the analysis due to numerous missing variables and less informative compared to those based on the current version (SFGSME). For example, the 2007 data do not have information on borrowers’ need for financing or reason for not applying for credit (i.e., does not allow to investigate demand-side constraint).

and business owners' characteristics, including gender and minority status of the owner, the owners' intentions to grow, innovation and international trade activities, etc. Second, they collect information about the firms' financing needs and applications and the detailed outcomes of the applications: approved or not, collateral requirements, etc. Finally, the survey data are linked, through Statistics Canada's linkable file environment, to the tax submissions of each respondent enterprise for years prior to the survey and for years following the survey. This allows for identification of lagged financial and employment information that are particularly useful for measuring firms' historical growth performance and for modeling lenders' loan adjudication criteria.

Statistics Canada designs the questionnaire and conducts this survey on behalf of Industry Science and Economic Development (ISED) Canada and Finance Canada. The population of interest for the surveys comprises all for-profit Canadian enterprises with fewer than 500 full-time-equivalent employees and annual gross revenues of less than \$50 million, drawn from the 1.3 million Canadian firms listed on the Business Register maintained by Statistics Canada (an exhaustive collection of all Canadian firms reporting a minimum of \$30,000 in revenues during any 12-month period).⁷⁰ Data were collected through computer-assisted telephone interviews, which gathered extensive firm demographic information along with attributes of the primary owners of the firms (the key respondents). The respondents were then weighted to best represent the underlying population while ensuring minimum data counts for each cell. The number of valid respondents to SFGSME surveys were 9,957 in 2011, 10,397 in 2014 and 9,115 in 2017.⁷¹

The surveys minimize the overall effects of non-response and selection biases by high response rates (typically exceeding 50 percent), by creating a large number of strata, and by surveying a large number of firms so that each stratum achieves a coefficient of variance of five per cent.⁷²

⁷⁰ More specifically, the following enterprises are excluded from the population: (1) firms with 500 or more employees; (2) firms with over \$50 million in gross revenue; (3) non-profit organizations; (4) cooperatives (until 2017) and joint ventures; (5) firms in specific industries, such as: (a) utilities; (b) finance and insurance; (c) management of companies; (d) educational services; (e) public administration; (f) automotive equipment or commercial/industrial machinery/ equipment rental and leasing; (g) health care services; (h) community food and housing; (i) emergency and other relief services.

⁷¹ Each survey is conducted independently with no intention to repeat respondents from survey to survey.

⁷² The strata variables include region, industry, size (the number of employees) and age of the firm, and participation to the Canada Small Business Financing (CSBF) loan guarantee program.

Key informant problems are minimal because the survey involves SMEs with a median firm size of less than 4 employees; access to the person who has the most detailed knowledge of the firm is unlikely to be an issue. Furthermore, interviewers ask specifically to speak with the person most knowledgeable with respect to the firms' finances.

II.3.2. Research question 1: Modeling the SME debt financing process

II.3.2.1. Model development

To investigate the first research question, this paper estimates the following three stages of the SME debt financing process.

Stages 1, 2 and 3 are represented by Equations II-1, II-2 and II-3 respectively. In the first stage, the firm identifies a need for financing (Equation II-1), so the dependent variable is whether or not the business owner recognized the need for financing. This variable equals to zero (no financing need) when: (1) the respondent's business requested neither a non-residential mortgage, a business line of credit nor a term loan; and (2) the respondent answered "Financing not required" to the question "Why did your business not request external financing in [survey year]".

Table II-1. SME debt financing process – First stage (need)

Survey questions and answers	Need respondent answer (Need=1)	No need respondent answer (Need=0)
In [survey year], did your business request a non-residential mortgage or refinancing of an existing non-residential mortgage?	"Yes" or "No"	"No"
In [survey year], did your business request a business line of credit or increase in the credit limit of the current line of credit?	"Yes" or "No"	"No"
In [survey year], did your business request a term loan?	"Yes" or "No"	"No"
<i>If above three answers are "No", prompt: Why did your business not request external financing in [survey year]?</i>	"Thought the request would be turned down", "Applying for financing is too difficult or time consuming", "Cost of financing is too high", "Unaware of financing sources that are available", or "Other"	"Financing not required"

In the second stage, the owner decides whether to apply for financing or refrain from applying (Equation (II-2)), thus the dependent variable is based on the answers to the following questions: “In [survey year], did your business request a non-residential mortgage or refinancing of an existing non-residential mortgage?”, “In [survey year], did your business request a business line of credit or increase in the credit limit of the current line of credit?” and “In [survey year], did your business request a term loan?”. If the respondent answered “Yes” to at least one of these questions, the dependent variable is equal to one. If the respondent: (1) answered “No” to all these questions; and (2) chose one (or more) of the following options: (a) “Thought the request would be turned down”; (b) “Applying for financing is too difficult or time consuming”; (c) “Cost of financing is too high”; (d) “Unaware of financing sources that are available”; and (e) “Other”; as its answer to the question “Why did your business not request external financing in [survey year]”, the respondent is classified as demand-constrained under the broad definition (thus the corresponding dependent variable is equal to zero).⁷³ If the respondent: (1) answered “No” to all these questions and (2) selected “Thought the request would be turned down” as its answer to the question “Why did your business not request external financing in [survey year]”, the respondent is classified as demand-constrained under the narrow definition and the corresponding dependent variable is equal to zero.

Table II-2. SME debt financing process – Second stage (apply)

Survey questions and answers	Apply respondent answer (Apply=1)	No apply respondent answer (Apply=0)
In [survey year], did your business request a non-residential mortgage or refinancing of an existing non-residential mortgage?	At least one “Yes”	“No”
In [survey year], did your business request a business line of credit or increase in the credit limit of the current line of credit?		“No”

⁷³ If a respondent answered (1) “No” and (2) did not select any options, the variable is treated as missing and the observation is excluded.

In [survey year], did your business request a term loan?		“No”
<i>If above three answers are “No”, prompt: Why did your business not request external financing in [survey year]?</i>	N/A	<u>Broad definition:</u> “Thought the request would be turned down”, “Applying for financing is too difficult or time consuming”, “Cost of financing is too high”, “Unaware of financing sources that are available”, or “Other” <u>Narrow definition:</u> “Thought the request would be turned down”,

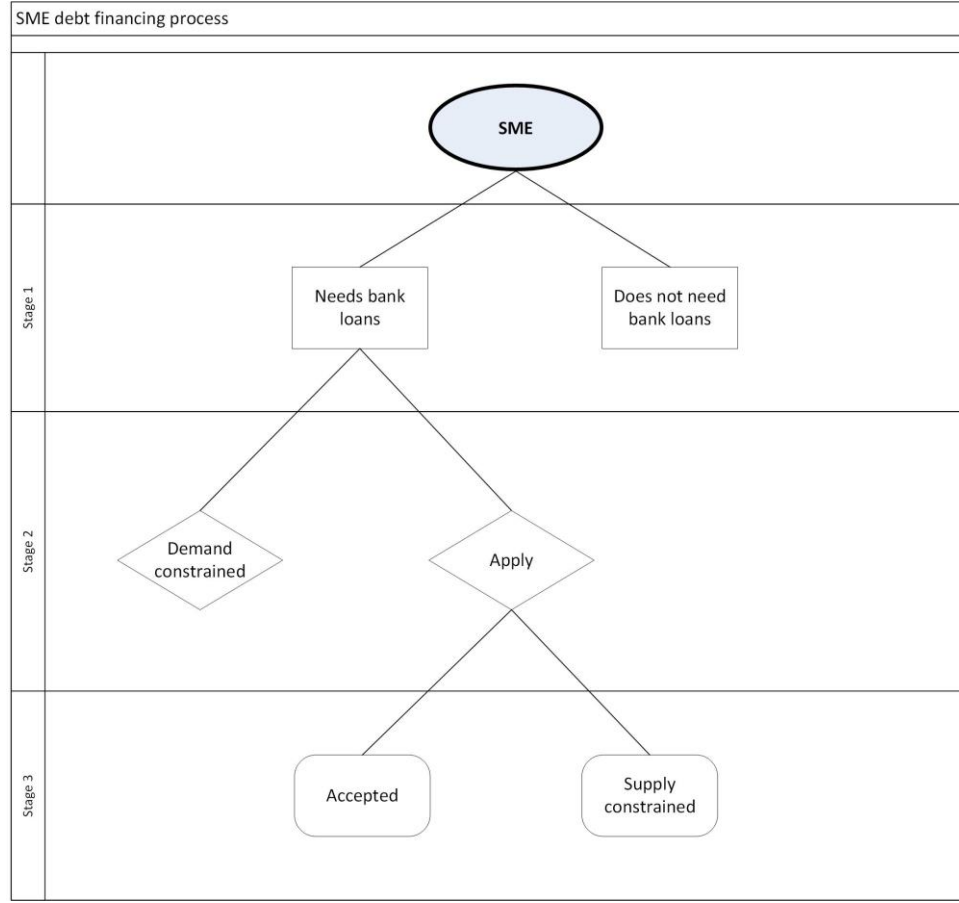
In the third stage, the lender either approves or rejects the firm’s loan application (Equation (II-3)), thus the dependent variable is derived from respondents’ answers to the following questions: “What was the outcome of this mortgage request?”, “What was the outcome of this business line of credit or increase in the current credit limit request?”, and “What was the outcome of this term loan request?”. If the respondent answered “The full amount was authorized”, the dependent variable is equal to one. If the respondent answered “Request was rejected”, the dependent variable is equal to zero.⁷⁴

Table II-3. SME debt financing process – Third stage (approved)

Survey questions and answers	Approved respondent answer (Approved=1)	Rejected respondent answer (Approved=0)
What was the outcome of this mortgage request?	“The full amount was authorized”	“Request was rejected”
What was the outcome of this business line of credit or increase in the current credit limit request?	“The full amount was authorized”	“Request was rejected”
What was the outcome of this term loan request?	“The full amount was authorized”	“Request was rejected”

⁷⁴ Applicants who had their loan amount partially authorized represented a very small per cent of loan applications that were authorized, and were therefore excluded.

Figure II-1. The SME debt financing process. Adapted from Riding et al. (2009)⁷⁵



The primary issue for the econometric setup is that the second and the third stages depend on the outcome of the previous steps. Specifically, the loan application outcome (Equation (II-3)) is observable only for those who needed financing (Equation (II-1)) and applied for loans (Equation (II-2)). Likewise, the firm's decision to apply for loans (Equation (II-2)) is relevant only after the owners identifies its necessity (Equation (II-1)). Thus each stage of the process can be modeled by their respective latent variables, as summarized below:

$$\text{Needs financing (N):} \quad N^* = W'\beta + \varepsilon, \quad \text{where } N = I(N^* > 0) \quad (\text{II-1})$$

$$\text{Applied (A):} \quad A^* = Y'\delta + \omega, \quad \text{where } A = I(A^* > 0) \text{ if } N = 1, \quad (\text{II-2})$$

and is missing otherwise

⁷⁵ As mentioned above, this study examines two types of demand-constraint – one based on the broader, and the other based on the narrow definition.

$$\text{Approved (P):} \quad P^* = Z'\theta + \tau, \quad \text{where } P = I(P^* > 0) \text{ if } A = 1 \text{ and } N = 1, \text{ and is missing otherwise} \quad (\text{II-3})$$

where:

N^*, A^*, P^* = latent variables driven by a vector of covariate

W, Y, Z = a vector of explanatory variables summarized in Table II-4

$\varepsilon, \omega, \tau$ = error terms

Previous research has found strong correlations among the three equations (Drakos and Giannakopoulos, 2018). In order to address this problem, this research follows Drakos and Giannakopoulos to utilize a weighted trivariate probit model with double selection to estimate the SME's debt financing process. The trivariate probit model simply extends the bivariate probit model often employed to address sample selection issues by adding a selection equation (Greene, 2018). This methodology is advantageous for two reasons. First, as mentioned, it considers the correlation among errors of the three equations. A combination of bivariate probit and univariate probit regressions utilized by previous studies does not account for all of the correlations across the three stages noted above, potentially leading to biased estimates (ex. Cole and Sokolyk (2016) and Cowling et al. (2020)). Second, it is superior to nested logit models in dealing with these correlations (Han et al., 2009), as it is designed to consider correlations among errors of equations, rather than those among outcome variable alternatives, which nested logit models account for (Capalleri and Jenkins, 2006; Hensher, Rose and Greene, 2015; Jenkins et al., 2006).⁷⁶

Accordingly, the trivariate probit model addresses the sample selection biases more appropriately by formulating the likelihood function based on the unconditional probabilities for the six types of outcomes in the sample, detailed below. The likelihood function contributions of each observation j are listed as follows. First, the likelihood contribution for a firm that did not need financing ($N = 0$) is

$$L_{1j} = w_j \phi_1(-W_j'\beta)^{(1-N_j)} \quad (\text{II-4})$$

⁷⁶ Classical textbooks point out that the nested logit model should not be used for a decision tree kind of analysis: “the [nested logit] tree structure is designed to accommodate the differences in error variances (including correlated alternatives) between alternatives (including the degenerate branch for one alternative), and as such should not be interpreted as a decision tree” (Hensher, Rose and Greene, 2015; p. 103).

Second, the likelihood contribution for a firm that needed financing but did not apply ($N = 1$, $A = 0$) is

$$L_{2j} = w_j \phi_2(W_j' \beta, -Y_j' \delta; -\rho_{NA})^{N_j(1-A_j)} \quad (\text{II-5})$$

Third, the likelihood contribution for a firm that needed financing, applied for financing but who's application was rejected ($N = 1$, $A = 1$, $P = 0$) is

$$L_{3j} = w_j \phi_3(W_j' \beta, Y_j' \delta, -Z_j' \theta; \rho_{NA}, -\rho_{AP}, -\rho_{NP})^{N_j A_j (1-P_j)} \quad (\text{II-6})$$

Fourth, the likelihood contribution for a firm that needed financing, applied for financing and whose application was accepted ($N = 1$, $A = 1$, $P = 1$) is

$$L_{4j} = w_j \phi_3(W_j' \beta, Y_j' \delta, Z_j' \theta; \rho_{NA}, \rho_{AP}, \rho_{NP})^{N_j A_j P_j} \quad (\text{II-7})$$

where ρ_{NA} , ρ_{AP} and ρ_{NP} are the cross-equation error correlations for equations (II-1)-(II-2), (II-2)-(II-3) and (II-1)-(II-3) respectively; ϕ_1 , ϕ_2 and ϕ_3 denote the univariate, bivariate and trivariate standard normal cumulative density functions respectively; and, w_j is the final survey weight for observation j . To estimate this model, the method draws on Roodman's (2011) estimation technique by implementing the Geweke-Hajivassiliou-Keane (GHK) algorithm to efficiently calculate the cumulative normal distributions associated with three correlated equations (Greene, 2018).

II.3.2.2. *Dependent, independent, and control variables*

The following section discusses each step, moving from the bottom to the top of Figure II-1.

Step 3: loan acceptance or rejection

The dependent variable for Step 3 is a binary variable equal to one if, among those firms that need and that applied for bank loans, the loan application was accepted; or zero if rejected.⁷⁷ The

⁷⁷ Lines of credit are different from term and mortgage loans in nature, so that lenders' loan adjudication criteria are presumed to be different. For example, Berger and Udell (1995) and Petersen and Rajan (1993) estimate two different loan pricing estimation models based on the same SME loan application datasets, where Berger and Udell (1995)

variables of interest include: owner attributes (gender, minority status) and growth strategies (innovation, exporting).

- Gender: categorical variable denoting if the gender composition of firm's ownership: 1) majority men, 2) 50/50 men-women or 3) majority women;
- Minority status: dummy variable equal to one denoting that the firm's ownership is comprised of aboriginal persons or of persons who are from a visible minority group (other than aboriginal); or zero otherwise;
- Innovation: dummy variable equal to one if the firm introduced any of the following innovations: a) a new or significantly improved good or service; b) a new or significantly improved production process or method; c) a new organizational method in your business practices, workplace organization or external relations; or, d) a new way of selling your goods or services;
- Exporting: dummy variable equal to one denoting if more than 25 per cent of the firm's revenues originated from export sales; zero otherwise.

The vector of control variables was created on the basis of the conventional wisdom regarding the lenders' loan approval criteria, that is: five-Cs of credit (character, capacity, capital, conditions, and collateral, Ross, Westerfield & Jordan, 2010), as well as those suggested by previous studies and that have influenced the three steps of the SME debt financing process. These variables are presented in Table II-4.

Table II-4. Control variables⁷⁸

Variable name	Description
<i>Firm characteristics</i>	

restrict the sample to line of credit applications while Petersen and Rajan do not impose such a restriction. Accordingly, this study's trivariate system of equations is estimated twice: (1) constraining Step 3 to term loan and mortgage applications only, and (2) constraining Step 3 to line of credit applications only.

⁷⁸ The final model will include a selection of these variables that maximizes the predictive accuracy of the loan adjudication model, taking multicollinearity problems into consideration (e.g., total debt/capitalization and EBITDA/total Debt are expected to be collinear).

Age	Categorical variable measured by years since firm inception: 1) New firm (under 3 years old), 2) Young firm (3 to 10 years old) or 3) Over 10 years old.
Size	Continuous variable measured by the natural logarithm of: (1) revenues; (2) total assets; and, (3) the number of employees. Of those, the one with least missing observations will be chosen. ⁷⁹
Size ²	Squared of size.
Location fixed effect	Categorical variable denoting the location of the firm: Ontario, Québec, East coast or West coast.
Urban	Dummy variable denoting one if the firm operates in an urban area; zero if rural.
Industry fixed effect	Categorical variable denoting the firm's industry: 1) Goods (manufacturing and primary sector), 2) Wholesale/retail, 3) Professional services or 4) Other services.
Other financing	Dummy variable denoting one if the firm obtained other types of financing such as leasing, trade credit, equity or government grants; zero otherwise.
Historical growth	Continuous variable measured by the firm's size growth performance in the previous period.
Intended use of loan	Categorical variable for the answer to the survey question "What were the intended uses of this financing?": 1) research & development, debt consolidation, enter new market, and/or other purposes; 2) real assets; 3) working capital.
<i>Owner characteristics</i>	
Experience	Categorical variable for the number of years owner has in managing a business: 1) 5 years or less; 2) 6 to 10 years; 3) more than 10 years.
Education	Ordinal variable for the highest level of education attained by the owner: 1) High school diploma or less; 2) A college/cegep/trade school diploma; 3) A bachelor's degree or higher.
Growth intention	Ordinal variable for the firms' response to the survey question "in the next three years, what is the expected average yearly growth of your business"

⁷⁹ Size is considered as a risk measure (see the discussion on this issue summarized by Kremp and Sevestre, 2013), and often found to be significantly positively correlated with the loan acceptance rate (Beck et al., 2005; Kremp and Sevestre, 2013).

	sales or total revenues?": 1) no growth or scale back business; 2) between 1% and 10% per year; 3) 10% or more per year.
<i>Loan characteristics</i>	
Lender type	Categorical variable denoting if the loan was extended by a 1) Chartered bank, including Alberta Treasury Branches, 2) Credit Union / Caisse Populaire, or 3) Government institution.
Loan type	Dummy variable denoting one if the firm applied for a term loan; zero if the firm applied for a mortgage.
<i>Financial ratios</i> ⁸⁰	
Capacity	Dummy variable equal to one if the ratio of amount of debt sought over total revenues is over one; zero otherwise.
Current ratio	Ratio of current assets over current liabilities.
ROA	Ratio of net income over total assets.
Profit margin	Ratio of net income over total revenues.
Gross margin	1 – ratio of cost of sales over total revenues.
Account payable/Sales	Ratio of account payable over sales, to control for the firm's historical availability of trade credit.
Short term debt /Sales	Ratio of short-term debt over sales, to control for the firm's historical availability of operating loans.
Interest coverage ratio	Ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) over interest expenses.
Financial slack	Ratio of tangible assets over total liabilities.
Internal funds	Ratio of cash flow over size.
Debt capitalization ratio	Ratio of liabilities over total liabilities and shareholder equity, which controls for the firm's proportion of debt used to finance assets.
External/total equity	Ratio of externally raised equity over total shareholder equity, to control for the firm's historical availability of equity fund. If also controls for the

⁸⁰ Unless specified otherwise, the financial ratio variables are measured using an ordinal variable denoting 1) if the firm's ratio value is equal or lower to the 30th percentile of the distribution; 2) if the firm's ratio value is between the 30th and 60th percentile; 3) if the firm's ratio value is above the 60th percentile.

	owner's enthusiasm and belief about the firm's future success (skin in the game).
Productivity	Ratio of total revenues over the number of employees.
Working capital	Dummy variable equal to 1 if the firm's working capital is over one; zero otherwise.
EBITDA / debt	Ratio of EBITDA over total liabilities.
Sales / working capital	Ratio of total revenues over working capital.

In order to avoid endogeneity issues induced by reverse causality, and following Carbo-Valverde et al. (2013) and Kremp and Sevestre (2013), variables are lagged by one-year to measure firms' financial conditions for the year preceding—rather than the year of—each of the three steps.

Step 2: loan application decision

The dependent variable for Step 2 is a binary variable equal to one if—among those firms that need bank credit—the firm applied for a loan; or zero if the firm decided not to do so.⁸¹ The right-hand side variables are identical to those of Step 3, with one exception. In order for the sample selection model to have structural interpretation, the selection equation (Equation (II-2)) needs to contain at least one explanatory variable that is not on the right-hand side of the equation in Step 3. Accordingly, the firm owner's growth intention is included as the additional variable in Step 2. Previous research has suggested that growth intention is an important indicator of whether firms seek external financing (Cosh et al., 2009; Freel et al., 2012) and has been argued to be unobservable by banks (Cowling et al., 2016).

Step 1: need financing or not

The dependent variable for Step 1 is a binary variable equal to one if the firm expressed a need for financing; or zero otherwise. As in the case of step 2, the second selection equation (Equation (II-3)) will include all variables from Step 2 plus one explanatory variable that is not on the right-hand side of the equation in Step 2. Accordingly, the firm's level of internal funds is used to satisfy the

⁸¹ Here firms that need and applied for bank loans are compared with those that need but did not apply for any reason (demand-side constrained firms). In section 3.6. (testing hypothesis 4), they are compared with those that need but did not apply for fear of rejection (discouraged borrowers).

exclusion restriction. Firms with higher levels of available funds are less likely to need external financing (Cole and Sokolyk, 2016).

II.3.3. Research question 2: Taste-based or statistical discrimination

The impacts of owners' gender and minority status are estimated in equation 3 in the previous section, which indicate levels of the "taste-based discrimination" associated with these two owner attributes. More specifically, a significant and negative effect for these variables in Equation (II-3) suggests the presence of taste-based discrimination against women- or minority-owned businesses among credit suppliers. To investigate statistical discrimination, following Cavalluzzo et al. (2002), Cavalluzzo and Wolken (2005), and Blanchard et al. (2008), this research interacts, in Equation (II-3), the subgroup dummy variables with owner and firm characteristic variables. Significant interaction terms would suggest evidence of statistical discrimination towards the respective subgroups. For example, a significant interaction term between the majority-women ownership and leverage would suggest that lenders perceive systematic risk (leverage ratio) differently between majority women- and majority men-owned firms, suggestive of statistical discrimination.

II.3.5. Research question 3: Differing reasons for demand-side constraints

Step 2 of the analyses on the three-stage SME debt financing process (described in section 3.2.) will draw the profile of firms that needed but refrained from applying for bank loans for any reason. To investigate research question 4, the analysis will be repeated using, as a dependent variable, a binary variable specifically according to whether "firms that needed but did not apply for bank loans for fear of rejection", rather than not applying for any reason. The profiles of these two types of demand-side constrained borrowers are then compared.

II.4. Empirical findings

II.4.1. Descriptive Statistics

Table II-5, Table II-6, and Table II-7 describe the pooled sample that combines the 2011, 2014 and 2017 survey data, with the breakdown of: (1) borrowers who need financing and those who didn't; (2) firms that applied for loans and those who didn't (among those who need financing);

and (3) applicants who obtained loans and those who were rejected (among those who needed financing and that applied).⁸²

Table II-5 describes the profiles of firms that need financing, and the percentage they account for the sample, compared with those that do not need financing.

Table II-5. Descriptive statistics – Financing need breakdown

<i>Labels</i>		Need financing	Did not need financing
Distribution		Low (***)	High
Distribution by year			
	2011	Low (***)	High
	2014	Low (***)	High
	2017	Low (***)	High
Age			
	New firms (<=3yrs)	High (***)	Low
	Young firms (3-10yrs)	High	Low
	Established firms (>10yrs)	Low (***)	High
Size (employees)		High (***)	Low
Province			
	Atlantic	High	Low
	BC and Territories	Low (***)	High
	Ontario	Low	High
	Prairies	Low	High
	Quebec	High (***)	Low
Industry			
	Goods	High (***)	Low
	Wholesale/Retail	High (***)	Low
	Professional services	Low (***)	High
	Other services	Low (***)	High
Exporter		High (***)	Low
Owner experience			
	5 years or less	High (***)	Low
	5-10 years	High (*)	Low
	More than 10 years	Low (***)	High
Education			
	High school diploma or less	High	Low

⁸² The descriptive statistics tables only summarize those variables that were included in Equation II-1, II-2 and II-3. In other words, some variables from Table II-4 are not included in the description of the data and other analyses in this chapter. The reason for such exclusions are discussed in Section II.4.2.

Growth intention	A college/cegep/trade school diploma	High (**)	Low
	A bachelor's degree or higher	Low (***)	High
Innovator	No growth or scale back	Low (***)	High
	1-10% growth	High	Low
	More than 10% growth	High (***)	Low
Minority		High (***)	Low
Gender		Low	High
Historical growth (1-year past employee growth)	Majority Men	High	Low
	50/50	High (*)	Low
	Majority Women	Low (**)	High
Debt capitalization ratio		High (***)	Low
Financial slack (Tangible assets / Total liabilities)	30th percentile or less	Low (***)	High
	Between 30th and 60th percentile	High (***)	Low
	Over 60th percentile	High (***)	Low
Productivity (Revenues / Employees)	30th percentile or less	Low	High
	Between 30th and 60th percentile	High (***)	Low
	Over 60th percentile	Low (***)	High
Interest coverage ratio (EBITDA / Total interest expense)	30th percentile or less	Low (***)	High
	Between 30th and 60th percentile	Low	High
	Over 60th percentile	High (***)	Low
Gross margin (1 - (Cost of sales / Revenues))	30th percentile or less	High (***)	Low
	Between 30th and 60th percentile	High (***)	Low
	Over 60th percentile	Low (***)	High
Working capital		Low (***)	High
Internal funds (Cash / Total assets)	30th percentile or less	High (***)	Low
	Between 30th and 60th percentile	High (***)	Low
	Over 60th percentile	Low (***)	High

Observations

7-8k

8-9k

The proportion of borrowers that do not need financing is slightly higher than that of borrowers that express a need for financing, and across each separate survey year.⁸³ The presence of this substantive number of borrowers who do not need credit highlights the importance of modeling Equation II-1. Overall, the results are in line with those presented by Cole and Sokolyk (2016): firms that do not express a need for financing are of higher quality and seem capable of generating sufficient capital from their business operations to finance their projects. The following summarizes the significant differences between the profiles of firms that need financing and those that do not need financing. In general, results are consistent with Cole and Sokolyk (2016).

- Age and size. Firms that express a need for financing tend to be larger and younger compared to those that do not need financing. Both characteristics are consistent with Cole and Sokolyk (2016), Cowling et al. (2020), Drakos and Giannakopoulos (2018), and Freel et al. (2012).
- Location and industry. Both province and industry distributions vary across the breakdown of financing need, highlighting the importance of controlling for geography and industry. For example, firms that need credit are more likely to operate in the goods and wholesale/retail industry compared to those that don't need financing, while those that do not need credit are more likely to operate in the services sector than those that need credit. This is consistent with Cole and Sokolyk (2016) and Cowling et al. (2020), and with the notion that firms in the services industry do not need to acquire assets to grow, compared to those in the wholesale/retail industry.
- Exporting. Firms that need financing are more likely to be exporters compared to firms that do not need credit, as expected in Section II.2.2.⁸⁴

⁸³ The proportion of firms that need financing and of those that do not need financing are both around 50 per cent. Cole and Sokolyk (2016) observe similar equally-distributed breakdowns for firms that need financing and those that do not, with the latter slightly outnumbering for two of their three survey years.

⁸⁴ The result is also consistent with the expectation (mentioned above) that the impact of exporting on financing needs might depend on the definition of “exporting”. Cowling et al. (2020) report an insignificant impact of exporting on financing need with the definition of an exporter being a firm with the greater than zero percent of sales made overseas; the present study finds significant impact of exporting when limiting exporters to those with at least 25 per cent of

- Owner experience. Firms that need financing are more likely to have lower levels of experience as a business owner compared to firms that do not need credit, consistent with Cole and Sokolyk (2016).
- Owner education. Compared to firms that do not need credit, those that need financing are more likely to be led by an owner with a college, cegep or trade school diploma.⁸⁵ On the other hand, firms that do not need credit are more likely to be led by an owner with a bachelor's degree or higher. Both results are consistent with Cole and Sokolyk (2016).
- Growth intention. Firms that need financing are more likely to have higher levels of growth intention compared to firms that do not need financing. Firms that do not need financing are more likely to not have an intention to grow compared to those that need it, consistent with Freel et al. (2012).
- Innovation. Firms that need financing are more likely to be innovation-oriented compared to those that do not need financing, as Brancati (2015) suggests: “sizable sunk costs linked to skilled workers, researchers, engineers and scientists who cannot be fired and hired without a consistent loss in human capital and accumulated knowledge” (p. 451).⁸⁶
- Minority and gender. There is no significant impact of minority status on the need for financing. However, firms that do not need financing are more likely to be majority-owned by women compared to those that need financing, aligned with Cowling et al. (2020).
- Historical growth. Firms that need financing are more likely to have experienced higher rates of employee growth in the past, confirming the notion that growth requires financing and consistent with Drakos and Giannakopoulos (2018) who show that firms that experienced growth in revenues in the previous period are more likely to need financing in the subsequent period.

their revenues originating outside of Canada. This definition avoids considering firms that only export one or two transactions to be defined as exporters, following Riding et al. (2009).

⁸⁵ Cegep is an acronym that means General and professional teaching college. They are schools located in Quebec, Canada that provide first level post-secondary education, such as pre-university and technical education programs.

⁸⁶ Cowling et al. (2020) do not report a significant effect of innovation on the firm's need for credit. This could be due to the broad definition of innovator used by Cowling et al. (whether the firm undertook innovative activities) compared to this study's narrow definition of an innovator (whether the firm introduced any of the following innovations over the last year: (a) a new or significantly improved good or service; (b) a new or significantly improved production process or method; (c) a new organizational method in their business practices, workplace organization or external relations; or, (d) a new way of selling their goods or services).

- Debt capitalization. Firms that need financing are more likely to be more heavily leveraged, as indicated by higher levels of debt capitalization (consistent with Cole and Sokolyk, 2016).
- Slack. Firms that need financing are more likely to have a middle level of financial slack (between the 30th and 60th percentile of the distribution) compared to those that do not need credit. Those that do not need credit are more likely to have higher levels of slack (tangible assets over total liabilities) compared to those that need credit.
- Productivity. Firms that need financing are more likely to have higher levels of productivity, as measured by total revenues over employees. This result is somewhat surprising as higher productivity generates greater amount of cashflow. One possible explanation is that this variable is a sign of revenue levels beyond an employee's capacity (i.e., a sign that revenues are getting greater and closer to the level that the current employees can handle).⁸⁷
- Interest coverage ratio. Firms that need financing are more likely to have lower levels of interest coverage ratio compared to firms that do not need credit. This is again consistent with Cole and Sokolyk (2016)'s notion of firms that need financing are of lower credit quality than firms that do not need financing.
- Gross margin. Firms that need financing are more likely to have lower levels of gross margin compared to firms that do not need financing.
- Working capital. Firms that need financing are more likely to have lower short-term liquidity as indicated by negative working capital compared to firms that do not need financing. This is again consistent with Cole and Sokolyk (2016)'s notion of firms that need financing are of lower credit quality than firms that do not need financing.
- Internal financing. Firms that need financing are more likely to have lower levels of internal funds compared to firms that do not need financing, consistent with Cole and Sokolyk (2016) and the notion that firms with higher levels of internal capital are likely to have enough capital to fund their projects and, accordingly, do not need to seek additional funding.

⁸⁷ Consistent with this explanation, productivity is positively correlated with past growth in revenues.

Table II-6 exhibits the profiles of firms that chose to apply for bank loans (which account for greater than 85% of financing-need firms) and the profiles of firms that chose to not apply for bank loans, among those that need external financing.

Table II-6. Descriptive statistics – Financing application breakdown

<i>Labels</i>		Applied for financing	Did not apply for financing
Distribution		High (***)	Low
Distribution by year			
	2011	High (***)	Low
	2014	High (***)	Low
	2017	High (***)	Low
Age			
	New firms (<=3yrs)	High	Low
	Young firms (3-10yrs)	Low	High
	Established firms (>10yrs)	High	Low
Size (employees)		High (***)	Low
Province			
	Atlantic	Low	High
	BC and Territories	Low	High
	Ontario	Low	High
	Prairies	High (***)	Low
	Quebec	Low	High
Industry			
	Goods	High (***)	Low
	Wholesale/Retail	Low	High
	Professional services	Low (*)	High
	Other services	Low (*)	High
Exporter		High	Low
Owner experience			
	5 years or less	Low	High
	5-10 years	High	Low
	More than 10 years	Low	High
Education			
	High school diploma or less	Low	High
	A college/cegep/trade school diploma	High	Low
	A bachelor's degree or higher	Low	High
Growth intention			
	No growth or scale back	Low (***)	High
	1-10% growth	High (***)	Low

Innovator	More than 10% growth	High (**)	Low
Minority		High (***)	Low
Gender		Low (***)	High
	Majority Men	High (***)	Low
	50/50	Low	High
	Majority Women	Low (***)	High
Historical growth (1-year past employee growth)		High (***)	Low
Debt capitalization ratio			
	30th percentile or less	High	Low
	Between 30th and 60th percentile	High (***)	Low
	Over 60th percentile	Low (***)	High
Financial slack (Tangible assets / Total liabilities)			
	30th percentile or less	Low (**)	High
	Between 30th and 60th percentile	High	Low
	Over 60th percentile	High	Low
Productivity (Revenues / Employees)			
	30th percentile or less	Low (***)	High
	Between 30th and 60th percentile	Low (*)	High
	Over 60th percentile	High (***)	Low
Interest coverage ratio (EBITDA / Total interest expense)			
	30th percentile or less	High (*)	Low
	Between 30th and 60th percentile	High (***)	Low
	Over 60th percentile	Low (***)	High
Gross margin (1 - (Cost of sales / Revenues))			
	30th percentile or less	High	Low
	Between 30th and 60th percentile	High	Low
	Over 60th percentile	Low	High
Working capital		High (***)	Low
Internal funds (Cash / Total assets)			
	30th percentile or less	High (***)	Low
	Between 30th and 60th percentile	Low	High
	Over 60th percentile	Low (***)	High
Observations		7-8k	0-1k

The following summarizes the significant differences between the profiles of firms that need and applied for financing compared to those that need financing but did not apply.⁸⁸ Variables in Table II-6 can be categorized in two types. The first type includes variables that possibly influence loan application outcomes so encourage (or discourage) owners to apply. The second type consists of variables that could be indicative of the level of seriousness in financing needs, regardless of the prospects of their application outcomes.

The results of the variables in the first type are:

- Size. Firms that apply for the financing they need tend to be larger, consistent with Brown et al. (2011), Cole and Sokolyk (2016) and Drakos and Giannakopoulos (2018).
- Debt capitalization. Firms that apply for the financing they need are more likely to have a middle level of debt capitalization (between the 30th and 60th percentile of the distribution). On the other hand, not applying for needed financing is associated with high levels of debt capitalization, suggesting that a high level of leverage discourages firms to take on additional debt (consistent with Cole and Sokolyk, 2016). This is also consistent with the notion of self-screening, where poor quality borrowers refrain from applying for the financing they need since they accurately think that they would be rejected (Kon and Storey, 2003).
- Productivity. Firms that apply for the financing are more likely to have higher levels of productivity compared to firms that do not apply for their needed financing. This is consistent with the notion that firms that apply for the financing they need are of higher quality than demand-constrained firms (Cole and Sokolyk, 2016).
- Working capital. Firms that apply for the financing they need are more likely to have positive working capital compared to firms that do not apply for their needed financing. Also, larger working capital implies higher liquidity, and thus likely to encourage firms to apply in the expectation that they will obtain the loan, given their increased liquidity.

⁸⁸ This subsection defines “firms that did not apply” as those that did not apply for any reason (uses the broad definition of the discouraged borrower/demand constraint). Section II.4.5 will investigate how the results differ when constraining the definition to those that needed financing but did not apply due to fear of rejection (when the analyses are based on the narrow definition).

Results on variables in the second group (those that appear to impact on the level of seriousness in financing needs, driving the owners to apply, regardless of the prospects of their application outcomes) are as follows:

- Growth intention. Owners of firms that apply for needed financing are relatively more likely to intend to grow their firms compared to firms that do not apply for their needed financing. This is consistent with Psillaki and Daskalakis (2009) who report that growth-oriented firms are more likely to seek financing since they are more likely to exhaust internal funds to finance their growth opportunities.
- Innovation. Firms that apply for the financing they need are more likely to be innovators compared to those that do not apply for their needed financing. This is consistent with the notion that innovators are more likely to apply for the financing they need since they cannot use their own internal funds to cover the significant costs of innovation (Brancati, 2015).
- Historical growth. Firms that apply for the needed financing are relatively more likely to have experienced higher employee growth in the past, consistent with the idea of the presence of momentum in growth, and that growth requires financing.
- Slack. Firms that apply for the financing they need are more likely to have lower levels of tangible assets as a percentage of total liabilities, compared to those that do not apply for their needed financing. Lack of assets that can be pledged as collateral might create urgent needs of financing when requiring it, leading to a higher likelihood of applying for financing for such firms.
- Interest coverage ratio. Firms more in financial distress, as measured by the interest coverage ratio, are more likely to apply for the financing they need than those with abundant cash flow.
- Internal financing. Firms that apply for the financing they need are more likely to have lower levels of internal funds compared to firms that do not apply for their needed financing, consistent with Brown et al. (2011) and Cole and Sokolyk (2016).

Moreover, loan application rates vary across different provinces and industries, highlighting the importance of controlling for province and industry. For example, firms that apply for the financing they need are more likely to operate in the goods (manufacturing and primary) sector,

consistent with the findings of Cole and Sokolyk (2016). Furthermore, there are variables that appear to relate neither the loan outcomes nor financing needs, yet exhibit significant impacts on the likelihood of loan application, such as the minority and gender status of the owner. The gender and minority-status differences in likelihood of loan application are aligned with most of the previous research reviewed in section II.2.2. (e.g., Cole and Sokolyk (2016), Gama et al. (2017) Neville et al. (2017) and Rostamkalaei et al. (2018)).

Multivariate analysis on the likelihood of applying will be performed in the next section to investigate whether the above effects persist while controlling for firm and owner characteristics.

Table II-7 exhibits the distribution of, among those firms that need and applied for financing, loan application outcome and describes the profiles of “approved” firms as compared with “rejected” counterparts.⁸⁹

Table II-7. Descriptive statistics – Financing approval breakdown

<i>Labels</i>	Term / mortgage		Line of credit		
	Approved	Rejected	Approved	Rejected	
Distribution	High (***)	Low	High (***)	Low	
Distribution by year					
	2011	High (***)	Low	High (***)	Low
	2014	High (***)	Low	High (***)	Low
	2017	High (***)	Low	High (***)	Low
Age					
	New firms (<=3yrs)	Low (**)	High	Low	High
	Young firms (3-10yrs)	Low (**)	High	Low	High
	Established firms (>10yrs)	High (***)	Low	High (*)	Low
Size (employees)		High (***)	Low	High (*)	Low
Province					
	Atlantic	High	Low	High	Low
	BC and Territories	Low	High	High	Low
	Ontario	Low (*)	High	Low (**)	High
	Prairies	High	Low	High (*)	Low
	Quebec	High	Low	High	Low
Industry					
	Goods	High (**)	Low	High (***)	Low
	Wholesale/Retail	Low	High	Low	High

⁸⁹ Borrowers who received a loan through the loan guarantee program were excluded from the analysis.

Exporter	Professional services	Low	High	Low	High
	Other services	Low	High	Low	High
		High	Low	High	Low
Owner experience	5 years or less	High	Low	Low	High
	5-10 years	Low	High	Low	High
	More than 10 years	High	Low	High	Low
Education	High school diploma or less	Low	High	Low	High
	A college/cegep/trade school diploma	High (*)	Low	High	Low
	A bachelor's degree or higher	Low	High	High	Low
Growth intention	No growth or scale back	Low	High	Low	High
	1-10% growth	High (***)	Low	High (**)	Low
	More than 10% growth	Low (*)	High	Low (**)	High
Innovator		Low	High	High	Low
Minority		Low	High	Low (*)	High
Gender	Majority Men	Low	High	High (**)	Low
	50/50	High	Low	High	Low
	Majority Women	Low	High	Low (**)	High
Historical growth (1-year past employee growth)		Low	High	High	Low
Debt capitalization ratio	30th percentile or less	High (***)	Low	High (***)	Low
	Between 30th and 60th percentile	High (**)	Low	High (**)	Low
	Over 60th percentile	Low (***)	High	Low (***)	High
Capacity (whether amount requested / (Revenues + 1) is over 1)		Low	High	N/A	N/A
Financial slack (Tangible assets / Total liabilities)	30th percentile or less	Low (***)	High	Low (**)	High
	Between 30th and 60th percentile	Low	High	Low	High
	Over 60th percentile	High (***)	Low	High (***)	Low
Productivity (Revenues / Employees)	30th percentile or less	Low (*)	High	Low (**)	High
	Between 30th and 60th percentile	High	Low	Low	High
	Over 60th percentile	High (*)	Low	High (***)	Low
Interest coverage ratio (EBITDA / Total interest expense)	30th percentile or less	Low (*)	High	High	Low
	Between 30th and 60th percentile	High (**)	Low	High	Low
	Over 60th percentile	High	Low	Low	High
Gross margin (1 - (Cost of sales / Revenues))					

	30th percentile or less	Low	High	High	Low
	Between 30th and 60th percentile	Low	High	Low	High
	Over 60th percentile	High	Low	Low	High
Working capital		High (**)	Low	High (**)	Low
Internal funds (Cash / Total assets)					
	30th percentile or less	High	Low	High	Low
	Between 30th and 60th percentile	High	Low	Low	High
	Over 60th percentile	Low	High	Low	High
Observations		2-3k	0-1k	2-3k	0-1k

Approved borrowers outnumber rejected borrowers for the whole sample and throughout each separate survey year.⁹⁰ Overall, the results are as expected: that is, rejected applicants are of lower quality than approved applicants. The following summarizes the significant differences between the profiles of borrowers that obtained financing and those that were rejected.

- Age and size. Accepted borrowers are older and larger than rejected borrowers for both term loan applications and line of credit applications. This is consistent with the notion that information asymmetry plays an important role in the loan adjudication process, that is: informationally opaque small young firms are disadvantaged in accessing loans (Berger and Udell, 1995).
- Location and industry. The approval/rejection rates appear to vary across both provinces and industries, highlighting the importance of controlling for province and industry. For example, approved borrowers are more likely to operate in the goods (manufacturing and primary) sector, consistent with Cowling et al. (2020)'s finding that firms in the primary sector are more likely to be approved.
- Growth intention. While accepted borrowers are more likely to express moderate growth intentions (1-10%) compared to rejected borrowers, they are less likely to express high growth intentions (above 10%) compared to rejected borrowers (for term loan and line of credit applications). This is consistent with the notion that lenders prefer lending to stable

⁹⁰ Approval rate is higher than 85 per cent for each survey year.

borrowers: those that intend to grow their firms in the future, but do not intend to grow at unrealistically high levels.

- Minority and gender status of the owner. Overall, there is no significant difference in the distribution of minority status and gender across borrower types for term loan applications. However, for line of credit applications, accepted borrowers are relatively less likely to be owned by women and by visible minority entrepreneurs. Berger and Udell (1995) argue that loan approval decisions rely more on soft information (lenders' impressions on the applicant) than hard information (financial statement figures) in the context of lines of credit than term loans. Accordingly, the discrimination a lender has against a certain group of firms could be more easily manifested in lines of credit loan approval decisions.⁹¹
- Debt capitalization. Rejected borrowers have higher debt capitalization ratios than approved borrowers across term loan and line of credit applications, highlighting the risk of leverage recognized by lenders, and consistent with Cole and Sokolyk (2016).
- Slack. Accepted borrowers have higher levels of financial slack compared to rejected borrowers, for both term loan and line of credit applications. This is consistent with the importance of tangible assets for lenders given their ability to be pledged as collateral.
- Productivity. Accepted borrowers have relatively higher levels of productivity, as measured by revenues over the number of employees, compared to rejected borrowers, among both term loan and line of credit applicants. This is consistent with the notion that higher levels of productivity send positive signals to lenders (Riding et al., 2007).
- Interest coverage ratio. For term loans, rejected borrowers are relatively more likely to have lower levels of interest coverage ratios, consistent with Damodaran (2019) who shows that lower credit ratings are largely driven by low interest coverage ratios.

⁹¹ However, Mitchel and Pearce (2011) argue that discrimination is less likely to occur in the context of lines of credit, given the positive signal of applying for a shorter-maturity loan, such as a line of credit. Applying for a shorter-maturity loan is generally received favorably by lenders (than requesting a longer-maturity loan) as it signals the applicant's intention to pay back quickly. Moreover, Mitchell and Pearce argue that "the suitability of credit lines for financing recurring needs (i.e., working capital) implies that credit-line applications are more likely to lead to a series of loans, which signals an intention to build reputation" (p.290). Multivariate analysis on the likelihood of applying will be performed in the next section to further investigate whether the discrimination effect persists after controlling for firm and owner characteristics.

- Working capital. Across term loan and line of credit applications, accepted borrowers are relatively more likely to have lower short-term liquidity risk, as indicated by positive working capital.

II.4.2. Entrepreneurs' attributes and growth strategies influence on the debt acquisition process

To estimate the system of equations: (1) a sample of borrowers that expressed whether they needed or did not need financing from each survey year was selected, based on which equation II-1 was estimated; (2) equation II-2 was estimated using the sample borrowers that expressed a need for financing; and (3) equation II-3 was estimated using the sample of borrowers that need and applied for financing.⁹² To control for differing loan adjudication criteria between two forms of debt, the system of equations was estimated for each of two sub-samples: (1) firms that applied for term or mortgage loans and (2) firms that applied for lines of credit.

The model estimation follows Riding et al. (2007). First, Equation II-3 is estimated for the sample of term loan / mortgage applications with all available variables that are frequently reported by previous research as having a significant influence in lenders' loan adjudication decisions (e.g., Carbó-Valverde, Rodriguez-Fernandez and Udell (2013), Duchin et al. (2010), ISED (2018), Kremp and Sevestre (2013)).⁹³ Next, the redundant (collinear) financial variables were removed while ensuring to keep one variable to capture each risk dimension (e.g., default risk). Table II-8 presents risk dimensions, financial variables from Table II-4 that assess each dimension, and the variable that was retained by the model for each dimension.⁹⁴

Table II-8. Correlated variables

Risk dimension	Financial variables	Selected variable(s)
Short term debt capacity	Loan amount / Revenues Current ratio Internal funds	Loan amount / Revenues

⁹² The estimation process described herein was also used for the propensity models detailed in Section I.6.2. of Chapter I.

⁹³ See Chapter 3 Table III-4 for the estimation results of the base model with all variables.

⁹⁴ The decision to keep a specific variable was based on the highest number of observations available. For example, if gross margin was available for 3,000 firms but profit margin was only available for 2,800 firms, gross margin was included instead of profit margin.

	Sales / Working capital	
Default risk	EBITDA / Debt Interest coverage ratio	Interest coverage ratio
Profitability	Return on assets Profit margin Gross margin Productivity	Gross margin Productivity
Long term debt capacity	Financial slack Debt capitalization ratio	Financial slack Debt capitalization ratio

In addition, the following variables were excluded:

- Loan purpose: due to a high correlation between the amount borrowed (captured by capacity) and the intended use of the loan (ex. higher loan size for real assets).
- Loan type indicator: given the lack of significant difference in nature between term loan and mortgage loan applications (both long term financing requests typically secured by real property).
- The dummy variable controlling for whether the firm received other financing: given the endogeneity concerns resulting from the unobservable timing of financing applications (that is, whether the loan applications were submitted prior to, or following the receipt of other financing). Likewise, a firm may have applied for other financing after having applied for the term loan or mortgage; hence the outcome of the term loan / mortgage application would be a strong predictor of whether they would subsequently receive other financing, or vice versa.

Finally, the model building follows the steps outlined in section II.3.2. That is, Equation II-2 contains the covariates from Equation II-3 along with the firm's growth intention, a variable that does not appear in Equation II-3 to respect the exclusion restriction. Similarly, Equation II-1 contains the covariates from Equation II-2 along with the firms' available internal funds, a variable that does not appear in Equation II-3 or in Equation II-3 to satisfy the exclusion restriction.

Columns 1, 2 and 3 of Table II-9 present the estimation results for the trivariate probit model consisting of equations II-1, II-2 and II-3 for term loan / mortgage applications.

The above estimation process was repeated for line of credit applications. Similar to Berger and Udell (1995), many performance variables were insignificant given the less “transaction-driven” nature of these applications. Accordingly, the reduced Equation II-3 for line of credit applications contains the only two financial variables that are significant: the firm’s debt capitalization ratio and working capital direction indicator. Columns 4, 5 and 6 of Table II-9 present the estimation results for the trivariate probit model consisting of equations II-1, II-2 and II-3 line of credit applications.

Table II-9. Weighted trivariate probit model on whether the firm needs, applies and obtains credit.

<i>Labels</i>	<i>Term / Mortgage</i>			<i>Line of credit</i>		
	(1) Accepted	(2) Apply	(3) Need	(4) Accepted	(5) Apply	(6) Need
Industry fixed effects	YES	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Innovator	+	-	+***	-	-	+***
Minority	-	_-***	+	-	_-***	+
Gender (Base = Majority Men)						
50/50	+	_-*	+*	+	_-**	+*
Majority Women	+	_-***	-	-	_-**	-
Exporter	+	-	+**	-	-	+***
Age (Base = New firms)						
Young firms (3-10yrs)	+	-	-	-	-	_-*
Established firms (>10yrs)	+**	-	_-**	-	-	_-**
Size (employees)	+***	+***	+***	+	+***	+***
Owner experience (Base = <5yrs)						
5-10 years	+	+	_-**	-	+	-
More than 10 years	+	+	_-***	-	+	_-***
Education (Base = High school diploma or less)						
A college/cegep/trade school diploma	+*	+	+	-	+	-
A bachelor's degree or higher	+	+	_-**	+	+	-
Growth intention (Base = 1-10% growth)						
No growth or scale back		_-***	_-***		_-***	_-***
More than 10% growth		-	+***		-	+***
Historical growth (1-year past employee growth)	-	+*	+***	-	+*	+***
Debt capitalization ratio (Base = <=30th perc)						
Between 30th and 60th percentile	+	-	+***	_-**	-	+***

Capacity (whether amount requested / (Revenues + 1) is over 1)	Over 60th percentile	-	***	***	***	***	***
		**					
Financial slack (Tangible assets / Total liabilities) (Base = <=30th perc)	Between 30th and 60th percentile	**	-	+	+	+	+
	Over 60th percentile	***	-	+	***		+
Productivity (Revenues / Employees) (Base = <=30th perc)	Between 30th and 60th percentile	+	+	**			
	Over 60th percentile	**	***	***			
Interest coverage ratio (EBITDA / Total interest expense) (Base = <=30th perc)	Between 30th and 60th percentile	+	+	-			
	Over 60th percentile	**	-	***			
Gross margin (1 - (Cost of sales / Revenues)) (Base = <=30th perc)	Between 30th and 60th percentile	+	+	+			
	Over 60th percentile	+	***	-			
Working capital	Between 30th and 60th percentile				***	***	*
	Over 60th percentile						
Internal funds (Cash / Total assets) (Base = <=30th perc)	Between 30th and 60th percentile			***			***
	Over 60th percentile			***			***
Constant		-	***	-	***	***	-
Observations		2-3k	7-8k	Over 15k	2-3k	7-8k	Over 15k
ρ_{AP}		-			-		
ρ_{NP}		+			-		
ρ_{NA}		**			***		

Note: This table reports the estimation results of the survey-weighted trivariate probit model presented in section II.3.2 with robust standard errors. Equation II-1 estimation results are reported under the column with the title “Need”. The dependent variable *Need* is equal to one if the firm indicated that it needed external financing (applied for financing or was demand constrained) and a value of zero if the firm reported that financing was not required for the respective survey year. Equation II-2 estimation results are reported under the column with the title “Apply”. The dependent variable *Apply* is equal to one if the firm applied for the needed financing and a value of zero if the firm did not apply for the needed financing because they thought the request would be turned down, applying for financing is too difficult or time consuming, the cost of financing is too high or was unaware of financing sources that are available. Equation II-3 estimation results are reported under the column with the title “Accepted”. The dependent variable *Accepted* is equal to one if the loan application was approved and a value of zero if the firm’s loan application was rejected. Independent variables are defined in Table II-4. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As pointed out by Roodman (2011), the usual likelihood ratio test for goodness of fit is not valid for survey weighted estimations with robust standard errors as “the likelihood function does not reflect the nonsphericity of the errors and so it is a pseudolikelihood” (p. 186). Accordingly, following Cole and Sokolyk (2016), Drakos and Giannakopoulos (2018), Cowling et al. (2020), the likelihood ratio test results are not reported.

The correlation between Equation II-1 (need or not) and Equation II-2 (apply or not), ρ_{NA} , are significant, highlighting the importance of accounting for sample selection when modeling the firm’s decision to apply for financing. Similarly, there is a significant correlation between the firm’s expressed need for credit and the application outcome, ρ_{NP} , highlighting the importance of accounting for the firm’s expressed need for credit when modeling loan approval, one that a combination of bivariate probits cannot account (for example, Cowling et al., 2020; Cole and Sokolyk, 2016).

To investigate RQ1, the impact of each firm and owner attribute (innovation, export status, gender and minority status) is assessed on each of the estimated three-part statistical model of the debt acquisition process.

Step 1: need financing or not

Age and Size. Among control variables, younger firms were more likely to indicate a need for credit (after controlling for size), consistent with the widely-held view that the limited ability to generate cash forced those firms to seek external financing. On the other hand, the measure of firm size exhibits a strong positive association with the firm’s need for credit, after controlling for age. This is probably because larger firms (given the same age) require more capital to fund operations and projects. Both age and size results are consistent with Freel et al. (2012), Cole and Sokolyk (2016), Drakos and Giannakopoulos (2018), and Cowling et al. (2020).

Owner experience and education. Firms with more experienced owners and those with relatively highly educated owners (to a lesser extent – significant only for term loans) appear to be less likely to express a need for credit, consistent with findings of Cole and Sokolyk (2016). This might be indicative of better financial management by more educated and experienced owners.

Growth intention and momentum. As expected, firms that have high growth intentions (over 10%) and those that experienced growth in the previous period are also more likely to express a need for credit, while those that do not intend to grow are less likely to need financing. Assuming momentum in growth, these results are consistent with the view that growth requires financing (Psillaki and Daskalakis, 2009).

As for the financial variables, most results are in line with Cole and Sokolyk's (2016) findings that firms that do not need external financing are of higher credit quality than those that do express a need for financing. For example, firms with higher interest coverage ratios (term loans only), higher short-term liquidity as expressed by positive working capital (lines of credit only) and higher levels of internal funds are less likely to need financing, while firms with higher debt capitalization ratios are more likely to express a need for financing. One exception is that firms with higher productivity are relatively more likely to express a need for financing. This might be indicative of more productive firms requiring external financing to continue to support their high levels of productivity. As mentioned earlier, this could be a sign of revenue levels beyond an employee's capacity (i.e., a sign that revenues are getting greater and closer to the level that the current employees can handle).

Growth strategies, gender and minority status. Among the independent variables, exporters and innovators were significantly more likely to express a need for external financing. This is consistent with the view that growth strategies such as innovation and exporting require additional capital due to their relatively high-cost structures (Brancati, 2015; Chakravarty and Xiang, 2013).⁹⁵ On the other hand, there is little evidence that owner gender or minority status has a significant impact on their likelihood of needing credit.⁹⁶ The absence of significance for differences in gender of owner is consistent with Cole and Sokolyk (2016).

⁹⁵ The results contradict with Cowling et al. (2020) who do not report a significant impact of exporting and innovation on financing need. As previously noted, this likely due to the difference in definitions of exporting and innovation between Cowling et al. (2020) and this study, with the former covering a wider range of companies as exporters.

⁹⁶ The exception is that equally men-and-women-owned firms are more likely to need credit compared to majority men- and majority women-owned firms. However, the effect is only marginally significant (10 per cent level).

Step 2: loan application decision

Among control variables, larger firms were relatively more likely to apply for needed financing, consistent with Brown et al. (2011), Cole and Sokolyk (2016), and Cowling et al. (2020). Growth-oriented firms are significantly more likely to apply for needed financing, consistent with the findings of Psillaki and Daskalakis (2009) and the notion that growth drives firms to seek financing.

Regarding financial variables, the results are again generally consistent with the univariate results from section II.4.1. As the univariate analysis did, the multivariable analysis detects two types of variables among those significantly influence firms' decision to apply for a loan. The first type is one that encourages (or discourages) owners to apply. Among variables of this type, debt capitalization ratio, productivity, and working capital are significantly related to the likelihood to apply, as in the univariate analysis. These results are also consistent with the notion that firms that apply for needed financing are of higher credit quality than those that do not apply for needed financing (Cole and Sokolyk, 2016). On the other hand, gross margin, which is insignificant at the univariate level, turns out to be significant at the multivariate level.

Variables in the second type category include those that significantly influence firms' decision to apply by escalating or lowering the level of seriousness in financing needs, regardless of the prospects of their application outcomes. Among variables of this type, historical growth is significantly related to the likelihood to apply, as in the univariate analysis.⁹⁷ On the other hand, slack, interest coverage ratio and internal financing, which are significantly related to firm's loan application decisions at the univariate level, are not insignificant after controlling for other firm characteristics at this multivariate level.

Among the independent variables, majority women-owned and minority-owned firms were consistently less likely to apply for needed financing, consistent with many of the previous studies on gender differences in demand-side constraints reviewed in Section II.2.2. On the other hand,

⁹⁷ The working capital variable could also be in the second type, as higher short-term liquidity could encourage firms to apply (as discussed in II.4.1).

innovators and exporters were neither more or less likely to apply for needed financing, both consistent with Cowling et al. (2020).⁹⁸

Step 3: loan acceptance or rejection

Term loan / Mortgage applications

Larger and older firms were more likely to have loan applications accepted: an expected result that is consistent with previous studies (ex. Carbó-Valverde et al. (2013), Cole and Sokolyk (2016), Cowling et al. (2020), Kremp and Sevestre (2013)). Owners with a college, Cégep or trade school diploma were relatively more likely to have loan applications approved relative to owners with a high school diploma or less, suggesting that a practical education might constitute a positive signal to lenders. This is in line with Cowling et al. (2020) who find that owners with A level education (a pre-university degree in the United Kingdom) were relatively more likely to obtain the financing they sought.

Among financial variables, firms that borrow for amounts greater than that of their annual sales are significantly less likely to receive financing, consistent with the increased default likelihood of such borrowers (Nitani and Legendre, 2021). Firms with relatively larger amounts of debt-to-revenues signal to lenders that they may have reached their maximum borrowing capacity. Finally, high levels of financial slack, productivity, and interest coverage all exhibit statistically significant and positive effects on the probability of loan approval. This result highlights the importance of firm financial performance and availability of collateral to lenders, consistent with findings of previous studies.

Lines of credit applications

Overall, the results with respect to line of credit applications were consistent with Berger and Udell's (1995) argument that such applications are relatively less "transaction-driven" in that there are not many significant factors associated with the outcome of applications for lines of credit. Variables that were significant include debt capitalization (negatively correlated with the

⁹⁸ The insignificant result for exporters, however, is at odds with other studies reviewed in Section II.2.2 (ex. Chakravarty and Xiang (2013)). This could be due to the fact that this study and Cowling et al. (2020) control for the "need" step of the debt acquisition process when estimating the demand model, while Chakravarty and Xiang (2013) do not.

probability of loan approval) as well as financial slack and short-term liquidity (positively correlated).

The following discusses the regression results on variables of interest, i.e., exporting, innovation, gender and minority status of the ownership.

Summary of independent variables

Exporters and Innovators. Overall, it appears that while exporters and innovators are relatively more likely to need credit, they do not face either demand-side or supply-side credit constraints. Regarding innovators, the result is consistent with Cowling et al. (2020), although contrary to earlier and outside-of-North-America studies such as Ughetto (2008) and Wang et al. (2015) that found a significant negative impact of innovation on loan approval rates. Among exporters, the absence of demand-side constraints is, as previously noted, consistent with Brown et al. (2011), Chakravarty and Xiang (2013), and Gama et al. (2017). The absence of supply-side constraints is also consistent with Brown et al. (2011) but at odds with Cowling et al. (2020). As mentioned earlier, this is likely due to the difference in the studies' definition of exporters. In short, the results of this study suggest – consistent with the some of the previous research reviewed here – that exporters and innovators in Canada are not demand- nor supply-side constrained.

Gender and Minority Status. It appears that, firms owned by visible minority groups and those majority-owned by women are relatively less likely to apply for needed financing, although there is no significant difference in external financing needs between visible minority/female-owned firms and non-visible minority/male-owned firms.⁹⁹ The results on application likelihoods are consistent with the higher likelihood of demand constraints reported by previous studies (see section II.2.2). As for financing needs, the result is consistent with Cole and Sokolyk (2016), who find that women-owned, Asian-owned and Hispanic-owned firms are relatively just as likely to express a need for financing as their respective men-owned and non-minority-owned counterparts. The results for women-owned firms, however, are at odds with Cowling et al. (2020), who find that while “women-led” firms are significantly more likely to need credit, those that do need credit are significantly less likely to be discouraged from applying and significantly more likely to be

⁹⁹ While the positive effect of equally mixed ownership (50 percent men and 50 per cent women) on the firm's need for financing is significant, the coefficient estimate is only significant at the 10 per cent level.

approved. Again, the divergence in results may be attributable to differences in definition. Cowling et al. (2020) use a binary approach to define a firm as women-owned “if firm is a women-led business” (p. 859), while not defining what a women-led business is. This study uses a categorical approach to distinguish among firms with equal ownership by men and women, majority-women owned, and majority-men owned firms. There is no inherent reason to expect that men-owned and equally owned SMEs are the same. They arguably differ systemically in terms of size and sectoral distributions and, according to the 2017 SFGSME, 45 per cent of firms with more than zero per cent female ownership are those owned equally by men and women, while only 33 per cent are owned by majority women (ISED, 2018). Importantly, women owners of small businesses who partner with men may benefit from “enhanced legitimacy, access to a larger number of resources [such as financing], and [a] stronger, more diverse social network” (Godwin, Stevens, and Brenner 2006, p. 623).¹⁰⁰ Given Cowling and colleagues’ lack of definition for “women-led”, it is not possible to consider how the difference in definitions affects the results, but it is possible to presume that the difference in findings is due to difference in definitions.

Neither the gender nor the minority status of ownership variable is significantly associated with loan application outcomes. This is to be expected for gender, given previous studies’ (see Section II-2.2) finding that the significance disappears when controlling for firm and owner characteristics (Cole and Mehran, 2009; Coleman, 2000; Fabowale et al., 1995; Orser et al., 2006). For minority, these results are consistent with Cole and Sokolyk (2016) and Mitchell and Pierce (2011) but at odds with Blanchard et al. (2008). The difference between this study, Cole and Sokolyk’s, and Mitchell and Pierce’s results and those reported by Blanchard et al. are likely due to the use of survey weights that enable inference at the population level (Blanchard et al. do not employ survey weights). That is: more reliable survey-weighted estimations support the view that minority status does not have an impact of loan application outcomes.

The next section further considers the effect of gender and minority status on the likelihood of loan approval, from the viewpoint of two types of discriminations.

¹⁰⁰ The remaining 22 per cent of women firms are those with 1 to 49 per cent women ownership (ISED, 2018).

II.4.3. Taste-based discrimination

The coefficient estimates in Table II-9 do not show evidence of lender having an animus towards women owners or minority owners (taste-based discrimination). That is, the gender results of this study are consistent with previous studies that do not report, after controlling for firm characteristics, likelihoods of receiving financing that differ for women- and minority-owned firms (Cole and Mehran, 2009; Cole and Sokolyk, 2016; Coleman, 2000; Eddleston et al., 2016; Fabowale et al., 1995; Mitchell and Pierce, 2011; Orser et al., 2006). The minority results are consistent with previous research that also uses survey weights (e.g., Mitchell and Pierce, 2011). This study adds to this debate by also controlling for the likelihood of double sample selection bias when estimating only a loan supply outcome model. When controlling for both firm characteristics and the double sample selection biases, the absence of taste-based discrimination result holds.

However, as mentioned in Section II.2.3, this does not guarantee the absence of “statistical” discrimination, that is: lenders may deny loans to people in certain groups in the belief that people in these groups have poor *unobserved* credit qualifications. To examine this point, the following section investigates whether lenders apply different loan adjudication criteria when screening women-owned and minority-owned applicants (statistical discrimination).

II.4.4. Statistical discrimination

To investigate the presence of statistical discrimination, the trivariate probit models from Table II-9 are re-estimated with the inclusion of interaction terms between the underrepresented groups (women and minorities). More specifically, the levels of majority women-owned business (within the gender ownership category) and the minority-owned dummy are interacted with control and independent variables included in Equation II-3, for term loan / mortgage applications and separately for line of credit applications.

The process of selecting which firm variables to interact was as follows. The first step was to attempt an estimation of the trivariate probit model with all firm characteristics and financial variables interacted with gender and minority in Equation II-3; however, the model did not converge. Accordingly, the second step comprised estimation of 14 trivariate probit models, each of which included one separate interaction term. For example, the first model added only the

interactions between age and gender and minority to Equation II-3 of the trivariate probit model from Table II-9; the second model added only the interactions between size and gender and minority to Equation II-3 of the trivariate probit model from Table II-9, and so on for each of the 14 variables.¹⁰¹

For each model in step two, the marginal effect of the respective interactions was calculated, given the bias associated with the reported coefficients of interaction terms in non-linear models.¹⁰² The final step comprised re-estimating the initial trivariate probit model from Table II-9 with only the significant (from step two) interaction terms. The marginal effects of the resulting model are presented in Table II-10.

Table II-10. Average marginal effects of subgroup interactions on whether the firm obtains financing.

<i>Labels</i>	<i>Term / Mortgage</i>	<i>Line of credit</i>
	Accepted	Accepted
Industry fixed effects	YES	YES
Province fixed effects	YES	YES
Year fixed effects	YES	YES
Minority	+	-
Gender (Base = Majority Men)		
50/50	+	+
Majority Women	+	-
<i>Minority interactions</i>		
Innovator	-	-
Age = Established firms (>10yrs)	-	-
Size (employees)		
ln(employees) = 0	+	-
ln(employees) = 1	+	-
ln(employees) = 2	+	-
ln(employees) = 3	-	-
ln(employees) = 4	-	-

¹⁰¹ Among applications for term loans / mortgages, these were innovator, exporter, age, size, owner experience, education, past growth, debt capitalization, capacity, financial slack, productivity, interest coverage ratio, and gross margin; for line of credit applications: innovator, exporter, age, size, owner experience, education, past growth, debt capitalization, financial slack, and working capital.

¹⁰² Given that the interaction effect in non-linear models is not necessarily equivalent to the reported associated coefficients (Ai and Norton, 2003, 2004; Greene, 2010), the average marginal effect of each interaction is presented in Table II-10, as suggested by Greene (2018) and Mitchell (2021).

ln(employees) = 5	-	+
ln(employees) = 6	-	+
Debt capitalization ratio = Over 60th percentile	-	-
Capacity	-	
Slack = Over 60th percentile	-	-
Gross margin = Over 60th percentile	_*	
<i>Gender interactions</i>		
Innovator	+	-
Age = Established firms (>10yrs)	+	-
Size (employees)	***	***
ln(employees) = 0	+**	-
ln(employees) = 1	+	-
ln(employees) = 2	-	-
ln(employees) = 3	-	-
ln(employees) = 4	_*	-
ln(employees) = 5	_*	-
ln(employees) = 6	-	-
Debt capitalization ratio = Over 60th percentile	+	-
Capacity	-	
Slack = Over 60th percentile	-	+
Gross margin = Over 60th percentile	+	
	Observations	2-3k
ρ_{AP}	_-***	-
ρ_{NP}	+***	-
ρ_{NA}	_-***	_-***

Note: This table reports the marginal effects of the subgroup interaction terms on the probability of loan approval (Equation II-3) using the survey-weighted trivariate probit model presented in section II.3.2 with robust standard errors and with interaction terms. The dependent variable *Accepted* is equal to one if the loan application was approved and a value of zero if the firm's loan application was rejected. Estimation results for the need and apply equations (Equation II-1 and Equation II-2) are omitted given the identical results as Table II-9. The size(employees) row contains the significance level of the joint test of the subgroup interaction across all values of employees. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The marginal effects from Table II-10 on the probability of loan approval suggest evidence of statistical discrimination for term loan applications.¹⁰³ When firms are small, applications were

¹⁰³ While the joint test of the majority-women and size interaction is significant for lines of credit, the individual tests of the difference in predicted probabilities across distinct values of employees between majority-women and size are not. Therefore, it is not possible to draw any conclusions from the joint test (Mitchell, 2021).

The lack of significant results for line of credit applications are consistent with Mitchell and Pearce (2011)'s argument that discrimination is less likely to occur for line of credit applications than for term loan applications. This is because applying for a line of credit sends a positive signal to the lender given the shorter-maturity of such loans (which conveys applicants' willingness of early loan repayments) and the recurring nature of lines of credit (lines of credit involve many repeated transactions, thus applying for a line of credit signals the firm's intention to build a relationship

more likely to be approved for term loan applications for majority women-owned firms relative to applications from majority men-owned counterparts. However, when managing large firms (around 50 to 150 employees), application from majority women-owned firms were less likely to be approved for term loans compared to applications from majority men-owned firms. These results suggest that lenders may be more confident in women entrepreneurs to manage small firms, but discount their ability to lead a large firm compared to men. Previous research has argued that women are more risk averse and less financially confident compared to men (Georgieva et al., 2021; Cowling et al., 2020; Bollen and Posavac, 2018; Constantinidis, Cornet, and Asandei 2006). It has also been argued that these features can lead to women making more prudent financial and managerial decisions (Alesina et al., 2013), lowering the risk of the firm. Lenders may thus prefer a more cautious female leader than a risk-taking male leader for smaller firms, given the higher likelihood of default associated with small firms (DeYoung et al., 2019; Nitani and Legendre, 2021; Ughetto and Vezzulli, 2011). For large firms, however, lenders may prefer to approve loans to those that are led by more self-confident entrepreneurs that could possibly lead a large number of employees well (again, previous studies suggest that men are more self-confident than women (e.g. Bollen and Posavac (2018))). Another possible explanation could be the perceived differences in the degree of empathy between women and men leaders. Previous research has argued that women are more empathetic compared to men (Bollen and Posavac, 2018). Lenders may prefer lending to a firm led by a more empathic leader who could lead its employees well, when it is small. For large firms, however, leaders' empathy is likely diluted and thus not as effective in boosting morale. Future research, however, is needed to investigate whether the difference in lending criteria is reflective of risk aversion, financial confidence, and/or empathy.

For entrepreneurs of visible minority groups, all variables are statistically insignificant (suggesting no statistical discrimination) except for gross margin: among firms that report high gross margins, applications submitted by visible minority owners are less likely to be approved relative to those

with the lender). Accordingly, “when banks include the soft information on loan-type choice in their information sets, minority status loses value as an information proxy because the soft information provides a more reliable signal of lenders' unobservable risk characteristics” (p. 280).

by non-minority entrepreneurs.¹⁰⁴ One possible explanation relates to possible differences in business reporting practices between minority-owned firms and non-minority-owned firms. Previous research has suggested that immigrant entrepreneurs are likely to face barriers relating to differences in the business environment (such as cultural, legal, ethical settings) between their home and host countries (Cukier, 2017; Neville et al., 2014).¹⁰⁵ This, in turn, could translate into minority entrepreneurs providing financial information about their businesses that may not reflect their current host country's financial reporting practices. Therefore, lenders may apply different lending criteria when reviewing the reported performance metrics from such entrepreneurs. In particular, financial statements reported by minority entrepreneurs, which exhibits some impressive performance metrics such as a high gross margin, might give lenders some suspicion whether such high performance comes from different reporting practices that makes it difficult for lenders to understand the current state of the business accurately. Future research, however, is required to investigate this point.

It is also important to note that even after the inclusion of interaction terms to detect statistical discrimination, the lack of taste-based discrimination from Table II-9 persists in Table II-10. It appears that taste-based and statistical-based discriminations do not necessarily exist simultaneously – when lenders apply different loan adjudication standards to a certain group of people, it does not imply that they also have animus against that group (see II.2.3).

II.4.5. Demand-side constraint reasons

To investigate RQ3, two bivariate probit models are estimated for Equation II-1 and Equation II-2.¹⁰⁶ The first model uses the same definition of demand-constrained for Equation II-2 from Table II-9. That is, firms that did not apply for any reason. The estimation results of this first model are presented in column 1 and 2 of Table II-11. The second model restricts the definition of demand-constrained to firms that did not apply for the needed financing because they thought the request

¹⁰⁴ The minority interactions with other variables such as slack and large firm (ln(employees) over 4) are almost significant (p-value slightly larger than 0.1). Accordingly, lenders may be applying different lending criteria for minorities across multiple firm characteristics.

¹⁰⁵ Around 92 per cent of owners of visible minority groups are also immigrants (ISED, 2018).

¹⁰⁶ Equation II-3 is omitted since RQ4 focuses on demand-side constraints, not supply-side constraints.

would be turned down.¹⁰⁷ More specifically, the demand constrained borrowers are now “firms that needed but did not apply for bank loans for fear of rejection”, rather than those that did not apply for any reason. The estimation results of this first model are presented in column 3 and 4 of Table II-11.

¹⁰⁷ Firms that answered other reasons (applying for financing is too difficult or time consuming, the cost of financing is too high or was unaware of financing sources that are available) are excluded from the sample.

Table II-11. Weighted bivariate probit model on whether the firm needs and applies for credit.

<i>Labels</i>	<i>Any reason</i>		<i>Fear of rejection</i>	
	Apply	Need	Apply	Need
Industry fixed effects	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Innovator	-	+***	+*	+***
Minority	_-***	+	-	+
Gender (Base = Majority Men)				
50/50	_-*	+*	_-**	+*
Majority Women	_-***	-	_-***	-
Exporter	-	+**	_-**	+**
Age (Base = New firms)				
Young firms (3-10yrs)	-	-	+	-
Established firms (>10yrs)	-	_-**	+	_-***
Size (employees)	+***	+***	+***	+***
Owner experience (Base = <5yrs)				
5-10 years	+	_-**	+	_-**
More than 10 years	+	_-***	+	_-***
Education (Base = High school diploma or less)				
A college/cegep/trade school diploma	+	+	+	+
A bachelor's degree or higher	+	_-**	+**	_-**
Growth intention (Base = 1-10% growth)				
No growth or scale back	_-***	_-***	-	_-***
More than 10% growth	-	+***	+	+***
Historical growth (1-year past employee growth)	+	+***	+	+***
Debt capitalization ratio (Base = <=30th perc)				
Between 30th and 60th percentile	-	+***	-	+***
Over 60th percentile	_-***	+***	_-**	+***

Capacity (whether amount requested / (Revenues + 1) is over 1)					
Financial slack (Tangible assets / Total liabilities) (Base = <=30th perc)					
Between 30th and 60th percentile	-	+	-	+	
Over 60th percentile	-	+	-	+	
Productivity (Revenues / Employees) (Base = <=30th perc)					
Between 30th and 60th percentile	+	***	***	***	
Over 60th percentile	***	***	***	***	
Interest coverage ratio (EBITDA / Total interest expense) (Base = <=30th perc)					
Between 30th and 60th percentile	+	-	-	-	
Over 60th percentile	-	***	***	***	
Gross margin (1 - (Cost of sales / Revenues)) (Base = <=30th perc)					
Between 30th and 60th percentile	+	+	***	+	
Over 60th percentile	***	-	***	+	
Internal funds (Cash / Total assets) (Base = <=30th perc)					
Between 30th and 60th percentile		***		***	
Over 60th percentile		***		***	
Constant	***	-	***	-	
Observations	7-8k	Over 15k	7-8k	Over 15k	
ρ_{NA}	**		-		

Note: This table reports the estimation results of the survey-weighted bivariate probit model presented in section II.4.5 with robust standard errors. Equation II-1 estimation results are reported under the column with the title “Need”. The dependent variable *Need* is equal to one if the firm indicated that it needed external financing (applied for financing or was demand constrained) and a value of zero if the firm reported that financing was not required for the respective survey year. Equation II-2 estimation results are reported under the column with the title “Apply”. The dependent variable *Apply* is equal to one if the firm applied for the needed financing. For the bivariate probit model under columns 1 and 2 (any reason), the dependent variable *Apply* is equal to a value of zero if the firm did not apply for the needed financing because they thought the request would be turned down, applying for financing is too difficult or time consuming, the cost of

financing is too high or was unaware of financing sources that are available. For the bivariate probit model under columns 3 and 4 (fear of rejection), the dependent variable *Apply* is equal to a value of zero if the firm did not apply for the needed financing because they thought the request would be turned down. Independent variables are defined in Table II-4. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The results for columns 1 and 2 are identical to those presented in Table II-9. When the definition of “demand-constrained borrowers” is restricted to firms that needed financing but did not apply for bank loans due to fear of being rejected, the profile of firms that need, apply and obtain bank loans changes. This is discussed presently.

Among control variables, the change in definition changes the impact of two variables, education and growth orientation. For the education variable, it was not significant when the broad definition was used, yet it becomes significantly positive when the restricted definition is used ($p\text{-value} < 0.05$) suggesting that owners with higher education (a bachelor’s degree or higher) are more likely to apply for financing. This is consistent with Chakravarty and Xiang (2013)’s finding that more educated firm owners are less likely to adjure themselves not applying because of fear of rejection.

Regarding the growth orientation variable, while firms with no growth intention were less likely to apply when the broad definition was used, there is no difference between growth-intended and non-growth intended firms in terms of the probability of not applying for fear of rejection (i.e., growth-oriented firms are just as likely as those with no growth intention to apply for needed financing). This is consistent with the results of Freel et al. (2012). Freel and colleagues also defined demand-constrained borrowers as those who chose not to apply for fear of rejection and they found that growth intention was only significant for the “need financing” equation of their bivariate probit modelling approach. One possible explanation for the change in significance across definitions of demand constraint is that firms that seek growth are more likely to be in an urgent need of financing. Accordingly, they may be less likely to be discouraged for any reason from applying for their needed financing. The lack of significance when using the narrow definition may be due to the small number of observations for growth-oriented firms that did not apply due to fear of rejection (less than 20 observations).

With respect to the financial variables, while interest coverage ratio variable was not significant when using the broad definition of demand-constrained, the variable becomes significantly negative when using the “fear of rejection” definition for demand-constrained. That is, firms with higher interest coverage ratios are less likely to apply for needed financing. It may be that firms with high interest coverage ratios are those with very low interest expenses and do not have experience applying for debt. Accordingly, these entrepreneurs might falsely think their application will be rejected because of their due lack of debt track record.

Among independent variables:

- Gender. The direction of the gender variable coefficients did not change with the change in the definition of demand-constraint: firms owned by 50/50 ownership and majority-owned by women were still less likely to apply. However, the coefficient is more highly significant when using the “fear of rejection” reason for not applying for needed financing. This suggest that firms owned by women are more likely than majority men-owned firms to fear of rejection compared to other reasons, consistent with the notion that women are less financially confident than men (Bollen and Posavac, 2018).
- Minority status. While the minority variable was significantly negative when using the broad definition of demand constrained, it becomes insignificant when using the “fear of rejection” definition. This could suggest that entrepreneurs of visible minorities are more likely to forego applying for needed financing for reasons other than fear of rejection, such as applying for financing is too difficult. Previous research has suggested that minority-owned, especially immigrant-owned, firms are likely to face barriers relating to differences in the business environment between their home and host countries and are not as knowledgeable in the local ways of conducting business (Glover and Sim, 2002; Neville et al., 2014). Such challenges could likely deter owners of visible minority group from applying for financing.
- Innovation. While the innovation variable was not significant with the broad definition of demand-constrained, innovators were more likely (although marginally so) to apply for needed financing when using the “fear of rejection” definition. One possible explanation is that innovators may have an urgent need for financing given the continuous costs of innovation that need to be paid over a longer period (Ughetto, 2008). Accordingly, innovators that need financing cannot permit themselves to forego applying for financing due to fear of rejection.
- International trade. Finally, while the exporter variable was not significant when using the broad definition of demand-constrained, it becomes significantly negative when using the “fear of rejection” definition. That is, exporters were more likely to refrain from applying due to fear of rejection. Given the higher risk associated with innovation and exporting discussed in section II.2.1, it would be expected that exporters follow the same direction

as innovators. The result for exporters is at odds with this expectation, and is likely a consequence of multicollinearity due to the significant positive correlation between exporter and innovator ($p\text{-value} < 0.05$). This significant correlation is to be expected, given the high correlation between exporting and innovating found by previous research (Love and Roger, 2015)

When changing the demand-constrained definition to the narrow definition, the findings can be summarized as follows. First, women-owned firms become even more likely to be demand-constrained for fear of rejection. Second, minority-owned firms, which are less likely apply when the broader definition of demand constraint is used, are just as likely to fear rejection as non-minority counterparts. Third, while innovators' and exporters' likelihoods of being demand-constrained does not differ from non-innovators and non-exporters when the broader definition is used, innovators are less likely to be subject to "fear of rejection", and exporters are more likely to fear their loan applications turned down (however, these results could be due to the positive and significant correlation between the two variables).¹⁰⁸

II.5. Conclusion

After controlling for the correlations among the three stages within SMEs' debt acquisition process (need, apply, and approved), and controlling for the risk associated with the loan, this study finds evidence relating to the characteristics of firms that need, apply, and are approved for credit.

First, exporters and innovators do not face different levels of the (broadly defined) demand-side and/or supply-side constraints, consistent with Cowling et al. (2020) who control for the correlation between two of the three steps involved in the SME debt acquisition process. This study's and Cowling et al.'s results contradict previous studies that do not control for any correlation between the SME debt acquisition process steps (e. g., Chakravarty and Xiang (2013), Gama et al. (2017)), highlighting the importance of controlling for the sample selection biases associated with loan demand and supply. These findings are also consistent with the notion that firms and lenders do not consider such growth strategies indicative of lower credit quality. The

¹⁰⁸ The results for exporter could also be driven by the very small number of exporters that did not apply for financing due to fear of rejection in the sample.

absence of constraints faced by these firms is particularly important (and good news), given that they are more likely to be a driver of economic growth.

On the other hand, firms owned by entrepreneurs of visible minority groups and those by majority women are less likely to apply for needed financing. This means that the more thorough analyses of demand-side constraint that controls for the correlation between the three steps of the SME debt acquisition process supports the presence of demand constraint among these groups of firms reported by Cole and Sokolyk (2016), Neville et al. (2017), and Orser et al. (2006).

On the supply-side, the coefficients of gender and minority status variables are insignificant. This suggests no evidence of taste-based discrimination against minority-owned and majority women-owned firms: there is no systematic difference in supply-side constraints for entrepreneurs of visible minority groups and firms owned by majority women. Again, this implies that this study's more thorough analyses, which takes the correlation between the three steps of the SME debt acquisition process into account, support: (1) for gender, Cole and Sokolyk (2016), Coleman (2000), Eddleston et al. (2016), and Orser et al. (2006) who argue that there is no gender difference in credit supply when other owner and firm characteristics are controlled for; and (2) for minority status, Cole and Sokolyk (2016), and Mitchel and Pearce (2011) who report no taste-based discrimination against minority-owned businesses.

However, this study finds that such firms are subject to statistical discrimination. That is, lenders apply different loan adjudication criteria for term loan applications. For majority women entrepreneurs, they are relatively more likely to be approved than majority men entrepreneurs when managing small firms, but relatively less likely to be approved when managing large firms. This might be due to lenders preferring more risk averse ownership for smaller firms, given their higher default likelihood (Nitani and Legendre, 2021), while preferring more self-confident owners with more ambitious investment goals for large firms. For minority-owned firms, marginally significant evidence of statistical discrimination is detected (among firms that report high gross margins, minority-owned firms are more likely to be rejected). This may be due to minority entrepreneurs' tendency to have financial information reporting practices different from those standardized in Canada, which leads lenders to have a suspicious view on impressive financial performance metrics, such as a high gross margin, reported by those entrepreneurs.

Previous studies, along with the findings of this study, suggest the following policy recommendations. First, initiatives that seek to alleviate credit supply constraints faced by exporters and innovators may not be necessary, given the absence of constraints faced by these firms. Second, transparency in lending adjudication criteria could help alleviate statistical discrimination. For example, governments could require lenders to explicitly disclose the reason for any credit scoring adjustments made for women borrowers and borrowers of visible minority groups. In Canada, reviewing such adjustments could be part of the Office of the Superintendent of Financial Institutions' (OSFI) mandate and included in their lender audits.¹⁰⁹ Third, entrepreneurial support programs for women and members of visible minority groups that focus on the training of *applying* for external capital may be useful in reducing demand-side constraints faced by these firms. Examples of such initiatives are the Women Business Centres (WBC) managed by the Small Business Administration (SBA) in the United States and the recent Black Entrepreneurship Program in Canada. Both programs provide the respective underrepresented groups with training and counselling, such as seeking capital to foster firm growth. Fourth, it may be beneficial for these support programs to partner with financial institutions. Involvements of financial institutions could enrich learning experience for program participants, as well as help lenders understand better about women/minority entrepreneurs, enabling them to provide business owners of these types with better support. In particular, such programs could offer both parties opportunities to work together to deal with factors causing statistical discriminations.

Like most empirical work, this study is not limitation free due to its reliance on secondary data. Due to the differences in questions included across different years of surveys (conducted by Statistics Canada, used exclusively in this study), the availability of variables is not consistent for all survey years. For example, a variable indicative of the demand-side constraint is not available for the 2007 survey, forcing this study to exclude the year when estimating the entire debt acquisition process. Furthermore, the investigation of statistical discrimination in the present paper is unable to distinguish between the lender's conscious or unconscious bias.¹¹⁰ Further research,

¹⁰⁹ In Canada, the Office of the Superintendent of Financial Institutions (OSFI) supervises federally regulated financial institutions (e.g. banks, federal credit unions (FCUs), pension plans). OSFI is mandated by the Government of Canada to ensure that financial institutions follow regulations, founded upon the Basel framework, designed to control and manage risk.

¹¹⁰ For example, Messick (2009) argues that some stereotypes can occur outside of consciousness (implicit stereotypes). Accordingly, it is difficult to distinguish whether (1) lenders apply different lending criteria to women

particularly qualitative research, could help determine the origins of discriminations biases. For example, experiments with lenders would be useful in rationalizing the statistical discrimination towards minority- and women-owned firms found in this study. To detect any unconscious bias, experimental research could investigate how much time lenders spend reviewing the financial information of the firm depending on the minority status of the entrepreneur. If lenders spend less time for minority-owned firms, this could suggest evidence of an unconscious bias towards entrepreneurs of visible minority groups. Understanding why lenders consider some subgroups of entrepreneurs more or less risky than others is crucial in effective policy building. Future research can also investigate how the demand-side and supply-side constraints have evolved in 2020 with more recent data. This is particularly important, given the recent COVID-19 pandemic and the Liberal government's announcement in September 2020 of new policies providing funding to Black business owners and entrepreneurs.¹¹¹ With the addition of more recent data (i.e., the 2020 version of the SFGSME, expected to be released in 2023), the larger sample size could enable other extensions such as the examination of financial constraints (statistical discriminations) experienced by firms majority-owned by women *and* members of visible minority groups.

Nevertheless, this work uses datasets that provide detailed information on the characteristics of respondent firms and their owners, including financing applications and their outcomes, as well as comprehensive financial statements, for each of the survey years of 2011, 2014 and 2017. Using these rich and unique datasets, this study contributes to the academic literature and policy makers through an unbiased estimation of the entire picture of the SME debt financing process. By doing so, this study provides a better understanding of SME financing challenges, shedding additional lights on the academic literature and public sectors that contemplate means to alleviate difficulties associated with particular subgroups of SMEs.

due to no explicit reason (unconscious) or (2) lenders apply different lending criteria to women and minorities being aware of women's high risk aversion and minority entrepreneurs' tendency to use different accounting standard.

¹¹¹ <https://pm.gc.ca/en/news/news-releases/2020/09/09/prime-minister-announces-support-black-entrepreneurs-and-business>

CHAPTER III : BEYOND “INCREMENTALITY”: A MORE COMPLETE ASSESSMENT OF A CREDIT GUARANTEE SCHEME

III.1. Introduction

The availability of capital for SMEs is a vital issue, as these firms have been long considered as an important source of job creation and economic welfare (Adelino et al., 2017; OECD, 2013). However, it is often argued that small firms suffer from information asymmetry and other market frictions (such as fixed costs associated with due diligence and interest rate caps) and thus face credit constraints. In this setting, many jurisdictions have attempted to address this problem using credit guarantee schemes (CGSs, a.k.a. loan guarantee scheme, or LGS). A CGS is a mechanism by which an entity (often a government body) guarantees a certain portion of a loan in the event of default.

Current practice is that the performance of a CGS has been assessed using two dimensions: (1) the proportion of loans extended under the CGS that would have not been advanced absent the program (the incrementality rate, also referred to as the additionality rate); and, (2) the extent to which the benefits of the program exceed its costs (Industry Canada, 2015). Incrementality gauges whether guarantee programs are simply transferring risk from the private to the public sector or are truly providing additional financing (Cusmano, 2018). The cost-benefit analysis seeks to ensure that taxpayers’ contributions in the program generate positive returns.

Nevertheless, this paper argues that an assessment of a CGS based only on these two measures fails to examine two vital aspects of CGS performance. First, such an assessment is unable to consider one of the three forms of lenders’ moral hazard a CGS possibly induces, i.e., excessive risk-taking, one that is implied in the theoretical considerations of CGSs.¹¹² The theoretical framework of Chaney and Thakor (1985) suggests that a CGS might possibly induce excessive risk-taking actions by lenders by betting on high risk (higher profit) borrowers for which potential losses would be covered by the guarantor. However, loans advanced as a result of such attempts by lenders are considered as “incremental,” as these loans would not have been granted without the CGS (thus meeting the condition for recognition as “additional” loans generated by the

¹¹² The other two forms of lenders’ moral hazard that might be induced by a CGS are risk shifting and less thorough due diligence. These three forms are discussed in detail in the conceptual framework section.

program). Traces of such actions could be detected through a cost-benefit analysis if costs are escalated by high levels of default claims; however, such an analysis is unable to measure the extent to which lenders are engaged in this form of moral hazard.

Second, neither the incrementality nor the cost-benefit analysis is able to assess the extent to which the program addresses the problem of particularly severe inaccessibility to bank loans faced by subgroups of firms within the general SME population. Previous studies identified possibilities that the availability of bank loans is disproportionately limited to exporters, innovators, and expansion-oriented firms within the general SME population (Binks and Enew, 1996; Mateut, 2018; Riding et al., 2009; Ughetto, 2008; Wang et al., 2015). If a CGS aims “to stimulate economic growth and create jobs” (Industry Canada, 2014: 1, as do many programs) an assessment of a CGS should examine whether it addresses the particularly severe credit gaps faced by these firms, as such firms are presumably risky yet likely to possess greater growth opportunities (Psillaki and Daskalakis, 2009). Other examples of SME subgroups that are thought to be disadvantaged in obtaining loans include those owned by members of visible minorities and women (Blanchard et al., 2008; Cole and Mehran, 2009; Eddleston et al., 2016). Again, an assessment of a CGS should examine the extent to which the program addresses these gender- and ethnicity-related credit gaps, should they exist. However, the two commonly used measures of CGS performance (incrementality and cost-benefit analyses) are unable to evaluate a program in these regards.¹¹³

Accordingly, this study attempts to develop a more complete picture of a CGS’s performance by examining the above two of a CGS’s performance (e.g., lender moral hazard and subgroup incrementality). More specifically, it proposes a new measure of CGS performance, the “appropriateness rate”, which is the incrementality rate minus the “risk taking rate”, and empirically estimates it using a CGS in Canada – the Canada Small Business Financing (CSBF) program.¹¹⁴ In addition, this paper examines the extent to which the CGS addresses particularly severe credit gaps faced by subgroups of SMEs and examines changes in a CGS’s performance

¹¹³ For example, assume that exporters are disadvantaged in obtaining bank loans. A 100 per cent incrementality rate does not mean that the program has addressed the problem of this particularly severe credit gap faced by exporters, as it is possible that all CGS loans, while they are incremental, went to non-exporters.

¹¹⁴ More specifically, the “appropriateness rate” is equal to the incrementality rate minus the risk-taking rate, where the former being the number of CGS loans that would not have been extended without the CGS divided by the total number of CGS loan; and the latter being the number of CGS loans that are the result of lenders’ excessive risk-taking behaviour divided by the total number of CGS loans.

over time. Previous research has focused on only one particular time period when assessing a CGS's performance, yet its effectiveness could vary over time due to macroeconomic and industry factors that affect firms' level of financial distress (Ben-Yashar et al., 2018; Chatzouz et al., 2017; Tsuruta, 2015; Wilcox and Yasuda, 2008). By estimating CGS performance across three different time periods, this paper aims to make some inferences on how a CGS's performance could be affected by changes in these conditions.

The findings of this chapter are summarized as follows. First, the CSBF is found to not be incremental, with a low incrementality rate of 5.3 per cent. This implies that CSBF is not achieving its goal of "providing loans to borrowers that would not have received a loan without the CGS", suggesting that taxpayers' money is not effectively used. This might be due to the increase in the CSBF's claim coverage limit from 10 to 12 per cent in 2009, which created space for lenders to include non-incremental loans under their CSBF portfolios. This might also suggest that Canada does not need government supports to facilitate SME lending, since Canadian lenders have higher approval rates for loans to SMEs. While the estimated rate is lower than previous attempts at gauging incrementality, this study argues that the estimated rate is more precise than such attempts due to its estimation model's ability to capture more firm and owner characteristics and high predictive accuracy, and done after the recent program changes. Second, lenders do not seem to be engaging in excessive risk-taking behaviour, as evidenced by an almost zero risk-taking rate. This might indicate that the 12 per cent maximum claim coverage (of lender's CSBF portfolio) is low enough to discourage lenders from taking overly risky borrowers or might be due to the stability and the conservative nature of Canadian banks, which reduces the need for lenders to take additional risk (risk-taking) to improve their performance.

Third, there is no evidence that lenders focus on particular subgroups of SMEs (such as women-owned firms, minority-owned firms, and innovative firms) in their allocations of the CSBF loans. This is understandable as this and previous chapters find no evidence suggesting severer disadvantages in terms of access to bank loans faced by these subgroups of firms.¹¹⁵¹¹⁶ However, I

¹¹⁵ This dissertation refers to a firm of which more than 50 per cent ownership (majority) is held by visible minorities as a minority-owned firm.

¹¹⁶ Chapter II finds no evidenced of taste-based discrimination towards members of visible minority groups or women business owners, but obtained empirical evidence suggesting statistical discriminations against large firms owned by women and minority-owned firms with high margins. However, as Chapter II attributes these to possible differences in financial confidence between men and women and possible differences in the financial statement reporting practices

find Canadian banks' tendency to allocate more CSBF loans to high growth-oriented borrowers (more than 10 per cent growth in revenues expected), although those firms are not disadvantaged with respect to the bank loan availability. On the contrary, firms with no growth intention and those with set back expectations have the lowest share of CSBF loans, although they are significantly less likely to obtain loans. This may have to do with one of the stipulated goals of the CSBF: to "help firms grow" (ISED Canada, 2016; p. 1), resulting in a higher share of CSBF loans to high growth intention firms.

Finally, the CGS' performance does not seem to vary significantly between the recession and post-recession time periods. This may be due to the absence of a CSBF quota that pressures lenders to extend more loans during a period of lowered loan demand. Another possible reason is that Canadian banks were not severely affected by the crisis, thanks to their increased stability (Haltom, 2013; Gravelle et al., 2013). Accordingly, Canadian banks did not need to place more loans under the CSBF to lower the risk of their non-guaranteed lending portfolio nor take additional risk through the guarantee program to improve their performance.

This research appears to be among the first to assess the performance of a CGS by: (1) taking lenders' excessive risk-taking behaviors into account; (2) evaluating its effectiveness across different subgroups of small firms; and, (3) across different time periods. It aims to contribute to academic literature by refining the existing measure of incrementality to include risk-taking behaviors, and to contribute to policymakers by providing empirical evidence using this performance measure of a CGS, an important government tool to stimulate SME growth. The methodologies used by this paper to estimate "incrementality" and the "appropriateness" measures follow and extend the two-step approach introduced by Riding et al. (2007). The rich datasets, based on a series of national-wide surveys on SMEs available at Statistics Canada, allows the research to take a variety of firm, owner, loan, and lender characteristics into consideration when the assessment measures are estimated.

This paper is organized as follows. The proceeding section provides a general description of loan guarantee schemes and the Canada Small Business Financing (CSBF) program. Section three

of immigrant-owned firms, this chapter suggests to address these statistical discriminations by developing joint-training programs for women, members of visible minority groups and lenders (rather than helping them through guaranteed program).

reviews the theoretical debates on guaranteed loans and empirical studies on CGS performance. Section four presents the conceptual framework and section five describes data and methodologies. Section six presents the empirical findings, and section seven concludes.

III.2. Loan guarantee schemes

III.2.1. What is a loan guarantee scheme?

A loan guarantee scheme is a mechanism by which an entity guarantees a certain portion of a loan in case of its default. It therefore involves three parties: the borrower, the lender, and the guarantor, where the guarantor is typically a government. The design of credit guarantee schemes involves the identification of target borrower groups, level of discretion given to the lender, coverage ratio (the percentage of loan that is guaranteed by the program), restrictions on the use of proceeds, fee structure of the program, among others.¹¹⁷ In most cases, providing a loan under a CG scheme comprises of the following process. First, the prospective borrower requests debt financing from a lender. The lender assesses the creditworthiness of the borrower and makes the decision on whether the application is to be: (1) rejected; (2) approved; or, (3) approved under the loan guarantee program.¹¹⁸ If approved under the scheme, the borrower pays the lender interest on the loan as well as prearranged fees to the guarantor. Finally, the guarantor collects the fee and agrees to repay the lender a predetermined portion of the loan balance in the event of default. These fees and coverage ratios vary per scheme but are around 5 per cent of the loan amount and 70-80 per cent of the loan balance, respectively (Honohan, 2010).

Most schemes have less than 100,000 guaranteed loans outstanding, and about two thirds of these schemes approve less than 1,000 new loans per year (de la Torre et al., 2017). The largest guarantee scheme is the Japanese credit guarantee program (as of 2013). It approves approximately 730,000 new loans per year and it had a total number of outstanding loans of 3.1 million valued at 305 billion USD in 2013 (Gozzi and Schmukler, 2015).

¹¹⁷ In certain aspects, CGS design varies by country. For example, the Korea Credit Guarantee Fund (KODIT) assesses loan applications using its own internal operations instead of delegating the process to the lender (de la Torre et al., 2017). Another example is Brazil's SEBRAE (Serviço Brasileiro de Apoio às Micro e Pequenas Empresas, Brazilian service of assistance to micro and small enterprises), which increases the program fees charged to the lender as the loan maturity increases (de la Torre et al., 2017).

¹¹⁸ Some schemes do not give the lender a full discretion as to whether the loan should be approved under the scheme.

III.2.2. Canada's credit guarantee scheme

Canada's credit guarantee scheme, the Canada Small Business Financing (CSBF) program, was first introduced in April 1999 under the Canada Small Business Financing Act (CSBFA) with the following three objectives: (1) "to help new businesses get started and established firms make improvements and expand"; (2) "to improve access to loans that would not otherwise be available to small businesses"; and, (3) "to stimulate economic growth and create jobs for Canadians" (Industry Canada, 2014: p. 1).¹¹⁹ In 2015, 5,044 loans advanced to Canadian small businesses were registered under the CSBF, with 60 per cent of those loans advanced to businesses less than one year old (Rivard, 2018).

Like many credit guarantee schemes, designated financial institutions hold the responsibility of approving the loan under the CSBF and registering it to the program. In other words, screening of potential guaranteed loan recipients is relegated to designated lending institutions.¹²⁰ To be eligible for a CSBF guaranteed loan, a business must have gross annual revenues of \$10 million CAD or less.¹²¹ Also, the proceeds of the loan must be used for capital expenditure (financing long term fixed assets), rather than working capital.

A business can apply for a loan worth up to \$1,000,000 CAD (see Appendix 5 for more details) where the maximum chargeable interest rate is the lender's prime rate plus three per cent. The program fees include a registration fee of two per cent of the total loan amount (that can be financed as part of the loan), and an annual 1.25 per cent administration fee payable quarterly.¹²² In the case of default, the lender receives 85 per cent of the outstanding loan balance up to 12 per cent of its CSBF loan portfolio value.

¹¹⁹ Prior to 1999, Canada's national loan guarantee program was operated under the Small Business Loans Act (SBLA), helping Canadian SMEs obtain debt financing since 1961.

¹²⁰ Gozzi et Schmukler (2015) explain that the operating costs incurred by a CGS are much higher when the program assesses applicants' creditworthiness on its own than when it gives lenders discretion as to who receive guaranteed loans (so that the full evaluation of potential guarantee recipients is lenders' task). For example, in the late 1990s the Korean and Colombian guarantee schemes had operating costs of 7.7 and 4.2 per cent of the value of outstanding guarantees respectively, yet Gozzi and Schmukler estimate that Colombia could have saved over two per cent of these costs if it had given the borrower screening task to financial institutions.

¹²¹ Until June 23rd 2015, the maximum gross annual revenues for eligible firms were \$5 million CAD. The CSBF program excludes farming businesses and not-for-profit, charitable, and religious organizations from its list of eligible applicants.

¹²² More specifically, the maximum rate for variable rate loans is the lender's prime lending rate plus three per cent, while for fixed rate loans it is the lender's single-family residential mortgage rate plus three per cent.

III.2.3. The 2009, 2014, and 2015 program amendments

Two significant changes were introduced to the CSBF program since its establishment in April 1999. The first one took place in 2009 in response to the 2007-2008 crisis in a form of an expansion of the scheme (as existing, or creation of new, loan guarantee schemes were observed in many countries, including 19 out of 23 OECD members after the crisis (OECD, 2013)). The amendments include: (1) an increase in eligible loan amount from \$250,000 to \$500,000 CAD; (2) an increase in the amount of claim a lender can make on loan losses from 10 to 12 per cent of its CSBF loan portfolio value; and, (3) a simplification of application procedures to reduce administrative tasks required to lenders. As a result, lending under the CSBF program increased from 953 million in 2009 to over one billion dollars in 2010 (Industry Canada, 2015).

The second amendment was made in 2014 in response to stakeholder concerns raised in the 2004-2009 CSBFA Comprehensive Review Report regarding complications associated with the guarantee loan application process and the decline in lending levels under the program. The changes include: (1) allowance given to lenders to charge borrowers administrative fees as they do under the non-guaranteed loan setting; (2) reduced requirements regarding the proof of purchase documentation; (3) elimination of the maximum financing percentage of 90 per cent of the value of assets purchased; (4) the allowance given to lenders to take unsecured personal guarantees to cover the full loan amount; and, (5) facilitation of claim payments (Industry Canada, 2015). Additional changes were made in June 2015, which include: (1) an increase in the eligible loan amount from \$500,000 to \$1,000,000 CAD for loans to purchase real properties; (2) a relaxation of eligibility requirements of the firm with respect to revenue limit, which was raised from \$5 million to \$10 million CAD; (4) an extension of the maximum term of a loan from 10 to 15 years; and, (5) a further simplification of application process.

III.3. Literature Review

III.3.1. Theory of loan guarantee schemes

The rationale for CGSs has been derived from theoretical models of credit rationing, represented by Stiglitz and Weiss' seminal works (1981, 1983) in which the causal relationship between

information asymmetry (cause) and credit rationing (effect) is demonstrated.¹²³ Since small and young firms are thought to be more informationally opaque than established counterparts, those firms are, according to the theory, subject to severe asymmetric information problems, and thus severe credit rationing. In order to address these market imperfections, governments in many nations intervene the credit market with credit guarantee schemes.¹²⁴

Accordingly, some contend positive impacts of loan guarantee programs to fight against credit rationing. Levitsky (1997) and Vogel and Adams (1997) argue that a CGS could act as a subsidy for lenders to gain information on new borrowers, which helps the lender to make loan approval decisions on the borrower's subsequent applications. Gale (1990) maintains that credit rationing is not driven by information asymmetry but by the bank's inability to break even, and CGSs would mitigate this problem. Banks need to ration credit because they are not allowed, by law, to charge a high enough interest rate in equilibrium to the risk level of the borrower (Besanko and Thakor, 1987; Stiglitz and Weiss, 1981, 1983). The interest rate lower than the equilibrium would create negative profit that lenders cannot afford in the competitive market, yet a CGS reduces the risk to the lender and allows the bank to receive a non-negative return on a would-be negative profit-generating and thus credit rationed borrower. Wilcox and Yasuda (2008) propose a theoretical model from the "the loss-given-default (LGD)" point of view, showing that loan guarantee programs reduce banks' risk exposure, which enables them to extended more loans (guaranteed and non-guaranteed). Honohan (2010) argues that CGSs are adopted for three reasons: (1) the guarantor can reduce information asymmetry by having additional information on the borrower with lower costs; (2) lenders that specialize themselves in specific sectors can diversify their risk by providing guaranteed loans to borrowers in different sectors and locations; and, (3) lenders can exploit regulatory arbitrage if the guarantor is not subject to the same rules as the lender (that is: guarantee premiums can drive interest rates above regulatory ceiling).

However, some studies argue against the use of credit guarantee schemes for this purpose, theoretically arguing that it would worsen borrowers' moral hazard problems. For example,

¹²³ However, de Meza and Webb (1987) show that a change in the return distribution assumed in Stiglitz and Weiss leads to a completely different conclusion: information asymmetry causes overlending.

¹²⁴ A number of studies have sought empirical evidence consistent with this discourse, and the literature generally agrees that: (1) young small firms are more severely subject to credit rationing due to their informational opacity (e.g., Meisenzahl, 2016); and, (2) SMEs have often been documented to have difficulty in obtaining external financing (e.g., OECD, 2008; Ardic, et al., 2012; Canton et al., 2013).

Chaney and Thakor (1985) demonstrate that loan guarantee programs increase the risk of healthy firms, as these healthy firms will aim to signal distress in order to receive a loan guarantee. Innes (1991) finds similar results through his theoretical model: firms will over-invest in riskier projects because they know the government will absorb the risk. Another example of moral hazard is that SMEs are less likely to feel compelled to pay back their loan, given that it is guaranteed.¹²⁵ Similarly, several theoretical models suggest that a CGS could worsen lenders' moral hazard, as it might reduce lenders' incentive to screen and monitor borrowers (Gozzi and Schmukler, 2015; Levitsky, 1997), while incentivizing them to shift the risk of their portfolios to the public sector (Cusmano, 2018) and to take more risk (Chaney and Thakor, 1985; Levitsky, 1997), with an expectation that the default on the loan will be covered by the program (the conceptual framework section discusses these three forms of lenders' moral hazard in more detail).

Lack of consensus on theoretical justification of a CGS makes it further important to ensure that it is *at least* empirically effective, in terms of whether it in fact increases the availability of credit to the underserved areas in an efficient manner (Vogel and Adams, 1997), which does not waste taxpayers' contributions.¹²⁶ Accordingly, existing research on CGSs has focused on testing the effectiveness of credit guarantee programs through a cost-benefit analysis of the program and the program's incrementality, the extent to which a LGS provides loans to borrowers who would not have obtained a loan without the program (Seens and Song, 2015).

III.3.2. Loan guarantee scheme performance measures

Previous studies have assessed the performance of a CGS through two approaches. The first one is the cost-benefit analysis, which ensures that the costs of the program do not exceed the benefits, one of the two conditions with which a policy intervention is justified (Vogel & Adams, 1997).¹²⁷ The second is through the estimation of the program's "incrementality rate", the percentage of loans under the CGS that would not have been extended without the program, to ensure that the program generates "additional" loans.

¹²⁵ Levitsky (1997) argues, however, that these moral hazard issues are not likely to occur. Lenders need to present high loan-portfolio performance and would suffer from borrower defaults on guaranteed loans. Similarly, SMEs are not likely to ignore paying their debts because it might hinder their chances of obtaining future loans.

¹²⁶ Some argue that many interrelated features of an LGS cannot be captured by simplified theoretical models, policy recommendations should not be based on such models (Hillier and Ibrahim, 1992, 1993; Parker, 2002).

¹²⁷ The other condition is that the intervention is to address market imperfection.

Several existing papers have carried out the cost-benefit analyses for CGSs in different countries. For example, Riding and Haines (2001) conduct such an analysis in the context of the Canadian CGS (CSBF described above), with costs measured primarily by the amount of lenders' claims that the government honored on loan defaults and benefits measured by job creation. They find that the program contributed significantly to job creation within the country in 1995 at a lower cost (\$2,000 per job created) than other Canadian government initiatives to create employment, such as the Self-employment Initiative program and the Community Futures program. Bradshaw (2002) finds similar results regarding the California State Loan Guarantee Program in the period from 1990 to 1996. Bradshaw observed an increase of as much as 40 per cent in employment and that of state tax revenues by USD\$25.5 million at an estimated cost of USD\$13 million. Boocock and Shariff (2005) examine the New Principal Guarantee Scheme (NPGS) offered by the Credit Guarantee Corporation (CGC) in Malaysia, and find that the total employment of firms in their sample, which received a loan through the NPGS, grew by 53 per cent between 1998 and 2000. Chandler (2012) reports that participation to Canada's CGS (CSBF) led to an increase of 12 per cent in the SMEs' salaries and employment, and of 7 per cent in the SMEs' revenues between 2004 and 2006. He estimates the total Canadian job creation attributable to the CGS to be 5,000 during this period at a cost of around \$6,000 per job, which is significantly lower than other public job creation initiatives in Canada, such as Young Canada Works and the New Employment and Development.

Seens (2015) finds that the benefits generated by the CSBF program are around five times the costs incurred by the program for each period between 2002 and 2012, where the former is estimated by the sum of: (1) administrative fees and interests paid to lenders; (2) salaries and wages paid to employees of new jobs created by the program; (3) direct and indirect GDP impacts; and, (4) fees paid to the guarantor, while the latter is measured by: (1) the program's administrative costs, costs of defaults covered by the program; and, (3) costs of defaults incurred by lenders. Brown and Earle (2017) examine the U.S. loan guarantee program, the Small Business Administration (SBA), from 1990 to 2009 using the matching procedure between SBA loan recipients and similar yet non-SBA loan recipient firms (based on size, age, industry, year, and past growth performance) while controlling for random variation in the supply of SBA loans through an instrumental variable approach. They find that for every \$1 million of loans raised through the SBA, three to 3.5 jobs are created in the first three years post SBA loan disbursement. Five years after the loan was

received, the estimated job creation is between four and seven. The effect of job creation is less important in regions where local credit availability is high.

Existing studies have also assessed CGS' performance in terms of the incrementality rate. An incrementality (or additionality) rate is the portion of loans extended under the CGS that would not have been granted without the guarantee program. Measuring incrementality is crucial in assessing whether guarantee programs are simply transferring risk from the private to the public sector or are truly providing additional loans (Cusmano, 2018). In fact, most credit guarantee schemes' primary objective is to provide *additional* loans. For example, the British Business Bank (BBB) describes the Enterprise Financing Guarantee program (the UK loan guarantee scheme) as "potentially enabling a 'no' credit decision from a lender to become a 'yes'" (BBB, 2017).¹²⁸ Therefore, maintaining a reasonable level of incrementality is a minimum criterion for a guarantee program's healthy operation (Levitsky, 1997).

Previous empirical studies have estimated the incrementality rates of CGSs in different countries using different methodologies (see Appendix 6). Boondock and Sharif (2005) investigate the incrementality of the New Principal Guarantee Scheme (NPGS) in Malaysia with a sample of 92 NPGS borrowers between 1998 and 2000, and find that 54 per cent of survey respondents considered the NPGS necessary to obtaining the loan. Riding et al. (2007) use the two-step approach to estimate the incrementality rate of 74.8 per cent for Canada's CSBF based on a sample of 208 SME term loan applications in 2000.¹²⁹ This rate appears to have decreased to 67 per cent in 2011 when Seens and Song (2015) estimate it using the same approach based on a sample of 2,404 SME loan applications. Similarly, Rivard (2018) find an incrementality rate of 69 per cent for the CSBF in 2014 using a sample of 1,748 SME loan applications. Zecchini and Ventura (2009) examine the Italian "State-funded guarantee scheme for SMEs (SGS)" using a sample of 11,261 Italian SMEs between 1999-2004, and find that guaranteed loan recipients exhibit a median value of bank loan amount 12.41 per cent higher than non-guaranteed loan counterparts, suggesting that the Italian guarantee scheme allows firms to borrow a larger amount. Similarly, Uesugi et al. (2010) find that firms that received a loan under the Japanese loan guarantee scheme had a 2 per cent higher loan to total asset ratio compared to firms that did not receive a guaranteed loan. Cowan

¹²⁸ <https://www.british-business-bank.co.uk/ourpartners/supporting-business-loans-enterprise-finance-guarantee/about-efg/>

¹²⁹ The rate was estimated with a $\pm$ nine per cent confidence interval.

et al. (2015) study a sample of 475 Chilean firms between 2004 and 2006 and find that each Chilean\$1,000,000 of guaranteed loans led to 0.147 additional loans. Wilcox and Yasuda (2008) measure incrementality using changes in volume of non-guaranteed loans extended by the bank.¹³⁰ Using annual data from 145 Japanese banks between 1995 and 2002, they apply panel regression on amounts of loans outstanding held by banks. They find that banks extended one to six additional non-guaranteed loans to a borrower that got one guaranteed loan from the same bank. A possible explanation for this increase is that the guarantee program allows banks to obtain qualitative firm information at lower costs, which allows them to extend additional non-guaranteed loans to firms that they once provide guaranteed loans.

In sum, there is an extensive literature that assesses the performance of a CGS, either through the estimation of the incrementality rates or by cost-benefit analysis. This research, however, suggests three shortfalls in the literature.

First, while incrementality and cost-benefit analyses are crucial performance measures, this study argues that one form of lenders' moral hazard cannot be detected through these analyses. More specifically, they fail to account for lenders' overly risk-taking behaviours. Incrementality examines whether recipients of CGS loans would have been able to obtain loans without the program, i.e., if CGS loans are incremental. This measure therefore captures two forms of lenders' moral hazard, namely: risk-transfer (extending CGS loans to borrowers that would have been approved in normal circumstances); and less thorough due diligence (placing loans under a CGS without thorough scrutinization of loan applications). However, it is unable to detect the other form of moral hazard, i.e., lenders' action to take more risk (knowing that it will be absorbed by the CGS (Chaney and Thakor, 1985; Levitsky, 1997). CGS loans resulting from this type of moral hazard are counted as incremental, as they would not be extended without the CGS. Lenders' overly risk-taking actions could manifest in the cost-benefit analyses, in a form of escalated cash outlays used to cover lenders' default losses. However, this type of analysis is unable to measure the extent to which the loans extended under the CGS result from this type of lenders' moral hazard.

¹³⁰ Cowan et al. (2015) and Zecchini and Ventura (2009) employ a similar methodology.

Second, there are subgroups of SMEs that are thought to suffer from particularly severe credit constraints, in comparison with the general SME population; however, no study has examined the impacts of a CGS on these subgroups of SMEs. Given that the primary goal of CGSs is to provide loans to those who would have not obtained a loan, we would expect CGSs to be especially effective for these subgroups of SMEs. Existing empirical research has provided evidence that SMEs with the following characteristics face particularly severe credit constraints, they are: exporters (Riding et al., 2009); growth oriented (Myers, 1977; Psillaki and Daskalakis, 2009; Psillaki and Mondello, 1996); innovative (Ughetto, 2008) as well as minority (Blanchard et al., 2008; Bostic and Lampani, 1999; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo and Wolken, 2005; Neville et al., 2017) and women-owned (Blanchard et al., 2008; Brown et al., 2011; Cavalluzzo et al., 2002; Coleman and Robb, 2014; Treichel and Scott, 2006).

Finally, there is limited research on the longitudinal performance of a CGS, while several studies suggests possibilities that a CGS's performance could vary over time due to shifts in macroeconomic environment that affect firm financial health (Wilcox and Yasuda, 2008), lenders' loan adjudication process/criteria (Ben-Yashar et al., 2018), and demand for loans (Chatzouz et al., 2017; Tsuruta, 2015).¹³¹ However, to my best knowledge, the only study that statistically tests the impact of an exogenous factor (firm financial distress) on a CGS performance is that of Wilcox and Yasuda (2008). They report that the number of additional non-guaranteed loans created by one guaranteed loan lending increased significantly from two to "at least six" during the 1997-2002 period.

This study therefore addresses these three gaps in the literature. It will examine the performance of Canada's CGS, the CSBF, across different sub-groups, and for multi-period of time (which enables us to consider exogenous factors that possibly influence the performance), while taking all three forms of lenders' moral hazard into account. Again, to my best knowledge this study is among the first to do so.

¹³¹ The comparison of the estimated incrementality rates for the case CSBF program between Riding et al. (2007, 74.8 per cent) and Seens and Song (2015, 67 per cent) also suggests possible time-varying feature of a CGS performance.

III.4. Conceptual framework

The existing literature suggests that one of the major obstacles to healthy CGS operation is lenders' moral hazard. Such moral hazard may hinder the CGS to attain its main objective, i.e., to provide *additional* loans, if it takes a form of risk-shifting or less thorough due diligence. It could also harm the program's cost-benefit balance if it is manifested through lenders' overly risk-taking behaviours. Accordingly, this conceptual framework contemplates the three forms of lenders moral hazard a CGS might induce, the factors that facilitate or suppress each type of moral hazard, and the ways in which each manifests itself in the empirical setting.¹³² In addition, the framework considers the impact of CGSs on loan accessibility for subgroups of small firms thought to be particularly disadvantaged in obtaining credit. Finally, it deliberates the impacts of changes in macroeconomic settings on CGS performance.

III.4.1. Does the CSBF program induce lenders' moral hazard?

The existing literature suggests three types of lenders' moral hazard that a CGS might induce:

1. Risk transfer: lenders can transfer the risk of loans, which they can provide without the CGS, to the public sector, by placing these loans under the guaranteed program (Cusmano, 2018).
2. Less thorough due diligence: in the presence of a CGS, lenders might be less incentivized to perform thorough assessments of loan applications and minimize the costs associated with these assessments (Innes, 1991; Levitsky, 1997).
3. Risk taking: a CGS might incentivize lenders to bet on high risk borrowers, with which greater profits should be expected (as high interest rates are justified) yet on which the majority of potential losses would be covered by the guarantor (Chaney and Thakor, 1985; Levitsky, 1997).

Among these, the risk transfer and less thorough due diligence interfere with the CGS's goal to provide additional loans, i.e., extend loans to firms that would not otherwise obtain them. The lenders' risk-taking behaviour harm the CGS performance by increasing the cost of the program

¹³² This paper argues that borrower firms' moral hazard (which that a CGS could induce) can be minimized by lenders' thorough due diligence and collateral requirements (Lelarge et al., 2010). Nevertheless, the investigation of the impacts of borrower moral hazard is outside of the scope of this paper, although it will be a topic for future research.

due to the escalated loan defaults. The following subsections consider each of these three types of lenders moral hazard.

III.4.1.1. Lenders' moral hazard type 1 & 2 (Risk transfer and less thorough due diligence)

The risk-transfer type of lenders' moral hazard arises if lenders provide guaranteed loans to borrowers whom they could extend a loan without the guarantee program.¹³³ Cusmano (2018) argues that guarantee programs could potentially be a device that simply transfer risk from the private to the public sector. However, if we assume that banks seek to grow their loan portfolios while minimizing risk, and given the presence of a restriction on the total amount of claims a bank could request from the CGS (as a percentage of the bank's guaranteed loan portfolio value), this is not likely to be the case as shown in the below simple theoretical model.

Let us say bank A receives a request for a loan of X dollars from a borrower i , of which default probability (risk level), r_i , is above a certain threshold, r (note that the risk here includes not only operational but also informational components). In this case, without the guaranteed program, bank A's exposure at default (EAD) associated with borrower i is r_iX . Under the guarantee scheme, however, bank A can lower the EAD by the CGS' coverage ratio, c ($EAD_{\text{guaranteed } i} = r_iX*(1-c)$), freeing up capital for an additional loan to extend. Now, assume that bank A receives another X dollar loan application from firm j , of which default probability (risk level), r_j , is below the threshold, r (that is: firm i is a risky borrower and j is a good borrower). Again, without the CGS, bank A's exposure at default (EAD) associated with borrower j is r_jX ; under the CGS, it is $r_jX*(1-c)$ ($EAD_{\text{guaranteed } j} = r_jX*(1-c)$).

If the bank desires to expand its market share in the small business lending market, it has incentive to approve both loan applications while minimizing the risk of their loan portfolio.¹³⁴ Under this scenario, the bank now has three choices: (1) approve both loan applications under the guaranteed program; (2) approve the good borrower's application as a guaranteed loan and then extend a non-guaranteed loan to the risky borrower; or, (3) approve the good borrower's loan as a non-

¹³³ This action would violate one of the primary goal of CGSs. Industry Canada highlights that one of the objectives of the Canadian CGS is "to improve access to loans that would not otherwise be available to small businesses" (Industry Canada, 2014: p. 1). Similarly, the British Business Bank (BBB) states that the goal of the British CGS is "potentially enabling a 'no' credit decision from a lender to become a 'yes'" (BBB, 2017).

¹³⁴ Basel III requires banks to maintain capital requirements as a function of the exposure at default (EAD) of their loans. Accordingly, banks have incentive to reduce the risk of their loan portfolio to decrease the amount of capital they are required to hold, allowing them to extend additional loans and expand their market share.

guaranteed loan and provide a guarantee loan to the risky borrower. The exposure at default (EAD) for bank A's small business loan portfolio for each of the three scenarios can be expressed as:

$$\text{Scenario 1} \quad r_i X \times (1 - c) + r_j X \times (1 - c) = EAD_1 \quad (\text{III-1})$$

$$\text{Scenario 2} \quad r_i X + r_j X \times (1 - c) = EAD_2 \quad (\text{III-2})$$

$$\text{Scenario 3} \quad r_i X \times (1 - c) + r_j X = EAD_3 \quad (\text{III-3})$$

Where c is between 0 and 1.

Now, it is assumed that the CGS restricts the total amount of claims as a percentage of the bank's guaranteed loan portfolio, which makes the scenario 1 infeasible as the total dollar value of claims in the case of both loans' defaults exceeds the maximum percentage. Under this assumption, given $r_i > r_j$, the bank's exposure at default is lower for scenario 3 than for scenario 2:

$$EAD_2 > EAD_3 \quad (\text{III-4})$$

Therefore, we expect lenders to approve CGS loans only when they are unable to approve them through non-guaranteed lending. In other words:

Proposition 1: Lenders' risk transfer under a CGS is unlikely when banks seek to grow their loan portfolios while minimizing risk, and when the CGS restricts the total amount of claims a bank could request.

Another form of lenders' moral hazard that could possibly be induced by a CGS is less through due diligence. Given that the majority of losses from loan defaults are covered by the program, lenders might be less incentivized to screen and monitor borrowers in the guaranteed loan setting (Innes, 1991; Levitsky, 1997). Regarding this point, however, we also argue that this type of lenders' moral hazard is unlikely when the CGS has a coverage ratio less than 100 per cent and a mechanism for close monitoring of creditors. First, with a coverage ratio of less than 100 per cent, lenders are still subject to losses on their portfolio. Therefore, we expect lenders to perform their usual due diligence to avoid the potential losses and avoid surpassing their claim limit. Second, a monitoring mechanism, such as the right to audit creditors, enables the CGS to ensure that creditors perform

thorough due diligence. Documentation requirement at the time when lenders make claims on defaults could act as a deterrent to moral hazard in the form of less thorough due diligence.

Proposition 2: Lenders' less thorough due diligence under a CGS is less likely when the CGS has a coverage ratio less than 100 per cent and performs close monitoring of lenders.

This work argues that the CSBF, Canada's credit guarantee scheme, satisfies the conditions necessary to minimize lenders' moral hazard in the form of risk transfer and less thorough due diligence. First, the Canadian banking industry is competitive and each player desires to expand its market share (Allen & Engert, 2007).¹³⁵ Second, the coverage ratio is less than 100 per cent (85 per cent of the outstanding loan balance up to 12 per cent of its CSBF loan portfolio value)¹³⁶. Third, the CSBF program closely monitors lenders through documentation requirements and the right to audit lenders at any time. For example, when submitting a claim, the lender must provide documentation supporting the due diligence steps performed during the initial loan approval and acknowledge and sign the Claim for Loss form stating that the lender has "acted in accordance with the due diligence requirements referred to in section 8 of the Regulations in making, administering and collecting the loan" (ISED Canada, 2017: p. 4).

As for due diligence, the CSBF makes specific requirements to lenders, which include to: (1) conduct their normal due diligence that would be performed on non-guaranteed loan of the same amount; (2) conduct or obtain a credit check on the borrower or anyone who is legally and financially responsible for the borrower; and, (3) conduct a risk assessment of the borrower's ability to repay the loan (ISED Canada, 2016). Moreover, according to R.A. Malatest & Associates Ltd. (2014), the majority of lenders (86 per cent in 2004 and 70 per cent in 2014) appear satisfied with these requirements, further suggesting that lenders agree with applying the same due diligence for guaranteed loans.¹³⁷

¹³⁵ More specifically, according to Allen and Engert (2007), the Canadian banking industry is monopolistically competitive, which describes an industry structure combining elements of both monopoly and perfect competition. While the largest six banks account for more than 90 per cent of the assets in the banking system, they face competition (especially in small-business banking) provided by credit unions and caisses populaires,

¹³⁶ More specifically, the sum of the default claims submitted by a lender for each five-year period is capped at a maximum of 90 per cent of the first \$250,000 in loans registered, plus 50 per cent of the next \$250,000. It is also capped at a maximum of 12 per cent of the total outstanding loan value in excess of \$500,000 for loans made on or after April 1, 2009 (10 percent for loans made before April 1, 2009) (ISED, 2015).

¹³⁷ Furthermore, among lenders who report dissatisfaction regarding the CSBF's due diligence requirements, the reason for dissatisfaction is not related to performing due diligence on guaranteed loans, but rather to the lack of

In sum, lenders' moral hazard in the form of risk transfer and less thorough due diligence could be minimized when: (1) the CGS coverage ratio is less than 100 per cent; (2) lenders attempt to grow their market shares in the small business lending market; and, (3) the CGS has a device to monitor financial institutions closely (as per proposition 1 and proposition 2). Since Canada's CSBF appears to satisfy these conditions, the levels of these two types of lender moral hazard are expected to be low in the CSBF program.

Since these forms of lenders' moral hazard result in the presence of CGS loans that could be extended without the CGS, the empirical examination in this regard is best addressed by the estimation of incrementality rate of the program (this is why most existing studies assess a CGS performance based on the incrementality). Accordingly, the expectation that the CSBF program has low levels of these types of moral hazard, built by the above argument, leads to the hypothesis that the CSBF exhibits a high level of incrementality.¹³⁸

*Hypothesis 1: Loans approved under the CSBF program are incremental.*¹³⁹

III.4.1.2. Lenders' moral hazard type 3 (Risk taking)

The last type of lenders' moral hazard, potentially induced by a CGS, is risk-taking. However, this study also argues that this is unlikely when the CGS: (1) limits the maximum chargeable interest rates; (2) sets the coverage ratio at less than 100 per cent; (3) has the right to monitor lenders; and, (4) operates in an environment where reputation plays an important role in the credit market. First, the restriction on maximum chargeable interest rates limits lenders' incentive to bet on high-risk borrowers, with which greater profits should be expected (as high interest rates are justified) yet on which potential losses would be covered by the guarantor. Second, the coverage ratio set to less

flexibility on the due diligence procedures required by the CSBF. Lenders claim that their usual due diligence procedures vary per borrower according to the specific needs, yet the CSBF requires lenders to apply the same due diligence steps (EKOS RESEARCH ASSOCIATES, 2018).

¹³⁸ Some studies also consider better loan conditions (ex. longer term, lower interest rates) as incremental. To test this, these studies compare the treatment group (those who received a guaranteed loan) to the matched untreated group (those who receive a non-guaranteed loan) and examine if the former received a loan with a better condition than the latter. For example, if the guarantee program is incremental, we would expect the untreated group's non-guaranteed loan to have a higher interest rate and shorter term than the treated group's guaranteed loan. See Lelarge et al. (2010) and D'Ignazio and Menon (2012) for examples of these studies.

¹³⁹ This study considers that the program is incremental when the majority of loans made under the program are incremental. More specifically, we regard the program as incremental when more than 75 per cent of loans under the program are incremental, as Riding et al. (2007) conclude that the CSBF meets its incrementality goal with an estimated incrementality rate of 75 per cent.

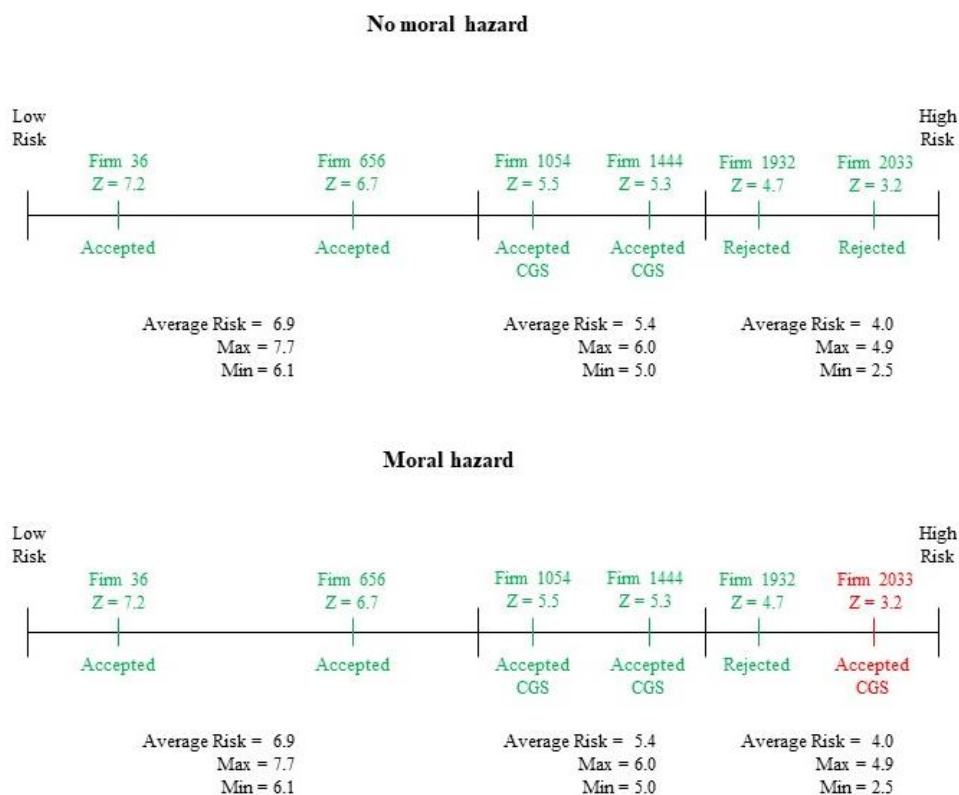
than 100 per cent leads lenders to incur a non-zero loss on default of a guaranteed loan (Seens & Song, 2015; Zecchini & Ventura, 2009). Levitsky (1997) investigates CGSs' guarantee coverage ratio (the percentage of the outstanding balance of the defaulted loan that is covered by the CGS), showing that CGSs that cover less than 50 per cent of the loan outstanding balance would not be attractive for lenders; on the other hand, those guarantee schemes that cover more than 80 per cent of the loan would induce the lender to take on riskier borrowers. Third, lenders' incentive to take more risk under a CGS would be presumably weaker in the setting where the moral hazard could be easily discovered; in other words, when lenders are not closely monitored by the CGS administration. Fourth, under the environment where reputation plays a role, lenders are still expected to have incentive to avoid defaults even on guaranteed loans (Levitsky, 1997). There is an extensive literature that argues the importance for banks to maintain their reputation, as it affects their abilities to attract and maintain deposits, accounts, and close relationships with borrowers; to protect themselves from hostile takeovers; and to evaluate, monitor, and negotiate with clients, which affects loan terms and conditions (see, for example, Dinç, 2000; Ross, 2010). A high default rate associated with the guaranteed loan portfolios certainly harms the bank's reputation.

Proposition 3: Lenders' overly risk taking behaviours are less likely when the CGS: (1) limits the chargeable maximum interest rates; (2) has the coverage ratio less than 100 per cent; (3) has the right to audit lenders; and, (4) operates in an environment where reputation affects lenders' operations.

Arguably, the CSBF program satisfies the above four conditions. First, the maximum chargeable interest rates for CSBF loans are restricted to be under the lender's prime lending rate (or single-family residential mortgage rate) plus three per cent. Second, while the CSBF program sets the coverage ratio of 85 per cent of the outstanding loan balance, which, according to Levitsky (1997), falls in the range of the coverage ratio that induces lenders' risk taking behaviours, it imposes another restriction regarding the default claim coverage: up to a maximum 12 per cent of lenders' CSBF loan portfolio value. Third, the Canadian banking industry is highly competitive, which, according to Dinç (2000), motivates players to build and maintain their reputations. Lastly, as mentioned above, the CSBF administration has the right to audit lenders, and lenders must be compliant to strict restrictions imposed by the Canada Small Business Act when providing CSBF

loans. Therefore, I expect that lenders would not engage in overly risk-taking activities under the CSBF program.

Figure III-1. CGS moral hazard



Lenders' engagements in moral hazardous actions in the form of risk-taking cannot be detected by the estimation of incrementality rates, as loans extended out of such behaviours are those that would not be approved without the CGS, i.e., they are incremental (see Figure III-1). To this point, this study argues that given the absence of their moral hazard, lenders provide firms in the least risky group with non-guaranteed loans; those in the moderately risky group with CGS loans; and those in the overly risky group with no loans. However, in the presence of lenders' moral hazard in the form of over risk-taking, they extend CGS loans to firms in the overly risky group. The expectation of a low level of lenders' overly risk-taking behaviours associated with the CSBF

loans, built on the above argument, therefore leads to the hypothesis that CSBF loan recipients should have a risk level lower than firms that had their loan applications rejected:¹⁴⁰

Hypothesis 2: Firms of which loan applications were approved under the CSBF program are less risky than those whose applications were rejected.

III.4.2. Do CSBF loans reach subgroups of SMEs that may have relatively more severe difficulty obtaining credit?

While SMEs are widely thought to face limited access to credit, certain subgroups within the SME population are believed to face especially severe credit constraints. Examples include exporters, innovators, growth-oriented firms, and minority- and women-owned firms. This study considers whether the CSBF program addresses credit gaps faced by these subgroups.

Exporters

Firms that generate revenues from outside of their country are generally thought to be riskier and therefore relatively more likely to be credit constrained. There are two major additional risks associated with exporting. The first one is the time lag between production and revenue generation (Amiti and Weinstein, 2011; Feenstra et al., 2014). According to Djankov et al. (2010), it takes an average of approximately 21 days for a product to be ready for shipping (from the time when it is out from factory), and then another 23 days until it is secured by the importer. During this period it is possible that the importer could default (exporters therefore often purchase insurance to minimize this risk). The longer the duration of this period, the higher the risk of importers' defaults. Moreover, this adds to the length of the cash flow conversion cycle, exacerbating the need for working capital financing (Feenstra et al., 2014). In addition, the assessment of the importer is difficult due to information asymmetry aggravated by distance (Boot, 2000; Brevoort & Hannan, 2006; Elyasiani & Goldberg, 2004). The second source of risk stems from the additional costs associated with international trade (Manova et al., 2015). These include both fixed costs (regulatory compliance, product customization, establishing foreign distribution networks) and variable costs (trade insurance, transportation, freight insurance, and duties). These costs are often substantial, and the fixed portion thereof increases operating leverage. These additional sources of

¹⁴⁰ Given the absence of lenders' moral hazard, we would expect that the risk level of CGS loan recipients should be lower than that of rejected loan applicants *yet higher than that of non-guaranteed loan recipients*.

risk make it more difficult for lenders to provide exporters with loans. This is especially true for SMEs, which are already perceived as more risky than established corporations—even without international trade being involved—and thus more likely to default on a loan.

Growth oriented firms

Firms that seek growth require additional capital to finance growth opportunities (Michaelas et al., 1999). However, growth-seeking firms are also perceived to be relatively more risky by lenders (Psillaki and Daskalakis, 2009), because: (1) the desire for growth encourages firms to adopt riskier strategies (international trade, R&D); (2) growth is often accompanied with revenue or profit volatility; (3) rapid growth means rapid changes in business operations, which increases the necessity of monitoring by lenders over the firm (Binks & Enew, 1996; Myers, 1977). Empirically, Binks and Enew (1996) observe, in the UK, that firms with growth expectations perceive more severe credit constraints than those without such expectations.

Innovative firms

Ughetto (2008) explains that there are three reasons for credit constraints to arise for innovative firms, which are especially pronounced for SMEs. First, there is additional uncertainty surrounding expected future cash flows from innovation activities. Second, these projects often face a low probability of success (Carpenter and Petersen, 2002; Leland and Pyle, 1977). Third, such investments are better understood by the entrepreneurs who have expertise about the product under development than by outsiders: exacerbating the problems of moral hazard and adverse selection (Jensen and Meckling, 1976; Stiglitz and Weiss, 1981). Fourth, the major assets for innovative firms are often the entrepreneurs' brains (ideas and intellectual properties), rather than tangible assets (which are easier to use to secure loans; Berger and Udell, 1990; Lev, 2001). Ughetto (2008) finds support for these arguments using a sample of Italian manufacturing firms from 1998 to 2003; innovative firms particularly suffer from credit constraints. More recent studies find similar results. Wang et al. (2015) find that Chinese firms that invest in innovation through R&D face more severe credit constraints than those that do not innovate through R&D. In this regard, Mateut (2018) finds that public subsidies are important for these financially constrained innovators.

Minority- and women-owned firms

Becker (1957) argues that some lenders are subject to taste-based discrimination against certain groups of borrowers in that they are willing to pay a cost to reject members of these groups even

if they have good credit quality, based on a social animus towards members of this group. In this regard, a number of empirical studies report that women- and minority-owned businesses are disadvantaged in access to finance, and two theories have attempted to explain this phenomenon.

Generally, the empirical literature reports limited availability of bank loans to minority-owned small businesses. In a foundational paper, Bates (1991) found that firms owned by blacks obtained smaller loans than otherwise identical non-black counterparts. Many (e.g., Blanchard et al., 2008; Bostic and Lampani, 1999; Cavalluzzo et al., 1998; Cavalluzzo and Wolken, 2005; Neville et al., 2017) observe higher rates of loan application rejection among minority small business owners: Blanchflower et al. (2003) report that such rejection rates are twice as high for minority-owned small businesses, and Cavalluzzo et al. (2002) and Mitchell and Pearce (2011) find this discrepancy especially severe in less competitive credit markets.

On the other hand, existing empirical studies on gender differences in credit accessibility have provided mixed evidence. Some studies find higher rejection rates for women-owned firms but claim that this is due to the characteristics of women-owned firms (Coleman, 2000; Cole and Mehran, 2009; Fabowale, 1995; Orser et al., 2006). For example, Coleman (2000), Cole and Mehran (2009), and Orser et al. (2006) report that women-owned firms tend to be younger and smaller in size, and that the gender difference in rejection rates disappeared after controlling for firm age and size. Conversely, Brown et al. (2011) find that women owners are more likely to have their loan applications rejected and Treichel and Scott (2006) and Coleman and Robb (2014) provided evidence that women-owned firms receive less favorable terms of loan, even after controlling for firm characteristics. Cavalluzzo et al. (2002) find loan approval discrimination against women-owned firms in more concentrated markets and Blanchard et al. (2008) report that, after controlling for firm characteristics, women-owned firms are more likely to be denied credit than men-owned counterparts when both are operating in a national market (instead of a local market). Finally, Brush et al. (2019), based on a meta-analysis, report that women-led start-ups have significantly less initial financing than their men counterparts.¹⁴¹

¹⁴¹ There are two types of discriminations. The first one is the taste-based discrimination, in which certain groups of firms are subject to loan application denial, regardless of their risk levels. The second type is “statistical discrimination”, in which lenders apply different loan adjudication criteria to specific groups of firms, based on the belief that members in such a group share common characteristics, which lenders believe to depreciate credit quality (Neville et al., 2017). This chapter focuses on taste-based discriminations.

Overall, existing studies suggest that exporters, growth-oriented firms, and innovators are relatively more likely to face limited access to credit than the general SME population, because they are either: perceived as riskier by lenders for some reason (and thus subject to either taste-based or statistical discrimination); face additional operational risk; or face more severe information asymmetry. Lenders are likely to extend guaranteed loans to borrowers that fall above their risk threshold to reduce their exposure at default (EAD), and firms in these subgroups are likely to fall above the threshold. We would accordingly expect that firms in these subgroups are more likely to receive CGS loans than non-guaranteed loans (i.e., CGS loans represent a larger share of total (both CGS and non-guaranteed) loans for these subgroups of firms than for the general SME population). Regarding the discriminations against women- and minority-owned firms, we should again observe higher shares of CGS loans than non-guaranteed loans for these subgroups of firms if they are in fact found to be discriminated in the bank loan market, given one of the purposes of the CSBF program, i.e., “to improve access to loans that would not otherwise be available to small businesses” (Industry Canada, 2014: p. 1):¹⁴²

Hypothesis 3: A subset of firms that faces particularly severe credit constraints is more likely to receive a CSBF loan than a non-guaranteed loan.

III.4.3. Do changes in exogenous factors affect the CSBF performance?

Existing studies theoretically demonstrate how macroeconomic shocks impact the supply and demand of credit, with which empirical literature generally agrees (Carbó-Valverde et al., 2013; DeYoung et al., 2015; Duchin et al., 2010; Ivashina and Scharfstein, 2010; Kahle and Stulz, 2013; Popov and Udell, 2012; Schleifer and Vishny, 2010).

As for the supply, the shock decreases their capital adequacy ratios while deteriorating their perceived quality of information, leading to the escalation of lenders’ level of risk averse and the contraction of credit supply. More specifically, when banks’ equity value falls due to the losses from toxic assets (which increases their debt-to-equity ratio) banks cannot simply take on more debt because they are already highly levered. As a result, they are forced to lower their assets via selling securities, not renewing loans and/or not making new loans, thus creating a credit

¹⁴² However, it is uncertain whether a CGS can address credit constraint stemming from this types discrimination (whether lenders, who reject loan applications submitted by members of a certain group based on a social animus towards this group, allocate CSBF loans to this group).

contraction (Brunnermeier, 2009). Since small firms suffer from severe information asymmetry even in the normal economic setting, it has been argued that the deterioration of information quality and therefore credit contractions would be worse among small businesses than established corporations (Berger et al., 2011; Beck et Demircug-Kunt, 2006; DeYoung et al., 2015; Ivashina and Scharfstein, 2009; and many others). Furthermore, access to capital gets harder due to the drop of asset prices and therefore collateral value (Kiyotaki and Moore, 1997). This especially hinders the ability of growth-seeking SMEs to obtain a loan, as they already suffer from lack of collateral (Binks and Enew, 1996). Financial crises are also argued to influence the demand for loans among SMEs due to increased uncertainty about the future demand for goods/services and thus the NPV of the growth opportunities to which financing is required (Kahle and Stulz, 2013).

This study conceives two conditions through which these supply and demand shock consequences would affect incrementality of a CGS. These are:

- The lender's level of moral hazard increases; and,
- The lender faces quotas for loans under CGS.

This study argues that the credit supply contraction itself does not have an impact on the CGS performance. The stronger pressure to avoid toxic assets triggered by the crisis would increase lenders' level of risk avoidance (Dowd, 2009); that is: according to the framework presented in 4.1.1, lenders' risk threshold is lowered from r to r_2 ($r > r_2$). This results in applicants who were regarded as "good" borrowers in a normal economic setting being "bad", i.e., those who were able to obtain non-guaranteed loans during the pre-crisis period might become CGS loan recipients. However, these CGS loans are still incremental, as, in the crisis setting, the banks can approve non-guaranteed loans only to firms of which risk level is above r_2 , i.e., they do not represent an increase in lender moral hazard (risk shifting) but rather a change in risk threshold.¹⁴³

However, the panic situation triggered by a crisis may cause the deterioration of ethics among bank employees. For example, the last financial crisis might have lowered the level of satisfaction and

¹⁴³ For example, during normal economic times, a bank provides, out of a pool of 100 applicants: (1) non-guaranteed loans to the top 50 least risky firms; and, (2) CGS loans to the next 30 less risky firm (the remaining 20 most risky firms are rejected). During a crisis, the bank increases its risk aversion and adjusts its loan adjudication accordingly. Then it provides, out of 100 applicants: (1) non-guaranteed loans to the top 30 least risky firms; and, (2) CGS loans to the next 20 less risky firm (leaving the remaining 50 unapproved). In both cases, the incrementality rates are 100 per cent.

loyalty among bank employees, which might have harmed their motivation to perform thorough due diligence. Alternatively, a strong pressure to avoid or reduce toxic assets might have created incentive for lenders to shift any risk of their portfolio to public sector or to bet on very risky borrowers. Expansions of the CGS in the form of an increase in the coverage ratio or the eligible loan amount, witnessed in many countries as a response to the financial crisis, might have encouraged lenders to commit such moral hazardous actions.¹⁴⁴ Belás (2013) observe the deterioration of bank employees' job satisfaction and loyalty, as well as their behaviours that prioritize "selling products at higher price" to "selling best-fit products to customers". Thus, while lenders' credit contraction itself may not have a direct impact on the CGS performance, the supply-side originated financial crisis may influence the performance through the channel of deteriorated moral hazard.

This study argues that the demand shock also influences the CGS's performance, if there is a quota that creates pressure on banks to extend a certain number of guaranteed loans. In the presence of quota, and in response to the lack of credit demand, lenders may need to change the pool of applicants they approve under a CGS. European banks surveyed by Chatzouz et al.'s (2017) report that the most important constraint to the use of CGSs is the lack of credit demand from SMEs. If these banks are keen to expand their market shares in their respective small business lending market, leading bank management to assign "objectives" on revenues (that is: the volume of loans extended to businesses per a specific time period) to their employees, or, if they are under pressure from CGS authorities to provide a certain number of guaranteed loans (Levitsky, 1997; Norway Ministry of Finance, 2020), the presence of such "pressure" may induce lenders' moral hazardous actions such as approving loans under the CGS, which could be granted without the scheme (under their new risk threshold, r_2), or approving overly risky loans (recall that one cause of the last financial crisis was providing mortgages and auto loans to people who had very low probability to repay (Linsley & Slack, 2013; Schoen, 2017)). This is because such actions solve the two issues they face: (1) the need to reduce the risk of loans extended in order to minimize the possibility to create additional toxic assets or to improve their financial statements by betting on risky loans that might generate high returns; and, (2) the need to compensate for the lack of credit demand and hit the objectives associated to market share goals (or to satisfy quotas imposed by the CGS). In turn,

¹⁴⁴ The CSBF increased the eligible loan amount from \$250,000 to \$500,000 CAD and the eligible claim a lender can make on loan losses from 10 to 12 per cent (see section 2.3).

the inclusion of good and overly risky borrowers in the CGS loan portfolio would ultimately lower incrementality and appropriateness rates at a time of crisis or during the subsequent recession.

In sum, there is a possibility that a financial crisis lowers the performance of a CGS through the channels of deteriorated lenders' ethics (coupled with the expansion of the CGS) and/or lowered demand for loans (coupled with the pressure to "extend" loans given to lenders). Accordingly:

Hypothesis 4: Performance of CSBF program is lower during the last financial crisis and subsequent recession period, compared to the post-crisis period.

III.5. Data and Methodology

III.5.1. Data

The work proposed here takes advantage of a datasets comprised of the "Surveys of Financing and Growth of Small-and Medium-Enterprises (SFGSME)" conducted in 2011, 2014 and 2017. These data are suited to this research as the surveys collect detailed information about the firm and its owner characteristics as well as the firms' financing applications and its outcomes (approved or not, approved under CSBF program or not, lending terms, interest rates, type of lender, etc.). These data are also linked, through Statistics Canada's linkable file environment, to the tax submissions of each respondent enterprise for years prior to the survey and for years following the survey, which provides detailed financial statement information for each firm.

Statistics Canada designs questionnaires and conducts surveys on behalf of Industry Science and Economic Development (ISED) Canada and Finance Canada. The population of interest for these surveys comprise approximately 800,000 for-profit businesses with fewer than 500 full-time-equivalent employees and annual gross revenues of at least \$30,000 from the Business Register maintained by Statistics Canada (an exhaustive collection of all Canadian firms reporting a minimum of \$30,000 in revenues during any 12-month period).¹⁴⁵ The surveys were undertaken via computer-assisted telephone interviews. Then, the observations were weighted to best

¹⁴⁵ More specifically, the following enterprises are excluded from the population: (1) firms with 500 or more employees; (2) firms with over \$50 million in gross revenue; (3) non-profit organizations; (4) cooperatives and joint ventures; (5) firms in specific industries, such as: (a) utilities; (b) finance and insurance; (c) management of companies; (d) educational services; (e) public administration; (f) automotive equipment or commercial/industrial machinery/equipment rental and leasing; (g) health care services; (h) community food and housing; (i) emergency and other relief services.

represent the underlying population while ensuring minimum data counts for particular cells. The surveys were administered in 2000 (11,015 valid responses), 2004 (13,042), 2007 (15,808), 2011 (9,957), 2014 (10,397), and 2017 (9,115).¹⁴⁶

The surveys minimize the overall effects of non-response and selection biases by high response rates (typically exceeding 50 percent), by creating a large number of strata variables, and by surveying enough firms within each stratum to achieve a coefficient of variance of five per cent.¹⁴⁷ Key informant problems are minimal with these datasets because the surveys involve SMEs with a median firm size of less than 4 employees: access to the person who has best detailed knowledge of the firm has not been an issue.

III.5.2. Methodology

The incrementality rate of CGSs has been measured through several different methodologies in the literature. They include:

- propensity score matching (Uesugi et al., 2010);
- asking respondent firms whether or not they could have obtained the loan without the guarantee program (Boondock and Sharif, 2005; Industry Canada, 2014);
- examining the correlation between the amount of CGS loans and the amount of non-guaranteed loans (Cowan et al., 2015; Wilcox and Yasuda, 2008; Zecchini and Ventura, 2009);
- and a two-stage loan adjudication approach (Riding et al., 2007; ; Rivard, 2018; Seens and Song, 2015).

Out of the above four methodologies, the two-stage loan adjudication method appears to be more appropriate. For example, Uesugi et al. (2010) measure incrementality by: (1) estimating a propensity score model (probit model) that distinguishes firms that received a guaranteed loan from those that obtained a non-guaranteed loan; (2) estimating the treatment effect (incrementality) of the guarantee program: guaranteed firms were matched with the nearest non-guaranteed firms (in terms of propensity scores from probit estimation); and, (3) calculate the difference in loan

¹⁴⁶ Each survey is conducted independently with no intention to repeat respondents from survey to survey.

¹⁴⁷ The strata variables include region, industry, size (the number of employees) and age of the firm, and participation in the Canada Small Business Financing (CSBF) loan guarantee program.

availability between the two.¹⁴⁸ While it is an interesting approach, it fails to provide a *rate* of incrementality, the availability of which allows to compare the guarantee program performance over time or across different subgroups of SMEs. Furthermore, as their dependent variable “loan availability” is measured by loan to total assets, etc., the numerator may include the amount of non-guaranteed loans held by the borrower.

Boondock and Sharraf (2005) and Industry Canada (2014) measure incrementality using a survey question asking the firm whether they think they would have received a loan without the guarantee program. However, it is difficult to assume that the respondents’ answers are suited to the assessment of a program performance, as they could be affected by the respondent’s biased – either optimistically or pessimistically – opinion on the likelihood of obtaining a non-guaranteed loan. In the end, it is the lender that decides if the borrower should receive the loan, and thus the distinction between “loans that could have been materialized without the guarantee program” and “those that could not” is better estimated by a lender’s loan adjudication model. Cowan et al. (2015), Wilcox and Yasuda (2008), and Zecchini and Ventura (2009) consider whether a loan guarantee program leads to an increase in the total amount of debt financing available to SMEs. However, this measure does not directly gauge incrementality as defined earlier. Rather, they consider whether a wider spread of guaranteed loans led to additional non-guaranteed loans, testing the theory of CGSs as subsidies for lenders to gain information, which allows them to extend subsequent non-guaranteed loans to the borrower who once received a guaranteed loan (Levitsky, 1997; Vogel and Adams, 1997). It also suffers from the inability to report a rate of incrementality as does Uesugi et al. (2010).

Riding et al. (2007), Rivard (2018), and Seens and Song (2015) employ a two-stage approach to measure incrementality rates. The first step uses the sample including firms that received non-guaranteed loans and those whose loan applications were rejected. The step estimates a logistic/probit regression model on the probability of an SME obtaining a non-guaranteed loan with a set of firm and owner characteristic variables (it essentially estimates the adjudication model with which lenders decide whether to approve or reject the loan application). The second step

¹⁴⁸ They measure loan availability through four variables: ratio of loans (long-term, short-term, bills discounted) to total assets, ratio of long-term loans (loans with more than 1 year maturity) to total assets, ratio of short-term loans (loans with less than or equal to 1 year maturity) to total assets, ratio of long-term loans to the combined value of long-term and short-term loans, and ratio of interest payments to amount of loans.

applies the adjudication model estimated in the first step to a sample of SMEs who received guaranteed loans. This allows the prediction of whether each of the guaranteed loan recipients would have received the loan even in the absence of the CGS, from which the program's incrementality rate is estimated. This methodology gives an objective measure of an incrementality rate, free from respondents' possibly biased perceptions, which directly gauges the percentage of guaranteed loan recipient firms that would not have obtained financing without the program. Accordingly, this paper utilizes this methodology. In addition, it performs a hit rate test that assesses the predictive power of the estimated models (see III.5.4. robustness check for more detail).

III.5.3. Loan adjudication model

The first step of the analysis is to run a logit regression model (Equation (III-1)), on each sample period, for the sample of non-CSBF loan applications (which excludes those who received guaranteed loans). The dependent variable is a binary variable equal to one if the loan application was accepted; or zero if rejected. The independent variables are those indicative of applicant firm's characteristics thought to influence lenders' loan adjudication, including the firm's risk and profitability measures and loan/firm/owner attributes. The universe of the analysis is all businesses in the data (i.e., "respondents" to the survey) who either received a (non-guaranteed) term loans or whose term loan applications were denied.¹⁴⁹

$$probit[P_i] = \beta_0 + \tilde{\beta}_1 \widetilde{SME}_i + \tilde{\beta}_2 \widetilde{Owner}_i + \tilde{\beta}_3 \widetilde{Loan}_i + \tilde{\beta}_4 \widetilde{Financial}_i + e_i \quad (III-5)$$

where:

P_i = binary variable equal to one if respondent firm i's loan application was accepted or zero if it was rejected

$\widetilde{SME}_i$ = a vector of variables associated with respondent firm i

$\widetilde{Owner}_i$ = a vector of variables associated with respondent firm i's owner

$\widetilde{Loan}_i$ = a vector of variables associated with the loan applied by respondent firm i

$\widetilde{Financial}_i$ = a vector of variables extracted from the financial statements of respondent firm i

e_i = error term

Details of the firm-, owner-, and loan-characteristic variables as well as those extracted from financial statements of the firm are exhibited in Table III-1. It is ensured that these vectors include

¹⁴⁹ The CSBF limits the use of proceeds of the loan under the program to long term fixed asset financing (working capital financing is not allowed).

variables used as risk measures by several previous studies (e.g., Carbó-Valverde et al. (2013), Duchin et al. (2010), and Kremp and Sevestre (2013)). The final model will include a selection of variables that maximizes the predictive accuracy of the loan adjudication model, while minimizing multicollinearity. In order to avoid the endogeneity issue in the estimation of the loan adjudication model due to reverse causality, firms' financial variables (those retrieved from their financial statements) are one-year lagged in the spirit of Carbó-Valverde et al. (2013) and Kremp and Sevestre (2013).

Table III-1. Subgroups and control variables

Variable name	Description
<i>Subgroups</i>	
Gender	Categorical variable denoting if the firm's ownership is comprised of 1) majority men, 2) 50/50 men-women or 3) majority women.
Minority status	Dummy variable denoting one if the majority ownership of the firm is comprised of aboriginal persons, of persons with a disability, or of persons who are from a visible minority group (other than aboriginal); or zero otherwise. ¹⁵⁰
Exporter	Dummy variable denoting one if over 25 per cent of the firm's revenues originated from exports sales; zero otherwise.
Innovator	Dummy variable denoting one if the firm introduced any of the following innovations: a) a new or significantly improved good or service; b) a new or significantly improved production process or method; c) a new organizational method in your business practices, workplace organization or external relations; or, d) a new way of selling your goods or services; zero otherwise.
Growth intention	Ordinal variable for the firms' response to the survey question "in the next three years, what is the expected average yearly growth of your business' sales or total revenues?": 1) no growth or scale back business; 2) between 1% and 10% per year; 3) 10% or more per year.
<i>Firm characteristics</i>	

¹⁵⁰ Contrary to the gender variable, the SFGSME data do not allow for the categorization of 1) majority-owned by minority, 2) 50/50 minority-non-minority or 3) majority-owned by non-minority. Accordingly, the minority variable is binary and limited to two categories: 1) majority-owned by minority or 2) not majority-owned by minority.

Age	Categorical variable measured by years since firm inception: 1) New firm (under 3 years old), 2) Young firm (3 to 10 years old) or 3) Over 10 years old.
Size	Continuous variable measured by the natural logarithm of: (1) revenues; (2) total assets; and, (3) the number of employees. Of those, the one with least missing observations will be chosen. ¹⁵¹
Size ²	Squared of size.
Location fixed effect	Categorical variable denoting the location of the firm: Ontario, Québec, East coast or West coast.
Urban	Dummy variable denoting one if the firm operates in an urban area; zero if rural.
Industry fixed effect	Categorical variable denoting the firm's industry: 1) Goods (manufacturing and primary sector), 2) Wholesale/retail, 3) Professional services or 4) Other services.
Other financing	Dummy variable denoting one if the firm obtained other types of financing such as leasing, trade credit, equity or government grants; zero otherwise.
Past growth	Continuous variable measured by the firm's growth in the number of employees during the previous period ($t=-1$ to $t=0$, where $t=0$ is the year in which the survey was conducted).
Intended use of loan	Categorical variable for the answer to the survey question "What were the intended uses of this financing?": 1) research & development, debt consolidation, enter new market, and/or other purposes; 2) real assets.
<i>Owner characteristics</i>	
Experience	Categorical variable for the number of years owner has experience in managing a business: 1) 5 years or less; 2) 6 to 10 years; 3) more than 10 years.
Education	Ordinal variable for the highest level of education attained by the owner: 1) High school diploma or less; 2) A college/cegep/trade school diploma; 3) A bachelor's degree or higher. ¹⁵²
<i>Loan characteristics</i>	

¹⁵¹ Size is considered as a risk measure (see the discussion on this issue summarized by Kremp and Sevestre, 2013), and often found to be significantly positively correlated with the loan acceptance rate (Beck et al., 2005; Kremp and Sevestre, 2013).

¹⁵² Cegeps (Collège d'enseignement général et professionnel, General and professional teaching college as in English translation) are schools located in Quebec, Canada, that provide first level post-secondary education, such as pre-university and technical education programs.

Lender type	Categorical variable denoting if the loan was extended by a 1) Chartered bank, including Alberta Treasury Branches, 2) Credit Union / Caisse Populaire, or 3) Government institution.
Collateral requirements	Dummy variable denoting one if the lender required collateral from the applicant; or zero otherwise.
<i>Financial ratios</i> ¹⁵³	
Capacity (inversed)	Dummy variable equal to one if the ratio of amount of debt sought over total revenues is over one; zero otherwise.
Current ratio	Ratio of current assets over current liabilities.
ROA	Ratio of net income over total assets.
Profit margin	Ratio of net income over total revenues.
Gross margin	One minus the ratio of cost of sales over total revenues.
Account payable/Sales	Ratio of account payable over sales, to control for the firm's historical availability of trade credit.
Short term debt /Sales	Ratio of short-term debt over sales, to control for the firm's historical availability of operating loans.
Interest coverage	Ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) over interest expenses.
Financial slack	Ratio of tangible assets over total liabilities minus one.
Internal financing	Ratio of cash flow over size.
Debt capitalization ratio	Ratio of total liabilities over total liabilities and shareholder equity.
External/total equity	Ratio of externally raised equity over total shareholder equity, to control for the firm's historical availability of equity fund. It also controls for the owner's enthusiasm and belief about the firm's future success (skin in the game).
Productivity	Ratio of total revenues over the number of employees.
Working capital	Dummy variable equal to 1 if the firm's working capital is over one; zero otherwise.

¹⁵³ Unless specified otherwise, the financial ratio variables are converted to categorical variables denoting 1) if the firm's ratio value is equal or lower to the 30th percentile of the distribution; 2) if the firm's ratio value is between the 30th and 60th percentile; 3) if the firm's ratio value is above the 60th percentile.

EBITDA / debt	Ratio of EBITDA over total liabilities.
Sales / working capital	Ratio of total revenues over working capital.

III.5.4. Robustness check for the estimated loan adjudication model

To ensure the estimated model exhibits strong predictive power, a hit rate test will be performed as suggested by Heij et al. (2004) to assess the predictive power of the loan adjudication model estimated in step 1. The procedure is as follows. First, the sample of non-guaranteed applicants was randomly split into two samples: (1) an estimation (training) sample, representing 80 per cent of the whole sample (which is used to estimate the model parameters); and (2) a holdout (test) sample, representing 20 per cent of the whole sample (which is to assess the predictive accuracy of the model). Second, the hit rate test examines if the predictive accuracy of the model is better than a “random” predictor. The random predictor is equal to:

$$q = \hat{p}^2 + (1 - \hat{p})^2 \quad (\text{III-6})$$

where $\hat{p}$ is the fraction of approved loan applications in the holdout sample. Given the small number of rejected borrowers, the split-sample procedure (the procedure in which the total sample is split into the training and test samples) was repeated 100 times. The final predicted accuracy was based on the average predictive accuracy obtained from the 100 simulations.

III.5.5. Testing risk shifting and less thorough due diligence: Incrementality (Hypothesis 1)

The second step of the analysis is to use the loan adjudication model estimated in the first step to predict how many guaranteed loans are “incremental”, i.e., loans that would not have been approved in the absence of the guarantee program. More specifically, the estimated loan adjudication model estimated from the sample of non-CSBF loans (those not guaranteed by the CSBF program) will be used to predict the would-be loan application outcomes of firms that received a CSBF loan (if they were in the world without the guarantee program). The number of CSBF borrowers that are predicted to have been denied without the guarantee program (“incremental” loans) over the total number of guaranteed loans extended throughout the observation period represents the incrementality rate of the loan guarantee program for that year. That is:

$$\text{Incrementality rate} = \frac{\text{Number of CSBF loans that are incremental}}{\text{Total number of CSBF loans}} \quad (\text{III-6})$$

The lower the incrementality rate, the lower the guarantee program's performance in terms of the extent to which the program has attained its goal, i.e., to increase the supply of credit to small businesses. This study considers that the program is incremental when the majority of loans made under the program are incremental. More specifically, the program is regarded as incremental when more than 75 per cent of loans under the program are incremental, as Riding et al. (2007) conclude that the CSBF meets its incrementality goal with an estimated incrementality rate of 75 per cent.

III.5.7. Testing risk-taking (Hypothesis 2)

Hypothesis 2 predicts that given the absence of lender moral hazard in the form of overly risk taking, firms of which loan applications were approved under the CSBF program are less risky than those whose applications were rejected. Testing this hypothesis starts with the estimation of risk scores for CGS loan recipients and applicants who were rejected for their loan requests based on the loan adjudication model estimated in section 5.3. More specifically, the loan adjudication model will be used to predict the probability of default for CGS loan recipients and firms who were rejected for their loan requests. These model-predicted probabilities represent the risk score for each borrower (the higher the predicted probability of loan approval, the lower the risk score).

The second step compares the risk scores between these two groups of firms, based on which the “risk taking” ratio is estimated, which is the ratio of CSBF loans advanced to firms riskier than firms of which loan applications were rejected to the total number of CSBF loans:¹⁵⁴

$$\text{Risk taking rate} = \frac{\text{Number of CSBF loans advanced to firms more risky than rejected firms}}{\text{Total number of CSBF loans}} \quad (\text{III-7})$$

The final step involves the estimation of “appropriateness” rate of the CSBF program, which is the percentage of CSBF loans that is accounted for by those incremental, yet not overly risky. That is:

¹⁵⁴ More specifically, the number of CSBF loans that are riskier than rejected loans is the number of CSBF loans that have a lower predicted probability of approval than the lowest predicted probability of approval of all rejected loans.

$$\text{Appropriateness rate} = \frac{\text{Number of CSBF loans that are incremental and not overly risky}}{\text{Total number of CSBF loans}}$$

$$\text{Appropriateness rate} = \text{Incrementality rate} - \text{Risk taking rate} \quad (\text{III-8})$$

Such a rate represents the percentage of CSBF loans that: (1) would not be extended without the CSBF program; and, (2) are not resulted from lenders' attempts to bet on high risk loans, with which relatively greater profits should be expected (as high interest rates are justified) yet on which potential losses would be covered by the guarantor. In other words, it represents the percentage of CSBF loans that are not the result of any of the three forms of lenders' moral hazard – risk shifting, less thorough due diligence, nor risk taking – behaviours.

III.5.8. Testing subgroups (Hypothesis 3)

To test hypothesis 3, the share of CSBF loans over total loan applications will be compared between subgroups of interest, which are: exporters (versus non-exporters); innovators (versus non-innovators); women-owned firms (versus men-owned firms); and minority-owned firms (versus non-minority-owned firms). More specifically, assume the case where women-owned firms are found to be more severely disadvantaged in access to credit than the general SME population. If hypothesis 3 holds, the share of CSBF loans (the total number of CSBF loan recipients over the total number of loan applications (rejected, approved and approved via CGS loan applications) is expected to be higher for women-owned than for men-owned firms.

III.5.9. Testing the impact of exogenous factors (Hypothesis 4)

To test hypothesis 4, t-tests will be performed for predicted incrementality, risk-taking, and appropriateness ratios across different survey years (2011, 2014 and 2017). If hypothesis 4 holds, we should observe significantly lower incrementality and appropriateness ratios for 2011 relative to 2014/2017, and significantly higher risk-taking rates for 2011 relative to 2014/2017. The 2011 survey year is expected to reflect the impact of the recession subsequent to the 2007-2008 financial crisis.¹⁵⁵

¹⁵⁵ For example, Carbó-Valverde et al. (2013) found delayed impacts of the crisis, evidenced by an increase in credit constraints in 2010. Similarly, unemployment rates in Canada remained high in 2011 (higher than the 1998-2010 period).

III.6. Empirical findings

III.6.1. Descriptive Statistics

Table III-2 describes the pooled sample that combines the 2011, 2014 and 2017 survey data. Note that “Accepted” indicates firms that were approved for term/mortgage loans without the guarantee program (“accepted” borrowers); “Guaranteed” refers to those that were approved for term/mortgage loans under the guarantee program (“guaranteed” borrowers); and “Rejected” denotes firms that had their term/mortgage loan applications rejected (“rejected” borrowers).

Table III-2. Descriptive statistics

<i>Labels</i>		Accepted	Guaranteed	Rejected
Distribution		High (+***, +***)	Mid	Low
Distribution by survey year				
	2011	High (+***, +***)	Mid	Low
	2014	High (+***, +***)	Mid	Low
	2017	High (+***, +***)	Mid	Low
<i>Subgroups</i>				
Gender				
	Majority Men	Mid (-,+)	High (+*)	Low
	50/50	Mid (+,-)	Low (-)	High
	Majority Women	Low (-,-)	Mid (-)	High
Minority		Low (-,-)	Mid (-)	High
Exporter		High (+***, +)	Low (-)	Mid
Innovator		Low (-,-)	Mid (-)	High
Growth intention				
	No growth or scale back	Mid (+***, -)	Low (-***)	High
	1-10% growth	High (+***, +**)	Mid (+)	Low
	More than 10% growth	Low (-***, -*)	High (+)	Mid
<i>Firm characteristics</i>				
Age				
	New firms (<=3yrs)	Low (-***, -*)	Mid (-)	High
	Young firms (3-10yrs)	Low (-***, -***)	Mid (-)	High
	Established firms (>10yrs)	High (+***, +***)	Mid (+)	Low
Size (employees)		High (+*, +***)	Mid (+**)	Low
Province				

	Atlantic	Mid (-**,+)	High (+*)	Low
	BC and Territories	Mid (+***,-)	Low (-**)	High
	Ontario	Mid (+***,-)	Low (-***)	High
	Prairies	High (+,+)	Mid (+)	Low
	Quebec	Mid (-***,+)	High (+***)	Low
Industry				
	Goods	High (+,****)	Mid (+)	Low
	Wholesale/Retail	Low (-,-)	Mid (-)	High
	Professional services	Mid (+,-)	Low (-)	High
	Other services	Low (-,-*)	Mid (-)	High
Historical growth (1-year past employee growth)		Low (-**, -)	High (+)	Mid
Urban		Low (-, -***)	Mid (-*)	High
Whether the firm received other financing		Mid (+,-)	Low (-)	High
<i>Owner characteristics</i>				
Owner experience				
	5 years or less	Low (-**, -)	Mid (-)	High
	5-10 years	Low (-***, -)	High (+)	Mid
	More than 10 years	High (+***, +*)	Low (-)	Mid
Education				
	High school diploma or less	Low (-,-)	High (+)	Mid
	A college/cegep/trade school diploma	Mid (-,+)	High (+)	Low
	A bachelor's degree or higher	Mid (+,-)	Low (-)	High
<i>Loan characteristics</i>				
Loan purpose				
	R&D and other	Mid (+,-*)	Low (-**)	High
	Real assets	Mid (-**, +***)	High (+***)	Low
<i>Financial ratios</i>				
Debt capitalization ratio				
	30th percentile or less	High (+, +**)	Mid (+)	Low
	Between 30th and 60th percentile	High (+, +***)	Mid (+***)	Low
	Over 60th percentile	Low (-, -***)	Mid (-***)	High
Whether Amount requested / (Revenues + 1) is over 1 (capacity)		Mid (+***, -)	Low (-***)	High
Slack (Tangible assets / Total liabilities)				
	30th percentile or less	Mid (+, -**)	Low (-***)	High
	Between 30th and 60th percentile	Mid (+, -)	Low (-)	High
	Over 60th percentile	Mid (-, +***)	High (+***)	Low

Productivity (Revenues / Employees)				
30th percentile or less	Low (-***,-**)	Mid (-)	High	
Between 30th and 60th percentile	Mid (-,+)	High (+)	Low	
Over 60th percentile	High (+***,+*)	Low (-)	Mid	
Interest coverage ratio (EBITDA / Total interest expense)				
30th percentile or less	Low (-*,**)	Mid (-)	High	
Between 30th and 60th percentile	Mid (-,+**)	High (+**)	Low	
Over 60th percentile	High (+,+)	Mid (+)	Low	
Gross margin (1 - (Cost of sales / Revenues))				
30th percentile or less	Mid (+**, -)	Low (-)	High	
Between 30th and 60th percentile	Low (-,-)	Mid (-)	High	
Over 60th percentile	Mid (-,+*)	High (+**)	Low	
Current ratio (Current assets / Current liabilities)				
30th percentile or less	Mid (+,-**)	Low (-**)	High	
Between 30th and 60th percentile	Mid (-*,+)	High (+**)	Low	
Over 60th percentile	High (+**,+)	Low (-)	Mid	
ROA (Net income / Total assets)				
30th percentile or less	Mid (+,-*)	Low (-**)	High	
Between 30th and 60th percentile	High (+**,+***)	Mid (+)	Low	
Over 60th percentile	Low (-**, -)	High (+)	Mid	
Profit margin (Net income / Revenues)				
30th percentile or less	Mid (+,-***)	Low (-***)	High	
Between 30th and 60th percentile	High (+,+)	Mid (+)	Low	
Over 60th percentile	Mid (-,+***)	High (+***)	Low	
Internal financing (Cash / Total assets)				
30th percentile or less	High (+**,+)	Low (-)	Mid	
Between 30th and 60th percentile	High (+,+)	Mid (+)	Low	
Over 60th percentile	Low (-*, -)	High (+)	Mid	
Sales / Working capital ratio				
30th percentile or less	Low (-,-*)	Mid (-)	High	
Between 30th and 60th percentile	High (+***,+)	Low (-)	Mid	
Over 60th percentile	Mid (-*,+)	High (+*)	Low	
EBITDA / Total liabilities				
30th percentile or less	Mid (+**, -*)	Low (-***)	High	
Between 30th and 60th percentile	Mid (-,+)	High (+)	Low	
Over 60th percentile	Mid (-,+)	High (+*)	Low	
Observations	2-3k	0-1k	0-1k	

Approved borrowers largely outnumber guaranteed and rejected borrowers for the whole sample and throughout each separate survey year.¹⁵⁶ Overall, the results are generally as expected: that is, rejected applicants and guaranteed applicants exhibit higher credit risk in their financial statement and have less experience managing a business than approved applicants; and guaranteed applicants have lower credit risk than rejected applicants. The following summarizes the significant differences between the profiles of borrowers that obtained non-guaranteed financing, those that obtained guaranteed financing, and those that were rejected.

Subgroups

- **Exporter.** While some previous studies suggest that exporters may face higher difficulties in obtaining credit (see section III.4.2), the univariate results do not suggest any significant difference in loan approval likelihoods between exporters and non-exporters. The absence of supply-side constraints is rather consistent with Brown et al. (2011) and Riding et al. (2009) who also find no difference in loan approval likelihoods between exporters and non-exporters. Furthermore, guaranteed borrowers are less likely to be exporters compared to accepted borrowers, likely due to exporters requiring bank loans for working capital financing (for which the CSBF loans are not eligible).
- **Growth intention.** Accepted borrowers are more likely to express moderate growth intentions (one to ten per cent range) and less likely to aim high growth of their company (above ten per cent), compared to guaranteed and rejected borrowers. (Aiming at) high growth brings additional risk to the company (Binks & Enew, 1996; Myers, 1977; Psillaki and Daskalakis, 2009; see III.4.2.), while no/negative growth expectations may imply financial distress. Thus lenders prefer stable borrowers: those that intend to grow their firms in the future, but do not intend to grow at unrealistically high levels.
- **Innovator.** While accepted borrowers are less likely to be innovators compared to guaranteed and rejected borrowers, the differences are not significant. The lack of

¹⁵⁶ Approval rate is higher than 85 per cent for all three survey years.

significance could be due to the difference in the definition of the innovator variable between this study and previous studies that find significant differences.¹⁵⁷

- Minority- and women-owned. The univariate results do not suggest any significant difference in loan approval likelihoods between (1) women-owned and men-owned firms, and (2) minority-owned and non-minority-owned firms. Section III.4.2. reviewed existing studies that report significant impacts of gender and minority status on credit constraint, and those that find insignificant impacts. It appears that the univariate analysis of this study is in the latter group.

Owner characteristics, firm characteristics, and financial ratios

- Age and size. Accepted borrowers are older and larger than both guaranteed and rejected borrowers, and guaranteed borrowers are larger than rejected borrowers. This is consistent with the notion that small and young companies are riskier, at least partially due to increased information asymmetry that these firms are subject to (Berger and Udell, 1995), and lending to those firms are often not profitable due to the fixed costs associated with lending relative to the loan size (Stiglitz and Weiss, 1981, 1983).
- Location and industry. Proportions of accepted, guaranteed and rejected borrowers vary across both province and industry, highlighting the importance of controlling for province and industry. For example, approved borrowers are more likely to operate in the goods sector than rejected borrowers, consistent with Cowling et al. (2020)'s finding that firms in manufacturing and primary sectors are more likely to be approved.
- Urban. Rejected borrowers are more likely to reside in an urban area compared to accepted and guaranteed borrowers, consistent with Cole and Sokolyk (2016).
- Owner experience. Owners of accepted borrower firms have significantly longer experience in managing a business than owners of guaranteed borrowers, consistent with

¹⁵⁷ Wang et al. (2015) find that firms more engaged in innovation projects are significantly more likely financially constrained than those less involved in such projects, when a firm's level of involvement in innovative projects are measured by R&D expenditure as a proportion of turnover. However, they find no significant difference in the level of financial constraints between innovators and non-innovators when defining innovators as firms that had innovation introductions with respect to seven domains: product, process, work, supply, markets, administration, and distribution. This study's definition resembles the latter definition of Wang et al. than the former (a firm is considered as an innovators if the firm introduced any of the following innovations over the last year: (a) a new or significantly improved good or service; (b) a new or significantly improved production process or method; (c) a new organizational method in their business practices, workplace organization or external relations; or, (d) a new way of selling their goods or services).

Cole and Sokolyk (2016) and the notion that more experienced owners send a positive signal to lenders.

- Historical growth. Guaranteed borrowers have higher historical growth rates than accepted borrowers. This univariate result suggests that the CSBF works efficiently towards its goal, that is: to fuel business growth (ISED Canada, 2016).
- Debt capitalization. Rejected borrowers have more debt (relative to the long term assets) than approved and guaranteed borrowers, highlighting the risk of leverage recognized by lenders, and consistent with Cole and Sokolyk (2016).
- Capacity. Guaranteed borrowers are less likely to have a capacity ratio (loan amount requested divided by revenues) over one, compared to approved and rejected borrowers.¹⁵⁸ Lenders may prefer registering smaller loans under the CSBF to extend a higher number of small loans under the program rather than a lower number of large loans, given the restriction on their CSBF loan portfolios (claim up to a maximum 12 per cent of lenders' CSBF loan portfolio value).
- Slack. Accepted and guaranteed borrowers have higher levels of financial slack (tangible assets over total liabilities) compared to rejected borrowers, confirming the importance of the presence of tangible assets that borrowers can pledged as collateral.
- Productivity. Accepted borrowers have relatively higher levels of revenue per employee compared to guaranteed and rejected borrowers, as it sends positive signals to lenders (Riding et al., 2007).
- Interest coverage ratio. Guaranteed and rejected borrowers are relatively more likely to have lower levels of EBITDA over interest expenses compared to accepted borrowers.
- Gross margin. Accepted and guaranteed borrowers have higher levels of gross margin (gross profit over total revenues) than rejected borrowers.
- Loan purpose. Both accepted and guaranteed borrowers are more likely to report that the intended use of the loan proceeds was real assets compared to rejected borrowers. This is to be expected for accepted borrowers relative to rejected borrowers, given the ability for real assets to be pledged as collateral. This is also to be expected for guaranteed borrowers

¹⁵⁸ Since most firms are small (revenues are not significantly different across borrower types), the denominator of the capacity variable (revenues) is unlikely, and the numerator (loan size) is more likely, to drive the results found for the capacity variable.

relative to rejected borrowers since only loans for real assets can be registered under the CSBF. Compared to accepted and guaranteed borrowers, rejected borrowers are more likely to report that they intended to use the funds for R&D, debt consolidations, purchasing a business, entering a new market, or other purposes.

- Current ratio. Rejected borrowers have lower levels of current assets over current liabilities compared to accepted and guaranteed borrowers, consistent with Cole and Sokolyk (2016).
- Return on assets. Rejected borrowers have lower levels of net income over total assets compared to accepted and guaranteed borrowers, again consistent with Cole and Sokolyk (2016). Compared to accepted borrowers, guaranteed borrowers have higher levels of return on assets, suggesting that lenders may be extending CSBF loans that are not incremental.
- Profit margin. Accepted and guaranteed borrowers have higher levels of net income over total revenues compared to rejected borrowers, as found in Cole and Sokolyk (2016).
- Internal financing. Guaranteed borrowers have higher levels of cash over total assets than accepted borrowers, again suggesting that lenders may be extending non-incremental CSBF loans.
- Sales-to-working capital. Accepted borrowers are more likely to have levels of sales over working capital between the 30th and 60th percentile compared to guaranteed borrowers.
- EBITDA-to-debt. Rejected borrowers have lower levels of EBITDA over debt compared to accepted and guaranteed borrowers.¹⁵⁹

III.6.2. Loan adjudication model estimations

To estimate the loan adjudication model described in section III.5.3., for each survey year a sample was constructed in such a way that each included: (1) borrowers that obtained non-guaranteed term or mortgage loans and (2) those whose loan applications were rejected.¹⁶⁰ After accounting for incomplete records due to missing observations, the final non-guaranteed loan samples comprised a total of approximately 3,000 firms in the 2011-2017 period combined.

¹⁵⁹ Overall, rejected borrowers have lower levels of financial performance (higher debt capitalization, lower productivity, lower interest coverage ratio, lower gross margin, lower current ratio, lower return on assets, lower profit margin, lower EBITDA-to-debt), consistent with Cole and Sokolyk (2016) and the notion that rejected borrowers are of lower quality.

¹⁶⁰ Since the CSBF loans are all term and mortgage loans, the sample include only term/mortgage loan applications.

The model estimation follows Riding et al. (2007). First, Equation II-3 is estimated for the sample of term loan / mortgage applications with all available variables that are frequently reported by previous research as having a significant influence in lenders' loan adjudication decisions (e.g., Carbó-Valverde, Rodriguez-Fernandez and Udell (2013), Duchin et al. (2010), ISED Canada (2018), and Kremp and Sevestre (2013). Next, the redundant (collinear) financial variables were removed while ensuring to keep one variable to capture each risk dimension (e.g., default risk). Table III-3 presents risk dimensions, financial variables from Table III-1 that assess each dimension, and the variable that was retained by the model for each dimension.¹⁶¹

Table III-3. Correlated variables

Risk dimension	Financial variables	Selected variable(s)
Short term debt capacity	Capacity Current ratio Internal financing Sales / Working capital	Capacity
Default risk	EBITDA / Debt Interest coverage ratio	Interest coverage ratio
Profitability	ROA Profit margin Gross margin Productivity	Gross margin Productivity
Long term debt capacity	Financial slack Debt capitalization ratio	Financial slack Debt capitalization ratio

In addition, the following variables were excluded:

- Loan purpose: due to a high correlation between the amount borrowed (captured by capacity) and the intended use of the loan (ex. higher loan size for real assets).

¹⁶¹ The decision to keep a specific variable was based on the highest number of observations available. For example, if gross margin was available for 3,000 firms but profit margin was only available for 2,800 firms, gross margin was included instead of profit margin.

- The dummy variable controlling for whether the firm received other financing: given the endogeneity concerns resulting from the unobservable timing of financing applications (that is, whether the loan applications were submitted prior to, or following the receipt of other financing). Likewise, a firm may have applied for other financing after having applied for the term loan or mortgage; hence the outcome of the term loan / mortgage application would be a strong predictor of whether they would subsequently receive other financing, or vice versa.

The resulting “reduced” model is presented in column 2 of Table III-4.

Table III-4. Loan adjudication model

<i>Labels</i>	Base model (1)	Reduced model (2)
Industry fixed effects	YES	YES
Province fixed effects	YES	YES
Year fixed effects	YES	YES
<i>Subgroups</i>		
Gender (Base = Majority Men)		
50/50	-	+
Majority Women	-	-
Minority	+	+
Exporter	+	+
Innovator	-	-
Growth intention (Base = 1-10% growth)		
No growth or scale back	_*	_*
More than 10% growth	-	-
<i>Firm characteristics</i>		
Age (Base = New firms)		
Young firms (3-10yrs)	+	+
Established firms (>10yrs)	***	***
Size (employees)	****	****
Historical growth (1-year past employee growth)	-	-
Urban	-	-
Whether the firm received other financing	-	-
<i>Owner characteristics</i>		
Owner experience (Base = <5yrs)		
5-10 years	+	+
More than 10 years	+	+

Education (Base = High school diploma or less)		
A college/cegep/trade school diploma	***	***
A bachelor's degree or higher	+	+
<i>Financial ratios</i>		
Debt capitalization ratio (Base = ≤30th perc)		
Between 30th and 60th percentile	-	-
Over 60th percentile	_*	-
Whether Amount requested / (Revenues + 1)	***	***
is over 1 (capacity)		
Slack (Tangible assets / Total liabilities) (Base = ≤30th perc)		
Between 30th and 60th percentile	+	***
Over 60th percentile	+	***
Productivity (Revenues / Employees) (Base = ≤30th perc)		
Between 30th and 60th percentile	+	+
Over 60th percentile	***	****
Interest coverage ratio (EBITDA / Total interest expense) (Base = ≤30th perc)		
Between 30th and 60th percentile	****	***
Over 60th percentile	***	****
Gross margin (1 - (Cost of sales / Revenues)) (Base = ≤30th perc)		
Between 30th and 60th percentile	+	+
Over 60th percentile	+	***
Loan purpose (Base = R&D and other)		
Real assets	***	
Loan type = term loan	+	
Current ratio (Current assets / Current liabilities) (Base = ≤30th perc)		
Between 30th and 60th percentile	+	
Over 60th percentile	+	
ROA (Net income / Total assets) (Base = ≤30th perc)		
Between 30th and 60th percentile	_*	
Over 60th percentile	***	
Profit margin (Net income / Revenues) (Base = ≤30th perc)		
Between 30th and 60th percentile	****	
Over 60th percentile	***	
Internal financing (Cash / Total assets) (Base = ≤30th perc)		
Between 30th and 60th percentile	-	
Over 60th percentile	-	
Sales / Working capital ratio (Base = ≤30th perc)		

	Between 30th and 60th percentile	-	
	Over 60th percentile	_*	
EBITDA / Total liabilities (Base = <=30th perc)			
	Between 30th and 60th percentile	-	
	Over 60th percentile	-	
Constant		+	-
	Observations	2-3k	2-3k
Holdout sample hit rate			
	Predictive accuracy	91.7	92.1
	Random hit rate	87.3	88.1
	Hit rate test p-value	**	**

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The above results of multivariate modelling confirm several of the key results of the univariate analyses reported in Table III-2. Among control variables, variables that show results (in Table III-4) that are consistent with Table III-2 include:

- Age and size. Larger and older firms were more likely to have loan applications accepted: an expected result that is consistent with previous studies (e.g., Carbó-Valverde et al. (2013), Cole and Sokolyk (2016), Cowling et al. (2020), and Kremp and Sevestre (2013)).
- Debt-to-capitalization. The negative and significant coefficient for this variable highlights the importance of the firm's existing level of debt for lenders' loan adjudication.
- Capacity. Firms that borrow for amounts greater than that of their annual sales are significantly less likely to receive financing, consistent with higher default likelihoods associated with such borrowers (Nitani and Legendre, 2021).
- Productivity, interest coverage ratio, gross margin. Positive and significant coefficients of these variables show firms' cash generating ability (relative to the current level of leverage of the firm, in the case of the interest coverage ratio) as one of the important determinants for lenders' loan adjudication. These results are consistent with findings of previous studies (e.g. Cole and Sokolyk, 2016).
- Slack. The positive and significant association of this variable with the loan approval likelihood also shows the importance of the availability of collateral (as measured by tangible assets over total liabilities) for lenders' loan adjudication.

The only variable on which Table III-4 exhibit results different from Table III-2 is education. While the univariate analyses (Table III-2) shows insignificant impact of this variable, the multivariate analysis (Table III-4) reveals that owners with a college, Cégep or trade school diploma were relatively more likely to have loan applications approved relative to owners with no more than a high school diploma, suggesting that a practical education might constitute a positive signal to lenders.¹⁶² This is consistent with Cowling et al. (2020) who find that owners with A level education (a pre-university degree in the United Kingdom) were relatively more likely to obtain the financing they sought.

Among the subgroups of interest, the results in Table III-4 are generally consistent with the univariate results from Table III-2. That is, exporters, innovators, women-owned firms, and minority-owned firms are not more/less likely to be rejected compared to their respective counterparts. The growth intention variable in Table III-4 also exhibits a result similar to that in Table III-2: firms with no growth intention and those with scale back expectations are significantly ($p\text{-value} < 0.1$) less likely to be approved for their loan application compared to those that intend to grow. However, significant difference between firms with middle-level growth expectations (1-10% growth) and those with high growth expectations (over 10%), detected at the univariate level (Table III-2), disappears at the multivariate level (Table III-4).

To assess the predictive power of the loan adjudication models estimated above, predictive accuracy was gauged by use of holdout samples as described in section III.5.4. in step 1. The model correctly classifies 92.1 per cent of the holdout sample's loan application outcomes, which is significantly ($p\text{-value} < 0.05$) higher than the random hit rate of 88.1 per cent.

III.6.3. Incrementality estimation (Hypothesis 1)

Table III-5 summarizes the incrementality estimations for the whole sample, and by survey year, using the loan adjudication model estimated in section III.6.2.

Table III-5. Incrementality, risk-taking and appropriateness estimation

<i>Incrementality</i>	<i>2011-2017</i>	<i>2011</i>	<i>2014</i>	<i>2017</i>
	(%)	(%)	(%)	(%)

¹⁶² On the other hand, experience, which has a significant impact on the loan approval likelihood at the univariate level (Table III-2) turns out to be insignificant at the multivariable level (Table III-4).

<i>Incrementality rate</i>	5.3	3.8	6.5	6.5
<i>Risk-taking rate</i>	0.5	0.3	1.0	1.2
<i>Appropriateness rate</i>	4.8	3.5	5.5	5.3
Observations	Under 1k	Under 1k	Under 1k	Under 1k

For the whole sample, and for each separate survey year, hypothesis 1 is rejected. That is, the CSBF is not incremental – the majority of CSBF loans would have been approved without the credit guarantee scheme since the incrementality rates are surprisingly lower than the 75 per cent, the threshold incrementality rate above which indicates that the program is incremental, used in Riding et al. (2007). This might be due to the increase in the CSBF’s claim coverage limit from 10 to 12 per cent in 2009. Such an increase may have created space for lenders to include non-incremental loans under their CSBF portfolios. Accordingly, the CSBF may no longer adequately satisfy Proposition 1 (e.g., the CSBF does not adequately restrict the total amount of claims a lender can request to mitigate lender risk transfer).

The estimated incrementality rates are much lower than that reported in Rivard (2018), i.e., the CSBF program was 69 per cent incremental in 2014. This raises an important question regarding the quality of the estimated loan adjudication models. First, the reduced model in this study captures more firm and owner characteristics through control variables that are not included in the model used by Rivard (2018). The variables used in this study not incorporated by Rivard (2018) are exporter, owner experience, education, growth intention, innovator, minority status, gender, past growth, slack, productivity, interest coverage ratio and gross margin. Second, the final loan adjudication (reduced) model estimated in this study exhibits significantly higher predictive accuracy (92.1 per cent) than the random hit rate of 88.1 per cent. In contrast, the model used by Rivard (2018) has a lower predictive accuracy of 66 per cent. Accordingly, the difference in incrementality estimation is likely due to this study’s ability to capture additional firm and owner characteristics and a higher predictive accuracy.

The estimated incrementality rates are also much lower than that reported in Riding et al. (2007), who report that the CSBF was 74.8 incremental based on a sample of 208 SME term loan applications in 2000. The first difference between this study and Riding et al. (2007) is the different survey year. Between the time period used in Riding et al. (the year 2000) and this study’s time

period (2011-2017), several changes were made to the program that could explain why the incrementality is lower. The first difference is that the CSBF claim coverage limit in Riding et al.'s time period (the year 2000) was 10 per cent compared to 12 per cent in this study's time period (2011-2017). The second difference is that the CSBF only registered term loans in 2000, leading Riding et al. to exclude mortgage applications from their sample.¹⁶³ The third difference is that Riding et al. (2007) use data from a different survey, the Survey on Financing of Small and Medium Sized Enterprises (SFSME). The target population of the SFSME includes zero employee firms, while the survey data used in this study (SFGSME) does not include zero employee firms in their target population. These firms represent a significant portion of guaranteed loan recipients: 30-40 per cent of sample firms had no employees (own account self-employed). Given the higher likelihood of small firms being rejected reported in this study and in Riding et al. (2007), it is reasonable to expect most of these especially risky firms to have been classified as "rejected", therefore driving up the incrementality rate.

When looking at incrementality rate each year, we see that they vary across different survey years. Section III.6.6. will investigate this point further for testing Hypothesis 4.

III.6.4. Risk-taking (Hypothesis 2)

Table III-5 presents the risk-taking rates across each of the survey years. For the whole sample, and for each separate survey year, hypothesis 2 is accepted: almost all of firms that were accepted under the CSBF program are less risky than rejected borrowers. This might also have to do with the 12 per cent (of lender's CSBF portfolio) as the maximum claim coverage – with this restriction, coupled with the capped maximum chargeable interest rate, lenders are unlikely to engage in overly risk-taking activities under the CSBF program. Another possible explanation is the stability of Canadian banks resilient against the last financial crisis, evidenced by the almost unchanged Tier 1 Capital ratios exhibited by these banks before, during, and after the crisis period (Gravelle et al., 2013; Haltom, 2013). Accordingly, they do not need to bet on overly risky borrowers to increase profitability.

¹⁶³ The difference could also have been led by a very small sample size for Riding et al. (2007). More specifically, the non-guaranteed sample of term loans used to estimate the loan adjudication model only included 208 firm-loan applications, which may not necessarily be representative of the around 800 SFSME respondents that applied for term loans. Similarly, Riding et al. analyze 88 guarantee term loans to estimate incrementality, which may not necessarily be representative of the around 1,000 SFSME respondents that indicated that their financing was guaranteed.

Table III-5 also summarizes the appropriateness rates (incremental rates minus the risk-taking rates). Given that all risk-taking rates are no more than 1.2 per cent, the appropriateness rates are nearly identical to the incrementality rates.

III.6.5. Subgroup incrementality (Hypothesis 3)

Assuming the presence of subgroups of small businesses that may face particularly severe credit constraints than the general SME population, this subsection examines whether the credit guarantee scheme helps lenders address such relatively severe credit gaps faced by these subgroups. Sections III.6.1 and III.6.2 revealed no significance difference in loan approval for exporters, innovators, and women-owned and minority-owned firms. Thus, Hypothesis 3 (*A subset of firms that faces particularly severe credit constraints is more likely to receive a CSBF loan than a non-guaranteed loan*) predicts no difference in the share of CSBF loans across the respective levels of exporting, innovation, gender and minority status. On the other hand, both rejected and guaranteed borrowers are more likely to express no growth or set back intentions. Accordingly, hypothesis 3 predicts that the share of CSBF loans should be higher for borrowers with no growth intentions than borrowers with such intention.

Table III-6 summarizes breakdowns of the ratio between (a) the total number of CSBF loans to (b) the total loan applications (the sum of rejected, approved, and approved under CGS applications) for SME subgroups mentioned above.

Table III-6. CSBF loan share across subgroups

<i>Subgroup</i>	<i>CSBF share</i>	<i>T-test significance</i>
Exporter		
Not an exporter (1)	27.3	
Exporter (2)	7.5	**
Growth orientation		
No growth or scale back (1)	17.8	
1-10% growth (2)	22.6	
More than 10% growth (3)	34.3	(3 – 1) **
Innovation		
Not an innovator (1)	25.5	
Innovator (2)	25.2	
Gender		

	Majority men (1)	27.8
	50/50 (2)	28.4
	Majority women (3)	30.9
Minority		
	Not a visible minority (1)	25.1
	Visible minority (2)	27.5
	Observations	

- Exporters. Surprisingly, the share of CSBF loans is significantly lower for exporters than for non-exporters. This is not consistent with hypothesis 3, given the model results from Table III-4 or the results of Chapter II, which suggest no significant difference in rates of loan approvals between exporters and non-exporters. One possible explanation is that exporters are less likely to seek financing for real asset acquisitions (for which the CSBF loans are eligible), and more likely to require working capital financing (for which the CSBF is not eligible). Existing studies point out additional working capital financing required by international trades (Feenstra et al., 2014), as well as additional expenses firms incur via exporting activities (Manova et al., 2015), as revealed in Section III.4.2.
- Innovators. There seems to be no significant difference in shares of CSBF loans between firms with R&D involvement and those without. This is consistent with hypothesis 3 as no significant difference in the likelihood of loan approval between innovators and non-innovators detected in Section III.6.2 and Chapter II results.
- Minority-owned firms. While the share of CSBF loans is slightly higher for firms owned by members of visible minorities than for firms that are not owned by members of visible minorities, the difference is not significant. Again, this is consistent with hypothesis 3 given no significant difference in loan approval rate between minority and non-minority-owned firms in Table III-4 and Chapter II.¹⁶⁴
- Women-owned firms. Similarly, there seems to be no significant difference in shares of CSBF loans between majority women-owned firms and majority men-owned firms. Given

¹⁶⁴ The exception is the marginal evidence (significant only at the 10 per cent level) of statistical discrimination towards minority-owned firms found in Chapter II. However, the result was only marginally significant at the 10 per cent level, which could explain why this chapter finds a slightly higher share of CSBF loans for minority-owned firms, although the difference is insignificant.

no gender difference in loan approval likelihood detected in Table III-4 and Chapter II, this result supports hypothesis 3.¹⁶⁵

- Growth orientation. The share of CSBF loans for firms with high growth intentions (more than 10 per cent) is significantly higher than the share of CSBF loans for firms with no growth intention (significant at the 5 per cent level). This is not consistent with hypothesis 3, given that it is the “no growth” and “set back” intention firm group that is more likely to get their loan applications rejected (Table III-4). This result is likely related to one of the major goals of the CSBF, that is: “help firms grow” (ISED Canada, 2016; p. 1), based on which lenders provide more CSBF loans to growth-oriented firms.¹⁶⁶

III.6.6. Incrementality across time (Hypothesis 4)

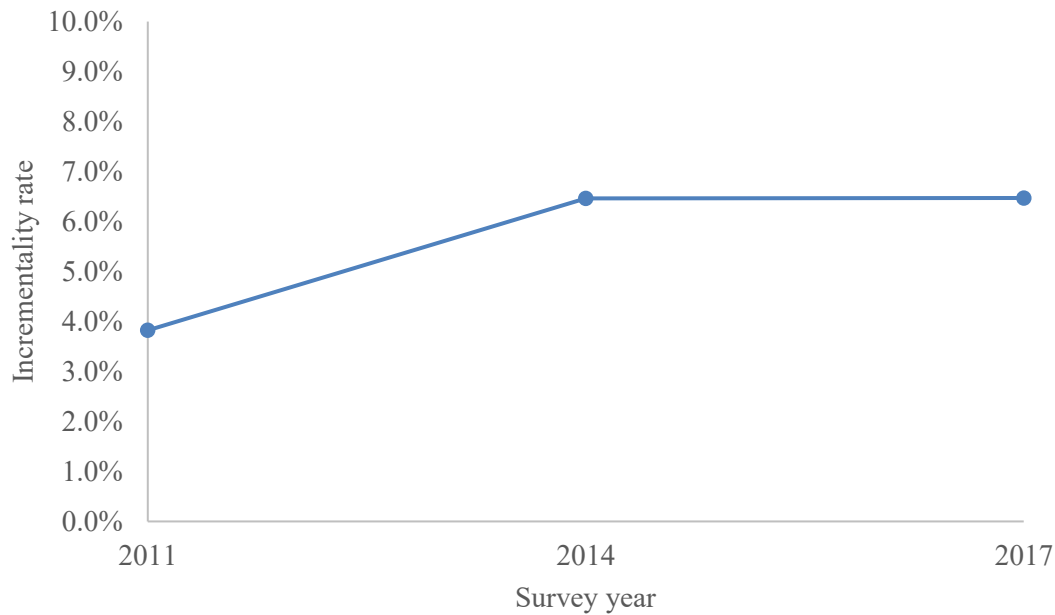
To test hypothesis 4, the estimated incrementality rates are compared between 2011 and 2014/2017, where 2011 represent a recession period (p-value <0.05).¹⁶⁷ Figure III-2 shows the evolution of incrementality across the three survey periods.

Figure III-2. Incrementality across time

¹⁶⁵ The exception is the evidence of statistical discrimination towards majority women-owned firms found in Chapter II. While women were less likely to be approved when managing large firms, they were more likely to be approved when managing small firms. These opposing effects may offset each other’s discrimination impact (e.g. for each large firm woman owner that is denied because of statistical discrimination, a small firm woman owner is accepted because of statistical discrimination). Accordingly, there would be no reason to expect a higher amount of CSBF loan share for women-owned firms in Chapter III. Unfortunately, investigating the gender differences in CSBF loan shares for small and for large firms is not feasible due to the very small sample sizes of CSBF loans for each subgroup across firm size categories.

¹⁶⁶ In the univariate analyses (Table III-2), high growth intention firms are significantly less likely to obtain loans. Thus the result (a higher CSBF loan share for high growth intention firms) is consistent with hypothesis 3 if the univariate result is taken into account.

¹⁶⁷ Given the almost zero risk-taking rates, the incrementality and appropriateness rates are almost identical and the risk-taking and appropriateness rates are thus not reported here.



Hypothesis 4 predicts that CSBF performance is lower in 2011 compared to post-crisis (2014/2017) periods due to the potential deterioration of lenders' ethics, coupled with the expansion of the CSBF program (discussed in Section III.4.3) and a decrease in loan demand – the combination of which might have created a pressure to “extend” loans. While the program performance is slightly lower as measured by the incrementality rates (higher in 2014 and in 2017 than in 2011), the differences are not significant. Accordingly, hypothesis 4 is rejected: CGS performance does not seem to be lower during the recession period. One possible explanation is that the CSBF does not impose a quota on lenders. Therefore, the Government pressure to extend guaranteed loans observed by international studies (e.g. Levitsky, 1997; Norway Ministry of Finance, 2020) is not likely to have occurred for Canadian lenders. Another possibility is related to the stability of Canadian banks mentioned earlier. Since their stability, as measured by the Tier 1 Capital ratio, allowed them to isolate themselves from the crisis to a certain extent, the crisis did not change Canadian banks' needs to: (1) place more loans under CSBF to lower the risk of their non-CSBF portfolios; and (2) take additional risk (risk-taking) to improve their performance.

III.7. Conclusion

SMEs contribute disproportionately to job creation and economic growth. However, they are also widely believed to suffer from limited availability of financing, which could impede their potential

to grow. The assessment of CGS program performance is crucial to ensure that governments effectively address credit gaps, if present, faced by small businesses, and that taxpayers' contributions are not wasted. This chapter improves on previous attempts to estimate incrementality through a new approach that assesses the effectiveness of a CGS using measures additional to the most widely employed measure (the incrementality rate). In doing so, this research reports on an investigation of the Canadian CGS program's performance: across subgroups of borrowers that thought to be considered more disadvantaged in credit access; and across different time periods (the recession and post-recession periods). The findings are summarized as follows.

First, this study finds that the CSBF is not incremental. Specifically, this study estimates that only 5.3 per cent of CSBF loans between 2011 and 2017 are incremental. This estimate is substantially lower than that of Rivard (2018)'s estimate of 69 per cent for 2014, the model used in this chapter controls for firm and owner characteristics additional to those controlled for in the model used by Rivard (2018), and exhibits higher predictive accuracy (92.1 per cent compared to 66 per cent). One possible explanation for the low level of incrementality is that the CSBF's restriction on the total default claims allowed by lenders (12 per cent of their CSBF portfolio) is too high. As shown in Section III.4.1., a high default claim coverage limit could create room for lenders to register non-incremental loans (risk transfer). Another possible explanation is that approval rates for non-guaranteed SME loans are high in Canada (over 90 per cent). Since not many SME loans require registration through the CGS, this allows lenders to place non-incremental loans under the CSBF in order to minimize the risk of their portfolios.

Second, this study argues that the incrementality rate is an incomplete measure because it is unable to capture lenders' use of risk-shifting and less thorough due diligence. The latter represent moral hazard in the form of taking advantage of the loan guarantee to accept relatively greater lending risks than they would absent the guarantee. It thereby conceives an additional measure that gauges lenders' actions with regard to placing bets on overly risky loans, knowing that a high proportion of losses are covered by the program. Empirical tests, using this measure, of the performance of Canada's CGS suggest that lenders do not engage in such risk-taking behaviors. This is consistent with the argument that lenders are unlikely to engage in overly risk-taking activities under the CSBF program given that the program limits the maximum chargeable interest rate on CSBF loans,

has a coverage ratio less than 100 per cent, has the right to audit lenders, and that the Canadian banking sector is highly competitive (Dinç, 2000). Another possible explanation is that Canadian banks were stable and did not need to place more loans under CSBF to take additional risk to improve their performance. It appears that the coverage limit the CSBF imposes is low enough to discourage lenders from taking overly-risky borrowers (given the stable bank environment), but is still too high leading to additional space in their CSBF portfolios in which lenders include non-incremental loans.

Third, this chapter analyzes the CGS performance across different sub-groups of small businesses and across multiple time periods. Consistent with the results of Chapter II, the current chapter revealed that minority-owned firms, women-owned firms, exporters, and innovators, and growth-oriented borrowers do not face relatively higher likelihoods of being credit constrained. Accordingly, the share of CSBF loans within subgroup levels (e.g., minority-owned vs. non-minority-owned) do not differ significantly, except for exporters vs. non-exporters. Among exporters, the share of CSBF loans is significantly lower for exporters relative to non-exporters. One possible explanation is that exporters are more likely to seek working capital financing rather than loans for real asset acquisitions. As for the growth intention, the multivariate analyses show that no growth and set back firms are more likely to be rejected for their loan application, yet the share of CSBF loans is significantly higher for high growth-oriented (more than 10 per cent) borrowers than firms that do not intend to grow or intend to set back. This is not aligned with one of the CSBF goal “to improve access to loans that would not otherwise be available to small businesses” (Industry Canada, 2014: p. 1). However, this finding is consistent with the other goal of the CSBF: “help firms grow” (ISED Canada, 2016; p. 1), which might have prompted lenders to provide more CSBF loans to these growth-oriented firms. Future research could investigate whether supporting no growth/set back firms – likely in financial distress – could translate in more economic stability and social welfare.

Furthermore, this study finds that CGS performance did not differ significantly between post-crisis and crisis periods, which is likely due to: (1) the absence of a CSBF quota that pressures lenders to extend more loans; and (2) the stability of Canadian banks, which lowers the needs to place more loans under CSBF to lower the risk of their non-CSBF portfolios or to take additional risk (risk-taking) to improve their performance. Overall, this study provides two elements of “good

news” with respect to CSBF performance: there is no evidence of risk-taking behaviour and the CSBF does not appear to oversupply guaranteed loans to enterprises that do not face higher difficulties in accessing financing. Conversely, there is “bad news” to the effect that the level of incrementality is low.

Like most empirical work, the analyses reported in this chapter are not without limitations. First, while this study attempts to gauge the extent to which lenders undertake CGS-induced moral hazard, borrower moral hazard in this regard is outside of the scope of this research. One possible extension of this research could address this point to examine the extent to which a CGS induces borrower moral hazard. Another limitation of this research relates to pre-2011 data: future research with data that extends to pre-crisis periods could investigate how the CSBF program changed from a pre-recession to a recession period, however, pre-2011 survey data were not consistent with the data employed herein.

Overall, this study provides a yet better understanding of SME financing, shedding additional light on the academic literature and public sectors that contemplate means of alleviating financing difficulties associated with SMEs. The policy implications drawn from this chapter can be summarized as follows. First, the CSBF program does not seem to be achieving its objective of providing loans to borrowers that would not have received a loan without the CGS (not incremental). However, lenders are not extending CSBF loans to borrowers that are riskier than rejected borrowers. CGS administration may consider further informing lenders about the goal of program incrementality. Given the low risk-taking rate found in this study, lenders may be too risk averse with respect to CGS loans.

CONCLUSION

This thesis addresses the issue of SME financing constraints from three different yet interrelated perspectives. It thus comprises three chapters which collectively investigate relationships among SME growth and credit constraints; impacts of firm characteristics on the SME debt acquisition process; and the performance of a widely-used form of policy intervention (credit guarantee schemes, CGSs).

The first chapter responds Fraser et al.'s (2015) call to investigate several crucial research questions not yet addressed in the literature of the growth-credit availability relationships. It quantifies the impact of financial constraints on growth, while (1) considering both the availability of bank loans and trade credit; (2) assessing the effect of supply- and demand-side constraints separately; and (3) controlling for firms' need for credit, desire to grow, as well as the availability of other sources of financing. After doing so, it finds evidence consistent with the premise that that firms whose owners (a) seek growth, (b) who apply for and (c) obtain bank debt or trade credit experience higher growth in the year following receipt of financing than do growth-oriented firms that were demand- or supply-constrained.¹⁶⁸ In the longer term (two years after receiving financing), the difference in growth between growth-oriented firms that applied for and obtained bank debt or trade credit and growth-oriented firms that were demand-constrained disappears. Also, growth-oriented firms that applied for and obtained bank debt exhibit higher growth in revenues than growth-oriented firms that were supply-constrained. When separating term loans and lines of credit within the bank debt sample, obtaining term loans were found to be the main driver of the growth differences mentioned above.

Second, while there is extensive literature that investigates SMEs' debt acquisition process, most of which fails to address the correlations and dependencies across the three stages of the debt acquisition process (need for, apply for, and obtain bank loans). The second chapter uses an unbiased econometric approach suggested by Drakos and Giannakopoulos (2018) to estimate the three related stages in order to draw a more complete assessment of the SME debt acquisition process. It focusses on four firm characteristics: gender and minority status of the owner, the level

¹⁶⁸ In terms of: employee and asset growth for term loans; and, employee, revenue, and productivity growth for trade credit.

of innovation, and exporter status. It finds that exporters and innovators do not face relatively more severer levels of demand-side and/or supply-side constraints. However, firms majority-owned by women and firms majority-owned by members of visible minority groups are more likely to face demand-side constraints and statistical discrimination when seeking credit. More specifically, women are more likely to have loan applications rejected compared to men when managing large firms, yet less likely to be rejected when managing small firms. Similarly, members of visible minority groups are less likely to be approved compared to owners that are not members of visible minority groups when reporting high gross margins. This might imply that lenders have perceptions that these firms use different standards when reporting financial performance. This chapter also detects differences in profiles of demand-constrained firms when different definitions of demand constraints are used. For example, women are even more likely to refrain from applying loans for fear of rejection, while innovators are less likely discouraged for this reason.

The third chapter assesses the performance of the CSBF program (Canada's CGS program) based not only on the incrementality rate, a widely used measure of CGS performance in existing studies, but also on a new measure developed in this study. The new measure evaluates the extent of lenders' excessive risk-taking behavior (which cannot be captured by the incrementality rate). It finds that while the CSBF program is not incremental (the incrementality rate is 5.3 per cent), Canadian lenders do not appear to be engaging in excess risk-taking behavior. It also finds that the Canadian CGS's performance does not vary significantly between recession and post-recession periods. While Chapter 2 identifies that women- and minority-owned firms might be subject to statistical discrimination in the loan application process, this chapter does not find any tendency among lenders to allocate more guaranteed loans to these groups of firms. Rather, lenders favor allocating guaranteed loans to growth-oriented borrowers (consistent with the goal of the CSBF to provide loans to growth-oriented firms).¹⁶⁹

Like most empirical work that relies on analyses of secondary data, the results reported herein are not limitation-free. Questionnaires for the periodic surveys conducted by Statistics Canada, used

¹⁶⁹ Exporters and innovative firms are not found to be supply-side constrained in Chapter 2. Consistent with this, Chapter 3 does not find lenders' tendency to allocate more guaranteed loans to innovators. For exporters, the share of CSBF loans are significantly lower for this group of firms than non-exporters, which might be explained by the tendency of exporters to be less likely to seek financing for real asset acquisitions (which is eligible under the CSBF), and more likely to require working capital financing (which is not eligible under the CSBF).

exclusively in this dissertation, are not identical from one to another. Some variables are not available for every survey year or are not consistently measured.¹⁷⁰ In addition, the investigation of statistical discrimination in the present dissertation is unable to distinguish between conscious or unconscious bias. Further research, particularly qualitative research, could help to assess the origins of discriminations biases. Experimental studies, for example, could be employed to assess the length of time lenders allocate to the review of financial information for firms that are majority-owned by women compared to those majority-owned by men.

Nevertheless, this work uses datasets that, compared to other existing sources of survey data, provide detailed information on the characteristics of respondent firms, their owners, and financing applications and outcomes. The data also include tax-based, comprehensive, and consistently-gathered financial statement information for each of the surveys for periods before and subsequent to the survey years. The multiple sources of data, the high survey response rates and the complex data weighting mitigate biases emanating from selection or key respondent biases.

These rich and unique datasets enable this PhD dissertation to contribute to the academic literature and policy-making in several ways. First, the findings of Chapter I suggest that policy initiatives that seek to promote the growth of SMEs should focus on (a) the availability of term loans and trade credit rather than on lines of credit, and (b) on the alleviation of both demand- and supply-side constraints. Second, the results of Chapter II suggest that while initiatives that seek to alleviate constraints faced by innovators and exporters may not be useful, there is a need for increased support that focuses on alleviating demand-side constraints among women and members of visible minority groups. There remains a need to address statistical discrimination faced by such groups of entrepreneurs. Third, the findings from Chapter III suggest that CGS administration should further emphasize the goal of incrementality and remind lenders to register loans under the CGS to borrowers that would not otherwise be able to receive a loan.

¹⁷⁰ For example, a variable indicative of the demand-side constraint is available for all but the 2007 survey, forcing this study to exclude the year when estimating the entire debt acquisition process as well as the impact of credit constraint on growth.

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APPENDICES

Appendix 1. Summary of growth and financial constraint literature

Author	Sample size, period, and country	Methodology	Summary	How do they measure financial constraint?	How do they measure growth?
Banerjee (2014)	SME survey data European Commission/EC B SAFE survey (2013), European Commission pilot survey (2005) and World Bank's World Business Environment Survey (1999-2000)	OLS (1999-2000) - DV= Employment and sales growth - IV= age, size, industry, listed, subsidiaries Probit (1) 2005 and 2013 - DV= 1 if new loan size > €100,000, 0 otherwise - IV= age, size, dummy on whether access to finance is firm's most pressing problem, interaction between the formers, country, industry, difficulty of finding customers, strength of competition, input costs, difficulty finding staff and regulation Probit (2) 2005 and 2013 - DV= 1 if profits increased, 0 otherwise - IV= age, size, dummy on whether access to finance is firm's most pressing problem, interaction between the formers, country, industry, difficulty of finding customers, strength of competition, input costs, difficulty finding staff and regulation	How financial constraints impact subsequent SME performance. 1st OLS: young firms' growth is significantly higher than for older firms. 1st probit: interaction between young firms (<5 years) and financial constraint is significantly negatively related to the probability of obtaining a new loan. The financial constraint variable, on its own, is positive and significant. 2nd probit: older firms are more likely to experience profit increases, and smaller firms are less likely to experience profit increase. The interaction between age and constraint is significant and negative for older firms. Not control for finance that is already available, does not properly estimate coefficients for interaction terms in the probit models	Survey question: dummy variable on whether access to finance is the firm's most pressing problem	Survey question: continuous employment and sales growth over three years subsequent to the survey

Rahaman (2011, JBF)	FAME database Panel data on UK and Irish large firms from 1991-2001 5,214 firms total	Arellano and Bond's (1991) differenced-GMM Separate estimations for small, medium-sized, and large firms - DV= 1-year employment growth - IV= size (assets), age, leverage [current ratio, financial leverage [debt/assets] and financial slack [tangible assets/liabilities]], governance (number of independent board directors), internal fund (1-year change in equity), bank credit facility (short-term bank loans and overdrafts / total liabilities), interaction between internal funding and bank credit facility, firm fixed effects - Instruments: lagged internal funding and bank credit facility Robustness checks - Redo above with profit margin to measure available internal funding - Im et al.'s (2003) panel co-integration test - Engle-Granger (1987) causality test from internal funding and bank credit facility to firm growth - Logit on inorganic growth (=1 if firm growth was > 100%, 0 otherwise) to control for potential growth through M&A instead of "organic" growth	Investigate the impacts of internal and external sources of financing on growth. The effect of internal financing decreases with an increase in the firm's access to external financing. These findings are more severe for small and unquoted firms.	Firm's access to credit facility as suggested by Suffi (2009, RFS): Short-term bank loans and overdrafts / Total liabilities	Continuous employment and sales growth over the year after the survey (log of the difference from t to t-1)
Beck et al. (2005, JF)	WBES survey and firm level data on over 4,000 firms from 54 countries (1995-1999)	Regression (they do not specify if multinomial or OLS) - DV= scale of 1-4 for how important financing obstacle is for operation and growth - IV= domestic bank credit to private sector / GDP, country legal system development, corruption indicator, size of the firm, interactions between size and all previous variables, country random effects	Impacts of financial, legal and corruption issues on firm growth. 1st regression: firm's perception on the severity of the financing obstacle is significantly higher for small firms (size is an important predictor for what obstacles to growth the firm perceives).	Survey question: on a scale of 1-4, how problematic are financing issues for the operation and growth of the business?	Percentage change in firm sales over the past 3 years

		OLS (2) obstacles - DV= firm sales growth rate - IV= government ownership, foreign ownership, exporter, subsidized, number of competitors, industry, country inflation, GDP, GDP per capita and GDP growth rate, financing obstacles, legal obstacles, corruption obstacles OLS (3) financing obstacles - DV= firm sales growth rate - IV= government ownership, foreign ownership, exporter, subsidized, number of competitors, industry, country inflation, GDP, GDP per capita and GDP growth rate, 11 financing obstacle dummies OLS (4): identical to (3) with size interactions with financing obstacle dummies OLS (5): identical to (3) with interactions with financing obstacle dummies and country level development (domestic bank credit to private sector / GDP, country legal system development, corruption indicator). OLS (6): identical to (3) with interactions among size of the firm, financing obstacle dummies, and country level development. Robustness checks - Reverse causality: lack of growth from firm will lead them to report/blame financial obstacles - Solution: use country level measures as instruments	2nd OLS: perceived financing obstacles have a significantly negative impact on firm growth. 3rd OLS: the top 3 financing issues that influence firm growth are higher interest rates, banks lack of money to lend and bank paperwork. 4th OLS: impact of financing issues is larger and more significant for small firms. 5th OLS: financing obstacles have less impact in countries with more developed financial and legal systems and less corruption. 6th OLS: impacts of the level of development in country's financial system and the level of corruption is stronger for small firms (shown by triple interaction).	Financing issues: (1) collateral requirements; (2) bank paperwork and bureaucracy; (3) high interest rates; (4) need for special connections with financial institutions; (5) banks lacking money to lend; (6) access to foreign banks; (7) access to nonbank equity; (8) access to export finance; (9) access to leasing; (10) inadequate credit and financial information on customers; and (11) access to long-term loans	
Motta (2018, SBE)	Cross-sectional firm-level data from WEBS	OLS (1) labor productivity DV= labor productivity (log of total annual revenue per number of employees)	The relationship between SMEs' export activities, access to external finance and labor productivity.	Credit constrained if they were rejected or	Labor productivity, measured by the natural log

	Brazil 2009	- IV= project quality (export sales), credit constrained (rejected or discouraged), dummy on whether financing is perceived as an obstacle, age, size, sector, sole proprietor, owner experience, gender GDP per capita, income per capita, years of schooling in Brazil Treatment effect using propensity score matching - Treated = with a loan - Untreated = without a loan - Probit: to estimate the probability of receiving treatment, conditional on observable characteristics OLS (2) labor productivity – estimated with whole sample and for both treatment groups - DV= labor productivity (log of total annual revenue per number of employees) - IV= same as OLS (1), with interactions between exports and credit constrained, and exports and financing obstacle OLS (3) labor productivity – estimated with whole sample and for both treatment groups - DV= labor productivity (log of total annual revenue per number of employees) - IV= same as OLS (2) except that the export variable is split into 2 variables: indirect and direct)	1st OLS: credit constrained firms have significantly less labor productivity. Young firms and exporters have significantly more labor productivity. 2nd OLS: Marginally significant (10%) negative coefficient is found for exporters that also perceive financing as an obstacle. 3rd OLS: When splitting exporters between direct and indirect, the interactions become significant at the 1% level for exporters (direct) that perceive financing as an obstacle and exporters (indirect) that did not obtain a loan or were discouraged.	discouraged for a loan application	of total annual revenue per number of employees
Botazzi et al. (2012, SBE)	Italian firm-level data on 161,297 firms from 2000-2003	ML with asymmetric Laplace residuals estimated for three samples: non-financial constrained (NFC), mildly FC, and highly FC - DV= firm growth (natural log of the 1-year difference in total sales) - IV= drift component, Gibrat's benchmark, age, assets, gross operating margin, lagged total sales (autoregressive component)	Younger firms grow significantly less, no matter how financially constrained they are, yet the effect is stronger for highly constrained firms. The firm's assets is positive and significant in explaining growth, which the authors view as evidence that hard assets provide collateral to finance growth when credit rating is low. The firm's	Official credit rating from CeBi (private company owned by Italian banks to share information on firms)	Natural log of the 1-year difference in total sales

		Robustness checks - Exponential term to model heteroskedasticity of growth shocks - Lagged assets and gross operating margin - Industry effects - asymmetric exponential power (AEP) estimates of growth shocks distribution	gross operating margin also positively impacts firm growth, especially for highly constrained firms. The magnitude of all these coefficients are increased the more the firm is constrained (sample with highly constrained has larger coefficients).		
Hutchinson and Xavier (2006, SBE)	Firm level data from Belgium (1993-2000) and Slovenia (1994-2002)	First-differenced GMM – Estimated for micro firm, SME, and large firm samples - DV= 1-year asset growth - IV= growth in real turnover (operating revenue), internal finance (real cash flow = net operating income plus depreciation), capital stock (total tangible fixed assets), time effects, unobserved sector heterogeneity, year-sector interactions - Instruments: lagged real cash flow (1-year and earlier) Sample definitions - Micro-firm: employees <10 & real turnover <2 million euros - SME: employees <250 & real turnover <50 million - Large firms: employees ≥250 & real turnover ≥50 million	Growth of Slovenian firms is more sensitive to their internal funding because of the lack of external finance available in Slovenia. Foreign-owned firms seem to be able to mitigate external finance constraints as evidenced by their lower reliance on internal funding. Growth of large firms is less dependent on internal funds than SMEs and micro firms.	Sensitivity of growth to internal finance (real cash flow). Most of Slovenian firms are credit constrained.	Log change in total assets (1-year)
Brown et al. (2011)	Cross-country loan-level data from 2004/2005 and 2008 surveys in Western and Eastern Europe	Descriptive statistics - Average sales, employees, innovation and R&D investment growth is calculated between 2005 and 2008 - Averages are compared through subgroups: (1) has loan, (2) rejected, (3) discouraged, (4) no need, and (5) all firms - T-tests on difference between subgroup (1) and all other (1 vs 2, 1 vs 3 and 1 vs 4)	There is a positive link between credit access and growth. Firms that were rejected or discouraged display weaker growth than those that applied and got accepted for a loan. However, difference is only significant for R&D investment and product innovation.	Credit constrained if they were rejected or discouraged for a loan application (survey question)	- Difference in sales and employees between 2005 and 2008. - Difference in % of firms that invested in R&D and

					product innovation
Ullah (2019)	Cross-country firm-level data from 2011 to 2014 in Eastern Europe and Central Asia	OLS (1) Sales growth - DV= $(Sales_{it} - Sales_{it-2}) / (Sales_{it} + Sales_{it-2})$ - IV= credit constraints, size, age, export status, foreign ownership, government ownership, largest ownership stake, privatized, industry OLS (2) Employment growth - DV= $(Employees_{it} - Employees_{it-2}) / (Employees_{it} + Employees_{it-2})$ - IV= same as OLS (1) Heckman (1979) Selection - DV= binary financially constrained variable - IV= audited, size, age, export status, foreign ownership, government ownership, largest ownership stake, privatized, industry - Main equations are OLS (1) and (2) above Ordered Probit (1) Financial constraints - DV= scale of 1 to 4 on how problematic access to finance is for the firm - IV= size, age, export status, foreign ownership, government ownership, largest ownership stake, privatized, industry, country	Financial constraints negatively impact firm sales and employment growth.	5 separate measures of constraint. Credit constrained if the firm: - Did not purchase any fixed assets last year - Does not have an overdraft facility - Does not have a line of credit or loan from financial institution - Definitions 2 and 3 combined - Reported that access to financing is a major or severe obstacle	$(Sales_{it} - Sales_{it-2}) / (Sales_{it} + Sales_{it-2})$ $(Employees_{it} - Employees_{it-2}) / (Employees_{it} + Employees_{it-2})$
Gambini and Zazzaro (2013)	Firm-level 2001 and 2004 survey data in Italy	OLS on Size growth - DV= annual growth rate of employees and assets (average over survey period) - IV= size, age, length of banking relationship, cash flow, leverage, export, group, R&D, M&A, HH index, local bank, # of bank branches, coop bank market	Banking relationships hinder the growth performance of small firms. Their first regression shows that credit rationing has a significant and negative effect on employment growth. Their last Heckman regression shows that credit rationing increases	Financial constraint = 1 if the firm reports it had desired more credit at the interest rate agreed with the	Average annual growth rate of employees and assets (size) measured by the difference

		share, savings bank market share, credit rationing, new bank branches, number of bank relationships, average length of bankruptcy trial in the province Quantile regression on Size growth - DV= annual growth rate of employees and assets (average over survey period) - IV= same as OLS but no credit rationing Multinomial logistic regression on Size growth - DV= positive growth, no growth or negative growth in employment - IV= same as OLS but no credit rationing Heckman – subsample of firms with positive growth – on Size growth - DV= growth rate if positive - IV= same as OLS - Selection equation=same as OLS, as well as ROA, default risk, financial constraint Heckman – subsample of firms with negative growth – on Size growth - DV= growth rate if negative - IV= same as OLS - Selection equation=same as OLS plus ROA, default risk, financial constraint	the likelihood of experiencing negative growth rates.	bank, zero otherwise.	in ln(size) between two periods
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Appendix 2. Data confidentiality

In order to ensure data confidentiality, Statistics Canada restricts the number of outputs (analysis results) that can be released from its databases. Accordingly, this thesis presents empirical results in a manner that is in compliance with Statistics Canada's suppressed output format. The approach is described as follows.¹⁷¹

Example 1. Descriptive statistics

The following is an extract from Table IV (p. 57) of Riding et al. (2007).

<i>Labels</i>	Ordinary term	CSBF loans
	loans	
Number of employees	35.54	19.18
Productivity (log(sales/employee))	11.56	11.00
Owned by visible minority	6.0%	11.0%
Observations	281	101

Suppressed output

Compliance with the Statistics Canada suppressed output format transforms the above table to the following:

<i>Labels</i>	Ordinary term	CSBF loans
	loans	
Number of employees	High	Low

¹⁷¹ The final outputs (with actual estimated figures) will be requested and included in this research at the final stage of this research (papers for journal publications); however, there is no guarantee that Statistics Canada will permit release of all results.

Productivity (log(sales/employee))	High	Low
Owned by visible minority	Low	High
Observations	Under 1k	Under 1k

In both outputs, the interpretations of the mean values are the same. That is, recipients of ordinary term loans tend to be larger and have higher productivity (“High”) than CSBF loan recipients (“Low”), but are less likely (“Low”) to be owned by a visible minority compared to CSBF loan recipients (“High”). However, this format is unable to show how different the two means are. Accordingly, the Statistics Canada suppressed output format also indicates the significance level of the between-group difference in means, as shown below.

<i>Labels</i>		
	Ordinary term loans	CSBF loans
Number of employees	High (+***)	Low
Productivity (log(sales/employee))	High (+)	Low
Owned by visible minority	Low (-**)	High
Observations	Under 1k	Under 1k

The table is interpreted as “recipients of ordinary term loans are significantly larger (+***) than CSBF loan recipients, but are significantly less likely to be owned by a visible minority (-**) compared to CSBF loan recipients. As in the case of the “usual” format (such as that shown in Table IV (p. 57) of Riding et al. (2007)), the interpretation focuses on those variables that are significantly different across different groups.

Suppressed output – More than 2 groups

In cases of the comparison of more than two groups, the descriptive statistics in the suppressed output format is exemplified below:

<i>Labels</i>	Accepted	Guaranteed	Rejected
Size (employees)	High (+*,+***)	Mid (+**)	Low
Age			Mid
New firms (<=3yrs)	Low (-***,-*)	Mid (-)	High
Young firms (3-10yrs)	Low (-***,-***)	Mid (-)	High
Established firms (>10yrs)	High (+***,+***)	Mid (+)	Low
Observations	Between 1-2k	Over 1k	Under 1k

As in the case of two-group comparisons, the asterisks in the parentheses indicate the level of significance in differences – the first one in the first column (accepted borrowers) corresponds to the significance in difference between accepted and guaranteed borrowers, and the second term specifies that between accepted and rejected borrowers. The asterisks in the parentheses in the second column (guaranteed borrowers) corresponds to the significance in difference between guaranteed and rejected borrowers.

Accordingly, the interpretation of the first row (size), for example, is as follows. Accepted borrowers are larger in size (number of employees) than guaranteed and rejected borrowers (at the ten and one per cent significance levels, respectively) and guaranteed borrowers are larger than rejected borrowers (at the five per cent significance level). Similarly, the interpretation of the last row (established firms) is, for example, as follows. Accepted borrowers are, on average, more likely to be older than guaranteed and rejected borrowers (at the one per cent significance level).

Example 2. Regression outputs

<i>Labels</i>	<i>Regression model 1</i>
Industry fixed effects	YES
Province fixed effects	YES

Debt capitalization ratio _t	_-***
Ln(age) _t	+**
Ln(employees) _t	+***
Constant	+
Observations	Under 1k

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In Example 2, the regression table presents the direction of the coefficient (+/-) and the significance level (*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1). The table value presented in Debt capitalization row, for example, shows that the variable, debt capitalization, has a negative and significant (at the 0.05 level) impact on the outcome variable. The reporting of observation count is identical to Example 1.

Appendix 3. Two-year and three-year growth models

Table A3-1. Propensity weighted two-year growth models

<i>Labels</i>	<i>Bank debt</i>					<i>Trade credit</i>		
	(1) 2-year employee growth	(2) 2-year asset growth	(3) 2-year revenue growth	(4) 2-year producti vity growth	(5) 2-year employee growth	(6) 2-year asset growth	(7) 2-year revenue growth	(8) 2-year producti vity growth
Panel A – Treatment effects								
Financial constraints								
NCF vs. DCF	+	+	+	-	+	+	+	+
NCF vs. GDCF	+	+	+	-	+	+	+	+
NCF vs. SCF	***	***	+	+	-	-	-	****
Panel B – Control variables								
Industry fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Age (Base = New firms)								
Young firms (3-10yrs)	**	**	**	+	-	+	+	+
Established firms (>10yrs)	*	**	*	+	-	+	+	+
Size (employees)	+	-	-	-	+	-	+	****
Size (employees) ^ 2	-	+	+	+	-	-	-	**
Exporter	+	-	-	-	+	+	+	+
Owner experience (Base = <5yrs)								
5-10 years	+	-	+	+	**	-	***	-
More than 10 years	+	**	-	-	***	-	***	-
Education (Base = High school diploma or less)								
A college/cegep/trade school diploma	-	-	-	***	+	+	+	+

A bachelor's degree or higher	-	_*	-	+	-	***	***	+
Innovator	+	+	+	+	+	-	+	+
Minority	-	-	-	-	_*	-	***	-
Gender (Base = Majority Men)								
50/50	+	+	+	_*	+	-	+	+
Majority Women	-	-	+	+	+	-	-	+
Historical growth (1-year past employee growth)	+	+	+	***	-	+	***	****
Debt capitalization ratio (Base = <=30th perc)								
Between 30th and 60th percentile	-	+	+	+	+	+	-	-
Over 60th percentile	-	-	-	+	-	-	-	-
Slack (Tangible assets / Total liabilities) (Base = <=30th perc)								
Between 30th and 60th percentile	+	-	-	-	+	-	+	+
Over 60th percentile	-	-	-	+	+	-	+	+
Internal funds (Cash / Total assets) (Base = <=30th perc)								
Between 30th and 60th percentile	-	-	-	-	-	-	-	-
Over 60th percentile	-	-	-	-	+	-	-	-
Constant	+	***	+	+	***	+	+	***
Observations	2-3k	2-3k	2-3k	2-3k	2-3k	2-3k	2-3k	2-3k
R ²	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2

Note: This table reports the estimation results of the propensity score weighted growth models (Equation I-11) presented in section II.5.1. The dependent variable *Growth Performance* for columns 1 and 5 is the two-year growth in the number of employees between t and t+2. The dependent variable *Growth Performance* for columns 2 and 6 is the two-year growth in total assets between t and t+2. The dependent variable *Growth Performance* for columns 3 and 7 is the two-year growth in total revenues between t and t+2. The dependent variable *Growth Performance* for column 4 and 8 is the two-year growth in productivity between t and t+2. The table presents the estimation results of the explanatory variables and their effect on growth. Explanatory variables are defined in Table I-1. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Two-year growth. When changing the growth time horizon to two years for the dependent growth variables, the following changes occur (relative to the results for the one-year time horizon) for the explanatory variables:

- Size no longer has a negative impact on growth, and now has a significantly positive impact on employee growth (bank debt model) and on productivity growth (trade credit model). This is consistent with the notion that it takes longer for large firms to hire grow their workforce given the increased complexity of their business structure. For example, the paperwork to hire additional workforce in a larger firm often goes through a human resources process, which is not the case for small firms. Similarly, training new employees in a large firm can take longer than in a small firm, suggesting that it takes longer to see the productivity output gains from new hires.
- Exporter remains positive and significant, but only for two-year asset growth (trade credit). This suggests that the impact of exporting on growth may be more important in the short-term than long-term.
- Owner experience remains significantly negative for employee growth and is now also negatively significant for revenue growth (trade credit models) and asset growth (bank debt). This further supports the notion that more experienced owners experience lower growth rates since they tend to manage older and larger firms. For example, firms 11 years or older are disproportionately owned by more experienced entrepreneurs (e.g. around 97 per cent of firms 11 years or older are owner by owners with at least five years of experience) (ISED, 2019). Similarly, owners with more experience tend to be older. Therefore, it is reasonable to expect that older, more experienced owners who manage established firms target lower growth targets than younger and less-experienced owners with ambitious growth targets.
- Owner education and innovator are no longer surprisingly negative for employee growth. In fact, the college/cegep/trade school diploma level is now positive and significant for productivity growth (bank debt).
- The surprising result for minority and gender disappears with only marginal significance ($p\text{-value} < 0.1$) remaining.
- The financial variables are still significantly positive, however the significance level of these variables is not as high. For example, debt capitalization ratio and financial slack are only marginally significant ($p\text{-value} < 0.1$).
- Treatment effects. Discouragement no longer matters for longer time horizon, while supply-side constraints are even more significant. One possible explanation is the non-persistent nature of discouragement. As owners gain more experience and get

more confident, they likely overcome their discouragement and potentially apply for financing the following year. On the other hand, those who are supply-side constrained are likely to keep being supply-side constrained, given the longer time required to build creditworthiness.

Table A3-2. Propensity weighted three-year growth models

<i>Labels</i>	<i>Bank debt</i>				<i>Trade credit</i>			
	(1) 3-year employee growth	(2) 3-year asset growth	(3) 3-year revenue growth	(4) 3-year producti vity growth	(5) 3-year employee growth	(6) 3-year asset growth	(7) 3-year revenue growth	(8) 3-year producti vity growth
Panel A – Treatment effects								
Financial constraints								
NCF vs. DCF	++	+	+	-	+	+	+	+
NCF vs. GDCF	++	+	+	-	+	+	+	+
NCF vs. SCF	-	+	+	-	-	-	-	++++
Panel B – Control variables								
Industry fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Age (Base = New firms)								
Young firms (3-10yrs)	-	+	+	+	+	++	+	+
Established firms (>10yrs)	-	-	+	+	-	+	+	-
Size (employees)	+	-	-	-	++	+	+	++++
Size (employees) ^ 2	-	+	+	+	-*	-	-	-**
Exporter	+	-	+	-	-	+++	+	+
Owner experience (Base = <5yrs)								
5-10 years	+	-	-	-	-**	-	-	-
More than 10 years	+	-	-	-	-**	+	-	-
Education (Base = High school diploma or less)								
A college/cegep/trade school diploma	-	+	-	+++	-	+	+	+
A bachelor's degree or higher	-	-	-	-	-	+	+++	+

Innovator			+	+	+	+	+	+	+
Minority	_*		-	+	+	+	-	-	+
Gender (Base = Majority Men)									
50/50	-	-	-	-	_*	+	-	+	+
Majority Women	-	-	+	-	+	+	-	+	+
Historical growth (1-year past employee growth)	-	+	+	+	***	_*	***	+	****
Debt capitalization ratio (Base = <=30th perc)									
Between 30th and 60th percentile	-	+	-	-	***	+	+	+	+
Over 60th percentile	+	+	+	+	+	-	+	****	+
Slack (Tangible assets / Total liabilities) (Base = <=30th perc)									
Between 30th and 60th percentile	+	-	-	-	-	****	+	**	+
Over 60th percentile	+	-	+	+	+	+	***	****	+
Internal funds (Cash / Total assets) (Base = <=30th perc)									
Between 30th and 60th percentile	-	_*	-	-	-	**	+	**	-
Over 60th percentile	+	-	-	-	-	+	+	+	-
Constant	+	+	-	-	-	+	+	-	****
Observations	1-2k	1-2k	1-2k	1-2k	1-2k	1-2k	1-2k	1-2k	1-2k
R ²	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4

Note: This table reports the estimation results of the propensity score weighted growth models (Equation I-11) presented in section II.5.1. The dependent variable *Growth Performance* for columns 1 and 5 is the three-year growth in the number of employees between t and t+3. The dependent variable *Growth Performance* for columns 2 and 6 is the three-year growth in total assets between t and t+3. The dependent variable *Growth Performance* for columns 3 and 7 is the three-year growth in total revenues between t and t+3. The dependent variable *Growth Performance* for column 4 and 8 is the three-year growth in productivity between t and t+3. The table presents the estimation results of the explanatory variables and their effect on growth. Explanatory variables are defined in Table I-1. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

When changing the growth time horizon to three years for the dependent growth variables, the coefficients for the control variables become mostly insignificant (relative to the results for the one-year time horizon).¹⁷² For example, while age was significant across most bank debt models, the variable is no longer significant for any of the bank debt models. The exceptions are the financial variables. For example, the slack variable is back to being significantly positive for trade credit (as they were for the one-year growth models). The treatment effects are also mostly insignificant, with only marginal significance ($p\text{-value} < 0.1$) remaining for the DCF/GDCF treatment effect on employee growth (bank debt) and the significance for the SCF treatment effect on productivity growth (trade credit).

¹⁷² Due to the availability of tax data limited to 2019, the 2017 survey data are excluded from the three-year growth models.

Appendix 4. SME loan supply studies that account for demand and more

Author(s)	Sample	Country	Account for demand?	Account for financing need?	Variables			
					Gender	Minority	Growth intention	Exporter status
Brown et al. (2011)	2004/2005 and 2008 Business Environment and Enterprise Performance Survey (BEEPS)	European cross-country	Yes	No	Yes	No	No	Yes
Cole and Sokolyk (2016)	1993, 1998 and 2003 Surveys of Small Business Finances (SSBFs)	United States	Yes	No ¹⁷³	Yes	Yes	No	No
Drakos and Giannakopoulos (2018)	2009 to 2014 Survey of Access to Finance of Enterprises (SAFE)	European cross-country	Yes	Yes	No	No	No	No

¹⁷³ Univariate probit on need for financing was not modeled jointly with bivariate probit demand and supply model.

Appendix 5. CSBF loan amounts (as of February 2016)

What can be financed?	Maximum amount of financing	Loan term
- purchase or improvement of land or buildings used for commercial purposes	\$1,000,000	15 years
- purchase or improvement of new or used equipment	\$350,000	10 years
- purchase of new or existing leasehold improvements, that is, renovations to a leased property by a tenant	\$350,000	10 years

Appendix 6. CGS empirical research summary - incrementality

Author(s)	Sample size and period	Country	Methodology	Summary
Boocock and Shariff (2005)	Survey – 92 borrowers between 1998 and 2000	Malaysia	Incrementality (additionality) measured by: (1) the proportion of financing raised through guaranteed financing: $(A+C-B)/A * 100$, where A = Guaranteed finance raised B = Alternative sources of finance that could have been raised C = Finance raised at the same time as the guaranteed finance (2) survey question asking whether or not the firm considers its guaranteed loan incremental	• Average rate of additionality across surveyed firms was 37% • 54% of survey respondents considered the guarantee program necessary to obtaining the loan • Greater additionality rates for SMEs
Riding et al. (2007)	Survey – 277 SME term loan applications in 2000	Canada	2-stage approach for measuring incrementality: (1) logistic regression: DV= 1 if the firm obtained a non-guaranteed loan, 0 = if the application rejected IV=purpose of the loan being working capital, length of banking relationship, owner age, number of loan account managers, sales/loan size, sales/employees, number of employees. (2) binary regression model from first step was used to predict whether the guaranteed loan recipients would have received the loan in the absence of the program. Incrementality was then calculated as the proportion of guaranteed loan recipients who would have rejected their loans applications if no CGS over the total guaranteed loans.	• Incrementality rate was $74.8 \pm 9\%$ • Logistic model had high levels of goodness-of-fit
Wilcox and Yasuda (2008)	145 annual bank data between 1995 and 2001	Japan	Panel data regression: DV=stock of loans outstanding, IV=stock of guaranteed loans, book value of equity, dummy if the bank is subject to Basel standards, government capital injection, payout on guaranteed loan defaults, bank fixed effects and control variables (unit of analyses = bank).	• Banks extended 1-6 additional non-guaranteed loans to a borrower that got a guaranteed loan from the same bank • Increase was higher for SMEs • CGS increases non-guaranteed bank lending more than government capital injection
Zecchini and Ventura (2009)	18,352 firm-year observations between 1999 and 2004	Italy	Difference-in-differences (DID) regression: DV=leverage ratios of SMEs (various measures were used), IV=number of employees, total sales, total assets, dummy if loan was guaranteed and firm fixed effects across SMEs.	• Guaranteed dummy variable is positive and significant • Median value for total liability is higher by 12.41% for guaranteed loan recipients than non-recipients counterparts

Uesugi et al. (2010)	54,993 firm-level observations on 10,144 firms between 1998 and 2005	Japan	(1) Propensity score estimation using a probit model: DV=1 if firm participated in the guarantee program, IV=credit available to the firm, firm's allocation of assets (ratio of cash, working capital and fixed tangible assets over total assets), firm performance (ROA, interest coverage ratio and capital ratio), industry, firm size, firm age, bank characteristics and relationship lending measures. (2) Treatment effect (incrementality) of the guarantee program estimation: guaranteed firms were matched with the nearest (in terms of propensity scores) non-guaranteed firms and the difference in loan availability between the two was calculated.	• Guaranteed borrowers have higher loan availability • However, most banks used CGS to replace non-guaranteed loans with guaranteed loans • Guaranteed borrowers had lower firm performance after receiving the loan than non-guaranteed borrowers
Cowan et al. (2015)	475 loan-level observations between 2004 and 2006	Chile	Time and fixed effect models: (1) DV=total credit, (2) DV=number of new loans, (3) DV=average size of new loans for the financial institution, IV=level of guarantee provided to the bank, and time and bank fixed effects.	• Each additional unit of guarantees to bank led to 0.65 additional credit to SMEs • Each Chilean\$1,000,000 guaranteed loans led to 0.147 additional non-guaranteed loans.
Seens and Song (2015)	Survey – 2,404 SME loan applications in 2011	Canada	2-stage approach for measuring incrementality, same as Riding et al. (2007), except for IV of the first logistic regression (to estimate the loan adjudication model): IV=return on assets, net profit margin, asset turnover, current ratio, debt-to-asset ratio, sales growth, firm age, size (# of employees), owner age, industry, and region.	• 67% of guaranteed loans were incremental • Partial incrementality was not considered (rejection definition did not include the cases where firms obtained the loan amount less than that applied for)
ISED (2018)	SFGSME (survey) – 1,748 SME loan applications in 2014	Canada	2-stage approach for measuring incrementality, same as Riding et al. (2007), except for IV of the first logistic regression (to estimate the loan adjudication model): IV=age, size, debt-to-asset ratio, net income, industry, and region	• 69% of guaranteed loans were incremental • Partial incrementality was not considered (rejection definition did not include the possibility that the borrower cases where firms obtained the loan amount less than that applied for)