The impact of the recent financial crisis on bank lending to SMEs in Canada

Nicolas Legendre

A thesis submitted to the
Faculty of Graduate and Postdoctoral Studies
in partial fulfillment of the requirements for the
MSc degree in Management

Telfer School of Management
University of Ottawa

Abstract

This study investigates the magnitude of credit contraction encountered by Canadian Small-and-Medium-Sized-Enterprises (SMEs) during the recent financial crisis of 2007-2008. These firms account for an important source of job creation and economic welfare (Haltiwanger et al., 2010); therefore, to ensure the creation and growth of SMEs through a smooth flow of capital is crucial for a healthy economic recovery from the crisis.

The empirical observation obtained in this study is contrary to what the theory suggests, as well as what many of the existing studies witnessed (i.e., a financial crisis has a negative impact on SME loan circulations). Using binary probit regression and structural break testing, this work finds that Canadian SME loan approval and application rates were higher during the crisis period. This somewhat counterintuitive result prompts the researcher to search for the possible factors enabling SME credit lending in Canada to retain its health during the time of financial distress, which include: (1) the stability of Canadian banks evidenced by the relatively constant Capital Tier I ratio during the crisis; (2) initiatives the Canadian government implemented as a response to the crisis. This result also raises a question whether the five billion dollars the federal government injected in the SME lending market under the Business Capital Availability Program (BCAP), a measure designed to insulate Canadian SMEs from the liquidity shock, could be justified. This research question will be investigated as a future area of research.

Table of Contents

Table of Figures and Tables

1. Introduction

1.1. Scope and background of this study

This study aims to investigate the impacts of a financial crisis on commercial loan markets for Small-and-Medium-Sized-Enterprises (SMEs). More specifically, this study empirically investigates how a crisis situation changes both the commercial banks' adjudication of lending to SMEs and the SMEs' needs for commercial loans, using the recent 2007-2009 crisis as a laboratory.

In early 2007, concerns about the risk of a "liquidity bubble" or "credit bubble" arose (Brunnermeier, 2009) and the asset based security indices began demonstrating a steady deterioration of subprime fundamentals (Gorton 2009). The increase in subprime mortgage defaults, first noted in February 2007, triggered the liquidity crisis.[1] The crisis hit its peak at the time of the collapse of Lehman Brothers in September 2008, followed by a recession with a lack of liquidity and decreasing GDP and unemployment rate. During this period, a large contraction of credit circulation was observed.[2]

If a credit crunch, in fact, occurred during the crisis, this constraint could possibly be more pronounced for Small and Medium Enterprises (SMEs) than for large corporations. Even in "normal" economic conditions, SMEs have been recognized to have difficulty obtaining external financing (OECD, 2008; Ardic, et al., 2012). The genesis of this debate lies in the Nobel Prize-

[1] While the financial crisis is often considered to start in July-August 2007 (e.g., Elliott, 2012) when TED spread began increasing, it actually began to have negative influences to the financial market much earlier.

[2] In the US, the total volume of new loans extended to large corporations fell by 79 per cent and the total number of new loans fell by 33 per cent from the second quarter of 2007 to the fourth quarter of 2008 (Ivashina and Scharfstein, 2010). In Canada, the rise in interest rates starting in 2006 signaled monetary tightening, which presumably impacted small businesses as it did consumer mortgages (http://www.bankofcanada.ca/wp-content/uploads/2010/09/selected_historical_v122530.pdf).

winning works of Stiglitz and Weiss (1981, 1983) whose seminal articles theoretically demonstrated that a financing constraint can arise from information asymmetry, and that small firms are relatively more likely to encounter this type of problem (Berger and Udell, 2006).

With this background, many argue that a crisis environment exacerbate the challenge SMEs face in accessing capital (Udell, 2009; Carbó-Valverde, et al., 2013; Popov and Udell, 2012; OECD, 2009).

If the above argument empirically holds (i.e., access to financing was in fact exacerbated for SMEs during the crisis), this would negatively impact the healthy recovery of the entire economy. This is because capital constraints on SMEs limit their growth, one of the major sources of job and welfare creations (Haltiwanger et al., 2010).

This study, therefore, empirically investigates this proposition. It focuses Canadian SMEs' access to bank loans, as: (1) to my knowledge, the impact of the 2007-2008 crisis on Canadian SMEs has not been fully investigated; and, (2) as in many other countries, commercial banks are the largest source of capital for Canadian small businesses. The following research questions are addressed: (1) whether the supply of bank loans was tightened for SMEs during the 2007-2008 financial crisis (how the crisis changes both the commercial banks' adjudication of lending to SMEs); and, (2) how the crisis changes SMEs' needs for commercial loans.[3]

Contrary to what many of the existing studies witnessed in other countries, this work observed that, in Canada, the SME loan approval and application rates were higher during the crisis period. This somewhat counterintuitive result might be explained by: (1) the Canadian

[3] The second research question is addressed in order to: (1) distinguish the supply-side cause of the decline in bank loan circulation from the demand-side origin; and (2) investigate how the business environment changed during the crisis.

banks has been stable even during the crisis period, as shown by the evolution of their Capital Tier I ratio and previous research (Haltom, 2013; Gravelle et al., 2013); and/or (2) initiatives the Canadian government implemented as a response to the crisis, like the increase of loan amounts borrowed under the Canadian Small Business Financing (CSBF) program and the increase of financial institution's reimbursement of claims as part of the Business Capital Availability Program (BCAP).[4] This result questions whether the BCAP program, through which the federal government injected five billion dollars in the SME lending market to counter the crisis, could be justified.

1.2. Importance and contributions of this study

It is well documented that growth in SMEs plays an important role of job creation and economic welfare (see, for example, Haltiwanger et al., 2010; Beck et al., 2005; Ayyahari et al., 2007; Beck et al., 2008; Dietrich, 2010; Ayyahari et al., 2011). As the recovery from the crisis requires economies to create employment opportunities (Ardic, et al., 2012), to ensure the creation and growth of SMEs through a smooth flow of capital is crucial for a healthy economic recovery from the crisis. The issue addressed by this study, the extent to which the financial crisis impeded the bank loan circulations to SMEs, is therefore useful when a smooth path for economic revival is considered.

Given the importance of SME growth in supporting sustainable, diversified and long-term economic growth, many governments had already, before the crisis, adopted policy measures to facilitate access to capital for SMEs. When the crisis occurred, many of those governments tried to insulate them from the liquidity shock primarily by introducing new, or

[4] See https://www.fin.gc.ca/bcap-pce/index-eng.asp for more details on BCAP in 2009.

expanding existing, policy schemes (OECD, 2013). In Canada, the government provided up to 200 billion dollars CDN to its Extraordinary Financing Framework (EFF) after the crisis (2009) and increased loan amounts borrowed under the Canadian Small Business Financing (CSBF) program and financial institution's reimbursement of claims in an attempt to ensure this smooth capital flow to SMEs, as it recognized the creation and growth of SMEs as an important item for the recovery from the recession after the crisis. The assessment of the efficacy of this government initiative requires a better understanding of the mechanism through which the crisis affected SMEs. This study aims to contribute to policy makers in this respect.

Furthermore, the conservatism among bank lenders might be heightened again in near future due to the provisions of Basel III and increased financial stresses triggered by slow-down economies in developing countries as well as escalating socio-political uncertainties. When this happens, understanding the nature of credit circulation in SME lending markets in a crisis situation might become yet more important for governments seeking even more effective policy measures to support SMEs. For practitioners (SME owners), the information about bank lenders' attitudes towards SME lending during the crisis period might help them in choosing appropriate actions when bankers' risk tolerance level is anticipated to decrease.

As for the contributions to the academic literature, this study fills the gap in the literature in the following ways. First, this study is one of the first studies that investigate the supply- and demand-side shocks of the crisis simultaneously. Most existing studies focus on the supply of credit during the crisis; the impact of the crisis on the demand of capital has not been fully investigated at the corporate level. Moreover, among empirical observations presented by existing studies as evidence of the supply-side shock, there are some that could possibly be interpreted as the evidence of demand shock (e.g., Ivashina and Scharfstein, 2009; DeYoung, et al., 2010; Popov and Udell, 2012; and Iyer, et al., 2013). By examining the impact of the crisis from both supply- and demand-side shock perspectives, this study provides a better understanding of each perspective *separately*.

Second, the empirical evidence on the impact of the financial crisis on SME financing is limited, and the literature on this stream has not reached the consensus (e.g., no additional credit rationing in France (Kremp and Sevestre, 2013); a tightening of credit supply in emerging European countries (Popov and Udell, 2012) and Spain (Carbó-Valverde, et al., 2013)). As one of the first studies to investigate the SME loan market in Canada, this study provides additional insights to this research stream. By doing so, it also contributes to the wider, and ongoing, debate about market gaps and capital rationing for SMEs in general (see, for reviews of this literature, Parker, 2002; Cressy, 2002).

This thesis is organized as follows. Chapter 2 provides a review of the literature on: (1) theoretical foundations of the impacts of a financial crisis on bank loan/credit circulation; (2) empirical studies on the capital flow during the crisis at the publicly traded corporation level; and, (3) empirical studies on SME lending during the crisis. Chapter 3 presents the theoretical framework, based on which the research questions and hypotheses are developed, followed by Chapter 4 that discusses data and methodology and Chapter 5 that discusses the empirical findings. Chapter 6 concludes.

2. Literature Review

The purpose of this literature review is to present what the existing research has discovered regarding the flow of debt capital with particular reference to the 2007-08 financial crisis. The first section reviews the theoretical literature, and the second section considers the empirical observations on macro-level economic shocks on credit markets. The third section focuses on the empirical research investigating the nature of capital flow to SMEs in relation to the recent macroeconomic shock.

2.1. Theories on financial crises

A financial crisis is a disruption to financial markets that leads to impaired circulation of capital within financial markets (Mishkin, 1992; Kahle and Stulz, 2013). Two major theories have been proposed in the literature considering channels through which a financial crisis impacts on capital circulation. Both theories attempt to explain why the amount of capital circulated in the market is reduced during and after a macroeconomic shock; they are, however, different in terms of the origin of such reduction. One of the two is known as the supply shock theory, which supports the idea that it is capital providers (lenders) that create a limited access to capital and thus reduced capital circulation (a decrease in supply; Caballero and Krishnamurthy, 2008; Brunnermeier, 2009; Gorton, 2010; Mian and Sufi, 2010; Schleifer and Vishny, 2010), while the other, the demand shock theory, argues that a financial crisis reduces borrowers' needs for capital (a decrease in demand; Kiyotaki and Moore, 1997; Kahle and Stulz, 2013). The following summarizes those two theories.

2.1.1. Supply shock theory

Theoretical papers within this literature can be broken down into two major groups: the bank lending supply shock theory and the credit supply shock theory, with the latter being an extension of the former by extending the argument to the credits of all kinds. The bank lending supply shock theory contends that a crisis situation reduces loan supply as banks try to counter loses from "toxic" assets by advancing less loans (Kahle and Stulz, 2013). 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 contraction (Brunnermeier, 2009). Schleifer and Vishny (2010) consider the impact of a financial crisis when banks engage in securitization activities: because a crisis makes the market prices of loans volatile, it also makes the credit supply to banks volatile – due to the volatility of the collateral, i.e., securitized loans - especially for banks with a high financial leverage.

A crisis situation negatively affects the quality of information perceived by market participants. This could translate into a higher degree of risk aversion (Bekaert, et al., 2009), as Epstein and Schneider (2008) describe "investors react in a worse-case manner to news of uncertain quality… they react more strongly to bad news than to good news" (p. 197). To this point, the supply shock theory can be applied not only to bank lending but also to credits of all kinds (e.g., corporate bonds), which forms the credit supply shock theory. Under the assumption that investors are ambiguity-averse, they tend to shy away from assets for which information quality is poor, especially when the asset prices are volatile. In other words, negative economic shocks lower the quality of information perceived by investors, making it further difficult for them to estimate the probability distribution of returns from the asset, at the time when the degree of risk aversion is heightened (Bekaert, et al., 2009). This leads investors to reduce the capital flow to these assets, thereby having strong negative effects on asset liquidity (Easley and O'Hara, 2010) and prices. Caballero and Krishnamurthy (2008) describe this point as "agents (lenders and suppliers) move toward holding uncontingent and safe assets, financial intermediaries hoard liquidity, and investment banks and trading desks turn conservative in their allocation of risk capital so that capital becomes immobile across markets" (p. 2223) in the event of an "uncertainty shock". Gorton (2010) also extends the bank lending theory to all credit supply as the 2007-08 crisis was centered on junk bonds and securitization combined with repurchase agreements (repo), which are vulnerable to information shocks and not bank-specific.

In summary, the supply shock theory suggests that a crisis decreases capital circulation in credit markets as it induces the reduction of credit supply by creating either (or both) toxic assets and/or informational shocks.

2.1.2. Demand shock theory

According to Kahle and Stulz (2013), a crisis induces the following: (1) contraction of credit; (2) decreased net worth (due to decreased asset prices); and (3) decreased consumption, which ultimately leads to a decrease in demand for goods/services and an increased uncertainty about the future demand for goods/services (demand shock). Also, the decline in demand and increased uncertainty about the future demand cause a decline in capital expenditure, as they make it optimal to postpone real options (Bloom, 2009), and thus less demand for capital.

Moreover, even if firms seek financing, access to capital becomes harder. A decrease in the net worth of the firm, due to the drop in asset prices, means: (1) less collateral (Kiyotaki and

Moore, 1997); (2) higher leverage, worsening agency problems between shareholders and creditors (Jensen and Meckling 1976; Holmstrom and Tirole, 1997). Decline in demand for goods/services creates losses and increased uncertainty exacerbates information asymmetry. All those will make more difficult to raise capital.

2.2. Empirical literature on crises

Empirical papers within this literature seek to provide empirical evidence regarding whether the theories of financial crises discussed above hold during the recent financial crisis of 2007-2008.

2.2.1. Empirical Evidence for supply shock

Previous research uses a variety of proxy variables or methodologies in their attempts to measure the impact of the recent crisis on the supply of bank loans. For example, DeYoung et al. (2012) use the elasticity of loan supply to loan returns. Ivashina and Scharfstein (2009) examine the relationship between the bank's total deposit and its loan supply, between the bank's exposure to Lehman's shock and its loan supply, as well as between the bank's exposure to Lehman's shock and its amount of credit line drawdowns. Duchin, et al. (2010) seek the evidence of the supply shock by investigating the relationship between firm-level investment and cash reserves. Santos (2010) examines the change in credit spread. Iyer, et al. (2013) use the banks' reliance on the European interbank market, which experienced an unexpected shock in August 2007, as a proxy for their levels of exposure to the crisis and examine if it impacted the loan supply.

The following reviews those papers and discusses what was discovered by this research stream as well as issues that remain inconclusive. It reviews each paper in detail, considering the implications of obtained empirical observations and methodological aspects, in the attempt to identify the best possible approach this research should employ.

DeYoung, et al. (2012) find that a supply shock played a significant role during the crisis in the small business sector, through the following three major results. First, small business loan supply was inelastic to the expected return on these loans, consistent with the view that credit to small businesses was rationed during the crisis. Second, the crisis increased banks' risk aversion, i.e., during the crisis banks reduced the supply of risky and illiquid loans (loans to the small business sector) especially when the bank already had a large amount of loans outstanding to that sector. Third, additional capital did not lead to more loans to small business sector for low capital banks, consistent with pressure from bank supervisors to increase risk-weighted capital ratios.

Ivashina and Scharfstein (2009) examine the relationship among loan supply, deposit financing, credit line withdrawals and the impact of the Lehman brothers' failure. They find that new large syndicated bank loan lending decreased in the first quarter of 2008 and continued to decline throughout 2008. On the other hand, commercial and industrial credit loans actually increased on the balance sheets of U.S. banks because firm credit line drawdowns increased (these drawdowns are not considered as a new loan issue). Based on those observations, Ivashina and Scharfstein perform regression analyses that yield the following four major findings. They argue that those results are consistent with the presence of the supply shock during the crisis:

1. Banks with larger amounts of deposit finance decrease their lending less than those with a smaller amount of deposit. Ivashina and Scharfstein argue that this is consistent with the view that deposit financing decreases the necessity of the reliance on short-term debt, of which availability was tightened during the crisis.

2. Banks that syndicated with Lehman in a more extensive fashion are more likely to experience a larger amount of credit line drawdowns from their borrowers. Ivashina and Scharfstein argue that Lehman's failure forced the other banks in the syndicate to commit to Lehman's portion of the loan. The credit line drawdowns increase represents the portion that the banks had to fund in Lehman's absence.
3. The percentage change in a firm's cash holdings over the crisis period is significantly positively related to its change in revolving line drawdowns and its lead bank's exposure to revolving line co-syndicated with Lehman. After the Lehman's shock, firms faced the risk of being unable to draw on its credit line (credit crunch). Rather than bearing this risk, firms may rationally choose to draw on its credit line, even if they do not have an immediate need for financing.
4. A bank's degree of exposure to Lehman's failure has a negative and significant impact on the percentage change in the number of total loans issued by the bank. Banks that syndicated with Lehman had to commit to Lehman's portion of the credit line, and more than likely at the expense of new lending, leading them to cut their lending.

Duchin, et al. (2010) argue that if cash reserves are related to firm investments after the onset of the crisis, this could be an evidence of a constraint on external financing that forced firms to use their own cash to finance their investments. The authors empirically test this implication of the supply shock theory and find that firm-level investment is significantly related to cash reserves during the crisis.[5] The average firm's cash balance (cash as percentage to assets) declined significantly from 2006 to 2008, suggesting again that firms used their cash to help

[5] To address the concern that a correlation between cash reserves and investments is a general feature of the data that should be apparent outside of the crisis period, Duchin, et al. apply the regression model to several samples before the crisis (placebos) and confirm that cash reserves is not significantly related to investments.

mitigate the external financing that was not available. The impact of cash reserves stronger for firms more financially constrained, dependent on external finance, dependent on equity, subject to information asymmetry, and with high net short-term debt.[6]

Duchin, et al. (2010) also test whether a demand shock arose later in, or after, the crisis by extending their regression to three quarters after the crisis: from July 1st, 2008 to March 31st, 2009. They argue that "if in this period firms' demand for investment decreased to such an extent that the tightened supply of external finance caused by the crisis was not the binding constraint, then we would not expect to see a relation between cash reserves and investment in the data" (p. 421). They find that corporate investment continues to decline over the three quarters when cash and investment were no longer related, consistent with a reduction in demand.

Santos (2010) finds that banks increased loan interest rates and reduced new loan amounts during the 2008 financial crisis. These effects are stronger for banks with larger losses in the subprime market. Santos also finds that bank-dependent borrowers experience a higher increase in loan rates than non-dependent borrowers. He considers this as evidence to further support to the supply shock hypothesis.[7]

Iyer, Peydro, da-Rocha-Lopes and Schoar (2013) find that the liquidity shock in the European interbank market decreased the supply of Portuguese bank loans. In August 2007, the European interbank loan spreads increased significantly, creating significant tensions in the market. The authors use the bank's level of reliance on the interbank market as the proxy for the

[6] For measures of financial constraint, see page 10. External finance dependence is measured by the proportion of investment not financed by cash flow from operations; equity dependence by the ratio of equity to investment; degree of information asymmetry by the industry standard deviation of productivity growth (the ratio of sales to the number of employees). The sample is divided by two based on the industry median (sample median for information asymmetry). Net short-term debt is short-term debt minus cash.

[7] Borrowers are classified as bank-dependent if: (1) their most recent public bond issue did not occur within the last three years of the loan; or (2) they borrowed from the lender of the current loan over the last year.

extent to which the bank was exposed to the crisis, and find that such a measure is significantly and negatively related its credit supply. Iyer, et al. (2013) also find: (1) a higher reduction in credit supply for smaller, younger, and weaker bank-relationship firms;[8] (2) credit-constrained firms were not able to mitigate the reduction of bank credit supply with other sources of financing (i.e., firms that were borrowing more from banks with higher interbank borrowing experienced a higher reduction in their level of debt).

The research work reviewed so far all observe some empirical evidence consistent with the supply shock explanation for the reduced credit circulation in the market during the crisis (see Table 1 that summarizes the empirical papers reviewed in this subsection). There is, however, a paper that questions the view that the supply shock is the dominant factor for the reduced circulation of debt capital during the crisis.

Kahle and Stulz (2013) hypothesize that if the bank lending supply shock theory holds, we should observe a higher reduction in capital expenditure (CAPEX), net debt issuance[9], and cash holdings for more bank- and/or credit dependent firms than others.[10] They find that CAPEX, net debt issuance and cash holdings for the whole sample fall significantly from 2006 to 2009. However, their further investigation reveals that: (1) there was no significant difference in capital expenditure evolution between bank-dependent firms and their matched counterparts during the crisis; (2) bank-dependent firms decreased their net debt issuance by only three percent more than the sample as a whole (not significantly different); and, (3) while non bank-dependent firms

[8] Relationship is measured by the credit outstanding between a firm and a bank as of 2007, Q2. As the dependent variable is change in credit extended within a firm-bank pair, this firm size effect is not due to the availability of other sources of financing available to large firms. Rather, the authors interpret this result as the indication of banks' incentive to maintain their relationship with larger clients, which are more valuable to them.

[9] Net debt issuance includes changes in both long-term debt and debt incurrent liabilities.

[10] A firm is recognized as being bank dependent if, before the crisis, it: (1) has at least two loan facilities with the same U.S. lead bank; (2) is within the top quintile of leverage and has a loan or a revolver; or, (3) has assets below the 20th percentile of assets (breakpoints based on NYSE firms) and a loan or a revolver, while not credit-rated. Kahle and Stulz also classify firms in the top quintile of leverage (highly leveraged) as credit-dependent.

decrease their cash holdings and net equity issuance during the crisis, bank-dependent firms do not reduce their cash holdings during the same period.

Based on those findings, Kahle and Stulz conclude that the empirical evidence questions the view that the supply shock is a dominant factor during the crisis. They argue that those findings are rather supportive of the demand shock theory; if the demand shock is the major source of credit circulation during a crisis, all firms should lower their capital expenditure and thus the demand for capital.[11]

2.2.2. Discussion on supply shock papers

From the six papers reviewed above, only Kahle and Stulz (2013) question whether there was a supply shock during the crisis. Here we consider possible factors that create difference in conclusions between Kahle and Stulz and the others, mainly based on the comparison between Kahle and Stulz and Duchin et al. (2010), as those two are similar yet arriving opposite conclusions.

First, they both use firm-level data. Second, both consider investment (capital expenditures) and cash holdings as shock-measurement variables. Third, they both make comparison between capital constrained and non-capital constrained companies. Those two studies are, however (and of course), not identical. One of the major differences is, while Kahle and Stulz compare capital expenditure and cash holdings *separately* between financially constrained (bank-dependent) and non-financially constrained firms, Duchin, et al. compare the investment-cash holding *relationship* between financially constrained and non-financially

[11] The paper also examines the equity substitution effect (the hypothesis that equity financing might have mitigated the effects of a credit or bank supply shock). During the first two years of the crisis (third quarter of 2007 –first quarter of 2009), equity issuance falls but bounces back up in the last year of the crisis (second quarter of 2009 –first quarter of 2010). The authors explain that this does not support substitution towards equity financing as the equity issuance that rises in the last year of the crisis is relatively small and some firms are still repurchasing equity.

constrained companies. Duchin's approach might be more realistic in the world of imperfect information, as the pecking order theory (Myers, 1984; Myers and Majluf, 1984) suggests, along with other seminal papers, that cash flow and investment are related (such as Fazzari et al. 1988; Kaplan and Zingales, 1997).

Another major difference is the measures of capital constraint. Both papers proxy financial constraint with reliance on external financing, but Duchin, et al. include additional measures. Kahle and Stulz quantify the firm's bank-/credit dependency using leverage, size (total assets), whether the firm has at least two loan facilities with the same bank in the last five years; whether the firm has a loan or a revolver two years in a row; whether the firm is in the top quintile of leverage in 2006; and whether the firm is credit-rated. On the other hand, Duchin, et al. use the Kaplan-Zingales index[12], the Whited-Wu index[13], size, the payout ratio, and bond ratings as proxies for firms' level of financial constraint. They also assume that firms that rely on external finance (measured by the proportion of investment not financed by cash flow from operations) are dependent on equity (measured by the ratio of equity to investment), are more subject to asymmetric information problems (measured by the standard deviation of the growth in productivity), and with high net short term debt, are more financially constrained. Duchin, et al.'s measure appears to be more thorough as it includes two index scores for the level of reliance on external financing. Those two studies are also different with respect to the methodology. Kahle and Stulz's results are based on the Average Treatment Effect on the Treated (ATT) method, while Duchin, et al. use regression analyses.

[12] The Kaplan-Zingales Index equation is given by index = -1.002*Cashflow + 0.283*Q + 3.319*Debt - 39.368*Dividends - 1.315* Cash

[13] The Whited-Wu Index equation is given by ww = - 0.091CF - 0.062DIVPOS + 0.021*TLTD - 0.044*LNTA + 0.102*ISG - 0.035*SG, where CF is the ratio of cash flow to total assets, DIVPOS takes that value of one if the firm pays cash dividends, TLTD is the ratio of the long-term debt to total assets, LNTA is the natural log of total assets, ISG is the firm's 3-digit industry sales growth and SG is firm sales growth (Whited and Wu, 2006).

Based on the above arguments, it appears that Duchin, et al.'s results (which support the presence of supply shock during the crisis) might be more convincing than Kahle and Stulz's conclusion (no evidence of supply shock).[14] Since Kahle and Stulz appear to be the only paper that does not support the supply shock theory, the literature appears to be close to the consensus that supply of lending was constrained during the crisis. Yet the papers supporting the supply shock are not shortcoming-free, suggesting challenges in research on loan supply and the impact of a crisis. For example, the comparison between Kahle and Stulz (2013) and Duchin, et al. (2010) exhibit the difficulties in the quantification of "financial constraint" and the mitigation of endogeneity issues in statistical analyses.[15] Other challenges include:

- Sampling frame
    - DeYoung et al. (2012) focus only on loans advanced by small community banks, assuming that small business tend to borrow more from community banks than large banks. It is true that the conventional view tends to position community banks as a major source of credit for small businesses (Cole et al., 2004; DeYoung et al., 2004). However, there are some papers that question this view (Strahan and Weston, 1996; De la Torre, et al., 2009).
    - While Duchin et al. (2012) find insignificant relationship between cash reserves and investments in the pre-crisis period, the seminal work of Fazzari, Hubbert and Peterson (1988) exhibit a significant relationship between the two, especially for

[14] There are three observations in Kahle and Stulz's study that could potentially provide evidence of a credit supply shock, which Kahle and Stulz do not acknowledge: (1) highly levered firms decrease their net debt issuance more than the others after the failure of Lehman Brothers (while this could be demand driven, it could also be evidence of banks' reluctance of lending); (2) bank-dependent firms decrease CAPEX more than the others near the end of the crisis in 2009 (which might imply that cash-rich firms used all their cash during the crisis, and then become capital constrained); and, (3) their regression analysis exhibit a significant negative correlation between bank-dependency and capital expenditures.

[15] To address endogeneity problems, Duchin, et al. measure firms' cash positions as much as four years prior to the crisis and Kahle and Stulz use matching approach rather than regression analyses.

small firms, during the normal economic period (1970-1984). This suggests that Duchin, et al. might have obtained a different result with respect to pre-crisis period of investment-cash holding relationship if they had focused on small firms.

- Sampling period.
    - Ivashina and Scharfstein (2009) test the nature of loan supply only for the beginning period of the crisis, up to the fourth quarter of 2008. There is a possibility that the loans advanced during the credit boom had a maturity after 2008 (which could explain why fewer loans are needed in 2008).
- Quantification of banks' "risk tolerance"
    - DeYoung, et al. (2012) look at the percentage of equity capital to total assets to measure the bank's risk tolerance. However, there appear to be more factors that influence banks' degree of risk aversion, e.g., the percentage of securitized assets to total assets, the level of exposure to mortgage loans, and the extension of this research could include other measures of banks' level of risk tolerance.
- Quantification of "cash availability"
    - In the examination of the relationship between a firm's cash availability and investment, Duchin et al. (2012) use pre-crisis cash balance (as of 2006), to avoid the influence of the crisis. As a result, the significance of cash-investment relationship gets weaker over time. In particular, in their last regression of 2009, Duchin et al. find insignificant cash-investment relationship along with the continuation of investment reduction, which they consider evidence of the demand shock. However, it is not clear whether the insignificant cash-investment relationship in 2009 is due to the weakened impact of the crisis or because of the

long-time distance between cash balance (measured as of 2006) and investment (measured as of 2009).

Another, and probably the most important challenge is how to measure the pure impact of the supply shock, isolating the influence of the demand-side influence. DeYoung, et al. (2010) find that additional capital does not lead to additional loan supply for poorly capitalized banks (which they claim evidence for the supply shock); this might be because small banks' customers experienced the reduction of the demand for their products/services that led to lesser necessity of capital (DeYoung et al. do not control for firm characteristics). Similarly, Ivashina and Scharfstein (2009) do not control for the characteristics of banks (except for their roles in a syndication, whether the lead or not). There might be systematic differences between banks with a larger amount of deposit and those with smaller amount, and between banks that syndicated with Lehman and others, that explain the net change in lending from the demand-side effect. A similar argument could apply to Iyer, et al. (2013): while they control for firm size, age, ROA, loan coverage ratio, and bank-firm previous credit volume, this might not be enough to control the difference in investment opportunities (and thus loan demand) across firms.

In this regard, Santos (2010) run regressions with the most comprehensive list of control variables associated with firm, bank, and loan characteristics, minimizing the impacts of changes in borrower risk levels on credit spreads as well as the impact of the change in credit demand on loan supply. Nevertheless, no study investigates the supply and demand shocks simultaneously (see Table 1 for the summaries of papers reviewed), thus it is still unknown to which extent the reduction of loan circulation was due to the supply and the demand shock during the crisis; this study addresses this question. The following reviews the literature that examines the impact of crisis on the demand for financing.

Table 1. Empirical research summary

Author(s)	**Sample size, country and period**	**Methodology**	**Summary**
DeYoung et al. (2012)	77,855 quarterly observations from 3,568 small US banks from Q1:1990 to Q4:2010	2-stage OLS, DV=Net lending change in sector i during period t for bank j; IV=expected loan-return, pre-existing loan stock in the same sector, and banks' equity to assets (risk tolerance).	Support supply shock and credit rationing, as: • NLC inelastic to expected return • Impact of pre-existing loan stock to SME sector on loan supply (loan/risk overhang effect) stronger • For poorly capitalized banks additional capital not leading to more loans to SMEs (less risk tolerant)
Ivashina and Scharfstein (2010)	US large syndicated bank loans during 2000-2008. 38 banks and 443 borrower firms extracted from the above sample	OLS and correlation • DV=% change in number of loans issued by a bank IV= amount of the bank's total deposit/total assets. • Correlation: used balance of revolving lines and amount of credit lines co-syndicated with Lehman/ total amount of credit lines originated before 2007 (bank's degree of Lehman exposure) • DV=% change in firm's cash holdings IV=change in revolvers drawn /total assets; lender's degree of Lehman exposure. • DV=% change in number of loans issued by a bank IV= amount of the bank's total deposit/total assets; bank's degree of Lehman exposure.	Support supply shock, as: • Banks with higher deposit financing reduced their lending less. • Banks that more extensively syndicated with Lehman are more likely to experience a larger amount of credit line drawdowns from their borrowers. • % change in a firm's cash holdings is significantly positively related to its change in revolving line drawdowns and its lead bank's exposure to revolving line co-syndicated with Lehman • Banks syndicated with Lehman more extensively dropped their lending more severely.
Duchin, Ozbas and Sensoy (2010)	26,421 quarterly observations for 3,668 US firms during Jul 1, 2006 - Apr 30, 2009.	OLS: DV=firm investment/total assets IV=cash reserves/total assets Control=Tobin's Q, EBITDA/total assets, firm fixed effects (not specified).	Support supply shock, as: • Cash reserves and investments significantly positively related, the impact of cash reserves stronger for firms more financially constrained, dependent on external finance, dependent on equity, subject to information asymmetry, and with high net short-term debt. Support demand shock, as: • After Jul 2008, investment continues to decline yet cash reserves and investments no longer related.
Santos (2010)	6,526 US loans between 2002 and 2008.	OLS and 2-stage OLS, DV=(1) credit spreads, and (2) size of loan, IV= a crisis period dummy, bank's net chargeoffs/ assets in quarter before the loan date Borrower variables: age, sales, debt to assets, market to book, profit margin, interest coverage ratio, NWC to total debt, tangibles (inventories, plant, property, and equipment) to assets, R&D to sales, advertisement expenses to sales, S.D. of stock return over 365 days before loan date, excess stock return relative to the market over the past twelve months, credit rating, expected default frequency computed by KMV. Banks' variables: total assets, S.D. of quarterly ROA over last three years,	Support supply shock, as: • Crisis-chargeoffs interaction term is positive and significant on credit spreads and negative and significant on the size of the loan; banks with larger losses provided smaller size of corporate loans while charging higher spreads during the crisis. • Banks with larger losses during the crisis increased the spreads to bank-dependent

		deposits to assets, subordinated debt to assets, cash and marketable securities over assets, Tier one capital to assets, sum of the mortgage-backed securities that are in the trading account and those that are "available for sale," scaled by bank's assets. Loan variable: amount, years to maturity, whether the firm also borrowed from the lender of the current loan during the last year, whether the loan is secured; whether the loan is senior; whether the borrower has a guarantor; whether the loan has restrictions on paying dividends, use of proceeds (corporate purposes, repayment of existing debt, WC working capital); type of loan (term loans or lines of credit), time trend in loan spreads.	borrowers but not to nondependent borrowers.
Iyer, Peydro, da-Rocha-Lopes and Schoar (2013)	293,896 loans (firm-bank paired) observations in Portugal between 2007 and 2009.	OLSs • DV= change in committed credit volume for each firm-bank pair IV= interbank borrowing/total assets in 2007:Q2, controlling for bank and firm characteristic variables. • DV= change in total bank loan (or overall debt) volume for a firm IV=weighted average interbank borrowing of the banks' lending to the firm, controlling for bank and firm characteristic variables. Bank control: size (total assets), short-term to total assets, ROA, defaulted loans to total assets, net worth to total assets, total bank-firm credit as of 2007 Q2 Firm Control: size (total assets), age, # of employees, interest coverage ratio, ROA.	Support supply shock, as: • Interbank borrowing had a negative impact on bank credit supply. • A higher reduction in credit supply for smaller and younger firms, and those that had a weaker bank relationship. • Firms borrowing more from banks with higher interbank borrowing experienced a higher reduction in their total debt (or bank debt); they were not able to mitigate the reduction of their borrowing capacity from one bank by finding other sources of loan/debt supply.
Kahle and Stulz (2013)	48,202 US firm quarterly observations from Q3:2006-Q1:2010.	DID and ATT. Subgroups include bank dependent and non-bank dependent firms and credit dependent and non-credit dependent firms controlling for industry, credit rating, the market-to-book ratio, operating cash flow, cash holdings, size, and leverage ratio through a matching approach. Variables of interest: capital expenditures, net debt issuance and cash holdings (all as % of assets).	Do not support supply shock, as: • Bank-dependent firms do not decrease CAPEX and net debt issuance more than non-bank-dependent firms (2) bank-dependent firms hoard cash during the crisis. • Reject the supply shock view as bank-dependent firms should have seen a higher reduction in net debt issuance, CAPEX, and cash holdings if they had trouble getting financing.
SMEs			
Berg and Kirschenmann (2012)	168,483 loan applications submitted by 88,370 SMEs to AccessBank Azerbaijan during the period of 2006-2009	Linear probability model (similar to probit and logit): • DV= 1 if the loan application is approved IV= dummy variables for Apr-Aug 2008 (funding shock) and Oct 2008-Dec 2009 (real economy shock) Loan control: Requested amount, value of collateral to requested amount, whether it is a repeat loan, whether loan requested in local currency, whether loan granted in a location of oil/gas sector, branch fixed effects Firm control: age, gender, marital status of owner	Weak support supply shock, as: • During the supply-side shock: AccessBank discouraged loan applications from new and existing customers, but loan approval rate unaffected. • During the economy shock: SME loan approval rates declined, bank-borrower relationships helped mitigate the effect of the shock.
Kremp and Sevestre (2013)	178,236 loan observations from	Disequilibrium model: • Demand model: DV = new bank loans (volume), IV = size (total assets),	Do not support supply shock, as: • Not many loan applicants were fully rationed (loan

	60,000 French SMEs observed over the years 2000-2010	financing needs (WC and investment, both as % of total assets), amount of internal resources (cash flow to total assets), amount of other sources of external financing available (non-bank financial debt and accounts payable to total assets), interest expenses to total debt, and year and industry dummies • Supply model: DV = new bank loans (volume), IV = size (total assets), risk indicators[16], ability to provide collateral as measured by tangibles to total assets, and year and industry dummy • Both models were estimated separately for 2004-2006 and 2007-2010 to analyze the crisis impact	was rejected) or even partially rationed • Their supply model results show that smaller, younger and firms with bad credit ratings are significantly more penalized than they were before the crisis
Popov and Udell (2012)	10,701 European firms in 1978 localities served by a total of 155 banks over the 2005–2008 period	Probit regressions • Demand: DV = dummy equal to 1 if firm desires bank credit, IV = Average of financial conditions (equity to total assets, Tier 1 capital ratio, gains on financial assets to total assets) for banks in the locality, firm size (# of employees), if public firm, if exporter, if sole proprietorship, if privatized, if audited, if competition fairly or very severe in firm's industry, if subsidized, country, industry, and year fixed effects • Credit constrained 1: DV = dummy equal to 1 if firm loan was rejected or didn't want to apply for loan because of adverse conditions, IV = same as Demand model (except for competition and subsidized) • R&D intensity (industry median R&D to sales) and capital intensity (industry median capital usage per worker) for mature Compustat firms over the period 1990–2000.	Support supply shock, as: • They find a higher probability of firms' being credit constrained in localities served by banks with poor financial conditions (a low ratio of equity to total assets, a low Tier 1 capital ratio, and high losses on financial assets, including ABSs and MBSs). • Firms that are riskier and that have less tangible assets are most sensitive to this bank credit supply shock.
Carbó-Valverde, Rodriquez-Fernandez and Udell (2013)	528,317 loan observations from 38,329 Spanish firms over the 1994-2010 period	Disequilibrium model with 2 separate estimations (both for demand and supply) with a break point between 1994-2006 and 2007-2010 to estimate borrowing constraints, partially constrained, and not constrained firms: • Demand: DV = outstanding loan amount, IV = lagged sales to total assets, lagged cash flow to total assets, loan interest spread, regional GDP growth, fixed assets/total assets (collateral), default risk (operating profits to interest paid), bank and industry fixed effects • Supply: DV = outstanding loan amount, IV = fixed assets/total assets (collateral), bank market power (Lerner Index),[17] default risk (operating profits to interest paid), GDP growth in the region the firm is located, lagged cash flow to total assets, lagged sales to total assets, bank-borrower relationship variables (age, # of years of bank-firm relationship, single vs. multiple relationship), annual growth in house prices in the region, annual growth in the number of firms in the industry the firm operates, bank and industry fixed effects Granger predictability test to investigate relationships between account payable	Support supply shock, as: • A strong relationship between account payable and investment for borrowing constrained firms, and this relationship becomes even stronger for the crisis period. • The fraction of credit constrained firms increased during the 2007-2010 period. • Firms with more fixed assets (relative to total assets) and longer bank relationship, as well as more established (older in age) and profitable (measured by lagged cash flow/total assets and lagged sales/total assets) are less likely borrowing constrained, and the impacts of those variables becomes stronger during the crisis period (2007-2010). • Firms located in higher regional GDP growth are

[16] Such as lagged financial debt to net cash flow, lagged cash flow to fixed and working capital, age, and rating by the Banque de France.
[17] Lerner Index = (price of total assets - marginal costs of total assets)/price.

		and investment, among constraints, partially constrained, and not constrained firms • DV = CAPEX to total capital IV = bank loans/total liabilities, bank loans/total liabilities*crisis dummy, account payable/total liabilities, account payable/total liabilities*crisis dummy, interbank interest rate, cash flow to capital, sales growth, growth in defaults on trade credit in region	less likely borrowing constrained but the impact becomes weaker during the crisis. • Firms with multiple bank relationships are more likely borrowing constrained and the impact does not change in during the crisis.

2.2.3. Empirical evidence for demand shock

To my knowledge, there is no study that finds direct empirical evidence on a demand-driven decline in available credit to firms during the crisis in the context of corporate lending. Although two studies reviewed above provide observations that could be consistent with demand shock, those observations appear weak as empirical evidence. First, Kahle and Stulz (2013) conclude that the reduced debt capital circulation during the crisis was more likely demand driven, because they do not find evidence for supply shock (they find no significant difference in the change in capital expenditure, debt issuance, and cash holdings between bank-dependent and non- bank-dependent firms). Second, Duchin, et al. (2012) find that corporate investment continues to decline in the three quarters after the crisis, during which the cash reserve-investment relationship disappeared, which Duchin, et al. consider as evidence for demand shock. However, this could also be seen as supply shock evidence as firms simply exhausted their cash holdings by the end of the crisis and were forced to keep lowering their investments as external financing was still unavailable.

While research on the demand shock is limited at the corporate level, it has been investigated at the household consumption level. Puri, Rocholl and Steffen (2010) present an empirical observation in Germany consistent with the demand shock: loan requests by retail customers declined during the crisis, and this decline was not substantially different between banks that had large exposure to the US subprime market and for those that had not. Mian and Sufi (2010) show that durable consumption and grocery spending declined from 2006 to 2010. The decline was at its highest from 2007 to 2009, and more pronounced for highly leveraged households. Mian, Rao and Sufi (2013) find that households that experienced a higher decrease in their home value decreased their spending more than households with a smaller decrease in their home value.[18][19] Those two studies suggest the reduction of demand for loans in two ways. First, a decline of demand for goods and services negatively impacts business revenues and expected future growth, lessening corporations' needs for capital expenditure demand for financing declines. Second, Mian, Rao and Sufi (2013) observe the balance sheet effect, i.e., households with a severe drop in property value are associated with lower consumption: there is no reason to believe that the balance sheet effect (a drop in asset value causes the demand for assets or capital) would not occur at the corporate level when it occurs at the consumer level.

2.3. Empirical literature on crises, focusing on SME lending

This final section in the literature review considers existing studies on the 2007-2008 crisis with a particular reference to SME lending. Those studies are concentrated outside of North America (except for DeYoung, et al. (2012), which was reviewed in section 2); this is in contrast to studies at the publicly traded corporate level (reviewed in section 2.1), most of which investigate the impact of the financial crisis in the US.

Berg and Kirschenmann (2012) compare the loan approval rates of AccessBank Azerbaijan between the period of the supply-side/funding shock and the period of the economic shocks. Kremp and Sevestre (2013) and Carbó-Valverde, Rodriquez-Fernandez, Udell (2013) estimate the disequilibrium model for loan supply and demand; the former estimate the level of credit rationing in France, while the latter investigate the usage of account payable as an alternative source of capital when Spanish firms are financially constrained. Popov and Udell

[18] The finding is based on the regression model on the marginal propensity to consume, which was measured by the change in total spending per household.

[19] The decline of consumer spending during the crisis could be supply-driven (i.e., the credit market tightens the supply of credit to highly levered households, making it difficult for those households to purchase durable goods) and the fact that credit card companies were not extending as much credit to individuals supports this view. On the other hand, an equally likely explanation is that highly-leveraged households simply lowered their consumption in order to meet their debt obligations (which caused the decline in demand for additional credit).

(2012) study the level of credit supply to SMEs in relation to banks' financial conditions in sixteen emerging European countries.

The following reviews those papers and discusses what was discovered by this research stream in the same manner as the supply and demand sections above.

Berg and Kirschenmann (2012) attempt to isolate the supply-side shock from the general economic shock by examining the lending practice of AccessBank Azerbaijan between the two distinct periods: (1) from April 2008 to August 2008, during which AccessBank faced difficult refinancing conditions due to its exposure to international capital markets; however, the general economy had not yet been slowed down (the supply-side/funding shock); and, (2) from October 2008 to the end of 2009, when economic growth eventually slowed down together with the sharp decline in oil prices, but AccessBank's refinancing pipeline strengthened again (the economy shock). Berg and Kirschenmann find a "kind of" supply side lending contraction during the funding shock in that AccessBank discouraged loan applications from new and existing customers (loan officers were encouraged to take vacations and marketing towards new clients was reduced), but loan approval rates were unaffected.[20] On the other hand, during the period of the real economy shock, a lower approval rate for SME loans was observed. This might imply that the riskiness of SME businesses increased during the period, making it difficult for the bank to approve their loan applications even if the bank has capital available; or that the bank became overly concerned about the economic environment surrounding the SMEs and thus contracted lending during the economy shock period, even if Accessbank retrieved its healthy refinancing

[20] AccessBank Azerbaijan was founded by international financial institutions with the mission to provide financial services at European standards to micro and small businesses, low and medium income families, as well as larger corporations (Berg and Kirschenmann, 2012).

pipeline at that time. Whichever the case, bank-borrower relationships helped mitigate the effect of the shock (repeat loans have a higher approval rate).

Kremp and Sevestre (2013) estimate the extent of credit rationing for French SMEs before and during the crisis using a disequilibrium model.[21] Kremp and Sevestre observe that the percentages of fully and partially rationed firms are low before the crisis (1.3 percent of firms with no loan, and 6 percent of firms with loans, respectively) and those percentages did not significantly increase during the crisis (1.9 and 6.9 percent, respectively). Therefore, the authors conclude that there is no evidence of credit rationing towards SMEs during/after the crisis.

However, Kremp and Sevestre (2013) find discrepancies in the likelihood of rationing across different characteristics of firms: small firms, young firms, as well as firms with a bad rating are more affected by credit rationing than other firms. Those firms are significantly more penalized during the crisis – it appears that banks adopted a more severe lending policy to those firms.[22] The collateral availability and lagged profitability affect positively, while the lagged debt to net cash flow affects negatively the credit ceiling, but the impacts of those factors do not significantly change during the crisis.[23]

Popov and Udell (2012) study the bank credit supply to SMEs before and during the crisis in 16 emerging European countries. First, they employ a probit regression for credit

[21] The disequilibrium model is employed, as the amounts demanded and available for supply are unobservable. It is based on three equations for their regression analysis: (1) a demand equation for new loans; (2) a supply equation for new loans; and (3) an equation that links the observed quantity of loans to the unobserved quantities demanded and available for supply, obtained by the minimum of (1) and (2). Both supply and demand regression models were estimated separately for 2004-2006 and 2007-2010 to analyse the crisis impact.

[22] This is in line with the usual argument that information asymmetries affect smaller and younger firms more strongly (Diamond and Verrecchia, 1991; Ozkan and Ozkan, 2004; Bigelli and Sanchez-Vidal, 2012).

[23] Small firms are more likely to demand loans. Cash-flow (profit), account payable, non-bank financial debt (all relative to total assets) as well as interest rate negatively, and working capital and investment (relative to total assets) positively, affect the demand for loans. Among those, only account payable to total assets becomes insignificant during the crisis.

demand to eliminate the firms that did not need extra financing. They use this regression for the Heckman selection correction to distinguish firms that do not apply for credit because they don't need it, or because they are discouraged. The second probit regression uses a binary variable equal to one if the firm is credit constrained (if the firm was refused a loan or didn't apply for one because of adverse loan conditions) as their dependent variable. The independent variables are the average of financial conditions (measured by equity to total assets, Tier 1 capital ratio, and gains on financial assets to total assets) of banks serving for the locality, a crisis dummy (equal to one if the observation is in 2008), a "non-affected" dummy (equal to one if the bank equity/assets ratio did not decline more than one standard deviation).

Popov and Udell observed a strong impact of bank financial conditions to SME lending. They find a higher probability of firms being credit constrained in localities served by banks with a low ratio of equity to total assets, a low Tier 1 capital ratio, and high losses on financial assets including asset and mortgage backed securities. Firms faced a 10% higher probability of being credit constrained if they did business with banks that experienced at least one-standard deviation deterioration in their financial health between 2005 and 2008 than firms that dealt with banks that had lower financial health deterioration. As for the firm characteristics, firms in the high R&D intensity industries and those in the low capital intensity (measured by capital usage per-worker) industries are most sensitive to this bank credit supply shock.

Carbó-Valverde, Rodriquez-Fernandez and Udell (2013) use a disequilibrium model (demand and supply equations) to estimate borrowing constraints, partially constrained, and not constrained firms, and investigate the relationships between investment and account payable among those three groups of firms.[24] They find a strong relationship between account payable and investment for borrowing constrained firms, and this relationship becomes even stronger for the crisis period. This suggests a supply shock to SMEs: the increased dependence of trade credits as an alternative source of financing during the crisis. This is also consistent with Kremp and Sevestre (2013), who find a lower demand for loans for SMEs with a higher volume of accounts payable relative to total assets.[25] Also, the authors show that the fraction of credit constrained firms increased during the 2007-2010 period.

As the review of the financial crisis studies at the publicly traded corporate level did, the analyses of the existing studies on SME lending exhibit the difficulties they face when investigating the impact of the crisis. One of the major challenges is the endogeneity issue.[26] Kremp and Sevestre (2013) acknowledge that some of their independent variables are endogenous, as it is unknown whether the fiscal end of the financial statement occurred before or after the loan was granted. Popov and Udell (2012) point out that the foreign bank entry to a specific region (which affects one of the independent variables, the average financial condition of banks in the locality) might have an endogeneity problem, as it may be a function of the

---

[24] Carbó-Valverde, et al (2013) find, in the disequilibrium model, that firms with more fixed assets and longer bank relationship, as well as more established (older in age) and profitable (measured by lagged cash flow/total assets and lagged sales/total assets) firms are less likely borrowing constrained, and the impacts of those variables becomes stronger during the crisis period (2007-2010). Firms located in higher regional GDP growth are less likely borrowing constrained but the impact becomes weaker during the crisis. Firms with multiple bank relationships are more likely borrowing constrained and the impact does not change during the crisis.

[25] However, in Kremp and Sevestre, this variable becomes insignificant during the crisis.

[26] Studies at the publicly traded corporate level also address the problem of endogeneity through: (1) the instrumental variable/two-stage least square approach (DeYoung et al, 2012; Santos, 2010); (2) the use of lagged variables (Duchin, et al., 2010); and, (3) the matching approach (Kahle and Stulz (2013). Carbó-Valverde, et al. (2013) also address this problem by using the lagged values for financial statement variables.

economic condition of the region (which affect the probability for firms to be financially constrained).[27] Both studies use instrumental variable approach to address this problem.[28]

The second problem arises from the presence of discouraged borrowers (firms discouraged from applying for bank credit by the anticipation of being turned down, by high rates, or by unfavorable collateral requirements). Without taking its presence into consideration, the estimation of the level of credit rationing, or the proportion of financially constrained firms, is biased. Among the four papers reviewed in this section, only Popov and Udell (2012) address this problem through the Heckman's correction procedure.

As in the case of the publicly traded corporate level research, the distinction between demand and supply-side effect is another challenge for the SME lending research. For example, Popov and Udell (2012) find that banks' financial positions have a significant impact on loan approval rate, but it is still possible that firms working with banks in a more deteriorated financial position are more likely to experience deteriorated market conditions for their products (or, as Popov and Udell admit, it is possible that both firm demand for credit and banks' assessment of the market for firms' products may be heavily influenced by the same factor). The survey data used by Popov and Udell does not have detailed firm information, which to make the demand side effect as constant as possible. Also, survey data is subject to self-reporting bias.

[27] Popov and Udel (2012) argue that, since their analyses is at locality –level, not country-level, that the possibility of the endogeneity problem arising from the "foreign bank entry" is small – the dominant method of entry for foreign banks in the region was through purchasing existing banks, and so although the entry choice is endogenous, the variation of local presence is somewhat predetermined conditional on entry.
[28] Kremp and Sevestre follow the procedure suggested by Rivers and Vuong (1988).

2.4. Concluding discussion

Theory suggests that a crisis situation induces the reduction of debt capital flow through either or both the supply and the demand sides; yet the literature has not yet fully understand the magnitude of the impact of each respective shock.

At the publicly traded corporate level, the impact of the supply shock (or whether the supply shock was present or absent) during the 2007-2008 financial crisis has been investigated by a number of studies, and all but one present a view supporting the presence of supply shock; it appears that the literature has reached consensus in this regard. However, almost all studies investigate the impact of the supply shock in the United States (except for Iyer, et al. (2013) that study bank-firm pairs in Portugal); to our knowledge, it appears that the nature, magnitude, and mechanism of the supply shock have not fully investigated in other countries. In addition, the existing literature presents a challenge to isolate the demand-side impacts from the supply shock. As a result, while several papers claim that their empirical observations are consistent with the supply shock theory, some of those could also possibly be interpreted as the manifestation of the demand-side effect. Finally, no study thoroughly investigates the contraction of demand for credit in a direct, extensive way. There appears the necessity of research investigating the supply- (demand-) side contraction of credit circulation that effectively segregates the demand- (supply-) side channel, and compare the relative magnitudes of those two forces.

The literature investigating the impact of the financial crisis on SME lending is different from that at the publicly traded corporate level in two ways. First, while most corporate level studies take place in the US, many studies on SME lending are outside of the US. Second, while most corporate level studies claim the presence of supply shock, studies on SME lending do not share a common view as to whether the supply shock was present. Kremp and Sevestre (2013) observe no significant difference in the level of credit rationing in France between before and during the crisis. On the other hand, Popov and Udell (2012) find that a tightening of credit supply occurred for firms dealing with banks with poor financial conditions in emerging European countries, and Carbó-Valverde, et al. (2013) find an even stronger relationship between account payable and investment during the crisis for borrowing constrained firms in Spain, consistent with the presence of supply shock. Overall, the literature has not reached a consensus. In addition, as in the case of publicly traded corporate level studies, no study has been done to investigate the demand-driven impact of the financial crisis.

This study seeks to fill those gaps of the literature. It investigates the impact of 2007-2008 financial crisis on Canadian SMEs, from both demand and supply side perspectives. It attempts to quantify the magnitudes of demand- and supply-driven contraction of loan circulation in the Canadian banking sector during the crisis. The survey data collected by Industry Canada and Statistics Canada provide rich information on Canadian SMEs, allowing to distinguish between demand and supply effects, as well as between firms that did not seek financing because they did not need it and those discouraged to apply for loans, while minimizing possible biases induced by endogeneity of variables and non-response bias. By doing so, it attempts to shed additional light on the impact of the financial crisis on the SME sector, where the literature has not reached a consensus. In addition, to our knowledge, it will be one of the first studies to investigate SME lending and the crisis in the Canadian context. As several studies reviewed here (Santos, 2010; Iyer, et al., 2013; Kremp and Sevestre, 2013) point out, young small businesses appear to be affected by adverse economic downturn more severely than large corporations, yet those firms are often considered as one of the inevitable drivers for the economic growth and job creation (Haltiwanger, et al., 2010). Deeper understanding this study attempts to obtain on the mechanisms, through which Canadian SMEs are affected by the financial crisis, will contribute to the Canadian economy and welfare as a whole.

3. Theoretical Framework

The conceptual framework for this dissertation draws on the process by which commercial lenders adjudicate SMEs' loan applications. It is based on the paradigm advanced by Besanko and Thakor (BT, 1987), and simplified by Nitani (2015).

The simplified form of the BT model introduces scale of borrowing into BT by supposing that the firm needs to borrow financial capital, *K*, for a risky positive expected-net-present-value project that has a probability of success δ and a *(1- δ)* probability of failure.[29] As per BT, in the event of success the project will earn rate of return, ρ. The lender requires the borrower to pay interest, α, on the loan and provide collateral of *c* per cent of the loan. The lender's variable cost of funds is given by *r;* and β represents the proportion of the collateralized value of the asset that the lender expects to realize in the event of failure. In a second departure from BT, it is supposed in this dissertation that the lender can avoid moral hazard through contract design (Berger and Udell, 1998) and can eliminate adverse selection through due diligence at a fixed cost, *F*, which reveals the risk expectation of the project to the lender. Finally, this work also differs from that of BT by supposing that lenders face an explicit limitation on net default losses of *d* per cent of the loan portfolio (Wynant and Hatch, 1991): d is therefore a measure of lender's degree of risk tolerance. The lender's bad debt constraint is therefore given by:

$$(1 - \delta)(1 - \beta c) < d \tag{1}$$

It is also assumed that the rational borrower undertakes the project only if the expected return on investment, net of borrowing costs (including the costs associated with applying for the loan), exceeds a minimum opportunity cost, *b,* such that:

[29] Project risk could, alternately, be expressed in a more complex fashion using a cumulative probability distribution; however, this simply adds complexity without substantive changes to the implications.

$$\delta(\rho - \alpha) - (1 - \delta)c > b \quad (2)$$

The lender seeks to maximize profit, (3), subject to rationality (2) and its bad debt limitation (1).

$$Profit = \delta\alpha + (1 - \delta)\beta c - r - ({}^{F}/_{K}) \quad (3)$$

Loan adjudication is modelled as a two-step decision process (Wynant and Hatch, 1991). The first step is the decision of whether or not it is worthwhile to undertake the due diligence that informs the second step, namely the decision about loan approval (or not) and terms of credit (α: rate of interest, *c:* rate of collateral required). The first step, where the lender decides, based on *a priori* estimates, whether it is worthwhile to proceed to due diligence or better to reject the application out of hand is modelled by (4):

$$r + F/K < \delta\rho - b - (1 - \delta - d)((1 - \beta)/\beta) \quad (4)$$

The lender moves to the second step only if the condition specified by the above equation (4) is met.

Following the literature review, the supply shock theory suggests that anticipated and actual losses that banks incur on their asset holdings reduce their net worth and make them more risk averse (Brunnermeier, 2009; Shleifer and Vishny, 2010; Kahle and Stulz, 2012; Easley and O'Hara, 2010), in other words, decrease the lender's degree of risk tolerance, *d*, in equation (4).

Decrease in lenders' risk tolerance during a crisis is anticipated to take a form of increased sensitivity to the potential borrower's risk, availability of collateral, and level of information asymmetry (Bekaert, et al., 2009; Epstein and Schneider, 2008; Caballero and Krishnamurthy, 2008). It is expected that a crisis would exacerbate lenders' tendency to shy away from riskier borrowers and those with smaller amount of collateralized assets, and lean towards more established borrowers with a long-standing relationship with lenders. It is also expected that financial institutions becomes more sensitive to their own structure of capital, in the sense that institutions with more constraint capital structures are more reluctant to extend loans (DeYoung *et al.*, 2012; Popov and Udel 2012). Overall, the theory suggests that a crisis would: (1) increase the frequency of out-of-hand rejections of loan applications (as equation (4) implies); and, (2) change the commercial banks' attitudes towards corporate lending (i.e., change in profile of borrowers whose applications are likely to be rejected).[30] The first research question empirically investigates these implications, along with the following hypothesis:

<u>Research Question 1:</u> to which extent did commercial banks change their attitudes (*d*) towards corporate lending during the financial crisis?

<u>Hypothesis 1:</u> the supply of credit to SMEs was tightened during the financial crisis.

Financing necessity is strongly associated with firm growth. A firm needs to raise capital to grasp promising growth opportunities. The demand shock theory suggests, however, a sudden disappearance of growth opportunities during a crisis period. A crisis increases uncertainty associated with such opportunities (Kiyotaki and Moore, 1997; Bloom, 2009; Kahle and Stulz, 2012), that is: the borrower's probability of success, δ, would decrease. Equation (2) suggests that borrowers might not even undertake the project in the first place as its expected return on investment might not exceed its minimum opportunity cost. The second research question empirically investigates this implication, along with the following hypothesis:[31]

---

[30] A crisis also increases uncertainty of the project through exacerbated information asymmetries, augmented business risk, and decreased collateral values. Loans become less liquid, as the "lemons problem" worsens (Akerlof, 1970); the demand for goods and services falls off and asset (collateral) values decrease (OECD, 2009; DeYoung, *et al.*, 2012). In other words a crisis reduces δ (success probability of the project), ρ (rate of return on the project), and β; (reduces the realizable value of collateral), while increasing F (cost of due diligence) due to higher levels of uncertainty and lower levels of liquidity. However, this study does not consider the decline in loan supply due to the worsened applicants' risk profiles as evidence of a supply shock.

[31] A drop in asset value causes higher cost of debt, leading the decline in demand for investment and thus for capital (Mian, Rao and Sufi, 2013).

Research Question 2: to which extent did companies change their demand for bank loans during the financial crisis?

Hypothesis 2: the demand for bank loans decreased during the financial crisis.

This study addresses the above research questions by the examination of the credit supplied to, and demand by, small- and medium sized businesses. The tightening of credit arguably affects the SME sector more severely than it does large corporations, as the existing literature (both theoretical and empirical) suggests that SME are facing higher barrier to access to capital even in a normal economic environment. The genesis of this debate lies in the Nobel Prize-winning works of Stiglitz and Weiss (1981, 1983) whose seminal articles theoretically demonstrated that a financing constraint can arise from information asymmetry, and that small firms are relatively more likely to encounter this type of problem (the argument was also presented by many others, e.g., Fazzari, et al., 1988; Berger and Udell, 2006; Kremp and Sevestre, 2013).

In fact, small (and young, in particular) firms do not have much financial information available, and the information is less reliable, compared to large, publicly traded corporations, due to lack of audited financial reporting obligations. Moreover, SMEs are more likely to suffer from lack collateral, small cash flows, underdeveloped bank-borrower relationships and high transaction costs (Ardic, et al., 2012). Therefore, even in non-crisis periods, lending agencies have difficulty in evaluating a potential SME borrower as they cannot use standard quantitative screening.[32]

[32] For example, EDC hardly uses quantitative screening but rely more heavily on qualitative analysis when assessing potential SME borrowers.

With this background, many argue that a crisis environment exacerbate the challenge SMEs face in accessing capital (Udell, 2009; Carbó-Valverde, et al., 2013; Popov and Udell, 2012). OECD (2009, p.6) raises reasons to believe that SMEs are more vulnerable to times of crisis; those include:

- it is more difficult for them to downsize as they are already small;
- they are individually less diversified in their economic activities;
- they have a weaker financial structure (i.e. lower capitalisation);
- they have a lower or no credit rating;
- they are heavily dependent on credit; and,
- they have fewer financing options

SMEs in global value chains are even more vulnerable as they often bear the brunt of the difficulties of the large firms.

Moreover, loans to SMEs are more illiquid (DeYoung *et al.*, 2012) than those to large corporations; banks' increased risk aversion during a crisis might be more visible in SME loan market when the TED spread skyrockets (this leads to higher fixed costs for due diligence relative to the loan amount sought due to higher information asymmetry).[33] For those reasons, SMEs may be particularly sensitive to the changes in economic conditions and thus changes in debt/credit circulation induced by a financial crisis could manifest more apparently in the SME lending market than in the debt market for large established corporations. This study, therefore,

[33] In this sense, this research is situated not only within the financial crises literature but also within the wider, and ongoing, debate about market gaps and capital rationing (see, for reviews of this literature, Parker, 2002; Cressy, 2002).

uses the SME lending market as a laboratory for a better understanding of the impact of a financial crisis on bank loan market.

4. Data and Methodologies

4.1. Data

This research utilizes a Statistics Canada dataset titled "Survey of Financing (and Growth) of Small-and Medium-Enterprises (SFSME (2000, 2001, 2004, 2007) and SFGSME (2011, 2014))" for its analyses. Each of these surveys employs the Canadian Business Register (includes all businesses in Canada) as the sampling frame from which random samples are drawn. Eligible firms were those SMEs with fewer than 500 full-time-equivalent employees and annual gross revenues of less than $50 million, and enterprises were randomly selected and surveyed. Statistics Canada conducted computer-assisted telephone interviews to collect firm and owner demographic data. Moreover, these data contain information on Canadian SME loan applications and financing needs.

Table 2. SFSME and SFGSME Data[34]

Year	Period Survey Conducted	Sample size (# of respondents)	Response Rate
2000	June 2001 to August 2002	11,015	62%
2001	September to October 2002	3,842	66%
2004	September 2004 to March 2005	13,042	55%
2007	September 2007 to March 2008	15,808	45%
2011	February to June 2012	14,004	56%

While it is often considered that the 2007-2008 financial crisis started in summer 2007 (e.g., Ivashina and Scharfstein, 2010; Kahle and Stulz, 2013; Iyer et al., 2013), its signals emerged much earlier. Brunnermeier (2009) documents that concerns about the risk of a "liquidity bubble" or "credit bubble" arose in early 2007, and the liquidity crisis was actually triggered by the increase in subprime mortgage defaults, first noted in February 2007. Also in early 2007, the asset based security indices began demonstrating a steady deterioration of

[34] 2014 SFGSME data was not yet available for analysis.

subprime fundamentals (Gorton, 2009) and TED spread began increasing.[35] In addition, the rise in interest rates starting in 2006 signaled monetary tightening, which presumably impacted small businesses as it did consumer mortgages.[36] Accordingly, this study uses the "2007" survey as observations indicative of the 2007-2008 crisis.[37]

4.2. Methodologies

Hypothesis 1: the supply of credit to SMEs was tightened during the financial crisis.

First, a simple t-test will examine whether the loan acceptance rate is significantly low during the crisis, in comparison to the periods before and after the crisis. This approach is, however, unable to distinguish the change in loan acceptance rate due to the change in the applicant's profile (i.e., decreased acceptance rate due to the increased risk in applicants' businesses during the crisis) from that due to the change in the supplier's profile (i.e., decreased acceptance rate due to the decreased level of financial institutions' risk tolerance). To address this point, this study performs a second analysis, which involves regression estimates.

The second step of the analysis is to run a probit regression model (equation 1). The dependent variable is a binary variable equal to one if the loan application was accepted; or zero if rejected. The independent variables include measures for: (1) a dummy variable indicating whether the loan application was made during the crisis, (2) the loan applicant's risk and

[35] https://research.stlouisfed.org/fred2/series/TEDRATE
[36] http://www.bankofcanada.ca/wp-content/uploads/2010/09/selected_historical_v122530.pdf
[37] The 2007 survey asks respondents about their loan applications over the last twelve months, thus covers SMEs' attitudes toward commercial loans between September 2006 and March 2008. This is consistent with Popov and Udell (2012), who use a survey conducted in March-April 2008, which asked respondents about their desire and applications for loans during 2007, to examine the impact of crisis.

profitability measures; and (3) the degree of information asymmetry[38]. The universe of the analysis is all businesses in the SFSME/SFGSME data (i.e., "respondents" to the survey) that sought term loans and/or lines of credit in the year when the survey was conducted. The applications for term and operating loans will be examined separately as well as together; three regression models will thus be estimated.

$$probit[LOANAPPR_i] = \beta_0 + \beta_1 CRISIS_i + \tilde{\beta}_2 \tilde{S}MERISK_i + \tilde{\beta}_3 \tilde{C}_i + e_i \tag{1}$$

where:

$LOANAPPR_i$ = binary variable equal to 1 if responding firm i's loan application was accepted or 0 if it was rejected

$CRISIS_i$ = a dummy variable equal to 1 if the loan application was made during the crisis or 0 if it was before or after the crisis

$\tilde{S}MERISK_i$ = a vector of risk measures associated with responding firm i. This consists of three sub vectors, firm risk ($\tilde{F}IRMRISK_i$), cash flow risk ($\tilde{C}FRISK_i$) and information risk ($\tilde{I}NFORISK_i$)

$\tilde{C}_i$ = a vector of control variables significantly associated with responding firm i

e_i = error term

The applicant's risk level is assessed by three dimensions. The first dimension evaluates firms by traditional measures of risk introduced in finance textbook, such as current ratio, interest coverage ratio, EBITDA/debt, sales/working capital, and total debt/capitalization, the amount of capital sought as % of total assets.[39] These variables are used as risk measures by several previous studies that investigate the impact of the financial crisis, including Duchin et al. (2010), Kremp and Sevestre (2013) and Carbó-Valverde, Rodriquez-Fernandez and Udell (2013). They are also variables frequently used by practitioners, such as Export Development

[38] 2007 Survey questionnaire did not ask the respondent for the financial institution's name, only whether the last financial institution or credit supply that the business approached was (a) a bank, (b) credit union/caisse populaire, (c) government institution or (d) other. Therefore, this study was unable to control for the financial institution's level of financial constraint. However, Chapter 5 presents a separate analysis of Canadian banks' Tier 1 capital ratios to examine whether or not they varied significantly from before to after the crisis.

[39] Multicollinearity problems (e.g., total debt/capitalization and EBITDA/total Debt are expected to be collinear) will be addressed by a factor analysis, correlation matrix analysis, variance inflation factor, and/or eliminating insignificant variables within each vector.

Canada (EDC), for business risk assessment. In addition, the followings might also be considered as factors that increase the risk level of the applicant by commercial bankers (Nitani and Riding, 2013):

1. The mismatch of the use of loan, i.e., the application of term loan intended to use for short-term working capital financing and vice versa;
2. A high level of a respondent's reliance on bank loans for business operation (Santos, 2010); [40]
3. Research and development expenditures as the intended use of proceed;
4. Firms with owners inexperienced in management.

Following EDC's business assessment model, as well as Kremp and Sevestre (2013) and Carbó-Valverde, et al (2013), the second risk dimension considers firms' cash flow generating capability through ROA, gross margin, and profit margin. A higher ROA and higher margins could be signs of higher certainty to repay the debt for applicants with more profitable businesses. Thus, positive coefficients are expected.

The last risk dimension quantifies the degree of information asymmetry between the applicant and the banking institution through the following three variables[41]: (1) age and size of the applicant firm; (2) whether the applicant firm devoted a portion of its total investment expenditure to research and development (R&D); and (3) the applicant's growth intention.[42]

[40] The survey asks respondents the extent to which commercial (or operating) loans are necessary to keep their businesses in operation. It is possible that firms with a higher debt-to-equity ratio are correlated with the level of necessity of bank loans for their business operation; multicollinearity problems will be addressed as stated earlier.
[41] The effect of a long-standing relationship for moderating information asymmetry between lender and borrower was excluded from the analysis as relationship data did not exist for the 2007 and 2011 versions of the survey questionnaire.

The age of the firm is also often used for a proxy of information asymmetry (e.g., Stiglitz and Weiss, 1981, 1983; Fazzari, et al., 1988; Aghion, et al., 2007). Binks and Ennew (1996) argue that growing firms are relatively more "informationally opaque" – that is, gathering and processing information on growing firms could potentially be more difficult because of the pace of change within the business. Guiso (1998) maintains that monitoring R&D activity is costly and requires technical knowledge, and Aboody and Lev (2000) provide evidence that R&D is a major contributor to information asymmetry.[43] It is expected that larger firms and/or older firms are more likely to get approved. On the other hand, firms that devote a higher portion of investment expenditure to R&D and/or have growth intention are less likely to be approved.

Lastly, the vector of control variables includes variables such as firm size, industry, location, exporter or not and controls for the owner(s)'s gender and ethnic group (minority or not).[44] Riding et al., (2012) and Popov and Udell (2012) report that exporters are more likely to seek, yet less likely obtain, external financing. Neville et al. (2014) document a systematic difference in performance between immigrant-owned businesses and others, which could influence the firm's propensity to seek and obtain external financing. Such systematic differences also appear to exist between male- and female-owned businesses (Berg and Kirschenmann, 2012; Orser and Riding, 2016).

---

[43] Popov and Udell (2012) report that firms in the high R&D intensity industries are most sensitive to this bank credit supply shock.

[44] Size will be measured by: (1) revenues; (2) total assets; (3) the number of employees. Of those, the one with least missing observations will be chosen. Size is also 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, among others). Total assets could be related to the loan approval rate via its proxy nature for the availability of collateral (Kremp and Sevestre, 2013; alternatively, fixed assets per employee or fixed assets/total assets could measure the availability of collateral, as Popov and Udell (2012) and Carbó-Valverde, et al (2013) suggest); however, in the case of small businesses: (1) majority of assets could be intangible; and, (2) the owner's personal assets are often required as collateral.

The empirical presence of the supply shock during the recent financial crisis will be examined by a generalised form of a structural break test (Chow test approximation)[45]. The structural break test investigates whether the impacts of loan applicants' risk and profitability measures, asymmetric information issues, and financial institutions' current financial (capital) structures, changed significantly during the crisis. The conceptual framework predicts that a crisis makes financial institutions less risk tolerant, and more sensitive to the potential borrowers' risk, moral hazard problems, and their own current financial situations. Thus, significant negative shifts in coefficients for loan applicant's risk, profitability, information asymmetry, and bank's capital structure variables during the crisis period suggest the presence of a supply shock.[46]

Hypothesis 2: the demand for bank loans decreased during the financial crisis.

As the first step, a t-test will be performed to examine whether the percentage of SMEs that sought for bank loans is significantly lower during the crisis, in comparison to the periods before and after the crisis.

The demand shock theory predicts a decline in demand for bank loans due to the fewer investment opportunities during the crisis. However, the above simple t-test is unable to distinguish bank loan demand for growth purposes from that for survival purposes, which might increase during the crisis due to the increased number of businesses with financial distress such as defaults of account receivables.

[45] The Quandt Likelihood Ratio test proposed by this research was unavailable due to the difference in firms throughout the samples. Therefore, the F-statistic was calculated using a Chow test approximation instead of the likelihood ratio.

[46] It is possible that banks with a more constraint capital structure are more sensitive to the loan applicants' risk and potential moral hazard problems. To address this point, the regression model will be estimated separately for each of the three subsamples based on the banks' capital structure level, to examine whether the negative changes in coefficients for applicants' risk and information asymmetry variables are more pronounced for the sub-sample of highly financial constraint lenders.

To address this point, a probit regression (equation 2) will be estimated. The dependent variable is a binary variable equal to one if the SME sought credit or zero if the SME did not seek credit. The independent variables include (1) a dummy variable indicating whether the loan application was made during the crisis, (2) the applicant's growth momentum and (3) controls for the risk of the applicant firm. Again, the applications for term and operating loans will be examined separately and together; three regression models will thus be estimated.

It is important to note that the survey-based SFSME/ SFGSME data enables this study to identify responding firms with financing needs that did not seek credit because they felt they would be rejected (discouraged borrowers) for 2000 and 2011. These discouraged borrowers are respondents who identified that they "thought the request would be turned down" for the question "Why did the business not attempt to obtain new financing". However, this variable is not available for 2004 and the 2007 version of the questionnaire did not include this question. Therefore, the analysis is not completely free from the contamination of the estimates induced by the unidentifiable presence of discouraged borrowers in the sample.

However, the proportion of discouraged borrowers, estimated based on the 2000 and 2011 samples, is not significant (e.g. one percent of total respondents in the sample for 2000 and 0.7 percent for 2011). Industry Canada's 2013 SME Research report also indicates a small fraction of the sample represented by discouraged borrowers, approximately three percent of firms that did not apply for financing are discouraged borrowers[47]. This study, therefore, assumes that the impact of contamination, which might result in biased estimates, due to the missing information on discouraged borrowers is minimal.[48]

[47] This three percent includes all types of financing, while this research focuses on lines of credit and/or term loans.
[48] Nevertheless, the Heckman correction procedure could be carried out as an area of future research.

The applicant's growth momentum will be measured by the geometric average growth rate in revenues over the five years prior to the survey year. In the period of normal economic condition, it is assumed that a momentum in growth exists, thus respondent firms that experienced a significant growth in the recent past are more likely to apply for new credit in order to sustain the continuous growth. On the other hand, the demand shock theory claims a sudden disappearance of growth opportunities in a crisis situation, making the recent historical growth an unreliable predictor for loan demand.[49]

The vector of risk measures is identical to that from the supply equation (equation 1). It is assumed, during the crisis period in particular, that firms in a distressed situation are also more likely to apply for loans, and the vector quantifies the degree of such distress. It is expected that current ratio, interest coverage ratio, EBITDA/debt, sales/working capital, profitability measures (ROA and margins) are negatively, and total debt/capitalization and the level of reliance on bank loans are positively, correlated to the probability of desiring credit, especially during the crisis (more firms might seek financing due to their distressed situations). Firms that are less subject to asymmetric information problems might be less reluctant to applying for loans (Kon and Storey, 2003).[50] Thus, firm age and growth intention are expected to be positively related with the probability of applying for a loan.

The vector of control variables is identical to that in equation 1, plus the variables in the vector of profitability measures used in equation 1, as Kremp and Sevestre (2013) identified those are significantly associated with the demand for loans.

[49] Alternatively, growth momentum of the industry the firm operates in, or in the region the firm located, could be used.
[50] Berg and Kirschenmann (2012) report that firms applying for repeat loans are less likely discouraged.

$$probit[APPCREDIT_i] = \beta_0 + \beta_1 CRISIS_i + \beta_2 GROWTHP_i + \tilde{\beta}_3 \tilde{S}MERISK_i + \tilde{\beta}_4 \tilde{C}_i + e_i \quad (2)$$

where:

$APPCREDIT_i$ =	binary variable equal to 1 if responding firm i applied for credit, 0 otherwise
$CRISIS_i$ =	a dummy variable equal to 1 if the loan application was made during the crisis or 0 if it was before or after the crisis.
$GROWTHP_i$ =	geometric average growth rate in revenues of firm i over the five years prior to the survey year
$\tilde{S}MERISK_i$ =	a vector of risk measures associated with responding firm i. This consists of three sub vectors, firm risk ($\tilde{F}IRMRISK_i$), cash flow risk ($\tilde{C}FRISK_i$) and information risk ($\tilde{I}NFORISK_i$)
$\tilde{C}_i$ =	a vector of control variables associated with responding firm i
e_i =	error term

As in the test for supply shock, the demand shock test includes a generalised form of a structural break test (Chow test approximation). A structural break test will examine if there are shifts in coefficients. Particular attention will be given to the growth momentum variable, as, upon demand shock, we should observe little or no effect of growth momentum variable on the firm's desire for credit.

Summary

This chapter has outlined the methodologies proposed to investigate the presence and the nature of supply and demand shocks in SME lending associated with the 2007-2008 financial crisis. The approach relies on estimation of probit models of the likelihood of loan applications and approvals of loan applications. The interpretation of the findings will be facilitated by the significance and direction of the crisis dummy and by drawing on structural break testing of the coefficients of the respective models.

5. Empirical Analyses and Findings

The following sections present descriptive statistics of the data (section 5.1), as well as the result of the probit regression and structural break tests analyses used for testing each hypothesis (section 5.2).

5.1. Descriptive Statistics

5.1.1 Geographic, Sector, and Size Breakdown

The following tables describe the sample of 14,151 SMEs that answer the question "Did you apply for financing in the last 12 months" in their respective surveys. Table 3 ~ 5 present the industry, geography, and size breakdowns of the firms in each of the samples of 2000, 2004, 2007 and 2011.[51]

Table 3 describes the industry breakdown of the sample throughout 2000, 2004, 2007 and 2011[52]. The Statistics Canada dataset categorized the sector of these SMEs using the three-digit North American Industry Classification System (NAICS). To create broader industry categories, the two-digit NAICS was used instead and some categories were combined. Appendix 1 explains the construction of these industry categories.

[51] 2001 Survey data was excluded due to the lack of respondents. After controlling for missing values, the dataset was too small to analyze.
[52] 2001 Survey data was excluded due to the lack of respondents. After controlling for missing values, the dataset was too small to analyze.

Table 3. Industry of SMEs

	Survey Year			
	2000	2004	2007	2011
Information and cultural industries	2.38%	2.54%	2.38%	0.72%
Manufacturing	16.74%	17.17%	14.53%	13.62%
Primary	20.55%	24.86%	28.17%	14.83%
Professional, administrative and health care services	28.54%	16.80%	18.15%	19.68%
Real estate and rental and leasing	2.79%	2.11%	2.28%	1.67%
Recreational services	8.84%	8.87%	11.31%	11.11%
Transportation and warehousing	2.84%	7.87%	6.45%	10.52%
Wholesale and Retail	17.32%	19.78%	16.72%	27.83%

As shown in Table 3, more than half of the SMEs in the sample are in the professional, administrative and health care services, primary and wholesale and retail industries (63.66%). Only 1.70% of SMEs are in the information and cultural industries, and 2.17% in the real estate and rental and leasing industries.

Table 4. Region of SMEs

	Survey Year			
	2000	2004	2007	2011
Atlantic	12.57%	12.40%	12.80%	10.64%
BC & Territories	23.57%	17.05%	12.95%	10.81%
Ontario	25.83%	19.09%	22.42%	32.43%
Prairies	17.08%	21.76%	22.97%	22.18%
Québec	20.95%	29.70%	28.87%	23.94%

As expected, Ontario and Québec represent the highest proportion, with 51.68% of the SMEs located in either Ontario or Québec. The other half of the sample is located in the Atlantic region (11.77%), British Columbia or Territories (15.96%) and the Prairies (20.59%).

Table 5. Number of employees

	Survey Year			
	2000	2004	2007	2011
0	10.89%	14.51%	12.10%	0.46%
1-4	18.42%	38.19%	19.94%	35.20%
5-19	30.46%	26.29%	31.75%	34.22%
20-99	29.00%	16.49%	20.49%	22.20%
100-499	11.24%	4.53%	15.72%	7.92%

As shown in Table 5, most SMEs from the sample employ 5 to 19 employees (29.96%). The size category with the smallest proportion is firms with 100 to 499 employees (11.02%) follow by firms where the owner is the only employee (11.90%).

The three tables indicate that the sector/geographical/size breakdowns are not stable across different sample. For example, 2011 sample includes fewer high tech firms (those in the information and cultural sector) and more wholesale and retail companies and those located in Ontario. 2007 sample includes more relatively large firms (those with 100-499 employees). Those indicate the importance of controlling for sector, geography, and size in the probit analyses, in order to ensure that those proportional differences across samples do not distort the results.

5.1.2. SME credit supply

Table 6 presents the loan approval rates for 2000, 2004, 2007 and 2011 for each type of loan.[53] To control for differences between loan types, (1) term loan applications and (2) lines of credit applications were examined separately as well as (3) together.[54]

Contrary to the supply shock theory, and Berg and Kirschenmann (2012) who find a decrease in SME loan approval during 2008 in Azerbaijan, the approval rates increased over the

[53] 2011 values for lines of credit and for term loans were not high enough for Statistics Canada to allow their release.
[54] The combined sample was also examined in order to preserve a large sample size.

years for all three types. T-tests on whether or not the approval rate was higher during/after the crisis are all significant at the, at least, five percent level (p-values are 0.000 for lines of credit; 0.045 for term loans; and 0.000 for lines of credit and/or term loans), suggesting that approval rates are significantly higher for 2007 sample than 2004 sample.[55]

[55] Proportions were also compared using 2000-2004 and 2007-2011 (where available) as the 2 samples to compare. Results were consistent with the previous results and significant at the one percent level: lines of credit (p-value = 0.000), term loans (p-value = 0.007) and lines of credit and/or term loans (p-value = 0.000) approval rates are significantly higher from 2000-2004 to 2007-2011.

Table 6. Loan approval rates

	Lines of Credit			Term Loans			Lines of Credit and/or Term Loans		
	Rejected	Accepted	# Firms	Rejected	Accepted	# Firms	Rejected	Accepted	# Firms
2000	17.69%	82.31%	503	10.32%	89.68%	407	14.01%	85.99%	942
2004	17.55%	82.45%	416	8.70%	91.30%	414	13.18%	86.82%	880
2007	6.98%	93.02%	559	5.96%	94.04%	638	6.21%	93.79%	1450
2011	N/A	N/A	N/A	N/A	N/A	N/A	2.88%	97.12%	555

5.1.3. SME credit demand

To control for differences between loan types, (1) term loan applications and (2) lines of credit applications were examined separately as well as (3) together.

Table 7 presents the loan application rates for 2000, 2004, 2007 and 2011 for each type of loan category.[56] The rates increase from 2000 to 2007 for all types of loans observed, but decline significantly from 2007 to 2011. For the "term loan" and "lines of credit and/or term loan" categories, t-tests on whether or not the application rate was higher during/after the crisis are significant at the one percent level (p-value = 0.000 for both categories); application rates are significantly higher for 2007 sample than 2004 sample. However, for the lines of credit category, the increase in approval rate from 2004 to 2007 is significant only at the ten percent level (p-value = 0.0953).

[56] 2011 values for lines of credit and for term loans were not high enough for Statistics Canada to allow their release.

Table 7. Loan application rates

	Lines of Credit			Term Loans			Lines of Credit and/or Term Loans		
	Did not apply	Applied	# Firms	Did not apply	Applied	# Firms	Did not apply	Applied	# Firms
2000	89.02%	10.98%	4583	91.12%	8.88%	4583	79.45%	20.55%	4583
2004	74.21%	25.79%	1613	74.33%	25.67%	1613	45.44%	54.56%	1613
2007	72.27%	27.73%	2016	68.35%	31.65%	2016	28.08%	71.92%	2016
2011	96.25%	3.75%	5939	95.69%	4.31%	5939	90.65%	9.35%	5939

Application rates decrease significantly from 2007 to 2011 for all three loan type categories. To investigate whether firms simply demanded credit in other forms, Table 8 presents the type of loans SMEs applied for in 2011.

Table 8. Loan type applications for 2011

	# applications
Credit card	17.12%
Equity	4.17%
Government Financing	14.22%
Lease	14.84%
Line of Credit	13.18%
Mortgage	2.74%
Term loan	11.36%
Trade credit	22.37%

In 2011, only 24.54% of loan applications were applications for line of credit and/or term loan, while the other 75.46% of firm applications were applications for other sources of credit. In particular, trade credit represents most popular source of credit with 22.37% of the share of loan applications, followed by credit cards with 17.12%. Credit cards and trade credit loan applications taken together represented 39.49% of the total amount of loan applications made in 2011. This is consistent with Carbó-Valverde, Rodriquez-Fernandez and Udell (2013), who find an increased dependence of trade credits as an alternative source of financing during the crisis.

With this switch in source of financing in mind, it is false to conclude that loan application rates decreased in 2011. By taking the application rate for other types of loans (excludes lines of credit and term loans), an application rate of 75.03% was observed for 2011.

5.2. Regression analysis

5.2.1 Variable description

Empirical tests on the supply shock (Hypothesis 1) and the demand shock (Hypothesis 2) both use probit regression analyses. For Hypothesis 1, the dependent variable is a binary variable equal to one if the loan application was accepted; or zero if rejected. The independent variables include measures for: (1) a dummy variable indicating whether the loan application was made during the crisis, (2) the loan applicant's risk and profitability measures; and (3) the degree of information asymmetry.

For Hypothesis 2, the dependent variable is a binary variable equal to one if the SME sought credit or zero if the SME did not seek credit. The independent variables include (1) a dummy variable indicating whether the loan application was made during the crisis, (2) the applicant's growth momentum and (3) controls for the risk of the applicant firm.

Table 9 presents the description of the variables included in the regression analyses. Note that EBITDA and EBITDAD are excluded as they are highly correlated with the firm's current ratio, revenue and total assets (see Appendix 2 for correlation matrix).

Table 9. Description of variables used in the regression models

Variable	Description
Dependent Variables	
$\boldsymbol{LOANACCEPTED_i}$	binary variable equal to one if firm i’s loan application was accepted; or zero if rejected, for term loan applications, lines of credit applications and both term and lines of credit applications
$\boldsymbol{TERMACCEPTED_i}$	binary variable equal to one if firm i’s loan application was accepted; or zero if rejected, for term loan applications
$\boldsymbol{LOCACCEPTED_i}$	binary variable equal to one if firm i’s loan application was accepted; or zero if rejected, for lines of credit applications
$\boldsymbol{LOANAPPLY_i}$	binary variable equal to one if firm i applied for a term loan, line of credit or both; or zero if firm i did not apply for a term loan, line of credit or both
$\boldsymbol{TERMAPPLIED_i}$	binary variable equal to one if firm i applied for a term loa; or zero if firm i did not apply for a term loan
$\boldsymbol{LOCAPPLIED_i}$	binary variable equal to one if firm i applied for a line of; or zero if firm i did not apply for a line of credit

Table 9. Description of variables used in the regression models (continued)

Variable	Description
Independent Variables	
$\boldsymbol{\widetilde{FIRMRISK}_i}$	
$CURRENT_i$	Current ratio of responding firm i
$INTCOV_i$	EBITDA/Interest expense of responding firm i
$WCAP_i$	Working capital of responding firm i
$SALESWC_i$	Sales/Working capital of responding firm i
$DEBTCAP_i$	Total debt/Capitalization of responding firm i
$AMOUNT_i$	The amount of capital sought from responding firm i divided by total assets[57]
$MISMATCH_i$	Binary variable equal to 1 if term loan application for short term investment and operating loan application for long term investment; 0 otherwise[58]
$SURVIVAL_i$	Binary variable equal to 1 if commercial/operating loans are necessary to keep responding firm i in operation; 0 otherwise
$FORRD_i$	Loan application seeking R&D financing[59]
$OWNERE_i$	Experience (in years of management / ownership) of responding firm i's owner(s)
$\boldsymbol{\widetilde{CFRISK}_i}$	
$RETASSETS_i$	Net income/Total assets of responding firm i
$GMARG_i$	1 – Cost of goods sold/Total Revenue of responding firm i
$PROFM_i$	Net income/Total revenue (profit margin) of responding firm i
$\boldsymbol{\widetilde{INFORISK}_i}$	
AGE_i	Age of responding firm i
RD_i	Equal to 1 if responding firm i involves research and development
$GROWTH_i$	Growth intention responding firm i
$\boldsymbol{CRISIS_i}$	Equal to 1 if the observation is during the crisis period; 0 otherwise
$\boldsymbol{MOMENTUM_i}$	Geometric average growth rate in revenue over the previous five years of responding firm i
$\boldsymbol{\widetilde{C}_i}$	
$REVENUE_i$	Total revenues of responding firm i
$TOTALASSETS_i$	Total assets of responding firm i
$EMPLOYEES_i$	Number of employees of responding firm i
$INDUSTRY_i$	Industry based on the North American Industry Classification System (NAICS)
$LOCATION_i$	Province of responding firm i
$EXPORT_i$	Percentage of revenues that came from exports of responding firm i
$OWNERG_i$	Categorical variable: 0 = 100% male-owned; 1 = male/female mixed; 2 = 100% female-owned
$\widetilde{OWNERM}_i$	Vector of binary variables equal to 1 if the majority ownership of responding firm i was held by persons with a disability ($OWNERMA_i$), Aboriginal persons ($OWNERMB_i$), persons who are from a visible minority group ($OWNERMC_i$) or persons who have resided in Canada for less than 5 years ($OWNERMD_i$), 0 otherwise

[57] This variable is excluded from the demand equation, as it is unobservable if the firm did not apply for a loan.
[58] This variable is excluded from the demand equation, as it is unobservable if the firm did not apply for a loan.
[59] This variable is excluded from the demand equation, as it is unobservable if the firm did not apply for a loan.

Lenders' (i.e., financial institutions') level of financial constraint is also excluded from the regression analyses due to data merging limitations posed by Statistics Canada. Nevertheless, Table 10 presents the evolution of financial institutions' asset constraint level, as measured by Tier 1 capital ratios, extracted from the COMPUSTAT database. The table shows the stability of Canadian banks, that their level of financial constraint did not materially change during the crisis, which implies that the lender's level of financial constraint variable would have not exhibited a strong explanatory power on the loan approval rate even if it had been included in the regression analyses. Moreover, the stability of Canadian banks exhibited in Table 10 may explain the lack of decrease in loan approval rates during the crisis; that is: Canadian banks were not significantly affected by the worldwide 2007-2008 financial crisis, as evidenced by their Tier I capital ratio, which was translated into a higher approval rate during that period. This explanation is consistent with the widely pointed out characteristics of Canadian banks (Haltom, 2013); their high level of conservativeness, leading them to shy away from innovative yet controversial products such as junk bonds and mortgage backed securities.

Table 10. Canadian banks' Tier 1 capital ratios

	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Bank of Montreal	9.81%	9.96%	10.22%	9.51%	9.77%	12.24%	13.45%	12.01%
Canadian Imperial Bank	10.50%	8.50%	10.40%	9.70%	10.50%	12.10%	13.90%	14.70%
Bank of Nova Scotia	11.50%	11.10%	10.20%	9.30%	9.30%	10.70%	11.80%	12.20%
National Bank Canada	9.60%	9.60%	9.90%	9.00%	9.40%	10.70%	14.00%	13.60%
Royal Bank of Canada	8.90%	9.60%	9.60%	9.40%	9.00%	13.00%	13.00%	13.30%
Toronto Dominion Bank	12.60%	10.10%	12.00%	10.30%	9.80%	11.30%	12.20%	13.00%

Note also that the increase in Tier 1 capital ratios starting from 2008 is probably due to the implementation of Basel II, which increased banks' capital requirements to create liquidity cushions for the future possible financial distresses.

5.2.2. SME credit supply

This section presents the probit regression analysis on the supply of credit to SMEs before, during and after the financial crisis (hypothesis 1). Three different models were estimates for both credit supply and credit demand probit regressions; (1) term loan applications, (2) lines of credit applications and (3) both term loan and lines of credit applications. The dependent variable is a binary variable equal to one if the loan application was accepted; or zero if rejected. Each table contains an initial specification (1) that includes all of the variables outlines in the methodology section. The subsequent models (2) eliminate insignificant variables until arriving at the final specification of the model (3). Particular attention should be paid to the crisis dummy variable to investigate the crisis' impact on the probability of the firm's loan being approved. All regressions control for firm industry, region and size. Variable coefficients marked "N/A" were not allowed for data release, however, they were still included in the regression estimation.

Table 11. Probit regression on probability of line of credit and/or term loan approval

		(1)	(2)	(3)
Crisis indicator				
	Crisis	0.321***	0.345***	0.324***
		(0.00369)	(0.000123)	(0.00101)
Firm risk				
	Current ratio	0.000878		
		(0.855)		
	Interest coverage ratio	7.28e-07		8.15e-07
		(0.241)		(0.189)
	Working capital	-2.30e-08*	-5.54e-09	
		(0.0816)	(0.233)	
	Sales/Working capital	2.98e-06		
		(0.898)		
	Debt capitalization	-0.316**	-0.172	-0.222
		(0.0396)	(0.164)	(0.118)
	Loan amount sought	-0.00815		
		(0.562)		
	Loan type mismatch	-0.0443		
		(0.556)		
	Survival loan	0.203***	0.196***	0.186**
		(0.00601)	(0.00346)	(0.0104)
	Intended use R&D	-0.210	-0.200	-0.232
		(0.188)	(0.157)	(0.131)
	Owner experience 5-10 years	0.185	0.173	0.156
		(0.161)	(0.132)	(0.208)
	Owner experience > 10 years	0.293***	0.258***	0.265***
		(0.00274)	(0.00239)	(0.00425)
Cash flow risk				
	Return on assets	0.186		
		(0.187)		
	Gross margin	-0.146		
		(0.224)		
	Profitability margin	-0.0284		
		(0.486)		
Information asymmetry risk				
	Firm age	0.00654**	0.00652***	0.00671***
		(0.0117)	(0.00469)	(0.00783)
	Growth intention	-0.00443		
		(0.953)		
	Involves R&D	-0.212***	-0.217***	-0.215***
		(0.00388)	(0.00115)	(0.00287)
Growth momentum				
	Average yearly growth rate	0.0854		
		(0.115)		
Control				
	Revenue	1.23e-08		
		(0.104)		
	Assets	-1.85e-09		
		(0.609)		
	Exporter	-0.189**	-0.159**	-0.180**
		(0.0283)	(0.0398)	(0.0325)
	Male/Female mixed ownership	-0.0572		
		(0.516)		
	100% female ownership	-0.316*	-0.292**	-0.319**
		(0.0550)	(0.0384)	(0.0421)
	Aboriginal ownership	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*
	Visible minority group ownership	-0.258**	-0.276**	-0.270**
		(0.0347)	(0.0104)	(0.0242)
	Observations	3,287	3,751	3,309
	Pseudo R2	0.0844	0.0693	0.0765
	Log likelihood	-876.5	-1059	-896.9
	LR chi2	161.6	157.8	148.6

Table 12. Probit regression on probability of term loan approval

		(1)	(2)	(3)	(4)
Crisis indicator					
	Crisis	0.179	0.153	0.187	0.162
Firm risk		(0.292)	(0.294)	(0.189)	(0.136)
	Current ratio	0.0210	0.0132		
		(0.378)	(0.343)		
	Interest coverage ratio	-3.68e-08			
		(0.943)			
	Working capital	8.45e-08	3.96e-08	4.40e-08	4.47e-08
		(0.163)	(0.178)	(0.119)	(0.115)
	Sales/Working capital	6.94e-07			
		(0.978)			
	Debt capitalization	-0.0245			
		(0.932)			
	Loan amount sought	-0.0218	-0.00975		
		(0.194)	(0.425)		
	Loan type mismatch	-0.242*	-0.207*	-0.227**	-0.220*
		(0.0626)	(0.0807)	(0.0482)	(0.0552)
	Survival loan	0.180	0.122	0.135	
		(0.140)	(0.274)	(0.219)	
	Intended use R&D	*N/A*	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*	*N/A*
	Owner experience 5-10 years	*N/A*	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*	*N/A*
	Owner experience > 10 years	0.143	0.0938	0.136	
Cash flow risk		(0.396)	(0.513)	(0.329)	
	Return on assets	0.497	0.292		
		(0.152)	(0.239)		
	Gross margin	-0.216	-0.376**	-0.354**	-0.346**
		(0.281)	(0.0358)	(0.0430)	(0.0468)
	Profitability margin	-0.0261			
Information		(0.716)			
asymmetry risk	Firm age	0.00825*	0.00580	0.00684*	0.00684*
		(0.0625)	(0.122)	(0.0681)	(0.0648)
	Growth intention	-0.0452			
		(0.717)			
	Involves R&D	-0.231*	-0.337***	-0.331***	-0.322***
Growth momentum		(0.0613)	(0.00264)	(0.00209)	(0.00265)
	Average yearly growth rate	0.0911	0.00716		
Control		(0.271)	(0.730)		
	Revenue	2.11e-09			
		(0.899)			
	Assets	8.46e-09			
		(0.530)			
	Exporter	0.131	0.113		
		(0.444)	(0.451)		
	Male/Female mixed ownership	-0.00544			
		(0.971)			
	100% female ownership	*N/A*	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*	*N/A*
	Aboriginal ownership	*N/A*	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*	*N/A*
	Visible minority group ownership	-0.330	-0.451**	-0.466***	-0.451***
		(0.101)	(0.0109)	(0.00678)	(0.00871)
	Observations	1,508	1,637	1,659	1,659
	Pseudo R2	0.0982	0.0847	0.0866	0.0832
	Log likelihood	-319.8	-373.9	-391.1	-392.5
	LR chi2	69.63	69.17	74.12	71.28

Table 13. Probit regression on probability of line of credit approval

		(1)	(2)	(3)	(4)
Crisis indicator					
	Crisis	0.369*	0.296*	0.413***	0.425***
Firm risk		(0.0615)	(0.0969)	(0.00492)	(0.00276)
	Current ratio	-0.00669			
		(0.502)			
	Interest coverage ratio	1.31e-06	1.37e-06	1.40e-06	1.42e-06
		(0.180)	(0.160)	(0.153)	(0.148)
	Working capital	-5.28e-08**	-5.11e-08***	-5.08e-08***	-5.09e-08***
		(0.0484)	(0.00377)	(0.00390)	(0.00383)
	Sales/Working capital	7.87e-05			
		(0.551)			
	Debt capitalization	-0.620***	-0.598***	-0.590***	-0.587***
		(0.00363)	(0.00261)	(0.00293)	(0.00303)
	Loan amount sought	-0.000757			
		(0.986)			
	Loan type mismatch	0.167	0.163		
		(0.232)	(0.239)		
	Survival loan	0.242**	0.231**	0.229**	0.229**
		(0.0217)	(0.0278)	(0.0285)	(0.0288)
	Intended use R&D	*N/A*	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*	*N/A*
	Owner experience 5-10 years	0.0973			
		(0.618)			
	Owner experience > 10 years	0.414***	0.373***	0.366***	0.366***
Cash flow risk		(0.00302)	(0.00115)	(0.00138)	(0.00138)
	Return on assets	0.0865			
		(0.599)			
	Gross margin	-0.229	-0.243	-0.238	-0.241
		(0.186)	(0.151)	(0.160)	(0.154)
	Profitability margin	-0.0314			
Information asymmetry risk		(0.609)			
	Firm age	0.00741*	0.00692*	0.00705*	0.00712*
		(0.0551)	(0.0682)	(0.0630)	(0.0599)
	Growth intention	0.102			
		(0.346)			
	Involves R&D	-0.209**	-0.199*	-0.201*	-0.202**
Growth momentum		(0.0458)	(0.0543)	(0.0517)	(0.0495)
	Average yearly growth rate	0.0630			
Control		(0.388)			
	Revenue	1.51e-08	1.59e-08*	1.60e-08*	1.63e-08*
		(0.147)	(0.0952)	(0.0919)	(0.0871)
	Assets	1.05e-09			
		(0.919)			
	Exporter	-0.252**	-0.252**	-0.261**	-0.262**
		(0.0287)	(0.0274)	(0.0219)	(0.0212)
	Male/Female mixed ownership	-0.0190	-0.0361	-0.0361	
		(0.876)	(0.762)	(0.761)	
	100% female ownership	*N/A*	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*	*N/A*
	Aboriginal ownership	*N/A*	*N/A*	*N/A*	*N/A*
		N/A	*N/A*	*N/A*	*N/A*
	Visible minority group ownership	-0.280*	-0.278*	-0.276*	-0.273
		(0.0975)	(0.0963)	(0.0982)	(0.102)
	Observations	1,413	1,420	1,420	1,420
	Pseudo R2	0.118	0.114	0.112	0.112
	Log likelihood	-447.3	-450.3	-451.0	-451.0
	LR chi2	119.9	115.7	114.3	114.2

Table 11, 12 and 13 present the results of the probit analyses on the probability of loan application approval against various independent and control variables. Table 11 exhibits the results for firms in the “term loans and/or lines of credit applications” category, Table 12 for the “term loan application” category, and Table 13 for the “lines of credit application” category.

The relationship between the crisis time period and the probability of the firm’s loan application being approved is significant and positive for the “term loans and/or lines of credit application” and the “lines of credit application” categories at the one percent level. For term loans, the crisis dummy is positive but marginally significant.[60] It appears that commercial lenders in Canada are more likely to approve line of credit applications during the crisis, but not term loan applications. It is expected that a crisis situation requires firms more working capital to protect themselves from the liquidity shock (i.e., more need to apply lines of credit) but not so fixed asset investments (i.e., less need to apply term loans). It therefore appears that banks accommodated the SMEs’ needs during the crisis period. This somewhat surprising result – higher loan approval rate during the crisis, especially for lines of credit even after controlling for the applicants’ risk level and other characteristics – calls for in depth contemplation and further investigations. Possible explanation for this counterintuitive result will be discussed in detail in the conclusion part.

For lines of credit, firm’s working capital has a negative and significant impact on the probability of its application being approved. This result is also counterintuitive – banks are more likely to provide short-term financing to firms that face higher short term liquidity risk and therefore necessitate short term financing. Again, it appears that banks accommodate SME needs

[60] Although the p-values for the coefficients are not available, the p-value for the crisis dummy was very close of being significant at the 10% level.

more than protecting themselves from the default risk. On the other hand, firm’s debt capitalization has a significant and negative impact on the probability of getting a line of credit. Here, banks exhibit their risk-averse attitude; they tend to shy away from highly leveraged and thus high default risk firms.

For the term loan applications, the mismatch between the loan type applied for and the intended use of the loan has a negative and significant impact on the probability of the firm’s loan being approved, consistent with the traditional finance wisdom that financing short term investment with long term liability is risky.

As expected, firms managed by experienced entrepreneurs appear to be considered less risky, as firm owner’s experience has a positive impact on the probability of the firm’s loan getting approved (although insignificant for term loans). Also as expected, the firm’s age has a significantly positive, and whether the firm involves R&D has a significantly negative impact on the probability of the firm’s loan getting approved for all types of loans. On the other hand, it is an enigma that firm’s gross margin has a significant and negative impact on term loan approvals. This counter intuitive result might be due to the peculiarity of this particular dataset, as this variable is highly insignificant in all other regression models. Consistent with Riding et al., (2012) and Popov and Udell (2012), exporter firms appear to be considered to have higher short term liquidity risk (especially the risk associated with account receivables issued outside of Canada), as their lines of credit applications are significantly more likely to be rejected.

Consistent with Berg and Kirschenmann (2012) and Orser and Riding (2016), the inclusion of females in the firm’s ownership decreases the probability of the firm’s loan getting approved. Having a one-hundred percent female ownership has a negative and significant (at the five percent level) impact on the firm's loan approval. Also, having persons from a visible minority group (other than aboriginal) has a negative and significant impact on the probability of the firm's loan getting approved. This could be due to the fact that female-owned firms are more likely to present poor credit history or insufficient collateral (Jung, 2010).

5.2.3. SME credit demand

This section presents the probit regression analysis on the demand of credit from SMEs before, during and after the financial crisis (hypothesis 2). Again, three different models were estimated; (1) for term loan applications, (2) for lines of credit applications and (3) term loan and/or lines of credit applications. As in the supply section, each table contains an initial specification (1) that includes all of the variables outlines in the methodology section. The subsequent models (2) eliminate insignificant variables until arriving at the final specification of the model (3). Particular attention will be given to the crisis dummy variable to investigate the crisis' impact on the probability of the firm applying for a loan.

Table 14 presents the regression results on firm term loans and/or lines of credit applications.

Table 14. Probit regression on probability of line of credit and/or term loan application

		(1)	(2)	(3)
Crisis indicator				
	Crisis	1.285***	1.292***	1.280***
		(0.0456)	(0.0428)	(0.0422)
Firm risk				
	Current ratio	-0.00200**	-0.00210**	-0.00224**
		(0.000977)	(0.000979)	(0.000982)
	Working capital	-6.31e-09*	-6.36e-09*	-6.41e-09*
		(3.33e-09)	(3.33e-09)	(3.34e-09)
	Sales/Working capital	-6.46e-07		
		(4.06e-06)		
	Debt capitalization	0.656***	0.653***	0.655***
		(0.0510)	(0.0507)	(0.0504)
	Survival loan	0.283***	0.280***	0.284***
		(0.0289)	(0.0288)	(0.0286)
	Owner experience 5-10 years	-0.0294		
		(0.0555)		
	Owner experience > 10 years	-0.124***	-0.110***	-0.110***
		(0.0421)	(0.0320)	(0.0319)
Cash flow risk				
	Return on assets	-0.00236		
		(0.00476)		
	Gross margin	-0.0134		
		(0.0171)		
	Profitability margin	0.00319	-0.000107	
		(0.00258)	(0.000113)	
Information asymmetry risk				
	Firm age	-0.00427***	-0.00435***	-0.00435***
		(0.000843)	(0.000840)	(0.000836)
	Growth intention	0.0521*	0.0505*	0.0523*
		(0.0277)	(0.0271)	(0.0269)
	Involves R&D	0.192***	0.195***	0.193***
		(0.0306)	(0.0305)	(0.0304)
Growth momentum				
	Average yearly growth rate	0.00175	0.00173	0.00175
		(0.00166)	(0.00165)	(0.00165)
Control				
	Revenue	-5.62e-09***	-5.61e-09***	-5.63e-09***
		(1.97e-09)	(1.96e-09)	(1.95e-09)
	Assets	1.32e-09*	1.32e-09*	1.33e-09*
		(7.70e-10)	(7.67e-10)	(7.65e-10)
	Exporter	0.0920***	0.0963***	0.0891***
		(0.0342)	(0.0341)	(0.0339)
	Male/Female mixed ownership	0.375***	0.376***	0.368***
		(0.0345)	(0.0343)	(0.0336)
	100% female ownership	0.0651	0.0566	
		(0.0636)	(0.0633)	
	Aboriginal ownership	0.0651		
		(0.0916)		
	Visible minority group ownership	0.234***	0.229***	0.236***
		(0.0584)	(0.0581)	(0.0579)
	Observations	13,500	13,575	13,672
	Pseudo R2	0.187	0.186	0.185
	Log likelihood	-6421	-6470	-6528
	LR chi2	2954	2952	2959

Table 15 presents the regression results on firm term loans applications.

Table 15. Probit regression on probability of term loan application

		(1)	(2)	(3)
Crisis indicator				
	Crisis	0.776***	0.787***	0.787***
Firm risk		(0.0492)	(0.0421)	(0.0421)
	Current ratio	-0.000325		
		(0.000709)		
	Working capital	-9.82e-09*	-1.00e-08*	-1.08e-08*
		(5.38e-09)	(5.44e-09)	(5.83e-09)
	Sales/Working capital	-9.81e-08		
		(4.55e-07)		
	Debt capitalization	0.611***	0.604***	0.600***
		(0.0618)	(0.0605)	(0.0603)
	Survival loan	0.219***	0.218***	0.218***
		(0.0341)	(0.0339)	(0.0339)
	Owner experience 5-10 years	0.0278		
		(0.0643)		
	Owner experience > 10 years	-0.0175		
Cash flow risk		(0.0478)		
	Return on assets	-0.00186		
		(0.00618)		
	Gross margin	0.104**	0.104**	0.103**
		(0.0411)	(0.0408)	(0.0410)
	Profitability margin	0.00330		
Information asymmetry risk		(0.00421)		
	Firm age	-0.00158	-0.00171*	-0.00175*
		(0.000988)	(0.000978)	(0.000978)
	Growth intention	0.0277	0.0275	0.0279
		(0.0332)	(0.0318)	(0.0318)
	Involves R&D	0.0956***	0.0955***	0.0950***
Growth momentum		(0.0361)	(0.0361)	(0.0360)
	Average yearly growth rate	0.00340*	0.00336*	0.00345*
Control		(0.00189)	(0.00187)	(0.00192)
	Revenue	-7.68e-09***	-7.61e-09***	-6.55e-09***
		(2.57e-09)	(2.57e-09)	(2.31e-09)
	Assets	1.02e-09	9.51e-10	
		(9.81e-10)	(9.83e-10)	
	Exporter	-0.104**	-0.105**	-0.105**
		(0.0423)	(0.0422)	(0.0422)
	Male/Female mixed ownership	0.288***	0.287***	0.288***
		(0.0417)	(0.0411)	(0.0410)
	100% female ownership	-0.0362		
		(0.0826)		
	Aboriginal ownership	0.0937	0.107	
		(0.104)	(0.104)	
	Visible minority group ownership	0.164**	0.164**	0.166**
		(0.0677)	(0.0675)	(0.0675)
	Observations	13,500	13,578	13,578
	Pseudo R2	0.119	0.119	0.119
	Log likelihood	-4392	-4418	-4419
	LR chi2	1191	1191	1189

Table 16 presents the regression results on firm lines of credit applications.

Table 16. Probit regression on probability of lines of credit application

		(1)	(2)	(3)
Crisis indicator				
	Crisis	0.577***	0.579***	0.581***
		(0.0497)	(0.0496)	(0.0496)
Firm risk				
	Current ratio	-0.00274**	-0.00281**	-0.00279**
		(0.00134)	(0.00135)	(0.00134)
	Working capital	-1.84e-09		
		(2.49e-09)		
	Sales/Working capital	-2.19e-06		
		(4.80e-06)		
	Debt capitalization	0.314***	0.317***	0.314***
		(0.0591)	(0.0587)	(0.0587)
	Survival loan	0.165***	0.165***	0.164***
		(0.0337)	(0.0337)	(0.0337)
	Owner experience 5-10 years	-0.209***	-0.211***	-0.211***
		(0.0639)	(0.0639)	(0.0639)
	Owner experience > 10 years	-0.203***	-0.202***	-0.203***
		(0.0462)	(0.0462)	(0.0462)
Cash flow risk				
	Return on assets	-0.00174		
		(0.00533)		
	Gross margin	-0.0240*	-0.00567	-0.00571
		(0.0143)	(0.00347)	(0.00348)
	Profitability margin	0.00209		
		(0.00281)		
Information asymmetry risk				
	Firm age	-0.00477***	-0.00479***	-0.00476***
		(0.00101)	(0.000999)	(0.000998)
	Growth intention	-0.00749	-0.00653	-0.00620
		(0.0327)	(0.0327)	(0.0327)
	Involves R&D	0.182***	0.182***	0.182***
		(0.0345)	(0.0345)	(0.0345)
Growth momentum				
	Average yearly growth rate	-0.0141	-0.0142	-0.0140
		(0.0114)	(0.0115)	(0.0114)
Control				
	Revenue	2.20e-10		
		(2.12e-09)		
	Assets	1.04e-09	6.69e-10	
		(7.83e-10)	(5.74e-10)	
	Exporter	0.212***	0.214***	0.215***
		(0.0383)	(0.0381)	(0.0381)
	Male/Female mixed ownership	0.325***	0.324***	0.323***
		(0.0402)	(0.0401)	(0.0401)
	100% female ownership	0.152**	0.147**	0.147**
		(0.0722)	(0.0721)	(0.0721)
	Aboriginal ownership	0.0542		
		(0.107)		
	Visible minority group ownership	0.189***	0.187***	0.188***
		(0.0643)	(0.0642)	(0.0642)
	Observations	13,500	13,506	13,506
	Pseudo R2	0.0881	0.0876	0.0874
	Log likelihood	-4543	-4546	-4547
	LR chi2	877.3	872.4	871.1

First of all, the relationship between the crisis and the probability of applying for a loan is significant and positive for all types of loans, rejecting hypothesis 2 that firms are less likely to apply for loans during the financial crisis. One possible explanation is that most loans sought during the crisis are for the purpose of business survival, rather than for the sake of growth. Section 5.4 will investigate the validity of this explanation with the results of the regression analyses that by separating the samples into two periods, before and after the crisis.

Regarding the firm risk variables, current ratio is insignificant for term loans, but significantly negative for lines of credit, as the more immediate liquidity the firms has, the less likely it is to need short-term financing. As expected (see the methodological development for hypothesis 2), the firm’s debt capitalization is significant and positive for all loan types. This is consistent with Popov and Udell (2012) who find a negative relationship between a firm’s equity over assets and its desire for bank credit. As also expected, the relationship between the firm’s need for loans to keep its business in operation (survival loan) and its probability of applying for a loan is significantly positive.

While the coefficient for the owner’s experience (in owning/managing a business) is insignificant for term loans, it is significant and positive for lines of credit. Experienced owners might be more likely to have long-held distribution/supply-chain relationships, which decreases the necessity of working capital financing. Another explanation comes from the positive correlation between the owner’s experience and the firm’s age (firm age is also significantly negative related to the probability of lines of credit application). Therefore, mature businesses (with mature owners) might be less likely to apply for short term financing as they have the necessary liquidity from their own revenue compared to younger firms.[61]

The firm's involvement in R&D is significantly positively related with the probability of applying for a loan.[62] R&D intensive firms are more likely to be with growth intention (Binks and Ennew, 1997) short in cash as it generally takes time for an R&D investment to cash out. The firm's growth intention is mostly insignificant throughout the sample (only significant for term loans and/or lines of credit), there might be due to the multicollinearity with R&D intensity. The results also yield similar findings for the firm's growth momentum (only significant for term loans and at the 10% level). Hypothesis 2 predicts that while growth intention has a positive impact on the firm's probability of applying for a loan, this relationship disappears in times of economic downturn. As in the case for the survival loan variable, Section 5.4 will investigate this by separating the sample into two, one for the period before and the other for the period after the crisis.

The relationship between the firm being an exporter and its probability of applying for bank loans is contradicting between term loans and lines of credit. While it is significantly positive at the one percent level for "lines of credit" and "term loans and/or lines of credit" categories, it is significantly negative at the five percent level for the term loan category. One possible explanation is that exporters are more likely suffer from risk associated with account receivable, as customers are located in outside of Canada, and that exporting does not always

[61] Firm revenue and age are positively correlated
[62] Gross margin is positively related to a firm's probability of applying for a loan (although it is only significant for term loans). It is, again, an enigma that high gross margin (cash rich) firms are more likely to apply for term loans, which may be due to the peculiarity of the data.

necessitate fixed asset investments. The popularity of EDC's Accounts Receivables Insurance product for exporters also supports this explanation. [63]

For all types of loans, firms with at least one female owner and those with owners from a visible minority group (other than aboriginal) are significantly more likely to apply for a loan.[64] Owners in a visible minority group may lack of long term business network (as they might be a recent immigrant), from which they could potentially find a source of financing. Likewise, women entrepreneurs tend to operate younger, smaller enterprises (Jung, 2010), which has not yet established solid business relationships.

5.3. Structural break test

For this test (as the other tests presented above), the following three different models were estimated: (1) term loan and/or lines of credit application category, (2) term loan application category, and (3) lines of credit application category, for both credit supply and credit demand regressions[65]. The structural break test (an approximated Chow test) is applied to all three models to ensure consistent results between the different types of loans. In order to compute the F-statistic, all three models are estimated for three time periods: (A) the full model (2000-2011), (B) before the crisis (2000-2004) and (C) after the crisis (2007-2011). As the Chow test requires linearity, OLS was performed on the error terms of each probit model[66] using the

[63] Popov and Udell (2012) report that exporters are more likely to seek external financing. However, unlike this study, they do not control for differences in types of loans.
[64] The visible minority-loan application relationship is significant at the one percent level for all types of loans. As for the relationship between female ownership and loan application, firms with a male-female mixed ownership are significantly (at the one percent level) more likely to apply for all types of loans, those with 100% female ownership are significantly more likely to do so only for lines of credit (at the five percent level).
[65] Specifications are based on the specifications from section 5.3 for each model.
[66] The Chow test's F-statistic was also computed with the probit regression's residuals and presented the same results.

same independent variables that were used in the probit model.[67] The new residuals of these OLS regressions were then used to calculate the F-statistic for the Chow test.

5.3.1. SME credit supply

The following tables show the probit regressions for the structural break test for the three models. The subsequent paragraphs provide the structural break test results as well as an overview on which coefficients and how they shifted during/after the financial crisis.

Table 17. Probit regression on probability of line of credit and/or term loan approval for 2007-2011 and 2007-2011

		2000 to 2004	2007 to 2011
Firm risk			
	Interest coverage ratio	7.95e-07	4.29e-07
		(0.984)	(0.409)
	Debt capitalization	-0.100	-0.365
		(0.579)	(0.139)
	Survival loan	0.357***	-0.109
		(0.000125)	(0.365)
	Intended use R&D	*N/A*	*N/A*
		N/A	*N/A*
	Owner experience 5-10 years	0.0126	*N/A*
		(0.942)	*N/A*
	Owner experience > 10 years	0.259*	0.262**
Information asymmetry risk		(0.0514)	(0.0324)
	Firm age	0.00887**	-0.000430
		(0.0261)	(0.899)
	Involves R&D	-0.147	-0.226*
Control		(0.111)	(0.0712)
	Exporter	-0.170	-0.156
		(0.112)	(0.285)
	Aboriginal ownership	*N/A*	*N/A*
		N/A	*N/A*
	Visible minority group ownership	-0.0709	-0.531***
		(0.683)	(0.00169)
	Observations	1,541	1,768
	Pseudo R2	0.0713	0.0779
	Log likelihood	-550.6	-317.1
	LR chi2	84.51	53.55

[67] See 3-step LM-test on page 457 of Econometric Methods with Applications in Business and Economics from Heij, C. et al., 2004.

For all three models, the Chow test is significant at the one percent level (p-value = 0.000), confirming a structural break in the supply of term loans and/or lines of credit between 2000-2004 and 2007-2011.

We observe a shift in the coefficients for several independent/control variables. For example, while the survival loan variable is significantly positive before the crisis, it becomes insignificant during/after the crisis; it appears that banks are tolerant to firms in the distressed situations in normal economic environment but become careful with such firms during the crisis. This tendency is observed for “lines of credit application” and “term loan and/or lines of credit” models, indicating banks’ concern about increased borrowers’ short term liquidity risk during the crisis. Likewise, R&D investments are considered riskier during the crisis, and thus firms that involve R&D are more severely penalized during/after the crisis. Commercial lenders also perceive increased risk associated with account receivables issued outside of Canada, as exporters are significantly less likely to obtain lines of credit during/after the crisis.

The coefficients for the firm age and visible minority variables are hard to interpret. Before the crisis, it is significantly more difficult for younger firms to obtain lines of credit, but this significance disappears during/after the crisis. On the other hand, it becomes significantly more difficult to obtain term loans and/or lines of credit for visible minorities during the crisis. A future research is called for in order to investigate why banks becomes more tolerant to younger firms but get more stringent towards visible minorities during/after the crisis.

Table 18. Probit regression on probability of term loan approval for 2007-2011 and 2007-2011

		2000 to 2004	2007 to 2011
Firm risk			
	Interest coverage ratio	-2.73e-05	1.94e-07
		(0.642)	(0.798)
	Debt capitalization	0.213	-0.441
		(0.501)	(0.291)
	Survival loan	0.281*	*N/A*
		(0.0710)	*N/A*
	Intended use R&D	*N/A*	*N/A*
		N/A	*N/A*
	Owner experience 5-10 years	*N/A*	*N/A*
		N/A	*N/A*
	Owner experience > 10 years	-0.0447	*N/A*
Information asymmetry risk		(0.859)	*N/A*
	Firm age	0.00944	0.00612
		(0.167)	(0.321)
	Involves R&D	-0.171	*N/A*
Control		(0.274)	*N/A*
	Exporter	-0.0207	0.592
		(0.917)	(0.104)
	Aboriginal ownership	*N/A*	*N/A*
		N/A	*N/A*
	Visible minority group ownership	*N/A*	*N/A*
		N/A	*N/A*
	Observations	722	796
	Pseudo R2	0.0859	0.129
	Log likelihood	-199.7	-119.7
	LR chi2	37.52	35.39

Table 19. Probit regression on probability of line of credit approval for 2007-2011 and 2007-2011

		2000 to 2004	2007 to 2011
Firm risk			
	Interest coverage ratio	2.10e-05	8.69e-07
		(0.776)	(0.328)
	Debt capitalization	-0.388*	-0.489
		(0.0945)	(0.191)
	Survival loan	0.380***	-0.235
		(0.00251)	(0.233)
	Intended use R&D	*N/A*	*N/A*
		N/A	*N/A*
	Owner experience 5-10 years	0.0565	*N/A*
		(0.805)	*N/A*
	Owner experience > 10 years	0.407**	*N/A*
Information asymmetry risk		(0.0170)	*N/A*
	Firm age	0.0110**	-0.00354
		(0.0499)	(0.492)
	Involves R&D	-0.206*	*N/A*
Control		(0.0923)	*N/A*
	Exporter	-0.180	-0.447**
		(0.182)	(0.0316)
	Aboriginal ownership	*N/A*	*N/A*
		N/A	*N/A*
	Visible minority group ownership	*N/A*	*N/A*
		N/A	*N/A*
	Observations	750	674
	Pseudo R2	0.0793	0.144
	Log likelihood	-314.1	-127.5
	LR chi2	54.11	42.96

For all three models, the Chow test F-statistics are significant at the one percent level, confirming a structural break in the data at the time of the crisis (2007).

5.3.2. SME credit demand

The following tables show the probit regressions for the structural break test for the three estimated models. The subsequent paragraphs provide the structural break test results as well as an overview on which coefficients and how they shifted during/after the financial crisis.

Table 20. Probit regression on probability of line of credit and/or term loan application for 2007-2011 and 2007-2011

		2000 to 2004	2007 to 2011
Firm risk			
	Current ratio	-0.00453**	-0.00128
		(0.00211)	(0.00106)
	Working capital	-3.81e-09	-5.63e-09
		(1.13e-08)	(3.48e-09)
	Debt capitalization	0.691***	0.541***
		(0.0733)	(0.0695)
	Survival loan	0.241***	0.807***
		(0.0379)	(0.0377)
	Owner experience > 10 years	-0.188***	-0.520***
Information asymmetry risk		(0.0485)	(0.0387)
	Firm age	0.000943	-0.00284***
		(0.00154)	(0.00102)
	Growth intention	0.154***	-0.345***
		(0.0359)	(0.0379)
	Involves R&D	0.212***	0.150***
Growth momentum		(0.0397)	(0.0461)
	Average yearly growth rate	0.000705	0.0949***
Control		(0.00147)	(0.0301)
	Revenue	-1.79e-09	-4.21e-09*
		(3.60e-09)	(2.36e-09)
	Assets	5.72e-09	1.38e-09*
		(3.75e-09)	(8.06e-10)
	Exporter	0.177***	0.00168
		(0.0471)	(0.0482)
	Visible minority group ownership	0.608***	0.0622
		(0.0967)	(0.0723)
	Observations	5,863	7,809
	Pseudo R2	0.0659	0.221
	Log likelihood	-3345	-3435
	LR chi2	471.6	1945

The results are similar across the three models. First of all, the Chow test is significant at the one percent level (p-value = 0.000) for all “term loan and/or lines of credit application”, “term loan application” and “lines of credit application” categories, confirming a structural break in the demand for term loans and/or lines of credit between 2000-2004 and 2007-2011.

All three models confirm an increase in the impact of survival loans on the probability of the firm applying for a loan. More specifically, we observe a strong shift in the impact of survival loans on the firm's probability of applying for credit from the period before to the period during/after the crisis: for "term loan and/or lines of credit application" model, coefficient shifts from 0.241 to 0.807; for "term loan" from 0.196 to 0.616; for "lines of credit" from 0.151 to 0.406, with all coefficients significant at the one percent level. This observation is able to explain why application rates did not decrease during the crisis.

While the relationship between the firm's growth intention and its probability of applying for a loan is significantly positive before the crisis, it becomes significantly negative during/after the crisis: for "term loan and/or lines of credit application" model, coefficient shifts from 0.154 to -0.345; for "term loan" from 0.102 to -0.311; for "lines of credit" from 0.104 to -0.167, with all coefficients significant at least at the five percent level. This negative and significant impact could reflect decreased confidence in growth opportunities during the crisis, causing firms to cancel/suspend their growth plans (even if they have growth intensions). This, along with the change in the coefficient of the survival variable, indicates a switch in the purpose of seeking loans from growth to survival purposes at the time of the crisis.

The coefficient of growth momentum variable becomes larger and more significant for "term loan and/or lines of credit" and "term loan" models. Firms that enjoyed a relatively high growth in sales are more likely to apply for loans during/after the crisis; it is not clear if those firms apply for loans for growth or survival purposes.[68]

---

[68] It is possible that start-up firms are contaminating the growth momentum variable by not being old enough to provide a reliable growth momentum indicator. To address this for publication purposes, this variable will be recoded for start-ups or removed completely, as growth intention variable can serve as the growth indicator.

The negative impact of owner experience magnifies during/after the crisis (coefficient of "more than ten years of experience" category of owner experience shifts from -0.188 to -0.520 for "term loan and/or lines of credit" model and from -0.246 to -0.564 for "lines of credit" model, all coefficients are significant at the one percent level).[69] This could be because experienced owners are more likely to have cash-rich income statements, which allow them to use their own retained earnings for their financing needs, and are more likely to do so in times of financial distress. The significant and negative impact of the firm's revenue and age on its probability to apply for loans during/after the crisis supports this argument, as larger and older firms are able to use their own capital for their financing needs and more likely to rely on their retained earnings during economic downturns (Duchin et al., 2010).

Exporters are more likely to apply for lines of credit, both before and during/after the crisis periods, indicating their constant demand for working capital financing to protect themselves from the risk associated with accounts receivables coming from abroad. On the other hand, exporters are significantly less likely to seek long term financing during the crisis period, probably due to the decreased growth options or increased uncertainty in foreign markets. The coefficient shift in the exporter variable for the "term loan and/or lines of credit application" model is a mixture of the different impact this variable has on the probability to apply for term loans and that for lines of credit, thus infeasible to interpret.

For all models, the relationship between the majority ownership being from a visible minority group and the firm's probability of applying for the loan is significantly positive before, but becomes insignificant during/after the crisis. Further research is required to investigate why

[69] The variable is excluded from the term loan application model as it was insignificant throughout the model's initial specifications in section 5.3.2.

this relationship would exist in normal economic conditions and why it would become insignificant during the crisis.

Firms that enjoy higher gross margins are less likely to apply for lines of credit during the crisis, consistent with the idea that cash-rich companies have their own capital to use for their short-term financing needs and rely on it more so in times of financial downturn. On the other hand, it is also found that those firms are more likely to apply for term loans during/after the crisis. One possible explanation for this is that those relatively healthy companies attempt to take advantage of lowered cost of debt as the government decrease the interest rate to stimulate slowdown economy. However, it is not clear why firms with high gross margins do not try to take advantage of lowered interest rate for their short-term financing.

Table 21. Probit regression on probability of term loan application for 2007-2011 and 2007-2011

		2000 to 2004	2007 to 2011
Firm risk			
	Working capital	-1.82e-09	-1.13e-08*
		(1.44e-08)	(6.40e-09)
	Debt capitalization	0.729***	0.519***
		(0.0902)	(0.0817)
	Survival loan	0.196***	0.616***
		(0.0454)	(0.0438)
	Gross margin	0.0234	0.233***
Information asymmetry risk		(0.0505)	(0.0719)
	Firm age	0.00301	-0.00251**
		(0.00183)	(0.00120)
	Growth intention	0.102**	-0.311***
		(0.0440)	(0.0424)
	Involves R&D	0.130***	0.0489
Growth momentum		(0.0487)	(0.0538)
	Average yearly growth rate	0.00280*	0.0676**
Control		(0.00169)	(0.0305)
	Revenue	2.84e-09	-8.64e-09***
		(3.60e-09)	(3.04e-09)
	Exporter	-0.0660	-0.143**
		(0.0599)	(0.0591)
	Visible minority group ownership	0.355***	0.110
		(0.113)	(0.0833)
	Observations	5,790	7,788
	Pseudo R2	0.0807	0.127
	Log likelihood	-2092	-2383
	LR chi2	367.1	695.7

Table 22. Probit regression on probability of line of credit application for 2007-2011 and 2007-2011

		2000 to 2004	2007 to 2011
Firm risk			
	Current ratio	-0.0104**	-0.000831
		(0.00447)	(0.00116)
	Debt capitalization	0.287***	0.190**
		(0.0874)	(0.0837)
	Survival loan	0.151***	0.406***
		(0.0443)	(0.0471)
	Owner experience 5-10 years	-0.105	-0.555***
		(0.0977)	(0.0837)
	Owner experience > 10 years	-0.246***	-0.564***
Cash flow risk		(0.0688)	(0.0584)
	Gross margin	0.00217	-0.141***
Information asymmetry risk		(0.00748)	(0.0527)
	Firm age	-0.00193	-0.00272**
		(0.00182)	(0.00125)
	Growth intention	0.104**	-0.167***
		(0.0429)	(0.0524)
	Involves R&D	0.200***	0.0850
Growth momentum		(0.0457)	(0.0541)
	Average yearly growth rate	-0.0213	-0.0123
Control		(0.0140)	(0.0323)
	Exporter	0.259***	0.149***
		(0.0527)	(0.0564)
	100% female ownership	-0.108	*N/A*
		(0.0751)	*N/A*
	Visible minority group ownership	0.465***	0.0852
		(0.104)	(0.0854)
	Observations	5,738	7,768
	Pseudo R2	0.0493	0.126
	Log likelihood	-2321	-2183
	LR chi2	240.8	628.0

Summary of findings

Table 23. Summary of findings

	Term loans and/or Lines of credit (A)	Term loans (B)	Lines of credit (C)
Supply			
Approval rates	• Higher during crisis	• Higher during crisis	• Higher during crisis
Regression (all years)	• More likely to have loan approved during crisis	• Insignificant impact from crisis on loan approval	• More likely to have loan approved during crisis
Regression (before and after crisis)	• Survival loans significantly negative before, but insignificant during/after crisis • Firm age significant and positive before, insignificant during/after • R&D firms more severely penalized during/after crisis • Minority group ownership insignificant before, significantly negative during/after crisis	*Not enough variables to comment*	• Survival loans significantly negative before, but insignificant during/after crisis • Exporters negative but insignificant before, but significant and negative during/after crisis
Structural break?	Yes	Yes	Yes
Demand			
Approval rates	• Higher during crisis • Decline of term loan and lines of credit applications from 2007 to 2011 due to change of financing source ○ Preference for trade credit and credit cards		
Regression (all years)	• More likely to seek credit during crisis	• More likely to seek credit during crisis	• More likely to seek credit during crisis
Regression (before and after crisis)	• Stronger impact for survival loans during/after crisis • Increased owner experience and firm revenue significantly less likely to apply during/after crisis • Growth intention significantly positive before, significantly negative during/after crisis • Exporter significantly positive before, insignificant during/after crisis • Minority group ownership significantly positive before, insignificant during/after crisis	Same results as C, except for: • Exporter insignificant before, significantly negative during/after crisis	Same results as C, except for: • Gross margin insignificant before, significantly negative during/after the crisis • Exporter significantly positive from 2000-2011
Structural break?	Yes	Yes	Yes
Conclusion			
Hypothesis 1	Rejected	Rejected	Rejected
Hypothesis 2	Rejected	Rejected	Rejected

6. Discussion and Conclusion

This research empirically investigates how the 2007-2008 financial crisis changes both the commercial banks' adjudication of lending to SMEs and the SMEs' needs for commercial loans. Contrary to the expectation, it is found that Canadian SME loan approval and application rates increased during the 2007-2008 financial crisis. All t-tests support that loan approval rates for all loan type categories (lines of credit category, term loan category, and lines of credit and/or term loan category) increased after the financial crisis compared to before.

As for loan application rates, the data exhibits an increase trend for both term and operating loans from 2000 to 2007, with the exception of 2011. In 2011, the demand for lines of credit and term loans decreased while applications for other types of debt, such as trade credit or credit card, represent the larger proportion of the total loans applied for by SMEs. There appears to be a shift in demand for credit from more traditional forms (term loans and line of credit) to other forms, including trade credit, credit card, leasing, and government financing, in 2011. Is this because there are more firms that are discouraged to apply for term and operating loans in the post crisis period, as Carbó-Valverde, Rodriquez-Fernandez and Udell (2013) find an increased dependence of trade credits as an alternative source of financing during the crisis? A future research is required when the possible factors contributing this shift are considered.

The regression estimates support these t-tests by showing that the crisis had a significant and positive impact on loan approval rates and loan application rates. More specifically, the rejection of the null hypothesis for all structural break tests supports the change in loan rejection rates and loan application rates. Firms that needed a loan to keep their business in operation were penalized by banks before the crisis but not during/after the crisis. On the other hand, R&D firms and exporters (for lines of credit) were not penalized before the crisis but significantly less likely to get loans during/after the crisis. For application rates, a switch between loans for growth purposes and loans for survival purposes was observed, as firms who needed loans to keep their business in operation were significantly more likely to apply during/after the crisis, while their growth intention deterred them from applying during/after the crisis.

The switch from the demand for loans for growth purpose to that for survival purpose explains the increased (not decreased) demand for loans during the crisis period. This observation is consistent with Mian, Rao and Sufi (2010), who find a decrease in consumer spending during the crisis in the U.S. consumer market. A decline in the demand for goods and services implies diminishing growth opportunities and increased needs for replacing the lost income with external financing to keep their business in operation.[70] It appears that the increased need for loans for the survival purpose exceeds the diminishing demand for loans for growth purpose, which opens the door for additional research on the evolution of consumer spending and its impact on SMEs' income statement in Canada during the financial crisis.

Another possible explanation for the increased loan application during the crisis could be that the number of discouraged borrowers decreased during that period. Firms that are discouraged to apply for loans in normal economic conditions may not be so much so during the crisis due to their acute necessity for loans for its survival purpose, which is stronger than the fear of having their loan request turned down.

Regarding the loan approval rate, this study finds empirical evidence contrasting from previous studies that take place in other countries. Here an important question arises: why are

[70] For publication purposes, this section will draw upon an additional table with firm revenue over the years. A drop in SME revenue from 2004 to 2007 could support a decrease in consumer consumption.

Canadian loan applicants more likely to get accepted during the 2007-2008 financial crisis? One possible explanation could be that Canadian banks are highly regulated and stable. Popov and Udell (2012) find a strong link between firms being credit constrained and banks that experience a decline in their Tier 1 capital ratios. In Canada, banks did not experience a decline in their Tier 1 capital ratios during the 2007-2008 period (only RBC by 0.4% and TD by 0.5%), therefore, an increase in credit constrained firms is not observed during the crisis.

A 2013 paper by Renee Haltom titled *Why Was Canada Exempt from the Financial Crisis* discusses Canada's banking system and explains its resilience throughout the 2008 financial crisis by being the only G-7 country to avoid a financial crisis. It explains that Canada's banking system is tightly regulated with higher capital requirements, greater leverage restrictions and fewer off-balance sheets activities than other countries such as the United States. The Canadian banking system also contains fewer banks and thus less fragmented than the United States' banking system. In the U.S., there are approximately 7,000 chartered banks[71] and more than one regulator. However, in Canada, there are only 80 banks and one overarching regular, the Office of the Superintendent of Financial Institutions (OSFI). This smaller banking system with a single regulating authority reduces the complexity of the banking system facilitates the monitoring of bank activities by the regulator. In the U.S., the 7,000 chartered banks can be regulated by the Fed, the Federal Deposit Insurance Corporation, the Office of the Comptroller of the Currency, or state regulators, creating a confusing and unstable regulatory system. Moreover, the United States' shadow banking activities represent 95 percent of the country's GDP, leading to a significant portion of, in a way, unregulated banks (Gravelle et al., 2013). In

[71] This is mostly because up until 1994, most states had regulations preventing banks from creating their own branches.

Canada, shadow banking activities[72] only represent 40 percent of the country's economy, and most of these activities are taken by Canadian banks themselves. Unlike its U.S. counterpart, Canadian banks also tend to hold on to mortgage loans as they are, rather than securitizing them. This reduces their exposure to the mortgage crisis, as less than 33 percent of Canadian mortgages were securitized before the financial crisis (compared to 66 percent for American mortgages), which reduced Canada's exposure to the mortgage crisis. In addition, mortgages are harder to obtain in Canada. In Canada, a minimum down payment of five percent required if it is backed by the government's Homeowner Mortgage Loan insurance (20 percent otherwise), while U.S. lending institutions like Fannie Mae and Freddie Mac offered, before the crisis, mortgages with no down payment required. Freddie Mac even offered loans with no down payment and was worth 105% of the house (Fried, 2012). This is translated into the fact that less than three percent of mortgages were classified as subprime in Canada compared to 15 percent in the United States. Overall, the Canadian banking system is more regulated, monitored and risk-averse than its neighbouring country, which could potentially explain why this study does not observe lower loan approval rate in Canada during the crisis period.

The validity of the explanation that the stability of Canadian banking system is the reason why lowered loan approval rate was not observed in Canada is supported by the finding of Kremp and Sevestre (2013), who find that there French SMEs were not strongly affected by the 2007-2008 crisis. An important commonality between this research and Kremp and Sevestre (2013) is that both studies examine the accessibility of bank loans in the countries that are considered to have relatively stable and organized banking systems (Black and Gilson, 1998).

[72] Shadow banking activities include (1) mortgage securitization, consisting of National Housing Act Mortgage-Backed Securities and Canada Mortgage Bonds, (2) private-label securitization, consisting of asset-backed commercial paper and term asset-backed securities, (3) repurchase agreements, (4) money market funds and (5) bankers' acceptances and commercial paper (Gravelle et al., 2013).

This could also explain why the findings of this research and Kremp and Sevestre's (2013) differ from Popov and Udell (2012) and Carbó-Valverde, et al (2013). Popov and Udell investigate the impact of the crisis on emerging European countries and Carbó-Valverde, et al. examine its impact on SMEs in Spain – one of the countries that originated the European sovereign debt crisis – neither the European emerging markets nor Spain are assumed to have a stable, established banking industry. In other words, more stable banking systems in Canada and France could help explain why the crisis did not negatively impact the supply of loans in those countries, while weaker banking systems in emerging countries and Spain could help explain why the crisis had a negative impact on the supply of loans there.

Another possible explanation could be that because the Canadian government reacted with its monetary injection to counter the crisis, the loan approval rate increased during and after the crisis. However, the federal government's Business Capital Availability Program (BCAP) became effective only in 2009 to insulate SMEs from the negative impact of the crisis, and this study shows that the increase in loans was consistent throughout 2000, 2004, 2007 and 2011. Therefore, the government injection could not have been the reason behind the increase in loan approvals from 2004 to 2007.[73]

While the above two reasons could potentially explain why the crisis did not have a negative impact on Canada's loan supply, they fail to explain why the crisis had a significantly *positive* impact on Canada's loan supply. One possible explanation could be that the Canadian banking system has a good understanding of SMEs' contribution to job creation and economic welfare, and at the time of the crisis it proactively played a role to support Canadian SMEs

[73] Nevertheless, this explanation is consistent with the observation that applications for other types of debt, including government financing, increased in 2011.

(before the government's implementation of the BCAP program). Again, further research is required to validate this explanation.

Whatever the reasons, the result of this study – higher loan acceptance rate during the crisis – presents an important question regarding to the justification of the Extraordinary Financing Framework and the BCAP program. Assuming that SMEs in Canada face severe limitation in access to capital, due to the financial crisis started in 2007, the government, as a part of the BCAP program, increased the maximum loan amount an SME could borrow under the Canada Small Business Financing (CSBF) program and also increased the limit on the reimbursement of claims made by institutions upon the default of a loan under the CSBF.[74] However, the data analyzed in this study indicate that, contrary to the government assumption, access to bank loans appeared to be easier for Canadian SMEs during the crisis period. Whether the expansion of the CSBF program was truly necessary and whether the taxpayers' money was well spent for Canada's economic stability and welfare, are the questions that must be addressed. I plan on investigating this in my future PhD studies.

The results of this study provide useful insights to SME financing literature, practitioners, and policymakers. To SME owners in Canada, the main finding of this research – and a higher loan approval rate at the time of economic downturn – might be good news. This may imply that Canadian SMEs are relatively less sensitive to worldwide scale economic downturns in terms of the availability of capital. An in-depth research is also necessary to examine why the Canadian banking system exhibited a higher loan approval rate during the crisis, to measure accurately the risk Canadian SMEs incur at the time of crisis. This study observes Canadian banks' attitude to

[74] More specifically, the government increased the maximum eligible loan amount an SME may borrow under the CSBF from the then-current limit of $250,000 to $350,000 (and to $500,000 for loans made for acquiring real property). The Government also increased from 10 per cent to 12 per cent the limit on reimbursement of claims by institutions with a portfolio of at least $500,000 in eligible loans (Industry Canada, 2010).

try to accommodate SMEs' needs (e.g., higher approval rates for lower working capital firms), suggesting their willingness to voluntary help SMEs in times of economic downturn. This possibility might help motivate SME owners in seeking bank credit during times of economic downturn to help their own financial situation. For the academic literature, this study sheds an additional light in the SME banking literature by presenting a result contrary to the widely held belief that SMEs are more seriously affected by an economic downturn in terms of the accessibility to bank loans. This study, along with Kremp and Sevestre (2013) who find no evidence of credit rationing in France during the crisis, suggests a possible relationship between a country's banking system and accessibility to commercial loans for SMEs especially during a crisis period.

As stated above, the result of this study implies a necessity for policy makers to review the measures of interventions the government implemented for the purpose of mitigating the negative impact of economic downturns. At the same time, the result suggests the difficulty of government interventions. On one hand, the government needs to react quickly when an event, which has the potential to induce negative consequences, occurs. On the other hand, it must be careful when making assumptions whether the event will have negative impacts. Further research that investigates the factors contributing the higher loan acceptance rates for Canadian SMEs will help policy makers regarding the design and implementation of government supports at the time of the next financial crisis. In addition, if the higher loan acceptance rate is due to the stability of the Canadian banking system, policy makers in other countries, especially those where access to capital was severely affected by the crisis, have a lot to learn from the Canadian banking system.

While the above arguments already points out the necessity of further investigations regarding the factors contributing the higher loan acceptance rate during the crisis, there are other research questions to be addressed. One of such questions would be whether SME owners were more discouraged from applying for loans after[75] the crisis. Analysis on discouraged borrowers during the crisis could provide additional useful insights on capital constrain among SMEs. An increase in the number of discouraged borrowers implies more financially limited SMEs during and after the crisis, even if commercial bankers are more likely to approve loan applications during that period. If this is the case, it might be worth investigating this increased discouragement through qualitative analysis to get better understanding of borrower discouragement during times of economic downturn.

Another possible extension of this study could address such questions as whether the cost of borrowing increased, the loan amount granted decreased, or the collateral requirements increased, during the crisis. This study focuses on the loan approval rates and loan application rates and finds that loan approval rates increased during the crisis. However, it might be premature to conclude that Canadian bankers did not change their loan adjudication process during the crisis, as their escalated risk avoidance might have manifested in the forms of increased interest rate charged, decreased amount of loans granted, and/or tightened collateral requirements.

Future studies could also address the sample selection bias that might present in this study. [76] A follow-up study could use a tobit model on loan amounts and/or interest rates to void

[75] Although the dataset utilized in this research did not contain data on 2004 and 2007 discouraged borrowers, Statistics Canada confirmed that it is possible to obtain data for 2004.
[76] When testing the supply shock theory, this study selects a sub-sample of firms that specifically applied for loans out of the total number of respondents (which includes firms that need for loans but did not apply), which suggests a potential sample selection bias.

such bias. Alternatively, it could employ the Heckman correction procedure prior to the probit analyses. Also, while the Chow test approximation accepts the hypothesis of a structural break in the data, further analysis could be performed to test the structural break on specific coefficients. Interaction terms between variables of interest and the crisis dummy for both supply and demand equations can also be created to isolate the effect of the crisis through a the change in the impact of specific variables on loan application/approval rate. This study provides preliminary results of such an approach in Appendix 3 that confirm the results of the structural break test for the credit demand equation with significant interaction terms.

Perhaps the most important extension of this research from a Canadian policy standpoint is the assessment of the CSBF program that was expanded during the crisis. Such an extended research could address the question whether or not the CSBF expansion is justified, given the finding of this study – banks are more likely to approve loan applications during the crisis. Did the expanded CSBF program effectively help commercial banks to lower their conservatism during the financial crisis, and therefore we observe a higher loan approval rate during the crisis? Or, is the higher approval rate a result of Canadian banks' stability (in this case, the CSBF expansion cannot be justified). Further research to address those questions, built upon the results of this study, is crucial to ensure that the government policies take a right track towards an healthy recovery from a financial crisis, and that taxpayers' money is used in an effective way. The structural break in bank lending to SMEs observed during the crisis period provides increased motivation for future research on this topic in order to consider the role of government interventions to the bank lending markets.

Appendices

Appendix 1. Construction of industry categories

Industry Group	Industries Within Groups
Primary	Agriculture, forestry, fishing and hunting
	Mining, quarrying, and oil and gas extraction
	Utilities
	Construction
Manufacturing	Manufacturing
Wholesale and Retail	Wholesale trade
	Retail trade
Transportation and warehousing	Transportation and warehousing
Information and cultural industries	Information and cultural industries
Real estate and rental and leasing	Real estate and rental and leasing
Professional, administrative and health care services	Professional, scientific and technical services
	Administrative and support, waste management and remediation services
	Health care and social assistance
Recreational services	Arts, entertainment and recreation
	Accommodation and food services
	Other services (except public administration)

Appendix 2.1. Correlation matrix of continuous variables

	CURRENT	EBITDA	INTCOV	EBITDAD	WCAP	SALESWC	DEBTCAP
CURRENT	1.0000	-0.0170	0.0020	0.2130	0.0220	0.0000	-0.1040
EBITDA	-0.0170	1.0000	0.1270	0.0000	0.2080	0.0100	0.0270
INTCOV	0.0020	0.1270	1.0000	0.0230	0.0520	0.0110	-0.0480
EBITDAD	0.2130	0.0000	0.0230	1.0000	0.0000	0.0000	-0.1600
WCAP	0.0220	0.2080	0.0520	0.0000	1.0000	0.0000	-0.0940
SALESWC	0.0000	0.0100	0.0110	0.0000	0.0000	1.0000	0.0160
DEBTCAP	-0.1040	0.0270	-0.0480	-0.1600	-0.0940	0.0160	1.0000
AMOUNT	0.0000	-0.0220	0.0080	0.0150	-0.0100	0.0250	0.0290
RETASSETS	0.0050	-0.0020	0.0120	0.1130	-0.0050	-0.0460	-0.0100
GMARG	0.0100	0.0320	0.0570	0.0340	-0.0070	0.0020	-0.0150
PROFM	0.0010	0.0050	0.0020	0.0020	0.0000	0.0000	-0.0090
AGE	-0.0050	0.2020	0.0280	-0.0360	0.0700	0.0000	-0.1020
REVENUE	-0.0220	0.7210	0.0580	-0.0300	0.2090	0.0050	0.0780
TOTALASSETS	-0.0030	0.4210	-0.0140	-0.0250	0.2780	-0.0010	-0.0370

Appendix 2.2. Correlation matrix of continuous variables

	AMOUNT	RETASSETS	GMARG	PROFM	AGE	REVENUE	TOTALASSETS
CURRENT	0.0000	0.0050	0.0100	0.0010	-0.0050	-0.0220	-0.0030
EBITDA	-0.0220	-0.0020	0.0320	0.0050	0.2020	0.7210	0.4210
INTCOV	0.0080	0.0120	0.0570	0.0020	0.0280	0.0580	-0.0140
EBITDAD	0.0150	0.1130	0.0340	0.0020	-0.0360	-0.0300	-0.0250
WCAP	-0.0100	-0.0050	-0.0070	0.0000	0.0700	0.2090	0.2780
SALESWC	0.0250	-0.0460	0.0020	0.0000	0.0000	0.0050	-0.0010
DEBTCAP	0.0290	-0.0100	-0.0150	-0.0090	-0.1020	0.0780	-0.0370
AMOUNT	1.0000	0.0330	0.0010	0.0010	-0.0210	-0.0260	-0.0180
RETASSETS	0.0330	1.0000	0.0170	0.0020	-0.0250	0.0020	-0.0150
GMARG	0.0010	0.0170	1.0000	0.0120	-0.0360	-0.0780	-0.0490
PROFM	0.0010	0.0020	0.0120	1.0000	-0.0070	0.0060	0.0010
AGE	-0.0210	-0.0250	-0.0360	-0.0070	1.0000	0.2570	0.0900
REVENUE	-0.0260	0.0020	-0.0780	0.0060	0.2570	1.0000	0.4520
TOTALASSETS	-0.0180	-0.0150	-0.0490	0.0010	0.0900	0.4520	1.0000

Appendix 3. Probit regression on probability of line of credit and/or term loan application with interaction terms

		(1)
Firm risk		
	Crisis	1.204***
		(0.0511)
	Current ratio	-0.00225**
		(0.000984)
	Working capital	-6.37e-09*
		(3.36e-09)
	Debt capitalization	0.650***
		(0.0503)
	Survival loan	0.280***
		(0.0285)
	Owner experience > 10 years	-0.132***
Information asymmetry risk		(0.0330)
	Firm age	-0.00407***
		(0.000836)
	Crisis x Growth intention	0.180**
		(0.0795)
	Growth intention	0.0265
		(0.0290)
	Involves R&D	0.193***
Growth momentum		(0.0303)
	Crisis x Growth momentum	0.0995*
		(0.0517)
	Average yearly growth rate	0.00147
Control		(0.00162)
	Revenue	-5.64e-09***
		(1.95e-09)
	Assets	1.35e-09*
		(7.66e-10)
	Exporter	0.0902***
		(0.0339)
	Male/Female mixed ownership	0.366***
		(0.0335)
	Visible minority group ownership	0.238***
		(0.0579)
	Observations	13,753
	Pseudo R2	0.186
	Log likelihood	-6541
	LR chi2	2985

References

Aboody, D., & Lev, B. (2000). Information asymmetry, R&D, and insider gains. *The Journal of Finance*, *55*(6), 2747–2766.

Aghion, P., Fally, T., & Scarpetta, S. (2007). Credit constraints as a barrier to the entry and post-entry growth of firms. *Economic Policy*, *22*(52), 732–779.

Ardic, O. P., Mylenko, N., & Saltane, V. (2012). Access to Finance by Small and Medium Enterprises: a Cross-Country Analysis with A New Data Set: Small and medium enterprise finance. *Pacific Economic Review*, *17*(4), 491–513. http://doi.org/10.1111/j.1468-0106.2012.00596.x

Ayyagari, M., Beck, T., & Demirguc-Kunt, A. (2007). Small and Medium Enterprises Across the Globe. *Small Business Economics*, *29*(4), 415–434. http://doi.org/10.1007/s11187-006-9002-5

Ayyagari, M., Demirgüç-Kunt, A., & Maksimovic, V. (2011). Small vs. young firms across the world: contribution to employment, job creation, and growth. *World Bank Policy Research Working Paper*, (5631). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1807732

Baas, T., & Schrooten, M. (2006). Relationship Banking and SMEs: A Theoretical Analysis. *Small Business Economics*, *27*(2-3), 127–137. http://doi.org/10.1007/s11187-006-0018-7

Beck, T., Demirguc-Kunt, A., & Levine, R. (2005). SMEs, growth, and poverty: cross-country evidence. *Journal of Economic Growth*, *10*(3), 199–229.

Beck, T., Demirgüç-Kunt, A., & Martinez Peria, M. S. (2008). Bank financing for SMEs around the world: Drivers, obstacles, business models, and lending practices. *World Bank Policy Research Working Paper Series, Vol*. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1312268

Bekaert, G., Engstrom, E., & Xing, Y. (2009). Risk, Uncertainty, and Asset Prices. *Journal of Financial Economics*, *91*(1), 59–82. http://doi.org/http://dx.doi.org.proxy.bib.uottawa.ca/10.1016/j.jfineco.2008.01.005

Berger, A., & Udell, G. F. (2004). A More Complete Conceptual Framework for SME Finance. In *Small and Medium Enterprises: Overcoming Growth Constraints*.

Berg, G., & Kirschenmann, K. (2012). Funding vs. real economy shock: the impact of the 2007-2009 crisis on small firms' credit availability. *World Bank Policy Research Working Paper*, (6030). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2035786

Binks, M. R., & Ennew, C. T. (1996). The relationship between UK banks and their small business customers. *Small Business Economics*, *9*(2), 167–178.

Black, B. S., & Gilson, R. J. (1998). Venture capital and the structure of capital markets: banks versus stock markets. *Journal of Financial Economics*, *47*(3), 243–277.

Bloom, N. (2009). The Impact of Uncertainty Shocks. *Econometrica*, *77*(3), 623–685.

Bordo, M. D., Redish, A., & Rockoff, H. (2011). *Why didn't Canada have a banking crisis in 2008 (or in 1930, or 1907, or...)?* National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w17312

Brunnermeier, M. K. (2009). *Deciphering the liquidity and credit crunch 2007-08*. National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w14612.ack

Caballero, R. J., & Krishnamurthy, A. (2008). Collective risk management in a flight to quality episode. *The Journal of Finance*, *63*(5), 2195–2230.

Carbó-Valverde, S., Rodriguez-Fernandez, F., & Udell, G. F. (2013). Trade credit, the financial crisis, and SME access to finance. In *26th Australasian Finance and Banking Conference*. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2307246

Cole, R. A., Goldberg, L. G., & White, L. J. (2004). Cookie cutter vs. character: The micro structure of small business lending by large and small banks. *Journal of Financial and Quantitative Analysis*, *39*(02), 227–251.

Copeland, T., Weston, J. F., & Shastri, K. (2005). *Financial Theory and Corporate Policy* (4th ed.). Pearson Addison-Wesley.

Cressy, R., & Toivanen, O. (2001). Is there adverse selection in the credit market? *Venture Capital*, *3*(3), 215–238. http://doi.org/10.1080/13691060110052104

De la Torre, A., Martinez Peria, M. S., & Schmukler, S. L. (2009). Drivers and obstacles to banking SMEs: The role of competition and the institutional framework. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1406956

Deyoung, R., Gron, A., Torna, G., & Winton, A. (2015). Risk Overhang and Loan Portfolio Decisions: Small Business Loan Supply before and during the Financial Crisis: Risk Overhang and Loan Portfolio Decisions. *The Journal of Finance*, *70*(6), 2451–2488. http://doi.org/10.1111/jofi.12356

DeYoung, R., Hunter, W. C., & Udell, G. F. (2004). The past, present, and probable future for community banks. *Journal of Financial Services Research*, *25*(2-3), 85–133.

Dietrich, A. (2010). Explaining loan rate differentials between small and large companies: evidence from Switzerland. *Small Business Economics*, *38*(4), 481–494. http://doi.org/10.1007/s11187-010-9273-8

Duchin, R., Ozbas, O., & Sensoy, B. A. (2010). Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics*, *97*(3), 418–

435. http://doi.org/10.1016/j.jfineco.2009.12.008

Easley, D., & O'Hara, M. (2010). Liquidity and valuation in an uncertain world☆. *Journal of Financial Economics*, *97*(1), 1–11. http://doi.org/10.1016/j.jfineco.2010.03.004

Epstein, L. G., & Schneider, M. (2008). Ambiguity, information quality, and asset pricing. *The Journal of Finance*, *63*(1), 197–228.

Fazzari, S., Hubbard, G., & Petersen, B. (1988). Financing Constraints and Corporate Investment. *Brookings Papers on Economic Activity*, *1988*(1), 141–195.

Fried, J. (2012). *Who Really Drove the Economy Into the Ditch?* Algora Publishing.

Gorton, G. B. (2009). Slapped in the Face by the Invisible Hand: Banking and the Panic of 2007. *Available at SSRN 1401882*. Retrieved from http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=1401882

Gravelle, T., Grieder, T., & Lavoie, S. (2013). Monitoring and assessing risks in Canada's shadow banking sector. *Financial System Review*, *55*. Retrieved from http://www.bankofcanada.ca/wp-content/uploads/2013/06/fsr-0613.pdf#page=63

Guiso, L. (1998). High-tech firms and credit rationing. *Journal of Economic Behavior & Organization*, *35*(1), 39–59.

Haltiwanger, J., Jarmin, R., & Miranda, J. (2010). *WHO CREATES JOBS? SMALL vs. LARGE vs. YOUNG* (Research Paper No. 10-17).

Haltom, R. (2013). Why Was Canada Exempt from the Financial Crisis?, *Econ Focus*(Fourth Quarter), 22–25.

Heij, C. et al. (2004). *Econometric methods with applications in business and economics*. Oxford ; New York: Oxford University Press.

Hetland, O. R., & Mjøs, A. (2011). Financing Constraints in the 2008-9 Financial Crisis. In *24th*

Australasian Finance and Banking Conference. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1917566

Holmstrom, B., & Tirole, J. (1997). Financial intermediation, loanable funds, and the real sector. *The Quarterly Journal of Economics*, 663–691.

Ivashina, V., & Scharfstein, D. (2009). Bank lending during the financial crisis of 2008. *Journal of Financial Economics*, *97*(3), 319–338. http://doi.org/10.1016/j.jfineco.2009.12.001

Iyer, R., Peydró, J.-L., da-Rocha-Lopes, S., & Schoar, A. (2013). Interbank Liquidity Crunch and the Firm Credit Crunch: Evidence from the 2007–2009 Crisis. *Review of Financial Studies*, *27*(1), 347–372. http://doi.org/10.1093/rfs/hht056

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360.

Kahle, K. M., & Stulz, R. M. (2013). Access to capital, investment, and the financial crisis. *Journal of Financial Economics*, *110*(2), 280–299. http://doi.org/10.1016/j.jfineco.2013.02.014

Kano, M., Uchida, H., Udell, G. F., & Watanabe, W. (2011). Information verifiability, bank organization, bank competition and bank–borrower relationships. *Journal of Banking & Finance*, *35*(4), 935–954. http://doi.org/10.1016/j.jbankfin.2010.09.010

Kaplan, S. N., & Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics*, 169–215.

Kiyotaki, N., & Moore, J. (1997). Credit Cycles. *Journal of Political Economy*, *105*(2), 211. http://doi.org/10.1086/262072

Kon, Y., & Storey, D. J. (2003). A theory of discouraged borrowers. *Small Business Economics*, *21*(1), 37–49.

Kremp, E., & Sevestre, P. (2013). Did the crisis induce credit rationing for French SMEs? *Journal of Banking & Finance*, *37*(10), 3757–3772. http://doi.org/10.1016/j.jbankfin.2013.05.028

Mian, A. R., Rao, K., & Sufi, A. (2013). Household balance sheets, consumption, and the economic slump. *Chicago Booth Research Paper*, (13-42). Retrieved from http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=1961211

Mian, A. R., & Sufi, A. (2012). *What explains high unemployment? The aggregate demand channel*. National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w17830

Mian, A., & Sufi, A. (2010). The Great Recession: Lessons from Microeconomic Data. *American Economic Review*, *100*(2), 51–56. http://doi.org/10.1257/aer.100.2.51

Mishkin, F. S. (1992). Anatomy of a financial crisis. *Journal of Evolutionary Economics*, *2*(2), 115–130.

Myers, S., & Majluf, N. (1984). Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have. *Journal of Financial Economics*, *13*(2), 187–221.

Nitani, M., & Riding, A. (2013). Growth, R&D intensity and commercial lender relationships. *Journal of Small Business & Entrepreneurship*, *26*(2), 109–124. http://doi.org/10.1080/08276331.2013.771852

OECD. (2009). The Impact of the Global Crisis on SME and Entrepreneurship Financing and Policy Responses.

OECD. (2013). *Financing SMEs and Entrepreneurs 2013: An OECD Scoreboard*. Paris: OECD.

Orser, B., & Riding, A. (2016). Women entrepreneurs in Northern Canada: contexts and challenges. *International Journal of Entrepreneurship and Small Business*, *27*(2-3), 366–383.

Parker, S. (2002). Do Banks Ration Credit to New Enterprises? Should Governments Intervene? *Scottish Journal of Political Economy*, *49*, 162–195.

Pauwels, L. L., Chan, F., & Wongsosaputro, J. (2012). Testing for structural change in binary choice models with autocorrelation. Retrieved from http://rbnz.govt.nz/research_and_publications/seminars_and_workshops/feb2012/4682256.pdf

Peltoniemi, J. (2007). The Benefits of Relationship Banking: Evidence from Small Business Financing in Finland. *Journal of Financial Services Research*, *31*(2-3), 153–171. http://doi.org/10.1007/s10693-007-0009-0

Popov, A., & Udell, G. F. (2012). Cross-border banking, credit access, and the financial crisis. *Journal of International Economics*, *87*(1), 147–161. http://doi.org/10.1016/j.jinteco.2012.01.008

Puri, M., Rocholl, J., & Steffen, S. (2010). Global retail lending in the aftermath of the US financial crisis: Distinguishing between supply and demand effects. *Journal of Financial Economics*, *100*(3), 556–578.

Racicot, F.-É., & Théoret, R. (2016). Macroeconomic shocks, forward-looking dynamics, and the behavior of hedge funds. *Journal of Banking & Finance*, *62*, 41–61. http://doi.org/10.1016/j.jbankfin.2015.10.004

Riding, A., Orser, B. J., Spence, M., & Belanger, B. (2012). Financing new venture exporters. *Small Business Economics*, *38*(2), 147–163. http://doi.org/10.1007/s11187-009-9259-6

Santos, J. A. C. (2010). Bank Corporate Loan Pricing Following the Subprime Crisis. *Review of*

Financial Studies, *24*(6), 1916–1943. http://doi.org/10.1093/rfs/hhq115

Seens, D., Canada, Industry Canada, Canada, Small Business Branch, & Research and Analysis Directorate. (2013). *Small business access to financing: request and approval rates, interest rates and collateral requirements (2000-10)*. Retrieved from http://epe.lac-bac.gc.ca/100/201/301/weekly_checklist/2013/internet/w13-30-U-E.html/collections/collection_2013/ic/Iu188-111-2013-eng.pdf

Shleifer, A., & Vishny, R. W. (2010). Unstable banking. *Journal of Financial Economics*, *97*(3), 306–318. http://doi.org/10.1016/j.jfineco.2009.10.007

Stiglitz, J., & Weiss, A. (1981). Credit Rationing in Markets with Imperfect Information. *American Economic Review*, *81*, 393–410.

Stiglitz, J., & Weiss, A. (1983). Incentive Effects of Terminations: Applications to the Credit and Labor Markets. *American Economic Review*, *73*, 912–927.

Udell, G. F. (2009). HowWill a Credit Crunch Affect Small Business Finance? *FRBSF Economic Letter*, (2009-09).

Weston, J., & Strahan, P. E. (1996). Small business lending and bank consolidation: Is there cause for concern? *Current Issues in Economics and Finance*, *2*(3). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1001240

Whited, T. M., & Wu, G. (2006). Financial Constraints Risk. *Review of Financial Studies*, *19*(2), 531–559. http://doi.org/10.1093/rfs/hhj012