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Firm-Level Evidence of Shifts in the Supply of Credit*

Karolina Holmberg[†]

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Abstract

Using panel data of 68,800 small and large firms, I examine whether firms are subject to shifts in the supply of credit over the business cycle. Shifts in the supply of credit are identified by exploring how firms substitute between commitment credit – lines of credit – and non-commitment credit. I find that firms on average rely more on commitment credits when monetary policy is tight and when the financial health of banks is weaker. The results are consistent with a bank lending channel of monetary policy and with shifts in the supply of credit following deteriorations in banks' balance sheets.

Keywords: Bank Lending Channel, Bank Capital, Business Fluctuations

JEL classifications: E32, E44, E51, G01, G21

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1 Introduction

The financial crisis has highlighted the need to understand what governs the availability of credit in the economy. Research to understand the role played by financial intermediaries in the business cycle has intensified. This paper uses firm-level data to investigate whether firms in general are subject to shifts in the supply of bank credit over the business cycle. In other words, do banks vary the conditions under which they offer credits to firms by more than what is implied by changes in the creditworthiness of firms or changes in the central bank policy rate?

Theories which allow for frictions in financial markets predict that this is the case.¹ According to the traditional bank lending channel of monetary policy, a tightening of monetary policy drains reserves from the banking system and induces banks to cut back on their lending, given that raising external funds is costly to banks. However, in recent models of the bank lending channel, this direct impact of monetary policy on bank reserves and credit supply is downplayed. Instead, shifts in the supply of credit is tied to the health of the financial intermediaries and in particular to the capital of the intermediaries.² Accordingly, the link between monetary policy and bank lending runs via the effect of the interest rate on the balance sheets of the banks and thereby on the premium they pay for external financing.³ As shown by Woodford (2010) in a simple macroeconomic model which allows for frictions in financial markets, a decrease in aggregate economic activity decreases the value of intermediaries' assets, and hence their net worth. This results in less borrowing by the intermediaries, and hence a cutback in the supply of credit. Clearly, not just monetary policy but any disturbance that affects banks' net worth will shift the supply of bank credit in this type of model.

Over the years, there has been ample empirical research devoted to identifying the bank lending channel and the occurrence of shifts in the supply of credit. Early empirical work on the bank lending channel focused on the correlation between aggregate output, bank debt and indicators of monetary policy (e.g. Bernanke and Blinder (1992)). It was commonly difficult in these type of studies to disentangle shifts in the supply of credit from shifts in credit demand. Kashyap, Stein and Wilcox (1993) handled this identification problem by examining relative movements in bank loans and commercial paper after monetary shocks. The intuition was that a monetary shock that operates through the standard interest rate channel lowers the demand for all types of finance, while a monetary shock that operates through a bank lending channel affects the supply of bank debt only. Kashyap, Stein and Wilcox found that the amount of outstanding bank loans declined relative to the outstanding stock of commercial paper after a monetary contraction, which seemed to suggest the existence of a bank lending channel. However, Rudebusch and Oliner (1996) pointed

¹See for instance Bernanke and Gertler (1995) for a review of this literature.

²See for instance Woodford (2010) and Disyatat (2011).

³Boivin, Kiley and Mishkin (2010) labels this "the bank capital channel" as distinct from the traditional bank lending channel.

to the fact that there might be a compositional shift in credit demand in recessions. If large firms are less severely hit in a recession and therefore demand relatively more credits than small firms, this could explain the relative increase in the issue of commercial paper, since most commercial papers are issued by large firms.

In line with Kashyap, Stein and Wilcox (1993), Becker and Ivashina (2010) examine firms' substitution between bank credit and public debt to identify shifts in bank-loan supply, but use firm-level data instead of aggregate loan data. They study both how changes in monetary policy and changes in banks' financial health affect firms' financing choices. The study is naturally limited to large firms, for which the issue of public debt is an available means of financing. They find evidence that firms substitute bank loans for bonds at times characterized by high levels of non-performing loans, low bank share prices and periods of tight monetary policy.

The idea in this paper is to use a contractual difference *across bank credits* to test for credit supply effects in a sample of both small and large firms. Firms applying for bank credit may seek either a commitment contract or a term loan. A commitment contract is a line of credit under which the firm is entitled to borrow up to a certain pre-set ceiling and at conditions set in advance. A term loan allows the firm to sign a loan contract as the need arises and with terms set on the spot. When banks aim to tighten credit conditions, they are free to reduce the supply of term loans, i.e. loans not under commitment. But their possibilities for reducing the supply of loans under commitment are more limited. In this way, loan commitments may protect firms from a credit contraction, as argued by James (2009).

The approach to use the distinction between commitment and non-commitment loans has been explored by Morgan (1998) and by Black and Rosen (2007). Using aggregated bank lending data, Morgan found that tighter monetary policy slowed the growth of loans not under commitment relative to loans under commitment. Black and Rosen examined detailed loan origination data and found no significant evidence that the number of non-commitment loans decreased relative to commitment loans when monetary policy was tight. Instead, when analyzing loan maturities, they found that banks reduced the *maturity* of loan originations during periods when the fed funds rate was high. The effect was a gradual reduction in loan supply, as predicted by the bank lending channel.

In this study, I use *firm-level data* to examine how firms substitute between commitment loans and non-commitment loans. The benefit of using firm-level data is that it addresses concerns about compositional changes in the set of firms raising debt. It also enables me to control for firm-specific factors that are likely to influence firms' financing decisions. In line with Becker and Ivashina, I employ several measures of credit conditions at the macro level: the central bank policy rate, the level of bank credit losses as a percentage of total bank lending and a bank stock market index. The sample consists of a large panel of Swedish firms over the period 1997 - 2009. The results indicate

that firms on average rely more on commitment credits, i.e. lines of credit, when monetary policy is tight and when the financial health of banks is weaker. I interpret this as evidence consistent with a bank lending channel of monetary policy and of negative shifts in the supply of credit following deteriorations in banks' balance sheets.

The outline is the following. Section 2 describes the data set I use and discusses some data limitations that need to be handled. Section 3 provides information on the characteristics of lines of credit and on their use by Swedish corporations. Section 4 presents the empirical set up and my results. Section 5 concludes.

2 The data

The study is conducted on a large panel data set of Swedish firms, *aktiebolag*. *Aktiebolag* is by approximation the Swedish equivalent of US corporations and UK limited liability businesses. The population of firms is collected from the Swedish credit bureau, Upplysningscentralen. The complete micro data is an unbalanced panel of approximately 340,000 Swedish firms. The credit bureau collects and compiles annual balance sheet and income statement data from the Swedish Companies Registration office. As a result, the data covers in principle all registered Swedish corporations, both public and private.

A difficulty when using accounting data is that the accounting years do not necessarily coincide with calendar years. Only around half of the firms in the panel have an accounting year that corresponds to the calendar year. I deal with this by converting the annual report data into quarterly observations by interpolation. That is, I assume that the variables remain constant over the quarters in a given reporting period.

The time period studied is 1997 to 2009. The time span is limited by the availability of data on firms' credit lines. Prior to 1997, firms' reporting on credit lines is poor. New, more extensive, accounting standards that conform with EU directives came into effect in 1996. According to the current accounting recommendations, a loan in the form of a revolving credit should be reported on the liability side of the balance sheet and the amount awarded should be reported in connection with the outstanding debt or in a note. As a result, as of 1997, data on firms' credit lines is much improved.

Nevertheless, it remains a problem that firms do not always report whether they have a line of credit or the used amount under an existent credit line. According to the accounting data, on average over the time period, only 41 percent of Swedish corporations had access to a line of credit. This is an unrealistically low share. I draw this conclusion by comparing with other studies (Sufi (2009), Lins, Servaes and Tufano (2010)) as well as with Swedish bank lending data. The Riksbank has access to a data set comprising all lending by one of the major Swedish banks. Among other

things, this data is informative on the different forms of corporate lending, such as credit lines and term loans. By merging the two data sets, I can cross-check that firms which have not reported a line of credit in their accounts neither have a line of credit according to the bank lending data. I find that 20 percent of the firms which are customers of the commercial bank *do* have access to a line of credit but have not reported so in their accounts.

A conceivable way of handling this problem would be to use the above-mentioned bank lending data instead. The data set comprises of bank lending data over the time period 2002 to 2009. However, this time span is arguably too short to study the use of credit lines over the business cycle. To cover a longer time period, I will use the accounting data in the estimations and restrict the sample to firms which have reported lines of credit in their annual accounts. However, to the extent that there is a systematic difference between firms which have a line of credit but have not reported so and firms which reported their lines of credit, my results may be unrepresentative. To get an appreciation of this potential sample selection problem, I make use of the bank lending data to conduct a formal analysis of which factors determine whether firms make use of bank lines of credit. I estimate a probit model of the likelihood that a firm has a line of credit according to this data set. I then compare this result with similar estimations using the accounting data but excluding all missing observations in this data set. The results, which are presented in table A1 in the appendix, show that, to a large extent, the same firm-specific variables determine the likelihood that a firm has access to a line of credit in both samples. For instance, the likelihood that a firm has a line of credit decreases with size of the firm and with the volatility of its cash flow. I draw the conclusion that there is no severe systematic difference between the population of firms which choose to report their lines of credit and the population of firms which actually have a credit line.

In addition to restricting the sample to firms which have reported their credit lines in their annual accounts, I make the following additional adjustments of the sample. I remove observations which have unrealistic values for some variables, for instance negative debt. With the aim of excluding inactive corporations, I also require that the annual reporting of the firm is consecutive, that the firm has reported an operating income each year and that it has at least one employee. For each firm, I also remove the first year which the firms occurs in the panel in order to delete observations with lines of credit negotiated in the current period. Finally, I remove firms belonging to the financial sector. After these removals, the sample comprises 68,800 corporations.

It is worth noting that the population of Swedish corporations is dominated by small firms; the median corporation has 4 employees and total assets of 2.4 million SEK (0.4 million USD). Some summary statistics of the sample of firm are presented in table 1.

3 The use of credit lines

Banks have traditionally provided liquidity insurance in the form of loan commitments to firms. Gatev and Strahan (2006) argue that synergies in lending and deposit-taking have provided banks with a natural hedge against market-wide declines in liquidity. Deposit inflows have tended to increase during periods of market stress. Thereby, funding has been more available to banks just when borrowers have wanted to draw funds from their loan commitments. This hedge has reduced the cost of supplying liquidity when the corporate sector's liquidity demand has risen.

From a firm's perspective, lines of credit offer an option on future liquidity. Relative to cash, they have the advantage that they provide liquidity only when needed, i.e. when valuable investment projects arise. In most cases, holding cash funded by a term loan is costly as cash yields a return that is lower than the interest rate paid on the debt to fund it (Demirougou and James (2011)).

In this section, I study the use of lines of credit among Swedish corporations. I outline some characteristics of lines of credit, specifically which types of firms have a line of credit, what interest rates banks charge and what the typical size of a line of credit is. The first two questions are answered by exploring the Swedish bank lending data mentioned above while the third question can be answered by use of the accounting data.

Lines of credit are a common means for financing for Swedish corporations. The bank lending data indicate that close to 70 percent of Swedish corporations have signed a credit line facility. This is somewhat lower than what is found in other studies. Sufi (2009), for instance, finds that about 85 percent of US firms had access to a line of credit during the years 1996 to 2003.

Figure 1 shows that lines of credit are more frequently used by small and medium-sized firms than large ones. The solid line maps the fraction of firms that have a line of credit across the asset size distribution. It is worth noting that while the share of firms with access to a line of credit decreases with asset size, still in the top decile, more than half of the Swedish firms have a line of credit.

The dotted line in figure 1 instead maps the fraction of firms that have a line of credit across the cash-flow distribution with cash-flow scaled by total assets. Sufi (2009) finds that firms with low cash-flows are less likely to have a commitment credit. Contrary to his result, figure 1 suggests that the fraction of Swedish firms which have a line of credit decreases with cash-flow. Sufi argues that an important channel for the positive correlation he finds is the use of cash flow-based financial covenants by banks that supply credit lines⁴; only firms that maintain high cash flows can be guaranteed access to credit under the loan agreement when the need arises. However, in Sweden the use of financial covenants is relatively rare, a factor that may explain why there is no positive

⁴Financial covenants on a line of credit require the maintenance of financial ratios. If a ratio, commonly a cash flow-related ratio, is not satisfied the borrower is in default of the loan agreement.

correlation between cash flow and the access to a line of credit visible in the Swedish data.

The negative impact of asset size and cash flow on the probability that a firm has a line of credit is confirmed by the formal probit estimations referred to earlier and reported in table A1 in the appendix. The table also suggests that the probability of having a line of credit increases with the rate of growth in sales. In other words, fast-growing firms are more inclined to have lines of credit than other firms. This finding is in line with Lins, Servaes and Tufano (2010) who show that lines of credit are related to a firm's need for external financing to fund future investment opportunities.

Credit line facilities allow firms to borrow up to a certain amount at a pre-set interest rate. For this right, firms pay an annual fee. The interest rate on the amount drawn on the facilities is an adjustable interest rate, set as a mark-up over a benchmark, commonly an interbank rate. As the interbank rate under normal market conditions follows the central bank policy rate (in Sweden, the repo rate), the interest rate on the credit lines normally evolves in line with this policy rate (see figure 2). However, the average mark-up is substantial. For instance, during 2004 and 2005, when the Swedish repo rate varied between 1.5 and 2 percent, the average firm paid an interest rate of between 6.25 and 7 per cent on drawdowns on lines of credit. However, large firms are charged a lower mark-up: the thick solid line illustrates that the interest rate weighted by the share of the used amount to total amount by all firms fluctuated between 3 and 4.25 percent those years.

During the financial crisis, the spread between the interbank rate and the repo rate rose. This is reflected in figure 2 as a peak in the credit line interest rate in late 2008. Hence, during the financial crisis, changes in the repo rate were not always representative of changes in the interest rates on lines of credit. For this reason, I include regressions where I use the interbank rate instead of the repo rate as interest rate variable. However, it turns out that this does not alter the results.

The potential of firms to borrow via their lines of credit is substantial. On average, the committed amount of a line corresponds to around 30 percent of firms' total assets and around two times the total of the outstanding bank debt of the firm.⁵ Figure 3 shows that smaller firms on average have larger lines of credit in relation to both total assets and total outstanding bank debt.

Figure 4 depicts the evolution over time in the share of commitment credit (i.e. drawdowns on lines of credit) in relation to total bank credit. The hypothesis in this study implies that this share increases when the supply of credit shifts inwards. The thick solid line in figure 4 shows a downward trend in the share of commitment credit between 2001 and 2006. In 2006, the decline abates, which coincides with a period of tightened monetary policy as shown by the dotted line in the figure. In the last quarter of 2007 and the first quarter of 2008, the average firm increases its share of credit line borrowing. The thin solid line illustrates that the increase in the share

⁵For clarification, it should be noted that figure 3 shows the size of the total lines of credit while table 1 displays statistics on the borrowed amount under the lines of credit.

during the financial crisis was particularly pronounced for firms with tight liquidity conditions, approximated as firms which did not pay out any dividends in 2007 and 2008. In the next section, I will explore whether this variation in the share of commitment loans over time can be statistically explained by variations in the monetary policy stance and/or by changes in banks' financial health.

4 Results

4.1 Empirical specification

The identification of a bank lending channel in this study rests on the assumption that lines of credit and term loans are substitutable forms of financing for firms: when credit conditions are tightened, either as a result of monetary policy and/or a deterioration of banks balance sheets, banks shift the supply of credit inwards. As the conditions for commitment loans are already negotiated and cannot easily be altered, firms have an incentive to protect themselves from the credit contraction by increasing their demand for commitment loans, i.e. drawing more on their lines of credit. An increase in the share of commitment loans over total loans following a monetary tightening or deteriorating financial health of banks is therefore evidence in favor of a bank lending channel.

In reality, there will be heterogeneity among firms as regards their incentives to substitute between different kinds of bank credit as larger firms also have the option to turn to the securities markets for financing. To the extent that this option is feasible and preferred for firms, it may make it harder for me to find the evidence I am looking for. In the extreme case where all firms would use this alternative, a credit tightening would not change the share of commitment loans relative to non-commitment loans. Instead the share of commercial papers and corporate bonds would increase relative to the volume of bank credit. However, as the sample of firms I examine is dominated by small firms, most firms in the sample are unlikely to have access to the securities markets. Hence, for these firms, the only trade-off possible in terms of credit is likely to be between different sources of bank credit.

The equation I estimate is of the following form:

$$x_{it} = \alpha_i + \beta_1 M_t + \beta_2 Z_{it-4} + \beta_3 D_{it} + \beta_4 t + \varepsilon_{it} \quad (1)$$

where $x_{it} = C_{it} / (C_{it} + N_{it})$, and C_{it} are commitment loans (drawdowns on lines of credit) by firm i in period t and N_{it} is non-commitment loans (term loans) of the same firm in the same period.

Z is a vector of control variables. I use the following firm-specific control variables: the log of total assets, the log of property, plant and equipment, the return on assets (defined as operating income before depreciation divided by total assets), leverage (defined as the sum of short and long term debt to total assets), the share of tangible assets (defined as property, plant and equipment,

liquid assets and accounts receivable to total assets) and the share of liquid assets (defined as cash and short term assets to total assets). To handle that x_{it} and the variables in Z_{it} may be co-determined, all control variables are lagged four quarters. D_{it} is a vector of three indicator variables: whether the firm is part of a group, whether it pays dividends in period t and a sectorial dummy. The sectorial classification is time-varying and based on industry classifications standards from 1992, 2002 and 2007 obtained from Statistics Sweden (SNI codes).

M_t is a time series measure capturing either monetary policy or banks' financial health. In my benchmark estimations, the stance of monetary policy is measured as the deviation in the real repo rate from trend. As measures of banks' financial strength, I use banks' loan losses as a percent of total bank lending and a stock price index for banks. The share of loan losses is total losses over lending for the four Swedish banks dominating the Swedish banking market. The bank index covers the same four banks. Details on the definition of the macro variables are given in the appendix, section A2.

4.2 Core results

I estimate (1) using OLS regression with fixed effects. Standard errors have been corrected for heteroscedasticity and correlation in the cross-section by clustering by quarters. In addition to estimating over the full sample of firms, I run regressions where I condition on firms' raising new bank debt in the current period. This is similar to Becker and Ivashina (2010). A rationale for this separation is that, in the full sample, the share of commitment loans over total bank loans may increase not only as firms draw more on their lines of credit but also as firms pay back on their term loans, transactions which may not be the result of relative cost changes.

Table 2 presents the results of equation (1) where the macro variables are the three different measures of monetary policy and banks' financial health described above.

As regards the firm-specific variables, the table shows that on average the share of borrowing in the form of commitment loans relative to total bank loans declines as the firm grows in terms of total assets. The reliance on funding in the form of commitment loans relative to non-commitment loans also decreases with growing fixed assets such as properties, plants and equipment and a growing share of tangible assets to total assets. The share of commitment funding is also lower when firms pay dividends, a result that may suggest that firms with satisfactorily liquidity rely less on lines of credit in their financing. Furthermore, it seems to be the case that the reliance on commitment loans declines with profitability, measured as return on assets. However, the marginal impact of increased profitability is small and in the sample limited to firms with a positive credit demand it is not significantly different from zero.

Turning to the variables of main interest in this study, the macro variables, table 2 shows that in all three specifications the macro variables have a significant impact on the relative share of

commitment loans for the average firm. A tighter monetary policy, as measured by a higher real central bank policy rate relative to trend, and a higher share of loan losses for banks covaries with a higher share of commitment loans. A higher share of commitment loans also covaries with a *lower* bank valuation. The results hold for both the full sample and the sample limited to firms with a positive credit demand.

The quantitative impact is such that one standard deviation rise in the real interest rate increases the share of credit line financing by 0.3 percentage points on average. The impact of a decline in bank valuation is similar, while the impact from an increase in banks' loan losses is somewhat lower: a one standard deviation rise in loan losses increases the share of commitment loans by 0.2 percentage points.

Overall, the results in table 2 are consistent with the hypothesis that the credit supply shifts inwards in periods of tight monetary policy and when the financial health of banks deteriorates. However, the quantitative impact appears to be small on average.

So far, I have implicitly assumed that firms' relative demand for commitment loans and non-commitment loans does not vary over the business cycle. Consequently, business cycle variations in credit demand are no concern. However, it is conceivable that lines of credit and term loans are to some extent used for different purposes. It may for instance be the case that, when monetary policy is tightened in a boom and firms' investment demand increases, so does their demand for term loans relative to lines of credit. If this is the case, separating shifts in the supply of credit from the demand impact remains a concern. The estimate of β_1 will then be biased. To deal with this, I will also estimate equation (1) with measures of monetary policy and banks' financial position where I control for the demand impact and, subsequently, use the obtained residuals as instruments for monetary policy and for changes in banks' financial conditions.

I control for the demand impact on monetary policy by two means. In the first set-up, I use a measure of monetary policy constructed as the deviation in the repo rate from a target level predicted by a Taylor rule. In the second measure, the residual of monetary policy is calculated using an extended set of demand related variables. In addition to the standard variables in the Taylor rule, I also include the deviation in industrial production from trend and the unemployment rate. By including additional demand variables, I want to make sure that I isolate a monetary policy term which is cleansed from any correlation with aggregate demand. I use the same extended set of demand variables to control banks' loan losses and banks' stock valuation from demand influences. (See the appendix, section A2, for details.)

The results of these estimations are shown in table 3. Also, when I control for demand variation over the business cycle, the results show that firms on average have a higher share of commitment loans over total bank loans when monetary policy is tight and when banks' financial health is weakened. The coefficients remain statistically different from zero in most set-ups. The quantitative

impact remains in the same order. A one standard deviation increase in the repo rate and a one standard deviation decrease in bank valuation lead to an increase in the share of commitment loans over total bank loans by approximately 0.3 percentage points. Variations in banks' loan losses still covary with somewhat smaller changes in the share of commitment loans; a one standard variation increase in loan losses results in a 0.2 percentage points increase in the share of commitment loans.

4.3 Robustness tests

In this section, I present several tests to check the robustness of the above results.

One concern is the possibility that it is mainly small firms that experience shifts in the credit supply and that the macro effect is negligible. Since the sample is dominated by small firms, I would still expect to get significant coefficients for the macro impact. To examine that this is not the case, I re-estimate equation (1) using weighted least squares. I assign weights on the basis of firms' total assets size. As illustrated in tables 4 and 5, the results are robust to assigning firms' weights after the size of their assets. All coefficients on macro variables which are significant according to tables 2 and 3 remain significant in tables 4 and 5. And the size of the coefficients are of the same order. Hence, it appears that the results are not driven by small firms without macro importance but rather that small and large firms are equally inclined to increase the share of commitment loans during periods of tight monetary policy and weaker financial positions of banks.

Another concern is that, when studying the substitution between different types of bank credit, the distinction between the bank lending channel and the broad credit channel is not clear-cut. This is not an issue when studying firms' substitution between bank credit and market financing as in Kashyap, Stein and Wilcox (1993). Firms' switching to non-bank credit can then be taken as evidence of changes in banks' credit conditions (the bank lending channel). But an increase in the share of commitment credit could potentially be caused by a deterioration in firms' financial positions with a subsequent increase in the cost of non-commitment bank loans (the broad credit channel). In the estimations above, I included several firm-specific variables with the aim of capturing changes in the firms' financial position. However, to the extent that these variables are insufficient measures of the financial conditions of firms, it could still be the case that the broad credit channel is affecting my results. Therefore, as an additional check of the possible impact of the broad credit channel, I also run regressions where I divide the sample of firms into three groups according to asset size. As the broad credit channel commonly is assumed to affect small firms more than large firms, a tightening of credit conditions should reduce access to non-commitment credit relatively more for small firms.⁶ The results of these estimations over different size groups

⁶See for instance Bernanke, Gertler and Gilchrist (1996) as regards the distributional impact of the broad credit channel.

of firms, presented in table 6, do not support the existence of a broad credit channel. There is little evidence that small firms are more prone to increase their demand of commitment credit during periods of tight monetary policy and weaker banks' balance sheets. On the contrary, the coefficients of the macro variable increase with asset size in three of the specifications. However, as the sample of firms is dominated by small firms, firms in the first tercile of firms are *very* small and even firms in the second tercile are small by international standards. As displayed in table 1, the median firm in the second tercile has an asset size of 2.5 billion SEK (0.4 billion USD) and 4 employees. It may therefore be more relevant to compare in particular the second tercile with the third tercile of firms when searching for a difference in impact between small and large firms. But neither in such a comparison is there any clear evidence that larger firms are less likely to substitute away from non-commitment credit when monetary policy is tight or banks' balance sheets are weakened. In three of the columns, the coefficient is lower for firms in the third tercile compared to the second tercile. But in another three columns, the coefficient is higher for firms in the third tercile.

In table 7, I examine whether my results are robust to measuring monetary policy conditions with a short-term market interest rate instead of the central bank policy rate. In normal times, the spread between the short-term market interest rate and the policy rate is fairly constant and, accordingly, it should be unimportant which interest rate is used in the estimations. However, during the financial crisis, the spread between the interbank rate and the Swedish policy rate, the repo rate, rose. As a result, the cost of using lines of credit did not follow monetary policy as closely as earlier. Nevertheless the results do not change in any significant way when I use a time series of the interbank rate instead of the repo rate. The coefficients are also in line with my earlier results when I restrict the time period to the financial crisis and onwards .

So far, I have used quarterly data in the estimations, where the firm-level data have been created by interpolation from the yearly accounting data. An alternative approach would be to instead express the macro variables, monetary policy and banks' credit losses as yearly averages. However, using yearly observations of firms' accounting data is not uncomplicated as firms' accounting years correspond to the calendar year in only half of the observations. Still, an additional concern is that the results in tables 2 and 3 are driven by the persistence created by the interpolation of yearly data. To check that this is not the case, I transform the firm level data to yearly data by only using annual accounts data as of the fourth quarter each year and by expressing monetary policy and banks credit losses and stock valuation as yearly averages. After doing this, I repeat the regression in table 2 and 3. The results of these estimations, which are displayed in table 8, show that the coefficients keep the same, expected sign. Changes in monetary policy and in banks' stock valuation still have a significant impact on the share of commitment loans, while changes in banks' loan losses no longer can be shown to have a significant impact on firms' loan structure. However,

using yearly averages of macro variables to explain year end fiscal positions of firms entails losing valuable information, so the lower degree of statistical significance is not unexpected.

Finally, a concern might be that the results in tables 2 and 3 are dominated by conditions during the financial crisis. It may be the case that the relationship between monetary policy and banks' financial health on the one hand and the share of commitment credit on the other hand is insignificant during less severe business cycle fluctuations. In tables 9 and 10, I split the time series into a pre-crisis period (from 1997 until the third quarter of 2007) and a crisis period (from the third quarter of 2007 until the end of 2009). As seen in table 9, also during the period prior to the financial crisis, firms tend to increase their drawdowns on credit line relative to total bank credit during periods of tighter monetary policy and when banks' balance sheets deteriorate. The size of the coefficients is also in the same order, with the exception of the impact from changes in banks' loan losses where column IV shows a substantially larger coefficient than in table 2. The results from the financial crisis period (table 10) show that firms' share of commitment loans also continued to covary positively with monetary policy and negatively with the stock market valuation of banks during the crisis. However, the coefficient of loans losses is now *negative* and no longer significant.⁷ The negative coefficient is in line with how the average share of commitment loans evolved during the crisis (as shown in figure 4) in relation to banks' loans losses (see figure A2). While banks' loan losses began to rise in the autumn of 2008 and continued to rise during the first half of 2009, the average share of commitment increased during the beginning of the crisis but then fell back again in the beginning of 2009.

Possibly, one reason why the historical relationship between banks' loans losses and the share of commitment credit did not hold up during the crisis is related to the measures undertaken by the Riksbank to facilitate the provision of credit by the banks. The implementation of such measures, which began during the fourth quarter of 2008, might have been successful in the sense that banks did not tighten credit conditions to the same extent that they otherwise would have given the sharp rise in banks' loan losses.⁸

⁷It should be noted that the lower degree of statistical significance from the financial crisis period is not unexpected from a statistical point of view. In the estimations, standard errors are clustered by quarter to take into account possible correlation between firms within a given quarter. When estimating over only the financial crisis, the number of clusters (quarters) will be low compared to the overall sample size and the standard errors are likely to be substantially larger than the OLS results. Potential problems with inference in the presence of group effects when the number of groups is small have been highlighted by Donald and Lang (2001).

⁸The measures to facilitate the supply of credit included loans by the Riksbank to the banks at longer maturities than usual. The Riksbank also offered loans in US dollars to Swedish banks and extended the possibility to borrow using mortgage bonds as collateral.

5 Conclusions

This study uses a comprehensive sample of small and large firms to examine whether firms are subject to shifts in the supply of credit over the business cycle. This is done by studying how firms substitute between commitment and non-commitment bank credit. The hypothesis is that, when banks tighten credit conditions, firms have an incentive to substitute commitment credit – lines of credit with terms set prior to the credit contraction – for non-commitment credit – credit with terms set on the spot. I use three different variables to capture potential variation in credit availability over the business cycle: the central bank interest rate, banks’ loan losses as a percent of total bank lending and the stock market valuation of banks.

I find that firms on average rely more on commitment credits, i.e. lines on credit, when monetary policy is tight and when the financial health of banks is weaker. This holds also when I allow for the possibility that firms’ demand for commitment and non-commitment credit varies over the business cycle. I interpret this as evidence consistent with a bank lending channel of monetary policy and of shifts in the supply of credit following deteriorations in banks’ balance sheets. The results are robust to several modifications, such as a transformation to yearly data instead of quarterly and a change of interest rate measure from the central bank policy rate to the interbank rate.

The time period covered is 1997 - 2009, where the last two years represent the financial crisis. In an additional robustness test, I run separate regressions for the period up until the crisis erupted and for the crisis period. Also over the pre-crisis period, I find that firms substitute between commitment and non-commitment credit in a way that supports the existence of shifts in the supply credit. Interestingly, I find that, during the financial crisis when there were widespread concerns of insufficient availability of credit, some of the results do not hold. In particular, the results suggest that the increase in banks’ loan losses did not lead to a credit tightening as in the pre-crisis period. A possible interpretation is that measures undertaken by the Swedish authorities during the second half of 2008 were successful in supporting the availability of credit; by lending extensively to the banking system, the tightening effect of loan losses, that would otherwise have occurred, might have been lessened.

A natural question that arises from the results in this paper is how *quantitatively* important shifts in the supply of credit over the business cycle have been for the activity of Swedish firms. Have shifts in the supply of bank credit affected firms’ inventory and investment behavior? The substitution of commitment credit for non-commitment credit offers firms a way of dampening the impact of an unexpected shift in the supply of credit. So the fact that firms have increased their share of commitment credit during times when credit conditions may have been tight cannot be taken as evidence that the cost of capital has increased in general for firms. The question of quantitative effects would be interesting to study both over a period characterized by normal business fluctuations and for the financial crisis period. However, answering this question satisfactorily

would require among other things data on firms' investment activities and has been beyond the scope of this paper.

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Tables and figures

Figure 1. The frequency of lines of credit

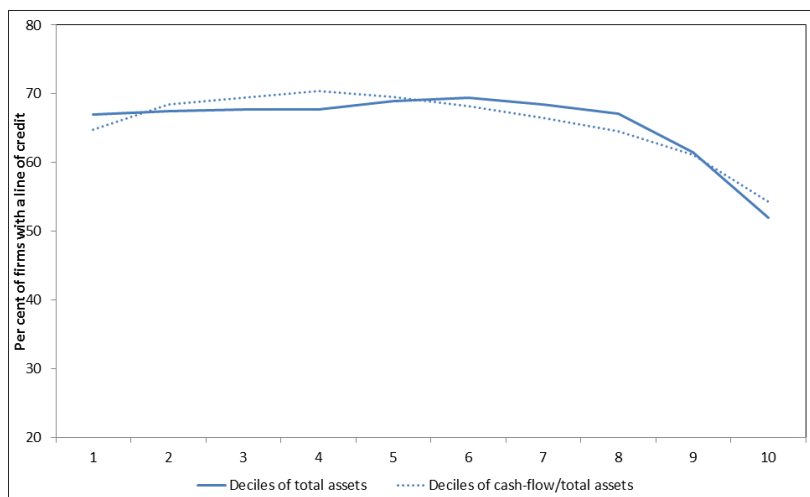


Figure Notes: The figure maps the percentage of firms which has a line of credit by assets and cash flow decile, respectively. Moving from left to right increases the size of the firms and the amount of cash flow.

Figure 2. Interest rates on lines of credit

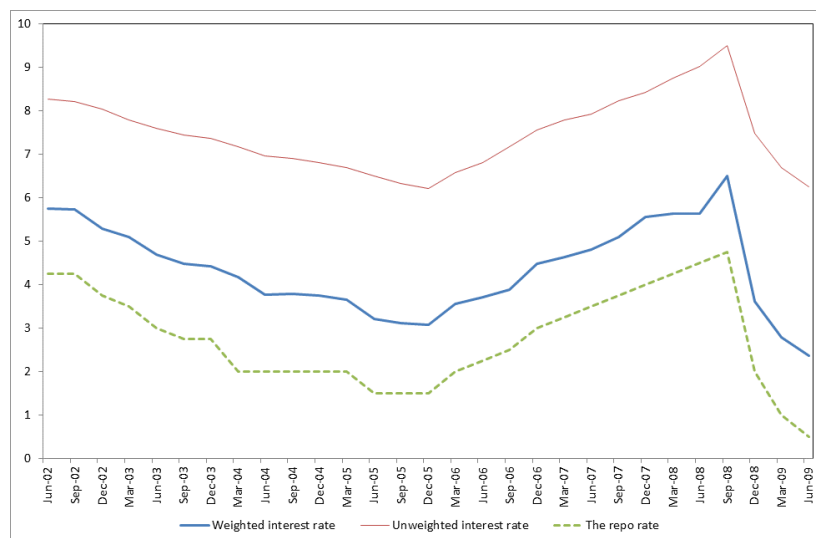


Figure Notes: The figure shows the interest rate paid on drawdowns on lines of credit as well as the Swedish central bank policy rate, the repo rate. The source of the data is the Riksbank's detailed data on all commercial lending by a major Swedish bank. The thin solid line is the interest rate paid in each period on all commitment lending by the bank, i.e. the interest rate paid on average by the firms. The thick solid line is a weighted interest rate, where the weights have been set according to the share of commitment credit of each firm to total outstanding commitment credit of the bank.

Figure 3. The size of the lines of credit

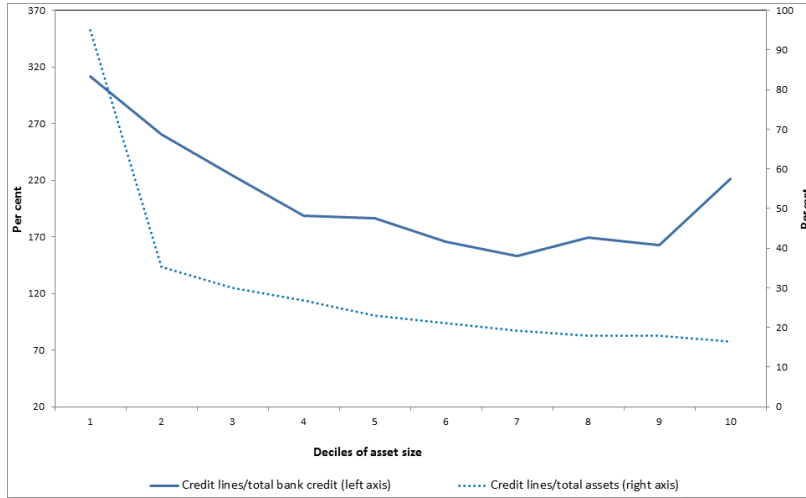


Figure Notes: The figure displays the size of lines of credit over the distribution of firms ordered in deciles after total assets. The size of the lines is related to total bank credit (the solid line) as well as to total assets (the dotted line).

Figure 4. The share of commitment credit to total bank credit and the repo rate

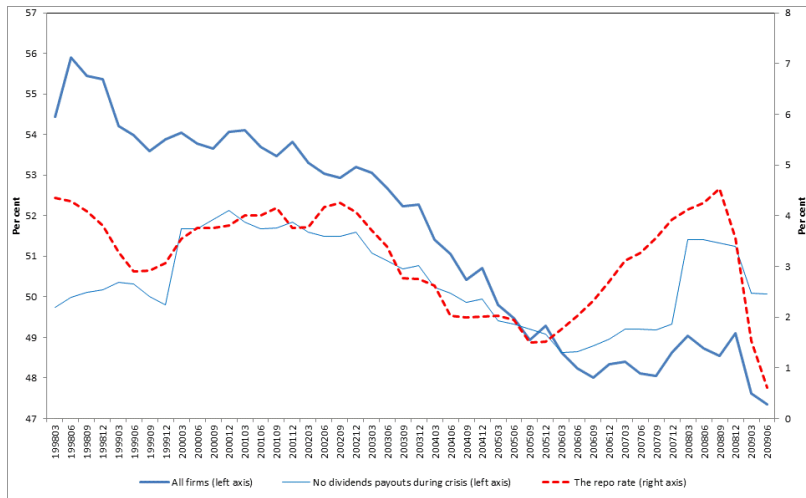


Figure Notes: The figure shows, for each period, the average share of commitment credit in relation to total bank credit and the repo rate. The thick solid line is the average share across all firms in the sample. The thin solid line is the average share for firms which did not pay dividends in 2007 and 2008.

Table 1. Summary statistics

| | Mean | Median | Standard deviation |
|--|--------|--------|-----------------------|
| <i>Total assets</i> | | | |
| All firms | 16.500 | 2.523 | 194.000 |
| Small firms | 0.737 | 0.720 | 0.349 |
| Medium sized firms | 2.650 | 2.478 | 0.908 |
| Large firms | 45.100 | 11.200 | 330.000 |
| <i>Number of employees</i> | | | |
| All firms | 10.6 | 4 | 63.60 |
| Small firms | 2.4 | 2 | 2.04 |
| Medium sized firms | 4.9 | 4 | 3.93 |
| Large firms | 24.1 | 11 | 107.75 |
| <i>Bank debt / Total assets</i> | | | |
| All firms | 0.348 | 0.316 | 0.220 |
| Small firms | 0.340 | 0.306 | 0.217 |
| Medium sized firms | 0.347 | 0.314 | 0.220 |
| Large firms | 0.356 | 0.328 | 0.223 |
| <i>Commitment credit / Total bank credit</i> | | | |
| All firms | 0.511 | 0.464 | 0.399 |
| Small firms | 0.680 | 0.924 | 0.377 |
| Medium sized firms | 0.477 | 0.404 | 0.389 |
| Large firms | 0.382 | 0.258 | 0.370 |
| <i>Drawdowns/ Total size of credit line</i> | | | |
| All firms | 0.570 | 0.648 | 0.359 |
| Small firms | 0.600 | 0.680 | 0.343 |
| Medium sized firms | 0.657 | 0.572 | 0.364 |
| Large firms | 0.537 | 0.607 | 0.366 |

Table Notes: This table reports some summary statistics of the sample of firms used in the estimations. Total assets are expressed in SEK billion. Bank debt is the sum of short- and long-term debt to credit institutions. Commitment credit to total credit is drawdowns on lines of credit in relation to the sum of drawdowns and term loans. Each variable is reported for the full sample of firms as well as for the first tercile (small firms), second tercile (medium-sized firms) and third tercile (large firms). The terciles are based on asset size.

Table 2. Fixed effect estimates of the effect of monetary policy and banks' financial health on the share of commitment loans over total bank credit

| | Monetary policy Full sample | Loan losses Full sample | Bank index Full sample | Monetary policy Positive credit demand | Loan losses Positive credit demand | Bank index Positive credit demand |
|------------------------------------|--------------------------------|----------------------------|---------------------------|--|--|---|
| Real interest rate | 0.42*** [0.095] | | | 0.22** [0.106] | | |
| Loan losses | | 4.32*** [1.441] | | | 5.84*** [1.402] | |
| Ln(Bank index) | | | -1.23*** [0.247] | | | -0.65** [0.295] |
| Ln(Total assets) (t-4) | -6.48*** [0.084] | -6.47*** [0.084] | -6.45*** [0.085] | -5.24*** [0.166] | -5.23*** [0.166] | -5.21*** [0.166] |
| PP&E (t-4) | -2.77*** [0.106] | -2.78*** [0.105] | -2.79*** [0.104] | -2.12*** [0.122] | -2.12*** [0.122] | -2.13*** [0.121] |
| ROA (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] |
| Leverage (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.005] | -0.02*** [0.005] | -0.02*** [0.005] |
| Tangible assets/total assets (t-4) | -0.09*** [0.003] | -0.09*** [0.003] | -0.09*** [0.003] | -0.04*** [0.004] | -0.04*** [0.004] | -0.04*** [0.004] |
| Liquid assets/total assets (t-4) | -0.02** [0.008] | -0.02** [0.008] | -0.02** [0.008] | -0.20*** [0.009] | -0.20*** [0.009] | -0.20*** [0.009] |
| Part of group | -0.21*** [0.072] | -0.23*** [0.071] | -0.25*** [0.072] | -0.43*** [0.139] | -0.42*** [0.133] | -0.45*** [0.140] |
| Dividend payer | -3.43*** [0.090] | -3.41*** [0.088] | -3.37*** [0.085] | -0.96*** [0.196] | -0.93*** [0.196] | -0.93*** [0.197] |
| Observations | 1,018,730 | 1,018,730 | 1,018,730 | 257,650 | 257,650 | 257,650 |
| R-squared (within) | 0.033 | 0.033 | 0.033 | 0.051 | 0.051 | 0.051 |
| R-squared (overall) | 0.180 | 0.180 | 0.180 | 0.243 | 0.242 | 0.243 |
| Number of firms | 67,708 | 67,708 | 67,708 | 36,705 | 36,705 | 36,705 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table Notes: This table reports estimates from panel regressions explaining the firm-level share of commitment loans over total bank loans between the first quarter of 1998 and the last quarter of 2009. All regressions include firm fixed effects, sectorial dummies and a time trend. Test-statistics reported in parantheses are based on heteroskedasticity consistent standard errors adjusted for clustering by quarters. The three columns to the left present results from estimations over the full sample of firms. The three columns to the right present results from estimations over a sample which in each period is restricted to firms raising new bank debt in that period. The columns labeled "Monetary policy" show the impact on the share of commitment loans from changes in monetary policy. Similarly, the columns labeled "Loan losses" and "Bank index" show the impact from changes in banks' loan losses and in banks' stock valuation. Details on the definitions of the macro variables are given in the appendix, section A2.

Table 3. Fixed effect estimates of the share of commitment loans over total bank credit. The effects of monetary policy and banks' financial health have been controlled for aggregate demand impact

| | Monetary policy Full sample | Monetary policy Full sample | Loan losses Full sample | Bank index Full sample | Monetary policy Positive credit demand | Monetary policy Positive credit demand | Loan losses Positive credit demand | Bank index Positive credit demand |
|---|--------------------------------|--------------------------------|----------------------------|---------------------------|--|--|--|---|
| Deviation from Taylor rule | 0.06 [0.077] | | | | 0.16*** [0.044] | | | |
| Interest rate controlled for demand impact | | 0.57*** [0.060] | | | | 0.38*** [0.082] | | |
| Loan losses controlled for demand impact | | | 1.76 [2.076] | | | | 5.94*** [2.079] | |
| Bank index controlled for demand impact | | | | -1.76*** [0.502] | | | | -0.59 [0.441] |
| Ln(Total assets) (t-4) | -6.45*** [0.084] | -6.50*** [0.081] | -6.45*** [0.082] | -6.45*** [0.083] | -5.21*** [0.164] | -5.25*** [0.166] | -5.24*** [0.165] | -5.22*** [0.166] |
| PP&E (t-4) | -2.78*** [0.105] | -2.77*** [0.104] | -2.78*** [0.106] | -2.79*** [0.104] | -2.13*** [0.122] | -2.12*** [0.121] | -2.12*** [0.122] | -2.13*** [0.121] |
| ROA (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] |
| Leverage (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.005] | -0.02*** [0.005] | -0.02*** [0.005] | -0.02*** [0.005] |
| Tangible assets/total assets (t-4) | -0.09*** [0.003] | -0.09*** [0.003] | -0.09*** [0.003] | -0.09*** [0.003] | -0.04*** [0.004] | -0.04*** [0.004] | -0.04*** [0.004] | -0.04*** [0.004] |
| Liquid assets/total assets (t- 4) | -0.02*** [0.008] | -0.02*** [0.008] | -0.02*** [0.008] | -0.02*** [0.008] | -0.20*** [0.009] | -0.20*** [0.009] | -0.20*** [0.009] | -0.20*** [0.009] |
| Part of group | -0.25*** [0.074] | -0.19*** [0.067] | -0.24*** [0.071] | -0.24*** [0.070] | -0.44*** [0.139] | -0.41*** [0.135] | -0.41*** [0.133] | -0.45*** [0.140] |
| Dividend payer | -3.42*** [0.089] | -3.40*** [0.088] | -3.43*** [0.090] | -3.39*** [0.083] | -0.95*** [0.195] | -0.94*** [0.197] | -0.97*** [0.195] | -0.95*** [0.196] |
| Observations | 1,018,730 | 1,018,730 | 1,018,730 | 1,018,730 | 257,650 | 257,650 | 257,650 | 257,650 |
| R-squared (within) | 0.033 | 0.033 | 0.033 | 0.033 | 0.051 | 0.051 | 0.051 | 0.051 |
| R-squared (overall) | 0.180 | 0.180 | 0.180 | 0.180 | 0.246 | 0.246 | 0.246 | 0.246 |
| Number of firms | 67,708 | 67,708 | 67,708 | 67,708 | 36,705 | 36,705 | 36,705 | 36,705 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table Notes: This table reports estimates from panel regressions explaining the firm-level share of commitment loans over total bank loans between the first quarter of 1998 and the last quarter of 2009. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering by quarters. The four columns to the left present results from estimations over the full sample of firms. The four columns to the right present results from estimations over a sample which in each period is restricted to firms raising new bank debt in that period. The columns labeled "Monetary policy" show the impact on the share of commitment loans from changes in monetary policy. Similarly, the columns labeled "Loan losses" and "Bank index" show the impact from changes in banks' loan losses and in banks' stock valuation. Details on the definitions of the macro variables are given in the appendix, section A2.

Table 4. Weighted least squares estimates of the share of commitment loans over total bank credit

| | Monetary policy | Loan losses | Bank index | Monetary policy | Loan losses | Bank index |
|------------------------------------|----------------------------|---------------------|---------------------|----------------------------|---------------------------|---------------------------|
| | Full sample | Full sample | Full sample | Positive credit demand | Positive credit demand | Positive credit demand |
| Real interest rate | 0.44*** [0.095] | | | 0.23** [0.107] | | |
| Loan losses | | 4.18*** [1.475] | | | 6.01*** [1.409] | |
| Ln (Bank index) | | | -1.20*** [0.259] | | | -0.68** [0.295] |
| Ln(Total assets) (t-4) | -6.20*** [0.082] | -6.18*** [0.082] | -6.17*** [0.083] | -4.97*** [0.160] | -4.97*** [0.160] | -4.95*** [0.160] |
| PP&E (t-4) | -2.83*** [0.112] | -2.84*** [0.112] | -2.84*** [0.110] | -2.21*** [0.126] | -2.21*** [0.126] | -2.21*** [0.125] |
| ROA (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] |
| Leverage (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.03*** [0.005] | -0.03*** [0.005] | -0.03*** [0.005] |
| Tangible assets/total assets (t-4) | -0.09*** [0.003] | -0.09*** [0.003] | -0.09*** [0.003] | -0.04*** [0.004] | -0.04*** [0.004] | -0.04*** [0.004] |
| Liquid assets/total assets (t-4) | -0.02*** [0.008] | -0.02*** [0.008] | -0.02*** [0.008] | -0.21*** [0.010] | -0.21*** [0.010] | -0.21*** [0.010] |
| Part of group | -0.20*** [0.075] | -0.22*** [0.074] | -0.24*** [0.075] | -0.42*** [0.137] | -0.41*** [0.131] | -0.44*** [0.137] |
| Dividend payer | -3.40*** [0.089] | -3.38*** [0.087] | -3.35*** [0.084] | -1.01*** [0.201] | -0.98*** [0.200] | -0.98*** [0.202] |
| Observations | 1,018,730 | 1,018,730 | 1,018,730 | 257,650 | 257,650 | 257,650 |
| R-squared (within) | 0.033 | 0.033 | 0.033 | 0.051 | 0.051 | 0.051 |
| R-squared (overall) | 0.248 | 0.248 | 0.248 | 0.183 | 0.183 | 0.183 |
| Number of firms | 67,708 | 67,708 | 67,708 | 36,705 | 36,705 | 36,705 |

Robust standard errors in brackets

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

Table Notes: This table reports weighted least squares estimates of the firm-level share of commitment loans over total bank loans between the first quarter of 1998 and the last quarter of 2009. Weights are set according to the relative asset size of the firms. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering by quarters. The three columns to the left present results from estimations over the full sample of firms. The three columns to the right present results from estimations over a sample which in each period is restricted to firms raising new bank debt in that period. The columns labeled "Monetary policy" show the impact on the share of commitment loans from changes in monetary policy. Similarly, the columns labeled "Loan losses" and "Bank index" show the impact from changes in banks' loan losses and in banks' stock valuation. Details on the definitions of the macro variables are given in the appendix, section A2.

Table 5. Weighted least squares estimates of the share of commitment loans over total bank credit. The effects of monetary policy and banks' financial health have been controlled for aggregate demand impact

| | Monetary policy Full sample | Monetary policy Full sample | Loan losses Full sample | Bank index Full sample | Monetary policy Positive credit demand | Monetary policy Positive credit demand | Loan losses Full sample | Bank index Full sample |
|--|-----------------------------------|-----------------------------------|----------------------------|---------------------------|--|--|----------------------------|---------------------------|
| Deviation from Taylor rule | 0.06 [0.079] | | | | 0.15*** [0.045] | | | |
| Interest rate controlled for demand impact | | 0.58*** [0.062] | | | | 0.40*** [0.081] | | |
| Loan losses controlled for demand impact | | | 1.85 [2.108] | | | | 6.37*** [2.032] | |
| Bank index controlled for demand impact | | | | -1.78*** [0.512] | | | | -0.66 [0.445] |
| Ln(Total assets) (t-4) | -6.16*** [0.082] | -6.22*** [0.079] | -6.17*** [0.080] | -6.17*** [0.081] | -4.95*** [0.158] | -4.99*** [0.161] | -4.98*** [0.160] | -4.95*** [0.161] |
| PP&E (t-4) | -2.84*** [0.112] | -2.83*** [0.110] | -2.84*** [0.112] | -2.84*** [0.110] | -2.21*** [0.126] | -2.21*** [0.125] | -2.20*** [0.126] | -2.21*** [0.125] |
| ROA (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] |
| Leverage (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.03*** [0.005] | -0.03*** [0.005] | -0.03*** [0.005] | -0.03*** [0.005] |
| Tangible assets/total assets (t-4) | -0.09*** [0.003] | -0.09*** [0.003] | -0.09*** [0.003] | -0.09*** [0.003] | -0.04*** [0.004] | -0.04*** [0.004] | -0.04*** [0.004] | -0.04*** [0.004] |
| Liquid assets/total assets (t-4) | -0.02*** [0.008] | -0.02*** [0.008] | -0.02*** [0.008] | -0.02*** [0.008] | -0.21*** [0.010] | -0.21*** [0.010] | -0.21*** [0.010] | -0.21*** [0.010] |
| Part of group | -0.24*** [0.076] | -0.18*** [0.069] | -0.23*** [0.074] | -0.23*** [0.073] | -0.43*** [0.136] | -0.40*** [0.133] | -0.40*** [0.131] | -0.43*** [0.138] |
| Dividend payer | -3.40*** [0.088] | -3.37*** [0.087] | -3.41*** [0.089] | -3.37*** [0.082] | -1.00*** [0.200] | -0.99*** [0.202] | -1.02*** [0.200] | -0.99*** [0.201] |
| Observations | 1,018,730 | 1,018,730 | 1,018,730 | 1,018,730 | 257,650 | 257,650 | 257,650 | 257,650 |
| R-squared (within) | 0.032 | 0.033 | 0.032 | 0.033 | 0.051 | 0.051 | 0.051 | 0.051 |
| R-squared (overall) | 0.183 | 0.183 | 0.183 | 0.183 | 0.249 | 0.249 | 0.249 | 0.249 |
| Number of firms | 67,708 | 67,708 | 67,708 | 67,708 | 36,705 | 36,705 | 36,705 | 36,705 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table Notes: This table reports weighted least squares estimates of the firm-level share of commitment loans over total bank loans between the first quarter of 1998 and the last quarter of 2009. Weights are set according to the relative assets size of the firms. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering at firm level. The four columns to the left present results from estimations over the full sample of firms. The four columns to the right present results from estimations over a sample which in each period is restricted to firms raising new bank debt in that period. The columns labeled "Monetary policy" show the impact on the share of commitment loans from changes in monetary policy. Similarly, the columns labeled "Loan losses" and "Bank index" show the impact from changes in banks' loan losses and in banks' stock valuation. Details on the definitions of the macro variables are given in the appendix, section A2.

Table 6. Fixed effect estimates of the share of commitment loans over total bank credit. The sample of firms divided in three size groups

| | Repo rate | Deviation from Taylor rule | Interest rate controlled for demand impact | Loan losses | Loan losses controlled form demand impact | Bank index | Bank index controlled for demand impact |
|-----------------------|--------------------|----------------------------------|--|--------------------|---|---------------------|---|
| Small firms | 0.29*** (0.065) | 0.01 (0.038) | 0.31*** (0.037) | 3.10*** (0.994) | 2.79* (1.552) | -0.66*** (0.134) | -0.78** (0.327) |
| Medium sized firms | 0.35*** (0.114) | 0.13* (0.070) | 0.56*** (0.069) | 5.44*** (1.443) | 1.26 (1.879) | -1.45*** (0.239) | -1.94*** (0.490) |
| Large firms | 0.50*** (0.079) | -0.03 (0.100) | 0.61*** (0.084) | 1.64 (1.701) | 0.41 (2.762) | -0.92** (0.398) | -1.95*** (0.598) |
| | ↑ | ? | ↑ | ? | ? | ? | ↑ |

Table Notes: This table reports the coefficients of the impact of the macro variables on the firm-level share of commitment loans over total bank loans between the first quarter of 1998 and the last quarter of 2009. The sample of firms has been divided into three groups based on the size of the firms' total assets. The sample is split at the 33th and the 66th percentile. The arrows indicate the macro variables for which the coefficients increase when going from the tertile of the smallest firms to the largest firms. The question marks indicate where there is no monotonicity in the coefficients over the asset size groups of firms. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering by quarters.

Table 7. Fixed effect estimates of the share of commitment loans over total bank credit. Estimates using the interbank rate instead of the repo rate

| | (I) | (II) | (III) | (IV) |
|---|---------------------|---------------------|---------------------|---------------------|
| Interbank rate | 0.30*** [0.057] | | 0.29*** [0.041] | |
| Interbank rate controlled for demand impact | | 0.37** [0.153] | | 0.52*** [0.141] |
| Ln (Total assets) (t-4) | -6.50*** [0.084] | -6.44*** [0.085] | -2.10*** [0.347] | -2.05*** [0.351] |
| PP&E (t-4) | -2.77*** [0.106] | -2.78*** [0.105] | -0.93** [0.312] | -0.94** [0.311] |
| ROA (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | 0.01** [0.004] | 0.01** [0.004] |
| Leverage (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | 0.01*** [0.002] | 0.01*** [0.002] |
| Tangible assets/total assets (t-4) | -0.09*** [0.003] | -0.09*** [0.003] | 0.00 [0.006] | 0.00 [0.006] |
| Liquid assets/total assets (t-4) | -0.02** [0.008] | -0.02** [0.008] | 0.17*** [0.035] | 0.17*** [0.035] |
| Part of group | -0.20*** [0.070] | -0.26*** [0.072] | -0.20 [0.299] | -0.21 [0.299] |
| Dividend payer | -3.43*** [0.090] | -3.41*** [0.086] | -2.28*** [0.083] | -2.29*** [0.085] |
| Observations | 1,018,730 | 1,018,730 | 189,046 | 189,046 |
| R-squared (within) | 0.033 | 0.033 | 0.007 | 0.007 |
| R-squared (overall) | 0.204 | 0.204 | 0.120 | 0.120 |
| Number of firms | 67,708 | 67,708 | 29,140 | 29,140 |

Robust standard errors in brackets

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

Table Notes: This table reports estimates explaining the firm-level share of commitment loans over total bank loans as a function of the interbank rate and firm-specific variables between the first quarter of 1998 and the last quarter of 2009. Column I and II are results of estimations for the full time period. In columns III and IV the time period is restricted to the financial crisis period, defined as 2007Q9 - 2009Q12. In columns II and IV the interbank rate has been controlled for aggregate demand impact in the same manner as the repo rate in previous tables. Details on the definitions of the macro variables are given in the appendix, section A2. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering at firm level.

Table 8. Fixed effect estimates of share of commitment loans over total bank credit. Yearly observations

| | Monetary policy (1) | Monetary policy (2) | Monetary policy (3) | Loan losses (4) | Loan losses (5) | Bank index (6) | Bank index (7) |
|--|------------------------|------------------------|------------------------|---------------------|---------------------|---------------------|---------------------|
| Real interest rate | 0.75*** [0.185] | | | | | | |
| Deviation from Taylor rule | | 0.02 [0.229] | | | | | |
| Interest rate controlled for demand impact | | | 0.73*** [0.186] | | | | |
| Loan losses | | | | 3.42 [4.664] | | | |
| Loan losses controlled for demand impact | | | | | 4.07 [4.901] | | |
| Ln(Bank index) | | | | | | -1.28* [0.661] | |
| Bank index controlled for demand impact | | | | | | | -2.51* [1.313] |
| Ln(Total assets) (t-1) | -6.43*** [0.136] | -6.36*** [0.139] | -6.43*** [0.132] | -6.37*** [0.138] | -6.38*** [0.134] | -6.36*** [0.141] | -6.36*** [0.143] |
| PP&E (t-1) | -2.74*** [0.190] | -2.76*** [0.195] | -2.75*** [0.189] | -2.77*** [0.194] | -2.76*** [0.195] | -2.77*** [0.192] | -2.77*** [0.191] |
| ROA (t-1) | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] | -0.02*** [0.003] |
| Leverage (t-1) | -0.02*** [0.004] | -0.02*** [0.004] | -0.02*** [0.004] | -0.02*** [0.004] | -0.02*** [0.004] | -0.02*** [0.004] | -0.02*** [0.004] |
| Tangible assets/total assets (t-1) | -0.08*** [0.006] | -0.08*** [0.006] | -0.08*** [0.006] | -0.08*** [0.006] | -0.08*** [0.006] | -0.08*** [0.006] | -0.08*** [0.006] |
| Ln(liquid assets) (t-1) | -0.29 [1.349] | -0.24 [1.359] | -0.28 [1.352] | -0.25 [1.358] | -0.27 [1.335] | -0.22 [1.366] | -0.24 [1.351] |
| Part of group | -0.12 [0.123] | -0.19 [0.134] | -0.11 [0.114] | -0.17 [0.129] | -0.16 [0.125] | -0.20 [0.132] | -0.18 [0.129] |
| Dividend payer | -3.55*** [0.175] | -3.56*** [0.176] | -3.52*** [0.167] | -3.56*** [0.173] | -3.57*** [0.180] | -3.52*** [0.163] | -3.51*** [0.158] |
| Observations | 256,881 | 256,881 | 256,881 | 256,881 | 256,881 | 256,881 | 256,881 |
| R-squared (within) | 0.032 | 0.032 | 0.032 | 0.032 | 0.032 | 0.032 | 0.032 |
| R-squared (overall) | 0.177 | 0.177 | 0.177 | 0.177 | 0.177 | 0.177 | 0.177 |
| Number of firms | 62,508 | 62,508 | 62,508 | 62,508 | 62,508 | 62,508 | 62,508 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table Notes: This table reports the firm-level share of commitment loans over total bank loans between 1998 and 2009. The underlying quarterly panel data has been transformed to annual data by using only firm-level data as of the fourth quarter each year. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering by date. The columns labeled "Monetary policy" show the impact on the share of commitment loans from changes in monetary policy. Similarly, the columns labeled "Loan losses" and "Bank index" show the impact from changes in banks' loan losses and in banks' stock valuation. In columns (2), (3), (5) and (7), the macro variables have been controlled for aggregate demand impact. Details on the definitions of the macro variables are given in the appendix, section A2.

Table 9. Fixed effect estimates of the share of commitment credit over total bank credit. Pre-crisis period: 1998Q3 - 2007Q6

| | (I) | (II) | (III) | (IV) | (V) | (VI) | (VII) |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Real interest rate | 0.45*** [0.117] | | | | | | |
| Deviation from Taylor rule | | 0.01 [0.085] | | | | | |
| Interest rate controlled for demand impact | | | 0.49*** [0.069] | | | | |
| Loan losses | | | | 13.29*** [4.865] | | | |
| Loan losses controlled for demand impact | | | | | -0.72 [2.544] | | |
| Ln(Bank index) | | | | | | -1.29*** [0.314] | |
| Bank index controlled for demand impact | | | | | | | -1.00* [0.556] |
| Ln(Total assets) (t-4) | -6.46*** [0.129] | -6.43*** [0.132] | -6.45*** [0.129] | -6.44*** [0.129] | -6.43*** [0.130] | -6.41*** [0.132] | -6.42*** [0.132] |
| PP&E (t-4) | -2.38*** [0.093] | -2.38*** [0.094] | -2.38*** [0.093] | -2.38*** [0.093] | -2.38*** [0.093] | -2.39*** [0.094] | -2.39*** [0.094] |
| ROA (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] |
| Leverage (t-4) | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] | -0.02*** [0.002] |
| Tangible assets/total assets (t-4) | -0.09*** [0.004] | -0.09*** [0.004] | -0.09*** [0.004] | -0.09*** [0.004] | -0.09*** [0.004] | -0.09*** [0.004] | -0.09*** [0.004] |
| Liquid assets/total assets (t-4) | -0.00 [0.010] | -0.00 [0.010] | -0.00 [0.010] | -0.00 [0.010] | -0.00 [0.010] | -0.00 [0.010] | -0.00 [0.010] |
| Part of group | -0.21*** [0.067] | -0.24*** [0.063] | -0.22*** [0.064] | -0.24*** [0.062] | -0.24*** [0.066] | -0.26*** [0.063] | -0.24*** [0.063] |
| Dividend payer | -3.20*** [0.125] | -3.20*** [0.121] | -3.17*** [0.124] | -3.17*** [0.121] | -3.20*** [0.122] | -3.15*** [0.118] | -3.18*** [0.119] |
| Observations | 829,684 | 829,684 | 829,684 | 829,684 | 829,684 | 829,684 | 829,684 |
| R-squared (within) | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 | 0.027 |
| R-squared (overall) | 0.173 | 0.173 | 0.173 | 0.173 | 0.173 | 0.173 | 0.173 |
| Number of firms | 58,464 | 58,464 | 58,464 | 58,464 | 58,464 | 58,464 | 58,464 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table Notes: This table reports estimates from panel regressions explaining the firm-level share of commitment loans over total bank loans between the first quarter of 1998 and the second quarter of 2007. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering by quarters. The first three columns present results from estimations where the macro variable is a measure of monetary policy. In the fourth and the fifth columns the macro variable is a measure of banks' loan losses and in the last two columns the macro variable captures banks' stock valuation. Details on the definitions of the macro variables are given in the appendix, section A2.

Table 10. Fixed effect estimates of the share of commitment credit over total bank credit. Financial crisis period: 2007Q9 - 2009Q2

| | (I) | (II) | (III) | (IV) | (V) | (VI) | (VII) |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Real interest rate | 0.44*** [0.065] | | | | | | |
| Deviation from Taylor rule | | 0.01 [0.141] | | | | | |
| Interest rate controlled for demand impact | | | 0.58*** [0.105] | | | | |
| Loan losses | | | | -4.25 [2.650] | | | |
| Loan losses controlled for demand impact | | | | | -10.16 [5.935] | | |
| Ln (Bank index) | | | | | | -0.78 [0.530] | |
| Bank index controlled for demand impact | | | | | | | -2.13*** [0.489] |
| Ln(Total assets) (t-4) | -1.95*** [0.376] | -1.84*** [0.375] | -1.95*** [0.381] | -1.85*** [0.375] | -1.87*** [0.371] | -1.89*** [0.383] | -1.94*** [0.373] |
| PP&E (t-4) | -0.94** [0.300] | -0.96** [0.298] | -0.94** [0.300] | -0.96** [0.300] | -0.96** [0.302] | -0.95** [0.297] | -0.94** [0.301] |
| ROA (t-4) | 0.01* [0.003] | 0.01* [0.003] | 0.01* [0.003] | 0.01* [0.003] | 0.01* [0.003] | 0.01* [0.003] | 0.01* [0.003] |
| Leverage (t-4) | 0.00 [0.001] | 0.00 [0.001] | 0.00 [0.001] | 0.00 [0.001] | 0.00 [0.001] | 0.00 [0.001] | 0.00 [0.001] |
| Tangible assets/total assets (t-4) | 0.01 [0.005] | 0.01 [0.005] | 0.01 [0.005] | 0.01 [0.005] | 0.01 [0.005] | 0.01 [0.005] | 0.01 [0.005] |
| Liquid assets/total assets (t-4) | 0.18*** [0.033] | 0.18*** [0.033] | 0.18*** [0.033] | 0.17*** [0.033] | 0.18*** [0.033] | 0.18*** [0.033] | 0.18*** [0.033] |
| Part of group | -0.20 [0.298] | -0.20 [0.300] | -0.20 [0.297] | -0.20 [0.299] | -0.20 [0.299] | -0.20 [0.300] | -0.20 [0.299] |
| Dividend payer | -2.25*** [0.077] | -2.30*** [0.070] | -2.26*** [0.076] | -2.30*** [0.071] | -2.29*** [0.070] | -2.28*** [0.072] | -2.27*** [0.073] |
| Observations | 193,342 | 193,342 | 193,342 | 193,342 | 193,342 | 193,342 | 193,342 |
| R-squared (within) | 0.007 | 0.006 | 0.007 | 0.006 | 0.007 | 0.007 | 0.007 |
| R-squared (overall) | 0.010 | 0.095 | 0.099 | 0.095 | 0.097 | 0.090 | 0.097 |
| Number of orgnr | 29,661 | 29,661 | 29,661 | 29,661 | 29,661 | 29,661 | 29,661 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table Notes: This table reports estimates from panel regressions explaining the firm-level share of commitment loans over total bank loans between the third quarter of 2007 and the last quarter of 2009. All regressions include firm fixed effects, sectorial dummies and a time trend. Test statistics reported in parantheses are based on heteroskedasticity-consistent standard errors adjusted for clustering by quarters. The first three columns present results from estimations where the macro variable is a measure of monetary policy. In the fourth and the fifth columns the macro variable is a measure of banks' loan losses and in the last two columns the macro variable captures banks' stock valuation. Details on the definitions of the macro variables are given in the appendix, section A2.

Appendices

A1. Assessment of sample selection impact

Table A1. Probit estimations of the likelihood that a firm has a line of credit (marginal effects)

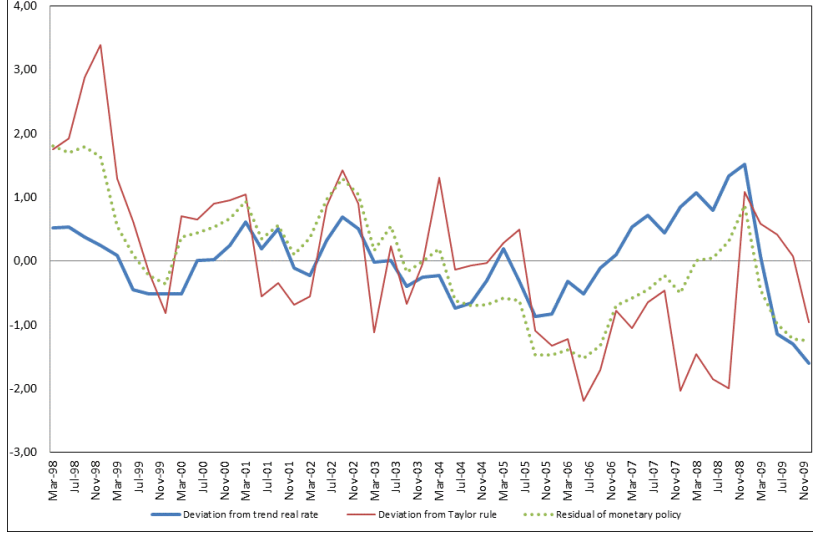
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
|---------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Cashflow/total assets | -0.051*** [0.019] | -0.053*** [0.019] | -0.053*** [0.019] | -0.036*** [0.002] | -0.036*** [0.002] | -0.036*** [0.002] |
| Ln (Total assets) | -0.045*** [0.002] | -0.045*** [0.002] | -0.045*** [0.002] | -0.001*** [0.000] | -0.001*** [0.000] | -0.001*** [0.000] |
| Tangible assets | -0.087*** [0.014] | -0.089*** [0.014] | -0.089*** [0.014] | -0.020*** [0.001] | -0.020*** [0.001] | -0.020*** [0.001] |
| Growth in sales | 0.014*** [0.002] | 0.014*** [0.002] | 0.014*** [0.002] | 0.005*** [0.000] | 0.005*** [0.000] | 0.005*** [0.000] |
| Part of group | 0.020* [0.012] | 0.021* [0.012] | 0.021* [0.012] | -0.007*** [0.001] | -0.007*** [0.001] | -0.007*** [0.001] |
| Cash flow volatility | | -0.016* [0.010] | -0.016* [0.010] | | -0.001** [0.001] | -0.001** [0.001] |
| Industry sales volatility | | | 0.228*** [0.038] | | | -0.010 [0.008] |
| Pseudo R ² | 0.07 | 0.07 | 0.07 | 0.03 | 0.03 | 0.03 |
| Observations | 114,783 | 114,783 | 114,783 | 1,718,168 | 1,718,168 | 1,718,168 |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table Notes: This table reports results from probit regressions where the dependent variable takes the value 1 if the the firm has a line of credit in the current period. Columns (I) to (III) report the estimated marginal effects of firm characteristics on the probability of having a line of credit from probit estimation using the bank lending data. Columns (IV) to (VI) report corresponding results based on the accounting data.

A2. Macro variables

Figure A1. Measures of the stance of monetary policy



The thick solid line in figure A1 is the deviation in the real Swedish repo rate from an estimated trend. The real interest rate is calculated as the nominal interest rate deflated by expected inflation one year ahead according to the survey Economic Tendency Survey Business and Consumer (Source: National Institute of Economic Research).

The thin solid line in figure A1 is the residuals of the following estimated equation:

$$i_t = \alpha + 1.5 (\pi_t - 2) + 0.5 (y_t - y_t^*) + \varepsilon_t \quad (\text{A1})$$

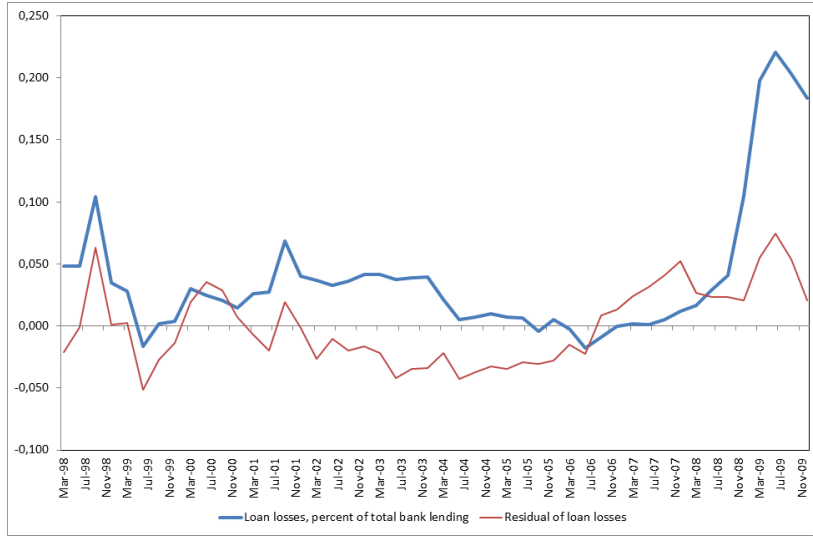
where $(y_t - y_t^*)$ is the output gap as calculated by the Riksbank (source: Monetary Policy Report, October 2010).

The dotted line is the residuals of the following estimated equation:

$$i_t = \alpha + \beta_1 (\pi_t - 2) + \beta_2 (y_t - y_t^*) + \beta_3 (\text{indprod}_t - \text{indprod}_t^*) + \beta_4 (u_t) + \varepsilon_t \quad (\text{A2})$$

where $(\text{indprod}_t - \text{indprod}_t^*)$ is the deviation in industrial production from trend and u_t is the unemployment rate. The trend in industrial production has been estimated by means of the Hodrick-Prescott filter.

Figure A2. Measure of banks' financial health: loan losses as a percent of total lending



The thick solid line shows total loan losses in each period for the four dominant Swedish banks. Loan losses are expressed as a percent of total bank lending according to:

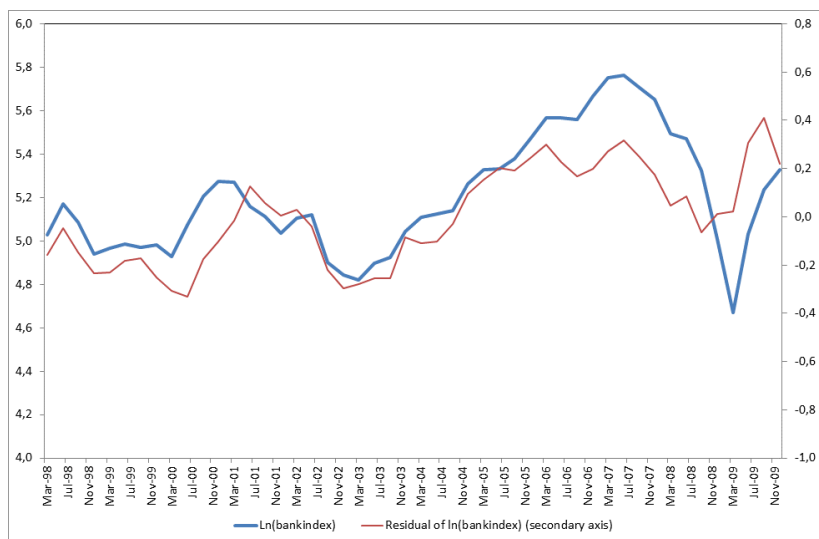
$$ll_t = \left(\frac{LL_t}{L_t + L_{t-1}} \right) * 100 \quad (A3)$$

where LL_t is loan losses in period t as reported in the banks' quarterly reports and L_t is bank lending in period t . (Source: The Riksbank.)

The thin solid line is calculated in the same way as in equation A2. That is, the residuals in:

$$ll_t = \alpha + \beta_1 (\pi_t - 2) + \beta_2 (y_t - y_t^*) + \beta_3 (indprod_t - indprod_t^*) + \beta_4 (u_t) + \varepsilon_t \quad (A4)$$

Figure A3. Measure of banks' financial health: $\ln(\text{bank index})$



The thick solid line in figure A3 is the log of a bank stock index and the thin line is calculated in the same way as in equation A4. The index is the OMX Stockholm Banks_GI, which is composed of the four major Swedish banks (Source: Nasdaq OMX.)

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