Federal Reserve Bank of Chicago

How the Credit Channel Works: Differentiating the Bank Lending Channel and the Balance Sheet Channel

Lamont K. Black and Richard J. Rosen

WP 2007-13

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by

Lamont K. Black
Board of Governors of the Federal Reserve System
Washington, DC 20551 U.S.A

and

Richard J. Rosen
Federal Reserve Bank of Chicago
Chicago, IL 60604 U.S.A

This draft: October 2007

ABSTRACT:

The credit channel of monetary policy transmission operates through changes in lending. To examine this channel, we explore how movements in the real federal funds rate affect bank lending. Using data on individual loans from the Survey of Terms of Bank Lending, we are able to differentiate two ways the credit channel can work: by affecting overall bank lending (the bank lending channel) and by affecting the allocation of loans (the balance sheet channel). We find evidence consistent with the operation of both internal credit channels. During periods of tight monetary policy, banks adjust their stock of loans by reducing the maturity of loan originations and they reallocate their short-term loan supply from small firms to large firms. These results are stronger for large banks than for small banks.

The opinions expressed do not necessarily reflect those of the Federal Reserve Board, the Federal Reserve Bank of Chicago, or their staffs. We would like to thank Shah Hussain for research assistance, John Duca for comments, and participants in presentations at the Federal Reserve Bank of Chicago, the Federal Reserve Bank of San Francisco, and the Federal Reserve System Conference on Bank Structure and Competition.

1. Introduction

Understanding the effect of monetary policy on bank lending is important for understanding the transmission mechanism of monetary policy. Models of the credit channel show that financial frictions can magnify the effects of monetary policy. Within the credit channel, there are two channels by which these financial frictions can operate: the bank lending channel and the balance sheet channel. Our main contribution is to empirically differentiate these two channels, identifying the specific contribution of each channel within bank lending, something not generally done in previous studies. We find evidence that during periods of tight monetary policy, banks adjust their stock of loans by reducing the maturity of loan originations and they reallocate their short-term loan supply from small firms to large firms. These results are consistent with the operation of both internal credit channels. We show that the bank lending channel operates through changes in loan maturity and the balance sheet channel operates through a reallocation of short-term loan supply.

The division of the credit channel into the bank lending channel and the balance sheet channel is made in Bernanke and Gertler (1995). In each channel, the effect of monetary policy is magnified due to a change in lending. The theory of the bank lending channel is based on the Bernanke and Blinder (1988) model, where a contractionary monetary policy leads to a reduction in bank deposits which, in turn, reduces aggregate loan supply. An alternative channel is described in Bernanke, Gertler, and Gilchrist (1996). There, the agency costs of lending endogenously change with monetary policy. Monetary contractions reduce the net worth of borrowers, which leads to an increase in agency costs, primarily for low-net-worth firms. In the Bernanke and Gertler (1989) model, when these agency costs increase, lenders reduce the amount of credit extended to risky firms and invest more in a safe alternative. This leads to our interpretation that the balance sheet channel implies that during periods of tight monetary policy, banks reallocate loan supply away from small firms and toward large firms, with the implicit assumption than small firms are riskier than large firms.

There is a significant literature on both the bank lending channel and the balance sheet channel. The evidence for the bank lending channel is based primarily on differences among banks (e.g. Kashyap and Stein (1995, 2000); Kishan and Opiela (2000); Jayaratne and Morgan (2000); Ashcraft (2006)). This literature generally shows that banks with weak

balance sheets (such as limited liquidity, limited capitalization, etc.) reduce their loan supply following a monetary contraction. The evidence for the balance sheet channel is based primarily on differences among firms. Cross-sectional analysis of firms shows that, following a monetary contraction, small firm debt decreases and large firm debt increases (Oliner and Rudebusch (1996); Bernanke, Gertler, and Gilchrist (1996)). A conclusion that one channel is operating is often asserted without differentiating the specific contributions of the two channels. Some papers explicitly state that they identify a credit channel, but cannot empirically separate the bank lending channel from the balance sheet channel (e.g. Kashyap, Lamont, and Stein (1994); Gertler and Gilchrist (1994); Morgan (1998)).

Our main contribution is to differentiate how the two channels operate. By using loan-level data from the Survey of Terms of Business Lending (STBL), we can separate changes in loan supply from changes in loan demand. This allows us to examine whether banks are changing aggregate supply and, within supply, changing the type of loans they make (and the borrowers they make them to). It is important to distinguish the two channels, because the effect of monetary policy on credit availability can differ for some borrowers across the two channels.

The key insight in our identification strategy is that banks make many of their loans under pre-existing loan commitments. It is less likely that a bank can alter the terms of a commitment loan than the terms of a loan not made under commitment (that is, a spot loan). When the level of monetary tightness changes, banks may want to respond by changing the level of their loan supply. The supply of spot loans can be changed instantaneously, because banks can immediately adjust their loan approval criteria. Banks can tighten their lending standards, for instance, and immediately make it more difficult for lower quality firms to acquire a loan. The supply of commitment loans, on the other hand, cannot be changed as readily. Firms with a pre-existing commitment can continue to draw funding from their bank as long as the firm does not experience a material adverse change in their credit quality.[1] Therefore, the supply of commitment loans is stickier than the supply of spot loans.

The restriction on adjustments to commitment loan supply allows us to identify changes in loan supply apart from changes in loan demand. If demand is relatively consistent

[1] Some firms may enter into new commitments right before drawing them down, but we provide evidence that most commitment drawdowns are made under commitments signed at least 6 months prior to the drawdown..

across the two types of borrowing, we can identify changes in the supply of spot loans by comparing spot lending *relative* to commitment lending. We assume that changes in the level of commitment lending reflect changes in loan demand. These could occur through the traditional "interest-rate" channel by which monetary policy affects firms' cost of borrowing. So, if the level of spot lending and commitment lending both rise or fall in tandem when monetary policy is altered, we attribute this to changes in loan demand rather than supply. However, if spot lending changes relative to commitment lending, we attribute the difference to a movement in loan supply. The important argument here is that commitment lending provides a cross-sectional baseline against which to evaluate changes in spot lending. It is the changes in spot lending relative to commitment lending that provides information about the supply of spot loans.

This approach matches nicely to our analysis of firm size, because it can be applied to small firms and large firms alike. This differs from the approach of Kashyap, Stein, and Wilcox (1993) who use outstanding commercial paper as a baseline for loan demand. Using public debt as a baseline for firm demand is feasible for large firms, but not for small firms, because small firms do not issue commercial paper or other forms of public debt (i.e., bonds). Our approach allows us to separately analyze bank loan supply to small and large firms by using commitment loans as our baseline.

When grouping all loans together and treating all loan originations equally, we do not find evidence of a decrease in aggregate loan supply as monetary policy tightens. Some results even indicate a slight increase in loan supply. While this is not supportive of the bank lending channel, the results can be misleading because they group different types of loans together. In order to more precisely test whether the bank lending channel operates, and to test whether the balance sheet channel also operates, we divide the data in several ways.

The STBL measures the *flow* of lending by a bank while the bank lending channel makes predictions about the *stock* of loans. If a bank shifts from making long-term loans to short-term loans, fairly quickly its stock of loans can decrease even if the flow of loans remains constant or increases. We find that, during periods of tight credit, banks reallocate their loan supply from long-term lending to short-term lending, consistent with the operation of a bank lending channel.

We then examine a proxy for firm size to test the balance sheet channel. The STBL does not have borrower information, so we use loan size as a proxy for firm size. We find that banks shift their lending from small firms to large firms, mostly due to changes in short-term lending. This suggests that banks may shift lending toward safe, transparent firms during periods of tight monetary policy, consistent with the balance sheet channel.

Our combined results help to differentiate the specific contributions of the two aspects of the credit channel. It appears that banks may reduce loan supply during periods of tight monetary policy by shortening loan maturities and thereby increasing the liquidity of their loan portfolio. It also appears that banks reallocate short-term lending from small to large firms, which may be a means of increasing the quality of their loan portfolio. These two effects separately identify how the bank lending channel and the balance sheet channel operate.

The remainder of the paper is organized as follows. Section 2 reviews the literature and section 3 describes the data used in our analysis. Section 4 explains our empirical methodology and section 5 lays out the results. Section 6 concludes.

2. Literature Review

In the traditional view of how monetary policy works, changes in monetary policy affect the real economy through the interest-rate channel. According to this view, policymakers set short-term real interest rates to influence the cost of capital, which affects business investment and demand for consumer durables. These changes in aggregate demand then affect the level of production (see Bernanke and Blinder (1992)).

Changes in monetary policy can also affect the supply side of the credit market. This is known as the credit channel. Financial frictions stemming from information asymmetries may be related to the underlying cost of capital. If the cost of external financing increases with short-term real interest rates, then this can reduce the availability of credit during periods of tight monetary policy.

Within the credit channel, the bank lending channel and the balance sheet channel have been proposed as two distinct channels (Bernanke and Gertler (1995)). Each is unique in how it operates, yet the two are very similar in their empirical predictions. Consequently, much of the literature has either estimated the channels in isolation or explicitly treated them

as one channel. In this section, we discuss the evidence for each of the channels as well as the evidence for the credit channel as a whole. Our paper builds on this work. We differentiate the channels by providing evidence on how the two channels operate.

The bank lending channel predicts that banks reduce their aggregate supply of loans when monetary policy is tight. The process begins with a monetary contraction which drains reserves from the banking system and this leaves banks with fewer funds to lend (Bernanke and Blinder (1988)). It is possible that banks can react to this by increasing non-reservable liabilities such as uninsured deposits, thus leaving lending unaffected (Romer and Romer (1990)). However, since raising non-reservable liabilities is costly, tightening monetary policy is expected to still result in a net reduction in loanable funds (Stein (1998)).

A number of papers have used cross-sectional variation in bank characteristics to identify changes in loan supply and have found evidence for the bank lending channel. Kashyap and Stein (1995, 2000), for instance, use bank size and liquidity to differentiate banks. The argument is that the lending of small banks with illiquid balance sheets should be most sensitive to changes in monetary policy, because raising wholesale liabilities is more costly for them. The authors find that small banks with liquid balance sheets reduce their lending less in response to monetary contractions than other small banks. Other studies find similarly that the effects of monetary tightening are decreasing in the expected costs of raising non-reservable liabilities.[2]

The balance sheet channel predicts that banks reallocate their loan supply away from small firms and toward large firms when monetary policy is tight.[3] This channel has also been referred to as the "flight to quality." Lang and Nakamura (1995), for instance, show that banks make proportionately more "safe" loans during periods of tight credit. Because agency costs are greater for low-net-worth firms, large firms tend to be safer than small firms. Bernanke, Gertler, and Gilchrist (1996) show cross-sectional implications of the balance sheet channel by firm characteristics. The authors hypothesize that borrowers who face significant agency costs should experience reduced access to credit, relative to other borrowers,

[2] Kishan and Opiela (2000) examine the effects of bank capitalization, Jayaratne and Morgan (2000) look at dependence on core deposits, and Ashcraft (2006) analyzes banks by holding company status.
[3] The more general form of the balance sheet channel refers to a reduction in loan supply to low-quality borrowers relative to high-quality borrowers.

following a monetary contraction. Using data for manufacturing firms, Bernanke et al. find that small firms reduce their debt and large firms increase their debt.

It is important to clarify that the bank lending channel does not imply differences between changes in bank loan supply to large and small firms. The bank lending channel predicts that, following a monetary contraction, banks reduce their aggregate loan supply. Earlier studies take advantage of the fact that only some firms can substitute into non-bank sources of debt. The "bank-dependent" firms face a credit constraint due to the reduction in bank loan supply, but firms with available external finance can substitute into non-bank finance. The difference between firms comes from a difference in outside options. The theory makes no prediction about banks themselves reallocating their loan supply across firms. Therefore, large and small firms should face a similar reduction in loan supply, regardless of whether they have access to non-bank debt. In our data, we are looking at firm differences solely *within* bank loan supply, which is one of the advantages of our approach. The bank lending channel makes no prediction about such a difference.

Similar concepts to the credit channel can also be found in the credit rationing literature. Stiglitz and Weiss (1981) show how credit rationing can exist in equilibrium. If moral hazard increases with increased interest rates, banks may optimally price loans in a way that leads to rationing. In the benchmark Stiglitz-Weiss model, there is rationing of all borrowers (observationally indistinguishable) when rates are high, which is similar to the bank lending channel. In an extension of the model to include borrower groups, the authors show that lower quality groups only receive loans if credit is not rationed for higher quality groups. This is rationing of distinguishably low-quality borrowers, which is similar to the balance sheet channel. Berger and Udell (1992) use the STBL data to test for credit rationing at the aggregate level. However, the authors do not differentiate by firm size, so they are unable to differentiate between the bank lending channel and the balance sheet channel.

Some papers identify a credit channel, but do not distinguish the bank lending channel from the balance sheet channel. Kashyap, Lamont, and Stein (1994) analyze inventories for bank-dependent firms and find that the inventories of bank-dependent firms fall faster than the inventories of non-bank-dependent firms following a monetary contraction. Gertler and

Gilchrist (1994) use a similar approach to analyze the inventories of small and large firms. [4] The authors find that the debt of small firms falls dramatically whereas large firm debt increases, which indicates changes in both loan supply and demand. Morgan (1998) uses aggregate spot loans and commitment loans and shows that spot loans fall relative to commitment loans following a contraction. The difficulty with using the borrower side is that it is difficult to separate the two channels within the credit channel. For instance, Gertler and Gilchrist do not attempt to separate the channels, because "the sets of borrowers who are balance-sheet constrained and who are bank-dependent overlap considerably" (p312).

One of the most influential approaches toward identifying changes in loan supply is based on the amount of non-bank finance used by firms. Kashyap, Stein, and Wilcox (1993) (hereinafter KSW) analyze the mix of bank debt and commercial paper (CP) debt to identify the bank lending channel. The authors find that the mix of bank debt relative to commercial paper debt decreases following a monetary contraction, which they interpret to be evidence for the bank lending channel.

The external finance approach to identification has raised questions about the nature of the credit channel. Oliner and Rudebusch (1996) argue that Kashyap et al. are measuring a shift in funding from small firms to large firms, which they call the broad credit channel. Oliner and Rudebusch make their argument by using the KSW approach to look at the debt mix of small and large firms. They note that small firms do not issue commercial paper, so they include "other" non-bank, non-CP debt in their measure of firms' baseline borrowing. KSW reply by questioning both the logic of the critique and this alternative mix measure for small firms which includes "other debt".

The value of the KSW approach is that commercial paper debt provides a baseline for measuring changes in the supply of bank debt to large firms. The early work on the credit channel focused on the response of aggregate lending to a monetary contraction (e.g. King (1986); Bernanke and Blinder (1992)), but did not distinguish between changes in loan supply and loan demand. The limitation of the KSW approach is that non-bank/non-CP debt is not a clear substitute for bank debt when the borrower is a small firm. Therefore, identifying changes in loan supply for both large firms and small firms requires a different approach.

[4] Gertler and Gilchrist (1994) use changes in sales, inventories, and short-term debt to identify liquidity constraints. They cannot address the two parts of the credit channel, because their firm data does not differentiate the mechanisms of the two channels.

Our approach is similar to the KSW approach, but we use a different cross-sectional baseline for identifying changes in loan supply. We use the share of spot lending in total lending as our baseline and we argue that a reduction in spot lending relative to commitment lending indicates a reduction in loan supply. This is similar to the argument that a reduction in bank debt relative to commercial paper indicates a reduction in loan supply. The advantage of our approach is that we can address changes in both the supply of bank loans to small firms and the supply of bank loans to large firms.[5] This allows us to address the relative importance of the bank lending channel and the balance sheet channel. Our results provide additional evidence in support of the claim that the balance sheet channel has a greater effect than the bank lending channel.

3. Data and summary statistics

The data are from the Survey of Terms of Business Lending (STBL), which is a survey conducted by the Federal Reserve Board of Governors. The STBL asks a sample of banks to provide data on every C&I loan issued during the first full business week of the second month of every quarter.[6] Our sample includes observations from the third quarter of 1982 through the first quarter of 2006, a time frame that covers numerous periods of tight credit.[7] Each quarter, the STBL includes a stratified sample of roughly 340 banks, including both small banks and large banks.[8] While banks move in and out of the STBL panel, the median length of time a bank is surveyed during our sample is 68 quarters.

Our empirical methodology analyzes the data on a loan-by-loan basis to test how loan supply changes with changes in monetary policy. This approach differs from Berger and Udell (1992), who construct aggregate observations for each bank in each quarter. To reduce noise in the data's time-series dimension, we apply additional filters to remove banks which

[5] Commitments have been used, but only at the aggregate level (e.g., Berger and Udell (1992) and Morgan (1998)).

[6] Although the survey includes several loan types, we focus strictly on commercial and industrial (C&I) loans in the survey (95.0% of the STBL loans are C&I loans). We also eliminate several groups of loans which are not appropriate to our analysis. We exclude all add-on loans, loans booked at a foreign office, loans with maturity greater than 10 years, and loans for which the interest rate spread over the Treasury of comparable maturity is less than -1 percent or greater than 10 percent.

[7] The STBL begins in 1977, but we exclude observations prior to the third quarter of 1982 because there is no data on the size of commitment lines.

[8] Some large banks report fewer than five days and include only a subset of total branches. We account for this when we do our analysis.

have a limited relevance to our analysis or limited presence in the STBL survey. First, we remove banks which issue almost all their loans under commitment or almost all their loans as spot loans, since these banks are unlikely to respond to changes in monetary policy by changing the mix of spot and commitment loans. Formally, we drop all banks where the average share of commitment loans in total loans is above 99% or below 1%. Second, we remove banks whose are in the survey fewer than 25 times. These banks have a limited time span in the survey, which reduces the possibility for changes over time. Finally, we remove banks which make less than 25 loans per week in the survey on average. With these filters, the final sample is 215 banks and 2,588,097 loans.

Table 1 lists the variables used in our tests along with the descriptive statistics of means and standard deviations. The loan characteristic variables are derived directly from the STBL data and the bank characteristics come from the Consolidated Report of Condition and Income (a.k.a. Call Report) associated with the bank making the loan. The STBL does not provide any information about the characteristics of the borrowing firms; therefore, all firm characteristics are imputed from loan level contract information. All nominal amounts are reported in 2006 US dollars.

The primary loan characteristic we use in our identification strategy is whether a loan is made under commitment. A commitment is either a formal commitment or an informal credit line which provides a borrower with the right to borrow up to a certain amount of credit over a fixed period of time. The important aspect of a commitment is that a bank is committed to making a loan upon request, independent of market conditions. Only a legal condition such as a clause for material adverse change (MAC) could release the bank from its commitment. Let COMMIT be a dummy variable equal to 1 if a loan is made under commitment and equal to 0 if the loan is a spot loan, which we define as a loan made to a firm when there was no prior commitment. The mean value of COMMIT is 0.816, which means that 81.6% of the STBL loans from 1982:Q3 to 2006:Q1 are made under commitment.

Our primary macroeconomic variable is our measure of monetary policy, which is the real federal funds rate (referred to as FUNDS RATE or “the funds rate”). The theory of the credit channel relates loan supply to real interest rates; therefore, we adjust the nominal funds rate for expected inflation. Our main measure of expected inflation is ex-ante inflation, so, in

other words, we use current inflation as the forecast of the next quarter's inflation. We construct the real federal funds rate as

$$\text{FUNDS RATE} = \textit{federal funds rate} - \textit{current inflation}, \quad (1)$$

where the federal funds rate is the weekly average of the effective federal funds rate during the week of the STBL survey and inflation is the quarterly growth rate in the core CPI (that is, the CPI net of food and energy prices). Our results are robust to using ex-post inflation as an alternative measure of expected inflation.

Our other main loan characteristic is based on loan size which we use as a proxy for firm size. Larger loans tend to correspond to larger borrowers, so our proxy allows us to discuss differences in the effect of monetary policy across firm sizes. To reflect thresholds in lending practices for firms of different sizes, we separate loan size into three categorical variables (jointly referred to as FIRM SIZE): "Small Firm" is a loan with a size of $100,000 or less, "Medium Firm" is a loan with a size of more than $100,000 and no greater than $1 million, and "Large Firm" is a loan with a size greater than $1 million.[9]

We collect additional loan-specific information from the STBL to control for other aspects of loan heterogeneity. We control for the maturity of the loan to ensure that the composition of short-term and long-term loans is not changing in a way that might be correlated with commitment status. The dummy variable "Short Maturity" (also referred to as SHORT MATURITY) indicates a loan with a maturity of less than one year. The maturity of loans in our sample ranges from 1 day to 10 years, with 83.5% having a maturity of less than one year. We also control for two other variants of loan maturity. Let "Demand" indicate a loan for which the bank has the right to demand repayment at any time or the borrower has the right to prepay without cost[10] and let "Overnight" indicate loans with a recorded maturity of one day. In addition to maturity, we control for several other loan contract terms which may be correlated with commitment status. Specifically, we include indicators for whether the loan is collateralized and whether the loan has a floating interest rate. These loan terms

[9] Erel (2006) uses credit size (the maximum of loan size and commitment limit) as a proxy for firm size in the STBL data. This proxy would have a bias in our specification due to its positive correlation with a loan's commitment status (by construction).

[10] We assign demand loans a maturity of one day.

may be endogenously determined when a loan or commitment is negotiated. Our results are robust to the omission of these variables.

The STBL identifies the bank originating each loan, which allows us to match the STBL data to the quarterly Call Report data for each lender. We focus on total bank assets as the primary bank characteristic in our empirical specification.[11] This provides an interesting question of whether bank size is related to the relative importance of the bank lending channel and the balance sheet channel. It is also possible that the prevalence of commitment loans could depend on the size of the bank making the loan, so we include the natural log of a bank's total assets as a control. Another advantage of the STBL match with bank identities is the opportunity it provides to use a bank-specific fixed-effects specification.

We also control for changes in macroeconomic factors other than monetary policy. Our secondary measure of credit conditions is the Baa-Aaa spread, which measures the risk premium in the corporate bond market. This variable may capture some of the changes in the probability of default at the economy-wide level. We also include the yield curve slope as a way of controlling for the term premium in the treasury market. For the real economy, we include GNP growth and quarterly unemployment. These measures are intended to control for potential changes in the business cycle that may be correlated with credit tightness. Lastly, a linear time trend controls for both unobserved changes in the macroeconomic environment and the upward trend in the number of commitment loans relative to spot loans.

4. Empirical methodology: Identifying changes in loan supply

The effect of tight monetary policy on bank lending differs in the two theories of the credit channel. According to the theory of the bank lending channel, aggregate bank loan supply is reduced during periods of tight monetary policy. In the theory of the balance sheet channel, bank loan supply is reallocated from small firms to large firms.

We use two empirical specifications to identify changes in bank lending in response to changes in monetary policy. Our first empirical specification is based on the *proportion* of commitment loans to spot loans while the second identifies the driving factors in these proportional changes by focusing on the *quantities* of commitment loans and spot loans. Both

[11] Future research could consider other bank characteristics, such as bank liquidity and capitalization.

are designed to identify changes in bank loan supply during periods of tight monetary policy and the quantity specification also allows us to estimate demand changes.

We use the loan-level contract features of the STBL to empirically differentiate the two theories of the credit channel. By using loan level data, we can control for some borrower heterogeneity through individual loan contract terms. Our main focus is on the difference between commitment loans and spot loans. The commitment status of each loan is the key component in our mechanism for identifying changes in loan supply. The basic idea is to use commitment lending as a baseline for measuring changes in the supply of spot loans. Our comparison of commitment lending and spot lending centers around a comparison by loan maturity and loan size. The ability to identify changes in loan supply helps us estimate the specific contributions of the bank lending channel and the balance sheet channel.

Loan commitments limit the ability of banks to control the amount of lending in a given period. If a firm has an existing line of credit, then it can draw down funds whenever it has a demand for credit.[12] This gives control over the amount of commitment lending to borrowers, meaning that changes in commitment lending reflect changes in loan demand. Although the writing of commitment contracts can vary the supply of commitment loans over longer periods of time, our data indicate that most drawdowns[13] occur months after the signing of a commitment. Starting in the third quarter of 2003, we have data on the date a commitment was signed if a loan is made under commitment. These data show that only 25% of commitment borrowings are from commitment agreements that were signed in the three months prior to the draw down, with 57% over 6 months old and 31% over one year old. Thus, the ability of banks to adjust the supply of commitment loans is likely to be limited in the short term, which means that changes in commitment lending can be used as a measure of changes in loan demand. To the extent that there is an impact on supply, it means that we may underestimate the effect of changes in supply and overestimate the effect of changes in demand.

Under the assumption that loan demand is relatively consistent across the two types of borrowing, changes in loan demand should be observed as joint movements in the levels of

[12] As noted above, commitments typically include a material adverse change (MAC) clause which protects the bank in the event that a firm's condition deteriorates. However, these clauses are not frequently exercised.
[13] A "drawdown" is a loan made to a firm with a loan commitment. The firm draws funds from its available credit.

spot loans and commitment loans. If the two types of lending increase together, this can be attributed to an increase in demand and, likewise, if the levels of the two types decrease together, this can be attributed to a decrease in demand. Such changes in response to monetary policy operate through the interest-rate channel rather than a credit channel. Although monetary policy tightening should slow loan demand, there is no reason that overall lending must decrease. A tightening reduces demand from what it otherwise would be, and since tightenings are more likely to occur when the economy is strong, loan demand may still increase when interest rates are rising.

Unlike with commitment loans, banks can immediately adjust the supply of spot loans. Banks adjust the supply of spot loans by simply raising or lowering their selection requirements for loan applications. The difference in the adjustability of loan supply for commitment loans and spot loans provides a mechanism for identifying changes in spot loan supply. When the quantity of spot loans changes *relative* to the quantity of commitment loans, we interpret this as a change in the supply of (spot) loans. In other words, we use the quantity of commitment loans as a baseline against which to measure changes in the supply of loans. If the quantity of spot loans decreases relative to the quantity of commitment loans, we interpret this as a reduction in the supply of loans. On the other hand, if the quantity of spot loans increases relative to the quantity of commitment loans, we interpret this as an increase in the supply of loans.

Logit Analysis

Our first empirical specification measures changes in the propensity for a loan to be under commitment. This approach is the loan-level equivalent of analyzing changes in the proportion of loans that are taken under commitment. This fits our loan supply identification strategy, which analyzes changes in spot loans relative to commitment loans.

The baseline model for testing our hypotheses is the fixed-effects logit model

$$\text{COMMIT} = f(\text{FUNDS RATE, SHORT MATURITY, FIRM SIZE, control variables}), \quad (2)$$

where COMMIT is the dummy variable indicating whether the loan is a drawdown under a loan commitment and where we control for bank fixed effects.

We estimate equation (2) to provide an estimate of how the credit channel operates at the aggregate level based on the number of loan originations. However, our loan-level data allows us to analyze bank lending beyond an aggregate measure of the number of loans. The bank lending channel and balance sheet channel may have a reallocative effect that might be hidden by this type of analysis.

An operative bank lending channel implies a reduction in the stock of loans during periods of tightening monetary policy, which may occur is the flow of lending slows or if a bank reduces the average maturity of the loans it issues. When a bank reduces the maturity of its new loans, it gradually reduces the size of its loan portfolio over time. The rate of "outflow," or the rate at which loans are paid off, increases, which reduces the number of loans in the portfolio at any given time. Dividing the sample by loan maturity allows us to examine how the maturity structure of the new loans measured by the STBL changes with monetary policy adjustments. We split the sample into two groups: short-maturity loans (SHORT MATURITY = 1, i.e., less than one year maturity) and long-maturity loans (all others). We choose the one year split, because this typically corresponds to the accounting distinction of short-term debt and long-term debt.

The effect of the balance sheet channel is that banks reallocate loan supply from small firms to large firms during periods of tight monetary policy. Small firms tend be riskier than large firms due to less diversification and, often, a riskier balance sheet, so the balance sheet channel predicts that a reduction in net worth due to a monetary contraction causes a shift in bank lending from small firms to large firms. To test this, we divide the sample by the loan size, our proxy for firm size. We use three size classes – small firms, medium firms, and large firms – to capture different aspects of the lending choice. Loans for small firms are often based on different criteria than those for larger firms (Berger and Udell (2006)) while the largest firms have more non-bank borrowing options than smaller firms. Our results are robust to different loan size splits.

Lastly, we analyze the full 6-way split by maturity and firm size. We analyze both dimensions together in the final set of regressions, because the response of lending to

monetary policy along both dimensions can be used to further differentiate the effects of the two channels.

The control variables include the Baa-Aaa spread, the yield curve slope, the log of bank assets, GNP growth, unemployment, and a time trend. We also include loan level control variables which indicate whether a loan is collateralized, floating rate, a demand loan, or a overnight loans. As noted, the regression includes fixed effects; therefore, the other variables explain changes of the probability of commitment for loans within a given bank. All the reported p-values in the regressions are robust and are corrected for bank-level clustering.

Our measure of monetary policy is the real federal funds rate (FUNDS RATE), with a higher rate indicating a policy tightening (Bernanke and Blinder (1992)). In our first analysis, we analyze whether the probability of a loan being under commitment increases or decreases with the funds rate. A positive coefficient on the funds rate indicates a reduction in loan supply when monetary policy while a negative coefficient implies the opposite. According to the theory of the bank lending channel, banks reduce their loan supply during periods of tight monetary policy, so a positive coefficient is consistent with the theory. The balance sheet channel does not have a clear prediction for the aggregate level of bank loan supply, because it is a theory about the reallocation of credit.

When we split the sample by loan maturity, a reallocation from long-term loans to short-term loans would be support for the bank lending channel. We would see this if the coefficients on the funds rate were more positive (or less negative) for long-term loans than for short-term loans. Again, the coefficients on the funds rate in these regressions do not allow us to test the balance sheet channel.

We use the firm size sample splits to analyze the balance sheet channel. The balance sheet channel predicts that banks reallocate loan supply away from small firms and toward large firms. If the coefficient on the the funds rate is decreasing in firm size, then banks are increasing spot lending relative to commitment lending more for large firms than for small firms, consistent with the predictions of an operating balance sheet channel.

As stated above, our approach can be thought of as similar to the KSW approach. KSW analyze changes in bank debt relative to commercial paper (CP) debt. Like us, they assume that credit demand is relatively consistent across two different forms of borrowing.

For their study, if the quantity of bank debt falls relative to CP debt following a contraction, then they interpret this as a reduction in bank loan supply. We apply a similar approach using loan commitments. If the quantity of spot loans falls relative to the quantity of commitment loans when monetary policy is tight, then we interpret this as a reduction in bank loan supply.

There are several advantages to examining changes in spot lending relative to commitment lending as an approach for identifying changes in loan supply. First, it can be applied both to small firms and large firms. The analysis in KSW is implicitly restricted to the largest borrowers, since only these firms have access to the commercial paper market while the alternative in Oliner and Rudebusch (1996) has similar issues, since they must assume that a catch-all category called "other debt" really measures bank loan substitutes for small firms. Second, our approach does not rely on other measures of real activity for firms, such as inventories (as in Kashyap, Lamont, and Stein (1994)). The commitment status approach compares the relative amounts of two forms of debt, where we can more closely separate changes in the demand and supply of debt.

Quantity Analysis

In our second empirical specification, we analyze the total quantities of commitment loans and spot loans. This provides us with information about the underlying elements behind the logit specification. We analyze the quantities of each type of loan to examine whether the ratio of the two loan types changes primarily due to changes in the numerator or changes in the denominator. Specifically, we identify the levels of commitment and spot loans separately and discuss their respective changes independently. These findings provide additional insight into how the two channels operate.

To look at quantity levels, we must depart from the loan-level observations of the logit specification. In the quantities specification, we use bank-quarter observations. We aggregate the loans by summing the number of loans made by a bank in a quarter. The dependent variable is the number of loans made by a bank in a quarter, normalized by the mean number of loans for the bank in the sample as a whole. This normalization implies that variation in the dependent variable is a bank-level percentage variation in the number of loans relative to a bank-level mean. Our baseline model for bank-level loan quantities is:

$$\text{Loan Quantity} = \alpha_0 + \alpha_1 \text{ FUNDS RATE} + \beta * \text{control variables} + \varepsilon. \quad (3)$$

where Loan Quantity represents either the normalized level of spot loans or commitment loans. The control variables include all of the same regressors as the logit specification except for the loan-level variables. We also include bank fixed effects to control for differences in the level of lending across banks. As with the logit results, all the reported p-values in the regressions are robust and are corrected for bank-level clustering.

We analyze the change in lending quantities for the sample as a whole and also for subsamples split by loan maturity and firm size. Again, these two dimensions allow us to differentiate the unique contributions of the bank lending channel and the balance sheet channel.

Again, the key independent variable is the real federal funds rate variable. A positive coefficient on the funds rate indicates that the number of loans increases with the tightness of monetary policy. Likewise, a negative coefficient indicates that the number of loans decreases with tight monetary policy. We use changes in the quantity of commitment loans as our measure of changes in loan demand. As stated above, this is based on the assumption that the supply of commitment loans adjusts slowly to changes in to the funds rate. We interpret changes in spot loans relative to commitment loans as a change in loan supply.

5. Results

Full Sample

Table 2 reports the results for our logit specification based on the full sample of all commitment and spot loans. Our first set of results analyzes the total flow in the number of loans as a first pass at identifying a change in loan supply. This approach treats all loans equally and identifies the relative changes in the total number of spot loans and the total number of commitment loans. Under this simplifying assumption, we can analyze the aggregate flow of new loans as a measure of aggregate loan supply. The bank lending channel prediction is that aggregate bank loan supply decreases when monetary policy is tight. Our results show that the coefficient on the funds rate is -0.025, which is negative but insignificant. This indicates that the number of spot loans does not significantly increase or decrease relative to the number of commitment loans when the funds rate increases. Based on

this result, there does not appear to be a reduction in bank loan supply when the funds rate increases.

The quantity results for the aggregate number of loans in our second empirical specification are shown in Table 3. Column 1 shows the results for all loans (including commitment and spot). The coefficient on the funds rate is 0.014, which is significant at the 1% level, indicating that the number of loans increases with the tightness of monetary policy. This relationship could be due to an increase in either loan demand or loan supply. Columns 2 and 3 show the results for the split samples of commitment loans and spot loans, respectively. These quantity results indicate that when the federal funds rate increases, there is no significant change in commitment lending but spot lending increases significantly. Because the supply of commitment loans is relatively sticky, this finding for commitment lending indicates that loan demand does not change significantly with tight monetary policy. The coefficient on the funds rate in the spot loan regression is 0.027, which is significantly larger than the coefficient in the commitment regression. This indicates that the percentage increase in the amount of spot lending is significantly greater than the percentage increase in the amount of commitment lending.[14]

The aggregate logit and quantity results together indicate a slight increase in loan supply with increased interest rates. Although this supply shift is not significant in the logit regressions, the positive sign on the funds rate is more indicative of an increase in loan supply than a decrease in loan supply. Additionally, the quantity results show a significant increase in spot lending relative to commitment lending. Therefore, our initial results do not support the bank lending channel prediction that loan supply decreases in periods of tight monetary policy. However, these results are based on the assumption that all loan originations have equal weight in a bank's loan portfolio.

By Loan Maturity

In our first sample split, we analyze changes in bank lending by loan maturity to test a potential mode of operation for the bank lending channel. Banks can control the size of their loan portfolio over time by varying the maturity of their loan originations. If a bank reduces

[14] The sample sizes are different, because not all banks make both commitment loans and spot loans in every quarter.

the maturity of its loan originations, this reduces the length of time that its capital is invested in each project. Although banks may not significantly cut back on the number of loans originations in response to tight monetary policy, a reduction in the maturity of loan originations reduces the outstanding stock of loans over time. This is a reduction in bank loan supply, as predicted by the bank lending channel.

The results in Table 4 show the coefficients for the logit regression split by short and long loan maturity. Column 1 shows the results for the sample of loans with a maturity less than a year. The coefficient on the real federal funds rate is -0.035 and is significant. Because the proportion of spot loans increases relative to the proportion of commitment loans, this indicates that the supply of short-term loans increases with the funds rate. Column 2 shows the coefficients for the regression on loans with at least a year of maturity. In this case, the coefficient on the funds rate is positive, but insignificant. Although the coefficient itself is not significant in this regression, it is significantly larger than the funds rate coefficient in the short-term regression.

The results for the quantities specification split by short-term and long-term are shown in Table 5. For short-term commitment loans, the coefficient on the funds rate is 0.001 and is insignificant, and for short-term spot loans, the coefficient is 0.030 and significant. Among short-term loans, it appears that commitment lending does not respond to monetary policy whereas spot lending increases during periods of tight monetary policy. For long-term commitment loans, the coefficient on the funds rate is 0.055 while for long-term spot loans, the coefficient is 0.025. Both are statistically significant and the difference between the coefficients of 0.030 is also significant. The increase in the quantity of commitment loans indicates an increase in demand for long-term loans. [15] In this case, it is the spot loans that minimally respond to monetary policy and the commitment loans that significantly increase when monetary policy is tight.

The logit results and the quantity results give a consistent picture. For short-term loans, the spot lending goes up with the federal funds rate while commitment lending does not change, which is consistent with a decrease in the proportion of commitment loans we find. Together, the short-term results show that spot lending increases relative to commitment

[15] As Gertler and Gilchrist (1994) have shown, this increased demand for debt may be due to an increased need to carry inventories. When firms face reduced sales due to reduced consumer demand, they may increase borrowing in order to maintain production and inventories.

lending, which we expect to lead to an increase in the supply of short-term loans. For long-term loans, the number of commitment loans increase more than the number of spot loans when the funds rate increases. This is consistent with the positive (albeit insignificant) coefficient on the funds rate in the long-term loan logit regression, Together, these results indicate that long-term commitment lending might weakly increase relative to long-term spot lending, which we interpret to be a slight reduction in the supply of long-term loans. The combined results indicate a reallocation of loan supply from long-term lending to short-term lending during periods of tight monetary policy.

These results for loan maturity are generally consistent with our hypothesis based on the bank lending channel. According to the bank lending channel, banks reduce their aggregate loan supply during periods of tight monetary policy. We did not find evidence for this reduction in our full-sample regressions; however, when we split the sample by maturity, we find that banks tend to reallocate their loan supply from long-term loans to short-term loans. This indicates a move toward greater liquidity in their portfolio which could be due to increased costs of bank financing. Over time, a reduction in the maturity of originations reduces the overall size of a bank's loan portfolio. This suggests that the bank lending channel may operate through a reduction in the maturity of loan originations.

By Firm Size

We analyze loan supply by firm size, because the balance sheet channel predicts a reallocation of loan supply across firms of different sizes. The advantage of the loan commitment approach to identifying loan supply is that we can analyze changes in loan supply to small firms and large firms using the same method for each. This can help us identify the contribution of the balance sheet channel within bank lending. In our framework, the theory of the balance sheet channel translates into the prediction that banks reallocate loan supply from small firms to large firms when the funds rate is high.

The logit results in Columns 1 through 3 of Table 6 present separate regressions of (2) for each of the three size categories. The results for small and medium firms do not indicate much movement in the proportion of commitment loans with the funds rate. The coefficients on the funds rate for small firms and medium firms are both statistically insignificant and economically small. These results indicate that the probability of a small or medium loan

being under commitment is not affected by movements in the real federal funds rate changes. Column 3 reports the results for a regression of (2) for large firms. The coefficient on the funds rate for large firms is a significant -0.054, indicating that, for large firms, the proportion of spot loans increases relative to commitment loans when the funds rate increases. Based on our identification of loan supply, these results indicate a difference in the response of loan supply across firms of different sizes. When monetary policy is tight, banks appear to increase the loan supply to large firms, but not to small firms or medium firms. An F-test for all three firm size interactions rejects the possibility that the coefficients are statistically identical. The results clearly indicate that the relationship between commitment status and the funds rate differs across borrower size categories.

The quantity results by firm size, as shown in Table 7, generally coincide with the logit results. For commitment lending, the coefficients on the funds rate are not significant, although there is a slight upward trend in firm size. However, spot lending increases significantly with the funds rate for small firms and the increase in spot lending to large firms is even greater. For spot lending to small firms, the coefficient on the funds rate is 0.033 while for large firms, it is an even larger 0.093. These two values are significantly different. These quantity results indicate that the increased proportion in spot lending to large firms is driven by a significant increase in spot lending with the funds rate.

The theory of the balance sheet channel predicts that banks reallocate credit away from small firms and toward large firms during periods of tight monetary policy. Our findings in the logit specification and the quantities specification are both consistent with this prediction. Although we do not find evidence for a reduction in the supply of loans to small firms, we do find evidence for an increase in the supply of loans to large firms relative to small firms. These results by firm size provide an initial indication of how the balance sheet channel operates.

By Loan Maturity and Firm Size

Table 8 shows differences in the effect of monetary policy by both loan maturity and firm size. This analysis gives a 6-way representation of the role of firm size across short-term and long-term loans. Splitting the loans two ways for maturity (short and long) and three ways for firm size (small, medium, and large) identifies six categories of loans. This analysis

combines our previous analyses by maturity and firm size so that we can further specify the unique contributions of the bank lending channel and the balance sheet channel.

The logit results from regressions of (2) on the 6-way split of SHORT MATURITY and FIRM SIZE are shown in the six columns of Table 8. Using this specification, we can identify the derivative with respect to the funds rate for each of these six categories. This specification also controls for differences in the control variable coefficients across the six regressions.

Among the short-term loans, the coefficients on the funds rate are negative for all firm sizes. The coefficients range from -0.019 for small firms to -0.074 for large firms, all significantly different from zero. This shows that the increase in short-term spot loans relative to short-term commitment loans is greatest for large firms. The combined results indicate that large firms experience an increased allocation in short-term loan supply relative to small firms.

For long-term loans, none of the coefficients on the federal funds rate are significant and there is no significant pattern across the firm sizes. However, it is important to note that the coefficients on the funds rate in the long-term loan regressions are each significantly more positive than the coefficients on the funds rate in the short-term loan regressions of the same firm size. For small firms, the long-term funds rate coefficient is 0.037, which is 0.056 greater than the short-term coefficient, a difference that is significant. This implies a shift from long-term to short-term lending for small firms. The shift is even greater for medium and large firms.

In the quantity regressions shown in Table 9, the differences between the short-term loans and the long-term loans are again clear. For the short-term loans, the coefficient on the funds rate is positive in each of the spot loan regressions. In the small firm spot loan regression, the coefficient is 0.031, while for the large firm spot loan regression, it is 0.125, with both significantly positive. This difference of 0.094 between the coefficients is also significant. This shows that the increase in short-term spot lending is greatest for large firms, which is consistent with the logit results. In the regressions for short-term commitment loans, none of the coefficients on the funds rate are statistically different from zero. For the long-term loans, the coefficients on the funds rate in the commitment loan regressions are all positive and significant, although they are not statistically different from each other.

According to our identification, we interpret this as an increase in loan demand. The coefficients on the funds rate for long-term spot lending are all insignificant.

The quantity regressions add a further layer of understanding to the 6-way maturity and size split. It is clear from these regressions why the proportion of short-term spot lending increases with the funds rate more for large firms. This occurs primarily because of the sizable increase in spot lending to large firms. Short-term commitment lending is relatively flat across the different size groups. For the long-term loans, the logit specification shows that the proportion of long-term commitment lending may increase with the funds rate for all firms and the quantity regressions also show a statistically significant increase in commitment lending relative to spot lending. These results show that there is limited variation in long-term lending across firms of different sizes.

Our 6-way split of the sample by maturity and firm size provides additional insight into the operation of the two channels. In this step, we show that the increase in loan supply to large firms is primarily among short-term lending. Therefore, the complete picture seems to indicate a reduction in loan maturity, which is consistent with the bank lending channel, and a shift in short-term lending toward large firms, which is consistent with the balance sheet channel.

By Bank Size

The credit channel literature has focused on bank size as an important factor in determining the sensitivity of loan supply to monetary policy. Although Romer and Romer (1990) argue that the lending channel has been weakened due to the availability of nondeposit sources of funds for banks, Stein (1998) shows that uninsured forms of bank finance are subject to adverse selection. Therefore, smaller banks may have significant costs of raising external funds during periods of tight monetary policy. Kashyap and Stein (1995) analyze the sensitivity of bank lending to monetary policy for different bank sizes under the hypothesis that large banks face lower costs of external financing. The authors find that the lending of large banks is not affected by monetary policy while the lending of small banks significantly declines when the nominal federal funds rate increases.

To test whether, because of differential funding costs or other reasons, a bank's size affects the way it reacts to monetary policy changes, we split our sample between large and

small banks. "Small banks" are banks with total assets less than or equal to $10 billion and "large banks" are banks with total assets greater than $10 billion. This threshold allows us to insure that the large banks in our sample have the low-cost access to financing present in the arguments of Stein (1998) and Kashyap and Stein (1995). In our full sample, there are 183 small banks and 112 large banks.

Table 10 presents results for the logit and quantity regressions when the sample is split by bank size. The results in the table also include the division of the sample by maturity and firm size. To simplify the presentation, we give the coefficient for the federal funds rate variable only, but we include all the controls used in the prior regressions.

Our results *do not* indicate that commercial lending is more responsive to monetary policy at small banks than at large banks. We find evidence consistent with an increase in the federal funds rate reducing the supply of long-maturity loans at banks of both sizes, as the coefficients in the logit regressions and in the commitment quantity regressions are positive and often significant. There are no significant differences between small and large banks in the impact of monetary policy changes on long-maturity loans. To the extent that bank size matters, we find a stronger reaction in short-maturity loans by large banks. When policy tightens, large banks increase the supply of short-maturity loans while there is no significant reaction at small banks. Overall, the bank lending channel seems to operate at both groups of banks and, if anything, more strongly at large banks.

The splits by firm size in Table 10 show some evidence of the balance sheet channel operating through both small and large banks. Although the statistical power is limited due to small sample sizes, the funds rate coefficients in the logit regression increase monotonically with firm size for long-maturity loans at small banks. This weakly indicates that the reduction in small banks' long-term loan supply may be greater for large firms than small firms. Large banks, on the other hand, appear to significantly shift their short-term loan supply from small firms to large firms. This finding is consistent with the theory that large banks are not as effective as small banks at overcoming information asymmetries in lending (Stein (2002)). In the theory of the balance sheet channel, lenders shift their lending from small firms to large firms during periods of tight monetary policy due to the increased agency costs associated with firms of low net worth. If large banks are less capable of mitigating agency costs than

small banks, this implies that an increase in agency costs for small firms would cause a greater shift in large banks' loan supply from small firms to large firms.

Our findings show that the credit channel works through both small and large banks, with some evidence that the strength of the channel is greatest for large banks. This is a surprising result, given previous findings (e.g. Kashyap and Stein (1995, 2000)) which indicate that large banks are less sensitive to the credit channel. This difference in results may arise because Kashyap and Stein do not examine loan maturity and firm size. Our analysis shows that the full sample results can hide significant shifts in loan maturity and borrower type over the monetary policy cycle. We find that the effect of the credit channel for large banks is primarily in the reduction of loan maturity and the reallocation from small firms to large firms.

Control Variables

Lastly, the coefficients on the control variables in the logit regressions provide some information about the relative probability of commitment lending and spot lending. The results for the control variables are relatively consistent across the various maturity and size specifications. When a loan is collateralized, has a floating rate, is repayable/recallable on demand, or is made overnight, the probability of the loan being made under commitment tends to be higher. The coefficients on bank size, on the other hand, tend to be negative, suggesting that large banks are less likely to make commitment loans, though the coefficients are generally insignificant. The macro variables suggest that commitment status is not systematically related to other financial or real-economy factors. The Baa-Aaa spread, the yield curve slope, GNP growth, and unemployment are generally insignificant. Finally, the coefficient on the time trend is positive and significant, indicating a trend toward more loans being taken under commitment over time.

6. Conclusion

The existence of a credit channel operating beyond the traditional interest-rate channel of monetary policy has been well documented (see Mishkin (2007) for a review). Less settled is whether the credit channel operates by variations in aggregate lending (the bank lending channel) or through changes in the aggregate risk of borrowers (the balance sheet channel).

Previous studies have found support for a single channel (e.g. Kashyap and Stein (2000) for the bank lending channel and Bernanke, Gertler, and Gilchrist (1996) for the balance sheet channel) or claimed that they could not differentiate the two channels (e.g. Morgan (1998)). The main contribution of our paper is to identify the unique operation of the bank lending channel and the balance sheet channel in the transmission of monetary policy.

We use an innovative approach for identifying changes in loan supply. The identification of loan supply using cross-sectional data is one of the central issues in analyzing the credit channel. Often, studies rely on external debt to benchmark changes in supply, but are subject to criticism based on the choice of external debt and because it is difficult to determine the external debt options of small firms (see the debate between Kashyap, Stein, and Wilcox (1993, 1996) and Oliner and Rudebusch (1996)). We use an alternative approach which is entirely internal to bank lending, taking advantage of the fact that banks make both commitment and spot loans to small and large firms.

Commitment loans and spot loans differ in how much flexibility they leave banks to quickly adjust supply when conditions change. It is difficult for a bank to change the supply of loan commitments. Other than the case of a firm undergoing a material adverse change, a bank cannot readily deny credit to a firm which has an existing commitment. Additionally, there is evidence that the majority of commitment loans are made under commitments signed at least 6 months prior to the drawdown. Therefore, we treat the commitment loan supply curve as fixed with respect to the interest rate cycle. The supply of spot loans, on the other hand, can be adjusted instantaneously. A bank can decide to tighten its credit standards and thereby deny an applicant who would have gotten a loan previously.

Since we pin down the commitment loan supply curve, changes in commitment lending when monetary policy changes reflect changes in loan demand. If demand is relatively consistent across commitment lending and spot lending, this allows us to determine changes in the supply of spot loans. We do this by examining how spot lending moves *relative* to commitment lending. A decrease in the number of spot loans relative to the number of commitment loans indicates a reduction in the supply of spot loans.

We test the operation of the credit channel using two different specifications. Our first specification examines the probability that a loan is taken under commitment versus as a spot loan. This specification, which is based on loan level data, allows us to control for some firm

heterogeneity using loan contract terms. The second specification analyzes the quantity of commitment lending and spot lending at the bank level. This allows us to decouple the commitment-to-spot ratio to analyze the separate changes in the numerator and denominator.

We focus our analysis on changes in lending by loan maturity and firm size, because these dimensions allow us to differentiate the operation of the bank lending channel and the balance sheet channel. The bank lending channel can operate through changes in loan maturity since if a bank increases the outflow of loans by requiring a short-term repayment and the bank does not increase the inflow of loan originations, this will gradually reduce the bank's stock of loans over time. This is equivalent to a reduction in the supply of bank loans, as predicted by the bank lending channel. The balance sheet channel operates through a reallocation of loan supply from small firms to large firms. We analyze changes in bank lending by firm size to test for the presence of a balance sheet channel in bank lending.

Our results provide new insight into the operation of the credit channel. We do not find evidence for a decrease in the aggregate flow of spot loan originations relative to commitment loan originations when the funds rate is high; however, these results are probably not the best indicator of loan supply. Both of the channels internal to the credit channel can operate through reallocations of loan supply. Our analysis by loan maturity reveals that banks reduce the maturity of their loan originations during periods of tight monetary policy. This indicates that banks increase the frequency of loan repayment, which reduces the size of banks' loan portfolios over time. This can effectively reduce loan supply, as predicted by the bank lending channel. Our analysis by firm size shows that banks increase their lending to large firms during periods of tight monetary policy. An analysis by maturity and firm size shows that this effect is driven by a reallocation of short-term lending. Consistent with the balance sheet channel, banks reallocate short-term lending from small firms to large firms.

The full set of our results helps us identify the unique contribution of two different theories of the monetary policy transmission mechanism. Although previous papers in the literature have identified the credit channel, or have even found evidence for the bank lending channel or balance sheet channel separately, the effects of the two channels have not been clearly evaluated. This was partly due to the difficulty of identifying changes in loan supply for both small firms and large firms.

Our paper uses a unique identification strategy to differentiate the operation of the two channels within the credit channel. By separating commitment lending from spot lending, we can identify changes in loan supply by loan maturity and firm size. Our results show that banks reallocate total loan supply from long-term to short-term and short-term loan supply from small firms to large firms. These findings suggest that, within the credit channel of monetary policy, the bank lending channel causes banks to reduce the maturity of their loans and the balance sheet channel causes banks to reallocate their short-term lending toward large firms.

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TABLE 1: Descriptive Statistics

The mean and standard deviation (in brackets) for the variables in our loan-level regressions The loan data are from the Survey of Terms of Business Lending (STBL). The macroeconomic data are drawn from Fred II at the St. Louis Federal Reserve. (The macroeconomic statistics are only shown for the full sample.) The sample covers 1982:Q3 - 2006:Q1.

		Total	Short Maturity	Long Maturity	Small Firm	Medium Firm	Large Firm
Commit	A dummy variable: a loan made under commitment	0.816	0.819	0.796	0.801	0.857	0.791
		[0.387]	[0.385]	[0.403]	[0.399]	[0.351]	[0.407]
Real Federal Funds Rate	Federal funds rate - current inflation (not seasonally adjusted)	2.142					
		[1.977]					
Short Maturity	A dummy variable: maturity < 1 year	0.835			0.864	0.788	0.785
		[0.371]			[0.343]	[0.409]	[0.411]
Long Maturity	A dummy variable: maturity ≥ 1 year	0.165			0.136	0.212	0.215
		[0.371]			[0.343]	[0.409]	[0.411]
Small Firm	A dummy variable: loan size ≤ $100K	0.626	0.647	0.516			
		[0.484]	[0.478]	[0.500]			
Medium Firm	A dummy variable: loan size > $100K and ≤ $1M	0.284	0.267	0.366			
		[0.451]	[0.443]	[0.482]			
Large Firm	A dummy variable: loan size > $1M	0.090	0.086	0.119			
		[0.286]	[0.280]	[0.323]			
Baa-Aaa Spread	The Baa yield - Aaa yield	0.949					
		[0.333]					
Yield Curve Slope	The 10-year treasury yield - the 3-month treas. yield	1.482					
		[1.242]					
Collateral	A dummy variable: a secured loan	0.739	0.731	0.765	0.779	0.743	0.440
		[0.439]	[0.443]	[0.424]	[0.415]	[0.437]	[0.496]
Floating	A dummy variable: a floating rate loan	0.865	0.871	0.835	0.887	0.900	0.606
		[0.341]	[0.335]	[0.371]	[0.316]	[0.300]	[0.489]
Demand	A dummy variable: a loan that can be repaid/recalled on demand	0.368			0.390	0.372	0.220
		[0.482]			[0.489]	[0.483]	[0.414]
Overnight	A dummy variable: a loan with a one day maturity	0.014			0.002	0.007	0.117
		[0.117]			[0.039]	[0.085]	[0.321]
Ln(Bank Assets)	Log of total bank assets	16.878					
		[1.490]					
GNP Growth	Quarterly growth rate in gross national product	3.206					
		[2.306]					
Unemployment	Percentage of unemployment	5.747					
		[1.279]					
Trend	A linear time trend	53.890					
		[26.373]					
Observations		258810	538780	427463	404938	366375	235394

The current "total" sample is a tenth of the full number of observations.

The short-maturity sample is a fourth of the short-maturity observations.
The long-maturity sample is the full long-maturity sample.

The small firm sample is a fourth of the small firm observations.
The medium firm sample is a half of the medium firm observations.
The large firm sample is the full large firm sample.

TABLE 2: Logit Results - Aggregate

A logit regression on a dummy variable indicating whether a loan is made under commitment. The regression also includes bank fixed-effects. The omitted category is long-maturity loans to small firms. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	Aggregate
Real Federal Funds Rate	-0.025
	[0.019]
Short Maturity	0.403
	[0.124]***
Medium Firm	0.469
	[.090]***
Large Firm	0.665
	[.269]**
Baa-Aaa Spread	-0.016
	[0.267]
Yield Curve Slope	0.0432
	[0.045]
Collateral	0.44
	[0.098]***
Floating	1.22
	[0.130]***
Demand	0.369
	[0.166]**
Overnight	0.595
	[0.363]
Ln(Bank Assets)	-0.263
	[0.250]
GNP Growth	0.006
	[0.011]
Unemployment	-0.033
	[0.050]
Trend	0.041
	[0.009]***
Observations	258810
Pseudo R-Squared	0.34

(The current sample is a tenth of the full number of observations. Other random samples have been checked for robustness.)

TABLE 3: Quantity Results - Aggregate

An OLS regression with bank fixed effects. The dependent variable in each column is the number of loans made by a bank in a given quarter divided by the mean number of loans made by the bank in the entire sample. In the "Commit" column, the dependent variable is based on the number of commitment loans made and, in the "Spot" column, the dependent variable is based on the number of spot loans made. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	(1) **Total**	(2) **Commit**	(3) **Spot**
Real Federal Funds Rate	0.014	0.009	0.027
	[0.005]***	[0.006]	[0.009]***
Baa-Aaa Spread	0.082	0.057	0.26
	[0.057]	[0.070]	[0.091]***
Yield Curve Slope	-0.019	-0.026	-0.013
	[0.007]**	[0.011]**	[0.013]
Ln(Bank Assets)	0.847	0.773	0.63
	[0.083]***	[0.094]***	[0.120]***
GNP Growth	0.003	0.004	0.007
	[0.004]	[0.005]	[0.005]
Unemployment	-0.023	-0.029	-0.003
	[0.013]*	[0.016]*	[0.025]
Trend	-0.004	0.004	-0.022
	[0.002]*	[0.003]	[0.003]***
Observations	12043	11563	10047
Adjusted R-Squared	0.30	0.30	0.12

TABLE 4: Logit Results By Maturity

A logit regression on a dummy variable indicating whether a loan is made under commitment. The regressions also include bank fixed effects. The omitted category is small firms. "Short Maturity" is the sample of loans with maturity less than a year and "Long Maturity" is the sample of loans with maturity of at least a year. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	(1) **Short Maturity**	(2) **Long Maturity**
Real Federal Funds Rate	-0.035	0.035
	[0.020]*	[0.023]
Medium Firm	0.451	0.433
	[0.095]***	[0.089]***
Large Firm	0.71	0.512
	[0.296]**	[0.252]**
Baa-Aaa Spread	-0.087	0.154
	[0.317]	[0.238]
Yield Curve Slope	0.059	-0.016
	[0.047]	[0.047]
Collateral	0.52	0.161
	[0.102]***	[0.175]
Floating	1.077	1.606
	[0.159]***	[0.137]***
Demand	0.429	
	[0.177]**	
Overnight	0.634	
	[0.321]**	
Ln(Bank Assets)	-0.265	-0.306
	[0.294]	[0.177]*
GNP Growth	0.007	0.018
	[0.013]	[0.010]*
Unemployment	-0.036	0.039
	[0.054]	[0.050]
Trend	0.042	0.05
	[0.012]***	[0.007]***
Observations	538780	427463
Pseudo R-Squared	0.35	0.37

(The short-maturity sample is a fourth of the short-maturity observations. The long-maturity sample is the full long-maturity sample.)

TABLE 5: Quantity Results By Maturity

An OLS regression with bank fixed effects. The dependent variable in each column is the number of loans made by a bank in a given quarter divided by the mean number of loans made by the bank in the entire sample. In the "Commit" columns, the dependent variable is based on the number of commitment loans made and, in the "Spot" columns, the dependent variable is based on the number of spot loans made. "Short Maturity" is the sample of loans with maturity less than a year and "Long Maturity" is the sample of loans with maturity of at least a year. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)
	Short Maturity		**Long Maturity**	
	Commit	**Spot**	**Commit**	**Spot**
Real Federal Funds Rate	0.001	0.030	0.055	0.025
	[0.006]	[0.010]***	[0.011]***	[0.014]*
Baa-Aaa Spread	-0.006	0.252	0.471	0.139
	[0.070]	[0.104]**	[0.097]***	[0.147]
Yield Curve Slope	-0.023	-0.018	-0.058	0.002
	[0.012]*	[0.015]	[0.017]***	[0.022]
Ln(Bank Assets)	0.818	0.65	0.669	0.974
	[0.093]***	[0.128]***	[0.112]***	[0.167]***
GNP Growth	-0.002	0.003	0.037	0.009
	[0.005]	[0.006]	[0.007]***	[0.009]
Unemployment	-0.028	0.011	-0.016	-0.023
	[0.017]*	[0.030]	[0.026]	[0.037]
Trend	0.001	-0.027	0.024	-0.013
	[0.003]	[0.003]***	[0.003]***	[0.005]**
Observations	11421	8887	7337	3591
Adjusted R-Squared	0.28	0.16	0.35	0.10

TABLE 6: Logit Results By Size

A logit regression on a dummy variable indicating whether a loan is made under commitment. The regressions also include bank fixed effects. "Small Firm" is the sample of loans with loan size ≤ $100K, "Medium Firm" is the sample of loans with loan size > $100K and ≤ $1M, and "Large Firm" is the sample of loans with loan size > $1M. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	(1) **Small Firm**	(2) **Medium Firm**	(3) **Large Firm**
Real Federal Funds Rate	-0.013	-0.025	-0.054
	[0.021]	[0.018]	[0.026]**
Short Maturity	0.525	0.25	-0.183
	[0.146]***	[0.130]*	[0.182]
Baa-Aaa Spread	-0.159	-0.05	0.023
	[0.287]	[0.278]	[0.268]
Yield Curve Slope	0.029	0.008	-0.009
	[0.030]	[0.051]	[0.033]
Collateral	0.779	0.133	-0.044
	[0.096]***	[0.078]*	[0.082]
Floating	1.635	0.857	0.381
	[0.151]***	[0.110]***	[0.163]**
Demand	0.446	0.409	-0.035
	[0.200]**	[0.153]***	[0.204]
Overnight	1.482	0.778	-0.228
	[0.372]***	[0.520]	[0.213]
Ln(Bank Assets)	-0.123	-0.415	-0.591
	[0.299]	[0.272]	[0.222]***
GNP Growth	0.007	0.013	-0.013
	[0.013]	[0.010]	[0.012]
Unemployment	-0.042	-0.007	-0.138
	[0.060]	[0.040]	[0.056]**
Trend	0.039	0.047	0.027
	[0.010]***	[0.010]***	[0.008]***
Observations	404938	366375	235394
Pseudo R-Squared	0.38	0.31	0.37

(The small firm sample is a fourth of the small firm observations.
The medium firm sample is a half of the medium firm observations.
The large firm sample is the full large firm sample.)

TABLE 7: Quantity Results By Size

An OLS regression with bank fixed effects. The dependent variable in each column is the number of loans made by a bank in a given quarter divided by the mean number of loans made by the bank in the entire sample. In the "Commit" columns, the dependent variable is based on the number of commitment loans made and, in the "Spot" columns, the dependent variable is based on the number of spot loans made. "Small Firm" is the sample of loans with loan size ≤ $100K, "Medium Firm" is the sample of loans with loan size > $100K and ≤ $1M, and "Large Firm" is the sample of loans with loan size > $1M. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Small Firm		**Medium Firm**		**Large Firm**	
	Commit	**Spot**	**Commit**	**Spot**	**Commit**	**Spot**
Real Federal Funds Rate	0.005	0.033	0.008	0.012	0.012	0.093
	[0.007]	[0.010]***	[0.006]	[0.015]	[0.009]	[0.032]***
Baa-Aaa Spread	0.078	0.312	0.028	0.145	-0.042	-0.122
	[0.085]	[0.104]***	[0.072]	[0.139]	[0.093]	[0.223]
Yield Curve Slope	-0.031	-0.005	-0.036	0.011	-0.028	-0.004
	[0.014]**	[0.014]	[0.011]***	[0.017]	[0.013]**	[0.032]
Ln(Bank Assets)	0.84	0.703	0.726	0.804	0.392	0.744
	[0.107]***	[0.133]***	[0.086]***	[0.120]***	[0.090]***	[0.151]***
GNP Growth	0.003	0.007	0.006	0.002	-0.001	0.001
	[0.005]	[0.006]	[0.005]	[0.011]	[0.008]	[0.017]
Unemployment	-0.023	-0.028	-0.029	-0.031	-0.023	0.163
	[0.019]	[0.027]	[0.017]*	[0.036]	[0.023]	[0.074]**
Trend	0.006	-0.026	0.005	-0.023	0.006	-0.015
	[0.003]*	[0.003]***	[0.003]*	[0.004]***	[0.003]*	[0.005]***
Observations	11175	8929	9701	4111	5699	1914
Adjusted R-Squared	0.29	0.13	0.33	0.08	0.16	0.12

TABLE 8: Logit Results By Maturity and Size

A logit regression on a dummy variable indicating whether a loan is made under commitment. The regressions also include bank fixed effects. "Short Maturity" is the sample of loans with maturity less than a year and "Long Maturity" is the sample of loans with maturity of at least a year. "Small Firm" is the sample of loans with loan size ≤ $100K, "Medium Firm" is the sample of loans with loan size > $100K and ≤ $1M, and "Large Firm" is the sample of loans with loan size > $1M. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Small Firm		**Medium Firm**		**Large Firm**	
	Short Maturity	**Long Maturity**	**Short Maturity**	**Long Maturity**	**Short Maturity**	**Long Maturity**
Real Federal Funds Rate	-0.019	0.037	-0.041	0.035	-0.074	0.042
	[0.024]	[0.030]	[0.022]*	[0.027]	[0.025]***	[0.034]
Baa-Aaa Spread	-0.215	0.097	-0.144	0.27	-0.044	0.148
	[0.339]	[0.197]	[0.291]	[0.334]	[0.233]	[0.426]
Yield Curve Slope	0.041	-0.008	0.016	-0.048	-0.001	-0.054
	[0.031]	[0.042]	[0.050]	[0.053]	[0.027]	[0.075]
Collateral	0.814	0.72	0.28	-0.261	0.144	-0.491
	[0.085]***	[0.277]***	[0.089]***	[0.111]**	[0.084]*	[0.166]***
Floating	1.586	1.86	0.553	1.374	0.213	0.751
	[0.182]***	[0.190]***	[0.131]***	[0.126]***	[0.183]	[0.182]***
Demand	0.52		0.375		-0.084	
	[0.214]**		[0.145]***		[0.206]	
Overnight	1.467		0.606		-0.224	
	[0.367]***		[0.459]		[0.199]	
Ln(Bank Assets)	-0.097	-0.231	-0.449	-0.312	-0.586	-0.525
	[0.341]	[0.170]	[0.320]	[0.199]	[0.231]**	[0.334]
GNP Growth	0.004	0.02	0.008	0.01	-0.019	0.014
	[0.015]	[0.013]	[0.012]	[0.012]	[0.013]	[0.015]
Unemployment	-0.058	0.031	-0.008	0.018	-0.139	-0.064
	[0.065]	[0.056]	[0.042]	[0.069]	[0.057]**	[0.066]
Trend	0.038	0.049	0.047	0.054	0.025	0.034
	[0.012]***	[0.007]***	[0.012]***	[0.008]***	[0.008]***	[0.010]***
Observations	347972	54665	288527	77475	184699	50555
Pseudo R-Squared	0.40	0.40	0.32	0.35	0.40	0.33

(The small firm sample is a fourth of the small firm observations.
The medium firm sample is a half of the medium firm observations.
The large firm sample is the full large firm sample.)

TABLE 9: Quantity Results By Maturity and Size

An OLS regression with bank fixed effects. The dependent variable in each column is the number of loans made by a bank in a given quarter divided by the mean number of loans made by the bank in the entire sample. In the "Commit" columns, the dependent variable is based on the number of commitment loans made and, in the "Spot" columns, the dependent variable is based on the number of spot loans made. "Short Maturity" is the sample of loans with maturity less than a year and "Long Maturity" is the sample of loans with maturity of at least a year. "Small Firm" is the sample of loans with loan size ≤ $100K, "Medium Firm" is the sample of loans with loan size > $100K and ≤ $1M, and "Large Firm" is the sample of loans with loan size > $1M. Errors are robust and clustered by bank. Standard errors are shown in brackets with *, **, and *** indicating significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
SHORT MATURITY	**Small Firm**		**Medium Firm**		**Large Firm**	
	Commit	**Spot**	**Commit**	**Spot**	**Commit**	**Spot**
Real Federal Funds Rate	-0.001	0.031	-0.001	0.02	0	0.125
	[0.007]	[0.011]***	[0.006]	[0.017]	[0.010]	[0.034]***
Baa-Aaa Spread	0.019	0.278	-0.093	0.01	-0.23	-0.245
	[0.084]	[0.119]**	[0.074]	[0.172]	[0.106]**	[0.257]
Yield Curve Slope	-0.028	-0.009	-0.022	0.019	-0.016	-0.008
	[0.016]*	[0.017]	[0.011]**	[0.019]	[0.015]	[0.038]
Ln(Bank Assets)	0.91	0.671	0.749	0.833	0.352	0.654
	[0.103]***	[0.174]***	[0.089]***	[0.158]***	[0.104]***	[0.201]***
GNP Growth	-0.003	0	-0.004	-0.011	-0.016	0.005
	[0.005]	[0.007]	[0.005]	[0.012]	[0.007]**	[0.019]
Unemployment	-0.022	-0.015	-0.032	-0.014	-0.034	0.22
	[0.019]	[0.033]	[0.017]*	[0.043]	[0.026]	[0.092]**
Trend	0.002	-0.029	-0.001	-0.026	-0.004	-0.013
	[0.003]	[0.004]***	[0.003]	[0.005]***	[0.003]	[0.006]**
Observations	10995	7721	9555	3147	4738	1549
Adjusted R-Squared	0.28	0.15	0.27	0.09	0.07	0.12

	(7)	(8)	(9)	(10)	(11)	(12)
LONG MATURITY	**Small Firm**		**Medium Firm**		**Large Firm**	
	Commit	**Spot**	**Commit**	**Spot**	**Commit**	**Spot**
Real Federal Funds Rate	0.034	0.009	0.046	-0.037	0.045	-0.031
	[0.013]**	[0.019]	[0.012]***	[0.052]	[0.015]***	[0.038]
Baa-Aaa Spread	0.566	0.323	0.572	-0.67	0.727	0.864
	[0.126]***	[0.203]	[0.114]***	[0.503]	[0.154]***	[0.925]
Yield Curve Slope	-0.048	0	-0.071	-0.08	-0.092	0.031
	[0.025]*	[0.029]	[0.018]***	[0.055]	[0.025]***	[0.188]
Ln(Bank Assets)	0.537	0.631	0.527	0.843	0.477	1.747
	[0.144]***	[0.259]**	[0.132]***	[0.363]**	[0.151]***	[0.986]
GNP Growth	0.035	0.009	0.042	-0.021	0.045	-0.005
	[0.008]***	[0.013]	[0.008]***	[0.036]	[0.011]***	[0.057]
Unemployment	-0.009	-0.105	-0.029	0.195	-0.066	-0.077
	[0.040]	[0.053]*	[0.033]	[0.134]	[0.046]	[0.073]
Trend	0.028	-0.005	0.029	-0.009	0.028	-0.017
	[0.004]***	[0.008]	[0.004]***	[0.006]	[0.005]***	[0.044]
Observations	5217	2163	4403	590	1948	121
Adjusted R-Squared	0.37	0.07	0.48	0.03	0.48	0.52

TABLE 10: Logit and Quantity Results by Bank Size, Maturity, and Firm Size

The coefficients on the real federal funds rate for both the logit and quantity regressions by firm size, maturity, and bank size. The logit regressions are on a dummy variable indicating whether a loan is made under commitment. The quantity regressions are OLS regressions in which the dependent variable in each column is the number of loans made by a bank in a given quarter divided by the mean number of loans made by the bank in the entire sample. In the "Commit" columns, the dependent variable is based on the number of commitment loans made and, in the "Spot" columns, the dependent variable is based on the number of spot loans made. The regressions all include bank fixed effects. The number of observations are shown under *Obs* .

"Short Maturity" is the sample of loans with maturity less than a year and "Long Maturity" is the sample of loans with maturity of at least a year. "Small Firm" is the sample of loans with loan size ≤ $100K, "Medium Firm" is the sample of loans with loan size > $100K and ≤ $1M, and "Large Firm" is the sample of loans with loan size > $1M. "Small Bank" is the sample of loans made by a bank with total assets less than or equal to $10 billion and "Large Bank" is the sample of loans made by a bank with total assets of at least $10 billion. All nominal values are in 2006 dollars. Errors are robust and clustered by bank. The *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

	Logit		**Quantity**			
			Commit		Spot	
	Coeff.	*Obs.*	*Coeff.*	*Obs.*	*Coeff.*	*Obs.*
Small Bank	0.013	802690	0.011	7323	0.015	6130
Short maturity	0.008	695519	0.006	7192	0.018	5254
Small firm	0.010	475973	0.009	4707	0.033 **	2926
Medium firm	0.015	179068	0.007	3185	-0.015	416
Large firm	-0.036	37041	0.005	333	0.137	103
Long maturity	0.052 **	106770	0.041 ***	3402	0.021	1421
Small firm	0.042	67951	0.038 *	1066	0.005	408
Medium firm	0.061 **	32235	0.033 ***	590	0.013	23
Large firm	0.097 ***	6189	0.002 **	44	n/a	n/a
Large Bank	-0.041 *	1784717	-0.003	6546	0.057 ***	3917
Short maturity	-0.053 **	1464265	-0.01	4229	0.064 ***	3633
Small firm	-0.039	920283	-0.014	6288	0.046 ***	4795
Medium firm	-0.071 **	396550	-0.009	6370	0.035 *	2731
Large firm	-0.080 **	146637	0.001	4405	0.132 ***	1446
Long maturity	0.022	320201	0.054 ***	3935	0.046 *	2170
Small firm	0.040	151654	0.028	4151	0.017	1755
Medium firm	0.010	123751	0.043 ***	3813	-0.044	567
Large firm	0.020	43702	0.046 ***	1904	-0.031	121

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