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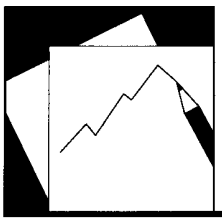

IMF Working Paper

Bank Leverage and Monetary Policy's Risk-Taking Channel: Evidence from the United States

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Abstract

We present evidence of a risk-taking channel of monetary policy for the U.S. banking system. We use confidential data on the internal ratings of U.S. banks on loans to businesses over the period 1997 to 2011 from the Federal Reserve's survey of terms of business lending. We find that ex-ante risk taking by banks (as measured by the risk rating of the bank's loan portfolio) is negatively associated with increases in short-term policy interest rates. This relationship is *less* pronounced for banks with relatively low capital or during periods when banks' capital erodes, such as episodes of financial and economic distress. These results contribute to the ongoing debate on the role of monetary policy in financial stability and suggest that monetary policy has a bearing on the riskiness of banks and financial stability more generally.

JEL Classification Numbers: E43; E52; G21

Keywords: Interest rates, monetary policy, banks, leverage, risk

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I. INTRODUCTION

The recent global financial crisis has reignited the debate on the link between short-term interest rates and bank risk taking, also known as monetary policy's "risk-taking" channel: the notion that interest rate policy affects the quality and not just the quantity of bank credit. Specifically, many hold the view that interest rates were held low for too long in the run up to the crisis (Taylor, 2009), and that this helped to fuel an asset price boom, spurring financial intermediaries to increase leverage and take on excessive risks (Borio and Zhu, 2008, Adrian and Shin, 2009). More recently, a related debate has ensued on whether continued expectations of exceptionally low interest rates are setting the stage for the next financial crisis (see, for example, Rajan, 2010, and Farhi and Tirole, 2012). These exceptionally loose monetary conditions in various countries are further maintained through unconventional monetary policy measures, including asset purchases and swaps of short-term paper for longer dated securities. Despite the obvious policy interest, the empirical evidence on this topic is scant, especially for the United States.

A growing theoretical literature analyzes the role of monetary policy in altering bank fragility in the presence of asymmetric information and funding liquidity risk. These models predict that banks may engage in riskier activities when monetary policy is expansive and agency problems are severe (e.g., Adrian and Shin, 2010; Freixas, Martin, and Skie, 2011; Diamond and Rajan, 2012; Dell'Ariccia, Laeven, and Marquez, 2013; and Acharya and Naqvi, 2012).

In this paper, we study the link between short-term interest rates and bank risk taking using confidential data on individual U.S. banks' loan ratings from the Federal Reserve's Survey of Terms of Business Lending (STBL). The paper makes three important contributions to the literature. First, to our knowledge, the paper is the first to present evidence of an inverse relationship between interest rates and bank risk taking, using disaggregated commercial bank loan data for the United States, which is critical to assess the impact on general credit conditions. (To the best of our knowledge, we are the first to use detailed STBL data for the purpose of studying the link between interest rates and bank risk taking.[2])

Second, the paper constructs an ex-ante measure of bank risk taking (unlike much of the existing literature[3]) using confidential loan-level data on the riskiness of loans of U.S. banks. This allows us to focus on the risk attitude of banks at the time a loan is issued, rather than on ex-post loan performance which could be affected by subsequent events.

Third, the paper links the strength of the relationship between policy rates and bank risk taking to the capital structure of the banking system. This provides a link with an important

[2] STBL data have been used before to study the determinants of risk taking in bank loans, but not to test their relationship with monetary policy conditions (e.g., Carpenter, Whitesell, and Zakrajšek, 2001, and Black and Hazelwood, 2013).

[3] An exception is Jimenez et al. (2008) who use credit history information on past doubtful loans as an ex ante measure of firm credit risk. Our measure of ex ante risk taking differs from their in the sense that ours is based on the bank's assessment of risk at the time the loan was made.

segment of the theoretical literature on banking which predicts that risk taking is a function of a bank's capital structure.

As a way of background, we present a simple model of bank risk taking in which banks operate under limited liability and with asymmetric information about borrower quality. The model predicts that bank risk taking is negatively associated with interest rates. The policy rate determines the bank's deposit rate and affects bank incentives to take risk through two opposite channels. First, there is a pass-through effect: higher deposit rate translate into higher lending rates. So the reward for the bank in case of success is higher. Second, there is the classical risk-shifting effect associated with the higher cost of liabilities. In this simplified model the first effect prevails. Its strength, however, depends on the leverage/capital of banks. For less capitalized banks, the classical risk-shifting effect is stronger and minimizes the net effect of a change in the policy rate. Note that our model serves solely as background to help motivate the empirical work. Other more elaborate existing models give similar predictions. The model by no means should be seen as the contribution of this paper. This is an empirical paper.

Consistent with the predictions of the model (and similar models), we find that bank risk taking—as measured by the risk ratings of the bank's loan portfolio—is negatively associated with short-term interest rates—as proxied by the federal funds rate[4]—and that this negative relationship is more pronounced for highly capitalized banks.

There is a growing empirical literature on the link between interest rates and bank risk taking. Using U.S. data on lending standards, Lown and Morgan (2006) find that credit standards tend to tighten following a monetary policy contraction (which raises interest rates), but results are not statistically significant. Maddaloni and Peydro (2011) find stronger (statistically significant) results using euro area lending survey data: credit standards are loosened when overnight rates are lowered. Moreover, using Taylor rule residuals, they find that holding rates low for prolonged periods of time softens lending standards even further. Similarly, Altunbas, Gambacorta, and Marquez-Ibañez (2010), using rating agency estimates of default probabilities as a proxy for risk taking, find that increases in interest rates and negative Taylor rule residuals are positively associated with default risk measures. A recent paper by Paligorova and Santos (2012) studies syndicated loan pricing for U.S. corporates together with data from the Federal Reserve's Senior Loan Officer Opinion Survey (SLOOS) results on bank lending standards and finds that loan pricing of riskier borrowers is more favorable (relative to safer borrowers) during periods of loose monetary policy, and that this effect is more pronounced for banks with greater risk appetite. (None of these studies uses the STBL data employed in this paper).

The paper is most closely related to Jimenez et al. (2008) and Ioannidou, Ongena, and Peydro (2009), who use detailed information on borrower quality from credit registry databases for Spain and Bolivia. They find a positive association between low interest rates at loan

[4] Our focus is on short-term interest rates. While current monetary policy, by setting the policy rate, has a direct influence only on short-term real interest rates, its effect on long-term interest rates depends on the degree to which the conduct of monetary policy affects inflationary expectations, and more generally about markets' expectations of monetary policy in the future.

origination and the probability of extending loans to borrowers with bad credit history or no history at all (i.e., risky borrowers). They also find that low rates decrease the riskiness of banks' overall loan portfolios. Therefore, holding interest rates low for a short period of time may improve the overall quality of banks' loan portfolios, but holding interest rates low for a prolonged period of time could increase loan default risk substantially over the medium term. Additionally, Jimenez et al. (2008) show that lower overnight interest rates induce banks to increase leverage and to lend to riskier new applicants, granting them loans that are larger and longer-term.

These studies vary in the use of bank risk measures, and most studies do not consider the role of bank leverage (the exception is Jimenez et al., 2008). Bank risk is mostly measured using information on changes in lending standards observed in lending surveys (e.g., Maddaloni and Peydro, 2011) or using ex-post measures of bank risk based on loan default rates, which are derived from either credit registers (Jimenez et al., 2008[5]) or rating agency estimates (Altunbas, Gambacorta, and Marquez-Ibañez, 2010). In the former case, information about the strictness of lending criteria on new loans is used as a proxy for lending standards. A loosening of lending standards is then interpreted as indicative of improved access to credit for low-quality borrowers. However, lending surveys, such as the ECB's Bank Lending Survey (BLS) or the Federal Reserve's SLOOS, generally provide information only about whether lending standards have changed relative to the recent past, not about the absolute level of strictness of lending criteria. Further, a decline in lending standards may reflect an improvement in the quality of the borrower pool, in which case the implications for risk taking are ambiguous. This is in contrast to the STBL survey we use, which captures the absolute level of risk on new business loans. The STBL has the additional advantage that it includes information on the marginal pricing of loans.

Moreover, most recent studies are conducted using non-U.S. data (specifically, data on Bolivia, Spain, or the euro area). One exception is Buch, Eickmeier, and Prieto (2011) but unlike us they use aggregate responses to the STBL rather than individual bank responses, which are not publicly available. The advantage of using U.S. data as we do (aside from the U.S. being of immediate interest, as the largest economy in the world and the epicenter of the recent global financial crisis) is twofold. The combination of STBL and Call Report data on balance sheets of individual banks offers relatively long time series (contrary to, say, euro area surveys) and information on a relatively large sample of banks with ample heterogeneity across banks in terms of leverage and other relevant bank characteristics (such as bank size, ownership, etc.). This is in contrast to data from countries such as Bolivia and Spain, which have more concentrated banking systems with fewer banks. For the above reasons, the STBL offers a preferable way to measure the marginal pricing of loans and the ex-ante risk taking of banks, and we therefore see our results as an important contribution to the literature.

Importantly, both the theoretical model and our empirical results should not be interpreted as implying that the additional risk taking associated with lower rates is "excessive." As it is the case with many other theoretical models and empirical results in this literature, our

[5] In addition to this ex-post measure of future loan defaults, Jimenez et al. (2008) also use an ex-ante measure of credit risk based on past doubtful loans.

model and statistical results are not well suited to answer whether or not the additional risk taking of banks facing more accommodative monetary policy is excessive (for an exception, see Stein, 2012).[6]

The paper proceeds as follows: Section II presents a simple model of bank risk taking that incorporates real interest rates and bank leverage. Section III presents the methodology used to assess the link between interest rates and bank risk taking. Section IV presents the data and descriptive statistics of the main variables used in the empirical analysis of this paper. Section V presents and interprets the empirical results, including a number of robustness tests and extensions. Section VI concludes.

II. A Simple Model of Interest Rates, Leverage, and Bank Risk Taking

In this section, we present a highly simplified version of the model in Dell'Ariccia, Laeven, and Marquez (2013). For a model in the same spirit but where banks choose among portfolios with different risk/return characteristics, see Cordella and Levy-Yeyati (2003). Consider a perfectly competitive banking system. Loans are risky and a bank's portfolio needs to be monitored to increase the probability of repayment. The bank is endowed with a monitoring technology. It can exert monitoring effort q which guarantees an identical probability of loan repayment. This monitoring effort entails a cost equal to $(1/2)cq^2$ per dollar lent.

Bank owners/managers raise deposits (or more generally issue debt liabilities) and invest their own money to fund the bank's loan portfolio. Let k represent the portion of bank assets financed with the bank owner's money (consistent with other models, this can be interpreted as the bank's equity or capital), and $1 - k$ the fraction of the bank's portfolio financed by deposits. In this simplified version of the model, we treat k as exogenous. Dell'Ariccia, Laeven, and Marquez (2013) show that similar results are obtained when k is endogenized.

Banks are protected by limited liability and repay depositors only in case of success. Let r^* be the economy's reference rate in real terms, which for simplicity and without loss of generality can be normalized to be the real risk-free interest rate (we will use "reference" and "risk free" interchangeably). Deposits are fully insured and thus insensitive to risk taking. It follows that the deposit rate is equal to the reference rate, so that $r_D = r^*$.

Equity, however, is more costly, with a yield $r_E = (r^* + \xi)/q$, with $\xi \geq 0$. The cost r_E can be interpreted as the opportunity cost for the bank owner/manager of investing in the bank, adjusted to reflect the bank's risk through the probability of success q.[7] The term ξ represents an equity premium in line with existing literature (see, for instance, Hellmann, Murdock, and

[6] Although our results can inform the design of optimal monetary policy, by themselves, they cannot determine whether past or present monetary policy is actually optimal.

[7] We assume that the premium on equity, ξ, is independent of the real interest rate r^*. However, from an asset pricing perspective these are likely to be correlated through underlying common factors that may drive the risk premium as well as the risk free rate. Our results continue to hold as long as the within-period correlation between ξ and r^* is sufficiently different from (positive) one.

Stiglitz, 2000, Repullo, 2004, Dell'Ariccia and Marquez, 2006, and Allen, Carletti, and Marquez, 2011).

We structure the model in two stages. For a fixed reference interest rate r^*, in stage 1, the lending rate is set competitively so that banks make zero expected profits in equilibrium. In stage 2, banks then choose how much to monitor their portfolio, q. We solve the model by backward induction, starting from the last stage. The bank's expected profit can be written as:

$$\Pi = \left(q\left(r_L - r_D(1-k)\right) - r_E k - \left(\frac{1}{2}\right) cq^2\right) L(r_L), \tag{1}$$

which reflects the fact that the bank's portfolio repays with probability q. When the bank's projects succeed, the owner (e.g., shareholders) receives a per-loan payment of r_L and earns a return $(r_L - r_D(1-k))$ after repaying depositors. When the bank fails, the owner receives no revenue but, because of limited liability, does not repay depositors. We can rewrite equation (1) as

$$\Pi = (q(r_L - r^*(1-k)) - (r^* + \xi)k - (1/2)cq^2)L(r_L). \tag{2}$$

Maximizing (2) with respect to q yields

$$\hat{q} = min\left\{\frac{r_L - r^*(1-k)}{c}, 1\right\}. \tag{3}$$

Substituting $\hat{q}$ back into the profit function (2), we get

$$\Pi(\hat{q}) = \frac{\left(r_L - r^*(1-k)\right)^2}{2c} - (r^* + \xi)k\,. \tag{4}$$

From which we can obtain the lending rate consistent with a free-entry competitive equilibrium by imposing zero profits:

$$r_L = r^*(1-k) + \sqrt{2ck(r^* + \xi)}. \tag{5}$$

Substituting r_L back into equation (3), we get

$$q^* = \frac{\sqrt{2ck(r^*+\xi)}}{c}. \tag{6}$$

from which it is immediate that $\frac{\partial q^*}{\partial r} > 0$ and $\frac{\partial (q^*)^2}{\partial r \partial k} > 0$.

An examination of (3) immediately reveals that changes in the reference rate affect bank monitoring through two distinct channels. First, because of limited liability, there is the classical risk-shifting channel. The rate the bank has to pay on its deposits goes up, which (holding other things equal) reduces bank profits in case of success and, hence, its incentive to monitor its portfolio. Second, there is a pass-through channel: The bank lending rate also responds to changes in the reference rate. This will increase bank profits in case of success, improving the bank's incentives. The relative strength of these two channels depends on the degree of bank capitalization. The risk-shifting effect is maximal for a fully levered bank and goes to zero for a bank fully funded with capital (for which limited liability becomes irrelevant).

This stylized model has the following testable implication: Bank risk taking is negatively associated with interest rates if banks are not capital constrained. However, this negative relationship depends on the capitalization of the bank and is *less* pronounced for poorly capitalized banks.

III. EMPIRICAL METHODOLOGY

We employ panel regression analysis to test the predictions from the stylized model in Section II.

A. Regression Model of Bank Risk Taking

Our basic regression model is as follows:

$$\sigma_{kit} = \alpha_i + \lambda_j + \beta r_t + \gamma K_{it} + \theta X_{kit} + \mu Y_{it} + \rho Z_{jt} + \varepsilon_{kit}, \quad (1)$$

where σ_{kit} is the loan risk rating of loan *k* extended by bank *i* during quarter *t* (which we use as a measure of ex-ante risk of each bank loan), r_t is the federal funds rate at the beginning of quarter *t*, K_{it} is the capital-asset ratio (inverse of bank leverage) of bank *i* at the beginning of quarter *t*, X_{kit} is a set of loan-specific control variables (loan size, an indicator for collateral backing, and loan maturity), Y_{it} is a set of bank-specific control variables (other than bank leverage), Z_{jt} is a set of time-varying regional (either U.S. state or Census region) control variables, α_i are bank-specific fixed effects, λ_j are state-specific fixed effects, and ε_{kit} is the error term. To control for dependence of observations within quarters, standard errors are clustered at the quarterly level. Our coefficient of interest is β, which we expect to be negative.

To test whether the effect of interest rates on bank risk taking depends on bank capital, we enrich regression model (1) by including an interaction term as follows:

$$\sigma_{kit} = \alpha_i + \lambda_j + \beta r_t + \gamma K_{it} + \delta K_{it} r_t + \theta X_{kit} + \mu Y_{it} + \rho Z_{jt} + \varepsilon_{kit}. \quad (2)$$

Our focus is on the interaction term between interest rates and bank capital. Based on the model and related literature, we expect to find a negative coefficient δ on the interaction between measures of bank capital and interest rates. This would support the notion that reductions in interest rates increase bank risk taking especially for banks with relatively high capital (low leverage).

As an alternative specification, we replace the interest rate variable with time fixed effects as follows:

$$\sigma_{kit} = \alpha_i + \lambda_j + \tau_t + \gamma K_{it} + \delta K_{it} r_t + \theta X_{kit} + \mu Y_{it} + \rho Z_{jt} + \varepsilon_{kit}, \quad (2a)$$

where $\boldsymbol{\tau_t}$ are quarter-specific fixed effects.

Note that, strictly speaking, the model in section (2) is cast in terms of real, not nominal, interest rates. This is, however, not a problem for our empirical approach as long as current

monetary policy, by setting the policy rate, has a direct influence on short-term real interest rates, which is the case as long as rigidities prevent prices from adjusting immediately. Of course, there are also other factors that determine real interest rates, such as expected GDP growth and capital flows (Warnock and Warnock, 2009). But, over our sample period (1997-2011), the correlation between nominal and real effective federal funds rates is high at 0.9.

B. Financial Stability Considerations and Monetary Policy: Evidence from FOMC Minutes

A key assumption underlying our identification approach is that interest rate changes induced by monetary policy are exogenous to bank risk taking, or more broadly, that monetary policy does not respond to financial stability considerations. Currently, a debate is ongoing on whether monetary policy frameworks should be revised to include explicitly financial stability as a target. It is fair to say, however, that prior to the crisis, financial stability considerations played a limited role in the setting of monetary policy (this statement holds of course particularly for central banks with an explicit inflation targeting framework).

To shed light on the relevance of financial stability considerations in the setting of monetary policy in the United States prior to the crisis in 2007, we analyze the contents of the minutes of the Federal Open Market Committee (FOMC) meetings, searching for keywords that are associated with financial stability, to gauge the attention given to financial stability considerations when conducting monetary policy. Specifically, we count the number of times each keyword appeared in FOMC minutes. We count both the total number of times each word appears in the minutes, and the number of reports each word appeared in. We compute both the total count and its frequency, determined as the number of times the word has been used within a time period divided by the number of quarters in that time period. We perform these counts for a total of 14 different keywords related to financial stability, varying from bank risk to financial conditions. The results are summarized in Appendix Table 1.

With the exception of the word “financial conditions,” which is a much broader concept than financial stability, we find that most keywords related to financial stability are rarely used in FOMC minutes, especially prior to the year 2007. Keywords such as financial stability, bank risk, and systemic risk did not appear even once during this period. Since 2007, as the recent financial crisis unfolded, keywords related to financial stability appeared more frequently in FOMC minutes, although the increase was small for most keywords. These results suggest that at least until recently financial stability considerations played a limited direct role in the setting of monetary policy.

This is of course a rough approximation, and in no way should this be interpreted as evidence that the Fed paid too little attention to financial stability risk. Instead, it is consistent with the then-well-established view that protecting financial stability was primarily the job of supervisory and regulatory policy and that interest rate policy was to focus on its traditional goals of price stability and moderating deviations of output from its potential (Bernanke, 2002, 2011, and Mishkin, 2010).

IV. Data and Descriptive Statistics

A. Survey of Terms of Business Lending

This paper uses confidential loan-level data over the period 1997-2011 from the Federal Reserve's Survey of Terms of Business Lending (STBL) to construct a measure of ex-ante bank risk taking. The STBL is a quarterly survey on the terms of business lending of a stratified sample of about 400 banks conducted by the U.S. Federal Reserve, which typically covers a very large share of assets in the U.S. banking sector. For example, the combined assets of the banks responding to the survey for the fourth quarter of 2011 represented about 60 percent of all assets of U.S. commercial banks.[8] The survey asks participating banks about the terms of all commercial and industrial loans issued during the first full business week of the middle month in every quarter. Banks report the risk rating of each loan by mapping their internal loan risk ratings to a scale defined by the Federal Reserve. Loan risk ratings vary from 1 to 5, with 5 representing the highest risk. The publicly available version of this survey encompasses an aggregate version of the terms of business lending, disaggregated by type of banks. In this paper, we use the confidential data on individual loans aggregated at the bank level.

In addition to the loan ratings, the STBL collects loan information on the face amount, the rate of interest (including the base pricing rate), the frequency of compounding, the date on which the loan rate can be recalculated (if any), the maturity date (if any), the commitment status, whether the loan is secured, and the risk rating. The data are collected for the first full business week of the middle month of each quarter (i.e., February, May, August, and November) and refer to individual loans made during the survey week. The STBL is complemented with a prime rate supplement that collects from STBL respondents their prime lending rates on each day of the survey week. There is a separate survey on the terms of bank lending to farmers. From these sample STBL data, estimates of the terms of business loans extended during the reporting week are constructed. The aggregate estimates for business loans are published in the quarterly release on the Survey of Terms of Business Lending.

The legal basis for the survey is the Federal Reserve Act and the survey is conducted on a voluntary basis. Individual responses are regarded as confidential under the Freedom of Information Act, and the STBL micro-level data are therefore not available to researchers outside the Federal Reserve System.

The STBL was designed to allow the Federal Reserve to measure the cost of business borrowing from banks and to analyze developments in bank loan markets. It replaced the Quarterly Interest Rate Survey and portions of the Survey of Selected Interest Rates of the Committee on Interest and Dividends (CID survey), and was designed to provide more accurate and detailed information on business loans, especially information concerning maturity and non-price terms, than the aforementioned surveys. Construction and land development loans were originally included in the STBL but were dropped from the survey in 1989.

[8] According to the Federal Reserve's H.8 statistical release, total assets of all commercial banks in the United States were $12.6 trillion as of December 2011.

Since its inception in February 1977, the STBL has been revised periodically to accommodate changes in lending practices. In 1997, the STBL respondent panel was expanded to include U.S. branches and agencies of foreign banks. At the same time, interest rate adjustments and maturity items were added and redefined, and a risk-rating item was added. In 2003, the STBL was modified: a field for the date on which the terms, including pricing, for loans made under formal commitment became effective was added, the number of base pricing rate options was reduced from five to two, and the data item indicating whether loans are callable was deleted. In 2006, the minimum size of loans reported was increased from $1,000, a level at which it had been held since the inception of the STBL in 1977, to $3,000. The adjustment reflected price inflation over the intervening period and the increased use of business credit cards, developments that had likely added significantly to the burden of reporting small loan amounts.

Analysis of the STBL data provides reliable estimates of the cost of important segments of business credit at banks that are representative of banking institutions nationwide. Currently, it is the Federal Reserve's only available source of data on bank loan pricing for individual loans of all sizes. Specifically, the STBL provides the only information on marginal returns on business loans for all banks and a wide range of loan sizes. As a result, the STBL provides valuable insights into shifts in the composition of banks' business loan portfolios and the implications of those shifts for bank profitability. Moreover, the STBL is an important source of individual loan data used by those concerned with lending to small businesses, for which banks are the primary source of credit.

The addition of loan risk ratings to the survey in 1997 has proven particularly useful. Because of the importance of the risk ratings, the Federal Reserve recommends that the Reserve Banks periodically verify that each respondent bank is correctly mapping its most current risk rating system to the risk categories defined in the STBL. This verification would occur no more frequently than once per year unless an anomaly in the data was found during the normal course of editing the data. The loan risk ratings are the primary focus in the analysis of our paper.

The prime rate supplement is completed by all banks that file STBL data. The prime rate is defined by the Federal Reserve as "the administered rate used for pricing business and other credit, which is adjusted from time to time in response to changes in market conditions." The prime rate is by far the most common base rate used to price variable rate business loans at small and medium-sized banks. Prime rate data are also collected from the fifty U.S. branches and agencies of foreign banks on the business loan survey. They provide valuable information about variations in the prime-lending rate across banks, which can be considerable. The prime rate supplement to the STBL is the only national source of data on the prime rate at banks of all sizes. The survey data on prime lending rates have been particularly useful for monitoring the changing role of the prime rate as a benchmark for business loan pricing and of shifts in the mix of fixed-rate and variable-rate lending as financial markets have changed.

Beyond their use for current analysis by the Federal Reserve Board, the STBL survey data have been used in a number of research papers, all of which are co-authored by Federal Reserve economists given the confidential nature of the dataset. For example, Friedman and Kuttner (1993) used STBL data to study credit conditions during the 1990-1991 economic

recession and Black and Rosen (2007) used STBL data to study the functioning of the monetary transmission mechanism in general. STBL data has also been used to study the likely effects of industry consolidation on the availability and pricing of small business loans (see Berger, Kashyap, and Scalise, 1995). Carpenter, Whitesell, and Zakrajšek (2001) used STBL data to show that more closely linking capital requirements to the riskiness of individual business loans might allow banks to set aside noticeably less capital for those loans and might not substantially change the cyclical behavior of required capital levels. Morgan and Ashcraft (2003) used the STBL to find that risk ratings on a bank's newly extended business loans help predict changes in the rating assigned to the bank by federal regulators. In the context of the recent financial crisis, Black and Hazelwood (2013) use STBL data to study the effect on bank risk taking of the capital injected through the Troubled Asset Relief Program (TARP) to stabilize U.S. banks.

B. Datasets and Variable Definitions

Loan specific variables

Risk rating is the ex-ante internal risk rating assigned by the bank to a given new loan, as reported in the Federal Reserve's Survey of Terms of Business Lending (STBL). The internal risk rating is a discrete index that increases with higher perceived risk. In the STBL scale, 1=Minimal Risk, 2=Low Risk, 3=Moderate Risk, 4=Acceptable Risk, and 5=Special Mention or Classified Asset. In addition, for each loan, the STBL reports the name of the bank extending the loan, the size (in dollars) and maturity (in years) of the loan, and whether or not the loan is secured by collateral. We exploit all these loan-specific variables in our empirical strategy.

Bank specific variables

We complement data from the STBL with banks' balance sheet information from the quarterly Consolidated Reports of Condition and Income (FFIEC 031 and 041) (Call Reports) for commercial banks. We construct the following variables using Call Report data: bank total assets, regulatory capital ratios, and common stock. In some specifications, we measure market capitalization as the end-of-quarter stock market capitalization of the entire bank holding company (BHC) as reported in CRSP for the largest bank in the BHC.

Bank location is based on its headquarters as reported in the National Information Center (NIC) database. We use information on bank location to match bank-specific data with regional (state-specific) data.

Regional specific variables

Our regressions control for state- or region-level factors (where state-level factors are unavailable). At the state level, we consider personal income, taken from the Bureau of Economic Analysis (BEA), the unemployment rate, taken from the Bureau of Labor Statistics (BLS), and the change in housing prices based on the index published by the Office of Federal Housing Enterprise Oversight/Federal Housing Finance Agency (OFHEO/FHFA). At the region level (as defined by the U.S. Census Bureau), we consider the quarter-over-quarter change in the consumer price index (CPI), taken from BLS.

Time specific variables

The short-term interest rate is measured using the three-month average target federal funds rate in nominal terms. By adjusting reserves, the Federal Reserve closely controls the market-determined effective federal funds rate, a process which allows it to implement monetary policy. The effective federal funds rate is a volume-weighted average of rates on trades arranged by major brokers and calculated daily by the Federal Reserve Bank of New York using data provided by the brokers.

The fraction of U.S. bank failures is taken from the U.S. Federal Deposit Insurance Corporation (FDIC) and is computed relative to the number of insured banks.

C. Descriptive Statistics of Main Variables

Table 1 reports summary statistics on our main regression variables. The average loan risk rating in the sample is 3.43, with a standard deviation of 0.85, indicating that the average loan over the sample period as reported by banks is somewhere between moderate risk (rating 3) and acceptable risk (rating 4).

A negative relationship between bank risk and the short-term interest rate, as measured using the nominal federal funds rate, is evident in aggregate data from the U.S. Survey of Terms of Business Lending (see Figure 1). Here ex-ante bank risk taking is measured using the weighted average loan risk rating. The data show a strong negative relationship between average bank risk and the nominal federal funds rate that is statistically significant at the 1% level, consistent with a positive relationship between q^* and r^*, as predicted by the model.[9] Both variables are detrended by subtracting their linear time trend, and we use quarterly data from the second quarter of 1997 until the fourth quarter of 2011. We obtain similar results when detrending these variables using a Hodrick-Prescott filter.

V. Empirical Results

In this section we present our main results concerning the effect of monetary policy conditions on bank risk taking (as measured by the loan ratings reported to the STBL) and the role played by bank capitalization in this relationship. We also present robustness checks that suggest that our baseline results are not driven by the behavior of large banks, large banking markets, or by periods of widespread financial distress. Finally, we also show that our results are more pronounced the longer monetary policy rates remain low.

A. Main Results

Table 2 reports the results from OLS regressions of bank loan risk ratings on the federal funds rate and control variables from the second quarter of 1997 to the fourth quarter of 2011.

[9] We obtain a very similar picture when using the real federal funds rate (nominal rate adjusted for CPI inflation) instead. After all, the correlation between the real and nominal federal funds rate is 0.9 over the sample period.

Regressions are estimated at the loan level with standard errors clustered at the quarter level. Results point to a significantly, negative relationship between short-term interest rates and ex-ante bank risk taking.

The economic effects or our result are significant. Based on the regression estimates in column 6 of Table 2, where we control for regional and bank-specific factors, a one-standard deviation decrease in interest rates of 1.853 would suggest an increase in loan risk ratings of 0.057. This is a significant though relatively small effect compared to the standard deviation of loan risk ratings of 0.85. However, as we will see, this effect varies markedly across different types of banks and across different periods.

Thus far, we have not controlled for other loan characteristics. Obviously, loan risk ratings depend on loan characteristics such as maturity, collateral, and loan size, and not controlling for these factors could confound the analysis on the relationship between interest rates and loan risk ratings.

In Table 3, we use additional info from the STBL to control for loan characteristics. In particular, we control for loan size, collateral, and maturity of the loan by including the following variables: Loan size (measured in logs), a dummy for secured loan (equal to 1 for loans secured by collateral), and loan maturity (in years). Panel B of Table 3 reports the results of running regressions in Table 2 when splitting the sample by loan characteristics. Columns 1 and 2 report results for the sample containing loans with size above median and below median, respectively. Columns 3 and 4 report results for the sample of loans secured by collateral and not secured by collateral, respectively. Columns 5 and 6 report results for the sample with loan maturities longer than the median and shorter than the median, respectively. As before, all regressions include state- and bank-fixed effects, with standard errors clustered by quarter. We continue to find a significantly negative relationship between interest rates and loan risk ratings.

Thus far, we have not considered the differential effect of bank capital on the link between interest rates and loan risk ratings. A key assumption underlying our model prediction of a negative relationship between interest rates and bank risk taking is that bank leverage can be adjusted easily without cost. In the presence of adjustment costs, however, poorly capitalized banks will increase monitor following a drop in real rates, lowering bank risk taking. In the extreme, when banks cannot adjust their capital ratio, the link between interest rates and bank risk taking is no longer universally negative, and can turn positive for poorly capitalized banks. It is therefore important to condition on bank capitalization when analyzing the link between interest rates and bank risk taking.

In Table 4, we estimate alternative versions of model (2) when including an interaction term between the federal funds rate variable and various measures of bank capital (or leverage), including the Tier 1 capital ratio (which equals the ratio of Tier 1 capital to risk-weighted assets), the Total capital ratio (which equals the ratio of Tier 1 plus Tier 2 capital to risk-weighted assets), the Common stock-assets ratio (which equals the ratio of common equity to total assets), and the Stock market capitalization-assets ratio (which equals the ratio of stock market capitalization to total assets) of the bank. Panel B reports the results of running regressions in

column 1 of Panel A splitting the sample by bank capital. Columns 1 and 2 report results for the sample of banks above and below the median Tier 1 capital ratio, respectively.

Consistent with our model predictions, we obtain a statistically significant, negative coefficient on the interaction term between bank capital and interest rates, irrespective of the measure of capitalization used. The economic effect is significant. Based on the estimates reported in column 2 of Table 4, a one standard deviation decrease in interest rates when evaluated at one standard deviation below the sample mean of the Tier 1 capital ratio variable would translate into an increase in loan risk ratings of 0.06, which is a significant effect compared to the standard deviation of the loan risk ratings variable of 0.85. The effect of a one standard deviation decrease in interest rates increases to 0.08, or one-tenth of the standard deviation of the loan risk ratings variable, when evaluated at one standard deviation above the sample mean of the Tier 1 capital ratio variable.

The economic effect is similar when using the Total capital ratio or Common stock to assets variable as a proxy for bank capitalization. The economic effect is more muted when using stock market capitalization rather than book capital ratios as a measure of capitalization, arguably because market values are more volatile than book values, and in particular tend to fluctuate more with the economic cycle and monetary policy stance. In what follows, we therefore focus on book value of capital, although results are qualitatively unaltered when using market values.

Finally, Panel C reports regressions similar to those in Panel A except that they replace the level (but not the interactions) of the target federal funds rate with time-fixed effects. The results on the interaction between capital ratios and federal funds rates in Panels A and C are very similar, which suggests that our baseline results are robust to controlling for economy-wide variation that is not captured by the target federal funds rate. In fact, the economic magnitude of our main result is somewhat larger when controlling for time-fixed effects.

The results in Panel C also give an indication of the range of interest rates over which increases in capital translate into higher bank risk taking. Specifically, they indicate the inflection point in terms of the level of interest rates at which the effect of an increase in capital ratios on risk taking turns negative. For example, based on the regression results in column 1 of Panel C, increases in Tier 1 capital ratios translate into a decrease in bank risk taking when the target federal funds rate exceeds 2.85 percent. Similarly, results in column 2 indicate that increases in Total capital ratios translate into a decrease in bank risk taking when the target federal funds rate exceeds 5.99 percent. This suggests that the relevant inflection points are obtained at realistic levels of interest rates.

Table 5 shows the results of regressions excluding from the sample any loans made under commitment prior to the quarter of the survey (these loans represent about 25% of observations). The reason for excluding these loans is that loans made under commitment are likely to be less responsive (as opposed to “discretionary loans”) to current macro conditions, including the interest rate environment. Including loans made under commitment into the sample could therefore underestimate the effect we focus on. Indeed, we find that the magnitude of the coefficients on the interaction terms between capital ratios and federal funds rates is generally

larger in absolute value in this smaller subsample. We maintain the complete sample in the rest of our regression analysis, to avoid dropping roughly 25% of observations.

B. Robustness Checks

One concern with the estimates reported thus far is that policy rates respond endogenously to bank risk. While the analysis in section 3.B helps mitigate these concerns, we now perform several sample splits to address specific endogeneity concerns and help identification.

First, endogeneity is likely more of a concern for nationwide banks whose loan portfolio reflects economic activity across the nation than it is for small, local banks that are affected primarily by local shocks. We can therefore run regressions on subsamples of loans from local banks. Table 6 reports regression results when restricting the sample to small banks, with small banks defined as those with assets below the top quintile.

We continue to find a significant, negative relationship between interest rates and loan risk ratings in these samples of relatively small banks. In fact, the negative coefficient on the interaction between bank capital and interest rates is similar to that obtained in the full sample that includes large banks and it increases in magnitude in several specifications. This suggests that our results are not contaminated by the inclusion of large banks.

Similarly, endogeneity is less likely to be a concern in states with primarily local banks. After all, such banks are less likely to transmit shocks to the overall economy, and are therefore less likely to prompt a monetary policy response. Indeed, to the extent that monetary policy responds to financial shocks, it is more likely to respond to shocks that are not localized. Therefore, in Table 7, we limit the sample of banks from states with small banking systems by excluding from the sample those states where banks in the top 1% of the asset distribution are headquartered. We continue to obtain a significant negative coefficient on the interaction term between bank capital and interest rates.

Finally, since the monetary policy stance is likely to be driven by nationwide economic conditions, we focus on states whose business cycle is "less in sync" with the overall U.S. cycle in columns 1 to 4 of Table 8. More precisely, we rank states by the correlation of their income growth with the U.S. GDP growth and run our main specification for the subsamples above and below the median state. If the results were primarily driven by the reaction of monetary policy to the cycle and the associated change in risk taking, they would become less significant in the subsample of states with cycles less correlated with the national cycle. Instead, our results remain roughly stable and always significant across the two samples. In absolute value, the coefficient of the target federal funds rate is smaller (columns 1 and 2) and that of the interacted term (columns 3 and 4) is larger in the low-correlation subsample, but the differences are not statistically significant. We obtain similar results when splitting the sample according to state income volatility in columns 5 to 8.

An additional consideration is that monetary policy is likely to be more responsive to bank risk when banks are in distress, so endogeneity is more of a concern during periods of financial crisis. We therefore run regressions on subsamples of crisis versus non-crisis periods,

with crisis period defined as the years 2008-2010 (subprime mortgage crisis). For example, it was during the third quarter of 2007 that the Federal Reserve started to aggressively lower interest rates in response to growing signs of weakness in the U.S. financial system as evidenced by the closure of two hedge funds of Bear Stearns with exposure to mortgage-backed securities and the disclosure of financial difficulties at Countrywide Financial. Moreover, it is especially during periods of financial crises that banks will find it costly to issue capital and adjust leverage. This is especially true for the recent financial crisis when interbank markets froze and the supply of external capital for U.S. banks became scarce and turned expensive due in part to heightened concerns about bank insolvencies and increased counterparty risk between financial institutions. Therefore, we expect that the negative link between interest rates and bank risk taking is more pronounced for well capitalized banks only during periods when there are no financial crises and leverage can easily be adjusted to increase risk.

Table 9 reports the results of estimating our regression model when splitting the sample between financial crisis periods (defined as observations during the years 2008-2010) and non-crisis periods. Consistent with our priors, we find that the negative effect of the interaction term between capital ratios and interest rates on bank risk taking is more pronounced during non-crisis periods. During crisis periods, this relationship breaks down, and the coefficient in fact turns mildly positive. The economic effect of our main result for the non-crisis period is substantial, and somewhat larger than when estimated over the full sample. Based on the estimates reported in column 2 of Table 9, when evaluated at one-standard deviation above the sample mean of the Tier 1 capital ratio, a one-standard deviation decrease in interest rates would translate into an increase in loan risk ratings of 0.10. This is a significant effect compared to the non-crisis sample standard deviation of loan risk ratings of 0.85.

In Table 9, column 5, we include as an additional variable the fraction of bank failures, taken from the FDIC, as a proxy for periods of banking distress (low capitalization). We find that reductions in interest rates have a disproportionately positive effect on bank risk taking during periods when there are relatively *few* bank failures, consistent with our earlier results on non-crisis periods. Finally, we consider alternative measures of *regional* monetary policy conditions, to allow for the possibility that monetary policy, which is set at the federal level, has potentially different regional effects on bank risk taking depending on local conditions such as inflation, employment, and economic activity. The results are reported in Table 10. In columns 1 and 2, regional monetary policy conditions are measured as the difference between the nominal target federal funds rate minus the change in regional CPI. In columns 3 and 4, regional monetary policy conditions are measured as the deviation between the nominal target federal funds rate and the nominal rate implied by a simple Taylor rule applied to the state where the bank is headquartered, computed as (regional inflation + 0.5×(regional inflation – 2%) + 0.5× (log(state income) – trend log(state income)). In either case, we continue to find a negative relationship between interest rates and bank risk taking, and that this link is less pronounced for poorly capitalized banks.

Another concern is that the risk rating scale adjusts endogenously with the state of the economy, potentially generating a bias in the estimated coefficients. Specifically, if loan officers are more optimistic with respect to risk during expansions, we would expect risk as reported to the survey to be underestimated during expansions. However, to the extent that the federal funds

rate co-moves with the cycle, being higher during expansion periods, this would bias our coefficient on the federal funds rate variable towards zero. Therefore, if anything, such measurement error in the risk rating scale would work against finding an effect of monetary policy on risk taking.

Nevertheless, to further reduce concerns that our results are not primarily driven by risk ratings being dependent on the state of the economy, we next run regressions that directly control for the interaction between the target federal funds rate and the state of the economy, as captured by real U.S. GDP growth and a time-specific dummy variable for NBER recessions. The regression results are presented in Table 11. The coefficients on the interactions between the target federal funds rate and banks' capital ratios are roughly unchanged when controlling for the state of the economy. Additionally, we find that the effect of the level of the federal funds rate becomes more pronounced during recessions. These results also allay concerns that our findings on the interactions between the target federal funds rate and banks' capital ratios are simply driven by a close association between banks' capital ratios and the state of the economy.

These robustness checks and results mitigate endogeneity concerns and lend additional support to our assertion that bank leverage is a key factor driving the risk taking channel of monetary policy.

C. Long Periods with Low Interest Rates

In Table 12, we test whether our results are stronger if interest rates are held low for extended periods. Our measure of duration of a period of low interest rates is the number of consecutive quarters without an increase in the target federal funds by the FOMC. Column 1 indicates that longer periods without increases in interest rates are associated with higher risk ratings of new loans. As shown in column 2, this effect is more pronounced for well-capitalized banks, an effect that is robust to controlling for the level of the target federal funds rate (column 3). Finally, in column 4 we find that the negative effect of the interaction term between capital ratios and interest rates on bank risk taking is more pronounced when interest rates are not raised for a prolonged period of time. These results are consistent with earlier findings by Maddaloni and Peydro (2011), who, using lending standards survey data, find that holding rates low for prolonged periods of time softens lending standards even further. Overall, these results suggest that not only the level but also the duration of interest rates matter for the link between bank leverage and risk taking.

VI. CONCLUSIONS

This paper provides strong evidence that a low short-term interest rate environment increases bank risk taking. Consistent with theoretical models of bank leverage and risk taking that embed risk shifting behavior, we find that the effect depends on the degree of bank capitalization: the effect of interest rates on bank risk taking is *less* pronounced for poorly capitalized banks. The economic effect of this result is meaningful: a one-standard deviation decrease in interest rates when evaluated at one standard deviation above the sample mean of the Tier 1 capital ratio variable would translate into an increase in loan risk ratings of about one-tenth its standard deviation. This effect is more pronounced in non-crisis times and during periods when interest rates are not raised for prolonged periods of time.

The findings in this paper bear on the debate about how to integrate macro-prudential regulation into the monetary policy framework to meet the twin objectives of price and financial stability (see, for example, Blanchard, Dell'Ariccia, and Mauro, 2013, and Bank of England, 2013,), even though they do not imply any excessive risk taking. Whether a trade-off between the two objectives emerges will depend on the type of shocks the economy is facing. For instance, no trade-off between price and financial stability may exist when an economy nears the peak of a cycle, when banks tend to take the most risks and prices are under pressure. Under these conditions, monetary tightening will decrease leverage and risk taking and, at the same time, contain price pressures. In contrast, a trade-off between the two objectives would emerge in an environment such as that in the run-up to the current crisis, with low inflation but excessive risk taking. Under these conditions, the policy rate cannot deal with both objectives at the same time: Tightening may reduce risk taking, but will lead to an undesired contraction in aggregate activity and/or to deflation. Other (macroprudential) tools may then be needed (although this is outside the scope of the analysis of this paper).

In this context, the potential interaction between interest rates decisions and bank risk taking implied by our analysis can be seen as an argument in favor of the centralization of macro-prudential responsibilities within the monetary authority. In addition, the complexity of this interaction points in the same direction. How these benefits balance with the potential for lower credibility and accountability associated with a more complex mandate and the consequent increased risk of political interference is a question for future research.

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Figure 1. Interest Rates and Bank Risk Taking

This figure plots the weighted average loan risk rating from the U.S. Survey of Terms of Business Lending against the nominal federal funds rate based on quarterly data from the second quarter of 1997 until the fourth quarter of 2011. Both variables are detrended by subtracting their linear time trend. The blue line indicates a regression line based on the two variables.

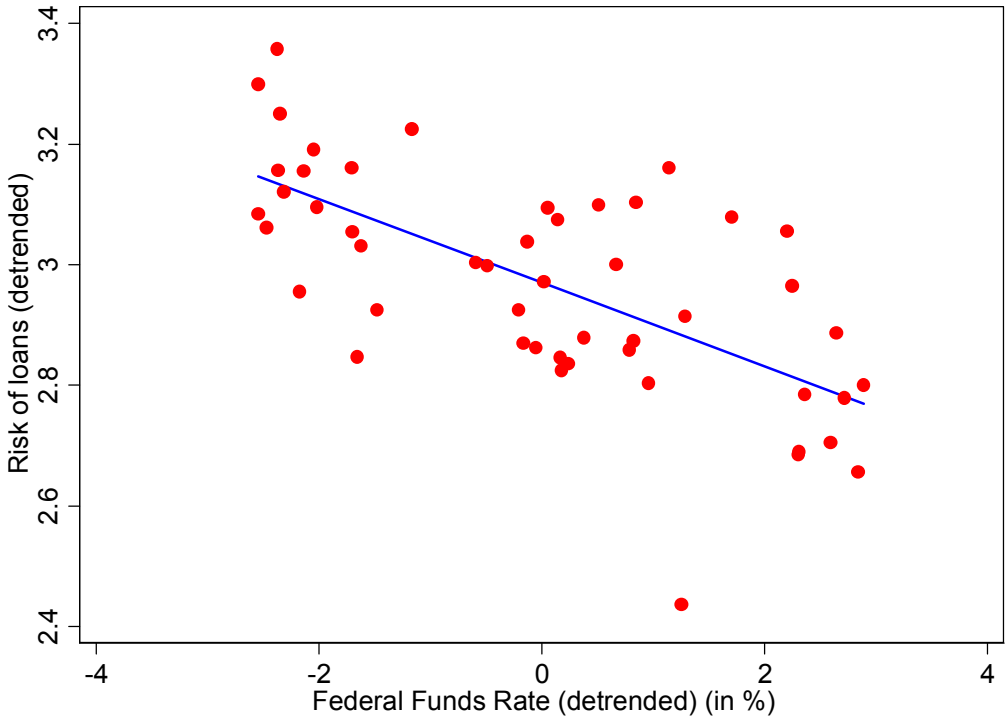

Table 1. Summary Statistics

This table reports the average and standard deviations for the dependent and explanatory variables of the regressions reported in Tables 2 and 3 from the second quarter of 1997 to the fourth quarter of 2011. Region-, state- and bank-level variables are weighted by the number of loans. Risk rating is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL, with 1=Minimal Risk, 2=Low Risk, 3=Moderate Risk, 4=Acceptable Risk, and 5=Special Mention or Classified Asset. Loan size, the dummy for loans secured by collateral, and loan maturity are all taken from the STBL. Bank location is based on its headquarters, as reported in the NIC database. Bank total assets, capital ratios, equity, and common stock are all taken from Call Report data. State personal income is from the BEA, change in region CPI (quarter over quarter) and state unemployment rate are from the BLS, and the change in state housing prices (quarter over quarter) is based on indexes published by OFHEO/FHFA.

	Observations	Average	Standard deviation
Risk rating	994,287	3.434	0.850
Loan size (dollars)	994,287	512,481	4,992,014
Dummy for loans secured by collateral	994,287	0.809	0.393
Loan maturity (years)	994,287	1.238	1.768
Bank total assets (millions of dollars)	994,287	191,624	279,194
Tier 1 capital ratio	994,287	0.094	0.027
Total capital ratio	994,287	0.122	0.023
Common stock to assets ratio	994,287	0.003	0.008
Equity to assets ratio	994,287	0.101	0.026
Target federal funds rate (%)	994,287	2.206	1.853
State personal income (dollars)	994,287	312,407	359,049
Change in region CPI (%)	994,287	0.596	0.858
State unemployment rate (%)	994,287	5.830	2.169
Change in state housing prices (%)	994,287	0.500	2.198

Table 2. Loan Risk Ratings and the Federal Funds Rate

This table reports the results of estimating panel regressions of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. State personal income is from the BEA, change in region CPI and state unemployment rate are from the BLS, and the change in housing prices is based on indexes published by OFHEO/FHFA. Bank size is measured as the log of total assets, and bank assets and Tier 1 capital ratio are both taken from Call Report data. Standard errors are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Target federal funds rate	-0.016***	-0.016**	-0.021***	-0.021***	-0.031***	-0.031***
	[0.000]	[0.007]	[0.006]	[0.006]	[0.009]	[0.008]
State personal income					0.000	-0.000***
					[0.000]	[0.000]
Change in region CPI					0.009	0.007
					[0.009]	[0.010]
State unemployment rate					-0.015**	-0.019***
					[0.007]	[0.007]
Change in state housing prices					0.002	0.004*
					[0.003]	[0.002]
Tier 1 capital ratio						-0.118
						[0.486]
Bank size						0.062***
						[0.013]
Constant	3.468***	3.468***	3.480***	3.649***	3.789***	2.748***
	[0.001]	[0.016]	[0.014]	[0.014]	[0.052]	[0.241]
Bank-fixed effects	No	No	Yes	Yes	Yes	Yes
State-fixed effects	No	No	No	Yes	Yes	Yes
Standard errors clustered by quarter	No	Yes	Yes	Yes	Yes	Yes
Observations	994,287	994,287	994,287	994,287	994,287	994,287
Number of banks	475	475	475	475	475	475
R^2	0.001	0.001	0.169	0.169	0.170	0.170

Table 3. Loan Risk Ratings, the Federal Funds Rate, and Loan Characteristics

Panel A of the table reports panel regression estimates of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011 including loan-level controls. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. Loan size (measured in logs), the dummy for secured loan (equal to 1 for loans secured by collateral), and loan maturity (in years) are all taken from the STBL. State personal income is from the BEA, change in region CPI and state unemployment rate are from the BLS, and the change in housing prices is based on indexes published by OFHEO/FHFA. Bank size is measured as the log of total assets, and bank assets and Tier 1 capital ratio are taken from Call Report data. Panel B reports the results of running regressions in Table II splitting the sample by loan characteristics. Column 1 (2) reports results for the sample with loans with size above (below) median. Column 3 (4) reports results for the sample of loans secured (not secured) by collateral. Column 5 (6) reports results for the sample with loan maturities longer (shorter) than the median. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Panel A

	(1)	(2)	(3)	(4)	(5)
Target federal funds rate	-0.031***	-0.031***	-0.031***	-0.030***	-0.031***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
Tier 1 capital ratio	-0.118	-0.089	-0.126	-0.123	-0.107
	[0.486]	[0.477]	[0.464]	[0.478]	[0.453]
Bank size	0.062***	0.074***	0.072***	0.062***	0.081***
	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]
Loan size		-0.031***			-0.024***
		[0.002]			[0.002]
Dummy for secured loans			0.241***		0.227***
			[0.008]		[0.008]
Loan maturity				-0.022***	-0.018***
				[0.002]	[0.001]
State personal income	-0.000***	-0.000**	-0.000***	-0.000**	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.007	0.007	0.007	0.007	0.006
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
State unemployment rate	-0.019***	-0.018***	-0.021***	-0.019***	-0.021***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
Change in state housing prices	0.004*	0.004*	0.004	0.004*	0.004
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Constant	2.831***	2.865***	2.397***	2.769***	2.526***
	[0.242]	[0.239]	[0.241]	[0.237]	[0.238]
Observations	994,287	994,287	994,287	994,287	994,287
Number of banks	475	475	475	475	475
R^2	0.170	0.174	0.179	0.172	0.183

Table 3. Loan Risk Ratings, the Federal Funds Rate, and Loan Characteristics (continued)

Panel B

	(1) Loan size above median	(2) Loan size below median	(3) Loans secured by collateral	(4) Loans not secured by collateral	(5) Loans with maturity longer than the median	(6) Loans with maturity shorter than the median
Target federal funds rate	-0.030***	-0.034***	-0.027***	-0.055***	-0.032***	-0.028***
	[0.007]	[0.010]	[0.009]	[0.005]	[0.008]	[0.009]
Tier 1 capital ratio	-0.043	-0.127	-0.438	0.403	-0.898*	0.751
	[0.468]	[0.630]	[0.506]	[0.558]	[0.474]	[0.530]
Bank size	0.094***	0.015	0.064***	0.086***	0.067***	0.052***
	[0.016]	[0.014]	[0.013]	[0.020]	[0.012]	[0.015]
State personal income	-0.000***	0.000	-0.000**	-0.000***	-0.000***	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.007	0.006	0.006	0.006	0.009	0.005
	[0.010]	[0.011]	[0.010]	[0.011]	[0.008]	[0.012]
State unemployment rate	-0.024***	-0.017**	-0.014**	-0.053***	-0.017**	-0.019**
	[0.006]	[0.008]	[0.007]	[0.007]	[0.007]	[0.007]
Change in state housing prices	0.004*	0.005	0.005*	0.000	0.002	0.007**
	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]	[0.003]
Constant	2.137***	3.460***	2.806***	2.246***	2.586***	2.597***
	[0.295]	[0.244]	[0.238]	[0.361]	[0.230]	[0.271]
Observations	520,258	474,029	804,163	190,124	510,972	483,315
Number of banks	0.157	0.200	0.185	0.170	0.188	0.169
R^2	466	467	474	424	470	462

Table 4. Loan Risk Ratings, the Federal Funds Rate, and Bank Capital

Panel A reports panel regression estimates of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011 including interactions between the target federal funds rate and bank capital ratios. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. Total capital ratio is Tier 1 plus Tier 2 capital to risk-weighted assets. Capital ratios are derived from Call Report data, except for the stock market capitalization-to-assets ratio. Market capitalization is taken from CRSP, measured at the end of the quarter at the BHC level, and is defined only for the largest bank in the BHC. All other variables are defined in Table 3. Panel B repeats the regressions in column 1 of Panel A when splitting the sample by bank capital. Column 1 (2) reports results for the sample of banks above (below) the median tier 1 capital ratio. Panel C reports results of replacing the target federal funds rate with quarter-fixed effects. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Panel A

	(1)	(2)	(3)	(4)	(5)
Target federal funds rate	-0.031***	-0.004	-0.003	-0.030***	0.014
	[0.008]	[0.009]	[0.015]	[0.008]	[0.016]
Tier 1 capital ratio	-0.107	0.267			
	[0.453]	[0.429]			
Tier 1 capital ratio × target federal funds rate		-0.317***			
		[0.082]			
Total capital ratio			0.661		
			[0.395]		
Total capital ratio × target federal funds rate			-0.239***		
			[0.077]		
Common stock-assets ratio				3.596***	
				[1.213]	
Common stock-assets ratio × target federal funds rate				-0.541***	
				[0.127]	
Stock market capitalization-assets ratio					0.575***
					[0.199]
Stock market capitalization-ratio × target federal funds rate					-0.077**
					[0.034]
Bank size	0.081***	0.082***	0.077***	0.085***	0.212***
	[0.013]	[0.013]	[0.012]	[0.013]	[0.038]
Loan size	-0.024***	-0.024***	-0.024***	-0.024***	-0.045***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.004]
Dummy for secured loans	0.227***	0.227***	0.227***	0.227***	0.306***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.011]
Loan maturity	-0.018***	-0.018***	-0.018***	-0.018***	-0.009***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]
State personal income	-0.000***	-0.000***	-0.000***	-0.000***	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.006	0.006	0.006	0.006	0.016
	[0.010]	[0.010]	[0.009]	[0.009]	[0.016]
State unemployment rate	-0.021***	-0.023***	-0.023***	-0.022***	0.020*
	[0.007]	[0.007]	[0.007]	[0.006]	[0.011]
Change in state housing prices	0.004	0.004	0.004	0.004	-0.004
	[0.002]	[0.002]	[0.003]	[0.003]	[0.005]
Constant	2.526***	2.483***	2.513***	2.434***	-0.143
	[0.238]	[0.233]	[0.231]	[0.240]	[0.703]

Bank fixed effects	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	994,287	994,287	994,287	994,287	374,192
Number of banks	475	475	475	475	118
R^2	0.183	0.183	0.183	0.183	0.197

Panel B

	(1) Banks with Tier 1 capital ratio above median	(2) Banks with Tier 1 capital ratio below median
Target federal funds rate	-0.048***	-0.019***
	[0.016]	[0.004]
Tier 1 capital ratio	0.560	-4.754***
	[0.487]	[0.995]
Bank size	0.056	0.145***
	[0.036]	[0.020]
Loan size	-0.033***	-0.017***
	[0.003]	[0.002]
Dummy for secured loans	0.214***	0.238***
	[0.010]	[0.012]
Loan maturity	-0.013***	-0.026***
	[0.001]	[0.003]
State personal income	0.000	-0.000***
	[0.000]	[0.000]
Change in region CPI	0.017	-0.001
	[0.016]	[0.009]
State unemployment rate	-0.013	-0.016*
	[0.010]	[0.008]
Change in state housing prices	0.007**	0.001
	[0.003]	[0.004]
Constant	2.891***	1.550***
	[0.558]	[0.340]
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Observations	490,064	504,223
Number of banks	455	184
R^2	0.227	0.155

Panel C

	(1)	(2)	(3)
Tier 1 capital ratio	1.109***		
	[0.372]		
Tier 1 capital ratio × target federal funds rate	-0.389***		
	[0.081]		
Total capital ratio		1.670***	
		[0.357]	
Total capital ratio × target federal funds rate		-0.279***	
		[0.085]	
Common stock-assets ratio			6.215***
			[1.363]
Common stock-assets ratio × target federal funds rate			-0.313*
			[0.157]
Bank size	0.029	0.032	0.037
	[0.045]	[0.045]	[0.046]
Loan size	-0.024***	-0.024***	-0.024***
	[0.001]	[0.001]	[0.001]
Dummy for secured loans	0.224***	0.225***	0.224***
	[0.008]	[0.008]	[0.008]
Loan maturity	-0.018***	-0.018***	-0.018***
	[0.001]	[0.001]	[0.001]
State personal income	-0.000**	-0.000***	-0.000**
	[0.000]	[0.000]	[0.000]
Change in region CPI	0.023	0.021	0.019
	[0.037]	[0.036]	[0.037]
State unemployment rate	-0.034***	-0.032***	-0.032***
	[0.006]	[0.006]	[0.006]
Change in state housing prices	0.000	0.000	0.000
	[0.003]	[0.003]	[0.003]
Constant	3.424***	3.253***	3.354***
	[0.884]	[0.872]	[0.888]
Bank fixed effects	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
Quarter-year fixed effects	Yes	Yes	Yes
Observations	994,287	994,287	994,287
Number of banks	475	475	475
R^2	0.188	0.188	0.188

Table 5. Loan Risk Ratings, the Federal Funds Rate, and Bank Capital for Loans Not Under Commitment

This table reports panel regression estimates of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011, including interactions between the federal funds rate and capital ratios, and excluding loans made under commitment established prior to the quarter of the survey. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. All other variables are defined as in Table 4. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)	(5)
Target federal funds rate	-0.016***	0.005	0.023**	-0.013***	0.057***
	[0.004]	[0.008]	[0.009]	[0.004]	[0.015]
Tier 1 capital ratio	-0.498	-0.247			
	[0.468]	[0.461]			
Tier 1 capital ratio × target federal funds rate		-0.236***			
		[0.079]			
Total capital ratio			0.265		
			[0.420]		
Total capital ratio × target federal funds rate			-0.327***		
			[0.067]		
Common stock-assets ratio				5.830***	
				[1.960]	
Common stock-assets ratio × target federal funds rate				-1.194***	
				[0.300]	
Market capitalization-assets ratio					0.813***
					[0.225]
Market capitalization ratio × target federal funds rate					-0.162***
					[0.043]
Bank size	0.102***	0.102***	0.095***	0.105***	0.242***
	[0.017]	[0.017]	[0.016]	[0.017]	[0.077]
Loan size	-0.023***	-0.023***	-0.023***	-0.023***	-0.048***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]
Dummy for secured loans	0.212***	0.212***	0.212***	0.211***	0.273***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.013]
Loan maturity	-0.021***	-0.021***	-0.021***	-0.021***	-0.021***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]
State personal income	-0.000***	-0.000***	-0.000***	-0.000***	-0.000**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.000	0.000	-0.001	-0.001	0.005
	[0.008]	[0.008]	[0.008]	[0.008]	[0.013]
State unemployment rate	-0.012*	-0.013**	-0.013**	-0.014**	0.039***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.013]
Change in state housing prices	0.002	0.002	0.002	0.002	-0.006
	[0.002]	[0.002]	[0.002]	[0.002]	[0.004]
Constant	1.911***	1.910***	1.983***	1.815***	-0.747
	[0.308]	[0.309]	[0.302]	[0.318]	[1.247]
Observations	743,665	743,665	743,665	743,665	239,374
Number of banks	455	455	455	455	117
R^2	0.195	0.195	0.195	0.195	0.236

Table 6. Loan Risk Ratings, the Federal Funds Rate, and Bank Capital in Small Banks

This table reports the results of estimating panel regressions of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011, including interactions between the target federal funds rate and bank capital ratios, and restricting the sample to small banks. Small banks are defined as those with assets below the top quintile. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. All other variables are defined as in Table 4. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)
Target federal funds rate	-0.020*	0.022	0.01	-0.016
	[0.010]	[0.014]	[0.016]	[0.010]
Tier 1 capital ratio	-0.069	0.556		
	[0.597]	[0.621]		
Tier 1 capital ratio × target federal funds rate		-0.396***		
		[0.119]		
Total capital ratio			-0.078	
			[0.498]	
Total capital ratio × target federal funds rate			-0.260**	
			[0.120]	
Common stock-assets ratio				5.839***
				[1.942]
Common stock-assets ratio × target federal funds rate				-0.824**
				[0.310]
Bank size	-0.016	-0.023	-0.024	-0.007
	[0.047]	[0.048]	[0.049]	[0.048]
Loan size	-0.023***	-0.024***	-0.023***	-0.023***
	[0.002]	[0.002]	[0.002]	[0.002]
Dummy for secured loans	0.151***	0.153***	0.152***	0.149***
	[0.012]	[0.012]	[0.012]	[0.012]
Loan maturity	-0.010***	-0.010***	-0.010***	-0.010***
	[0.001]	[0.001]	[0.001]	[0.001]
State personal income	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	-0.012	-0.011	-0.011	-0.011
	[0.011]	[0.011]	[0.011]	[0.011]
State unemployment rate	-0.021**	-0.023**	-0.021**	-0.020*
	[0.010]	[0.010]	[0.010]	[0.010]
Change in state housing prices	0.011***	0.010**	0.010**	0.011**
	[0.004]	[0.004]	[0.004]	[0.004]
Constant	4.144***	4.189***	4.262***	3.961***
	[0.673]	[0.682]	[0.717]	[0.706]
Observations	217,513	217,513	217,513	217,513
Number of banks	414	414	414	414
R^2	0.305	0.305	0.305	0.305

Table 7. Loan Risk Ratings, the Federal Funds Rate, and Bank Capital in States without Large Banks

This table reports the results of estimating panel regressions of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011 including interactions between the target federal funds rate and bank capital ratios, excluding from the sample those states where banks in the top 1% of the asset distribution are headquartered. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. All other variables are defined as in Table 4. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)
Target federal funds rate	-0.061***	-0.041*	-0.035	-0.061***
	[0.014]	[0.022]	[0.025]	[0.015]
Tier 1 capital ratio	0.932*	1.215**		
	[0.499]	[0.498]		
Tier 1 capital ratio × target federal funds rate		-0.209*		
		[0.110]		
Total capital ratio			1.436***	
			[0.447]	
Total capital ratio × target federal funds rate			-0.219*	
			[0.113]	
Common stock-assets ratio				4.104***
				[1.386]
Common stock-assets ratio × target federal funds rate				-0.387*
				[0.221]
Bank size	0.150***	0.148***	0.145***	0.157***
	[0.035]	[0.035]	[0.035]	[0.036]
Loan size	-0.032***	-0.032***	-0.032***	-0.032***
	[0.002]	[0.002]	[0.002]	[0.002]
Dummy for secured loans	0.203***	0.203***	0.204***	0.202***
	[0.012]	[0.012]	[0.012]	[0.012]
Loan maturity	-0.014***	-0.014***	-0.014***	-0.014***
	[0.002]	[0.002]	[0.002]	[0.001]
State personal income	-0.000**	-0.000**	-0.000**	-0.000*
	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.012	0.011	0.011	0.013
	[0.017]	[0.017]	[0.017]	[0.018]
State unemployment rate	-0.056***	-0.057***	-0.057***	-0.054***
	[0.010]	[0.010]	[0.010]	[0.011]
Change in state housing prices	0.009***	0.009***	0.009***	0.009***
	[0.003]	[0.003]	[0.003]	[0.003]
Constant	1.688***	1.698***	1.694***	1.624***
	[0.554]	[0.558]	[0.572]	[0.582]
Observations	598,017	598,017	598,017	598,017
Number of banks	443	443	443	443
R^2	0.214	0.214	0.214	0.214

Table 8. Loan Risk Rating, the Federal Funds Rate, and Bank Capital and State Cyclicality

This table reports the results of estimating panel regressions of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011. The dependent variable is the internal risk rating assigned by the bank a given loan, as reported in the Federal Reserve's Survey of Terms of Business Lending (STBL). All other variables are defined as in Table 4 (Panel A). The sample in columns (1) and (3) are loans by banks located in states where state income growth is highly correlated with US GDP growth (i.e., above median correlation). The sample in columns (2) and (4) are loans by banks located in states where state income growth is not highly correlated with US GDP growth. The sample in columns (5) and (7) are loans by banks located in states where state income growth more volatile (i.e., volatility above median). The sample in columns (6) and (8) are loans by small banks located in states where state income growth is less volatile. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1) States with high correlation with US GDP	(2) States with low correlation with US GDP	(3) States with high correlation with US GDP	(4) States with low correlation with US GDP	(5) States with high income growth volatility	(6) States with low income growth volatility	(7) States with high income growth volatility	(8) States with low income growth volatility
Target federal funds rate	-0.037**	-0.021***	-0.018	0.009	-0.024***	-0.032**	-0.015**	0.005
	[0.014]	[0.004]	[0.016]	[0.008]	[0.003]	[0.014]	[0.006]	[0.016]
Tier 1 capital ratio	0.707	-1.153*	0.995	-0.736	0.173	-0.829	0.306	-0.265
	[0.918]	[0.637]	[0.930]	[0.590]	[0.360]	[0.751]	[0.373]	[0.739]
Tier 1 capital ratio ×			-0.226*	-0.349***			-0.111	-0.436***
target federal funds rate			[0.131]	[0.095]			[0.067]	[0.151]
Bank size	0.019	0.078***	0.020	0.081***	0.049***	0.036	0.050***	0.039
	[0.044]	[0.009]	[0.044]	[0.010]	[0.007]	[0.048]	[0.007]	[0.049]
Loan size	-0.043***	-0.001	-0.043***	-0.002	0.002	-0.039***	0.002	-0.039***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]	[0.003]	[0.003]
Dummy for secured	0.260***	0.191***	0.259***	0.191***	0.193***	0.253***	0.193***	0.252***
loans	[0.012]	[0.010]	[0.012]	[0.010]	[0.014]	[0.009]	[0.014]	[0.009]
Loan maturity	-0.019***	-0.018***	-0.019***	-0.018***	-0.020***	-0.018***	-0.020***	-0.018***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]
State personal income	0.000	-0.000***	0.000	-0.000***	-0.000***	0.000	-0.000***	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.002	0.009	0.002	0.008	-0.002	0.010	-0.003	0.010
	[0.014]	[0.006]	[0.014]	[0.007]	[0.004]	[0.014]	[0.004]	[0.014]
State unemployment rate	-0.031**	0.005	-0.032**	0.001	0.012**	-0.025**	0.011**	-0.027**
	[0.012]	[0.008]	[0.013]	[0.008]	[0.005]	[0.012]	[0.005]	[0.012]
Change in state housing	0.007	0.000	0.007	0.000	0.001	0.007*	0.001	0.007*
prices	[0.004]	[0.003]	[0.004]	[0.003]	[0.003]	[0.004]	[0.003]	[0.004]
Constant	3.651***	1.982***	3.612***	2.166***	2.430***	3.362***	2.403***	3.284***
	[0.738]	[0.167]	[0.740]	[0.179]	[0.144]	[0.802]	[0.145]	[0.822]
Observations	561,642	432,645	56,1642	432,645	371,190	623,097	371,190	623,097
Number of banks	283	193	283	193	184	297	184	297
R^2	0.212	0.147	0.212	0.147	0.140	0.207	0.140	0.207

Table 9. Loan Risk Ratings, the Federal Funds Rate, and Bank Capital during Periods of Bank Distress

This table reports the results of estimating panel regressions of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011 including interactions between the target federal funds rate and bank capital ratios splitting the sample between financial crisis periods (2008-2010) and other periods. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. Fraction of bank failures is taken from the FDIC and is computed relative to the number of insured banks. All other variables are defined as in Table 4. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1) Crisis years	(2) Non-crisis years	(3) Crisis years	(4) Non-crisis years	(5) Years with many bank failures	(6) Years with few bank failures	(7) Years with many bank failures	(8) Years with few bank failures
Target federal funds	-0.031*	0.008	-0.042*	-0.007	0.026	0.017*	0.018	0.009
rate	[0.016]	[0.011]	[0.022]	[0.020]	[0.024]	[0.008]	[0.027]	[0.014]
Tier 1 capital ratio	0.757	0.056			-0.712	0.148		
	[0.703]	[0.605]			[0.507]	[0.727]		
Tier 1 capital ratio ×	0.263*	-0.549***			0.063	-0.394***		
target federal funds rate	[0.133]	[0.109]			[0.187]	[0.096]		
Total capital ratio			1.316*	0.662			-0.003	1.414**
			[0.605]	[0.498]			[0.483]	[0.664]
Total capital ratio ×			0.291	-0.259**			0.139	-0.202**
target federal funds rate			[0.194]	[0.123]			[0.190]	[0.094]
Bank size	0.075*	0.079***	0.067*	0.070***	0.089**	0.040	0.074*	0.043*
	[0.038]	[0.015]	[0.034]	[0.014]	[0.040]	[0.024]	[0.038]	[0.024]
Loan size	-0.020***	-0.024***	-0.020***	-0.024***	-0.021***	-0.023***	-0.021***	-0.023***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Dummy for secured	0.212***	0.241***	0.212***	0.241***	0.217***	0.242***	0.217***	0.242***
Loans	[0.012]	[0.009]	[0.012]	[0.009]	[0.009]	[0.010]	[0.009]	[0.010]
Loan maturity	-0.024***	-0.017***	-0.024***	-0.017***	-0.025***	-0.016***	-0.025***	-0.016***
	[0.003]	[0.001]	[0.003]	[0.001]	[0.003]	[0.001]	[0.003]	[0.001]
State personal income	0.000	0.000	0.000	-0.000*	-0.000***	0.000**	-0.000***	0.000**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.012***	0.012	0.011***	0.011	0.006	0.012	0.005	0.012
	[0.003]	[0.018]	[0.003]	[0.018]	[0.004]	[0.019]	[0.004]	[0.018]
State unemployment	0.014	-0.042**	0.010	-0.040**	0.038***	0.094***	0.036**	0.097***
rate	[0.008]	[0.016]	[0.009]	[0.016]	[0.012]	[0.024]	[0.013]	[0.023]
Change in state housing	-0.006***	0.000	-0.006***	0.001	-0.006***	0.004	-0.006***	0.004
prices	[0.002]	[0.003]	[0.002]	[0.003]	[0.001]	[0.005]	[0.001]	[0.005]
Constant	2.007**	2.746***	2.119***	2.821***	1.843**	2.479***	2.118***	2.256***
	[0.675]	[0.247]	[0.600]	[0.234]	[0.650]	[0.310]	[0.609]	[0.325]
Observations	254,761	739,526	254,761	739,526	348,329	645,958	348,329	645,958
Number of banks	301	459	301	459	312	386	312	386
R^2	0.200	0.194	0.201	0.193	0.192	0.206	0.192	0.206

Table 10. Loan Risk Ratings, Bank Capital, and Regional Monetary Policy Conditions

This table reports the results of estimating panel regressions of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011 including regional measures of monetary policy conditions. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. In columns 1 and 2, regional monetary policy conditions are measured as the difference between the nominal target federal funds rate minus the change in regional CPI. In columns 3 and 4, regional monetary policy conditions are measured as the difference between the nominal target federal funds rate and the nominal rate implied by a simple Taylor rule applied to the state where the bank is headquartered, regional inflation + 0.5×(regional inflation – 2%) + 0.5×(log(state income) – trend log(state income)). All other variables are defined as in Table 4. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)
Target federal funds rate minus change in region CPI	-0.031***	-0.007		
	[0.008]	[0.009]		
Deviation from regional Taylor rule			-0.031***	-0.012
			[0.008]	[0.009]
Tier 1 capital ratio	-0.107	0.033	-0.098	0.167
	[0.453]	[0.445]	[0.452]	[0.432]
Tier 1 capital ratio × Target federal funds rate minus change in region CPI		-0.274***		
		[0.083]		
Tier 1 capital ratio × Deviation from regional Taylor rule				-0.217***
				[0.080]
Bank size	0.081***	0.082***	0.081***	0.083***
	[0.013]	[0.013]	[0.013]	[0.013]
Loan size	-0.024***	-0.024***	-0.024***	-0.024***
	[0.002]	[0.002]	[0.002]	[0.002]
Dummy for secured loans	0.227***	0.227***	0.227***	0.227***
	[0.008]	[0.008]	[0.008]	[0.008]
Loan maturity	-0.018***	-0.018***	-0.018***	-0.018***
	[0.001]	[0.001]	[0.001]	[0.001]
State personal income	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	-0.025**	-0.026**	-0.040***	-0.042***
	[0.012]	[0.012]	[0.014]	[0.015]
State unemployment rate	-0.021***	-0.022***	-0.020***	-0.021***
	[0.007]	[0.007]	[0.006]	[0.007]
Change in state housing prices	0.004	0.004	0.004	0.004*
	[0.002]	[0.002]	[0.002]	[0.002]
Constant	2.526***	2.497***	2.545***	2.507***
	[0.238]	[0.235]	[0.240]	[0.240]
Observations	994,287	994,287	994,287	994,287
Number of banks	475	475	475	475
R^2	0.183	0.183	0.183	0.183

Table 11. Loan Risk Rating, the Federal Funds Rate, Bank Capital, and the State of the Economy

This table reports panel regression estimates of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011 including interactions between the target federal funds rate and bank capital, as well as interactions between the target federal funds rate and both real U.S. GDP growth and a time-specific dummy for NBER recessions. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's Survey of Terms of Business Lending (STBL). All other variables are defined as in Panel A of Table 4. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)	(5)
Target federal funds rate	-0.021***	0.008	0.005	-0.019***	0.027
	[0.006]	[0.009]	[0.010]	[0.006]	[0.018]
Target federal funds rate × GDP growth	-0.003	-0.003	-0.003	-0.002	-0.004
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Target federal funds rate × NBER recession dummy	-0.028**	-0.029**	-0.031**	-0.030**	-0.022
	[0.013]	[0.013]	[0.013]	[0.013]	[0.022]
Tier 1 capital ratio	-0.780*	-0.360			
	[0.445]	[0.442]			
Tier 1 capital ratio × target federal funds rate		-0.329***			
		[0.084]			
Total capital ratio			0.250		
			[0.417]		
Total capital ratio × target federal funds rate			-0.212***		
			[0.070]		
Common stock-assets ratio				5.408***	
				[1.426]	
Common stock-assets ratio × target federal funds rate				-0.368**	
				[0.177]	
Market capitalization-assets ratio					0.584**
					[0.226]
Market capitalization ratio × target federal funds rate					-0.080**
					[0.039]
GDP growth	0.007	0.007	0.007	0.007	0.006
	[0.005]	[0.006]	[0.006]	[0.006]	[0.011]
NBER recession dummy	-0.020	-0.015	-0.006	-0.010	0.067
	[0.034]	[0.035]	[0.035]	[0.034]	[0.072]
Bank size	0.068***	0.069***	0.060***	0.071***	0.192***
	[0.023]	[0.022]	[0.021]	[0.021]	[0.042]
Loan size	-0.024***	-0.024***	-0.024***	-0.024***	-0.044***
	[0.001]	[0.002]	[0.002]	[0.001]	[0.003]
Dummy for secured loans	0.223***	0.223***	0.223***	0.223***	0.306***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.010]
Loan maturity	-0.018***	-0.018***	-0.018***	-0.018***	-0.009***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]
State personal income	-0.000***	-0.000***	-0.000***	-0.000***	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.003	0.003	0.003	0.003	0.018
	[0.009]	[0.009]	[0.009]	[0.009]	[0.018]
State unemployment rate	-0.024***	-0.025***	-0.025***	-0.026***	0.023*
	[0.005]	[0.005]	[0.005]	[0.005]	[0.012]

Table 11. Loan Risk Rating, the Federal Funds Rate, Bank Capital, and the State of the Economy (contd…)

Change in state housing prices	-0.002	-0.002	-0.002	-0.002	-0.005
	[0.002]	[0.002]	[0.002]	[0.002]	[0.005]
Constant	2.832***	2.802***	2.889***	2.704***	0.176
	[0.404]	[0.389]	[0.374]	[0.382]	[0.778]
Observations	994,287	994,287	994,287	994,287	374,192
Number of banks	0.185	0.186	0.185	0.186	0.197
R^2	475	475	475	475	118

Table 12. Loan Risk Rating, Bank Capital, and Long Periods of Low Interest Rates

This table reports the results of estimating panel regressions of bank loan risk ratings from the second quarter of 1997 to the fourth quarter of 2011 including a measure of the length of periods of low interest rates. The dependent variable is the internal risk rating assigned by the bank to a given loan, as reported in the Federal Reserve's STBL. Periods without increase in rates is the number of consecutive quarters without an increase in the target federal funds rate. All other variables are defined as in Table 4. All regressions include state- and bank-fixed effects. Standard errors clustered by quarter are reported in brackets. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)
Periods without increase in rates	0.005*	-0.001	-0.007*	0.006*
	[0.002]	[0.003]	[0.003]	[0.003]
Tier 1 capital ratio	0.633	0.459	-0.298	0.116
	[0.556]	[0.531]	[0.468]	[0.489]
Periods without increase in rates × tier 1 capital ratio		0.058*	0.080**	
		[0.029]	[0.033]	
Target federal funds rate			-0.031***	-0.024***
			[0.008]	[0.008]
Periods without increase in rates × target federal funds rate				-0.004**
				[0.002]
Bank size	0.093***	0.093***	0.082***	0.076***
	[0.014]	[0.014]	[0.012]	[0.014]
Loan size	-0.024***	-0.024***	-0.024***	-0.024***
	[0.002]	[0.002]	[0.002]	[0.002]
Dummy for secured loans	0.227***	0.227***	0.227***	0.227***
	[0.008]	[0.008]	[0.008]	[0.008]
Loan maturity	-0.019***	-0.019***	-0.018***	-0.018***
	[0.001]	[0.001]	[0.001]	[0.001]
State personal income	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
Change in region CPI	0.005	0.005	0.007	0.010
	[0.008]	[0.008]	[0.010]	[0.009]
State unemployment rate	0.003	0.003	-0.020***	-0.025***
	[0.005]	[0.005]	[0.006]	[0.007]
Change in state housing prices	0.006**	0.006**	0.004	0.001
	[0.003]	[0.003]	[0.002]	[0.002]
Constant	2.045***	2.063***	2.517***	2.610***
	[0.247]	[0.244]	[0.219]	[0.245]
Observations	994,287	994,287	994,287	994,287
Number of banks	475	475	475	475
R^2	0.182	0.182	0.183	0.183

Appendix Table 1. Frequency of Keywords Appearing in FOMC Minutes

Keyword	# of times the keyword was used in FOMC meetings from 1997Q2—2011Q4		# of times the keyword was used in FOMC meetings from 1997Q2—2006Q4		# of times the keyword was used in FOMC meetings from 2007Q1—2011Q4		Frequency of times the keyword was used in FOMC meetings from 1997Q2—2006Q4		Frequency of times the keyword was used in FOMC meetings from 2007Q1—2011Q4	
	Conservative	Liberal	Conservative	Liberal	Conservative	Liberal	Conservative	Liberal	Conservative	Liberal
Bank risk	0	0	0	0	0	0	0.000	0.000	0.000	0.000
Banking risk	0	0	0	0	0	0	0.000	0.000	0.000	0.000
Banking sector	10	14	1	1	9	13	0.026	0.026	0.450	0.650
Banking system	15	19	3	3	12	16	0.077	0.077	0.600	0.800
Condition of the banking system	2	2	2	2	0	0	0.051	0.051	0.000	0.000
Financial conditions	112	351	74	187	39	167	1.897	4.795	1.950	8.350
Financial stability	14	17	0	0	14	17	0.000	0.000	0.700	0.850
Financial system	11	19	1	2	10	17	0.026	0.051	0.500	0.850
Health of the banking system	0	0	0	0	0	0	0.000	0.000	0.000	0.000
Risks to the financial system	1	1	0	0	1	1	0.000	0.000	0.050	0.050
Stability of the financial system	2	3	0	0	2	3	0.000	0.000	0.100	0.150
Systemic	2	4	0	0	2	4	0.000	0.000	0.100	0.200
Systemic risk	0	0	0	0	0	0	0.000	0.000	0.000	0.000
Troubles of the banking system	1	1	0	0	1	1	0.000	0.000	0.050	0.050

Notes: Frequency is determined as the number of times a word has been used within a time period divided by the number of quarters in that time period. Conservative = the number of reports the word appears in (if a word appears several times in a report, that's not counted). Liberal = the total number of times the word appears in the reports.

Source: FOMC Minutes