

Monetary Policy and Bank Lending Terms: Evidence from a Survey of U.S. Loans

by

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Madrid, May 24, 2017

* Our views not necessarily reflect those of the IMF, IMF Board, ECB, Federal Reserve System, or its Board of Governors

Motivation

- Renewed debate: is accommodating monetary policy setting the stage for future crises? (e.g., Rajan (2010))
- Interest rate and unconventional monetary policy affects the quality of credit
- Risk-taking channel of monetary policy

Existing literature

- Theoretical work:
 - Adrian and Shin (2010), Acharya, and Naqvi (2012), Diamond and Rajan (2012), Dell’Ariccia, Laeven, and Marquez (2013)

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 - Adrian and Shin (2010), Acharya, and Naqvi (2012), Diamond and Rajan (2012), Dell’Ariccia, Laeven, and Marquez (2013)
- Empirical work:
 - Non-U.S. data: Ioannidou, Ongena, and Peydró (2009), Altunbas, Gambacorta, and Marques-Ibañez (2010), Maddaloni and Peydró (2011), Jimenez et al. (2011)
 - U.S. data: Paligorova and Santos (2012), Delis et al. (2012), Dell’Ariccia, Laeven, and Suarez (2014), Chodorow-Reich (2014).

Preview of results

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2. We find that, controlling the ex-ante riskiness of the loans, lending terms tend to be easier when monetary policy is more accommodating
3. These results are stronger for banks that are likely to be more sensitive to short-term interest rates or fluctuations in the price of securities

Outline

1. Data: Survey of Terms of Business Lending
2. Empirical strategy
3. Results
4. Conclusions

Data: Survey of Terms of Business Lending

- Loan-level data from the Fed's Survey of Terms of Business Lending (STBL) supplemented with Call Report data for individual banks.
- STBL: Banks report data on all individual new loans extended on the first business week of the middle month of the quarter since 1977.
- Since 1997, the STBL has asked banks to report the internal risk rating of each new loan

Data: Survey of Terms of Business Lending

The internal risk rating for the loan is an increasing, discrete index of loan riskiness:

1 = Minimal risk

2 = Low risk

3 = Moderate risk

4 = Acceptable risk

5 = Special mention or classified asset

Empirical strategy

Baseline regression 1 (conventional monetary policy):

$$Terms_{kit} = \alpha_i + \lambda_j + \beta r_t + \theta X_{kit} + \mu W_{it} + \rho Z_{jt} + \gamma M_t + \varepsilon_{kit}$$

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- r_t is the fed funds rate

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- r_t is the fed funds rate
- X_{kit} , W_{it} , Z_{jt} , M_t are loan, bank, region, and macro controls

Empirical strategy

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- $Terms_{kit}$ represents terms of loan k by originated by bank i in quarter t : spread, collateralization
- r_t is the fed funds rate
- X_{kit} , W_{it} , Z_{jt} , M_t are loan, bank, region, and macro controls
- X_{kit} includes the ex-ante loan risk rating

Empirical strategy

Example of baseline regression 1 (conventional monetary policy):

$$Spread_{kit} = \alpha_i + \lambda_j + \beta r_t + \theta X_{kit} + \mu W_{it} + \rho Z_{jt} + \gamma M_t + \varepsilon_{kit}$$

If $\beta > 0$, terms are tighter (easier) when short-term interest rates are higher (lower)

$\beta > 0$ provides evidence for the risk-taking channel of monetary policy

Empirical strategy

Baseline regression 2 (unconventional monetary policy):

$$\begin{aligned} Terms_{kit} = & \alpha_i + \lambda_j + \beta Fed\ holdings_t + \theta X_{kit} + \mu W_{it} + \rho Z_{jt} \\ & + \gamma M_t + \varepsilon_{kit} \end{aligned}$$

- *Fed holdings_t* is the ratio of Federal Reserve holdings of Treasury securities to nominal GDP

Empirical strategy

Additional tests:

$$Terms_{kit} = \alpha_j + \lambda_j + \tau_t + \delta Monetary Policy_t * v_{it} + \theta X_{kit} + \mu W_{it} + \rho Z_{jt} + \varepsilon_{kit}$$

- v_{it} is a bank characteristic (included in the vector X_{kit}).
- Monetary policy is the federal funds rate or Federal Reserve asset holdings
- τ_t are time-fixed effects.

Baseline regression: interest rates

	Dependent variable	
	Loan spread	Dummy for secured loan
Target federal funds rate	0.037*** (0.016)	0.007*** (0.002)
Bank and region fixed effects?	Yes	Yes
Region and macro controls?	Yes	Yes
Bank controls?	Yes	Yes
Loan controls?	Yes	Yes
R^2	0.321	0.212
Obs	1,438,826	1,438,824

Additional results: interest rates

	Dependent variable			
	Loan spread	Dummy for secured loan	Loan spread	Dummy for secured loan
Short-term deposits/Deposits × target federal funds	0.546*** (0.103)	0.040** (0.017)		
Bank capital × target federal funds			-3.782*** (0.996)	0.052 (0.067)
R^2	0.337	0.214	0.337	0.214
Obs	1,438,826	1,438,824	1,438,826	1,121,510

Baseline regression: Asset holdings

	Dependent variable	
	Loan spread	Dummy for secured loan
Federal Reserve holdings/GDP	-2.703*** (1.059)	0.273 (0.244)
Bank and region fixed effects?	Yes	Yes
Region and macro controls?	Yes	Yes
Bank controls?	Yes	Yes
Loan controls?	Yes	Yes
R^2	0.374	0.316
Obs	472,034	472,034

Additional results: Asset holdings

	Dependent variable			
	Loan spread	Dummy for secured loan	Loan spread	Dummy for secured loan
Bank security holdings/assets × Federal Reserve holdings/GDP	-10.392*** (3.458)	-6.039* (3.464)		
Bank capital × Federal Reserve holdings /GDP			-312.147*** (87.982)	5.739 (4.908)
R^2	0.377	0.321	0.380	0.319
Obs	472,034	472,034	472,034	472,034

Conclusions

- Evidence that banks lending terms are correlated with monetary policy, controlling for the riskiness of loans
- The evidence suggest that lending spreads are lower when interest rates are lower and when the central bank asset holdings are higher
- This relationships appear stronger for banks that appear to be ex-ante more sensitive to monetary policy

END

Additional slides

Federal Reserve Asset Holdings

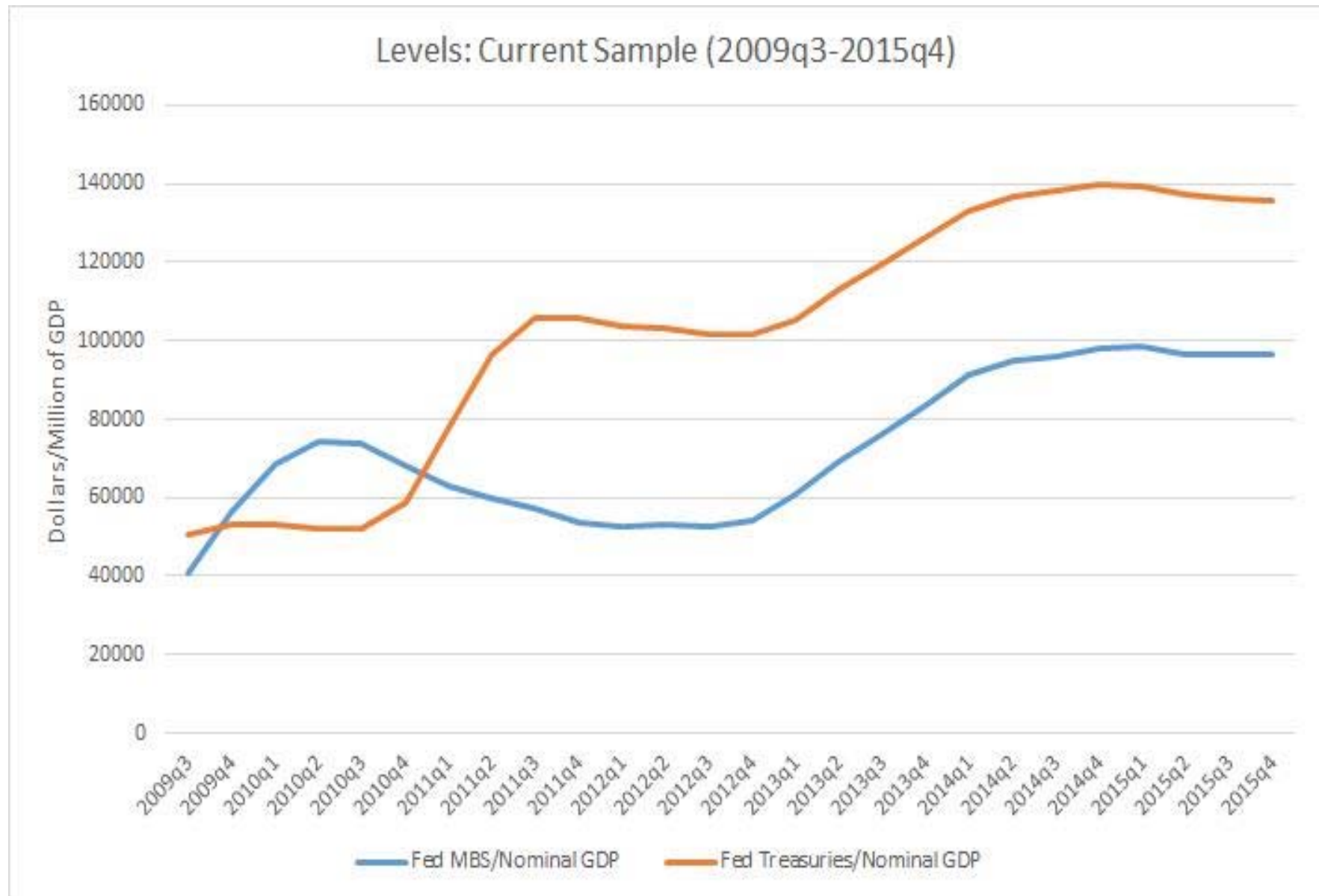


Table 1: Summary statistics

	Observations	Average	25 th percentile	75 th percentile	Standard deviation
<i>Loan-level variables</i>					
Loan spread (in percentage points)	1,438,832	0.648	-0.161	1.391	1.525
Dummy for loans secured by collateral	1,438,830	0.828	1	1	0.378
Risk rating	1,438,832	3.279	3	4	0.849
Loan size (dollars)	1,438,832	477,770	17,845	140,000	5,244,079
<i>Bank-level variables</i>					
Bank total assets (\$ millions)	15,006	25,385	381	6180	130,100
Leverage ratio	15,006	0.006	0.001	0.007	0.012
Net income / assets	15,006	0.006	0.003	0.009	0.008
Liquid assets / assets	15,006	0.024	0.012	0.032	0.018
Deposits / assets	15,006	0.788	0.738	0.860	0.097
Short-term deposits / deposits	15,006	0.015	0	0	0.064
Non-retail deposits / deposits	15,006	0.337	0.169	0.369	0.666
Loans / assets	15,006	0.638	0.566	0.733	0.142
C&I loans / loans	15,006	0.215	0.129	0.273	0.124
<i>Regional variables</i>					
State personal income growth (%)	3291	4.247	2.161	6.581	4.964
Change in region CPI (%)	300	2.131	1.040	3.480	2.126
State unemployment rate (%)	3,291	5.621	4.200	6.600	2.028
Change in state housing prices (%)	3291	3.292	0.246	6.940	7.095
<i>Nationwide variables</i>					
Target federal funds rate (%)	75	2.398	0.125	4.916	2.283
Real GDP growth (%)	75	4.112	3.067	5.797	2.826
NBER recession	75	0.107	0	0	0.311

Table 1: Summary statistics (2)

	Observations	Average	25 th percentile	75 th percentile	Standard deviation
<i>Loan-level variables</i>					
Loan spread (in percentage points)	472,034	0.482	-0.301	1.116	1.634
Dummy for loans secured by collateral	474,711	0.908	1	1	0.289
Risk rating	474,711	3.139	3	4	0.862
Loan size (dollars)	474,711	317,081	27,118	128,997	6,000,118
<i>Bank-level variables</i>					
Bank total assets (\$ millions)	5,501	36,936	559	6,213	182,697
Treasury and MBS holdings / assets	5,501	0.142	0.084	0.184	0.089
Leverage ratio	5,501	0.005	0.001	0.004	0.012
Net income / assets	5,501	0.005	0.002	0.008	0.008
Liquid assets / assets	5,501	0.014	0.008	0.017	0.012
Deposits / assets	5,501	0.812	0.774	0.864	0.071
Short-term deposits / deposits	5,501	0.005	0	0	0.024
Non-retail deposits / deposits	5,501	0.317	0.155	0.340	0.618
Loans / assets	5,501	0.635	0.575	0.726	0.140
C&I loans / loans	5,501	0.192	0.116	0.242	0.107
<i>Regional variables</i>					
State personal income growth (%)	1,172	3.609	1.619	5.699	4.848
Change in region CPI (%)	108	1.642	0.488	2.735	1.720
State unemployment rate (%)	1,172	7.211	5.600	8.600	2.207
Change in state housing prices (%)	1,172	1.666	-2.266	5.971	7.202
<i>Nationwide variables</i>					
Treasury Holdings / nominal GDP	27	0.101	0.059	0.136	0.0338
MBS Holdings / nominal GDP	27	0.071	0.054	0.095	0.020
Target federal funds rate (%)	27	0.126	0.125	0.125	0.008
Real GDP growth (%)	27	3.457	2.089	5.054	2.044
NBER recession	27	0.037	0	0	0.192

Table 2: Terms and interest rates

	Dependent variable	
	Loan spread	Dummy for secured loans
	(1)	(2)
Target federal funds rate	0.037** [0.016]	0.007*** [0.002]
Loan risk rating	0.355*** [0.012]	0.051*** [0.003]
Loan size	-0.269*** [0.007]	-0.005*** [0.001]
Bank size	-0.273*** [0.038]	0.012** [0.005]
Bank leverage ratio	2.624*** [0.717]	0.259* [0.130]
Bank net income / assets	-5.883*** [1.690]	-0.142 [0.267]
Bank liquid assets / assets	2.406** [1.127]	-0.211 [0.215]
Bank deposits / assets	-0.348 [0.215]	0.092** [0.040]
Short-term deposits / deposits	-1.026*** [0.245]	-0.259*** [0.053]
Non-retail deposits / deposits	-0.086** [0.042]	-0.014 [0.009]
Bank loans / assets	1.155*** [0.191]	0.189*** [0.039]
Bank C&I loans / loans	-0.447** [0.206]	0.140*** [0.033]
State personal income growth	0.005** [0.003]	-0.000 [0.000]
Change in region CPI	-0.011 [0.007]	-0.003 [0.002]
State unemployment rate	0.124*** [0.014]	0.012*** [0.002]
Change in state housing prices	0.001 [0.002]	0.000 [0.000]
GDP growth	0.004 [0.007]	-0.001 [0.001]
NBER recession dummy	0.031 [0.038]	-0.008 [0.007]
Constant	5.568*** [0.808]	0.030 [0.100]
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Time fixed effects	No	No
Observations	1,438,826	1,438,824
Number of banks	612	612
R ²	0.321	0.212

Table 3: Sensitivity to interest rates

	Dependent variable	
	Loans spread	Dummy for secured loan
	(1)	(2)
Target federal funds rate x short-term deposits / deposits	0.546*** (0.103)	0.040** (0.017)
Loan risk rating	0.363*** (0.011)	0.052*** (0.003)
Loan size	-0.270*** (0.007)	-0.005*** (0.001)
Bank size	-0.121*** (0.043)	0.018** (0.008)
Bank leverage ratio	53.128*** (14.746)	1.013*** (0.379)
Bank net income / assets	-6.230*** (1.771)	-0.053 (0.430)
Bank liquid assets / assets	1.973* (1.088)	-0.189 (0.208)
Bank deposits / assets	0.024 (0.201)	0.065 (0.047)
Short-term deposits / deposits	-3.317*** (0.578)	-0.474*** (0.096)
Non-retail deposits / deposits	0.050 (0.046)	-0.004 (0.010)
Bank loans / assets	0.669*** (0.133)	0.143*** (0.038)
Bank C&I loans / loans	-0.855*** (0.188)	0.096** (0.037)
State personal income growth	0.001 (0.003)	-0.001 (0.001)
Change in region CPI	-0.020 (0.015)	-0.007 (0.005)
State unemployment rate	-0.017 (0.014)	0.015*** (0.004)
Change in state housing prices	0.002 (0.002)	0.000 (0.001)
Constant	4.268*** (0.781)	0.043 (0.134)
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	1,438,826	1,438,824
Number of banks	612	612
R ²	0.337	0.214

Table 4: Bank capital

	Dependent variable	
	Loans spread	Dummy for secured loan
	(1)	(2)
Target federal funds rate x Leverage ratio	-3.782*** [0.996]	0.052 [0.067]
Loan risk rating	0.362*** [0.011]	0.052*** [0.003]
Loan size	-0.270*** [0.007]	-0.005*** [0.001]
Bank size	-0.152*** [0.044]	0.016** [0.008]
Bank leverage ratio	55.496*** [14.555]	0.984*** [0.369]
Bank net income / assets	-6.221*** [1.932]	-0.101 [0.432]
Bank liquid assets / assets	2.382** [1.163]	-0.146 [0.210]
Bank deposits / assets	0.103 [0.185]	0.066 [0.047]
Short-term deposits / deposits	-0.764*** [0.232]	-0.274*** [0.053]
Non-retail deposits / deposits	0.008 [0.040]	-0.005 [0.010]
Bank loans / assets	0.855*** [0.150]	0.147*** [0.038]
Bank C&I loans / loans	-0.618*** [0.179]	0.107*** [0.036]
State personal income growth	0.001 [0.003]	-0.001 [0.001]
Change in region CPI	-0.026* [0.015]	-0.007 [0.005]
State unemployment rate	-0.011 [0.014]	0.015*** [0.004]
Change in state housing prices	0.000 [0.002]	0.000 [0.001]
Constant	4.641*** (0.762)	0.073 (0.134)
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	1,438,826	1,438,824
Number of banks	612	612
R ²	0.337	0.214

Table 5: Federal Reserve assets

	Dependent variable	
	Loan spreads	Dummy for secured loans
	(1)	(2)
Federal Reserve treasury holdings	-2.703** (1.059)	0.273 (0.244)
Loan risk rating	0.370*** (0.025)	0.037*** (0.006)
Loan size	-0.220*** (0.009)	0.002 (0.001)
Bank size	-0.172 (0.184)	-0.070** (0.027)
Bank leverage ratio	121.529*** (33.299)	-1.092** (0.423)
Bank net income / assets	-3.261* (1.735)	-0.740*** (0.254)
Bank liquid assets / assets	-22.070*** (7.213)	0.918 (1.089)
Bank deposits / assets	-3.055*** (0.551)	-0.065 (0.150)
Short-term deposits / deposits	-4.000*** (1.336)	-0.615 (0.505)
Bank loans / assets	1.244*** (0.190)	0.334** (0.135)
Bank C&I loans / loans	-2.003*** (0.305)	-0.008 (0.044)
State personal income growth	-0.000 (0.003)	-0.001 (0.001)
Change in region CPI	-0.000 (0.007)	-0.007** (0.002)
State unemployment rate	0.055** (0.021)	-0.001 (0.004)
Change in state housing prices	0.004* (0.002)	-0.000 (0.001)
GDP growth	-0.006 (0.009)	-0.005** (0.002)
NBER recession dummy	-0.255*** (0.057)	-0.056*** (0.014)
Constant	6.618** (3.061)	1.896*** (0.346)
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Time fixed effects	No	No
Observations	472,034	472,034
Number of banks	318	318
R ²	0.374	0.316

Table 6: Bank asset holdings

	Dependent Variable	
	Loans spread	Dummy for secured loan
	(1)	(2)
Federal Reserve treasury holdings x Bank Securities Holdings / assets	-10.392*** (3.458)	-6.039* (3.464)
Loan risk rating	0.374*** (0.024)	0.038*** (0.006)
Loan size	-0.218*** (0.009)	0.002 (0.001)
Bank size	0.100 (0.207)	-0.084* (0.044)
Bank leverage ratio	121.222*** (33.041)	-1.766*** (0.363)
Bank net income / assets	-2.062 (2.326)	-0.822 (0.915)
Bank liquid assets / assets	-19.991** (8.007)	0.309 (1.271)
Bank deposits / assets	-1.522** (0.735)	-0.034 (0.256)
Short-term deposits / deposits	-2.448 (1.449)	-0.500 (0.527)
Bank loans / assets	-2.118*** (0.348)	-0.023 (0.051)
Bank C&I loans / loans	-0.005 (0.005)	-0.001 (0.002)
State personal income growth	-0.056** (0.020)	-0.005 (0.013)
Change in region CPI	-0.070*** (0.025)	-0.010 (0.007)
State unemployment rate	0.003 (0.003)	-0.001 (0.001)
Change in state housing prices	1.777 (3.511)	2.327*** (0.836)
Constant	-10.392*** (3.458)	-6.039* (3.464)
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	472,034	472,034
Number of banks	318	318
R ²	0.377	0.321

Table 7: Bank capital

	Dependent Variable	
	Loans spread	Dummy for secured loan
	(1)	(2)
Federal Reserve treasury holdings x Leverage ratio	312.147*** (87.982)	5.739 (4.908)
Loan risk rating	0.374*** (0.024)	0.038*** (0.006)
Loan size	-0.218*** (0.009)	0.002 (0.001)
Bank size	0.112 (0.206)	-0.059 (0.035)
Bank leverage ratio	57.014 (35.802)	-2.358* (1.191)
Bank net income / assets	-3.377* (1.902)	-0.849 (0.899)
Bank liquid assets / assets	-22.169*** (7.528)	0.511 (1.241)
Bank deposits / assets	-0.982 (0.644)	0.051 (0.275)
Short-term deposits / deposits	-3.168** (1.276)	-0.605 (0.533)
Bank loans / assets	1.516*** (0.209)	0.334** (0.149)
Bank C&I loans / loans	-1.646*** (0.285)	0.003 (0.057)
State personal income growth	-0.006 (0.005)	-0.001 (0.002)
Change in region CPI	-0.060*** (0.020)	-0.006 (0.013)
State unemployment rate	-0.059** (0.024)	-0.009 (0.007)
Change in state housing prices	0.001 (0.003)	-0.001 (0.002)
Constant	0.689 (3.478)	1.642** (0.650)
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	472,034	472,034
Number of banks	318	318
R ²	0.380	0.319

Table 8: Federal Reserve MBS holdings

	Dependent variable	
	Loan spread	Dummy for secured loan
	(1)	(2)
Federal Reserve MBS holdings	-3.742*** (1.181)	-0.268 (0.434)
Loan risk rating	0.372*** (0.025)	0.037*** (0.006)
Loan size	-0.219*** (0.009)	0.002 (0.001)
Bank size	-0.210 (0.180)	-0.056** (0.025)
Bank leverage ratio	123.032*** (33.422)	-1.133*** (0.407)
Bank net income / assets	-3.989** (1.560)	-0.676** (0.250)
Bank liquid assets / assets	-21.679*** (7.422)	0.915 (1.029)
Bank deposits / assets	-2.752*** (0.613)	-0.006 (0.172)
Short-term deposits / deposits	-3.399** (1.354)	-0.607 (0.500)
Bank loans / assets	1.241*** (0.182)	0.339** (0.137)
Bank C&I loans / loans	-2.026*** (0.323)	-0.009 (0.044)
State personal income growth	0.002 (0.003)	-0.000 (0.001)
Change in region CPI	-0.013 (0.009)	-0.007** (0.003)
State unemployment rate	0.061*** (0.016)	-0.006 (0.005)
Change in state housing prices	-0.000 (0.003)	-0.001 (0.001)
GDP growth	-0.002 (0.009)	-0.004* (0.002)
NBER recession dummy	-0.301*** (0.052)	-0.071*** (0.021)
Constant	7.064** (3.050)	1.681*** (0.327)
Bank fixed effects	Yes	Yes
State fixed effects	Yes	Yes
Time fixed effects	No	No
Observations	472,034	472,034
Number of banks	318	318
R ²	0.374	0.316