

Short-Term Interest Rates and Bank Lending Terms: Evidence from a Survey of U.S. Loans

by

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

Motivation

- Renewed debate: are low interest rates setting the stage for future crises? (e.g., Rajan (2010))
- Interest rate policy affects the quality and not just the quantity 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)

Preview of results

1. We use confidential loan-level data from the Fed's Survey of Terms of Business Lending (STBL) to measure how US bank lending terms change controlling for the riskiness of their loans

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2. We find that, controlling the ex-ante riskiness of the loans, lending terms tend to be easier when interest rates are lower
3. These results are stronger for banks that are likely to be more sensitive to short-term interest rates

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:

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

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- 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:

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

Empirical strategy

Example of baseline regression 1:

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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:

$$\sigma_{kit} = \alpha_i + \lambda_j + \tau_t + \delta r_t * v_{it} + \theta X_{kit} + \mu W_{it} + \rho Z_{jt} + \varepsilon_{kit}$$

- v_{it} is a bank characteristic (included in the vector X_{kit}).
- τ_t are time-fixed effects.

Baseline regression 1

	Dependent variable		
	Loan spread	Dummy for secured loan	Loan maturity
Target federal funds rate	0.037*** (0.012)	0.008*** (0.002)	0.013 (0.010)
Bank and region fixed effects?	Yes	Yes	Yes
Region and macro controls?	Yes	Yes	Yes
Bank controls?	Yes	Yes	Yes
Loan controls?	Yes	Yes	Yes
R^2	0.331	0.183	0.130
Obs	1,121,510	1,121,510	773,814

Baseline regression 2

	Dependent variable			
	Loan spread	Dummy for secured loan	Loan spread	Dummy for secured loan
Short-term deposits/Deposits	-1.677*** (0.416)	0.681* (0.375)		
Short-term deposits/Deposits × target federal funds	0.201*** (0.063)	0.175** (0.086)		
Loan risk rating			0.319*** (0.014)	0.028*** (0.003)
Loan risk rating × target federal funds			0.022*** (0.003)	0.008*** (0.001)
R^2	0.338	0.132	0.338	0.186
Obs	1,121,510	1,121,510	1,121,510	1,121,510

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	Loan spread	Dummy for secured loan	Loan spread	Dummy for secured loan
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Robustness

	Dependent variable			
	Loan spreads	Dummy for secured loan	Loan spread	Dummy for secured loan
Taylor rule residual (traditional rule)	0.034*** (0.013)	0.005*** (0.002)		
Taylor rule residual (<i>expanded</i> rule)			0.019* (0.011)	0.003* (0.009)
R^2	0.330	0.183	0.212	0.147
Obs	1,121,510	1,121,510	941,063	941,063

Conclusions

- Evidence that banks lending terms vary with short-term interest rates, controlling for the riskiness of loans
- The evidence suggest that lending spreads and the probability of loan collateralization increase are lower when interest rates are lower
- This negative relationship is stronger for banks that appear to be ex-ante more sensitive to interest rates

END

Additional slides

Table 1: Summary statistics

	Observations	Average	25 th percentile	75 th percentile	Standard deviation
<i>Loan-level variables</i>					
Loan spread (in percentage points)	1,121,510	0.754	0.074	1.425	1.444
Dummy for loans secured by collateral	1,121,508	0.807	1	1	0.395
Loan maturity (years)	773,814	1.427	0.315	1.567	2.130
Risk rating	1,112,510	3.306	3	4	0.837
Loan size (dollars)	1,121,510	520,529	14,800	142,285	4,703,035
<i>Bank-level variables</i>					
Bank total assets (\$ millions)	11,854	21,072	318	5,884	104,353
Tier 1 capital ratio	11,854	0.122	0.095	0.135	0.049
Net income / assets	11,854	0.006	0.003	0.010	0.009
Liquid assets / assets	11,854	0.027	0.014	0.035	0.019
Deposits / assets	11,854	0.779	0.724	0.858	0.103
Short-term deposits / deposits	11,854	0.018	0	0	0.071
Non-retail deposits / deposits	11,854	0.362	0.190	0.461	0.267
Loans / assets	11,854	0.641	0.566	0.737	0.141
C&I loans / loans	11,854	0.219	0.131	0.277	0.127
<i>Regional variables</i>					
State personal income growth (%)	2,604	2.114	-0.549	4.794	4.824
Change in region CPI (%)	236	2.386	1.112	3.985	2.908
State unemployment rate (%)	2,604	5.434	4.000	6.233	2.079
Change in state housing prices (%)	2,604	3.104	-0.523	7.739	8.356
<i>Nationwide variables</i>					
Target federal funds rate (%)	59	3.012	1.000	5.250	2.203
Real GDP growth (%)	59	2.257	1.318	3.600	2.837
NBER recession	59	0.186	0	0	0.393

Table 2: Terms of lending and the fed funds rate

	Dependent variable		
	Loan spread	Dummy for secured loan	Loan maturity
	(1)	(2)	(3)
Target federal funds rate	0.037*** [0.012]	0.008*** [0.002]	0.013 [0.010]
Loan risk rating	0.346*** [0.010]	0.056*** [0.004]	-0.026** [0.011]
Loan size	-0.275*** [0.007]	-0.006*** [0.001]	0.109*** [0.010]
Bank size	-0.088*** [0.032]	-0.030*** [0.006]	0.179*** [0.016]
Bank tier 1 capital ratio	3.754*** [0.571]	-0.106 [0.152]	2.677*** [0.807]
Bank net income / assets	-6.641*** [1.495]	0.277 [0.248]	-0.942 [1.828]
Bank liquid assets / assets	-2.158** [0.975]	-0.126 [0.286]	-4.556*** [0.839]
Bank deposits / assets	1.104*** [0.224]	0.068 [0.052]	0.659** [0.286]
Short-term deposits / deposits	-0.548*** [0.193]	-0.102* [0.053]	1.762*** [0.183]
Non-retail deposits / deposits	-0.08 [0.073]	-0.014 [0.015]	0.041 [0.079]
Bank loans / assets	0.799*** [0.115]	0.107** [0.046]	0.171 [0.173]
Bank C&I loans / loans	0.476** [0.184]	0.197*** [0.039]	0.361 [0.267]
State personal income growth	-0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]
Change in region CPI	-0.002 [0.006]	0 [0.001]	-0.005 [0.005]
State unemployment rate	0.099*** [0.011]	0.019*** [0.002]	-0.035*** [0.010]
Change in state housing prices	-0.002 [0.001]	0 [0.000]	-0.001 [0.002]
GDP growth	0.008 [0.006]	0.001 [0.001]	0.009* [0.005]
NBER recession dummy	0.012 [0.039]	-0.003 [0.005]	-0.007 [0.041]
Constant	2.043*** [0.690]	0.809*** [0.113]	-3.438*** [0.401]
Bank fixed effects	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
Observations	1,121,510	1,121,508	773,814
Number of banks	455	590	585
R ²	0.331	0.183	0.13

Table 3: Relationship by loan risk rating

	Dependent variable		
	Loan spread	Dummy for secured loan	Loan maturity
	(1)	(2)	(3)
Target federal funds rate × Loan risk rating	0.022*** [0.003]	0.008*** [0.001]	0.018*** [0.004]
Loan risk rating	0.319*** [0.014]	0.028*** [0.003]	-0.094*** [0.014]
Loan size	-0.265*** [0.007]	-0.005*** [0.001]	0.106*** [0.010]
Bank size	-0.142*** [0.030]	0.006 [0.009]	0.097*** [0.018]
Bank tier 1 capital ratio	1.888** [0.712]	-0.008 [0.156]	3.074*** [0.854]
Bank net income / assets	-8.708*** [1.586]	0.465 [0.367]	-4.038** [1.975]
Bank liquid assets / assets	0.635 [0.932]	-0.683** [0.266]	-3.072*** [1.034]
Bank deposits / assets	1.140*** [0.263]	0.117* [0.058]	0.203 [0.313]
Short-term deposits / deposits	-1.063*** [0.188]	-0.088 [0.055]	1.542*** [0.174]
Non-retail deposits / deposits	0.166* [0.091]	-0.005 [0.017]	0.031 [0.069]
Bank loans / assets	0.609*** [0.151]	0.075 [0.048]	0.243 [0.170]
Bank C&I loans / loans	-0.059 [0.180]	0.191*** [0.042]	0.572** [0.277]
State personal income growth	-0.000** [0.000]	0.000*** [0.000]	0 [0.000]
Change in region CPI	0.006 [0.015]	-0.002 [0.003]	0.006 [0.017]
State unemployment rate	-0.028** [0.012]	0.028*** [0.003]	-0.044*** [0.012]
Change in state housing prices	0.002 [0.002]	-0.001 [0.001]	0.001 [0.002]
GDP growth	0 [0.006]	0.007*** [0.002]	0.046** [0.018]
NBER recession dummy	-0.068 [0.047]	0.031*** [0.010]	0.062 [0.038]
Constant	4.176*** [0.607]	0.053 [0.184]	-1.478*** [0.372]
Bank fixed effects	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	1121510	1121508	773814
Number of banks	590	590	585
R ²	0.338	0.186	0.132

Table 4: By sensitivity to interest rates

	Dependent variable		
	Loan spread	Dummy for secured loan	Loan maturity
	(1)	(2)	(3)
Target federal funds rate × Short term deposits / deposits	0.201*** [0.063]	0.034* [0.020]	0.175** [0.086]
Loan risk rating	0.353*** [0.009]	0.056*** [0.004]	-0.028** [0.012]
Loan size	-0.279*** [0.007]	-0.006*** [0.001]	0.105*** [0.010]
Bank size	-0.074** [0.028]	0.005 [0.009]	0.101*** [0.018]
Bank tier 1 capital ratio	2.984*** [0.504]	-0.053 [0.157]	3.051*** [0.838]
Bank net income / assets	-6.054*** [1.539]	0.652* [0.356]	-3.878* [1.962]
Bank liquid assets / assets	-0.009 [0.798]	-0.719*** [0.265]	-3.095*** [1.017]
Bank deposits / assets	1.090*** [0.228]	0.099* [0.057]	0.131 [0.325]
Short-term deposits / deposits	-1.677*** [0.416]	-0.263** [0.113]	0.681* [0.375]
Non-retail deposits / deposits	0.096 [0.079]	-0.014 [0.016]	0.018 [0.070]
Bank loans / assets	0.581*** [0.102]	0.085* [0.047]	0.246 [0.166]
Bank C&I loans / loans	-0.114 [0.147]	0.168*** [0.045]	0.42 [0.290]
State personal income growth	-0.000*** [0.000]	0.000*** [0.000]	0 [0.000]
Change in region CPI	0.012 [0.012]	-0.002 [0.003]	0.006 [0.017]
State unemployment rate	-0.01 [0.011]	0.028*** [0.003]	-0.046*** [0.012]
Change in state housing prices	0.002 [0.001]	-0.001 [0.001]	0.001 [0.002]
GDP growth	-0.009 [0.007]	0.006*** [0.002]	0.044** [0.018]
NBER recession dummy	-0.023 [0.039]	0.031*** [0.009]	0.064* [0.037]
Constant	2.719*** [0.673]	0.002 [0.181]	-1.407*** [0.413]
Bank fixed effects	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	1121510	1121508	773814
Number of banks	590	590	585
R ²	0.338	0.185	0.132

Table 5: Taylor rule

	Dependent variable		
	Loan spread	Dummy for secured loan	Loan maturity
	(1)	(2)	(3)
Taylor rule residual	0.034*** [0.013]	0.005*** [0.002]	0.020* [0.010]
Loan risk rating	0.346*** [0.010]	0.056*** [0.004]	-0.025** [0.011]
Loan size	-0.275*** [0.007]	-0.006*** [0.001]	0.108*** [0.010]
Bank size	-0.098*** [0.031]	-0.033*** [0.006]	0.179*** [0.016]
Bank tier 1 capital ratio	3.818*** [0.552]	-0.095 [0.153]	2.735*** [0.798]
Bank net income / assets	-7.305*** [1.513]	0.152 [0.232]	-1.148 [1.793]
Bank liquid assets / assets	-2.214** [0.970]	-0.136 [0.285]	-4.578*** [0.813]
Bank deposits / assets	1.060*** [0.227]	0.069 [0.052]	0.607** [0.283]
Short-term deposits / deposits	-0.549*** [0.194]	-0.101* [0.053]	1.758*** [0.181]
Non-retail deposits / deposits	-0.086 [0.073]	-0.013 [0.015]	0.035 [0.077]
Bank loans / assets	0.815*** [0.115]	0.114** [0.046]	0.174 [0.170]
Bank C&I loans / loans	0.508*** [0.183]	0.207*** [0.039]	0.343 [0.257]
State personal income growth	-0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]
Change in region CPI	0.013* [0.008]	0.002** [0.001]	0.004 [0.006]
State unemployment rate	0.093*** [0.010]	0.015*** [0.002]	-0.029*** [0.009]
Change in state housing prices	-0.002 [0.001]	0 [0.000]	0 [0.002]
GDP growth	0.012* [0.007]	0.002** [0.001]	0.011** [0.005]
NBER recession dummy	0.015 [0.041]	-0.003 [0.005]	-0.006 [0.040]
Constant	2.719*** [0.673]	-1.407*** [0.413]	0.002 [0.181]
Bank fixed effects	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	1121510	1121508	773814
Number of banks	590	590	585
R ²	0.330	0.183	0.130

Table 6: Modified Taylor rule

	Dependent variable		
	Loan spread	Dummy for secured loan	Loan maturity
	(1)	(2)	(3)
Modified Taylor rule residual	0.019*	0.003**	0.021**
	[0.011]	[0.001]	[0.009]
Loan risk rating	0.333***	0.050***	-0.030**
	[0.010]	[0.004]	[0.013]
Loan size	-0.261***	-0.004***	0.114***
	[0.007]	[0.001]	[0.012]
Bank size	-0.105***	-0.040***	0.190***
	[0.035]	[0.008]	[0.019]
Bank tier 1 capital ratio	4.241***	-0.196	2.754***
	[0.643]	[0.164]	[0.998]
Bank net income / assets	-7.458***	0.222	-1.585
	[1.696]	[0.250]	[1.880]
Bank liquid assets / assets	-1.181	-0.286	-5.186***
	[1.115]	[0.358]	[1.092]
Bank deposits / assets	1.391***	0.114**	0.712**
	[0.264]	[0.056]	[0.349]
Short-term deposits / deposits	-0.767***	-0.116*	1.693***
	[0.200]	[0.060]	[0.214]
Non-retail deposits / deposits	0.019	-0.011	0.089
	[0.081]	[0.017]	[0.090]
Bank loans / assets	0.940***	0.052	0.18
	[0.131]	[0.045]	[0.168]
Bank C&I loans / loans	0.790***	0.244***	0.352
	[0.209]	[0.040]	[0.318]
State personal income growth	-0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]
Change in region CPI	0.002	0.001	-0.004
	[0.007]	[0.001]	[0.005]
State unemployment rate	0.087***	0.013***	-0.035***
	[0.012]	[0.002]	[0.008]
Change in state housing prices	-0.003**	0	0
	[0.001]	[0.000]	[0.002]
GDP growth	0.006	0	0.008
	[0.008]	[0.001]	[0.006]
NBER recession dummy	0.012	-0.005	-0.001
	[0.048]	[0.004]	[0.035]
Constant	1.815**	1.116***	-3.735***
	[0.690]	[0.126]	[0.442]
Bank fixed effects	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	941063	941062	645018
Number of banks	543	543	537
R ²	0.318	0.185	0.142

Frequency of keywords 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