Assessing Targeted Macroprudential Financial Regulation: The Case of the 2006 Commercial Real Estate Guidance for Banks

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Division of Monetary Affairs
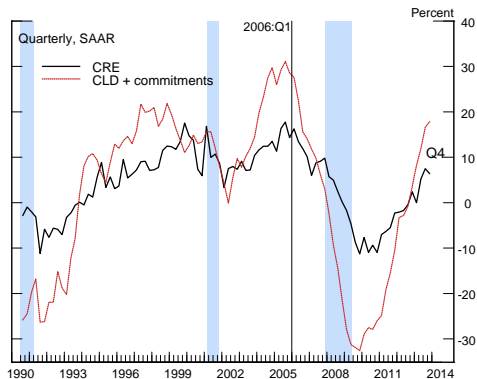Federal Reserve Board

September 23, 2014

Commercial real estate sector was part of the boom and bust of the late-2000s.

Note: CRE includes loans for construction and land development and off-balance sheet commitments to fund those loans, loans backed by multifamily housing, and loans secured by nonfarm, nonresidential structures.

Source: Call Reports

Motivation for Guidance and This Paper

- CRE is a volatile sector linked to prior periods of banking distress.
- Recognizing risks, regulators imposed strict new supervisory policies on CRE loans in late-2006 (just before financial strains emerged).
- These policies are an example of a targeted approach to Macroprudential Financial Policy
  - Seeks to protect the stability of the U.S. financial system while promoting sustainable economic growth.
  - Embodied in financial reforms such as the Dodd-Frank Act and Basel III.
  - One suggested approach: Prevent excess concentrations in specific asset classes.
- **Research Question**: What were the effects of the CRE Guidance?

Literature Review

- Banking shocks propagate to the real economy - Bernanke(1983)

- **Effect of supervisory actions:** Supervisory stringency, particularly during economic downturns, restricts loan supply - Peek and Rosengren(1995), Curry, Fissel, and Ramirez(2008), Bassett, Lee, and Spiller (2012)

- **Capital requirements:** Well-capitalized banks grow faster, but lending slows during transition to higher requirements - Bernanke and Lown (1991), Hall(1993), Furfine(2000,2001)

- **Assessments of Guidance:** Banks originated fewer non-performing loans but faced greater credit and liquidity risk due to their CRE concentrations - Lopez(2007), Pana(2010), Friend et al.(2013)

Description of CRE Guidance

- Goal was to achieve changes in risk management, underwriting standards, diversification, and capital levels at concentrated banks
- Reinforced standards for risk management for all CRE lending banks
- Applied **Unprecedented** and **unexpected** numerical thresholds to determine 'concentrated' banks.
  - Ratio of CRE to risk-based capital > 300% and 36 mo. CRE growth > 50%
  - Ratio of CLD to risk-based capital > 100%
- GAO said guidance was applied stringently and often incorrectly, with thresholds treated as strict caps

Distribution of Ratios of CRE to Risk-Based Capital
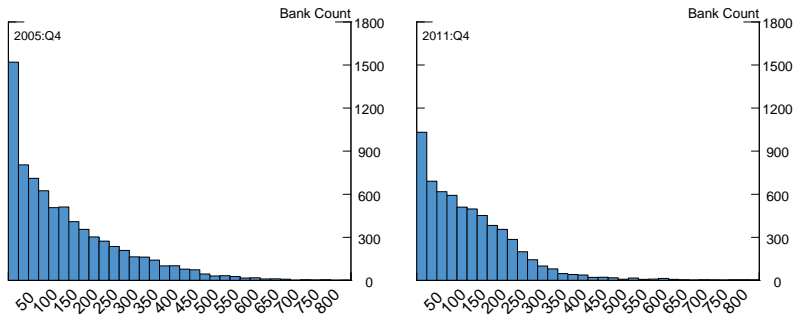
Note: CRE includes loans for construction and land development, loans backed by multifamily housing, loans secured by nonfarm, nonresidential structures, and off-balance sheet commitments to fund CRE loans.
A few banks with ratios greater than 850, negative risk-based capital, or without CRE holdings have been dropped from the graph.

Source: FFIEC Call Reports
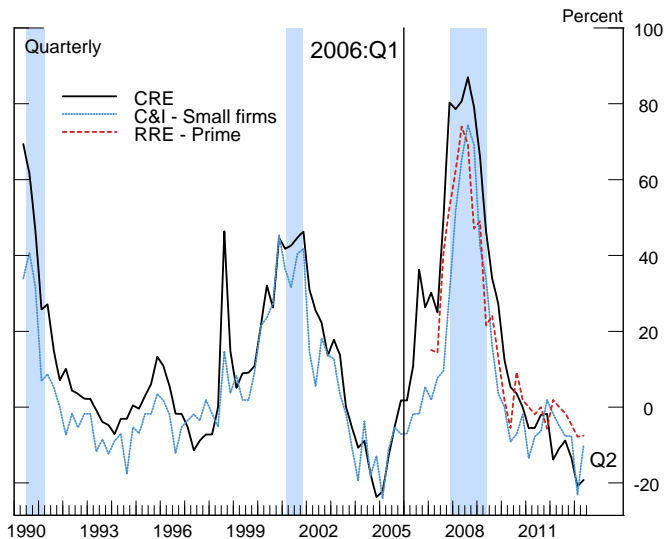
Source: Senior Loan Officer Opinion Survey

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Key Concept: Unanticipated numerical thresholds and inconsistent application yield 'natural experiment' and provide empirical identification.

Define indicator variables for:

- Comment: dates between 2006:Q1 and 2006:Q4
- Final: dates after 2006:Q4
- Threshold: banks with concentrations in excess of those defined by guidance or researchers

Key variables: Coefficients on the interaction of "Threshold" with "Comment" or "Final"

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Other Control Variables

- Quarterly Call Reports for bank-specific financial variables and growth rates
- Local economic variables: FDIC SOD data create bank-specific, deposit-weighted state-level conditions
    - Annualized quarterly percent change in CoreLogic HPI
    - One quarter difference in state unemployment rate (BLS)
    - Total charge-off rate at competing banks one-quarter ahead
    - Herfindahl-Hirschman Index of deposit concentration
- Macroeconomic and aggregate financial variables
    - Quarterly Real GDP growth (Commerce Department)
    - Quarterly change in CoStar national CRE price index
    - Quarter-end level of S&P 500 VIX
    - Treasury yield curve slope (10 yr - 2 yr) and target federal funds rate

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CRE Models with Threshold Variables[†]

	(1) CRE	(2) CLD	(3) CLD+cmt
$comment_t$	-0.447***	0.0466	0.650
	(-4.02)	(0.07)	(0.74)
$final_t$	-0.895***	-3.028***	-2.901***
	(-9.08)	(-6.33)	(-5.66)
$threshold_{i,j,t-1}$	-0.815***	-2.483***	-2.706***
	(-7.48)	(-8.67)	(-8.98)
$threshold_{i,j,t-1} \times comment_t$	-0.508**	-1.741*	-2.488**
	(-2.82)	(-2.37)	(-2.69)
$threshold_{i,j,t-1} \times final_t$	-0.927***	0.353	0.0600
	(-7.05)	(0.81)	(0.13)
Clusters	2829	539	548
Avg. Obs/Bank	51.52	38.30	38.02
R-Squared	0.0678	0.116	0.0962

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

† - Regressions include all bank-specific and macrofinancial variables.

Non-CRE Models with Threshold Variables[†]

	(1) C&I	(2) RRE	(3) CONS
$comment_t$	-1.021***	-0.359***	-0.436***
	(-10.66)	(-8.68)	(-8.03)
$final_t$	-0.633***	-0.0505	0.252***
	(-7.67)	(-1.24)	(4.46)
CRE threshold$_{i,j,t-1}$	-0.00245	0.407***	-0.352
	(-0.02)	(4.08)	(-1.91)
CRE threshold$_{i,j,t-1} \times comment_t$	0.0688	-0.375*	0.642*
	(0.28)	(-2.50)	(2.31)
CRE threshold$_{i,j,t-1} \times final_t$	-0.661***	0.310**	0.644**
	(-3.76)	(2.64)	(3.08)
Clusters	5821	6779	4587
Avg. Obs/Bank	49.63	53.38	50.01
R-Squared	0.0240	0.0606	0.0683

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

† - Regressions include all bank-specific and macrofinancial variables.

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Hypothetical Thresholds for Non-CRE Loan Categories

We define hypothetical thresholds for non-CRE loan categories approximately one standard deviation above their long-run mean.

	CRE	CLD	C&I	RRE	CONS
Mean	166.86	126.39	121.76	197.07	97.57
Std.Dev.	115.83	86.89	78.66	116.86	79.11
Threshold			200	300	200

Roughly equivalent to those issued in the guidance for CRE loans.

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	(1) CRE	(2) CLD+cmt	(3) C&I	(4) RRE	(5) Consumer
$\frac{\partial y_{i,t}}{\partial comment_t}$	-1.245***	-1.007	-2.391***	-0.840***	-1.648***
	(-5.02)	(-1.61)	(-8.16)	(-7.88)	(-4.90)
$\frac{\partial y_{i,t}}{\partial comment_t} - \beta_{comment_t}$	-1.223***	-1.699	-1.462***	-0.399***	-1.164***
	(-4.72)	(-1.67)	(-4.86)	(-3.61)	(-3.44)
$\frac{\partial y_{i,t}}{\partial final_t}$	-2.141***	-2.695***	-2.059***	-0.656***	-0.174
	(-11.03)	(-5.28)	(-9.75)	(-7.57)	(-0.70)
$\frac{\partial y_{i,t}}{\partial final_t} - \beta_{final_t}$	-1.752***	-0.0478	-1.327***	-0.575***	-0.321
	(-9.44)	(-0.09)	(-6.63)	(-7.04)	(-1.31)

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Updated Distribution of Ratios of CRE to Risk-Based Capital
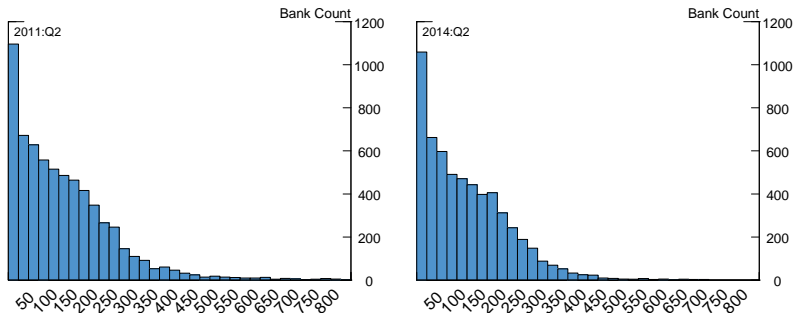
Note: CRE includes loans for construction and land development, loans backed by multifamily housing, loans secured by nonfarm, nonresidential structures, and off-balance sheet commitments to fund CRE loans.
A few banks with ratios greater than 850, negative risk-based capital, or without CRE holdings have been dropped from the graph.

Source: FFIEC Call Reports

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Conclusion

Targeted macroprudential policy that reduced concentrations and growth, but may have had unintended spillovers.

We identified three consequences of the CRE regulation:

- Growth of CRE loans at banks over the thresholds was substantially slower than at banks below the thresholds
- The same banks also reduced C&I lending, which is often partially collateralized by property, more than expected.
- Residential real estate loans increased at banks over the thresholds, despite the weakness in that market; consumer loans also increased at those banks.

Moreover, the relationships between growth in those loan categories and concentrations of CRE loans were materially different than the relationships before the guidance was issued

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- How best to control for sample selection and other enforcement actions.
- The results are dependent on adequate controls for macroeconomic and financial conditions.
- Importantly, our analysis does not examine the riskiness of banks over the thresholds.
- Future research could examine the riskiness and performance of banks over the threshold during the crisis.

Distribution of Ratios of CLD to Risk-Based Capital
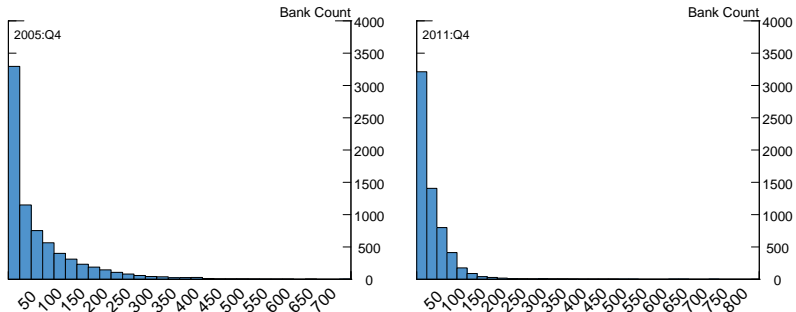
Note: A few banks with ratios greater than 850, negative risk-based capital, or without CLD holdings have been dropped from the graph.

Source: FFIEC Call Reports

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Sample Construction

Banks with the following characteristics are removed.

- Ratio of loans to total assets $< 2\%$ and average loans $< \$1B$
- Dependent variable growth rates outside the 2.5 and 97.5 percentiles
- NIM and NIE ratios $> 10\%$
- Delinquency Rates $> 33\%$
- Charge-off rates $< $ 1st percentile or $> 20\%$
- Leverage ratios $< 4\%$ or $> 33\%$
- less than 30 remaining time series observations

	CRE	CLD+cmt	C&I	RRE	Consumer
Clusters	2829	548	5821	6779	4587
Avg. Obs/Bank	51.52	38.02	49.63	53.38	50.01

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Fully Interacted Panel Regression with Bank Fixed Effects

$$
\begin{aligned}
y_{i,j,t} &= \beta_0 + \sum_{n=1}^{4} \beta_n y_{i,j,t-n} + \beta_5 \frac{loans_{i,j,t-1}}{RBC_{i,t-1}} + \beta_6 threshold_{i,j,t-1} \\
&+ \left(\beta_7 + \beta_8 threshold_{i,j,t-1} + \beta_9 threshold_{i,j,t-1} \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}} \right) \times comment_t \\
&+ \left(\beta_{10} + \beta_{11} threshold_{i,j,t-1} + \beta_{12} threshold_{i,j,t-1} \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}} \right) \times final_t \\
&+ \sum_{n=1}^{2} \chi_{i,t-n} \beta_{12+n} + \sum_{n=1}^{2} \Gamma_{i,t-n} \beta_{14+n} + \sum_{n=1}^{2} \delta_{t-n} \beta_{16+n} \\
&+ \sum_{n=1}^{3} \beta_{18+n} Q_n + \beta_{22} \psi_i + \varepsilon_{i,j,t}
\end{aligned}
$$

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Fully Interacted Model of Thresholds and Ratios[†]

	(1) CRE	(2) CLD+cmt	(3) C&I	(4) RRE	(5) Consumer
$comment_t$	-0.0220	0.692	-1.005***	-0.424***	-0.384***
	(-0.20)	(0.79)	(-10.45)	(-10.21)	(-7.04)
$final_t$	-0.390***	-2.647***	-0.618***	-0.119**	0.303***
	(-3.84)	(-5.07)	(-7.43)	(-2.89)	(5.34)
$threshold_{i,j,t-1}$	1.371***	-1.147**	0.114	-0.0712	0.100
	(9.51)	(-3.30)	(0.69)	(-0.65)	(0.51)
$threshold_{i,j,t-1} \times comment_t$	-2.888***	-1.778	-0.364	0.351	-0.345
	(-3.85)	(-1.47)	(-0.33)	(0.54)	(-0.24)
$threshold_{i,j,t-1} \times final_t$	-3.687***	-0.584	-0.817	-0.212	0.249
	(-6.89)	(-0.79)	(-1.19)	(-0.49)	(0.33)
$\frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$	-0.0156***	-0.0244***	-0.000795	0.00343***	-0.00304***
	(-22.86)	(-9.33)	(-1.49)	(11.58)	(-6.52)
$comment_t \times threshold_{i,j,t-1} \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$	0.00555**	0.000787	0.00110	-0.00186	0.00270
	(3.04)	(0.21)	(0.40)	(-1.15)	(0.73)
$final_t \times threshold_{i,j,t-1} \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$	0.00645***	0.00536	0.000381	0.00139	0.00109
	(4.89)	(1.61)	(0.22)	(1.26)	(0.56)
Clusters	2829	548	5821	6779	4587
Avg. Obs/Bank	51.52	38.02	49.63	53.38	50.01
R-Squared	0.0737	0.103	0.0240	0.0612	0.0686

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

† - Regressions include all bank-specific and macrofinancial variables.

$$\frac{\partial y_{i,j,t-1}}{\partial comment_t} = \beta_7 + \beta_8 threshold_{i,j,t-1} + \beta_9 threshold_{i,j,t-1} \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$$

$$\frac{\partial y_{i,j,t-1}}{\partial final_t} = \beta_{10} + \beta_{11} threshold_{i,j,t-1} + \beta_{12} threshold_{i,j,t-1} \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$$

	(1) CRE	(2) CLD+cmt	(3) C&I	(4) RRE	(5) Consumer
$\frac{\partial y_{i,t}}{\partial comment_t}$	-1.245***	-1.007	-1.040**	-0.631**	0.0804
	(-5.02)	(-1.61)	(-3.00)	(-3.05)	(0.19)
$\frac{\partial y_{i,t}}{\partial comment_t} - \beta_{comment_t}$	-1.223***	-1.699	-0.0345	-0.207	0.465
	(-4.72)	(-1.67)	(-0.10)	(-0.99)	(1.10)
$\frac{\partial y_{i,t}}{\partial final_t}$	-2.141***	-2.695***	-1.320***	0.0843	0.879***
	(-11.03)	(-5.28)	(-5.69)	(0.57)	(3.48)
$\frac{\partial y_{i,t}}{\partial final_t} - \beta_{final_t}$	-1.752***	-0.0478	-0.702**	0.203	0.576*
	(-9.44)	(-0.09)	(-3.12)	(1.39)	(2.30)

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Estimated Coefficients on Macro and Deposit-Weighted State-Level Control Variables

	(1) CRE	(2) CLD+cmt	(3) C&I	(4) RRE	(5) Consumer
$HPI_{i,t-1}^{growth}$	0.0686***	0.113***	0.0160**	0.00111	0.0312***
	(11.87)	(5.16)	(2.98)	(0.39)	(7.15)
$\Delta Unemp_{i,t-1}$	1.324***	0.182	-0.854***	0.583***	-0.497***
	(10.57)	(0.35)	(-8.80)	(13.24)	(-8.03)
$St\text{-}Chargeoffs_{k\neq i,t+1}$	-2.892***	-5.931***	-1.745***	-0.320***	-0.400**
	(-9.41)	(-5.81)	(-8.52)	(-3.51)	(-2.72)
$HHI_{i,t-1}$	13.95***	20.21	14.85***	10.84***	30.41***
	(4.52)	(1.85)	(5.77)	(7.44)	(14.04)
$\Delta \ln GDP_{t-1}$	0.0330	-0.0856	-0.273***	0.293***	-0.166***
	(0.78)	(-0.48)	(-8.00)	(17.52)	(-7.62)
$\Delta \ln CRE_{t-1}^{Price}$	0.0202***	0.0324			
	(3.75)	(1.49)			
VIX_{t-1}	-0.00637	-0.0318*	-0.000982	-0.00728***	0.00357
	(-1.73)	(-2.19)	(-0.33)	(-4.86)	(1.78)
$slope_{t-1}$	-0.833***	-1.675***	-0.781***	0.236***	-0.372***
	(-13.31)	(-6.30)	(-15.08)	(9.01)	(-10.14)
$FedFunds_{t-1}^{target}$	-0.292***	-0.651***	-0.0561*	0.251***	0.0548**
	(-9.46)	(-4.79)	(-2.15)	(19.59)	(3.04)
Clusters	2829	548	5821	6779	4587
Avg. Obs/Bank	51.52	38.02	49.63	53.38	50.01
R-Squared	0.0737	0.103	0.0240	0.0612	0.0686

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CRE Models with Loan-to-Capital Ratio Variables[†]

	(1) CRE	(2) CLD	(3) CLD+cmt
$comment_t$	-0.0255	-0.936	-0.284
	(-0.14)	(-1.44)	(-0.37)
$final_t$	-0.135	-3.111***	-2.936***
	(-1.03)	(-5.74)	(-5.06)
$\frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$	-0.0119***	-0.0268***	-0.0283***
	(-19.12)	(-10.48)	(-11.47)
$\frac{loans_{i,j,t-1}}{RBC_{i,t-1}} \times comment_t$	-0.000922	0.00161	-0.00174
	(-1.39)	(0.56)	(-0.54)
$\frac{loans_{i,j,t-1}}{RBC_{i,t-1}} \times final_t$	-0.00268***	0.00545*	0.00391
	(-5.48)	(2.19)	(1.43)
Clusters	2829	539	548
Avg. Obs/Bank	51.52	38.30	38.02
R-Squared	0.0732	0.121	0.101

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

† - Regressions include all bank-specific and macrofinancial variables.

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	(1) C&I	(2) RRE	(3) CONS
$comment_t$	-0.927***	-0.343***	-0.600***
	(-6.75)	(-6.02)	(-7.99)
$final_t$	-0.266**	-0.169***	0.162*
	(-2.77)	(-3.56)	(2.58)
$\frac{CRE\ loans_{i,j,t-1}}{RBC_{i,t-1}}$	0.000407	0.00336***	-0.00358***
	(0.80)	(11.15)	(-7.02)
$\frac{CRE\ loans_{i,j,t-1}}{RBC_{i,t-1}} \times comment_t$	-0.000843	-0.000892*	0.00260***
	(-1.26)	(-2.55)	(4.63)
$\frac{CRE\ loans_{i,j,t-1}}{RBC_{i,t-1}} \times final_t$	-0.00338***	0.000576*	0.00186***
	(-7.36)	(2.17)	(4.35)
Clusters	5821	6779	4587
Avg. Obs/Bank	49.63	53.38	50.01
R-Squared	0.0242	0.0611	0.0686

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Regression with Hypothesized Thresholds

	(1) CRE	(2) CLD+cmt	(3) C&I	(4) RRE	(5) Consumer
$comment_t$	-0.0220	0.692	-0.929***	-0.442***	-0.483***
	(-0.20)	(0.79)	(-9.89)	(-10.20)	(-8.95)
$final_t$	-0.390***	-2.647***	-0.732***	-0.0815	0.147**
	(-3.84)	(-5.07)	(-8.85)	(-1.94)	(2.63)
$threshold_{i,j,t-1}$	1.371***	-1.147**	1.014***	0.436***	0.221*
	(9.51)	(-3.30)	(10.14)	(9.00)	(2.06)
$threshold_{i,j,t-1} \times comment_t$	-2.888***	-1.778	-3.456***	-1.046***	-1.773**
	(-3.85)	(-1.47)	(-3.92)	(-3.49)	(-2.60)
$threshold_{i,j,t-1} \times final_t$	-3.687***	-0.584	-3.351***	-1.204***	-0.754
	(-6.89)	(-0.79)	(-6.24)	(-4.26)	(-1.69)
$\frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$	-0.0156***	-0.0244***	-0.0198***	-0.0107***	-0.00664***
	(-22.86)	(-9.33)	(-26.85)	(-34.03)	(-8.56)
$threshold_{i,j,t-1} \times comment_t \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$	0.00555**	0.000787	0.00997**	0.00216**	0.00304
	(3.04)	(0.21)	(3.07)	(2.98)	(1.41)
$threshold_{i,j,t-1} \times final_t \times \frac{loans_{i,j,t-1}}{RBC_{i,t-1}}$	0.00645***	0.00536	0.0101***	0.00210**	0.00216
	(4.89)	(1.61)	(5.13)	(2.81)	(1.65)
Clusters	2829	548	5875	6825	4658
Avg. Obs/Bank	51.52	38.02	50.80	54.99	51.42
R-Squared	0.0737	0.103	0.0294	0.0669	0.0668

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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