

Easy Monetary Policy and Tight Capital Requirement: An Empirical Study of Bank Lending Behavior

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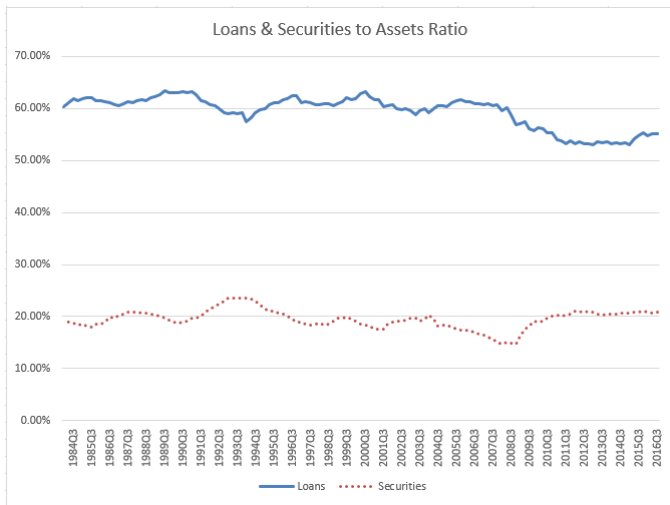
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Introduction - Observation

FDIC Aggregate Bank Data



Introduction - RBC

Risk-based Capital Requirements (RBC) - require banks to hold enough capital in terms of a ratio of capital to risk-weighted assets (loans ...): More lending requires more capital

Basel III

- Common Equity Tier 1 Capital Ratio ¹ - 4.5%
- Tier 1 Capital Ratio ² - 6%
- Total Risk-Weighted Capital Ratio ³ - 8%

The Stress Tests

- Risk-based capital ratio under stressed macroeconomic scenarios

¹CET1: Mainly retained earnings and common stock equity

²T1: Include preferred stock equity in addition to CET1

³Sum of T1 and T2 capital (Subordinated Bond)

Introduction - Motivation

Substantially Heightened Capital Requirements - Basel III and the Stress Tests since 2009:

- Pros - more capital buffer, stable banking system, more lending during bad times
- Cons - less profitable banks, unstable banking system ⁴, lending slowdown
- Capital Requirements and Monetary Policy ⁵
 - Easing & Capital Constrained Banks: not effective
 - Easing & Capital Unconstrained Banks: effective
 - Tightening & Capital Constrained Banks: effective
 - Tightening & Capital Unconstrained Banks: not effective

Motivation: use bank-level data to evaluate the effects of risk-based capital ratio and monetary policy on bank lending

⁴Congdon & Hanke (2017); Gramm & Solon (2016); Sarin & Summers (2016)

⁵Kishan & Opiela (2006)

Introduction - Motivation - Why should one care?

- How does risk-based capital ratio affect banks' lending? Lending slowdown? More lending during bad time? Or doesn't matter?
- Should regulation be lifted or strengthened?
- How is the effectiveness of monetary policy in affecting lending across periods?

Background - Basel

Basel I (1988)

- Tier 1 Capital Ratio - 4%
- Total Risk-Weighted Capital Ratio - 8%

Basel II (2004)

- Give banks discretion when evaluating capital requirements
- Enhance supervision and transparency

Basel III (2010)

- Improve capital quality and quantity
- Common Equity Tier 1 Ratio (CET1) - 4.5% (7% if including conservation buffer)
- Tier 1 Capital Ratio - 6%

2013 - The U.S. will implement Basel III by 2019 on all sizes of banks except for BHCs with assets of less than \$500 million

Background - Stress Tests

The U.S. Stress Tests

- 2009 - SCAP, implemented on the 19 largest U.S. BHCs
 - Require banks to raise capital, can overrule plan of stock repurchase and dividend payout
- 2011 - CCAR, same 19 largest BHCs, gradually expand to cover other large banks with assets of more than \$50 billion ⁶
- 2013 - DFAST, company run stress tests on mid-size BHCs with assets of between \$10 - \$50 billion

⁶34 BHCs in 2017

Literature Review - Credit Crunch

Limited support for supply-side credit crunch ⁷ , favor macro-demand factors, insignificant or marginally positive RBC:

- Bernanke & Lown (1991): 1989 - 1991 state and bank level (New Jersey) data, lagged capital ratio on loan growth, significantly positive but small, 2 - 3 percentage points
- Hancock & Wilcox (1994): 1990 - 1991 bank level data, banks contract portfolios to shortfalls on either unweighted 4.75% or risk-weighted 8% capital standard, bank credit fall by \$4.5 for \$1 shortfall in unweighted standard, insignificant RBC when both are included
- Berger & Udell (1994): 1979 - 1992 quarterly bank level data, compare different hypotheses, RBC the worst explanation, inconsistent effects compared to predictions

⁷RBC, Leverage ratio standard, Perceived risks

Literature Review - Credit Crunch

Support for the significant effects of RBC:

- Peek & Rosengren (1996): 1988 - 1995 semiannual data on branches of Japanese banks operated in the U.S., natural experiment isolating supply from demand factors, economically and statistically significant, 1-percentage-point decline in parents RBC - 6% decline in total loans at U.S. branches

Newer studies:

- Berrospide & Edge (2010): 1990 - 2008 quarterly BHCs data, panel and VAR, capital shortfall and capital ratio, modest long run effects on loan growth, 0.7 - 1.2 percentage points, favor perceived risk retrenchment and macro demand factors
- D'Erasmus (2018): literature review, negative effects of risk-based capital requirements on lending in equilibrium using GM model and simulation

Conclusion: mixed results on the effects of capital, worth to study because RBC has been substantially heightened in recent years

Literature Review - Monetary Policy

Interaction between monetary policy and capital requirements, an additional requirement to the reserve requirement ⁸:

- Kishan & Opiela (2006): 1980 - 1999 quarterly bank level data, policy-stance asymmetry, examine expansionary and contractionary policy separately on loan of low-capital and high-capital banks between pre-Basel and post-Basel periods, hold in post-Basel period, require certain level of stringency
- Gambacorta & Shin (2016): 1994 - 2012 annually data on international banks in G10, leverage ratio, GMM, smaller monetary tightening effects for high-capitalized banks, -1.1% and -1.7%, lower costs, 4 basis point cost reduction

Conclusion: Most studies do not explicitly differentiate between monetary stance, insufficient empirical evidence, stringent RBC and monetary easing

⁸Bliss & Kaufman (2002)

Data

- ① FDIC - Bank level panel data, 6,000 - 9,000 FDIC insured institutions, quarterly data from 2001Q4 - 2017Q3, 64 quarters, 500,000 obs, unbalanced due to merger and acquisition
- ② FRED - Macro economics data, federal funds rate, real GDP, unemployment rate, inflation rate (CPI)
- ③ Bureau of Economic Analysis - State level personal income
- ④ Federal Reserve Bank of Chicago - BHC data, total assets

Large N, small T, System GMM, T around 25, divide data into 2 sub-samples, before and after heightened requirements in 2009 ⁹, data for CET1 begins in 2015, use a proxy ¹⁰

⁹First round of SCAP

¹⁰ $(T1 - \text{preferred stock equity}) / \text{risk-weighted assets}$

Model - Baseline Specification

The Standard Dynamic Lending Model based on Kashyap & Stein (1995), Gambacorta & Mistrulli (2004), Berrospide & Edge (2010), Gambacorta & Shin (2016), Borio & Gambacorta (2017)

$$\Delta \ln L_{i,t} = \alpha_i + \sum_{j=1}^4 \beta_j \Delta \ln L_{i,t-j} + \eta \text{ CET1} R_{i,t-1} + \sum_{j=1}^4 \mu_j \Delta MP_{t-j} + \phi Z_{i,t-j} + \epsilon_{i,t}$$

Quarterly data, 4 lags of the dependent variable
Unit root, differenced for stationarity

Model - Variables

Dynamic model, lagged dependent variables

Factors of interest:

- CET1R: Common equity tier 1 ratio, a measure of higher quality capital, unavailable before 2015, use proxy:

$$(Tier\ 1\ capital - preferred\ stock\ equity) / risk\ weighted\ assets$$

correlate with Tier 1 capital

- MP: Federal funds rate

Control variables (Z):

- Macroeconomic Control Variables - use 4 lags
 - Real GDP
 - Unemployment rate
 - Inflation rate
 - State level personal income

Model - Variable Continued

- Bank Specific Variables - use 1 lag
 - Credit risk: net-Charge offs to total assets ratio
 - Credit risk: non-performing loans to total assets ratio
 - Liquidity ratio: (cash + securities)/total assets
 - Profitability of lending: interest income from domestic loan to total assets ratio
 - Intermediation costs: non-interest expense to average assets
 - Bank size: log of bank's assets
- Dummy Variables
 - Basel: 1 if bank or BHC assets over \$500 million since 2013; 0 otherwise
 - Stress Test: 1 if BHC participates in SCAP, CCAR or DFAST since 2009 ¹¹; or 1 if bank or BHC assets over \$10 billion ¹² since 2013; 0 otherwise

¹¹Largest BHCs

¹²Medium banks

Other Specifications

Undivided profit:

$$\Delta \% RE_{i,t} = \alpha_i + \sum_{j=1}^4 \beta_j \Delta \% RE_{i,t-j} + \eta CET1R_{i,t-1} + \sum_{j=1}^4 \mu_j \Delta MP_{t-j} + \phi Z_{i,t-j} + \epsilon_{i,t}$$

Common stockholders' equity:

$$\Delta \ln CS_{i,t} = \alpha_i + \sum_{j=1}^4 \beta_j \Delta \ln CS_{i,t-j} + \eta CET1R_{i,t-1} + \sum_{j=1}^4 \mu_j \Delta MP_{t-j} + \phi Z_{i,t-j} + \epsilon_{i,t}$$

Method

Dynamic Panel Model:

- Contain lagged dependent variable, endogenous, difference will not work, y_{t-1} correlates to ϵ_{t-1}
- pooled OLS and FE are not consistent

Literature: weak instruments, focus on improving efficiency

- Anderson & Hsiao (1981): instrument variable, y_{t-2}
- Arellano & Bond (1991): further lags, GMM
- Ahn & Schmidt (1995): non-linear GMM
- Blundell & Bond (1998): system GMM, lagged variables as instruments for difference equation, lagged difference as instruments for level equation

Lags of variables are also used to reduce endogeneity

Loan - One Step System GMM - Standard Variance

	All Sample		Pre 2009		Post 2009	
Capital Ratio	0.000019***	(3.46)	0.000066**	(2.94)	0.000011*	(2.11)
Monetary Policy (-1)	-0.0050*	(-2.23)	-0.0042	(-0.86)	0.10***	(13.84)
Monetary Policy (-2)	-0.0080***	(-3.52)	-0.028***	(-6.74)	0.0077	(1.12)
Monetary Policy (-3)	0.00021	(0.09)	-0.051***	(-7.85)	0.046***	(8.88)
Monetary Policy (-4)	0.0026	(0.99)	-0.031***	(-4.57)	0.014**	(3.02)
Net Charge-off	0.012***	(8.47)	0.017***	(6.49)	-0.0059***	(-3.58)
Nonperforming Loan	-0.0010	(-1.72)	-0.0032**	(-3.21)	-0.0029***	(-4.04)
Asset	-0.35***	(-90.21)	-0.52***	(-69.14)	-0.44***	(-65.69)
Liquidity Ratio	0.0100***	(65.26)	0.012***	(45.83)	0.0082***	(42.73)
Interest Expense	0.0036*	(2.50)	-0.039***	(-11.99)	0.067***	(26.07)
Income on Loan	0.0019***	(7.91)	0.00027	(0.52)	0.0024***	(8.85)
Intermediation Cost	0.0012**	(3.11)	-0.0027***	(-5.02)	0.0066***	(10.78)
Observations	449038		206697		242341	

t statistics in parentheses

All variables are in lag form, number in parentheses indicate lag order

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

Loan - Two Step System GMM - Robust Variance

	All Sample		Pre 2009		Post 2009	
Capital Ratio	0.000020	(1.37)	0.000089	(0.59)	0.000011	(1.12)
Monetary Policy (-1)	-0.0031	(-0.30)	-0.0070	(-1.17)	0.084***	(3.41)
Monetary Policy (-2)	-0.0057*	(-2.02)	-0.018***	(-3.85)	0.0080	(0.50)
Monetary Policy (-3)	-0.00040	(-0.06)	-0.038***	(-4.96)	0.036*	(2.30)
Monetary Policy (-4)	0.0015	(0.21)	-0.025**	(-3.04)	0.013	(1.08)
Net Charge-off	0.011	(1.45)	0.0051	(0.49)	-0.0056	(-0.47)
Nonperforming Loan	-0.0015	(-1.31)	-0.0032***	(-5.34)	-0.0032*	(-2.40)
Asset	-0.34***	(-7.45)	-0.45***	(-5.59)	-0.43***	(-4.11)
Liquidity Ratio	0.0095***	(6.81)	0.010***	(6.18)	0.0078***	(4.91)
Interest Expense	0.0041	(0.17)	-0.027	(-1.85)	0.066	(1.53)
Income on Loan	0.0020	(0.57)	0.00091	(0.12)	0.0024	(0.63)
Intermediation Cost	0.0013	(0.35)	-0.0025	(-0.49)	0.0066	(1.04)
	All Sample		Pre 2009		Post 2009	
Cumulative Monetary Policy	-0.0077	(-0.94)	-0.089***	(-5.51)	0.14**	(2.87)

t statistics in parentheses

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

Loan - Two Step Robust - More Capital Lags

	All Sample		Pre 2009		Post 2009	
Capital Ratio (-1)	0.000036	(1.73)	0.00015	(0.82)	0.000034	(1.75)
Capital Ratio (-2)	0.000023	(1.42)	0.000099	(0.82)	0.000021	(1.28)
Capital Ratio (-3)	0.000012	(0.90)	0.000048	(0.60)	0.000011	(0.63)
Capital Ratio (-4)	-0.0000075	(-0.64)	0.000042	(0.63)	-0.000019	(-1.54)
Capital Ratio (-5)	0.000011	(0.86)	-0.000013	(-0.41)	0.000029*	(2.01)
Monetary Policy (-1)	-0.0031	(-0.30)	-0.0070	(-1.17)	0.084***	(3.41)
Monetary Policy (-2)	-0.0058*	(-2.02)	-0.018***	(-3.81)	0.0080	(0.49)
Monetary Policy (-3)	-0.00042	(-0.06)	-0.038***	(-4.80)	0.036*	(2.31)
Monetary Policy (-4)	0.0015	(0.21)	-0.025**	(-2.99)	0.013	(1.09)
Net Charge-off	0.011	(1.45)	0.0052	(0.50)	-0.0056	(-0.47)
Nonperforming Loan	-0.0015	(-1.29)	-0.0032***	(-5.32)	-0.0032*	(-2.38)
Asset	-0.34***	(-7.47)	-0.44***	(-5.42)	-0.43***	(-4.16)
Liquidity Ratio	0.0095***	(6.80)	0.010***	(6.13)	0.0077***	(4.90)
Interest Expense	0.0040	(0.17)	-0.027	(-1.82)	0.065	(1.53)
Income on Loan	0.0020	(0.56)	0.00091	(0.12)	0.0024	(0.61)
Intermediation Cost	0.0014	(0.36)	-0.0025	(-0.50)	0.0067	(1.06)
Observations	449038		206697		242341	

t statistics in parentheses

All variables are in lag form, number in parentheses indicate lag order

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

Loan - Two Step Robust - More Capital Lags

Linear Combination of Monetary Policy

	All Sample	Pre 2009	Post 2009
Cumulative Monetary Policy	-0.0078 (-0.95)	-0.088*** (-5.35)	0.14** (2.87)

t statistics in parentheses

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

Linear Combination of Capital Ratio

	All Sample	Pre 2009	Post 2009
Cumulative Capital Ratio	0.000074 (1.52)	0.00032 (0.78)	0.000075 (1.40)

t statistics in parentheses

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

Loan - Two Step Robust - Cutoff at 2009 Q3

	Pre 2009Q3		Post 2009Q3	
Capital Ratio (-1)	0.00016	(0.96)	0.000035*	(2.17)
Capital Ratio (-2)	0.000058	(0.75)	0.000020	(1.52)
Capital Ratio (-3)	0.000055	(0.90)	0.0000089	(0.67)
Capital Ratio (-4)	0.000028	(0.73)	-0.000017	(-1.57)
Capital Ratio (-5)	-0.0000072	(-0.65)	0.000028**	(2.84)
Monetary Policy (-1)	-0.000019	(-0.00)	0.061*	(2.04)
Monetary Policy (-2)	-0.0012	(-0.45)	0.010	(0.30)
Monetary Policy (-3)	-0.0053	(-1.37)	0.0032	(0.19)
Monetary Policy (-4)	-0.011*	(-2.30)	0.036*	(2.09)
Net Charge-off	0.0084	(0.98)	-0.0072	(-0.52)
Nonperforming Loan	-0.0025***	(-3.52)	-0.0025	(-1.63)
Asset	-0.37***	(-5.65)	-0.44***	(-4.02)
Liquidity Ratio	0.0091***	(6.52)	0.0081***	(4.50)
Interest Expense	0.0063	(0.75)	0.079	(1.38)
Income on Loan	0.00016	(0.02)	0.0027	(0.70)
Intermediation Cost	-0.0010	(-0.25)	0.0078	(1.03)
Observations	230927		218111	

t statistics in parentheses

All variables are in lag form

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

Loan - Two Step Robust - Cutoff at 2009 Q3

Linear Combination of Monetary Policy

	Pre 2009Q3	Post 2009Q3
Cumulative Monetary Policy	-0.018** (-2.80)	0.11 (1.48)

t statistics in parentheses

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

Linear Combination of Capital Ratio

	Pre 2009Q3	Post 2009Q3
Cumulative Capital Ratio	0.00029 (0.97)	0.000076 (1.66)

t statistics in parentheses

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

Retained Earnings - One Step Robust

	All Sample		Pre 2009		Post 2009	
Retained Earnings (-1)	0.0019	(1.37)	-0.00053	(-0.25)	0.0028	(0.90)
Retained Earnings (-2)	0.012	(1.35)	0.013	(0.97)	0.011	(0.99)
Retained Earnings (-3)	0.0019	(1.33)	-0.00015	(-0.05)	0.0030	(1.42)
Retained Earnings (-4)	-0.0013	(-0.60)	0.0017	(1.09)	-0.0023	(-0.73)
Capital Ratio (-1)	-0.0056	(-0.99)	-0.022	(-0.73)	-0.00025	(-0.05)
Capital Ratio (-2)	-0.0072	(-1.49)	-0.019	(-0.76)	-0.00029	(-0.08)
Capital Ratio (-3)	-0.0053	(-0.56)	-0.040	(-1.35)	-0.0025	(-0.39)
Capital Ratio (-4)	-0.00095	(-0.10)	-0.018	(-0.87)	-0.0028	(-0.35)
Capital Ratio (-5)	-0.0014	(-0.20)	-0.0011	(-0.15)	-0.0032	(-0.27)
Monetary Policy (-1)	-10.9	(-0.52)	-61.8*	(-2.28)	-161.3	(-1.14)
Monetary Policy (-2)	12.2	(1.08)	-15.9	(-0.75)	20.8	(1.09)
Monetary Policy (-3)	29.5	(1.13)	-4.90	(-0.15)	56.4	(1.62)
Monetary Policy (-4)	-6.19	(-0.32)	61.3	(1.84)	-34.1	(-0.53)
Net Charge-off	-4.24	(-0.41)	18.8	(1.15)	-2.77	(-0.14)
Nonperforming Loan	-8.95*	(-2.04)	-13.7	(-1.31)	-5.70	(-0.80)
Asset	-114.9	(-1.92)	-179.8	(-1.88)	-74.3	(-0.86)
Liquidity Ratio	0.90	(1.06)	0.78	(0.67)	0.75	(0.61)
Interest Expense	-74.0	(-0.99)	-1.91	(-0.04)	-167.6	(-0.81)
Income on Loan	-5.41	(-0.87)	-3.79	(-1.03)	-36.5	(-0.92)
Intermediation Cost	-20.2	(-1.51)	-31.1	(-1.23)	-2.59	(-1.10)
Observations	448340		206320		242020	

t statistics in parentheses

All variables are in lag form, number in parenthese indicate lag order

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

Retained Earnings - One Step Robust

Linear Combination of Monetary Policy

	All Sample	Pre 2009	Post 2009
Cumulative Monetary Policy	24.6	-21.2	-118.2
	(0.96)	(-0.68)	(-0.64)

t statistics in parentheses

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

Linear Combination of Capital Ratio

	All Sample	Pre 2009	Post 2009
Cumulative Capital Ratio	-0.020	-0.100	-0.0090
	(-0.73)	(-1.49)	(-0.34)

t statistics in parentheses

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

Retained Earnings - without Lags - OLS

	All Sample		Pre 2009		Post 2009	
Capital Ratio (-1)	0.0036	(1.63)	0.030	(1.32)	0.0015	(0.90)
Monetary Policy (-1)	-4.57	(-0.36)	-48.6*	(-2.37)	-28.2	(-0.58)
Monetary Policy (-2)	-6.81	(-0.50)	-8.48	(-0.47)	-5.31	(-0.22)
Monetary Policy (-3)	5.15	(0.20)	6.24	(0.34)	-3.04	(-0.07)
Monetary Policy (-4)	7.26	(0.26)	54.8**	(2.62)	-0.66	(-0.01)
Net Charge-off	2.03	(0.32)	18.5*	(2.21)	3.23	(0.31)
Nonperforming Loan	-1.49	(-0.70)	-6.13	(-0.96)	-0.058	(-0.06)
Asset	2.92	(1.01)	-1.66	(-0.56)	4.39	(1.27)
Liquidity Ratio	-0.72*	(-2.12)	-0.55*	(-2.11)	-1.40	(-1.64)
Interest Expense	-4.29	(-0.65)	0.87	(0.14)	-10.6	(-0.34)
Income on Loan	-6.22	(-1.25)	-3.01	(-1.10)	-26.2	(-1.36)
Intermediation Cost	-1.47	(-1.26)	-2.86	(-1.26)	-0.18	(-0.41)
Observations	448689		206512		242177	
	All Sample		Pre 2009		Post 2009	
Cumulative Monetary Policy	1.03	(0.06)	3.93	(0.27)	-37.2	(-0.61)

t statistics in parentheses

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

Common Stock Equity - Two Step Robust

	All Sample		Pre 2009		Post 2009	
Common Stock Equity (-1)	-0.063***	(-4.26)	-0.044**	(-3.02)	-0.077**	(-3.08)
Common Stock Equity (-2)	-0.012	(-1.91)	-0.0072	(-0.84)	-0.014	(-1.28)
Common Stock Equity (-3)	-0.0093	(-1.19)	-0.00086	(-0.14)	-0.017	(-1.16)
Common Stock Equity (-4)	-0.020	(-1.63)	-0.0049	(-0.72)	-0.034	(-1.54)
Capital Ratio (-1)	0.0000040	(1.43)	-0.000013	(-0.37)	0.0000025	(0.77)
Capital Ratio (-2)	-0.0000020	(-0.54)	-0.000016	(-0.58)	-0.0000010	(-0.56)
Capital Ratio (-3)	-0.0000023	(-0.83)	-0.000011	(-0.54)	-0.0000016	(-0.47)
Capital Ratio (-4)	-0.0000042*	(-2.05)	-0.000012	(-0.74)	-0.00000097	(-0.53)
Capital Ratio (-5)	0.0000030	(1.01)	-0.0000056	(-1.34)	0.0000035	(0.93)
Monetary Policy (-1)	-0.00034	(-0.11)	0.0039	(1.20)	-0.0095	(-0.93)
Monetary Policy (-2)	-0.0043	(-1.42)	-0.0088*	(-2.03)	-0.0013	(-0.16)
Monetary Policy (-3)	0.00033	(0.09)	-0.021**	(-2.88)	0.019*	(2.16)
Monetary Policy (-4)	-0.0018	(-0.48)	-0.013*	(-2.01)	0.0087	(1.10)
Net Charge-off	-0.0010	(-0.24)	-0.0067	(-0.70)	0.0033	(0.81)
Nonperforming Loan	0.00026	(0.21)	-0.00046	(-0.45)	0.00018	(0.10)
Asset	-0.13***	(-3.31)	-0.25***	(-3.87)	-0.028	(-0.62)
Liquidity Ratio	0.0011*	(2.10)	0.0010	(1.31)	0.00056	(0.86)
Interest Expense	-0.011	(-1.76)	-0.0072	(-0.87)	-0.0081	(-0.99)
Income on Loan	-0.00077	(-1.94)	-0.0013*	(-2.48)	-0.00038	(-0.92)
Intermediation Cost	-0.00083	(-0.77)	-0.0015	(-0.90)	-0.0013	(-0.99)
Observations	449038		206697		242341	

t statistics in parentheses

All variables are in lag form, number in parentheses indicate lag order

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

Common Stock Equity - Two Step Robust

Linear Combination of Monetary Policy

	All Sample	Pre 2009	Post 2009
Cumulative Monetary Policy	-0.0061 (-1.19)	-0.040** (-3.25)	0.017 (1.00)

t statistics in parentheses

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

Linear Combination of Capital Ratio

	All Sample	Pre 2009	Post 2009
Cumulative Capital Ratio	-0.0000015 (-0.14)	-0.000057 (-0.59)	0.0000024 (0.56)

t statistics in parentheses

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

Common Stock Equity - Cutoff at 2009 Q3

	Pre 2009Q3		Post 2009Q3	
Common Stock Equity (-1)	-0.059***	(-3.85)	-0.065**	(-3.08)
Common Stock Equity (-2)	-0.014	(-1.44)	-0.0092	(-0.87)
Common Stock Equity (-3)	0.00092	(0.13)	-0.014	(-0.86)
Common Stock Equity (-4)	-0.0076	(-1.13)	-0.032	(-1.29)
Capital Ratio (-1)	-0.000020	(-1.04)	0.0000023	(0.70)
Capital Ratio (-2)	-0.000015	(-0.83)	-0.0000014	(-0.68)
Capital Ratio (-3)	-0.000013	(-1.12)	-0.0000021	(-0.63)
Capital Ratio (-4)	-0.000012	(-1.08)	7.7e-09	(0.00)
Capital Ratio (-5)	-0.0000047	(-1.71)	0.0000033	(0.94)
Monetary Policy (-1)	0.0058*	(2.08)	0.038	(1.19)
Monetary Policy (-2)	-0.000034	(-0.02)	0.026	(1.26)
Monetary Policy (-3)	-0.0087**	(-2.60)	0.019	(1.69)
Monetary Policy (-4)	-0.0058	(-1.57)	0.046*	(2.54)
Net Charge-off	-0.0066	(-0.88)	0.0031	(0.67)
Nonperforming Loan	-0.00045	(-0.48)	0.00053	(0.25)
Asset	-0.24***	(-4.00)	-0.017	(-0.37)
Liquidity Ratio	0.00086	(1.32)	0.00079	(1.05)
Interest Expense	-0.0038	(-0.76)	-0.0063	(-0.69)
Income on Loan	-0.0011*	(-2.23)	-0.00038	(-0.81)
Intermediation Cost	-0.00095	(-0.69)	-0.0015	(-0.81)
Observations	230927		218111	

t statistics in parentheses

All variables are in lag form

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

Common Stock Equity - Cutoff at 2009 Q3

Linear Combination of Monetary Policy

	Pre 2009Q3	Post 2009Q3
Cumulative Monetary Policy	-0.0088 (-1.96)	0.13* (1.98)

t statistics in parentheses

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

Linear Combination of Capital Ratio

	Pre 2009Q3	Post 2009Q3
Cumulative Capital Ratio	-0.000065 (-1.13)	0.0000021 (0.47)

t statistics in parentheses

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

Common Stock Equity - without Lags - FE

	All Sample		Pre 2009		Post 2009	
Capital Ratio (-1)	-0.00000077	(-0.94)	-0.000015	(-1.51)	-0.00000038	(-0.58)
Monetary Policy (-1)	0.0058*	(2.19)	0.016**	(2.97)	0.0032	(0.30)
Monetary Policy (-2)	-0.0030	(-1.01)	-0.00080	(-0.14)	-0.0053	(-0.66)
Monetary Policy (-3)	-0.000034	(-0.01)	-0.0069	(-0.88)	0.020	(1.92)
Monetary Policy (-4)	-0.00081	(-0.24)	-0.0099	(-1.22)	0.0048	(0.72)
Net Charge-off	-0.0037	(-1.14)	-0.0097	(-0.90)	-0.0014	(-0.66)
Nonperforming Loan	0.000100	(0.20)	0.0013	(1.16)	0.00012	(0.16)
Asset	-0.0084**	(-3.29)	-0.021**	(-2.70)	-0.0097	(-1.38)
Liquidity Ratio	0.000059	(0.66)	0.00047*	(2.19)	-0.00012	(-0.73)
Interest Expense	-0.00074	(-0.73)	0.0028	(1.11)	0.0021	(0.75)
Income on Loan	0.00014	(0.73)	0.00024	(0.45)	0.00038**	(2.67)
Intermediation Cost	-0.00012	(-0.69)	-0.00021	(-0.61)	-0.00033	(-1.31)
Observations	449038		206697		242341	
	All Sample		Pre 2009		Post 2009	
Cumulative Monetary Policy	0.0020	(0.66)	-0.0020	(-0.28)	0.022	(1.73)

t statistics in parentheses

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

Conclusion

- The risk-based capital ratio does not cause the lending slowdown. It is insignificant, or only marginally, positively significant after 2009 in affecting lending, not negative. Therefore, no need to relax regulation which might risk another crisis
- Factors such as monetary policy, perceived risks, bank size and the liquidity ratio are significant in affecting lending
- The risk-based capital ratio does not significantly affect banks' retained earnings and common stock equity
- Banks can adjust capital levels through common stock equity more flexibly than retained earnings during bad times

Future Extension

- Variable Endogeneity
- Interaction between the risk-based capital ratio and monetary policy - A specification with interaction (Gambacorta & Mistrulli, 2004):

$$\begin{aligned} \Delta \ln L_{i,t} = & \alpha_i + \sum_{j=1}^4 \beta_j \Delta \ln L_{i,t-j} + \eta \text{ CET1}R_{i,t-1} + \sum_{j=1}^4 \mu_j \Delta MP_{t-j} \\ & + \sum_{j=1}^4 \lambda_j \text{ CET1}R_{i,t-1} \cdot \Delta MP_{t-j} + \phi Z_{i,t-1} + \epsilon_{i,t} \end{aligned}$$

- Extension on Model

THANK YOU!

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