How do Capital Requirements Affect Loan Rates?

Evidence from High Volatility Commercial Real Estate

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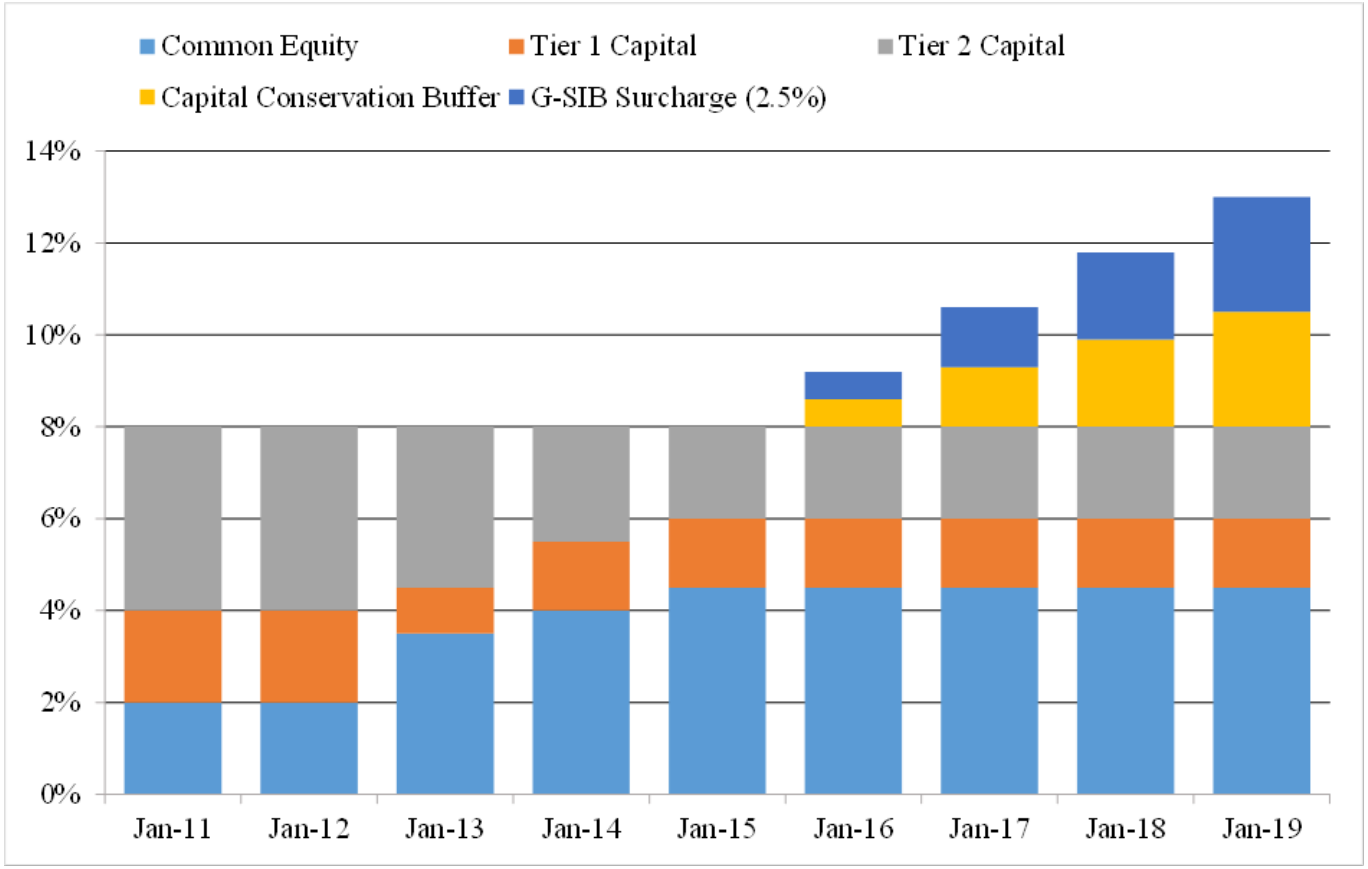
Motivation: Capital Requirements Have Risen in the Post-Crisis Period

Figure: Minimum Required Capital Ratios: 2011-2019



- Policy/academic interest in quantifying benefits and **costs**

Background on High Volatility Commercial Real Estate

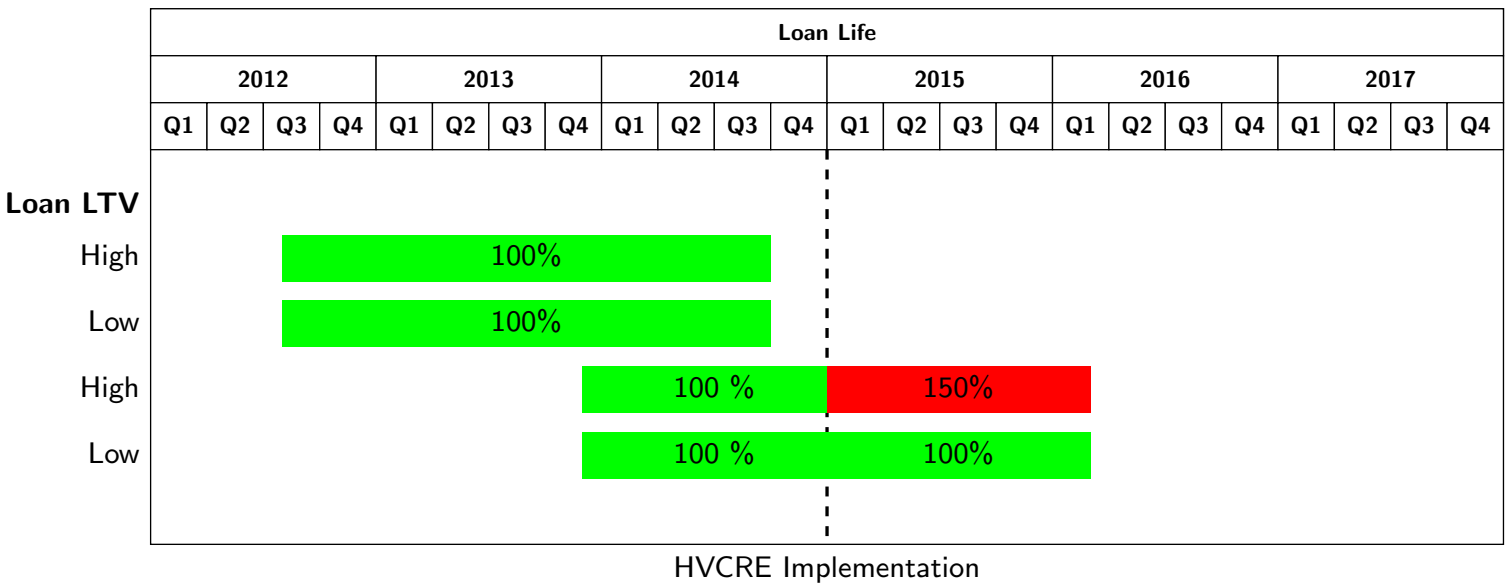
June 2012 release of proposed Basel III implementation:

- Created new loan category: High Volatility Commercial Real Estate (HVCRE)
  - Finances acquisition, development or construction (ADC) of non-1-4 family residential properties
  - Has either a loan-to-value (LTV) ratio above supervisory limits or borrower contributed capital less than 15% of completed value
- HVCRE given 150% risk weight, other CRE stayed at 100%
- Implication: After 2015 implementation, banks need to fund 12% of an HVCRE loan with equity, compared to 8% before
- **Loans not to be grandfathered in**
- Recent changes as part of the May 2018 Economic Growth, Regulatory Relief and Consumer Protection Act not relevant to our paper

This Paper

We provide an empirical estimate of how capital requirements affect loan rates by studying banks' responses to a 50% increase in the risk weighting of High Volatility Commercial Real Estate

- Difference-in-differences estimate exploiting **within bank** variation in
  - Whether terms qualify a loan as HVCRE
  - Percent of loan life subject to increased capital requirements



Preview of Results

- HVCRE rule caused a 38 basis point increase in loan rates
  - 1 pp $\uparrow$ required capital $\implies$ 9.5 bp $\uparrow$ loan rates
- No effects found for:
  - Exempt CRE loan categories
  - Placebo HVCRE dates
  - Banks far from risk-weighted capital constraint
- Riskiness of loans little changed

Literature

Calibrated estimates of effect of capital requirements on loan rates vary widely:

- "*The impact of a 1 percentage point increase in capital requirements on lending rates ranges from merely 2 basis points to 20 basis points*"-Survey of Dagher et al. 2016
- Disparate estimates reflect different assumptions regarding Modigliani-Miller effects

Recent empirical literature uses loan-level data, typically exploiting either:

- Cross-bank variation in capital requirements
- Within-bank variation from 2008 European Basel II implementation

Our paper: Within-bank variation, U.S. banks, non-crisis sample period

Data Details

Loan-level data on bank Commercial Real Estate holdings (FR Y-14Q) submitted as part of annual stress tests

- Banks with at least $50 billion in assets
- Loans with a committed exposure of at least $1 million

Key variables of interest:

- High LTV: Indicator for whether loan-to-value ratio exceeds threshold to be characterized as HVCRE
    - LTV = Committed exposure/Value at origination
- Pct. HVCRE: Percentage of life of loan extending after implementation date (origination, maturity dates)
- Other terms and characteristics: Loan interest rate, 5-digit zip (s.d. of house prices), probability of default, loss given default, credit rating, fixed rate indicator
- Loan type: Non-1-4 family ADC vs. 1-4 family ADC vs. Other CRE

Difference-in-differences results

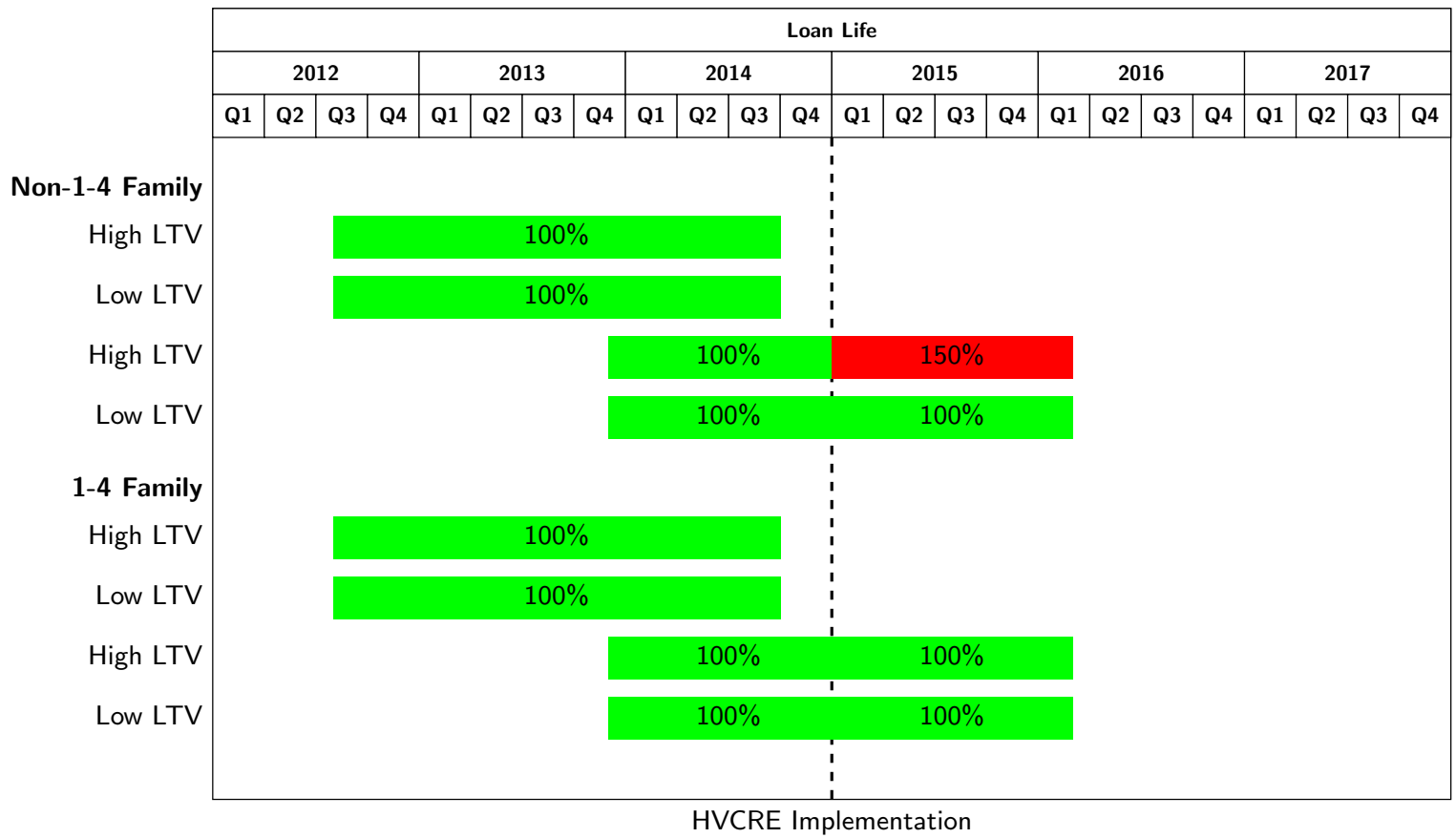
$$r_{i,b,t} = \beta(\text{High LTV}_{i,b,t} \times \text{Pct. HVCRE}_{i,b,t}) + \gamma \mathbf{X}_{i,b,t} + \tau_{b,t} + \varepsilon_{i,b,t}$$

Effect of HVCRE Rule on Loan Rates

	(1)	(2)	(3)	(4)
High LTV x Pct. HVCRE	0.59**	0.38**	0.36**	0.38**
	(0.12)	(0.11)	(0.12)	(0.11)
Pct. HVCRE	-0.29**	-0.43**	-0.52	-0.41
	(0.07)	(0.07)	(0.07)	(0.71)
High LTV	-0.20*	-0.18**	2.16**	2.02**
	(0.08)	(0.07)	(0.06)	(0.64)
Loan controls	X	X	X	X
Time FE	X	X	X	
$1_{\text{Fixed Rate}} \times \{\text{Pct. HVCRE; High LTV}\}$		X		
All Controls$\times\{$Pct. HVCRE; High LTV$\}$			X	X
Bank-Time FE				X
R_a^2	0.366	0.379	0.383	0.464
No. banks	31	31	31	31
No. loans	7516	7516	7516	7516

Triple-Difference Approach

$$r_{i,b,t} = \beta(\text{High LTV}_{i,b,t} \times \text{Pct. HVCRE}_{i,b,t} \times \text{Non-1-4 family ADC}_{i,b,t}) + \gamma \mathbf{X}_{i,b,t} + \tau_{b,t} + \varepsilon_{i,b,t}$$



Triple-Difference results

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Effect of HVCRE Rule on Loan Rates

	Sample of ADC Loans		Sample of CRE Loans	
	(1)	(2)	(3)	(4)
High LTV x Pct. HVCRE	-0.08	-.04	-0.35**	-0.25*
	(0.22)	(0.23)	(0.10)	(0.11)
x Non-1-4 family ADC	0.67*	0.40	1.05**	0.78**
	(0.26)	(0.26)	(0.16)	(0.15)
Loan controls	X	X	X	X
Bank-Time FE	X	X	X	X
All Controls×{Pct. HVCRE; High LTV}		X		X
All Controls×{Non-1-4 Fam ADC}	X	X	X	X
R_a^2	0.457	0.471	0.448	0.466
No. banks	31	31	36	36
No. loans	9270	9270	31592	31592

Taking Stock

Results thus far:

- Loans impacted by HVCRE rule have higher rates (Diff-in-diif)
- Effects only found for
  - Treated loan categories (triple difference)
  - Period after announcement (placebo)
  - Banks with more binding constraints

Concern: long-lived, high LTV loans are generally more expensive for some reason specific to non-1-4 family construction loans

Placebo Test

If findings are due to HVCRE rule, the same relationship between maturity and LTV shouldn't exist in other time periods

- Before announcement: Banks do not know about the rule
- After implementation: Maturity irrelevant to average risk weight

Placebo test:

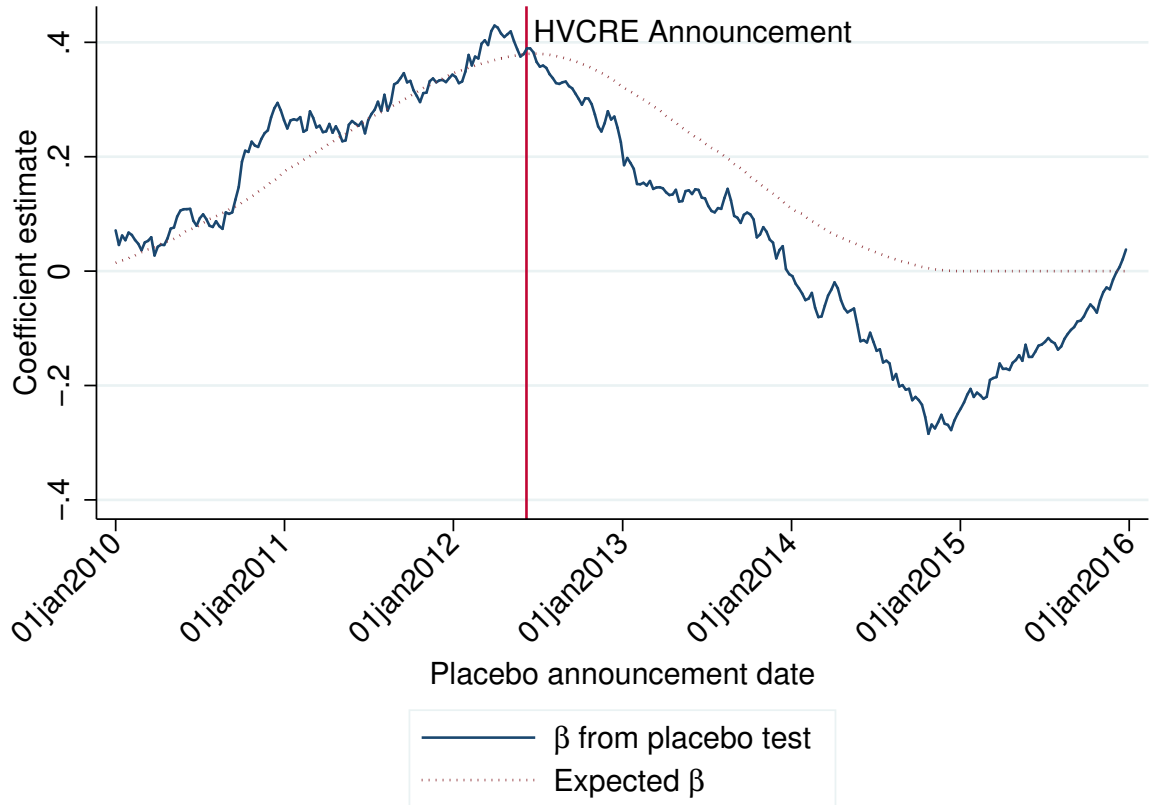
$$\begin{aligned} r_{i,b,t} &= \beta \times (\text{Placebo Pct. HVCRE}_{i,b,t,t'} \times \text{High LTV}_{i,b,t}) \\ &\quad + \gamma \mathbf{X}_{i,b,t} + \tau_{b,t} + \varepsilon_{i,b,t} \end{aligned}$$

- Placebo Pct. $\text{HVCRE}_{i,b,t,t'}$ constructed with a "placebo" announcement to implementation period that matches length of the June 2012 to Jan 2015 period length rolled forward through the sample

Expectation if results due to HVCRE rule:

- Effect maximized when window starts June 2012
- No effects 10 quarters before announcement or after 2015

Placebo Test



- Solid line: Coefficient from Placebo Pct. $\text{HVCRE}_{i,b,t,t'} \times \text{High LTV}_{i,b,t}$
- Dotted line: 0.38 times the coefficient from regressing Pct. $\text{HVCRE}_{i,b,t} \times \mathbb{1}_{t \text{ after HVCRE announcement}}$ on Placebo Pct. $\text{HVCRE}_{i,b,t,t'}$

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Concern: Supply response not driving results (could be demand response, e.g.)

Heterogeneous Effects: Proximity to Capital Constraints

Not all banks should respond to the HVCRE rule:

- Banks close to a risk-based capital constraint would need to use more equity to fund an HVCRE loan due to the rule
- Banks for whom these constraints are far from binding should be less affected

We interact treatment variables with an indicator for whether bank is closer than the median to its minimum Tier-1 capital ratio.

Results Driven by Capital Constrained Banks

Effect of HVCRE Rule on Loan Rates

	Sample of Non-1-4 Family ADC Loans		Sample of ADC Loans		Sample of CRE Loans	
	(1)	(2)	(3)	(4)	(5)	(6)
Capital Constrained						
x High LTV x Pct. HVCRE	0.61**	0.35^{+}	-1.02^{+}	-1.24**	-0.33	-0.28
	(0.21)	(0.19)	(0.53)	(0.47)	(0.22)	(0.23)
x High LTV x Pct. HVCRE x Non-1-4 ADC			1.80**	1.66**	1.12**	0.86**
			(0.57)	(0.50)	(0.31)	(0.30)
High LTV x Pct. HVCRE	0.24^{+}	0.14	0.40	0.59*	-0.20	-0.09
	(0.14)	(0.15)	(0.33)	(0.28)	(0.16)	(0.16)
High LTV x Pct. HVCRE x Non-1-4 ADC			-0.18	-0.51	0.40^{+}	0.25
			(0.34)	(0.31)	(0.21)	(0.21)
Loan controls	X	X	X	X	X	X
Bank-Time FE	X	X	X	X	X	X
All Controls×{Pct. HVCRE; High LTV; Capital Constrained}		X		X		X
All Controls×{Non-1-4 Fam ADC}				X		X
R^2_a	0.449	0.465	0.426	0.477	0.445	0.467
No. banks	30	30	30	30	32	32
No. loans	6899	6899	8551	8551	28726	28726

- Consistent with a supply response

Taking Stock

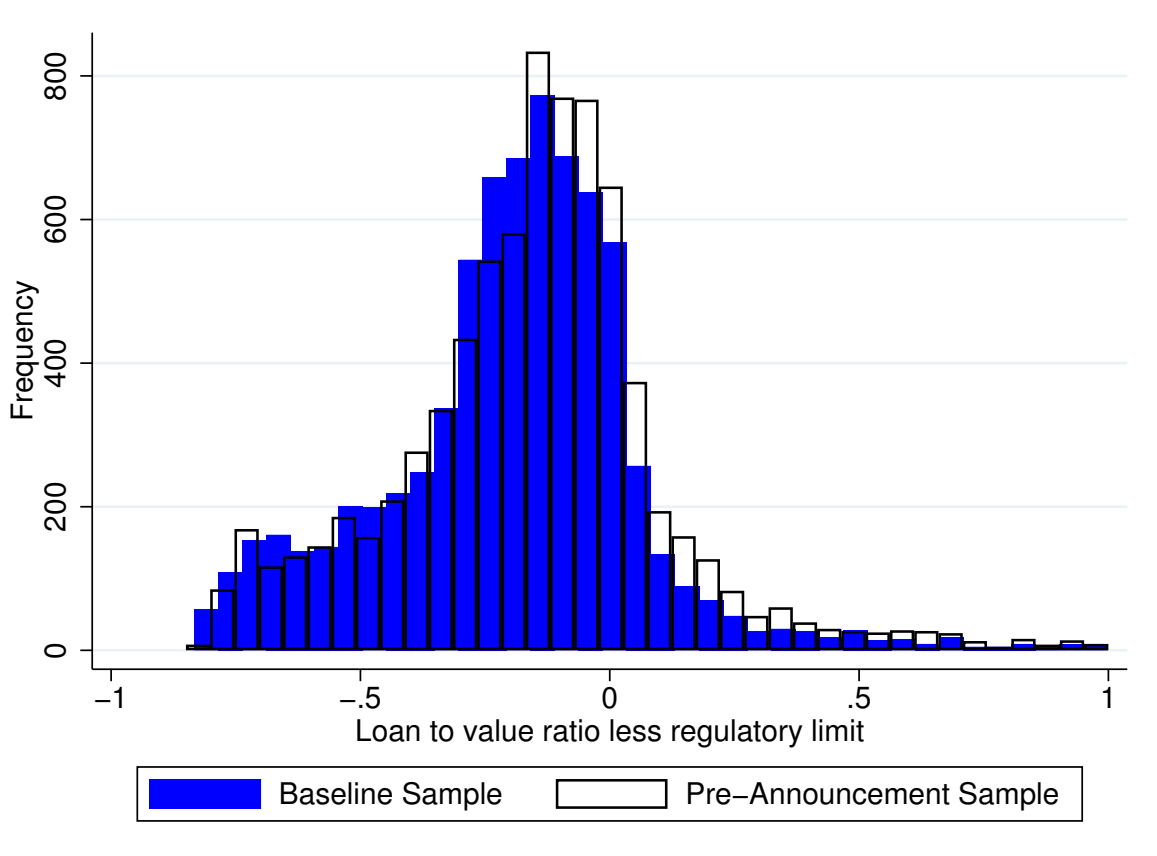
Results thus far:

- Loans impacted by HVCRE rule have higher rates (Diff-in-diif)
- Effects only found for
  - Treated loan categories (triple difference)
  - Period after announcement (placebo)
  - Banks with more binding constraints

Concern: Estimated effect of the HVCRE rule on interest rates could reflect both changes in funding costs and the changes in the composition of borrowers

Bunching Below the Threshold

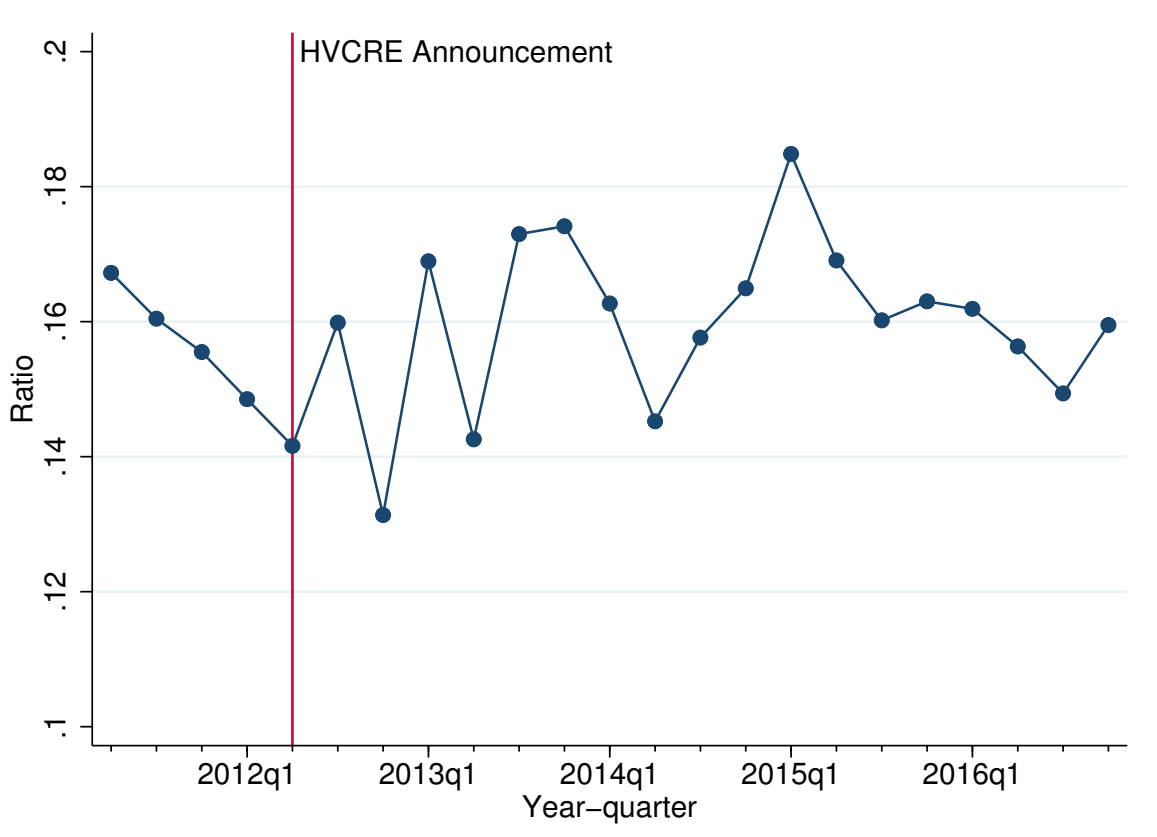
Figure: Density of Loan to Value Ratios Relative to Supervisory Threshold



- Only a minimal increase in bunching after announcement.

Did Originations of High LTV Loans Decrease?

Figure: Percent of Non-1-4 Family Residential ADC Newly Committed Exposures Classified with a high LTV



- Share declines until announcement and then no trend thereafter

Were Treated Loans Riskier?

$$r_{i,b,t} = \beta(\text{High LTV}_{i,b,t} \times \text{Pct. HVCRE}_{i,b,t}) + \gamma \mathbf{X}_{i,b,t} + \tau_{b,t} + \varepsilon_{i,b,t}$$

Effect on Riskiness of Loans

	Prob. of Default	Loss Given Default	House Price Volatility
High LTV x Pct. HVCRE	-0.42^{+}	-0.49	0.35
	(0.23)	(1.06)	(0.34)
High LTV	0.30	-14.44*	1.33
	(1.27)	(7.13)	(1.73)
Pct. HVCRE	-0.57	5.49	1.36
	(1.62)	(6.55)	(1.68)
Loan controls	X	X	X
Time FE	X	X	X
Bank-Time FE	X	X	X
All Controls×{Pct. HVCRE; High LTV}	X	X	X
R^2_a	0.289	0.617	0.096
No. banks	26	26	31
No. loans	5338	5338	7516

Bias from Misclassified Treatment Likely Small

$$r_{i,b,t} = \beta(\text{High LTV}_{i,b,t} \times \text{Pct. HVCRE}_{i,b,t}) + \gamma \mathbf{X}_{i,b,t} + \tau_{b,t} + \varepsilon_{i,b,t}$$

Effect of HVCRE Rule on Loan Rates (Excluding Some Loans)

	(1)	(2)	(3)
High LTV x Pct. HVCRE	0.64**	0.44**	0.40**
	(0.14)	(0.13)	(0.13)
Pct. HVCRE	-0.38**	-0.70	-0.58
	(0.11)	(0.11)	(0.87)
High LTV	-0.27*	3.61**	3.24**
	(0.09)	(0.08)	(0.66)
Loan controls	X	X	X
Time FE	X	X	
All Controls×{Pct. HVCRE; High LTV}		X	X
Bank-Time FE			X
R^2_a	0.371	0.403	0.496
No. banks	30	30	30
No. loans	3272	3272	3272

- This table drops loans with LTVs between 0.5 and the Regulatory Limit
- Similar results dropping above 0.3

Conclusion

Higher capital constraints come at a cost

- 50% ↑ required capital $\implies$ about 40bp ↑ loan rates
- No effect for:
  - 1-4 family construction loans (effect due to the rule)
  - Loans originated before rule announcement ("parallel trends")
  - Loans originated by unconstrained banks (consistent with a supply response)
- No evidence of compositional effects
- Downward bias from misclassified treatment likely small

This doesn't mean that raising capital requirements is bad policy

- Capital requirements lessen distortions from other guarantees, thus costs are private, not social (Admati & Hellwig)
- Costs in terms of credit supply must be weighed against benefits from greater financial stability
  - Miles, Yang & Marcheggiano find that these benefits are substantial.

Appendix: Relation to Calibration Work

Weighted average funding cost for a bank:

$$WACC = R_e \frac{E}{E+D} + R_d \frac{D}{E+D}(1-\tau)$$

Assuming that R_e is a function of leverage, the relationship between funding costs and leverage is:

$$\begin{aligned} \frac{\partial WACC}{\partial(\frac{E}{E+D})} &= R_e - R_d + \frac{E}{E+D}\frac{\partial R_e}{\partial(\frac{E}{E+D})} + \tau R_d \\ &= (1 - MM_{offset})(R_e - R_d) + \tau R_d, \end{aligned}$$

Assuming that changes in funding pass through to loan rates, we can take our estimated elasticity and values of R_e and R_d from Miles et al. and solve for the Modigliani-Miller Offset implied by our results

$$MM_{offset} \approx 21\% \tag{1}$$