

# How do Capital Requirements Affect Loan Rates?

## Evidence from High Volatility Commercial Real Estate

David Glancy & Robert Kurtzman<sup>1</sup>

Federal Reserve Board

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<sup>1</sup>Disclaimer: The views expressed in this presentation are those of the authors and do not necessarily reflect the views of the Board of Governors of the Federal Reserve System or anyone else associated with the Federal Reserve System.

# Question: How Do Tighter Capital Requirements Impact Bank Loan Rates?

Effect is theoretically uncertain:

- Capital Structure Irrelevance principle: Increasing equity funding has the offsetting effect of reducing the costs of equity and debt (Modigliani-Miller)
- Subsidization of debt or frictions in equity issuance may make regulations costly (e.g. Myers-Majluf)

Calibrated estimates of effects 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

# This Paper

We provide an empirical estimate of how capital requirements impact 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 variation in
  - Whether terms qualify a loan as HVCRE
  - Percent of loan life subject to increased capital requirements
- Triple-differences estimate
  - 1-4 family construction loans exempt from increase in risk weights, other construction loans impacted

## Preview of Results

- HVCRE rule caused a 35 basis point increase in loan rates
  - 1 pp  $\uparrow$  required capital  $\implies$  8.8 bp  $\uparrow$  loan rates
- No effect on 1-4 family construction loans, which were exempt
- No effect before announcement of the HVCRE rule
- Effect driven by banks close to their Tier-1 capital constraint

## Background on HVCRE

June 2012 release of proposed Basel III implementation:

- Created new loan category: High Volatility Commercial Real Estate Loans (HVCRE)
- 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

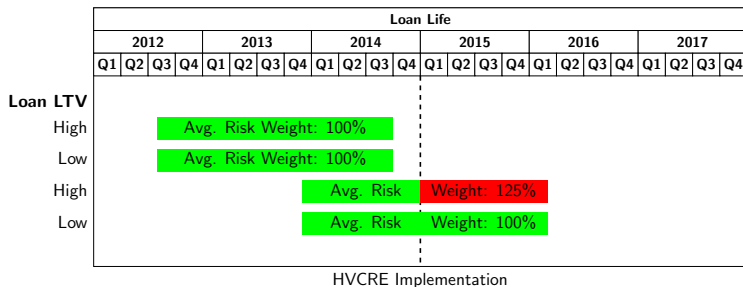
Definition of HVCRE loan:

- Finances acquisition, development or construction 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

# Empirical Strategy

Diff-in-diff exploiting variation in whether the loan exceeds the HVCRE LTV limit (High LTV<sub>*i,b,t*</sub>) and the portion of the loan's life occurring after the implementation date (Pct. HVCRE<sub>*i,b,t*</sub>)

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



# Data

Loan-level data on bank Commercial Real Estate holdings (FR Y-14Q)

- Reported for Comprehensive Capital Analysis and Review (Stress Tests)
- Banks with at least \$50 billion in assets report loans with a committed exposure of at least \$1 million

Key variables of interest:

- Loan interest rate
- High LTV: Indicator for whether loan-to-value ratio exceeds threshold to be characterized as HVCRE
- Pct. HVCRE: Percentage of life of loan extending after implementation date

## Difference-in-differences results

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

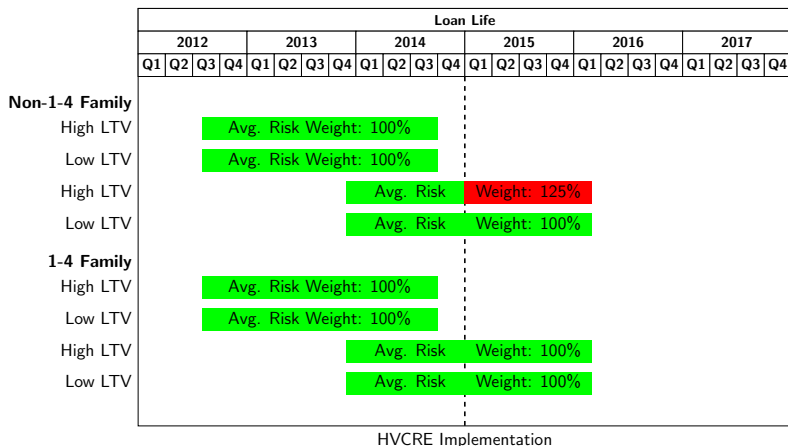
Effect of HVCRE Rule on Loan Rates

	(1)	(2)	(3)
High LTV x Pct. HVCRE	0.55** (0.12)	0.58** (0.11)	0.35** (0.10)
Pct. HVCRE	-0.28** (0.07)	-0.21** (0.07)	-0.33 (0.65)
High LTV	-0.19* (0.08)	-0.19** (0.06)	2.04** (0.58)
Loan controls	X	X	X
Time FE	X		
Bank-Time FE		X	X
Controls × {HVCRE, High LTV}			X
R <sub>a</sub> <sup>2</sup>	0.360	0.441	0.457
No. banks	30	30	30
No. loans	7458	7458	7458



# Triple-Difference Approach

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



## Triple-Difference results

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

Effect of HVCRE Rule on Loan Rates

	Sample of ADC Loans		Sample of CRE Loans	
	(1)	(2)	(3)	(4)
High LTV x Pct. HVCRE	-0.04 (0.23)	0.00 (0.23)	-0.34** (0.11)	-0.22 <sup>+</sup> (0.12)
x Non-1-4 family ADC	0.59* (0.27)	0.33 (0.26)	0.97** (0.17)	0.69** (0.15)
Loan controls	X	X	X	X
Bank-Time FE	X	X	X	X
Controls x {HVCRE, High LTV}		X		X
Controls x {Non-1-4 Fam ADC}	X	X	X	X
R <sub>a</sub> <sup>2</sup>	0.449	0.461	0.447	0.465
No. banks	30	30	32	32
No. loans	9457	9457	30519	30519

# Taking Stock

Results thus far:

- Diff-in-diff: Loans most impacted by HVCRE rule have higher interest rates
- Triple-differences: Relationship between LTV and exposure to post-implementation period only occurs for treated category of CRE loans (not general pricing relationship)

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

## Does the same relationship hold before announcement?

Placebo test: Run specification on loans originated prior to the announcement of the rule

- Placebo Pct. HVCRE: Percentage of life of loan extending after *announcement* date
- If results are due to HVCRE rule, we should find no effect on interest rates in period when banks are unaware of the rule
- If results are due to general pricing of non-1-4 family construction loans, we should see a similar relationship before the announcement of the rule

# Placebo results

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)
High LTV x Pct. HVCRE	0.13 (0.11)	0.06 (0.10)	0.37 <sup>+</sup> (0.21)	0.36 (0.22)	0.08 (0.09)	0.04 (0.09)
x Non-1-4 family ADC			-0.23 (0.24)	-0.26 (0.23)	0.10 (0.12)	0.04 (0.11)
Loan controls	X	X	X	X	X	X
Bank-Time FE	X	X	X	X	X	X
Controls × {HVCRE, High LTV}		X		X		X
Controls × {Non-1-4 Fam ADC}			X	X	X	X
$R^2_{\text{adj}}$	0.285	0.290	0.285	0.289	0.373	0.380
No. banks	28	28	30	30	36	36
No. loans	7770	7770	9410	9410	39334	39334

Baseline Results

# 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 capital constraints are far from binding should be unaffected

We interact treatment variables with an indicator for whether bank is closer than the median to their 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	0.69** (0.21)	0.42* (0.19)	-0.91+ (0.50)	-1.26** (0.46)	-0.42+ (0.24)	-0.39 (0.24)
x High LTV x Pct. HVCRE x Non-1-4 ADC			1.74** (0.56)	1.75** (0.50)	1.25** (0.33)	0.98** (0.32)
High LTV x Pct. HVCRE	0.16 (0.14)	0.06 (0.14)	0.21 (0.35)	0.54+ (0.31)	-0.13 (0.17)	0.00 (0.16)
High LTV x Pct. HVCRE x Non-1-4 ADC			-0.07 (0.37)	-0.55 (0.35)	0.25 (0.21)	0.09 (0.21)
Loan controls	X	X	X	X	X	X
Bank-Time FE	X	X	X	X	X	X
Controls x {HVCRE, High LTV, Capital Constrained}		X		X		X
Controls x {Non-1-4 Fam ADC}				X		X
R <sub>a</sub> <sup>2</sup>	0.437	0.456	0.411	0.464	0.448	0.471
No. banks	30	30	30	30	32	32
No. loans	6848	6848	8662	8662	27930	27930

# Discussion

Higher capital constraints come at a cost

- 50%  $\uparrow$  required capital  $\implies$  35bp  $\uparrow$  loan rates
- No effect for:
  - 1-4 family construction loans
  - Loans originated before rule announcement
  - Loans originated by unconstrained banks

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.



## 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:

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

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

$$MM_{offset} \approx 30\% \quad (1)$$

# Triple-Difference Results (Post Announcement)

Effect of HVCRE Rule on Loan Rates

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x Non-1-4 family ADC			0.59* (0.27)	0.33 (0.26)	0.97** (0.17)	0.69** (0.15)
Loan controls	X	X	X	X	X	X
Bank-Time FE	X	X	X	X	X	X
Controls x {HVCRE, High LTV}		X		X		X
Controls x {Non-1-4 Fam ADC}			X	X	X	X
R <sub>a</sub> <sup>2</sup>	0.441	0.457	0.449	0.461	0.447	0.465
No. banks	30	30	30	30	32	32
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Baseline Results