

# Monetary Stimulus and Bank Lending

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## Central Banks and Asset Purchases

Unprecedented monetary intervention in recent years.

- ▶ Quantitative Easing in the U.S., Japan, Europe, and elsewhere.
- ▶ In the U.S., large amounts of MBS and Treasury (TSY) securities purchased.
- ▶ Goals: reduce yields, boost lending, and stimulate economic activity.

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- ▶ How did banks respond to asset purchases?
- ▶ Did response affect firms that borrow from these banks?
- ▶ Did MBS and Treasury purchases have different effects?

## Identification Approach

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- ▶ Use a direct measure of monetary policy: Amount of assets purchased per quarter to isolate asset purchase effects from other contemporaneous policies and economic changes.
- ▶ Exploit the heterogeneity of the impact across banks:
  - ▶ *Capital Gains Channel*: Banks hold different quantities of securities on their balance sheets, creating differential effects of purchases.
  - ▶ *Origination Channel*: Some banks are securitizers of loans, allowing them to package and sell MBS to the Fed.

## Main Findings

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- ▶ Asymmetric effects: Firm investment is not negatively affected when Treasury purchases increase.
- ▶ Effects stronger for more constrained banks and firms with fewer sources of external capital.

# Outline of Rest of the Talk

Related Literature and Data

Bank Lending Results

- ▶ Mortgage Lending
- ▶ C&I Loan Growth

Effects on Borrowing Firms

- ▶ Real Effect on Firm Investment
- ▶ Firm-Level Loan Amount Results

Additional Discussion and Results

## Related Literature: Bank Lending Channel and Crowding Out

Impact of aggregate monetary stimulus through bank lending channel:

- ▶ Bernanke (1983); Stein (1998); Kashyap and Stein (2000)
  - ▶ Assumes banks and firms are somewhat financially constrained: Kashyap and Stein (1995); Peek and Rosengren (1995); Holmstrom and Tirole (1997); Bolton and Freixas (2006).



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Crowding out of capital from one sector by another sector during booms:

- ▶ Theoretically by Farhi and Tirole (2012), empirically by Chakraborty, Goldstein and MacKinlay (2016).

## Related Literature: Bank Lending and Quantitative Easing

- ▶ Rodnyanski and Darmouni (2016): Closest to ours. Finds QE increased bank lending.
  - ▶ Research design utilizes the timing of QEs as source of exogenous variation. Hence, any aggregate variation coinciding with QE is used as source of variation. Examples: TARP with QE1, Dodd Frank Street Reform and QE2, Basel III scheduled with QE3.

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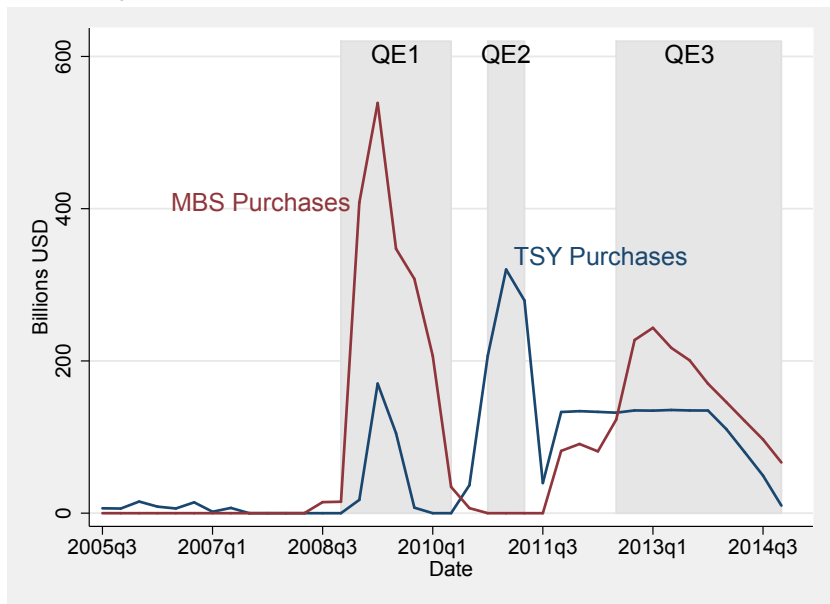
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- ▶ We focus on consequences of QE using a careful identification approach.

# Fed Monetary Stimulus



► Net Purchases

## Asset Purchase Details

### Asset Purchase Data from New York Federal Reserve

Federal Reserve places trades using a primary dealer system.

- ▶ Majority of agency MBS purchases are in the to-be-announced (TBA) forward market.
  - ▶ Agree on six parameters of contract: coupon, maturity, issuer, settlement date, face value, and price.
  - ▶ Typical settlement of MBS security is in 1-3 months.
- ▶ Fed held more than 20% of agency MBS market over this period.

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- ▶ Smaller subset have pool purchase contracts: allow them to undertake swap transactions and create their own agency MBS.

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Use additional measure to capture differences in Treasury exposure:

- ▶ Amount of non-MBS securities held as a % of total assets.
  - ▶ Results similar if use only Treasury and other federal agency debt.

# Mortgage and Bank Data

## Mortgage Origination Data from HMDA

- ▶ Captures all of bank's mortgage origination activity, not just what is kept on balance sheet.
- ▶ Only available on an annual basis.

## Match origination data to bank holding companies.

- ▶ Use Call Report data for other bank-level data, such as C&I Loan Growth and control variables.
- ▶ Analysis that does not use mortgage data done on a quarterly frequency.

## State-Level Mortgage Lending

$$\text{Mort Orig Mkt Share}_{jst} = \alpha_j + \beta_1 \text{Asset Purch Vars}_{t-1} + \beta_2 \text{Bank Vars}_{jt-1} \\ + \beta_3 \text{Bank Asset Hldgs}_{jt-1} \times \text{Asset Purch Vars}_{t-1} + \gamma_{st} + \epsilon_{jst}.$$

	Mortgage Orig Market Share				
	(1)	(2)	(3)	(4)	(5)
High MBS Holdings $\times$ MBS Purchases	0.605** (0.266)	0.562** (0.246)	0.351* (0.198)		
Securitizer $\times$ MBS Purchases				4.273** (2.009)	4.194** (1.983)
Orthog. MBS Holdings	No	No	Yes	No	No
Bank Controls	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	No	No	Yes	No
State by Year-Quarter Fixed Effects	No	Yes	Yes	No	Yes
Observations	45582	45582	39993	45582	45582
Adjusted $R^2$	0.482	0.508	0.289	0.483	0.509

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Mortgage Lending: Economic Effects

Mean quarterly MBS purchases: 95.3 billion.

For 1 s.d. increase in MBS purchases (142.8 billion per qtr), increase of 0.24 bps for high MBS banks (Column 1).

- ▶ With mean market share of 26.2 bps, this is approx. 0.92% higher market share or 1.53 billion USD additional lending by banks with high MBS holdings.

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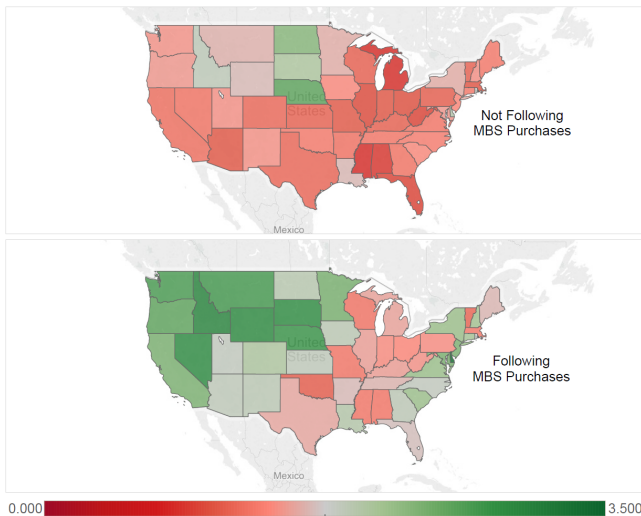
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For the total MBS purchases of 1.76 trillion by the Fed:

- ▶ Securitizer banks provided total additional lending worth \$130 billion (based on Column 5).
- ▶ MBS asset purchases spurred additional mortgage lending for certain banks.



## Avg State-Level Market Share, Securitizor Banks



- ▶ Securitizor banks' lending increases after MBS purchases.

▶ Non-Securitizor Banks

## Effects of Asset Purchases on C&I Loan Growth

Mean Quarterly C&I Loan Growth: 1.58%

	C&I Loan Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
High MBS Holdings × MBS Purchases	-0.0469** (0.0209)		-0.0452** (0.0209)	-0.0584** (0.0233)		
Securitizer × MBS Purchases					-0.344*** (0.101)	-0.342*** (0.100)
High Securities Holdings × TSY Purchases		0.0928*** (0.0312)	0.0920*** (0.0312)	0.103*** (0.0337)		0.0929*** (0.0312)
Orthog. MBS/Sec. Holdings	No	No	No	Yes	No	No
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank's Primary State Year-Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	77950	77950	77950	64350	77950	77950
Adjusted $R^2$	0.0542	0.0546	0.0546	0.0518	0.0543	0.0547

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- ▶ Columns 1, 3: One s.d. increase in MBS purch. reduces growth by 7.5 bps (annualized).
- ▶ Columns 5, 6: For securitizers, one s.d. increase in MBS purch. reduces loan growth about six times more (comparison with Column 4).

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- ▶ Columns 5, 6: For securitizers, one s.d. increase in MBS purch. reduces loan growth about six times more (comparison with Column 4).
- ▶ Treasury purchases led to more C&I lending by banks with higher securities holdings.
- ▶ Asymmetric effects of MBS and Treasury purchases on C&I lending.

## C&I Lending: Economic Effects

Mean quarterly MBS purchases: 95.3 billion.

For 1 s.d. increase in MBS purchases at the mean (142.8 billion per qtr), securitizer banks' loan growth goes down 54.7 bps (Column 5).

- ▶ More than 40% of the total loan volume originated by securitizer banks.
- ▶ For each \$100 of asset purchases, aggregate loan growth is depressed by 40 cents.

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For the total MBS purchases of 1.76 trillion by the Fed:

- ▶ Securitizer banks reduced loan growth by \$28.2 billion (Column 5).
- ▶ As discussed before, this is in comparison to \$130 billion additional mortgage lending.

## Bank Lending Channel: Effect on Borrowing Firms

Does drop in C&I lending growth affect firms' loans and real activity?

Similar to Chakraborty, Goldstein, and MacKinlay (2016):

- ▶ Use DealScan to establish relationships between firms and banks.
- ▶ For syndicated loans, assume relationship is with lead agent.
- ▶ Assume relationship terminates at maturity of final loan observed between firm and bank.
- ▶ Use Compustat for firm-level data.
- ▶ Construct a panel of firm-bank-year-quarter observations.

# Unintended Real Effects on Firm Investment

$$\text{Investment}_{ijt} = \beta_1 \text{Firm Variables}_{it-1} + \beta_2 \text{Asset Purchase Variables}_{t-1} + \beta_3 \text{Bank Variables}_{jt-1} + \beta_4 \text{Bank Asset Holdings}_{jt-1} \times \text{Asset Purch. Variables}_{t-1} + \alpha_{ij} + \gamma_{sit} + \epsilon_{ijt}$$

	Investment					
	(1)	(2)	(3)	(4)	(5)	(6)
High MBS Holdings × MBS Purchases	-0.0530*** (0.0130)		-0.0672*** (0.0143)	-0.0480** (0.0241)		
Securitizer × MBS Purchases					-0.0458** (0.0222)	-0.0517** (0.0212)
High Securities Holdings × TSY Purchases		0.00722 (0.0153)	-0.00238 (0.0163)	0.00966 (0.0201)		-0.00478 (0.0169)
Firm and Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional Firm Interactions	Yes	Yes	Yes	Yes	Yes	Yes
Orthog. MBS/Sec. Holdings	No	No	No	Yes	No	No
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm State by Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32758	32758	32758	14234	32758	32758
Adjusted R <sup>2</sup>	0.499	0.499	0.500	0.545	0.500	0.500

Standard errors in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

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Mean quarterly TSY purchases: 70.3 billion.

- ▶ No negative effects on firm investment.

## Additional Evidence: Firm Loans After Controlling for Firm Demand

Firms with multiple loans in a given year-quarter:

- Use firm-quarter fixed effects to control for any firm-specific demand factors.

$$\text{Loan Amount}_{ijt} = \beta_1 \text{Loan Controls}_{ij} + \beta_2 \text{Asset Purchase Variables}_{t-1} + \beta_3 \text{Bank Variables}_{jt-1} \\ + \beta_4 \text{Bank Asset Hldgs}_{jt-1} \times \text{Asset Purch Vars}_{t-1} + \alpha_j + \theta_{it} + \epsilon_{ijt}.$$

	Loan Amount					
	(1)	(2)	(3)	(4)	(5)	(6)
High MBS Holdings × MBS Purchases	-0.0999** (0.0413)		-0.205*** (0.0764)	-0.496** (0.225)		
Securitizer × MBS Purchases					-0.179** (0.0793)	-0.238** (0.106)
High Securities Holdings × TSY Purchases		0.00380 (0.0466)	0.170* (0.0873)	0.0450 (0.116)		0.152* (0.0926)
Bank and Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes
Orthog. MBS/Sec. Holdings	No	No	No	Yes	No	No
Firm by Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	400	400	400	274	400	400
Adjusted $R^2$	0.446	0.446	0.443	0.840	0.446	0.443

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- Similar findings for loan share growth at syndicate member level.

## Additional Discussion and Results

### Constrained Banks and Asset Purchases

- ▶ Commercial lending reduction concentrated in the constrained banks.
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### Interest Rate and Riskiness of New Mortgage Lending

- ▶ Reduction in average interest rate for mortgages from affected banks.

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### Interest Rate and Riskiness of New Mortgage Lending

- ▶ Reduction in average interest rate for mortgages from affected banks.

### Affordability of New Mortgage Lending

- ▶ Mortgage share gains concentrated in low-affordability (high-price) markets.



## Commercial Lending and Bank Constraints

	C&I Loan Growth	
	Tier 1 Capital and Demand Deposits (Constrained) (1)	(Unconstrained) (2)
Securitizer $\times$ MBS Purchases	-0.466*** (0.118)	-0.0204 (0.133)
High Securities Holdings $\times$ TSY Purchases	-0.319 (0.307)	0.00892 (0.0731)
<i>Wald Test:</i>		
(Constrained = Unconstrained)		6.27**
Bank Fixed Effects	Yes	Yes
Bank's Primary State Year-Quarter Fixed Effects	Yes	Yes
Observations	12017	11455
Banks	1230	1138
Adjusted $R^2$	0.155	0.0766

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- ▶ Commercial lending reduction concentrated in the constrained banks.

## Commercial Lending and QE Rounds

C&I Loan Growth			
	(1)	(2)	(3)
High MBS Holdings × MBS Purchases, through QE1	-0.105*** (0.0251)	-0.110*** (0.0278)	
High MBS Holdings × MBS Purchases, post QE1	0.0157 (0.0249)	-0.00650 (0.0279)	
Securitizer × MBS Purchases, through QE1			-0.358*** (0.114)
Securitizer × MBS Purchases, post QE1			-0.317*** (0.108)
High Securities Holdings × TSY Purchases, through QE1	-0.0162 (0.0402)	-0.00333 (0.0436)	-0.0114 (0.0402)
High Securities Holdings × TSY Purchases, post QE1	0.147*** (0.0325)	0.157*** (0.0352)	0.139*** (0.0324)
Orthog. MBS/Sec. Holdings	No	Yes	No
Bank Fixed Effects	Yes	Yes	Yes
Bank's Primary State Year-Quarter Fixed Effects	Yes	Yes	Yes
Observations	77950	64350	77950
Banks	4913	4576	4913
Adjusted $R^2$	0.0551	0.0522	0.0549

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- ▶ Reduction strongest through QE1, although still present post QE1.

## Firm Investment and Firm Constraints

	Investment			
	Firm Size		Bond Rating	
	(Constrained) (1)	(Unconstrained) (2)	(Constrained) (3)	(Unconstrained) (4)
High MBS Holdings × MBS Purchases	-0.0878*** (0.0289)	-0.0147** (0.00733)	-0.0565*** (0.0214)	0.0102 (0.00754)
High Securities Holdings × TSY Purchases	0.00626 (0.0196)	0.00849 (0.0180)	0.0223 (0.0247)	-0.0263 (0.0169)
<i>Wald Test:</i>				
(Constrained = Unconstrained)		6.01**		8.65***
Firm and Bank Controls	Yes	Yes	Yes	Yes
Firm-Bank Fixed Effects	Yes	Yes	Yes	Yes
Firm's State by Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes
Observations	19451	13064	24055	8458
Adjusted $R^2$	0.477	0.623	0.483	0.673

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- ▶ Constrained firms reduce investment more.

## Interest Rate and Riskiness of New Mortgage Lending

- ▶ Based on sub-sample of riskier mortgages with high APR (3%+ above Treasury rate).

	Avg. Rate (1)	Rate Mkt. Share (2)	Avg. Rate (5)	Rate Mkt. Share (6)
High MBS Holdings × MBS Purchases	-0.865** (0.344)	0.758 (1.311)		
Securitizer × MBS Purchases			-1.684** (0.654)	16.52** (6.533)
Orthog. MBS Holdings	No	No	No	No
Bank Controls	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
State by Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	21732	21732	21732	21732
Adjusted $R^2$	0.663	0.442	0.663	0.450

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- ▶ Banks reduced interest rates in response to MBS purchases.
- ▶ Banks increased riskier mortgage lending as well.

## Affordability and Mortgage Lending

	CBSA Mortgage Orig. Share	
	(IV) (5)	(IV) (6)
Securitizer $\times$ CBSA HPI to Per Capita Income	5.077 (13.18)	3.525 (13.97)
Securitizer $\times$ CBSA HPI to Per Cap. Inc. $\times$ MBS Purchases	7.281** (3.095)	7.224** (3.188)
Bank by Year-Quarter Fixed Effects	Yes	Yes
CBSA Fixed Effects	No	Yes
Observations	57521	57521
Adjusted $R^2$	0.252	0.280

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- ▶ In response to asset purchases, securitizer banks lend more in less affordable localities.

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- ▶ In response to asset purchases, securitizer banks lend more in less affordable localities.
- ▶ To address endogeneity of house prices to economic conditions, we use measure of land availability (Saiz (2010)) and national mortgage rate as instruments.
- ▶ Similar to Mian and Sufi (2011), Chaney, Sraer, and Thesmar (2012), Adelino, Schoar, and Severino (2015), Chakraborty, Goldstein, and MacKinlay (2016).

## Concluding Remarks

MBS asset purchases motivate some banks to increase mortgage lending.

- ▶ Concentrated in banks with more existing MBS holdings and especially active securitizers.
  - ▶ *Origination channel* played a strong role in QE transmission.

These banks have lower commercial lending growth.

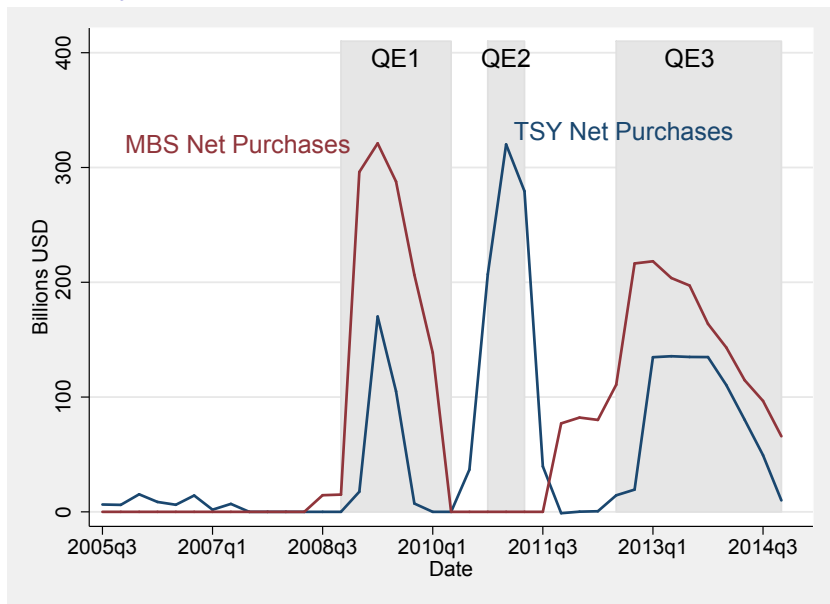
- ▶ Reduction strongest in more constrained banks.

Firms that have relationships with these banks:

- ▶ Have smaller loan amounts.
- ▶ Have lower investment levels.
- ▶ Especially for firms with fewer sources of external capital.

Same effects not seen for Treasury asset purchases.

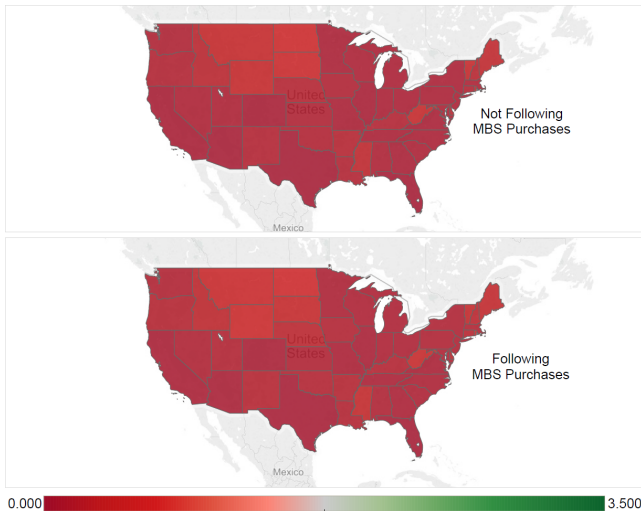
## Fed Monetary Stimulus



► Gross Purchases (Back)



# Avg State-Level Market Share, Non-Securitizer Banks



▶ Securitizer Banks (Back)

## Additional Evidence: Khwaja-Mian (2008) Approach

Loan growth at firm-bank pair level, rolling window of a year (4 quarters)

$$\text{C\&I Loan Growth}_{ijt} = \beta_1 \text{Asset Purchase Variables}_{t-1} + \beta_2 \text{Bank Variables}_{jt-1} \\ + \beta_3 \text{Bank Asset Hldgs}_{jt-1} \times \text{Asset Purch Vars}_{t-1} + \alpha_i + \gamma_j + \theta_t + \epsilon_{ijt}.$$

	Log Loan Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
High MBS Holdings × MBS Purchases	-1.014*** (0.307)		-0.959*** (0.331)	-1.680*** (0.387)		
Securitizer × MBS Purchases					-0.933*** (0.297)	-0.865*** (0.287)
High Securities Holdings × TSY Purchases		0.490** (0.225)	0.671*** (0.184)	0.746 (0.499)		0.438** (0.208)
Orthog. MBS/Sec. Holdings	No	No	No	Yes	No	No
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1425	1425	1425	778	1425	1425
Adjusted R <sup>2</sup>	0.324	0.323	0.325	0.444	0.323	0.324

Standard errors in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

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Standard errors in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

- ▶ Loan growth results are found in firm-bank pair level regressions.

# HMDA Data

## LAR Record

Respondent: CORNERSTONE HOME LENDING, INC.  
Respondent ID: 76-0236067 Year: 2014  
Agency Code: 7 - Department of Housing and Urban Development (HUD)  
Loan Type: 1 - Conventional Loans  
Property Type: 1 - One-to-four Family  
Loan Purpose: 1 - Home Purchase  
Occupancy: 1 - Owner-occupied  
Loan Amount(\$000s): 405  
Preapprovals: 3 - Not applicable  
Action Type: 1 - Loan Originated  
State Code: 48 - TEXAS  
MSA/MD Code: 19124 - DALLAS-PLANO-IRVING, TX  
County Code: 113 - DALLAS COUNTY  
Tract Code: 0044.00 Sequence: 0025599  
Applicant: Co-Applciant:  
Ethnicity: 2 - Not Hispanic or Latino 3 - Not provided  
Race 1: 5 - White 6 - Not provided  
Race 2:  
Race 3:  
Race 4:  
Race 5:  
Sex: 1 - Male 3 - Not provided  
Applicant Income(\$000s): 206  
Purchaser Type: 6 - Commercial bank, savings bank, or savings association  
Denial Reason 1:  
Denial Reason 2:  
Denial Reason 3:  
Rate Spread: NA  
HOEPA Status: 2 - Not a HOEPA loan  
Lien Status: 1 - First Lien  
Edit Status: - No edit failures  
Population: 3107  
Minority Population %: 33.73  
FFIEC Median Family Income(\$): 69100  
Tract to MSA/MD Income %: 149.96  
Number of Owner Occupied Units: 1010  
Number of 1-to 4-Family Units: 1420  
App. Date Indicator: 0 - Application Date >= 01-01-2004

# HMDA Data

## LAR Record

Respondent: **SUNTRUST MORTGAGE, INC**

Respondent ID: **54-0259290** Year: **2014**

Agency Code: **9 - Consumer Financial Protection Bureau**

Loan Type: **1 - Conventional Loans**

Property Type: **1 - One-to-four Family**

Loan Purpose: **1 - Home Purchase**

Occupancy: **1 - Owner-occupied**

Loan Amount(\$000s): **405**

Preapprovals: **3 - Not applicable**

Action Type: **6 - Loan Purchased by the institution**

State Code: **48 - TEXAS**

MSA/MD Code: **19124 - DALLAS-PLANO-IRVING, TX**

County Code: **113 - DALLAS COUNTY**

Tract Code: **0044.00** Sequence: **0059552**

Applicant: Co-Aplicant:

Ethnicity: **4 - Not applicable** **4 - Not applicable**

Race 1: **7 - Not Applicable** **7 - Not Applicable**

Race 2:

Race 3:

Race 4:

Race 5:

Sex: **4 - Not applicable** **4 - Not applicable**

Applicant Income(\$000s): **206**

Purchaser Type: **1 - FNMA**

Denial Reason 1:

Denial Reason 2:

Denial Reason 3:

Rate Spread: **NA**

HOEPA Status: **2 - Not a HOEPA loan**

Lien Status: **4 - Not applicable**

Edit Status: **6 - Quality edit failure only**

Population: **3107**

Minority Population %: **33.73**

FFIEC Median Family Income(\$): **69100**

Tract to MSA/MD Income %: **149.96**

Number of Owner Occupied Units: **1010**

Number of 1-to 4-Family Units: **1420**

App. Date Indicator: **2 - NA (Not Available)**