

# Quantitative easing and bank risk taking: evidence from lending

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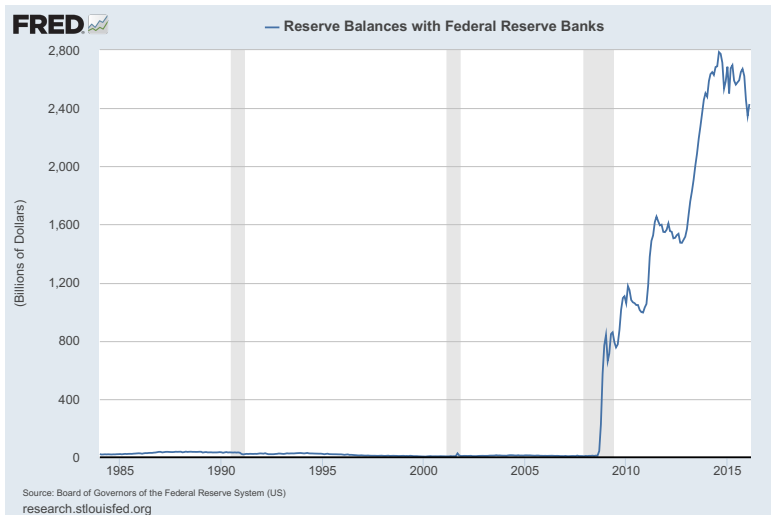
## **ECB workshop** **Non-standard monetary policy measures**

*Disclaimer: The analysis and conclusions set forth are those of the authors alone and do not indicate concurrence by the Board of Governors of the Federal Reserve System or by anyone else associated with the Federal Reserve System.*

# Motivation – Portfolio balance channel

- Different classes of financial assets are not perfect substitutes in investors' portfolios.
- Imperfect substitutability of assets implies that changes in the supplies of various assets available to private investors may affect the prices and yields of those assets.
- As investors rebalance their portfolios the prices of other assets should rise and their yields decline.

# Motivation, cont'd



## How might reserves matter? – Motivation, cont'd

“[...] bank holders of redundant balances will turn first to securities comparable to those they have sold, say, fixed-interest coupon, low-risk obligations. But as they seek to purchase they will tend to bid up the prices of those issues. Hence they [...] will look farther afield: **the banks, to their loans**”

Friedman and Schwartz (1963)

“If money is an imperfect substitute for other financial assets, then large increases in the money supply will lead investors to seek to rebalance their portfolios, raising prices and reducing yields on alternative, non-money assets.”

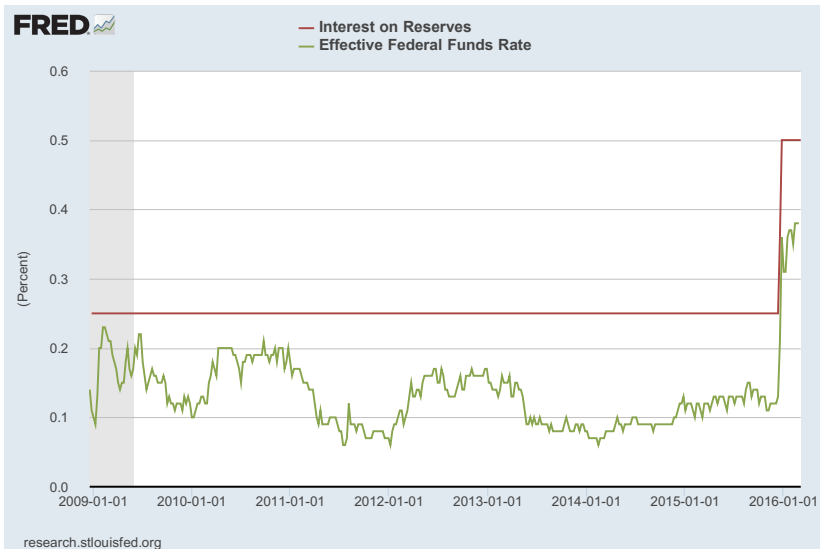
Bernanke and Reinhart (2004)

- Does reserve accumulation *per se* contribute to the transmission of QE?
  - Banks are *forced* to hold the newly created reserves, in aggregate
- Why are we interested in this question?
  - Reserve creation is the defining characteristic of QE
  - Little work on the effects of forced reserve accumulation on bank behavior or role in QE transmission
    - Christensen and Krogstrup (2015)

# How to identify effects of reserves on bank-level outcomes?

- Issue: endogeneity of reserves at the bank level
  - Distribution of reserves *across* banks is determined through private, arms-length transactions
- Identification strategy: IV approach exploiting a regulatory change mandated by Dodd-Frank
  - Post-crisis financial reform legislation

# The fed funds/IOER arbitrage

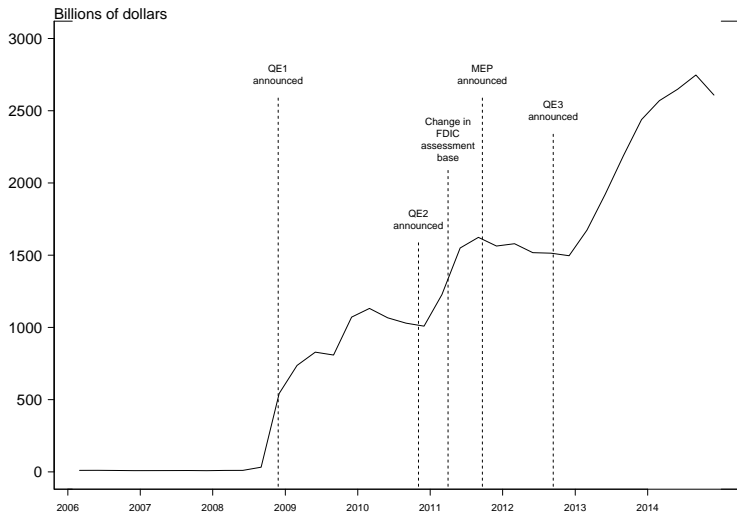


- Dodd-Frank (2010) provision to change FDIC Deposit Insurance Fund (DIF) assessment base
  - DIF assessment fee = assessment base  $\times$  assessment rate
- Assessment base changed from domestic deposits (since 1935) to Assets - Equity
  - Implementation date: April 1, 2011. Effective announcement date: Nov. 9, 2010 (just before QE2 purchases start)
- The higher all-in cost of holding reserves disturbed the fed funds arbitrage enjoyed by banks to that point

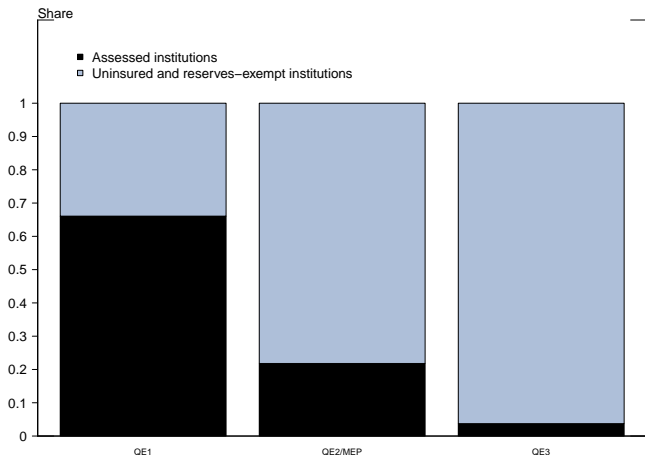


- Not all banks are subject to the FDIC assessment on reserves
  1. FBSEA: foreign branches and agencies established after Dec 19,1991 are not covered by deposit insurance
  2. Banks with custodial businesses and banker's banks can exclude reserves from their assessment base
- For assessed institutions, the net cost of holding reserves went up with implementation of new regulation

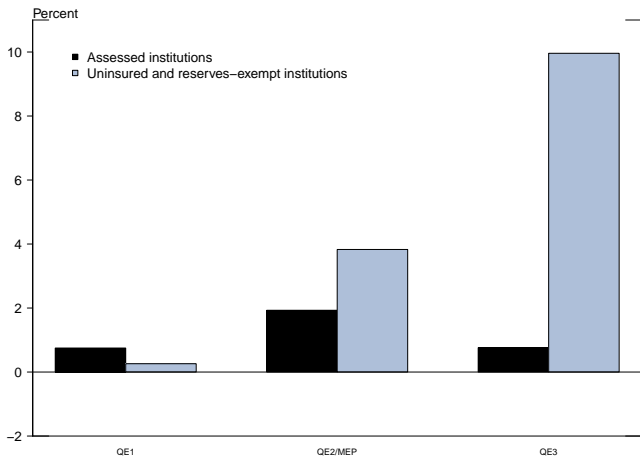
# Forced reserve accumulation through QE



# 1st stage – share of newly-created reserves



# 1st stage – change in reserves as a share of assets



# Exclusion restriction

- Biggest concern: regulatory change affected liability side as well
  - To the extent that banks increase deposit funding, BLC dynamics might *increase* lending (Butt et al., 2014)
- Can rely on comparison of QE2 and QE3
  - QE3 started well after liability adjustments had taken place
- More generally: can't directly test exclusion restriction but we provide suggestive evidence of validity
  - QE1 offers the opportunity to perform placebo tests
  - Pseudo-test of exclusion restriction when no 1st stage

# Descriptive statistics

## Panel A: Assessed institutions

	2010 Q4		2012 Q3		2014 Q3	
	mean	std. dev.	mean	std. dev.	mean	std. dev.
Assets (billions)	4.1	53.2	4.7	58.0	5.7	65.0
Capital/Assets (%)	9.8	5.5	10.5	5.3	10.6	5.4
Liquidity/Assets (%)	19.5	14.0	21.8	15.1	21.7	15.0
Core Deposits/Liabilities (%)	67.3	22.0	72.4	23.8	73.5	20.9
Reserves/Assets (%)	4.5	7.6	5.8	9.6	5.3	10.9
Loans/Assets (%)	64.2	16.5	61.5	17.0	63.2	17.8
High-Risk Loans/Total Loans (%)	53.0	20.8	52.3	21.1	52.8	21.4
NPL/Total Loans (%)	3.6	4.4	2.8	3.5	1.5	2.3
Observations	3453		3262		2996	

## Panel B: Uninsured institutions

	2010 Q4		2012 Q3		2014 Q3	
	mean	std. dev.	mean	std. dev.	mean	std. dev.
Assets (billions)	9.0	19.8	10.5	23.9	13.5	28.2
Capital/Assets (%)	6.1	16.3	5.8	17.2	5.2	15.3
Liquidity/Assets (%)	10.0	18.4	9.0	17.5	7.1	14.2
Core Deposits/Liabilities (%)	10.0	22.9	12.1	58.4	10.9	23.7
Reserves/Assets (%)	13.4	21.3	21.3	26.8	27.4	30.3
Loans/Assets (%)	43.9	34.5	42.2	34.2	41.8	35.5
High-Risk Loans/Total Loans (%)	68.7	31.2	69.7	32.2	69.3	32.8
NPL/Total Loans (%)	1.7	5.2	1.5	4.8	0.6	2.6
Observations	208		200		190	

# Descriptive statistics, cont'd

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## Panel C: Reserves-exempt institutions

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	2010 Q4		2012 Q3		2014 Q3	
	<u>mean</u>	<u>std. dev.</u>	<u>mean</u>	<u>std. dev.</u>	<u>mean</u>	<u>std. dev.</u>
Assets (billions)	161	411	181	440	195	471
Capital/Assets (%)	13.8	13.5	14.5	13.0	16.1	17.5
Liquidity/Assets (%)	19.2	18.6	21.3	18.3	19.3	12.5
Core Deposits/Liabilities (%)	57.6	28.5	66.4	27.1	66.4	26.4
Reserves/Assets (%)	11.1	13.7	12.9	14.6	14.3	13.7
Loans/Assets (%)	49.6	24.4	46.3	23.9	43.8	23.4
High-Risk Loans/Total Loans (%)	52.8	21.6	51.1	22.6	53.5	21.5
NPL/Total Loans (%)	3.4	3.4	3.0	4.5	1.7	3.1
Observations		50		48		48

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$$\Delta y_i = \alpha + \rho \cdot \left( \frac{\Delta Reserves_i}{Assets_i} \right) + \Phi' \mathbf{x}_i + \varepsilon_i$$

- Special case of above equation for a single instrument and no other covariates:

$$\rho = \frac{\mathbb{E} [\Delta y_i | D_i = 1] - \mathbb{E} [\Delta y_i | D_i = 0]}{\mathbb{E} \left[ \frac{\Delta Reserves_i}{Assets_i} | D_i = 1 \right] - \mathbb{E} \left[ \frac{\Delta Reserves_i}{Assets_i} | D_i = 0 \right]}$$



# Results: Total loan growth

Uninsured dummy instrument						
Dependent Variable:						
Total loans (percent change)						
	QE2/MEP			QE3		
	(1)	(2)	(3)	(1)	(2)	(3)
Change in Reserves	0.58*** (0.08)	0.50*** (0.08)	0.19 (0.18)	0.21*** (0.08)	0.36** (0.17)	0.74* (0.42)
ln(assets)		1.45*** (0.52)	2.30*** (0.51)		2.30*** (0.54)	3.12*** (0.56)
CAR		0.42** (0.17)	0.86*** (0.18)		0.76*** (0.21)	0.62*** (0.20)
Lending HHI		3.11 (4.51)	10.9*** (3.80)		-6.00 (5.00)	-1.40 (4.66)
Liquidity		0.20*** (0.05)	0.19*** (0.04)		-0.05 (0.04)	-0.01 (0.04)
Core Deposits		-0.08** (0.03)	0.00 (0.03)		0.01 (0.06)	0.03 (0.06)
Country fixed effects	—	—	✓	—	—	✓
Observations	3,135	3,135	3,135	2,859	2,859	2,859
Wu-Hausman test ( <i>p</i> -value)	0.00	0.00	0.12	0.10	0.09	0.13
First-stage <i>F</i> -statistic	217.5	248.8	62.6	267.6	55.9	19.6

# Results: Higher-risk loan growth

Uninsured dummy instrument						
Dependent Variable:						
Higher-Risk Loans (percent change)						
	QE2/MEP			QE3		
	(1)	(2)	(3)	(1)	(2)	(3)
Change in Reserves	1.27*** (0.20)	2.50*** (0.37)	1.75*** (0.51)	0.23** (0.11)	0.27 (0.23)	1.58** (0.70)
ln(assets)		0.09 (1.13)	1.40 (0.92)		2.25*** (0.76)	2.98*** (0.85)
CAR		2.55*** (0.39)	2.25*** (0.31)		0.74** (0.30)	0.73** (0.31)
Lending HHI		10.15 (9.81)	18.49** (7.47)		11.10 (7.38)	10.71 (8.04)
Liquidity		0.27*** (0.10)	0.22*** (0.07)		-0.11* (0.06)	-0.11 (0.07)
Core Deposits		0.15* (0.09)	0.11* (0.07)		0.05 (0.08)	0.07 (0.09)
Country fixed effects	—	—	✓	—	—	✓
Observations	3,126	3,126	3,126	2,849	2,849	2,849
Wu-Hausman test ( <i>p</i> -value)	0.00	0.00	0.00	0.10	0.28	0.03
First-stage <i>F</i> -statistic	194.5	87.0	44.9	274.4	67.0	24.3

# Results: Non-performing loans as a share of total loans

Uninsured dummy instrument						
Dependent Variable:						
NPL ratio (percent change)						
	QE2/MEP			QE3		
	(1)	(2)	(3)	(1)	(2)	(3)
Change in Reserves	6.82*** (1.81)	5.81** (2.28)	10.01** (4.14)	10.87*** (3.66)	10.90 (7.00)	33.48* (18.90)
ln(assets)		-32.41*** (7.01)	-32.17*** (7.56)		-24.50*** (8.99)	-29.74*** (8.93)
CAR		1.73 (2.57)	0.15 (2.63)		0.31 (3.35)	1.31 (3.53)
Lending HHI		-15.58 (61.38)	1.05 (62.37)		78.98 (71.64)	0.77 (89.43)
Liquidity		-0.02 (0.62)	-0.05 (0.61)		1.23** (0.62)	0.70 (0.76)
Core Deposits		-1.76*** (0.55)	-1.86*** (0.54)		-0.80 (0.97)	-0.99 (1.06)
Country fixed effects	—	—	✓	—	—	✓
Observations	2,945	2,945	2,945	2,654	2,654	2,654
Wu-Hausman test ( <i>p</i> -value)	0.00	0.01	0.02	0.01	0.16	0.07
First-stage <i>F</i> -statistic	149.6	91.34	62.5	259.9	71.9	15.3

# Pseudo test of the exclusion restriction

- QE3 effects are similar to QE2
- Can also look at a reduced form regression for QE1 period
  - similar (positive/significant) coefficients  $\implies$  failure of exclusion restriction

$$\text{LATE} = \frac{\text{reduced form}}{\text{first stage}}$$

# 2SLS regression estimates for QE1

<b>Panel A: IV regression results</b>			
	Total loans	Higher-risk loans	Non-performing loans
Change in Reserves	-0.27 (0.69)	-1.58 (1.85)	80.64 (107.29)
ln(assets)	-0.87 (0.54)	-0.21 (0.98)	-19.28 (25.20)
CAR	0.85*** (0.17)	2.52*** (0.46)	-8.25 (18.51)
Lending HHI	0.38 (3.83)	36.14*** (6.13)	405.35 (311.54)
Liquidity	0.22*** (0.05)	0.30*** (0.09)	8.33** (4.01)
Core Deposits	0.04 (0.07)	-0.08 (0.08)	-4.29 (3.38)
Country fixed effects	✓	✓	✓
Observations	3,208	3,199	2,993
First-stage $F$ -statistic	8.3	4.8	1.7

# Reduced-form regression estimates for QE1

<b>Panel B: Reduced-form regression results</b>			
	Total loans	Higher-risk loans	Non-performing loans
Uninsured	-2.52 (6.31)	-10.93 (9.90)	302.10 (387.03)
Reserves Exempt	-1.33 (4.45)	-9.79 (6.98)	-52.72 (220.76)
ln(assets)	-0.76 (0.50)	0.44 (0.78)	-19.14 (23.88)
CAR	0.81*** (0.15)	2.16*** (0.26)	5.48 (8.70)
Lending HHI	0.09 (3.68)	35.88*** (5.81)	571.59*** (177.55)
Liquidity	0.23*** (0.04)	0.35*** (0.06)	5.68*** (1.93)
Core Deposits	0.01 (0.04)	-0.15** (0.07)	-2.07 (2.15)
Country fixed effects	✓	✓	✓
Observations	3,208	3,199	2,993

- How generalizable is our estimated LATE?
- The FDIC assessment fee altered banks' costs of holding reserve balances
- The ultimate holders of QE-created reserves will be determined by the differential costs (however defined) of holding reserves
  - The results may be more generalizable than they first appear

In this paper, we show the following:

- Reserve accumulation is associated with behavior consistent with theories of portfolio substitution effects of QE
  - Instrument for reserve accumulation using a regulatory change around the time of QE2
  - No first stage exists for QE1, and no evidence of an effect in reduced-form regressions for this program
  - More reserves  $\Rightarrow$   $\uparrow$  lending growth,  $\uparrow$  risk-taking
- Suggests QE works at least in part through reserve accumulation in and of itself