QE: Implications for Bank Risk-Taking, Profitability, and Systemic Risk

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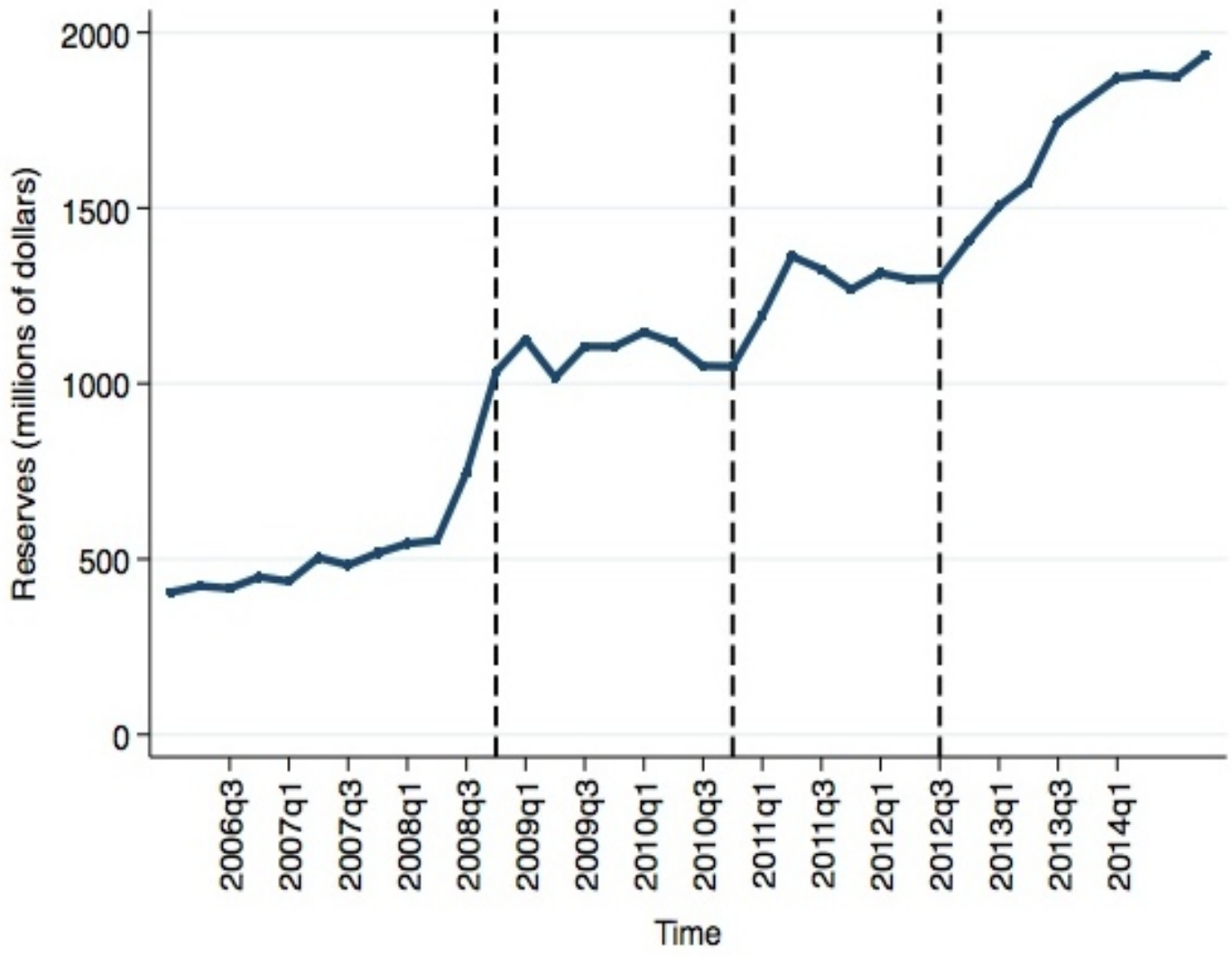
Motivation

- U.S. Fed implemented unconventional policy measures in reaction to the Global Financial Crisis
  - **QE1** (2008Q4 - 2010Q2): Fed purchased $100billion GSE debt, $1,250billion Mortgage-backed securities (MBS)
  - **QE2** (2010Q4 -2011Q2): $600billion Treasury bills
  - **QE3** (2012Q3 - 2014Q3): $ 1,750billion MBS and $1,680billion Treasury bills
  - By the end of all three rounds, the Fed balance sheet reached **$4.5 trillion**
- Quantitative easing (QE) is implemented through a reallocation of assets on the balance sheet of the bank $\rightarrow$ By purchasing securities and crediting the reserve account of banks with the Fed, QE increases the amount of liquid assets on banks' balance sheet.

Figure: Reserves Accumulation of all bank-holding companies



Related Literature on QE

- Different channels through which QE is transmitted to the economy (Bernanke et al., 2020)
  - Signalling channel: Krishnamurthy & Vissing-Jorgensen (2011), Berger & Bouwman (2013)
  - Portfolio channel: Gagnon et al. (2011), D'Amico et al. (2012), Koijen et al. (2021)
  - Lending channel: Rodnyansky & Darmouni (2017), Chakraborty et al. (2020), Luck & Zimmermann (2018), Maggio et al. (2016)
  - Risk-taking channel:
    - Gambacorta (2009), Altunbas et al. (2010), Delis & Kouretas (2011): Negative relation between monetary policy and bank risk-taking
    - Kandrac & Schlusche (2017): Reserves created during QE led to increase in higher risk lending activity within banks' loan portfolios

QE and financial stability

- *Positive effects of QE*: lower yields (Krishnamurthy & Vissing-Jorgensen 2011, Gagnon et al. 2011); increased lending (Rodnyansky & Darmouni 2017, Chakraborty et al. 2017, Luck & Zimmermann 2018)
- *Negative effects of QE*: long periods of low interest rates encourage excessive risk taking and fuel asset bubbles (Kandrac & Schlusche 2017)
- *Net effect* of QE on banking sector stability is not obvious, depends on whether benefits outweigh its costs

Contribution and Research Question

- Suggest a new effect of large scale asset programs: banks reduce contribution to systemic risk due to their higher risk-taking capacity and increased profitability during QE
- This study is the first to provide a distributional perspective on whether QE increased or decreased systemic risk in the financial system.

Research Question

What is the impact of Quantitative Easing on bank risk-taking, bank profitability, and systemic risk?

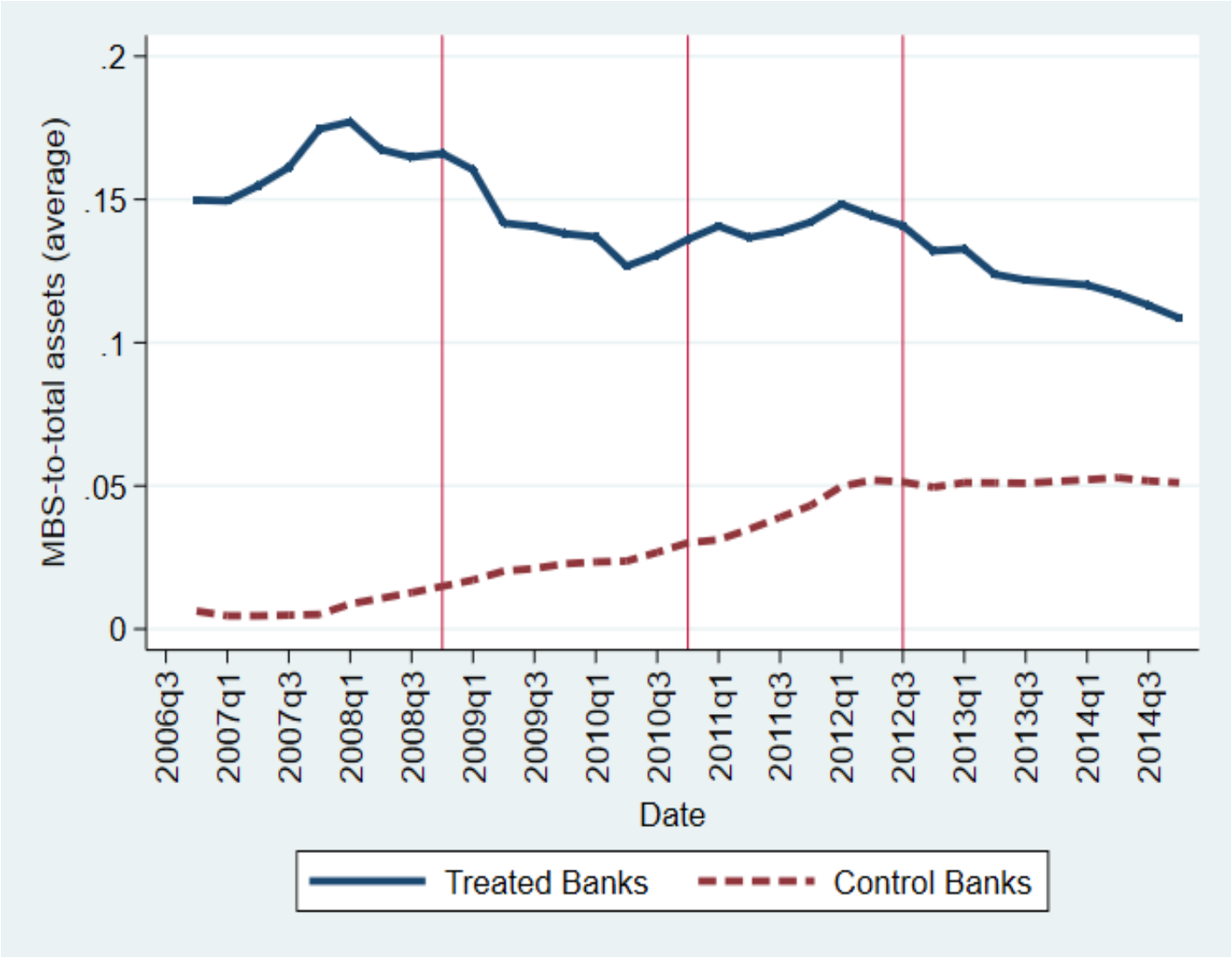
Data and Identification strategy

- BHC-data and CRSP/COMPUSTAT data for all publicly listed institutions including financial firms from 2006:Q1 to 2014:Q4
- Bank's reliance on QE is measured by ratio of MBS-to-total assets in 2007Q4

$$Y_{i,t} = \alpha_i + \beta_t + \rho_{i,t} + \gamma_1' QE_t + \gamma_2 Treat_i + \theta' Treat_i \times QE_t + \delta' X_{i,t-1} + \epsilon_{i,t}$$

- $Y_{i,t}$ = measure of risk-taking, profitability and systemic risk
- $Treat_i$ = indicator variable that takes a value of 1 if bank belongs to treatment group and 0 for control group
- Treatment and Control group banks based on top and bottom quartiles of MBS-to-assets holdings in 2007:Q4
- $QE_t = (QE1_t, QE2_t, QE3_t)$ time dummy corresponding to introduction of each QE
- Our panel models (single equations and systems) exploit the variation in MBS holdings across banks

Figure: MBS distribution for Treated and Control Banks



Measuring bank risk-taking

Primary measure:

- Z-score: risk measure $\rightarrow$ bank's probability of default
- captures either the stability of the banking sector or the inverse probability of insolvency of a bank

$$Z_{i,t} = \frac{ROA_{i,t} + EA_{i,t}}{\sigma_{i,t}^{ROA}}$$

- $ROA_{i,t}$:return on assets for bank i, $EA_{i,t}$:ratio of bank's equity to total assets in time t; $\sigma_{i,t}^{ROA}$:variability of return on assets
- A lower Z-score indicates higher bank risk-taking

Alternative measure:

- Ratio of risk assets to total assets

Measuring bank profitability

Primary measure:

- Logarithm of Net Interest Income

Alternative measure:

- Return on Assets

Measuring Systemic Risk

Primary measure:

- Systemic Expected Shortfall (SES) $\rightarrow$ expected systemic deficit by Acharya et al. (2017)
- Uses both market and balance sheet information to measure a bank's propensity to be undercapitalized under stress conditions
- $SES_{i,t}$ measures the extent to which a bank is undercapitalized in an event in which the entire financial system is under distres
- Increases in $SES_{i,t}$ indicates increase in banks' expected losses during crisis

Measuring Systemic Risk

$$SES_{i,t} = 0.15 MES_{i,t-1} + 0.04 LVG_{i,t-1}$$

- where,

$$MES_{i,t} = E(R_t^i | R_t^m < C)$$

- Estimates how a firm reacts when there is an extreme loss in the aggregated return of the financial market

$$LVG_{i,t} = \left[\frac{(BookAssets_{i,t} - BookEquity_{i,t}) + MarketEquity_{i,t}}{MarketEquity_{i,t}} \right]$$

- Leverage is defined as the quasi-market value of assets to market value of equity

Measuring Systemic Risk

Alternative measure:

- Brownlees and Engle (2016) measure: *SRISK*
- Function of bank size which is captured by the amount of equity, leverage ratio, and long-run *MES*

$$\begin{aligned} SRISK_{i,t} &= E_t[CapitalShortfall_{i,t+1}|Crisis] \\ &= E_t[k(Debt_{i,t+1} + Equity_{i,t+1}) - Equity_{i,t+1}|Crisis] \\ &= kDebt_{i,t} - (1-k)(1-LRMES_{i,t})Equity_{i,t} \end{aligned}$$

Table: Summary Statistics

Variable	Mean	Standard Deviation	p25	p50	p75	Observations
Treatment Variable:						
MBS/Total Assets	0.095	0.088	0.026	0.076	0.138	31,754
Dependent Variables:						
$\ln(Z - score)$	3.38	0.687	3.05	3.417	3.752	27,094
Risk assets/assets	0.933	0.064	0.918	0.953	0.972	31,754
ln(Net Interest Income)	10.11	1.37	9.26	9.87	10.61	31,754
Return on Assets	0.095	9.465	0.002	0.005	0.008	28,508
$\Delta(SES)$	-3.1	1.00	-3.3	-3.25	-3.19	5,087
SRISK	-3.34	13.21	0.63	0.82	1.01	4,843
Bank-Specific Controls:						
Bank Size	14.176	1.325	13.365	13.768	14.534	31,754
Tier 1 Capital Ratio	13.932	22.608	10.67	12.57	15.03	30,484
Leverage Ratio	9.968	15.371	8.19	9.31	10.63	30,484
Deposits Ratio	0.782	0.113	0.750	0.805	0.849	29,408
Liquidity	0.854	65.42	0.029	0.045	0.083	29,388

Results: Benchmark QE regressions

Table: The impact of QE on bank risk-taking

	Z-score					
	(1)	(2)	(3)	(4)	(5)	(6)
$QE1_t \times Treat_i^Q$	0.010	0.022				
	(0.018)	(0.017)				
$QE2_t \times Treat_i^Q$	0.008	-0.013				
	(0.025)	(0.023)				
$QE3_t \times Treat_i^Q$	-0.043**	-0.048***				
	(0.017)	(0.017)				
$QE1_t \times Treat_i^D$			-0.026	-0.011		
			(0.027)	(0.025)		
$QE2_t \times Treat_i^D$			0.008	-0.040		
			(0.038)	(0.035)		
$QE3_t \times Treat_i^D$			-0.054**	-0.125***		
			(0.026)	(0.026)		
$QE1_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					0.074	0.104
					(0.085)	(0.084)
$QE2_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					0.098	0.050
					(0.117)	(0.115)
$QE3_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					-0.220***	-0.263***
					(0.081)	(0.087)
Observations	11,391	10,128	4,591	4,082	20,876	19,724
R-squared	0.077	0.114	0.067	0.102	0.122	0.127
Bank-level Controls	No	Yes	No	Yes	No	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Results: Benchmark QE regressions

Table: The impact of QE on bank profitability

	Net Interest Income					
	(1)	(2)	(3)	(4)	(5)	(6)
$QE1_t \times Treat_i^Q$	0.051***	0.061***				
	(0.008)	(0.006)				
$QE2_t \times Treat_i^Q$	0.045***	0.050***				
	(0.011)	(0.008)				
$QE3_t \times Treat_i^Q$	0.076***	0.038***				
	(0.012)	(0.010)				
$QE1_t \times Treat_i^D$			0.082***	0.074***		
			(0.012)	(0.009)		
$QE2_t \times Treat_i^D$			0.058***	0.048***		
			(0.016)	(0.012)		
$QE3_t \times Treat_i^D$			0.078***	0.019*		
			(0.017)	(0.010)		
$QE1_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					0.340***	0.354***
					(0.040)	(0.033)
$QE2_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					0.238***	0.271***
					(0.057)	(0.048)
$QE3_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					0.467***	0.253***
					(0.062)	(0.056)
Observations	12,785	11,040	5,148	4,445	24,995	21,523
R-squared	0.978	0.991	0.977	0.992	0.980	0.992
Bank-level Controls	No	Yes	No	Yes	No	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Results: Benchmark QE regressions

Table: The impact of QE on systemic risk

	Systemic Expected Shortfall					
	(1)	(2)	(3)	(4)	(5)	(6)
$QE1_t \times Treat_i^Q$	-0.014	-0.015				
	(0.029)	(0.029)				
$QE2_t \times Treat_i^Q$	-0.013	-0.011				
	(0.046)	(0.046)				
$QE3_t \times Treat_i^Q$	-0.092**	-0.125***				
	(0.039)	(0.041)				
$QE1_t \times Treat_i^D$			-0.027	-0.027		
			(0.055)	(0.055)		
$QE2_t \times Treat_i^D$			-0.028	-0.015		
			(0.084)	(0.085)		
$QE3_t \times Treat_i^D$			-0.141*	-0.134*		
			(0.080)	(0.084)		
$QE1_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					-0.100	-0.105
					(0.139)	(0.136)
$QE2_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					-0.056	-0.037
					(0.217)	(0.213)
$QE3_t \times \left(\frac{MBS}{TotalAssets}\right)_i$					-0.363*	-0.494**
					(0.191)	(0.192)
Observations	1,958	1,919	786	781	3,813	3,736
R-squared	0.193	0.175	0.125	0.128	0.209	0.217
Bank-level Controls	No	No	No	No	No	No
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Results: Systems Approach

- In order to account for potential cross-equation correlations in residuals and improve efficiency, we also estimate our three specifications in a system of pooled equations via the seemingly unrelated regressions (SUR) and general methods of moments (GMM) estimators.

Table: The impact of QE on bank risk-taking, profitability and systemic risk: Seemingly Unrelated Regressions

	Z-Score (1)	**NII** (2)	**SES** (3)
$QE1_t \times Treat_i^Q$	-0.098	0.091	-0.010
	(0.126)	(0.071)	(0.032)
$QE2_t \times Treat_i^Q$	0.028	0.081	-0.011
	(0.204)	(0.114)	(0.051)
$QE3_t \times Treat_i^Q$	-0.304*	0.202**	-0.113**
	(0.176)	(0.099)	(0.044)
Observations	1,686	1,686	1,686
R-squared	0.715	0.801	0.044
QE_t	Yes	Yes	Yes
Treatment variable	Yes	Yes	Yes

Results: Systems Approach

Table: The impact of QE on bank risk-taking, profitability and systemic risk: System GMM

	Z-score (1)	**NII** (2)	**SES** (3)
$QE1_t \times Treat_i^Q$	-0.097	0.171**	-0.067*
	(0.122)	(0.083)	(0.039)
$QE2_t \times Treat_i^Q$	-0.037	0.256**	-0.160**
	(0.133)	(0.118)	(0.065)
$QE3_t \times Treat_i^Q$	-0.273*	0.567***	-0.816***
	(0.142)	(0.191)	(0.276)
Observations	1,691	1,691	1,691
QE_t	Yes	Yes	Yes
Treatment variable	Yes	Yes	Yes

Heterogenous Analysis: Results

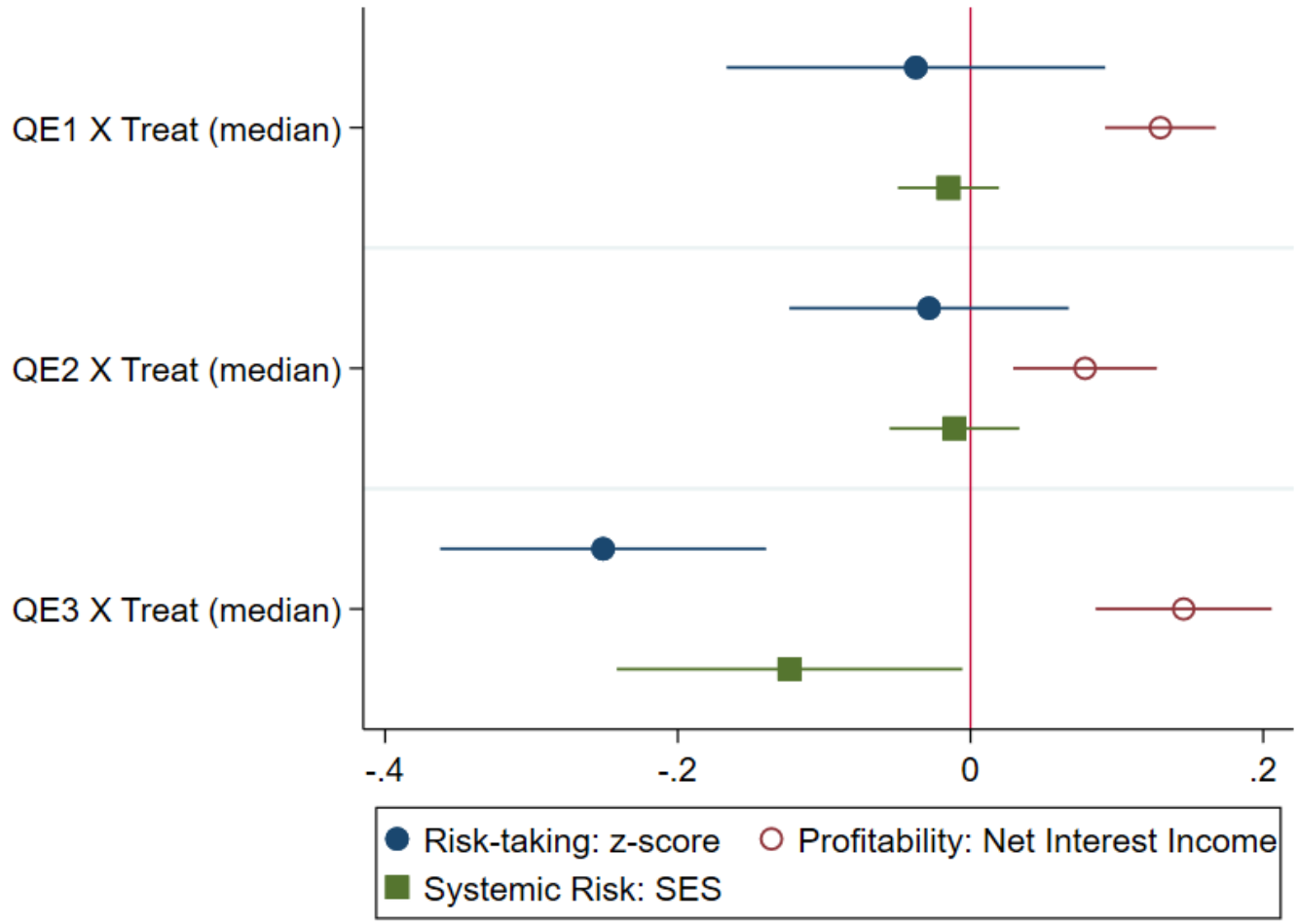
Table: The impact of QE on systemic risk for Too Big To Fail Banks

	Systemic Expected Shortfall	
	(1)	(2)
$QE1 \times TBTF_i$	-0.008	-0.006
	(0.015)	(0.014)
$QE2 \times TBTF_i$	-0.080*	-0.081*
	(0.043)	(0.045)
$QE3 \times TBTF_i$	-0.138**	-0.147**
	(0.061)	(0.064)
Observations	4,548	4,355
R-squared	0.235	0.220
Number of banks	277	246
QE_t	Yes	Yes
Bank- level controls	No	No
Year-Quarter Fixed Effects	Yes	Yes
Bank Fixed Effects	Yes	Yes
State Fixed Effects	Yes	Yes

Other Robustness Checks 1

- Varying definitions of the treatment variable

Figure: Robustness test: treatment variable based on median



Other Robustness Checks 2

- Varying treatment variable specification

Table: The impact of QE on bank risk-taking, profitability and systemic risk-varying treatment definition

	Z-score		Net Interest Income		SES	
	(1)	(2)	(3)	(4)	(5)	(6)
$QE1_t \times Treat/Sec_i^Q$	0.005	0.014	0.038***	0.043***	-0.015	-0.016
	(0.018)	(0.017)	(0.008)	(0.006)	(0.022)	(0.021)
$QE2_t \times Treat/Sec_i^Q$	-0.038*	-0.031	0.041***	0.050***	0.001	-0.000
	(0.022)	(0.019)	(0.011)	(0.008)	(0.035)	(0.034)
$QE3_t \times Treat/Sec_i^Q$	-0.095***	-0.071***	0.068***	0.043***	-0.065**	-0.077**
	(0.020)	(0.021)	(0.011)	(0.008)	(0.030)	(0.031)
Observations	10,757	9,607	12,109	10,459	3,687	3,613
R-squared	0.646	0.665	0.984	0.993	0.229	0.236
Bank-level Controls	No	Yes	No	Yes	No	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Other Robustness Checks 3

- Alternate measures of bank risk-taking, profitability, and systemic risk

Table: Varying measures of dependent variable

	Risk/TA (1)	**ROA** (2)	**SRISK** (3)
$QE1_t \times Treat_i^Q$	-0.005***	0.001***	0.174
	(0.002)	(0.000)	(0.346)
$QE2_t \times Treat_i^Q$	0.010***	0.001***	-0.782
	(0.002)	(0.000)	(0.550)
$QE3_t \times Treat_i^Q$	0.013***	0.001***	-0.684*
	(0.002)	(0.000)	(0.405)
Observations	11,040	10,585	1,940
R-squared	0.758	0.654	0.903
Bank-level Controls	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes
Year-Quarter Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes

Conclusions

- Study aims to deepen the understanding by assessing the effects of LSAPs on financial stability
- QE promoted banks to increase risk-taking in search for higher profits
- Higher profit margins indicate banks' ability to generate profits thus making them more stable and efficient
- These banks reduced their contribution to systemic risk suggesting that the implementation of QE had an overall positive effect on banking sector stability

Thank You !!