QE-QT, Bank Liquidity Management, and Non-Bank Funding: Evidence from Administrative Data

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Note to Program Committee: These slides are part of ongoing research using proprietary data from the Federal Reserve. Clearance for sharing the full draft is pending, but we expect to provide it soon.

Disclaimer: The views expressed are those of the authors and do not necessarily represent the views of the Federal Reserve Board.

Motivation

- Unprecedented expansion of central bank balance sheets since the GFC, highlighting ongoing financial stability challenges Figure on Fed balance sheet expansion
  - Repo rate spike, "Dash for cash"

- Pandemic-related QE and QT involve more than just expanding or shrinking central bank balance sheets (Acharya et al., 23) Figure on Banks and NBFIs OMO securities
  - NBFI heavily participated in the pandemic-related QE by selling assets, resulting in a surge in their uninsured deposits

- A fundamental question is how banks manage liquidity risk across assets and liabilities to prevent "double runs"
  - Kashyap et al., (02): If credit lines drawdowns and deposit withdrawals are imperfectly correlated → banks manage liquidity more efficiently (see also Diamond & Dybvig, 83; Diamond & Rajan, 01; Rochet & Vives, 04; Hanson et al., 15)
  - Freixas & Rochet (08): Banks with unstable funding may engage in excessive risk-taking, leading to poor liquidity risk management

This paper

- **Question:** How does funding fragility affect deposit and credit outcomes, and what are the broader implications for financial stability?
  - Both across and within: (i) banks (ii) deposit counterparty and (iii) firms
- **Administrative data**: Deposit data and credit register matched to bank & firm balance sheets
- **QE & QT:** Analyzing both the bank asset and liability side, beyond the more common asset-side and risk-taking focus
- **Identifying "exposed" bank:** Banks' shares of NBFI uninsured deposits relative to total deposits as of February 2020, prior to the onset of pandemic-induced QE

Preview of results

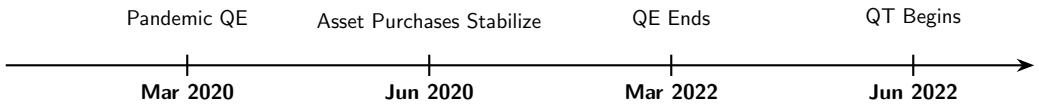
- **Exposed banks experienced a redistribution of deposits, with notable shifts between insured and uninsured categories**
  - A sharper rise in NBFI uninsured deposits and a drop in other non-NBFI uninsured deposits
  - A rise in insured deposits
  - The rise in uninsured NBFI deposits is mainly from supervised NBFIs (e.g., MMFs, insurance companies, broker-dealers) rather than hedge funds, private equity, or REITs
  - Adjust deposit rates by increasing rates on insured deposits while decreasing rates on uninsured deposits

- **Banks more exposed to non-bank funding provide less liquidity insurance to firms**
  - No effect on drawdowns of credit lines
  - Reduction in the undrawn balances of credit lines
  - Decline in the amount of new credit lines issued
  - Increase in term loans
  - No significant differences in pricing of credit
  - Even greater declines in the undrawn balances of credit lines for COVID-affected firms

- **Evidence of comprehensive liquidity risk management by banks**

Institutional Context

Timeline of events



- Mar 2020: Fed announces **QE** in response to the COVID-19 pandemic
- Jun 2020: Asset purchases stabilize at **$120 billion/month** ($80B U.S. Treasuries, $40B in MBS)
- Mar 2022: Fed ends QE, signalling a shift towards tightening monetary policy
- Jun 2022: Fed begins **QT** with a balance sheet reduction of **$47.5** billion per month

QE with Banks: Asset Swap

Initial Balance Sheet Conditions

FEDERAL RESERVE

Assets	Liabilities
Securities	Reserves held by banks Cash

BANKING SECTOR

Assets	Liabilities
Securities Reserves at the Fed	Deposits Capital

The Fed Purchases Assets from Banks

FEDERAL RESERVE

Assets	Liabilities
Securities +$1	Reserves held by banks +$1 Cash

BANKING SECTOR

Assets	Liabilities
Securities -$1 Reserves at the Fed +$1	Deposits Capital

Source: Leonard, Martin, and Potter (2017)

QE with Non-Banks: BS expansion

Initial Balance Sheet Conditions

FEDERAL RESERVE

Assets	Liabilities
Securities	Reserves held by banks Cash

BANKS

Assets	Liabilities
Securities Reserves at the Fed	Deposits Capital

NON-BANKS

Assets	Liabilities
Deposits Securities	Net worth

The Fed Purchases Assets from Non-Banks

FEDERAL RESERVE

Assets	Liabilities
Securities +$1	Reserves held by banks +$1 Cash

BANKS

Assets	Liabilities
Securities Reserves at the Fed +$1	Deposits +$1 Capital

NON-BANKS

Assets	Liabilities
Deposits +$1 Securities -$1	Net worth

Source: Leonard, Martin, and Potter (2017)

Data and Empirical Strategy

Administrative datasets

- **Deposit data** (FR 2052a)
  - Data spans deposit at the counterparty-bank level for all large U.S. bank holding companies (30 BHCs)
  - Daily data for banks with \$700B+ or \$10T+ custody; monthly data for banks \$50B-\$700B assets.
  - Time coverage: January 2016 to February 2023 (monthly data).
  - Impute deposit rates for insured and uninsured deposits using RateWatch data (S&P Global)

- **Matched with:**
  - **Credit register (Y-14)**: Term loans and credit lines extended by 30 banks to 120,797 non-financial firms, covering 2016Q1 to 2022Q4 (quarterly data)
  - Supervisory bank data
  - Firm registry

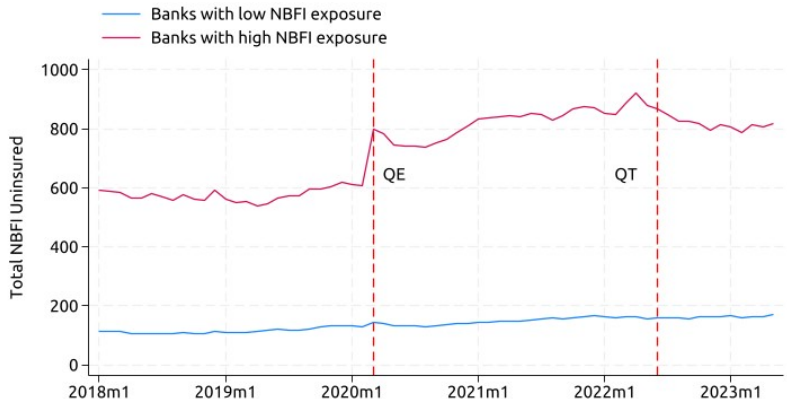
Descriptive statistics table

Empirical strategy

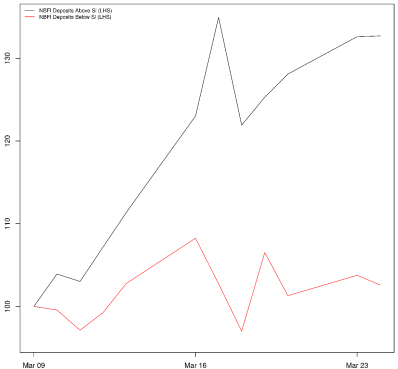
- We analyze deposit and credit data by exploiting:
  - Increases in uninsured NBFI deposits due to QE operations
    - Transactions between the Fed and nonbanks via primary dealers during QE result in increased bank reserves and nonbank uninsured deposits
  - Behavior of banks post-QE and during QT:
    - Whether banks hold reserves to back new nonbank deposits or reoptimize their loan portfolios
  - Differential bank exposure to NBFIs deposits based on the shares of NBFI uninsured deposits relative to total deposits as of February 2020. $Shares_b = (NBFI\ Un.\ Deposits / Deposits)_{Feb-20}$
    - Further heterogeneity: Rate on insured and uninsured deposits
- Exploiting data at the *bank-day*, *bank-counterparty-month*, *firm-bank-quarter level*, and differential granular level of fixed effects

Bank Exposure to Uninsured NBFI Deposits: Bank-Day-Level Evidence

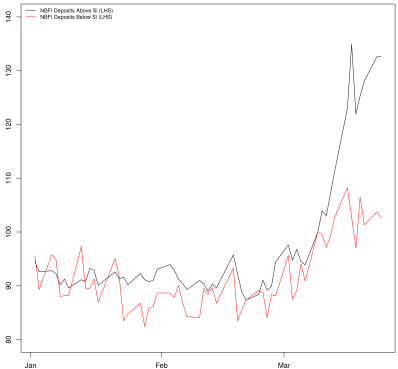
Uninsured NBFI deposits (billions of USD)



Growth in daily uninsured NBFI deposits for banks



March 2020



January-February-March 2020

Reserves daily growth

Characteristics of Exposed Banks

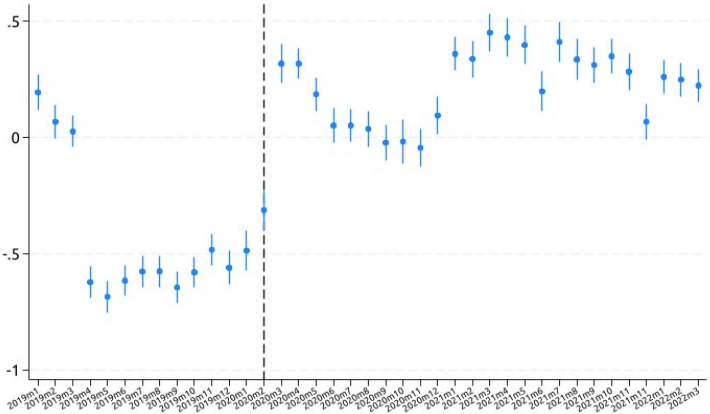
Identifying exposed banks: Balancing test

	Low NBFI exposure		High NBFI exposure		Difference
	Mean	SD	Mean	SD	Std. Diff.
Uninsured Deposits	101,010	169,088	183,840	250,834	-0.38723
NBFI Deposits	4,897	8,250	36,777	45,127	-0.98277
Total Deposits	242,035	341,501	279,393	400,393	-0.10039
Total Assets	522,865	657,313	540,855	757,324	-0.02537
Tier1 Capital Ratio	0.1442	0.043586	0.1455	0.05081	-0.02614
C&I Loans	43,517	58,056	43,360	49,395	0.00292
Treasury + Agency securities	54,091	103,368	56,660	79,715	-0.02783

The table reports normalized differences in bank characteristics between Exposed and Non-Exposed banks, using the standardized difference approach. Exposed banks are defined as those with above-median uninsured NBFI deposits, while Non-Exposed banks have below-median uninsured NBFI deposits. According to Imbens and Wooldridge (2008), a standardized difference above 0.25 indicates a substantial imbalance between the two groups. All units are in millions of USD, except for the capital ratio.

Parallel trends

$$Log(Un.\ NBFI_{i,t}) = \sum_{t=1}^{T} \lambda_{1,t}(MonthQE_t \cdot Shares_i) + \lambda_2(QT_t \cdot Shares_i) + \beta \log(TA_{i,t}) + a_i + a_t + \varepsilon_{i,t}$$



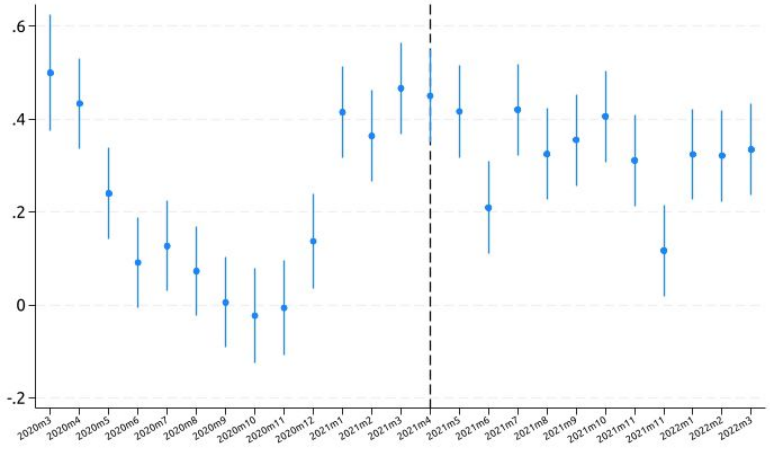
Uninsured Deposits from NBFIs: Deposit-Level Evidence

NBFI uninsured deposits: Counterparty-bank level

Dependent variable:	1	2	3	4	5
	Log(uninsured NBFI deposits)				
			Bank size	SLR	NBFI credit
QE * Shares	0.286***	0.256***	0.272***		0.267***
	(5.258)	(4.274)	(4.655)		(4.150)
QT * Shares		-0.187**	-0.099	0.025	0.025
		(-2.600)	(-1.196)	(0.327)	(0.354)
Bank size			0.347***	0.348***	0.741***
			(3.365)	(3.369)	(7.378)
QE (SLR relaxation)* Shares				0.194***	
				(2.733)	
QE (SLR activation)* Shares				0.346***	
				(6.176)	
NBFI credit					0.046***
					(2.940)
Month FE	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
Observations	2,079	2,079	2,077	2,077	2,066
R-squared	0.968	0.968	0.969	0.968	0.970

Notes: *QE* and *QT* are dummies set to one from March 2020 to March 2022 and from June 2022 onwards, respectively; *Shares* indicates the share of uninsured NBFI deposits in total deposits as of February 2020; Bank size is the log of bank's assets; *QE (SLR relaxation)* refers to the exclusion of securities and reserves from SLR calculations (April 1, 2020, to April 1, 2021) where *QE (SLR activation)* marks the reinstatement of SLR criteria; NBFI credit is the log of total outstanding credit (credit lines and term loans) that NBFIs received.

$$Log(Un.\ NBFI_{i,t}) = \sum_{t=1}^{T} \lambda_{1,t}(MonthQE_t \cdot Shares_i) + \lambda_2(QT_t \cdot Shares_i) + \beta \log(TA_{i,t}) + a_i + a_t + \varepsilon_{i,t}$$



Other deposits: Counterparty-bank level

	1	2	3
Dependent variable:	Log(Total uninsured deposits excluding) NBFI)	Log(Total uninsured deposits)	Log(Total insured deposits)
QE * Shares	-0.416***	-0.253***	1.711***
	(-8.512)	(-6.469)	(14.754)
Bank size	0.364***	0.516***	2.302***
	(9.083)	(9.406)	(11.418)
Month FE	Y	Y	Y
Bank FE	Y	Y	Y
Observations	2,585	2,145	2,000
R-squared	0.976	0.981	0.957

Notes: *QE* is a dummy set to one from March 2020 to March 2022; *QT* is a dummy set to one from June 2022 onwards; and *Shares* indicates the share of uninsured NBFI deposits in total deposits as of February 2020.

"Flightiness" of NBFI types: Supervised vs. other

	1	2	3	4
Dependent variable:	Log(uninsured NBFI deposits)			
Group:	Supervised NBFI		Non-supervised NBFI	
QE * Shares	2.615***	2.735***	0.064	0.061
	(3.556)	(4.106)	(1.045)	(0.977)
Bank size		0.162		0.088
		(0.979)		(1.555)
Month FE	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Observations	1,736	1,734	1,625	1,623
Adjusted R-squared	0.877	0.877	0.952	0.952

Notes: *QE* is a dummy set to one from March 2020 to March 2022; and *Shares* indicates the share of uninsured NBFI deposits in total deposits as of February 2020. "Supervised" NBFI includes MMF, insurance companies, and broker-dealers, while "other" includes hedge funds, private equity funds, Mutual Funds (other than MMFs) and REITs.

Time evolution



Supervised NBFI



Non-supervised NBFI

Liquidity Risk Management: Evidence on Deposit Rates

Deposit rates

	1	2	3	4	5	6
Dependent variable:	Rates on Insured Deposits			Rates on Uninsured Deposits		
QE * Shares	0.529***	0.660***	0.609***	-0.496***	-0.592***	-0.597***
	(6.049)	(9.864)	(10.257)	(-6.074)	(-5.715)	(-5.733)
QT * Shares		0.695**	0.660**		-0.555***	-0.577***
		(2.496)	(2.383)		(-3.524)	(-3.591)
Bank size			-0.233**			0.020*
			(-2.122)			(1.775)
Month FE	Y	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y	Y
Observations	1,224	1,224	1,224	659	659	659
R-squared	0.722	0.724	0.724	0.516	0.519	0.518

Notes: *QE* is a dummy set to one from March 2020 to March 2022; *QT* is a dummy set to one from June 2022 onwards; and *Shares* indicates the share of uninsured NBFI deposits in total deposits as of February 2020.

Banks exposure to NBFIs and credit outcomes:

Loan-level evidence

Credit line: Undrawn outstanding

	1	2	3	4	5	6
Dependent variable:	Log(Undrawn credit lines)					
QE * Shares	-0.188*	-0.118*	-0.143***	-0.340***	-0.139*	-0.174***
	(-1.949)	(-1.821)	(-3.342)	(-3.007)	(-1.952)	(-3.823)
QT * Shares	-0.399**	-0.294***	-0.295***	-0.532***	-0.323***	-0.320***
	(-2.507)	(-3.139)	(-4.821)	(-3.206)	(-3.277)	(-5.159)
Bank size				-0.030	-0.029	0.048
				(-0.434)	(-0.577)	(1.471)
Bank reserves				-0.045***	-0.019***	-0.001
				(-3.621)	(-2.599)	(-0.181)
Bank insured deposits				-0.076*	-0.052**	-0.037**
				(-1.915)	(-2.104)	(-2.015)
Bank uninsured deposits				0.060	0.057	0.022
				(1.255)	(1.644)	(0.903)
Bank FE	Y	Y		Y	Y	
ILST FE	Y			Y		
Firm*Time FE		Y	Y		Y	Y
Bank*Firm FE			Y			Y
Observations	577,426	313,601	310,243	557,600	303,987	300,796
R-squared	0.679	0.78	0.941	0.680	0.783	0.942

Credit line: Drawdowns

	1	2	3	4	5	6
Dependent variable:	Log(Utilized credit lines)					
QE * Shares	0.219	-0.031	-0.115	0.191	0.022	-0.055
	(1.257)	(-0.212)	(-1.178)	(0.923)	(0.130)	(-0.538)
QT * Shares	0.068	-0.172	-0.119	-0.360	-0.241	-0.076
	(0.237)	(-0.870)	(-0.818)	(-1.180)	(-0.124)	(-0.477)
Bank size				-0.489***	-0.133	0.093
				(-3.765)	(-1.325)	-1.562
Bank reserves				0.029*	0.031**	0.027**
				(1.852)	(2.206)	(3.074)
Bank insured deposits				-0.139	-0.235**	-0.082*
				(-1.468)	(-2.362)	(-1.878)
Bank uninsured deposits				0.335***	0.253***	0.093*
				(3.576)	(3.085)	(1.865)
Bank FE	Y	Y		Y	Y	
ILST FE	Y			Y		
Firm*Time FE		Y	Y		Y	Y
Bank*Firm FE			Y			Y
Observations	434,124	195,894	192,968	416,777	187,329	184,557
R-squared	0.536	0.578	0.577	0.538	0.586	0.874

Term loan

	1	2	3	4	5	6
Dependent variable:	Log(Term loans)					
QE * Shares	0.260**	0.240**	0.038	0.433***	0.348***	0.115
	(2.236)	(2.228)	(0.416)	(3.573)	(3.376)	(1.462)
QT * Shares	0.005	0.012	-0.087	0.205	0.079	-0.024
	(0.024)	(0.060)	(-0.579)	(1.012)	(0.449)	(-0.182)
Bank size				0.112	-0.034	0.078
				(1.167)	(-0.369)	(1.053)
Bank reserves				0.003	0.004	0.005
				(0.222)	(0.311)	(0.553)
Bank insured deposits				-0.112**	-0.072	-0.069*
				(-2.312)	(-1.574)	(-1.863)
Bank uninsured deposits				-0.173**	-0.164**	-0.043
				(-2.571)	(-2.343)	(-0.710)
Bank FE	Y	Y		Y	Y	
ILST FE	Y			Y		
Firm*Time FE		Y	Y		Y	Y
Bank*Firm FE			Y			Y
Observations	248,731	97,162	95,485	242,360	96,883	95,215
R-squared	0.724	0.698	0.919	0.723	0.698	0.918

Heterogeneous effect:
Firm's Liquidity during COVID

	1	2
Dependent variable:	Log(Undrawn credit lines)	
QE * Shares	-0.135*	-0.161***
	(-1.875)	(-3.473)
QE * Shares * Liquidity * COVID	1.155	-4.426**
	(0.729)	(-2.275)
QT * Shares	-0.343***	-0.323***
	(-3.353)	(-5.003)
QT * Shares * Liquidity * COVID	4.752	-3.369***
	(1.513)	(-3.044)
Bank controls	Y	Y
Double & triple interactions	Y	Y
Bank FE	Y	Y
Firm*Time FE	Y	
Bank*Firm FE		Y
Observations	286,737	284,575
R-squared	0.781	0.941

Cost of lending

Interest rate on drawn credit lines

	1	2	3	4
Dependent variable:	Log(Interest Rate on Credit Lines)			
QE * Shares	-0.000	0.001	0.000	0.001
	(-0.114)	(0.353)	(0.074)	(0.322)
QT * Shares	0.020***	0.021***	0.025***	0.025***
	(2.780)	(3.091)	(3.261)	(3.550)
Bank size			0.006*	0.006**
			(1.915)	(2.263)
Bank reserves			-0.000	-0.000
			(-0.234)	(-0.888)
Bank insured deposits			0.002	0.001
			(1.252)	(0.649)
Bank uninsured deposits			0.009***	0.009***
			(3.817)	(4.152)
Bank FE	Y	Y	Y	Y
Firm*Time FE	Y		Y	
Bank*Firm FE		Y		Y
Observations	311,880	308,420	300,930	297,656
Adjusted R-squared	0.645	0.798	0.649	0.799

Interest rate on term loans

	1	2	3	4
Dependent variable:	Log(Interest Rate on Term Loans)			
QE * Shares	-0.002**	-0.001	-0.000	-0.000
	(-2.455)	(-1.429)	(-0.001)	(-0.346)
QT * Shares	0.008***	0.006***	0.009***	0.007***
	(4.353)	(3.182)	(5.130)	(3.469)
Bank size			-0.003***	-0.002**
			(-3.190)	(-2.525)
Bank reserves			0.000	-0.000
			(0.297)	(-0.605)
Bank insured deposits			-0.001***	-0.001***
			(-4.919)	(-2.129)
Bank uninsured deposits			0.004***	0.002***
			(6.385)	(3.847)
Bank FE	Y	Y	Y	Y
Firm*Time FE	Y		Y	
Bank*Firm FE		Y		Y
Observations	96,395	94,731	96,102	94,447
R-squared	0.805	0.894	0.806	0.894

Summary

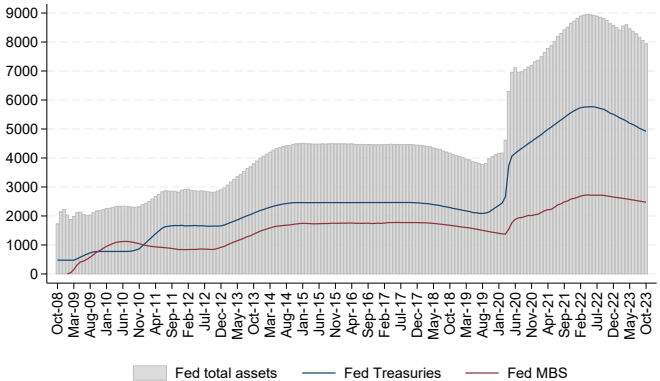
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  - A sharper rise in NBFI uninsured deposits, a drop in other non-NBFI uninsured deposits, and a rise in insured deposits
  - The rise in uninsured NBFI deposits is mainly from supervised NBFIs (e.g., MMFs, insurance companies, broker-dealers) rather than hedge funds, private equity, or REITs
  - Adjust deposit rates by increasing rates on insured deposits while decreasing rates on uninsured deposits

- Banks with a more fragile liability structure (more exposed to NBFI uninsured deposits) provide less liquidity insurance. Evidence consistent with Hanson et al., 15.
  - No effect on drawdowns of credit lines, reduction in the undrawn balances of credit lines, decline in the amount of new credit lines issued and increase in term loans
  - No significant differences in pricing of credit
  - Even greater declines in the undrawn balances of credit lines for COVID-affected firms

- Important finding for policy: Banks do manage liquidity risk both on the liability and asset side

Appendix

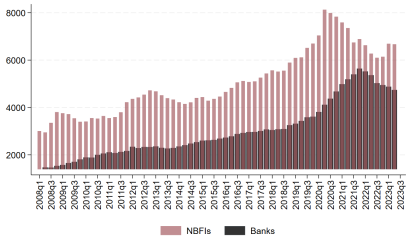
Treasuries, MBS and Fed total assets (billions of USD)



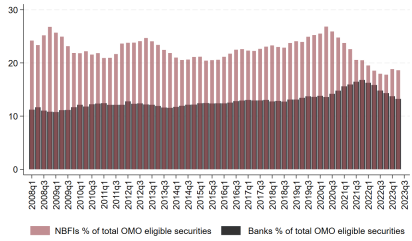
Note: This figure shows the Fed's total assets, Treasuries holdings and MBS holdings using monthly data over the period 2008.M10 - 2023.M10. Source is FRED

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Banks and NBFIs Holdings of OMO Securities



Banks and NBFIs holdings of OMO eligible securities



Banks and NBFIs holdings as % of total OMO eligible securities

Return to slide

Descriptive statistics: Aggregate volumes

Panel A: Deposit Funding by Counterparty

	Feb-20	Mar-20	Pre QE		QE		QT	
	Mean	Mean	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Uninsured NBFI	746.6	953.6	699.7	42.2	978.7	72.6	1051.1	93.2
Insured NBFI	19.3	19.4	23.3	2.3	17.6	4.5	49.3	21.2
Uninsured Retail	1,383.9	1,449.6	1,240.7	56.9	1,750.5	217.5	2,007.1	100.5
Insured Retail	3,573.0	3,738.5	3,281.2	119.5	4,162.5	214.8	4,575.1	159.3
Other	819.7	844.6	714.2	65.2	893.3	69.5	917.8	42.5

Panel B: Bank Exposure to Insured and Uninsured Deposits

	Uninsured NBFI Ratio		Insured Retail Ratio		Total Uninsured Ratio	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Banks with low NBFI Share	2.12%	1.79%	53.84%	16.39%	40.63%	15.65%
Banks with high NBFI Share	22.84%	20.14%	17.66%	15.40%	78.69%	17.59%

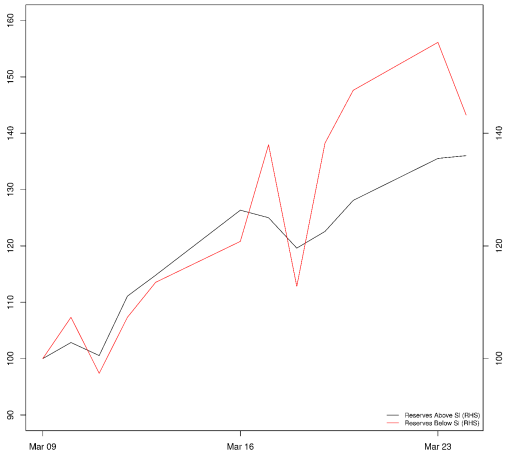
Panel C: Statistics on Loan-Level Data

Period	Total Commitments	Utilized & Drawn Credit	Undrawn Credit Lines	Utilized Credit Lines	Term Loans
2019q4	1.78	0.70	1.03	0.44	0.27
2020q1	1.76	0.86	0.90	0.58	0.29
Pre-QE	1.37	0.55	0.82	0.35	0.21
QE	1.76	0.66	1.10	0.40	0.25
QT	1.96	0.75	1.21	0.45	0.30

Note: Panel A contains the distribution of deposits by counterparty type in billions of USD. Panel B provides comparative statistics on deposit ratios for banks with different shares of NBFI deposits as of February 2020. Panel C displays aggregated summary statistics of loan-level data in trillions of USD.

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Growth in Daily Reserves for Banks in March 2020



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