Banks' Balance-sheet Costs, Monetary Policy, and the ONRRP

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Bank balance-sheet costs, NBFIs, and the central bank

- Monetary policy interacts with bank regulation
  - ◇ QE/QT can affect banks' balance-sheet costs

1. What are the effects on non-bank financial institutions (NBFIs)?

2. What are the effects on the composition of the central bank balance sheet?
   - ◇ In particular, on its liability side?

This paper

- Sample period: 2020-2021 (large QE operations)
- Exogenous variation in balance-sheet costs: SLR relief of 2020Q2-2021Q1
- Effect on money market funds (MMFs):
  - ◇ MMF size
  - ◇ MMF investment at overnight reverse repo facility (ONRRP) with the Fed

Our Results

1. Bank balance-sheet costs go up $\Rightarrow$ MMF industry grows
   - ◇ Banks shed deposits, which flow into MMF shares

2. Bank balance-sheet costs go up $\Rightarrow$ MMFs tilt portfolios towards ONRRP
   - ◇ Banks reduce their wholesale short-term borrowing

3. Other important drivers of ONRRP take-up:
   - ◇ Higher interest-rate risk
   - ◇ Lower Treasury bill supply

Balance-sheet costs: Supplementary Leverage Ratio (SLR)

- Costs that are proportional to the size of bank balance sheets

- Basel III: SLR$=\frac{\text{Tier 1 Capital}}{\text{Assets}} \geq$ minimum requirement

  ◇ Assets are not risk-weighted

  ◇ Balance-sheet expansions for safe asset intermediation are more penalized

  $\rightarrow$ Low=return, low-risk activities

  ◇ Minimum level depends on bank type (e.g., 5% for GSIBs)

- Assets of funds affiliated with banks are not included in SLR calculation

The SLR Relief of 2020-2021

- March 2020: severe strains in Treasury and other money markets
- March-April 2020: the Fed increases central bank reserves by $1.6 trillion
- Temporary "SLR relief:"
  - ◇ Reserves and Treasuries excluded from SLR denominator
  - ◇ Announcement: April 2020. Effective: April (BHC), June (DI). Expiration (scheduled): March 2021
  - ◇ Goal: facilitate banks' (and their dealers') intermediation in safe-asset markets (e.g., Treasuries).

Effect of SLR Relief on Bank Balance-Sheet Costs

- SLR of GSIBs from 2016Q3 to 2022Q4
- End of SLR relief: sudden permanent increase in balance-sheet costs

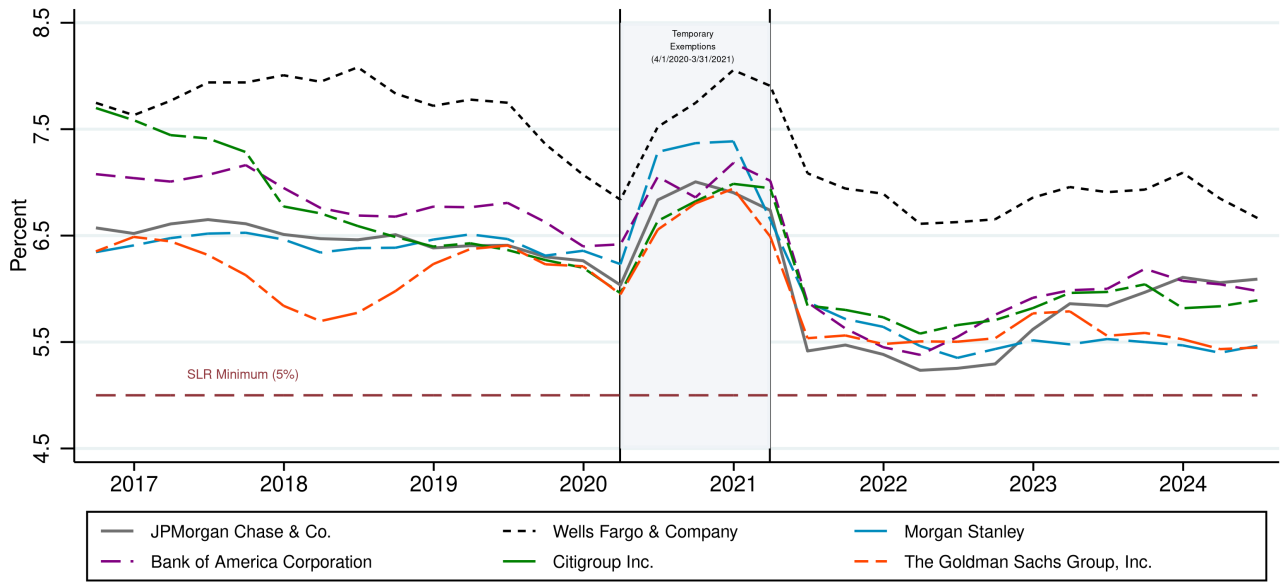


Figure: Supplementary Leverage Ratio for the Largest US Banks

Money Market Funds (MMFs)

- $5 trillion in assets under management in March 2020
  - Currently around $7 trillion

- Two types:
  - Government: Government debt & repos backed by government debt
  - Prime: all above + CD, CP, ABCP, FRNs

- Important alternative to bank accounts for depositors

- Main wholesale short-term lenders to banks (especially repos)

- 30% of MMFs are affiliated with bank holding companies

Overnight Reverse Repo facility (ONRRP)

- Eligible institutions invest at the Fed via overnight Treasury-backed repos
  - ◇ Banks, Primary Dealers, GSEs, and MMFs
  - ◇ ONRRP rate is set by the FOMC
  - ◇ Floor on money-market rates (outside option for MMFs & other lenders)
- ONRRP is a liability in the Fed balance sheet
  - ◇ ONRRP increases $\Rightarrow$ reserves decline (total size of Fed balance sheet remains the same)
  - ◇ ONRRP investing by MMF: transfer from reserves of the MMF's bank to ONRRP

ONRRP Take-up over Time

- MMFs have been main users of ONRRP since its inception (September 2013)
- 82% on average

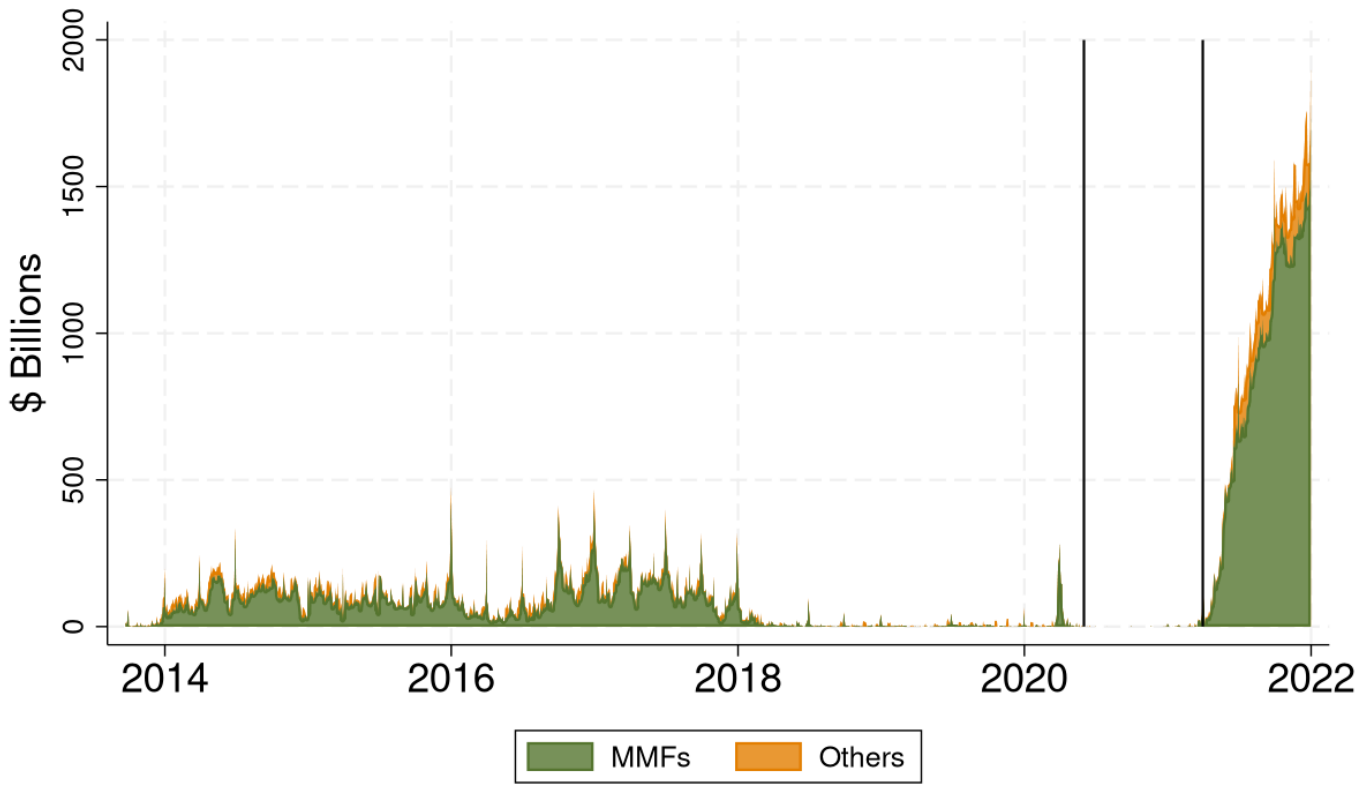


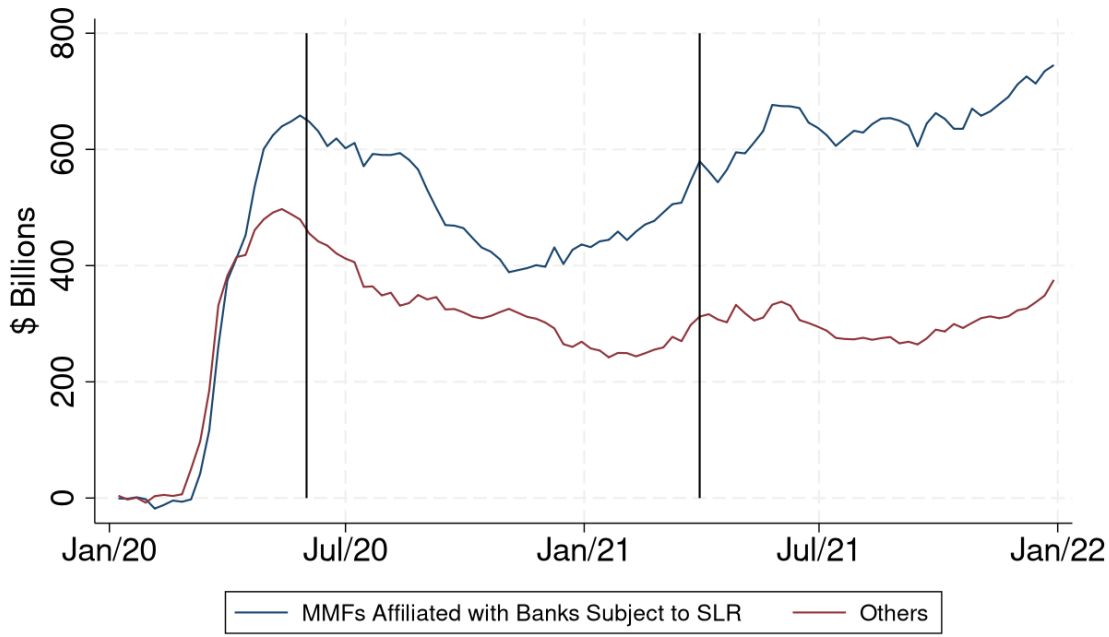
Figure: ON RRP Take-up by Counterparty Type

Outline

- **Effect of Balance-Sheet Costs on MMF Flows**
- Effect of Balance-Sheet Costs on MMF Portfolio
- Confounding Factors: Interest-Rate Risk & T-Bill Supply

Effect of Balance-Sheet Costs on MMF Flows

- Increased balance-sheet costs ⇒ banks shed deposits ⇒ MMF inflows
  - ◇ End of SLR relief (3/31/2021): permanent increase in balance-sheet costs
- Identification: Stronger effect in MMFs affiliated with "SLR banks"
  - ◇ Banks retain customers & customers pay lower switching costs



Effect of End of SLR Relief of MMF Flows

$$\begin{aligned}\text{Flow}_{it} =& \beta_1 \, 2021\text{Q1}_t \times \text{SLR-Bank MMF}_i + \beta_2 \, 2021\text{Q2}_t \times \text{SLR-Bank MMF}_i \\ &+ \Gamma X_{i,t-1} + \alpha_i + \mu_t + \varepsilon_{it}\end{aligned}$$

- Daily fund-level regression
- Controls: lagged net yield, net flow
- Sample: June 20-December 21; April 20-December 21 (Appendix)

Effect of End of SLR Relief of MMF Flows

	Flow$_{it}$ ($bn)			
	(1) MMF	(2) MMF	(3) MMF	(4) Gov MMF
2021Q1$_t$ × SLR-Bank MMF$_i$	0.033**		0.037**	0.043**
	(0.015)		(0.018)	(0.021)
2021Q2$_t$ × SLR-Bank MMF$_i$	0.022		0.021	0.028
	(0.019)		(0.021)	(0.026)
Linear Trend × SLR-Bank MMF$_i$		0.000		
		(0.000)		
2021Q1$_t$ × Bank MMF$_i$			-0.004	
			(0.007)	
2021Q2$_t$ × Bank MMF$_i$			0.001	
			(0.007)	
Fund FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
R^2	0.02	0.04	0.02	0.03
Sample Period	6/20–12/21	6/20–12/20	6/20–12/21	6/20–12/21
Observations	78219	30255	78219	57890

- In the two quarters around the end of the SLR relief, SLR bank-affiliated net flows see an additional increase in AUM of $3.4B per fund, corresponding to an additional $364B relative to the rest of the industry.

Two Ways to Strengthen Identification

1. Weaker effect for MMFs affiliated with custodial SLR banks
   - ◇ Custodial banks have continued to be able to exclude reserves from SLR even after the end of the relief

	Flow_{it} ($bn)	
	(1) MMF	(2) Gov MMF
$2021Q1_t \times$ Non-Custodial SLR-Bank MMF_i	0.049**	0.064**
	(0.020)	(0.029)
$2021Q2_t \times$ Non-Custodial SLR-Bank MMF_i	0.029	0.038
	(0.026)	(0.035)
$2021Q1_t \times$ Custodial SLR-Bank MMF_i	0.009	0.012
	(0.018)	(0.023)
$2021Q2_t \times$ Custodial SLR-Bank MMF_i	0.008	0.012
	(0.021)	(0.027)
Fund FE	Y	Y
Date FE	Y	Y
Controls	Y	Y
R^2	0.02	0.03
Sample Period	6/20–12/21	6/20–12/21
Observations	78219	57890

Two Ways to Strengthen Identification

2. Stronger effect when SLR is closer to minimum requirement

	Flow_{it} ($bn)	
	(3) MMF	(4) Gov MMF
$2021Q1_t \times (\text{SLR - SLR Req})_{i2019Q4}$	-0.005**	-0.005**
	(0.002)	(0.003)
$2021Q2_t \times (\text{SLR - SLR Req})_{i2019Q4}$	-0.002	-0.001
	(0.002)	(0.003)
Fund FE	Y	Y
Date FE	Y	Y
Controls	Y	Y
R^2	0.05	0.06
Sample Period	6/20–12/21	6/20–12/21
Observations	25100	18358

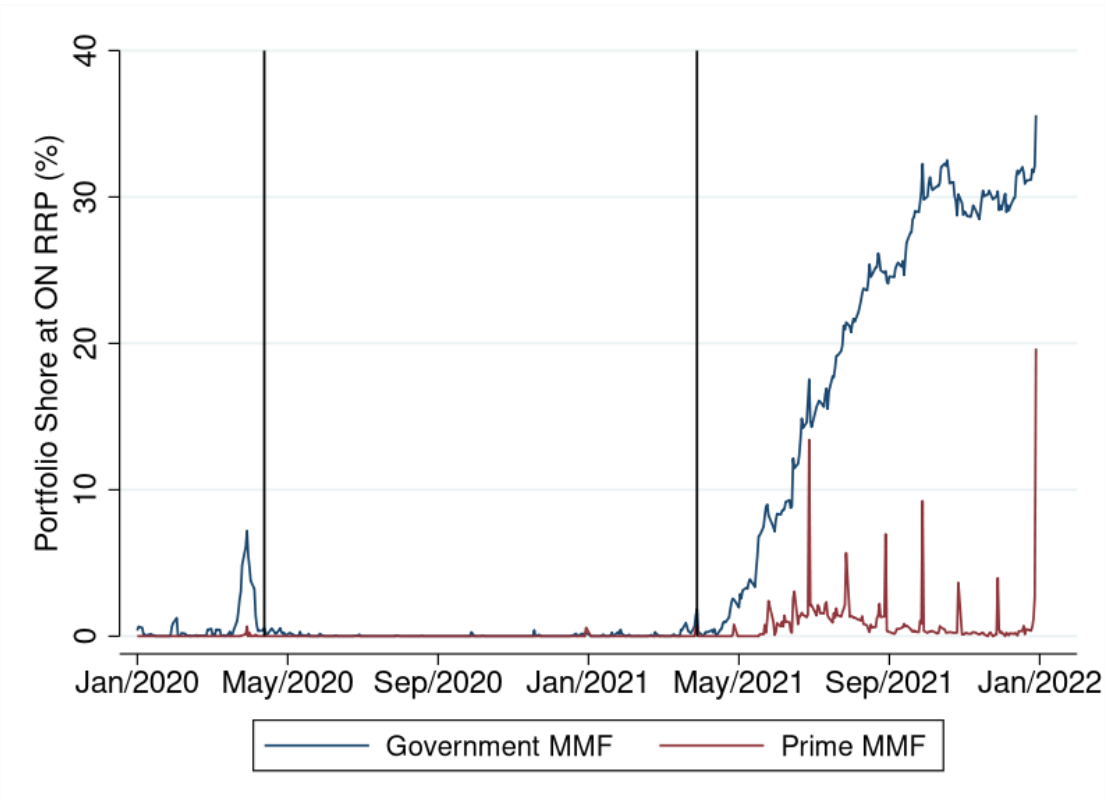
- A 10pp reduction in a bank's SLR buffer leads to inflows into the affiliated MMFs of $50 million per day per fund, corresponding to an increase in fund AUM of $3 billion per fund over 2021Q1.

Outline

- Effect of Balance-Sheet Costs on MMF Flows
- **Effect of Balance-Sheet Costs on MMF Portfolio**
- Confounding Factors: Interest-Rate Risk & T-Bill Supply

Effect of Balance-Sheet Costs on MMF Portfolio

- Balance-sheet costs $\uparrow \Rightarrow$ bank debt supply $\downarrow \Rightarrow$ MMFs tilt portfolios to ONRRP
  - ◇ End of SLR relief: permanent increase in balance-sheet costs
- Identification: Stronger effect for government MMFs:
  - ◇ Fewer investment options & SLR more costly for repo intermediation



Effect of End of SLR Relief on MMF Portfolios

$$\%\ \text{ONRRP}_{it} = \beta\, \text{Post SLR Relief}_t \times \text{Gov}_i + 2021\text{Q1}_t \times \text{Gov}_i + \sum_{m \in \{\text{Month ends}\}} \delta_m \text{Month End}_t^{(m)} \times \text{Gov}_i + \Gamma X_{i,t-1} + \alpha_i + \mu_t + \varepsilon_{it}$$

- Daily fund-level regression
- Controls: lagged net yield, net flow
- Sample: June 20-December 21; April 20-December 21 (Appendix)

Effect of End of SLR Relief on MMF Portfolios

	$\%ONRRP_{it}$	
	(1) MMF	(2) MMF
Post SLR Relief$_t$ × Gov$_i$	19.251***	
	(1.682)	
Linear Trend × Gov$_i$		0.000
		(0.000)
Fund FE	Y	Y
Date FE	Y	Y
Controls	Y	Y
R^2	0.75	0.09
Sample Period	6/20–12/21	6/20–12/20
Observations	30850	11673

- After end of SLR relief, portfolio share invested at the ON RRP increased significantly more in gov MMFs than in prime MMFs (more than 19pp).

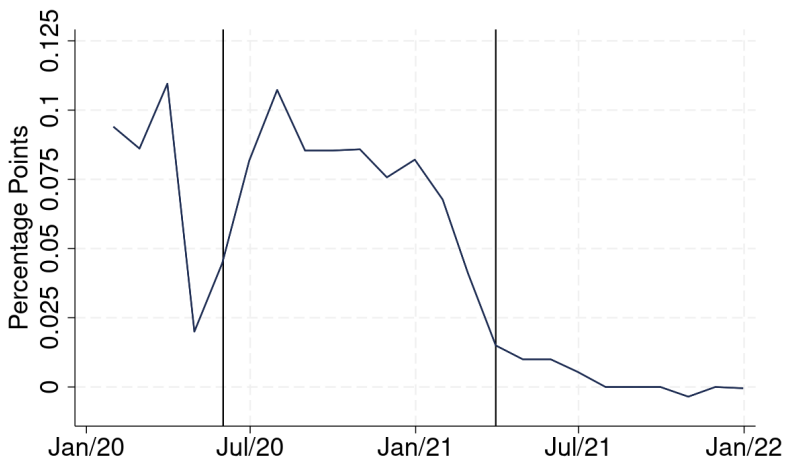
Strengthening Identification

◇ Within government MMFs: funds relying on private repo were more exposed.

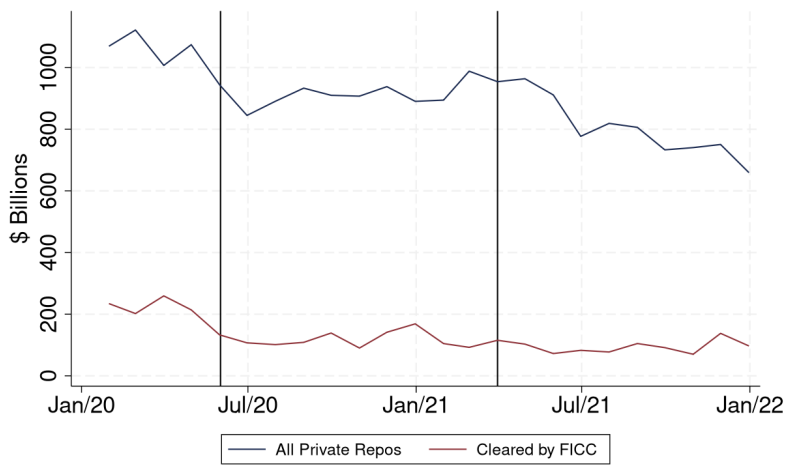
	(1) MMF	%ONRRP$_{it}$ (2) MMF	(3) Gov MMF
Post SLR Relief$_t$ × Gov$_i$	19.251***		
	(1.682)		
Linear Trend × Gov$_i$		0.000	
		(0.000)	
Post SLR Relief$_t$ × Private Repo Share$_{i2019Q4}$			0.238***
			(0.023)
Fund FE	Y	Y	Y
Date FE	Y	Y	Y
Controls	Y	Y	Y
R^2	0.75	0.09	0.81
Sample Period	6/20–12/21	6/20–12/20	6/20–12/21
Observations	30850	11673	22496

Repo Spreads and MMF Investment in Sponsored Repos from January 2020 to December 2021

- SOFR spread declined.
- Nettable private repos (FICC sponsored repos) were not affected.



SOFR - ON RRP Spread



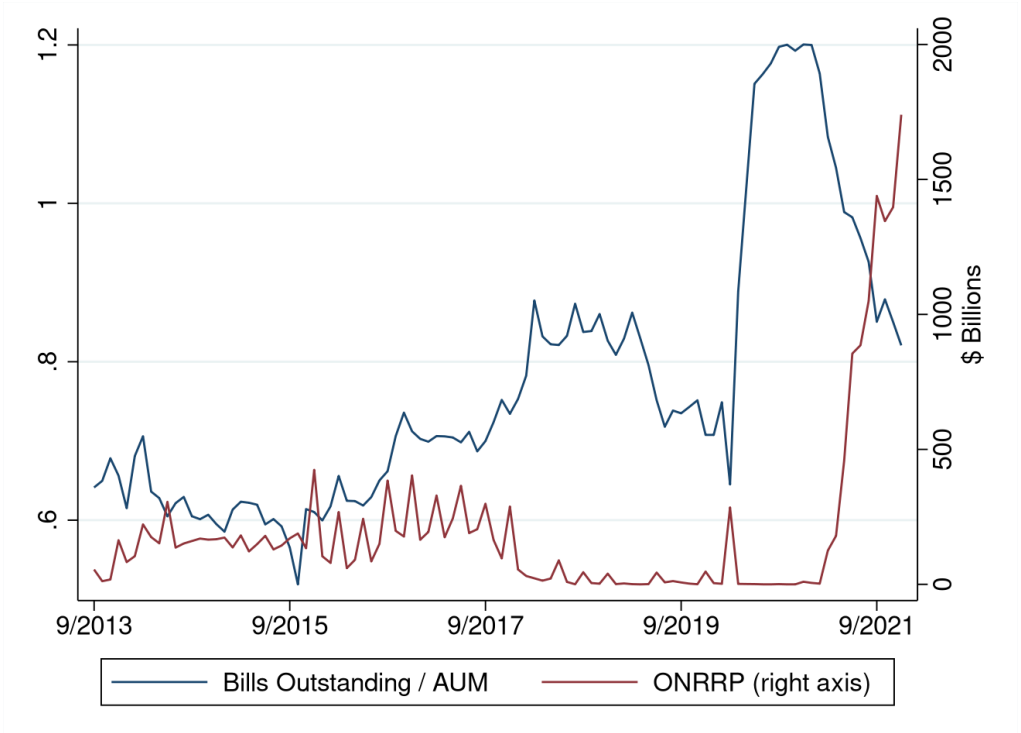
Private and Sponsored Repos held by MMFs

Outline

- Effect of Balance-Sheet Costs on MMF Flows
- Effect of Balance-Sheet Costs on MMF Portfolio
- **Confounding Factors: Interest-Rate Risk & T-Bill Supply**

Confounding Factors: Interest-Rate Risk & T-Bill Supply

- Higher interest rate risk ⇒ MMFs reduce portfolio duration ⇒ More ONRRP
- Lower T-bill supply ⇒ MMFs reduce Treasury investment ⇒ More ONRRP



- Both effects are stronger for government MMFs: fewer investment options

Interest Rate Risk, T-bill Supply, and the Share of MMF portfolio invested at the ON RRP

	%ONRRP$_{it}$		
	(1) MMF	(2) MMF	(3) MMF
MOVE$_{t-1}$ × Gov$_i$	0.562***		
	(0.057)		
T-Bills Issuance$_{t-30}$ × Gov$_i$		-14.823***	
		(2.589)	
$\frac{\text{T-Bills Outstanding}_{t-30}}{\text{Avg Total AUM}_{t-30}}$ × Gov$_i$			-40.545***
			(4.958)
Fund FE	Y	Y	Y
Date FE	Y	Y	Y
Controls	Y	Y	Y
R^2	0.72	0.69	0.72
Sample Period	6/20–12/21	6/20–12/21	6/20–12/21
Observations	30850	30850	30850

Controlling for interest-rate risk and T-bill supply

- Interest-rate risk: MOVE index
- T-bill supply: (i) issuance; (ii) value outstanding/MMF industry size

	%ONRRP$_{it}$	
	(1) MMF	(2) MMF
Post SLR Relief$_t$ × Gov$_i$	11.639***	9.218***
	(2.152)	(2.249)
MOVE$_{t-1}$ × Gov$_i$	0.328***	0.352***
	(0.055)	(0.046)
T-Bills Issuance$_{t-30}$ × Gov$_i$	-8.250***	
	(1.693)	
$\frac{\text{T-Bills Outstanding}_{t-30}}{\text{Avg Total AUM}_{t-30}}$ × Gov$_i$		-25.731***
		(3.794)
Fund FE	Y	Y
Date FE	Y	Y
Controls	Y	Y
R^2	0.76	0.77
Sample Period	6/20–12/21	6/20–12/21
Observations	30850	30850

Dollar investment at ONRRP by all channels

	$ONRRP_{it}$			
	(1) MMF	(2) MMF	(3) MMF	(4) MMF
Post SLR Relief$_t$ × SLR-Bank MMF$_i$	1.212***	1.174***	3.067***	3.042***
	(0.183)	(0.185)	(0.323)	(0.327)
Post SLR Relief$_t$ × SLR-Bank MMF$_i$ × (SLR - SLR Req)$_{i2019Q4}$			-0.711***	-0.717***
			(0.064)	(0.063)
Post SLR Relief$_t$ × Gov$_i$	7.628***	6.342***	8.066***	6.763***
	(1.282)	(1.425)	(1.295)	(1.440)
MOVE$_{t-1}$ × Gov$_i$	0.246***	0.257***	0.246***	0.257***
	(0.037)	(0.031)	(0.037)	(0.031)
T-Bills Issuance$_{t-30}$ × Gov$_i$	-5.113***		-5.092***	
	(1.088)		(1.091)	
$\frac{\text{T-Bills Outstanding}_{t-30}}{\text{Avg Total AUM}_{t-30}}$ × Gov$_i$		-14.963***		-15.018***
		(2.586)		(2.580)
Fund FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
R^2	0.54	0.54	0.54	0.54
Sample Period	6/20–12/21	6/20–12/21	6/20–12/21	6/20–12/21
Observations	30850	30850	30850	30850

Dollar investment at ONRRP by all channels

- Look at $ ONRRP investment as dependent variable
- Put all channels together (effect on flows, effect on portfolio, . . .)
- Due to the end of SLR relief:
  - ◇ SLR-bank MMFs ↑ daily ONRRP investment by $1.2 bn per fund
  - ◇ Government MMFs ↑ daily ONRRP investment by $7.8 bn per fund
- MOVE ↑ by 12 pts ⇒ Gov MMFs investment ↑ additional $2.9 bn
- T-bill issuance ↓ by $300 bn ⇒ Gov MMFs investment ↑ additional $1.5 bn

Conclusions

- Bank balance-sheet costs affect NBFIs & central bank balance sheet

- Higher balance-sheet costs:

  1. Banks shed deposits $\Rightarrow$ MMFs grow ($\Rightarrow$ more ONRRP ceteris paribus)

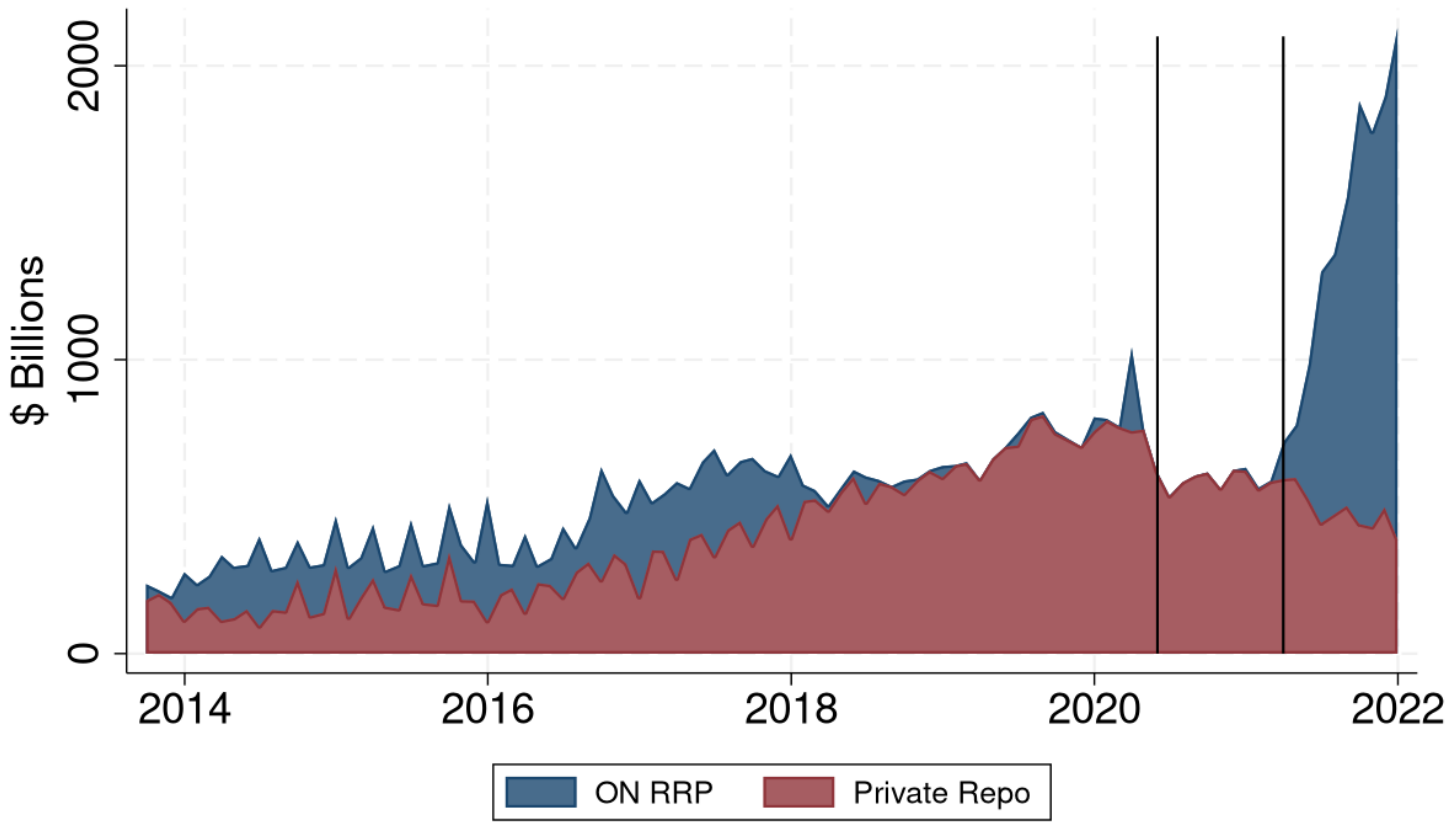
  2. Banks reduce wholesale funding $\Rightarrow$ MMF portfolios shift to ONRRP

◇ QE/QT interact with bank regulation affecting size and portfolios of NBFIs

◇ NBFI access to central bank balance sheet $\Rightarrow$ banks can drain reserves

Open question: does this limit effectiveness of QE?

Public and Private Overnight Treasury-Backed Repo Investment by MMFs



ONRRP Investment Share by all channels

	$\%ONRRP_{it}$ (%)			
	(1) MMF	(2) MMF	(3) MMF	(4) MMF
Post SLR Relief$_t$ × SLR-Bank MMF$_i$	1.832***	1.750***	2.147***	2.087***
	(0.301)	(0.307)	(0.437)	(0.440)
Post SLR Relief$_t$ × SLR-Bank MMF$_i$ × (SLR - SLR Req)$_{i2019Q4}$			-0.121*	-0.129**
			(0.063)	(0.063)
Post SLR Relief$_t$ × Gov$_i$	11.744***	9.295***	11.818***	9.371***
	(2.150)	(2.247)	(2.143)	(2.245)
MOVE$_{t-1}$ × Gov$_i$	0.330***	0.354***	0.330***	0.354***
	(0.056)	(0.046)	(0.055)	(0.046)
T-Bills Issuance$_{t-30}$ × Gov$_i$	-8.039***		-8.036***	
	(1.681)		(1.681)	
$\frac{\text{T-Bills Outstanding}_{t-30}}{\text{Avg Total AUM}_{t-30}}$ × Gov$_i$		-25.489***		-25.499***
		(3.787)		(3.787)
Fund FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
R^2	0.76	0.77	0.76	0.77
Sample Period	6/20–12/21	6/20–12/21	6/20–12/21	6/20–12/21
Observations	30850	30850	30850	30850