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Abstract

In June 2022, the Federal Reserve started reducing the size of its balance sheet, which had expanded to just under $9 trillion in response to the COVID-19 pandemic. However, whereas banks' reserves at the Federal Reserve have decreased, the investment of money market funds (MMFs) at the Federal Reserve's overnight reverse repo (ON RRP) facility has continued to increase, reaching $2.4 trillion in September 2022. In this paper, we causally identify the drivers of ON RRP take-up through a diff-in-diff approach. By exploiting a temporary change in the computation of banks' Supplementary Leverage Ratio (SLR) implemented in 2020-21, we show that banks' balance sheet costs incentivize them to push deposits toward MMFs and to reduce their overnight borrowing from MMFs, leading to an increase in MMF investment at the ON RRP. Furthermore, we show that monetary policy tightening, and Treasury bill scarcity are two additional factors contributing to the recent increase in ON RRP usage.

Key words: balance sheet constraints, banks, leverage ratio, monetary policy, money market funds, ONRRP

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This paper presents preliminary findings and is being distributed to economists and other interested readers solely to stimulate discussion and elicit comments. The views expressed in this paper are those of the author(s) and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System. Any errors or omissions are the responsibility of the author(s).

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1 Introduction

On June 1, 2022, the Federal Reserve began normalizing its balance sheet. Over the previous fifteen months, the size of the balance sheet had doubled as the Federal Reserve responded to the Covid-19 crisis. To support the flow of credit to the real economy, in addition to lowering rates to near zero and setting up several facilities, the Federal Reserve used quantitative easing, purchasing Treasury and agency mortgage-backed securities and expanding its assets to $9 trillion by April 2022.[1]

After a stark increase following the onset of the pandemic, the aggregate reserves of the US banking system–a liability in the Federal Reserve balance sheet–declined from an all-time maximum of $4.2 trillion in September 2021 to $3.1 trillion in September 2022. During this period, however, balances at the Overnight Reserve Repo (ON RRP) facility–another liability in the Federal Reserve balance sheet–continued to increase steadily, going from a few billions in March 2021 to over $2.2 trillion in October 2022. Through the ON RRP, eligible financial institutions, including non-banks such as money market funds (MMFs), can invest at the Federal Reserve Bank of New York via overnight repurchase agreements (repos) collateralized by Treasuries.

As Figure 1 shows, MMFs are the main investors at the ON RRP facility, representing 89 percent of total usage since the facility's inception in September 2013; indeed, 92% of the increase in the ON RRP between April 2021 and September 2022 comes from MMF take-up. When MMFs invest in the ON RRP, they use their custodian banks, which, in turn, use their reserve balances to make the transfer. The result is an increase in ON RRP take-up and an equal decrease in bank reserves. Importantly, by design, ON RRP take-up can change without any intervention by the Federal Reserve.

The recent and persistent increase in the ON RRP has therefore important implications for the normalization of the Federal Reserve balance sheet because it can affect the speed at which banks' reserves decline as the central bank's balance sheet shrinks: a rapid decline in reserves may pose challenges to banks, as they need to quickly adjust to lower reserve levels, and to the Federal Reserve, as it assesses the effect of lower reserves on interest rate control.[2]

In this paper, we study the drivers of ON RRP take-up by MMFs. Through a difference-in-differences strategy, we identify three main channels: banks' balance-sheet constraints, monetary policy, and the supply

[1]For a description of the facilities put in place in response to the Covid-19 crisis, see the special issue of the *Economic Policy Review*, on "Policy Actions in Response to the COVID-19 Pandemic."

[2]In the current monetary policy framework, the Federal Reserve intends to implement monetary policy in a regime of ample reserves, where interest rate control is exercised through the setting of its administered rates, the ON RRP rate and the interest on reserves balances, and in which active management of the supply of reserves is not required. See, for instance, the January 2019 FOMC Statement Regarding Monetary Policy Implementation and Balance Sheet Normalization.

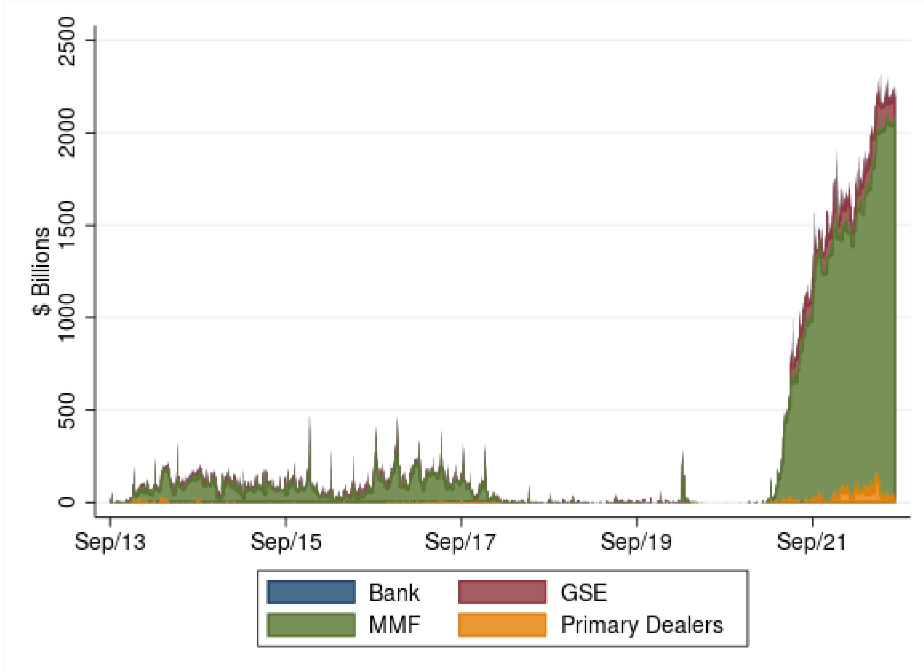


Figure 1: ON RRP Take-up by Counterparty

of Treasury bills (T-bills).[3] First, we show that banks' tighter balance-sheet constraints lead to higher MMF take-up at the ON RRP; this is because tighter balance-sheet constraints (1) limit MMFs' investment options, as banks have an incentive to reduce their wholesale short-term debt, including overnight private repos, in which MMFs invest a large part of their portfolios, and (2) increase the size of the MMF industry, as banks also try to shed deposits, for which MMF shares are a close substitute. Both effects imply an increase in ON RRP take-up.

Our identification strategy relies on the temporary change to banks' Supplementary Leverage Ratio, the so-called SLR relief of 2020-2021, which excluded U.S. Treasury securities and reserves from the SLR calculation, making the regulatory constraint less tight.[4] After the SLR relief period ended, banks had less flexibility to expand their balance sheets by increasing their holdings of reserves and Treasuries without affecting this capital requirement. As a result, the effect of banks' balance-sheet constraints on MMFs' ON

[3]Here, and in most of the paper, we use the term "banks" to refer to bank holding companies.

[4]The supplementary leverage ratio (SLR) is a regulatory capital requirement that applies to large depository institutions and bank holding companies. It was adopted in July of 2013 as part of the 2013 revised capital rule and is broadly consistent with Basel III leverage ratio (Federal Registry, 2013). Large banking organizations began disclosing their supplementary leverage ratios on January 1, 2015 and were required to comply with their requirements beginning on January 1, 2018. In 2020, to ease strains in the Treasury market resulting from the COVID-19 pandemic and to promote lending to households and businesses, regulatory agencies temporarily modified the SLR; the temporary relief expired on March 31, 2021.

RRP investment should be more pronounced after the relief period. In particular, this channel should be more prominent for MMFs that do not have investment options outside the banking sector, such as government MMFs (versus prime MMFs, which can also lend to non-financial corporates), and MMFs with higher reliance on private repos (which is the main form of short-term wholesale funding for banks). In fact, we find that after the expiration of the SLR relief on March 31, 2021, the share of government MMFs' portfolios invested at the ON RRP increased by 19 percentage points more than that of prime MMFs. Similarly, a ten-percentage-point increase in the pre-sample share of private repos in a fund's portfolio increases the share of the fund's portfolio invested at the facility by 3.9 percentage points after the expiration of SLR relief.

Similarly, after the SLR relief ended, banks had lower incentive to accept deposits, which would expand the banks' balance sheets. For this reason, we expect that MMFs affiliated with banks subject to the SLR may, by virtue of their affiliation, receive more inflows than other MMFs, as balance-sheet constraints push banks to shed their deposits. Indeed, this is the case: after the end of the SLR relief period, the assets under management (AUM) of MMFs affiliated with banks subject to the SLR increased by $2.7 billion more than other MMFs on average, for an industry total of $170 billion.

Monetary policy also affects ON RRP usage. First, we show that the pass-through of policy rate changes is much tighter for MMF yields than for deposit rates. For this reason, the MMF industry increases in size during periods of monetary policy tightening, as depositors move from bank deposits to MMF shares (Drechsler et al., 2017; Xiao, 2020). Ceteris paribus, the increase in the size of the MMF industry implies higher take-up.

Moreover, aggressive rate hikes, like those put in place by the Federal Reserve in 2022 to fight inflation, usually imply higher interest-rate risk. During periods of monetary policy tightening, unexpected rate increases cause bond prices to fall, leading to capital losses and pushing debt holders, such as MMFs, away from long-term investments (e.g., Treasuries) and towards short-term ones (e.g., overnight repos). We hypothesize that the effect of monetary policy on MMFs' portfolios should be more prominent for government funds, which have fewer options to manage their interest-rate risk exposure than prime funds, and for funds with a lower (one-month lagged) weighted-average maturity (WAM), which we take as a proxy for lower tolerance to interest-rate risk. Using data from 2002 to 2022 to exploit variation from several monetary policy cycles, we find that a one-percentage-point increase in the effective federal funds rate (EFFR) reduces the share of Treasuries in government funds' portfolios more than it does in prime funds by almost by 2 percentage points. Similarly, a decrease in a fund's WAM lagged by one month leads to an additional drop in its Treasury portfolio share by 60 basis points, following a one-percentage-point increase in the EFFR. As the share of MMF Treasury investment decreases, ON RRP take-up increases.

Finally, the third channel that affects the usage of the ON RRP facility is the availability of T-bills. A decrease in the supply of T-bills limits MMF investment opportunities, tilting their portfolios towards the ON RRP facility. To causally identify this channel, we rely on the assumption that MMFs that specialize in Treasuries securities should be more exposed to shocks in the T-bill supply. We find that a monthly decrease of T-bill issuance by $100 billion increases the portfolio share of ON RRP investment significantly more in government MMFs than in prime MMFs, by roughly 2.6 percentage points. We find similar results when looking at funds with a higher (pre-sample) share of Treasury securities in their portfolios: a $100 billion decrease in the monthly issuance of T-bills increases the portfolio share invested at the ON RRP by 0.3 percentage points more for funds with a 10 percent higher portfolio share of Treasuries in the pre-sample.

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 estimates the effects of banks' balance-sheet constraints and monetary policy on the size of the MMF industry, the main investors at the ON RRP facility. We then move to understanding the determinants of MMFs' portfolio choice and, in particular, their investment at the ON RRP in Section 4. Subsection 4.1 explores the first channel and estimates the impact of banks' balance-sheet constraints, while Subsection 4.2 estimates the effect of changes in the supply of T-bills; Subsection 4.3 discusses the third channel and estimates how interest-rate risk determines MMFs' portfolio choices.

2 Data

In our analysis, we use data on ON RRP take-up by MMFs, on MMFs' portfolios, investor flows, and bank affiliation, on banks' regulatory requirements and leverage ratios, on money market rates, and on T-bill supply.

Daily data on ON RRP take-up by institution type (e.g., MMF, primary dealer) are from the Federal Reserve Bank of New York (FRBNY) and are publicly available (https://www.newyorkfed.org/markets/desk-operations/reverse-repo). Our analysis focuses on prime and government MMFs, which represent the vast majority of the MMF industry.[5] In order to run our regressions on the impact of balance-sheet constraints on MMF take-up and portfolio choice, we also use daily data on individual MMF ON RRP take-up; these data are also from the FRBNY but are confidential.

Daily data on MMFs' bank affiliation, AUM, net yields, net flows, and portfolio maturity, as well as weekly data on their portfolio allocations at the asset-class level (e.g., repos, Treasuries, CP), are available from iMoneyNet (https://financialintelligence.informa.com/products-and-services/data-analysis-and-tools/imoneynet); these data also allow us to distinguish between prime and government MMFs, as well as between institutional

[5]The other MMF category is tax-exempt MMFs, which mainly invest in short-term debt issued by local governemnts and authorities.

and retail share classes. We complement these data with the monthly N-MFP filings submitted by MMFs to the SEC, which are publicly available on the SEC website; these filings allow us to identify feeder funds, which we drop from our MMF sample.

After cleaning the names of the banks sponsoring MMFs in the iMoneyNet dataset, we match these fund-level data with publicly available data on the bank they are affiliated to, such as whether the bank is subject to the SLR requirement and its quarterly SLR; these data can be found on the institutions' websites. The average rate on retail bank deposits is the 3-month small certificates of deposit (CDs) from RateWatch (https://www.spglobal.com/marketintelligence/en/campaigns/ratewatch).

Daily EFFR data and weekly averages of aggregate bank reserves are from FRED (series "EFFR" and "WRESBAL"). Monthly data on aggregate, Treasury-backed repo lending in the Tri-Party Repo platform, on which ON RRP trades are also settled, are from the FRBNY website (https://www.newyorkfed.org/data-and-statistics/data-visualization/tri-party-repo/index.html).

Finally, monthly data on the issuance of T-bills and on the total amount of marketable T-bills outstanding are from Haver (FSGSBI@USECON and PDIMTBU@USECON).

3 The Size of the MMF Industry

3.1 Monetary Policy

The response of bank deposit rates to changes in the monetary policy stance is relatively slow (Hannan and Berger, 1991; Neumark and Sharpe, 1992; Driscoll and Judson, 2013; Drechsler, Savov, and Schnabl, 2017); moreover, these so-called deposit betas have been decreasing over time (Kang-Landsberg and Plosser, 2022). In contrast, MMF net yields—the interest rates paid by MMFs to their investors—move much more closely with the effective federal funds rate (EFFR) and have remained tightly linked to the policy rate in the aftermath of the global financial crisis (Figure 2).

To formalize this intuition, we ran the following panel regression at a weekly frequency:

$$\Delta \text{NetYield}_{it} = \alpha_i + \sum_{j=0}^{12} \beta_j \Delta \text{EFFR}_{t-j} + \sum_{j=0}^{12} \gamma_j \Delta \text{EFFR}_{t-j} \times \text{MMF}_i + e_{it}, \tag{1}$$

where NetYield_{1t} is the average rate on retail deposits (from RateWatch); $\text{NetYield}_{i>1,t}$ is net yield paid by MMF i; EFFR_t is the effective federal funds rate; MMF_i is a dummy for MMFs (i.e., for $i > 1$); and α_i are entity fixed effects. Regression (1) is estimated, through OLS, on the period from 2002 until 2022; standard errors are robust to heteroskedasticity, serial correlation, and cross-correlation. As the first column of Table

1 shows, the impact of changes in the EFFR is significantly stronger on MMF yields than on bank deposit rates; moreover, as Columns (2) and (3) show, whereas the beta on deposits has decreased over time from 42% in the first half of the sample to 4% in the second half , the beta on MMF yields has remained stable at around 87% throughout 2002-2022.[6]

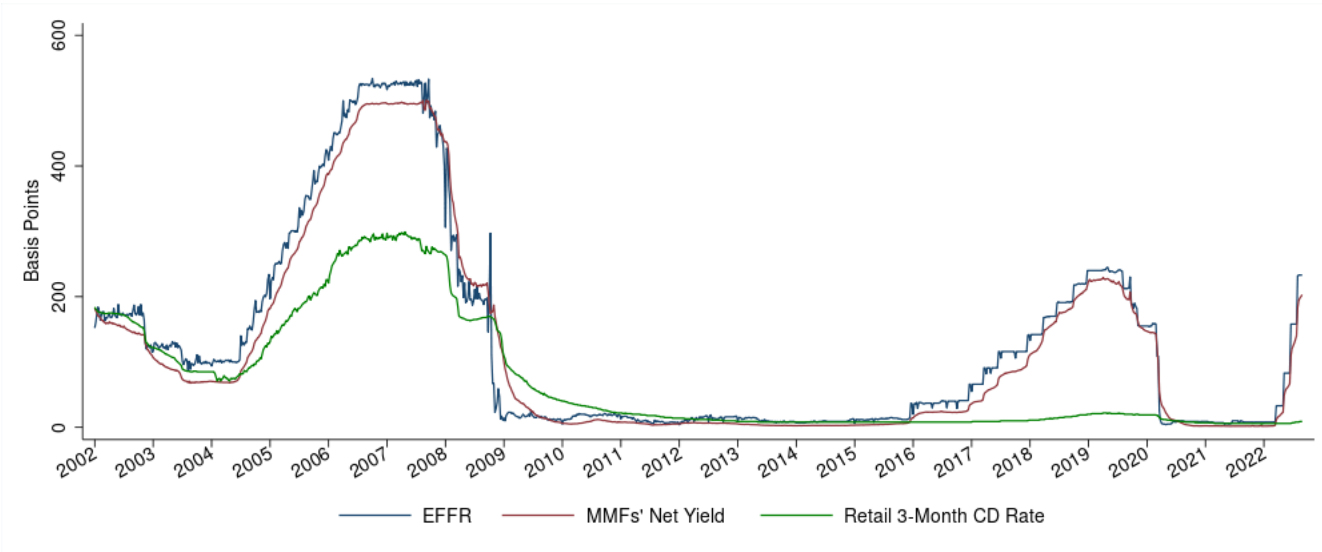


Figure 2: EFFR, MMFs' Net Yields, and Retail CD Rates.

[6]One concern is that MMF shares are also offered to institutional investors, who are more sophisticated than retail ones; as a result, the differential beta estimated in Columns (1)-(3) could be driven only by the yields offered by MMFs to institutional investors. In the appendix, we rule out this concern by showing that retail MMFs have a higher beta than retail deposits throughout the sample; however, the effect of the changes in the EFFR is even stronger for institutional MMFs, consistent with the higher sophistication of institutional investors (see Cipriani and La Spada, 2020), especially in the second half of the sample.

	ΔNet Yield$_{it}$		
	(1)	(2)	(3)
$\sum_{n=0}^{12} \Delta\text{EFFR}_{t-n}$	.28***	.417***	.039***
(F-statistic)	29.953	51.183	31.194
$\sum_{n=0}^{12}(\Delta\text{EFFR}_{t-n} \times \text{MMF}_i)$	.587***	.452***	.836***
(F-statistic)	87.767	68.925	232.187
Fund FE	Y	Y	Y
Sample	2002-2022	2002-2009	2010-2022
Observations	540178	313754	226424

Table 1: Betas on bank deposits and MMF shares. The regression is run on a weekly panel including the average bank deposit ($i = 1$) and publicly offered MMFs ($i > 1$). The outcome variable, change in the fund's net yield or in the average deposit rate, is weekly and in percentage. EFFR is the effective federal funds rate, in percentage. F-statistics are calculated using Driscoll-Kraay standard errors with 4 lags.

Consistent with a stronger monetary policy pass-through relative to bank deposits over the last 20 years, the size of the MMF industry has moved with the monetary policy cycle: when the Federal Reserve increases interest rates, the MMF industry expands, whereas it contracts when the Federal Reserve lowers rates. Figure 3 shows this relationship by plotting the size of the MMF industry, the EFFR, and the spread between MMF yields and bank deposit rates between 2002 and 2022. Note that although MMFs' assets under management (AUM) track the path of the federal funds rate, they do so with a lag of one to two years. To quantify the relationship between monetary policy and the size of the MMF industry, we run the following panel regression at the MMF level and weekly frequency:

$$\text{Flow}_{it} = \alpha_i + \sum_{j=0}^{103} \beta_j \Delta\text{EFFR}_{t-j} + \text{Industry Dislocations}_t + e_{it}, \tag{2}$$

where Flow_{it} is the net flow into fund i in week t; α_i are fund fixed effects; and MMF-Industry Dislocation_t is a set of time dummies representing episodes of severe dislocation within the MMF industry (2008 run, 2014 SEC reform, and 2020 run; Cipriani and La Spada, 2020 and 2021). The regression is estimated through OLS from 2002 until 2022; standard errors are robust to heteroskedasticity, serial correlation, and cross-correlation. Results are in Table 2. The dependent variable is measured in billions in Columns (1) and (2) and in percentage over the previous week's AUM in Columns (3) and (4); in Columns (5) and (6), the dependent variable is the weekly change in the log ratio between MMFs' AUM and commercial banks' total deposits, so as to capture the growth of the MMF industry relative to bank deposits. Columns (1), (3), and (5) are for the full sample; Columns (2), (4), and (6) are for 2002-2019, i.e., before the Covid crisis and the most recent expansion of the Federal Reserve's balance sheet. A one-percentage-point increase in the EFFR increases inflows into the average MMF by roughly $200 million, or 6 percent of its AUM, over the next two years. Considering that there are on average roughly 500 MMFs in our sample and their average size is $5 billion, our estimates imply that, over the two years following a one-percentage-point increase in the EFFR, the size of the MMF industry increases by between $100 and $150 billion. Similarly, relative to bank deposits, the MMF industry increases by roughly 6% over the two years following a one-percentage-point increase in the EFFR. Results are similar when estimating the regression on the restricted sample, 2002-2019. Our results are consistent with Xiao (2020), who considers the 1990-2012 period.

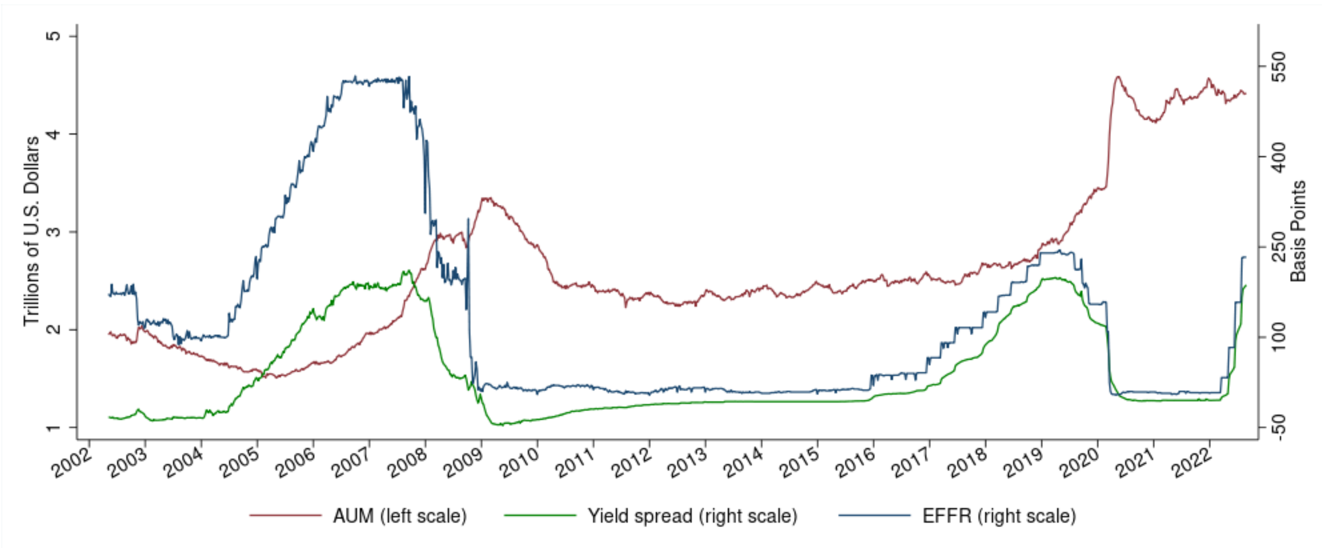


Figure 3: Effective Federal Funds Rate (EFFR), Spread between MMFs' Yields and Banks' Deposit Rates, and MMFs' AUM.

	(1) $ Flows$_{it}$	(2) $ Flows$_{it}$	(3) % Flows$_{it}$	(4) % Flows$_{it}$	(5) $\Delta\log(\frac{AUM_{it}}{Deposits_t})$	(6) $\Delta\log(\frac{AUM_{it}}{Deposits_t})$
$\sum_{n=0}^{103} \Delta \text{EFFR}_{t-n}$	.177***	.165***	6.043***	6.132***	.065***	.056***
(F-statistic)	30.166	31.677	42.337	34.757	38.58	27.659
Fund FE	Y	Y	Y	Y	Y	Y
Sample	2002-2022	2002-2019	2002-2022	2002-2019	2002-2022	2002-2019
Observations	449719	416756	451198	416109	451197	416111

Table 2: Monetary policy and the size of the MMF industry. Regressions are run at the fund level and weekly frequency. The outcome variable in Columns (1) and (2) is net MMF flows in billions of dollars. The outcome variable in Columns (3) and (4) is net MMF flows in percentage relative to the previous week's AUM; flows are trimmed at the 1 and 99 percentile. The outcome variable in Columns (5) and (6) is the weekly change in the log of MMFs' AUM over bank deposits. All columns include control dummies for the following periods of dislocation in the MMF industry: 2008 MMF run (September-December 2008), the SEC reform's implementation in 2016 (November 2015-October 2016), and the 2020 MMF run (March 2020). EFFR is the effective federal funds rate, in percentage. F-statistics are calculated using Driscoll-Kraay standard errors with 4 lags.

3.2 Banks' Balance-sheet Constraints

During the most recent easing cycle, although the Federal Reserve quickly cut the policy rate to zero and kept it there for two years (March 2020-March 2022), MMFs' AUM only mildly decreased in the second half of 2020 and, actually, started to increase again in early 2021. A possible reason could be that, following the Federal Reserve's balance-sheet expansion, banks' balance-sheet constraints may have counteracted the effect of monetary policy easing on MMFs' AUM. When reserves become abundant, banks' balance sheets expand, and their balance-sheet constraints become tighter; banks may respond by shedding deposits and other short-term liabilities, which then flow into MMF shares, the closest substitute to banks' deposits.[7]

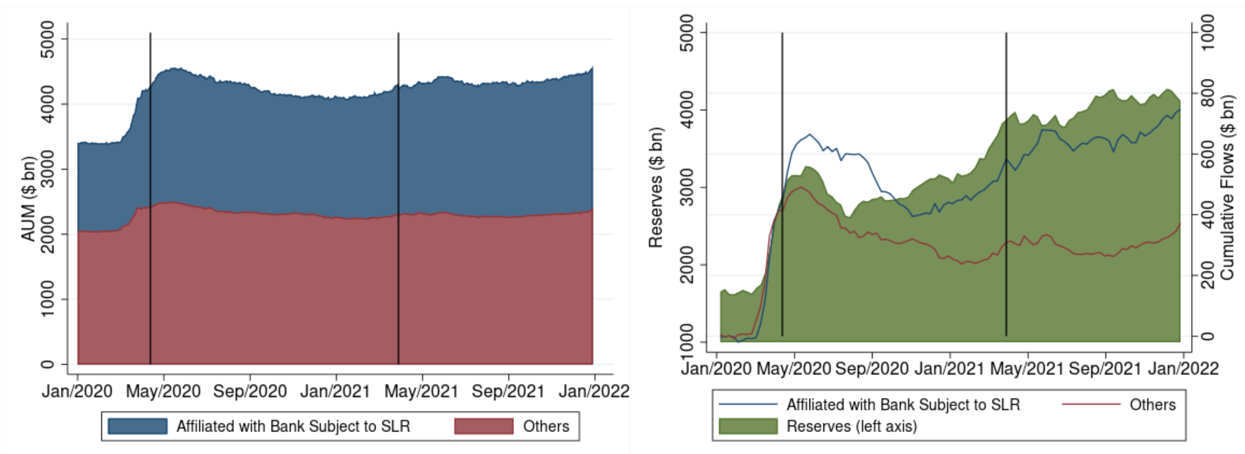
We causally identify this mechanism by hypothesizing that, if present, it would have a stronger effect on MMFs that are affiliated with banks subject to regulatory requirements that are directly affected by the increase in reserves, such as the supplementary leverage ratio (SLR) requirement.[8] To capture time-series variation in banks' balance-sheet constraints, we exploit the introduction of the SLR regulatory relief of April

[7]As we discussed above, in our main analysis, we use "banks" to refer to bank holding companies (BHCs); in the Appendix, we repeat the analysis at the depository institution (DI) level, obtaining similar results.

[8]Note that the MMFs themselves are not subject to the requirement; rather, it is the banks subject to the SLR the ones that have an incentive to push deposits into their own bank-affiliated MMFs.

2020-March 2021: for banks subject to the SLR, balance-sheet constrains were likely less pronounced during the relief.[9]

Panels (a) and (b) of Figure 4 show the AUM and dollar flows of MMFs affiliated with banks subject to SLR requirements and all other MMFs in our sample. Consistent with our hypothesis, before and after the SLR-relief period, funds affiliated with banks subject to the SLR grew more than other funds; for the same reason, their AUM decreased more during the SLR relief period.



(a) MMFs' Assets under Management

(b) MMFs' Dollar Flows and Banks' Aggregate Reserves

Figure 4: Size of the MMF industry from January 2020 to December 2021, based on fund affiliation with banks subject to SLR requirements. The vertical lines represent the dates when the SLR-relief period for BHCs becomes effective, on April 14, 2020, and when the SLR relief period ends, on March 31, 2021.

To formalize the observation in Figure 4, we run the following panel regression at the fund level and daily frequency:

$$\text{AUM}_{it} = \alpha_i + \mu_t + \beta \, \text{Post SLR Relief}_t \times \text{SLR-Bank Affiliated}_i + e_{it}, \tag{3}$$

where AUM_{it} is MMF i's AUM on day t in billions of dollars; α_i are fund-fixed effects; μ_t are time-fixed

[9]Our estimation strategy does not imply that the SLR requirement is the only or even the main driver of banks' balance-constraints at all times, nor that banks did not have additional leverage capacity or excess capital with respect to the regulatory ratios at the time of the SLR relief; we are focusing on the SLR because the introduction of a temporary relief in 2020 allows us to exploit useful time-series variation in the tightness of this specific balance-sheet constraint; even banks with regulatory ratios above the mandated minima may respond to changes in the tightness of these regulatory constraints, e.g., if they target an internal level above the required minima. As our baseline SLR-relief period, we use April 14, 2020-March 31, 2021, when the relief became effective for bank holding companies. In the Appendix, we show that we obtain similar results if we define the SLR-relief period as June 1, 2020-March 31, 2021, when the relief was offered to depository institutions.

effects; Post SLR Relief_t is a time dummy for the period after the SLR relief ended (March 31, 2021); and SLR-Bank Affiliated_i is a dummy for funds affiliated with banks subject to the SLR requirement. The regression is estimated through OLS from April 14, 2020 (when the SLR relief became effective) to December 2021; standard errors are robust to heteroskedasticity, serial correlation, and cross-correlation. Since the expiration date of the SLR relief was announced at the time of its introduction, we also include the interaction of a time dummy for 2021Q1 (three months before the end of the relief) with the fund dummy SLR-Bank Affiliated_i, to capture possible anticipation effects of banks subject to the SLR.

As Column (1) of Table 3 shows, on average, the AUM of a MMF affiliated with a bank subject to the SLR requirement increased significantly more, by roughly \$2.7 billion, than those of other MMFs after the expiration of the SLR temporary relief; the effect is stronger for government funds (\$3.2 billion), which are closer substitutes to bank deposits (Column (2)). Since there are 63 MMFs affiliated with banks subject to the SLR, the size of this subsegment of the industry has increased by an additional \$170 billion due to the end of the SLR relief program. Moreover, both in government funds and in MMFs at large, the effect is stronger when we restrict the sample to those funds that have access to the ON RRP: after the SLR relief ended, the AUM of an ON RRP-eligible fund affiliated with a bank subject to the SLR requirement increased by an additional \$5 to \$6 billion relative to other ON RRP-eligible funds (Columns (3) and (4)). The fact that the effect is larger suggests that the incentive to shed deposits and push them into affiliated MMFs is stronger if the affiliated funds have access to the ON RRP, which allows them to place the additional cash flow easily and overnight.

To strengthen our identification, we restrict our sample to MMFs affiliated with banks subject to the SLR regulatory requirement and use data on banks' SLR levels; namely, we run the following daily regression at the fund level:

$$\text{AUM}_{it} = \alpha_i + \mu_t + \beta \, \text{Post SLR Relief}_t \times (\text{SLR} - \text{SLR Req})_{i,2019Q4} + e_{it}, \tag{4}$$

where $(\text{SLR} - \text{SLR Req})_{i,2019Q4}$ is the difference between the SLR and the required SLR for the bank to which MMF i is affiliated, calculated in 2019Q4 to control for endogeneity. Results are in Table 4 and show that for MMFs affiliated with banks subject to the SLR requirement, a lower SLR relative to the required level causes a greater increase in AUM after the end of the SLR relief. In the Appendix, we replicate regression (4) using the distance of the bank's SLR from its requirement lagged by three quarters as the treatment variable to capture time variation in the tightness of bank's balance-sheet constraints; results are largely similar.

	AUM$_{it}$			
	(1)	(2)	(3)	(4)
	MMF	Gov MMF	MMF	Gov MMF
Post SLR Relief$_t$ × Affliated with Bank Subject to SLR$_i$	2.692***	3.246***	5.685***	6.293***
	(13.905)	(12.008)	(21.444)	(16.319)
Jan - March 2021$_t$ × Affliated with Bank Subject to SLR$_i$	0.149	-0.013	1.786***	1.275***
	(0.849)	(-0.049)	(7.085)	(3.526)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
ONRRP-Eligible Only	N	N	Y	Y
Observations	85178	62870	33593	24280

Table 3: Banks' Balance-Sheet Constraints and the Size of the MMF Industry. Fund-level daily regression estimated through OLS from April 14, 2020 (when the SLR relief was established for BHC) to December 2021. The outcome variable is MMF AUM in billion of dollars. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

	AUM$_{it}$			
	(1)	(2)	(3)	(4)
	MMF	Gov MMF	MMF	Gov MMF
Post SLR Relief$_t$ × (SLR - SLR Req)$_{i2019Q4}$	-0.324***	-0.695***	-0.502***	-1.682***
	(-3.066)	(-4.706)	(-2.947)	(-7.312)
Jan - March 2021$_t$ × (SLR - SLR Req)$_{i2019Q4}$	0.068	0.011	-0.338*	-0.637**
	(0.617)	(0.069)	(-1.685)	(-2.366)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
ONRRP-Eligible Only	N	N	Y	Y
Observations	26923	19514	14888	10388

Table 4: Banks' Balance-Sheet Constraints and the Size of the MMF Industry. Fund-level daily regression estimated through OLS from April 14, 2020 (when the SLR relief was established for BHC) to December 2021. The sample is restricted to MMFs affiliated with banks subject to the SLR regulatory requirement. The outcome variable is MMF AUM in billion of dollars. SLR is in percentage. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

One concern with our analysis is that, due to some confounding factor, the AUM in MMFs affiliated with banks subject to the SLR increased more after the end of the relief simply because those funds are affiliated with a bank, not because the affiliated bank is subject to the SLR. To rule out this possibility, we re-estimate regression (3) including an interaction of the post-SLR relief dummy with a dummy for funds affiliated with any bank (not necessarily subject to the SLR). Results are in the Appendix and are similar to those in Table 3: bank affiliation does not per se lead to relatively higher AUM after the SLR relief ends, whereas being affiliated with a bank subject to the SLR does.

4 MMF Portfolio Choice

We now turn to the determinants of MMFs' ON RRP investment as a share of their portfolios (i.e., holding the size of the industry constant). We focus on three drivers: banks' balance-sheet constraints (i.e., their supply of private debt), the supply of T-bills, and monetary policy.

4.1 Banks' Balance-sheet Constraints

Given the size of the MMF industry and the composition of ON RRP participants, MMFs' portfolio choice between ON RRP investment and alternative opportunities is a key determinant of the facility's take-up. We first show that, in an environment of abundant reserves, banks' balance-sheet constraints, by reducing banks' incentive to borrow, also limit MMFs' investment options, pushing them to place their money in the ON RRP facility. That is, tighter banks' balance-sheet constraints reduce the supply of private short-term debt (such as overnight private repos) available for purchase to MMFs, which then absorb this negative shock by substituting private short-term debt with the ON RRP. Consistent with this intuition, Figure 5 shows that ON RRP take-up by MMFs has increased steeply since the end of the SLR relief in March 2021, whereas MMFs' private repo holdings remain roughly constant throughout 2021 and actually decrease in the first half of 2022.

To causally identity this channel, we hypothesize that the impact of banks' balance-sheet constraints on MMFs' investment choices would be less pronounced during the SLR regulatory relief of April 2020-March 2021. We proxy the extent to which an MMF is limited in its portfolio choices with two treatment variables: (i) a dummy for government funds, which can only lend to the private sector via repos typically issued by banks (prime funds, in contrast, can also lend to non-financial corporations and local governments); and (ii) the share of private repos in a fund's portfolio, measured before our sample to control for endogeneity, which captures the fund's reliance on the short-term debt typically issued by banks. In particular, we ran the following two panel regressions at the fund level and daily frequency, on the sample of MMFs eligible to invest in the ON RRP:

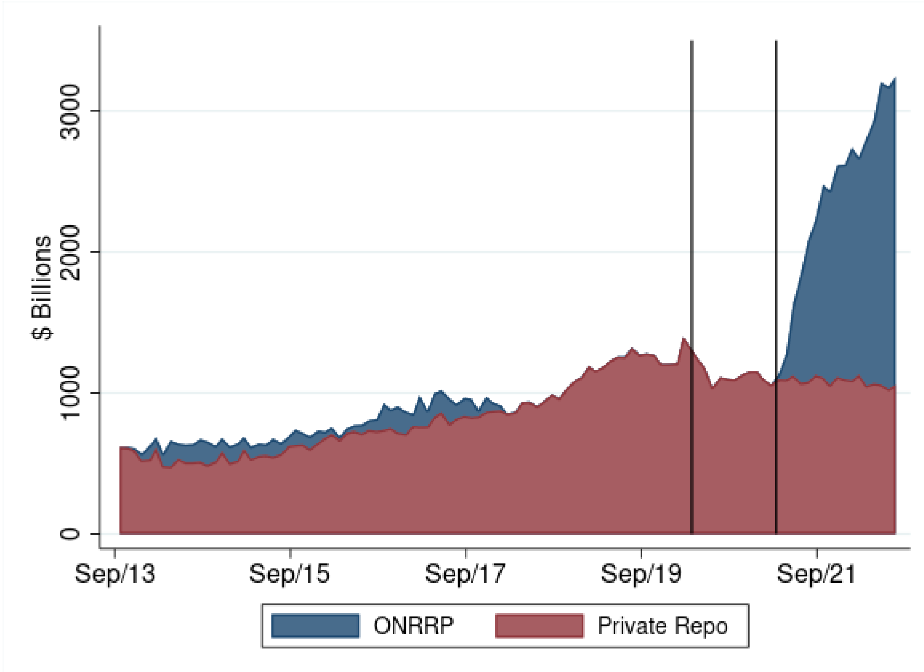


Figure 5: Tri-Party Repo Volume: Private Repos and ON RRP Take-up. The vertical lines represent the dates when the SLR relief becomes effective for BHCs, on April 14, 2020, and when the SLR relief period expires, on March 31, 2021.

$$\text{ON RRP Share}_{it} = \alpha_i + \mu_t + \beta\,\text{Post SLR Relief}_t \times \text{Gov}_i + e_{it}, \tag{5}$$

$$\text{ON RRP Share}_{it} = \alpha_i + \mu_t + \beta\,\text{Post SLR Relief}_t \times \text{Private Repo Share}_{i,2019Q4} + e_{it}, \tag{6}$$

where ON RRP Share_{it} is the percentage of MMF i's AUM invested in the ON RRP on day t; α_i are fund fixed effects; μ_t are time fixed effects; Post SLR Relief_t is a time dummy for the period after the SLR relief expired (March 31, 2021); Gov_i is a dummy for government funds; and Private Repo $\text{Share}_{i,2019Q4}$ is the percentage of private repo investment in fund i's portfolio in 2019Q4. The regression is estimated through OLS from April 2020 (when the SLR relief was established) to December 2021; standard errors are robust to heteroskedasticity, serial correlation, and cross-correlation.

As Column (1) of Table 5 shows, ON RRP portfolio share increased significantly more, by roughly 16 percentage points, in Government MMFs after the expiration of SLR relief than in prime MMFs. Similarly, Column (3) of Table 5 shows that, after the expiration of SLR relief, a ten-percentage-point increase in the pre-sample share of private repos in a fund's portfolio increases the fund's ON RRP portfolio share by 3.4 percentage points.[10]

	ON RRP Share$_{it}$			
	(1)	(2)	(3)	(4)
	MMF	MMF	MMF	MMF
Post SLR Relief$_t$ × Gov$_i$	16.151***	16.200***		
	(12.483)	(12.535)		
Jan - March 2021$_t$ × Gov$_i$		0.197***		
		(5.080)		
Post SLR Relief$_t$ × Private Repo Share$_{i2019Q4}$			0.341***	0.342***
			(12.485)	(12.531)
Jan - March 2021$_t$ × Private Repo Share$_{i2019Q4}$				0.004***
				(3.178)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
Observations	33593	33593	33593	33593

Table 5: Share of ON RRP Investment in MMFs' Portfolios and the SLR Relief. Panel regressions at the fund-day level. The sample is all MMFs eligible to invest in the ON RRP and covered by iMoneyNet. The time period is 4/14/2020-12/31/2021. ON RRP Share$_{it}$ is the percentage of MMF i's AUM invested in the ON RRP on day t. Post SLR Relief$_t$ is a time dummy for the period after the SLR relief expired (3/31/2021)Gov$_i$ is a dummy for government funds; and Private Repo Share$_{i,2019Q4}$ is the percentage of private repo investment in fund i's portfolio in 2019Q4. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

4.2 T-bill Supply

The availability of T-bills may also limit MMF investment options and therefore affect their portfolio share in the ON RRP facility. Figure 6 shows T-bills outstanding as a share of the AUM of the MMF industry, together with ON RRP take-up by MMFs: ON RRP take-up increases as the share of T-bills outstanding decreases.

To capture this relation between T-bills and MMFs' ON RRP investment, we run the following two regressions:

[10] In Columns (2) and (4), we repeat the regressions including the interaction of a time dummy for January-March 2021 with the fund-level treatment dummies; this robustness check aims to control for possible anticipation effects ahead of the SLR relief's end, as the end date was specified when the relief program was announced.

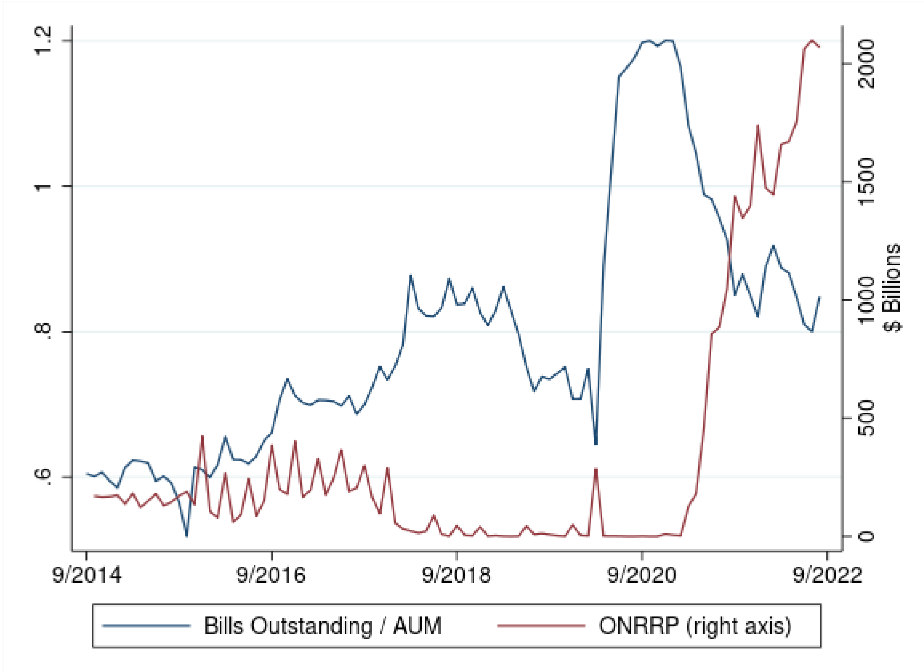


Figure 6: Marketable T-bills Outstanding over MMFs' AUM (left axis) and ON RRP Take-up by MMFs (right axis).

$$\text{ON RRP Share}_{it} = \alpha_i + \mu_t + \beta\,\text{T-Bill Supply}_t \times \text{Gov}_i + e_{it}, \tag{7}$$

$$\text{ON RRP Share}_{it} = \alpha_i + \mu_t + \beta\,\text{T-Bill Supply} \times \text{Treasury Share}_{i,2019Q4} + e_{it}, \tag{8}$$

where ON RRP Share_{it} is the proportion of fund i's AUM that fund i invests at the ON RRP on day t (in percentage); α_i are fund-fixed effects; μ_t are time-fixed effects; T-Bill Supply_t is measured as the total T-bill issuance in the month of day t in trillions of dollars (Columns (1) and (3) in Table 6) or as T-bills outstanding as a share of MMFs' AUM on day t in percentages (Columns (2) and (4)); Gov_i is a dummy for government funds; and Treasury $\text{Share}_{i,2019Q4}$ is the percentage of Treasury securities in fund i's portfolio in 2019Q4. This identification strategy relies on the assumption that government MMFs—which can only hold Treasuries, agency debt, and repos collateralized by either asset class—and MMFs specializing in Treasuries securities are more exposed to shocks in the T-Bill supply. The regressions are estimated on the daily panel of ON RRP-eligible MMFs between April 2020 and August 2022; standard errors are corrected for autocorrelation and heteroskedasticity.

	ON RRP Share_{it}			
	(1)	(2)	(3)	(4)
	MMF	MMF	MMF	MMF
$\text{Gov}_{it} \times \text{T-Bills Issuance}_t$	-23.409***			
	(-11.089)			
$\text{Gov}_{it} \times \frac{\text{T-Bills Outstanding}_t}{\text{Gov AUM}_t}$		-43.173***		
		(-12.850)		
$\text{T-Bills Issuance}_t \times \text{Treasury Share}_{i2019Q4}$			-0.277***	
			(-12.468)	
$\frac{\text{T-Bills Outstanding}_t}{\text{Total AUM}_t} \times \text{Treasury Share}_{i2019Q4}$				-0.576***
				(-11.834)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
Observations	47478	47478	47478	47478

Table 6: Share of ON RRP Investment in MMFs' Portfolios and and T-bill Supply. Panel regressions at the fund-day level. The sample is all MMFs eligible to invest in the ON RRP and covered by iMoneyNet. The time period is 4/14/2020-8/31/2022. ON RRP Share_{it} is the percentage of MMF i's AUM invested in the ON RRP on day t. Gov_i is a dummy for government funds; Treasury $\text{Share}_{i,2019Q4}$ is the percentage of Treasury securities in fund i's portfolio in 2019Q4; T-bills oustanding and AUM are in billions of dollars; T-bills issuance is in trillions of dollars. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

As Column (1) of Table 6 shows, a monthly decrease of T-bill issuance by $100 billion increases the portfolio share of ON RRP investment significantly more in government MMFs than in prime MMFs, by roughly 2.3 percentage points. Results are similar when we use the pre-sample share of Treasury securities in the fund's portfolio as treatment (Column (3)) and when we measure variation in the T-bill supply using the ratio of T-bills outstanding over MMF AUM.

In the Appendix, we re-estimate regression (8) on a longer sample (January 2015-August 2022) to exploit more variation in the T-bill supply; results are similar. Finally, in the Appendix, we test simultaneously both the banks' balance-constraint channel and the T-bill supply channel by including both treatments as explanatory variables; results are similar.

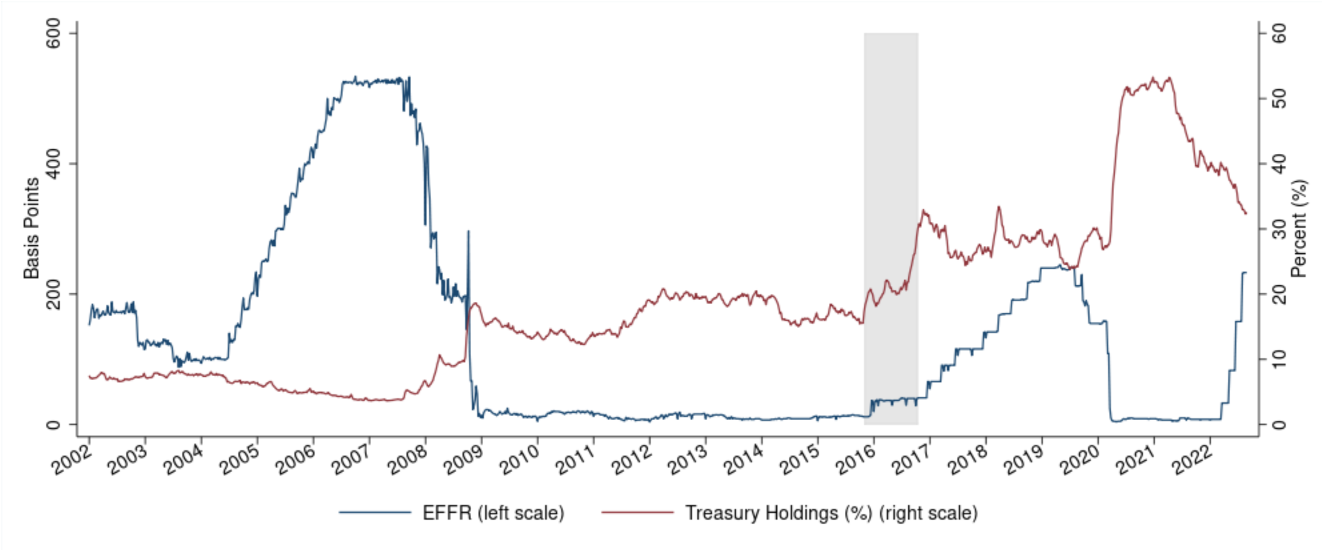


Figure 7: Share of Treasury Securities in MMFs' Portfolios and the EFFR. The gray shaded area represents the period from November 2015 to October 2016, when the MMF industry adjusted to the 2014 SEC reform, with more than one trillion dollars flowing from prime to government MMFs.

4.3 Monetary Policy and Interest Rate Risk

A third factor that determines the share of MMFs' portfolios invested in the ON RRP facility is interest-rate risk. Since MMFs hold debt securities, and the size of rate hikes and the length of tightening cycles are uncertain, they may suffer capital losses; these losses are larger for funds holding longer-term securities such as Treasuries. In contrast, when interest rates are low, MMFs have an incentive to load on Treasuries in order to preserve a meaningful yield. Indeed, as Figure 7 shows the Treasury share in MMFs' portfolios comoves with the interest rate cycle.

To identify the impact of monetary policy on MMF portfolio choice in a causal way, we use two treatment variables for a fund's exposure to interest rate risk: (i) a dummy for government MMFs, which have fewer options to manage interest-rate risk than prime MMFs, and (ii) the one-month lagged weighted-average maturity (WAM) of the fund's portfolio, which works as a proxy for the fund's idiosyncratic tolerance to interest-rate risk; the lower the WAM, the lower the fund's tolerance for interest-rate risk. We run the following regressions

$$\Delta \text{TreasuryShare}_{it} = \alpha_i + \mu_t + \sum_{j=0}^{3} \beta_j \Delta \text{EFFR}_t \times \text{Gov}_i + e_{it}, \tag{9}$$

$$\Delta\text{TreasuryShare}_{it} = \alpha_i + \mu_t + \sum_{j=0}^{3} \beta_j \Delta\text{EFFR}_t \times WAM_{i,t-4} + e_{it}, \quad (10)$$

where $\text{TreasuryShare}_{it}$ is the share of Treasuries in the portfolio of fund i on day t; α_i are fund-fixed effects; μ_t are time-fixed effects; EFFR_t is the effective federal funds rate in percentage;Gov_i is a dummy for government funds; and $WAM_{i,t}$ is the weighted-average maturity of fund i's portfolio. The regressions are estimated on weekly data between 2002 and 2022; standard errors are corrected for heteroskedasticity, serial correlation, and cross-correlation. The results are in Table 7: over a month, an increase in the EFFR by one percentage point decreases the share of Treasuries in government funds' portfolio by 1.8 percentage points more than in prime funds. Similarly, a decrease in a fund's lagged WAM by one month leads to an additional drop in its Treasury portfolio share by 60 basis points, following a one percentage point increase in the EFFR.[11]

	ΔTreasury Share_{it}					
	(1)	(2)	(3)	(4)	(5)	(6)
$\sum_{n=0}^{3}(\Delta\text{EFFR}_{t-n} \times \text{Gov}_{it})$	-1.816***	-1.792***	-1.871**			
(F-statistic)	13.623	10.033	5.032			
$\sum_{n=0}^{3}(\Delta\text{EFFR}_{t-n} \times \text{WAM}_{it-4})$				.064***	.061**	.085***
(F-statistic)				9.103	6.478	9.381
Fund FE	Y	Y	Y	Y	Y	Y
Date FE	Y	Y	Y	Y	Y	Y
Sample	2002-2022	2002-2009	2010-2022	2002-2022	2002-2009	2010-2022
Observations	547860	321830	226030	545389	320062	225327

Table 7: Share of Treasury Securities in MMFs' Portfolios and the EFFR. Linear regressions at the fund, week level. Sample is iMoneyNet funds. The EFFR is the weekly average effective federal funds rate, in percentage. Portfolio share variables are in percentage. WAM is in days. F-statistics are calculated using Driscoll-Kraay standard errors with 4 lags.

[11] As we explained above, a fully-anticipated interest-rate increase would not impact funds' portfolio choices; the estimated impact stems from the fact that rate changes are, at least partially, unanticipated during the monetary policy cycle.

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A Appendix

A.1 The Size of the MMF Industry: Monetary Policy

Table 8 replicates Table 1 of the main text, separating the effect for retail and institutional funds. Since we do not have data on wholesale bank deposit rates, we add the triple interaction term $\Delta\text{EFFR}_t \times \text{MMF}_i \times \text{Inst}_i$, where Inst_i is a dummy for institutional MMFs. This specification allows us to separately estimate the additional beta, relative to retail bank deposits, of retail and institutional MMFs.

	ΔNet Yield$_{it}$		
	(1)	(2)	(3)
$\sum_{n=0}^{12} \Delta\text{EFFR}_{t-n}$	.28***	.417***	.039***
(F-statistic)	29.952	51.181	31.192
$\sum_{n=0}^{12}(\Delta\text{EFFR}_{t-n} \times \text{MMF}_i)$	.569***	.443***	.776***
(F-statistic)	88.014	66.965	140.821
$\sum_{n=0}^{12}(\Delta\text{EFFR}_{t-n} \times \text{MMF}_i \times \text{Inst}_{it})$	.036**	.019	.111***
(F-statistic)	5.501	1.202	16.547
Fund FE	Y	Y	Y
Sample	2002-2022	2002-2009	2010-2022
Observations	540178	313754	226424

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Betas on bank deposits and MMF yields, separately for institutional and retail funds. The regression is run on a panel including the average bank deposit ($i = 1$) and publicly offered MMFs ($i > 1$). The outcome variable, change in net yield or in the average deposit rate, is weekly and in percentage. EFFR is an average, in percentage, within each week. F-statistics are calculated using Driscoll-Kraay standard errors with 4 lags.

A.2 The Size of the MMF Industry: Banks' Balance-Sheet Constraints

Table 9 replicates Table 3 of the main text, using the DI SLR relief period (June 2020-March 2021).

	AUM_{it}			
	(1)	(2)	(3)	(4)
	MMF	Gov MMF	MMF	Gov MMF
Post SLR Relief_t × Affliated with Bank Subject to SLR_i	2.774***	3.499***	5.385***	6.177***
	(13.115)	(12.028)	(19.783)	(14.363)
Jan - March 2021_t × Affliated with Bank Subject to SLR_i	0.210	0.216	1.480***	1.154***
	(1.097)	(0.781)	(5.726)	(2.828)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
ONRRP-Eligible Only	N	N	Y	Y
Observations	78237	57895	30854	22498

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Banks' Balance-Sheet Constraints and the Size of the MMF Industry. Fund-level daily regression estimated through OLS from June 1, 2020 (when the SLR relief was established for DIs) to December 2021. The SLR Relief Period is defined to be 6/1/2020-3/31/2021, inclusive. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

In Novemeber 2019, as required by the Economic Growth, Regulatory Relief, and Consumer Protection Act (EGRRCPA), the federal bank regulatory agencies authorized the DIs of banking organizations predominantly engaged in custodial activities to exclude all qualifying central bank reserves from the calculation of their SLR, starting from 2020Q2. To control for this differential treatment of custodial banks at the DI level, Table 10 replicates the results of Table 9 adding the interaction of a custodial-bank dummy with the Post SLR Relief_t dummy. Our results show that, at the DI level, MMFs affiliated with custodial banks, which were relatively less constrained by the SLR than other banks subject to the SLR requirement becasue they could exclude their reserve balances from its calculation, received relatively less inflows than MMFs affiliated with other DIs subject to the SLR requirement.

	AUM_{it}			
	(1)	(2)	(3)	(4)
	MMF	Gov MMF	MMF	Gov MMF
Post SLR Relief$_t$ × Affliated with Bank Subject to SLR$_i$	2.877***	4.243***	5.549***	7.722***
	(13.854)	(14.120)	(21.656)	(18.095)
Jan - March 2021$_t$ × Affliated with Bank Subject to SLR$_i$	0.191	0.497	1.727***	2.057***
	(0.795)	(1.427)	(6.206)	(4.533)
Post SLR Relief$_t$ × Affliated with Custodial Bank$_i$	-0.313**	-2.027***	-0.534**	-4.270***
	(-2.567)	(-13.374)	(-2.565)	(-15.186)
Jan - March 2021$_t$ × Affliated with Custodial Bank$_i$	0.049	-0.699***	-0.808***	-2.501***
	(0.283)	(-2.654)	(-3.026)	(-5.981)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
ONRRP-Eligible Only	N	N	Y	Y
Observations	78237	57895	30854	22498

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Banks' Balance-Sheet Constraints and the Size of the MMF Industry. Fund-level daily regression estimated through OLS from June 1, 2020 (when the SLR relief was established for DIs) to December 2021. The SLR Relief Period is defined to be 6/1/2020-3/31/2021, inclusive. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

Table 11 replicates the results of regerssion (4) of the main text (see Table 4), using the three-quarter lagged difference between a bank's SLR and its regulatory requirement ($\text{SLR}_{i,t-60} - \text{SLR Req}_{i,t-60}$) as the treatment variable for the exposure of the affiliated MMFs to the bank's balance-sheet constraints. As in Table 4, the regresion is run on the sample of MMFs affiliated to banks subject to the SLR regulatory requirement.

	AUM_{it}			
	(1)	(2)	(3)	(4)
	MMF	Gov MMF	MMF	Gov MMF
Post SLR Relief$_t$ $\times$ (SLR - SLR Req)$_{it-60}$	-0.421***	-0.700***	-0.855***	-1.653***
	(-5.254)	(-6.032)	(-7.668)	(-9.441)
Jan - March 2021$_t$ $\times$ (SLR - SLR Req)$_{it-60}$	0.029	-0.006	-0.428***	-0.706***
	(0.388)	(-0.055)	(-3.730)	(-4.114)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
ONRRP-Eligible Only	N	N	Y	Y
Observations	28051	20266	15640	10764

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Banks' Balance-Sheet Constraints and the Size of the MMF Industry. Fund-level daily regression estimated through OLS from April 14, 2020 (when the SLR relief was established for BHC) to December 2021. The sample is restricted to MMFs affiliated with banks subject to the SLR regulatory requirement. T-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

Finally, Table 12 replicates the results of Table 3 in the main text adding the interaction of a dummy for MMFs affiliated to any bank (including those not subject to the SLR) with the Post SLR Relief$_t$ dummy; results show that generic bank affiliation does not lead to higher AUM in the period after the SLR relief, indicating that the inflows into MMFs affiliated with banks subject to the SLR requirement after 2021Q1 were not driven by investors' general preference for MMFs affiliated with banks.

	AUM$_{it}$			
	(1)	(2)	(3)	(4)
	MMF	Gov MMF	MMF	Gov MMF
Post SLR Relief$_t$ × Affliated with a Bank$_i$	0.682***	-0.221***	2.076***	-0.435*
	(11.800)	(-3.292)	(11.271)	(-1.939)
Jan - March 2021$_t$ × Affliated with a Bank$_i$	0.517***	0.098	-0.497***	-1.758***
	(10.031)	(1.293)	(-4.268)	(-9.090)
Post SLR Relief$_t$ × Affliated with a Bank$_i$ × Subject to SLR$_{it}$	2.081***	3.440***	3.716***	6.697***
	(10.222)	(12.308)	(19.470)	(26.753)
Jan - March 2021$_t$ × Affliated with a Bank$_i$ × Subject to SLR$_{it}$	-0.313	-0.099	2.258***	2.918***
	(-1.565)	(-0.343)	(10.909)	(10.048)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
ONRRP-Eligible Only	N	N	Y	Y
Observations	85178	62870	33593	24280

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Banks' Balance-Sheet Constraints and the Size of the MMF Industry. Fund-level daily regression estimated through OLS from April 14, 2020 (when the SLR relief was established for BHC) to December 2021. The variable Bank Affiliated$_i$is a dummy for MFFs affilaited to any bank (either subject or not subject to the SLR requirement). t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

A.3 MMF Portfolio Choice: Banks' Balance-Sheet Constraints

Table 13 replicates Table 5 of the main text, using the DI SLR relief period (June 2020-March 2021). Results are almost identical.

	ONRRP$_{it}$/AUM$_{it}$			
	(1)	(2)	(3)	(4)
	MMF	MMF	MMF	MMF
Post SLR Relief$_t$ × Gov$_{it}$	16.096***	16.141***		
	(12.464)	(12.527)		
Jan - March 2021$_t$ × Gov$_{it}$		0.156***		
		(4.399)		
Post SLR Relief$_t$ × Private Repo Share$_{i2019Q4}$			0.341***	0.342***
			(12.483)	(12.539)
Jan - March 2021$_t$ × Private Repo Share$_{i2019Q4}$				0.004***
				(3.459)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
Observations	30854	30854	30854	30854

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: ONRRP Take-up over AUM the SLR belief. Linear regressions at the fund, day level. Sample is iMoneyNet funds. ONRRP takeup and AUM are daily and in billions. ONRRP takeup over AUM is a percent (multiplied by 100). Portfolio share variables are in percentages. The SLR Relief Period is defined to be 6/1/2020-3/31/2021, inclusive. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

A.4 MMF Portfolio Choice: T-bill Supply

Table 14 replicates column (3) and (4) of Table 6 of the main text, using a longer sample starting in 2015 and using the one-month lagged share of Treasuries in a fund's portfolio as proxy for the fund's exposure to shocks in the T-Bill supply. Results are similar.

	$\text{ONRRP}_{it}/\text{AUM}_{it}$	
	(1)	(2)
	MMF	MMF
T-Bills Issuance_t × Treasury Share_{it-20}	-0.092***	
	(-14.299)	
$\frac{\text{T-Bills Outstanding}_t}{\text{Total AUM}_t}$ × Treasury Share_{it-20}		-0.153***
		(-14.405)
Institution FE	Y	Y
Date FE	Y	Y
Sample	1/1/15-8/31/22	1/1/15-8/31/22
Observations	135694	135694

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Share of ON RRP Investment in MMFs' Portfolios and and T-bill Supply. Panel regressions at the fund-day level. The sample is all MMFs eligible to invest in the ON RRP and covered by iMoneyNet. The time period is 1/1/2015-8/31/2022. ON RRP Share_{it} is the percentage of MMF i's AUM invested in the ON RRP on day t. Treasury $\text{Share}_{i,2019Q4}$ is the percentage of Treasury securities in fund i's portfolio in 2019Q4; T-bill volumes are measured in trillions of dollars. t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

To test simultenously both the banks' balance-sheet constraint channel and the T-bill supply channel, we run a daily-frequency, fund-level panel regression including both treatments as explanatory variable; that is, we regress a fund's portfolio share in the ON RRP against both the interaction of the Post SLR Relief_t dummy with our proxies for a fund's exposure to the banks' balance-sheet constraint channel (Gov_i dummy and Private Repo $\text{Share}_{i,2019Q4}$) and the interaction of our proxies for variation in the T-bill supply with the proxies for a fund's exposure to this second channel (Gov_i dummy and Treasury $\text{Share}_{i,2019Q4}$). The regression is run from April 14, 2020 to December 31, 2021; results are in Table 15 and are very similar to those in the paper obtained from measuring the effect of each channel separately (Tables 5 and 6).

	ON RRP Share_{it}			
	(1)	(2)	(3)	(4)
	MMF	MMF	MMF	MMF
Post SLR Relief_t × Gov_{it}	15.137***	14.074***		
	(10.830)	(9.505)		
Jan - March 2021_t × Gov_{it}	-0.844***	0.441**		
	(-3.123)	(2.196)		
Gov_{it} × T-Bills Issuance_t	-2.829***			
	(-3.611)			
$\text{Gov}_{it} \times \frac{\text{T-Bills Outstanding}_t}{\text{Gov AUM}_t}$		-8.368***		
		(-4.389)		
Post SLR Relief_t × Private Repo $\text{Share}_{i2019Q4}$			0.344***	0.354***
			(12.494)	(12.523)
Jan - March 2021_t × Private Repo $\text{Share}_{i2019Q4}$			0.006***	0.004***
			(3.613)	(2.745)
T-Bills Issuance_t × Treasury $\text{Share}_{i2019Q4}$			-0.143***	
			(-8.202)	
$\frac{\text{T-Bills Outstanding}_t}{\text{Total AUM}_t}$ × Treasury $\text{Share}_{i2019Q4}$				-0.392***
				(-8.195)
Institution FE	Y	Y	Y	Y
Date FE	Y	Y	Y	Y
Observations	33593	33593	33593	33593

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Share of ON RRP Investment in MMFs' Portfolios, SLR Relief, and T-bill Supply. Panel regressions at the fund-day level. The sample is all MMFs eligible to invest in the ON RRP and covered by iMoneyNet. The time period is from 4/14/2020 (when SLR relief became effective for BHCs) to 12/31/2021. ON RRP Share_{it} is the percentage of MMF i's AUM invested in the ON RRP on day t; Post SLR Relief_t is a time dummy for the period after the SLR relief expired (3/31/2021); Gov_i is a dummy for government funds; Private Repo $\text{Share}_{i,2019Q4}$ is the percentage of private repo investment in fund i's portfolio in 2019Q4; Treasury $\text{Share}_{i,2019Q4}$ is the percentage of Treasury securities in fund i's portfolio in 2019Q4; T-bill issuance and MMF AUMs are measured in billions of dollars; T-bills issuance is measured in trillions of dollars t-statistics are calculated using Driscoll-Kraay standard errors with 5 lags.

A.5 MMF Portfolio Choice: Monetary Policy

Chart 8 below show the WAM of Government MMFs; Chart 9below show the WAM of Government MMFs.

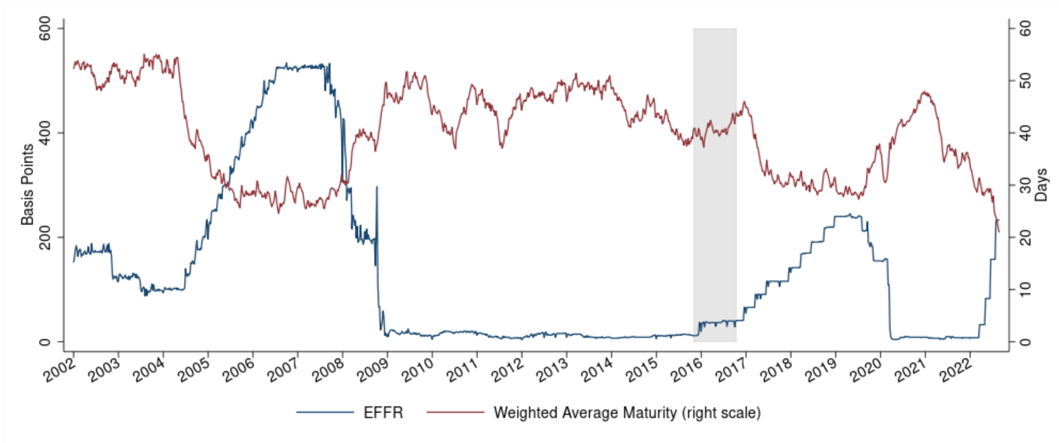

Figure 8: WAM of Government Funds and the EFFR.

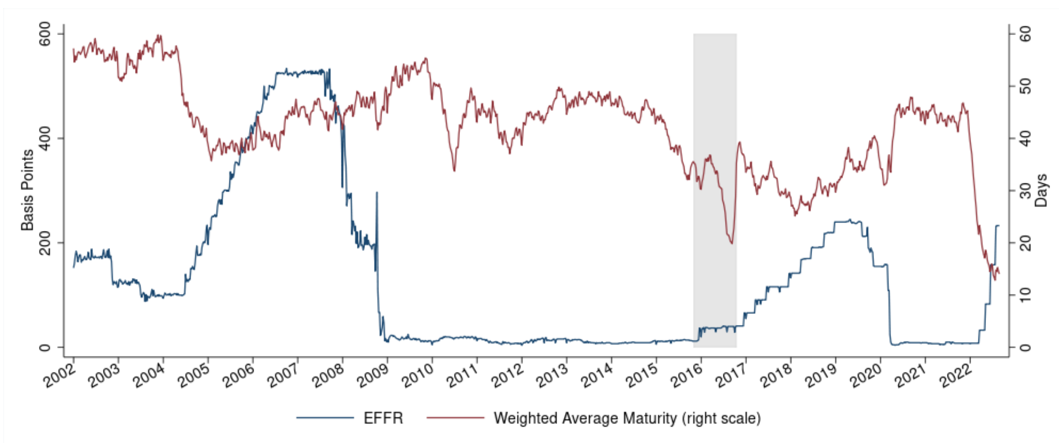

Figure 9: WAM of Prime Funds and the EFFR.