

US Rates

Primer: Fed policy plumbing, '25 edition

Primer

Fed plumbing critical to understanding money markets

The rates market starts at the front end of the curve. To understand the US front end, it is critical to understand the plumbing, which includes the setting of Fed administered rates, fed funds, & other key rates (OBFR & SOFR). This primer delves into the plumbing.

This primer also reviews the basics of the Fed balance sheet, QT mechanics, & discusses impacts of this liquidity drain on money markets. This primer builds off our '24 piece (see the report: [Fed policy plumbing, '24 edition](#)). Key topics highlighted in this primer:

Fed key policy rates & tools: We review key front-end rates and how IORB and ON RRP are adjusted to keep the fed funds rate within the target range.

Dynamics of the fed funds market: we discuss how fed funds dynamics remain dominated by Federal Home Loan Bank lending.

Fed balance sheet: we provide an overview of the Fed's balance sheet, including key liability items like bank reserves, Fed overnight reverse repo, and Treasury cash balance.

QT progress to date: we review Fed QT progress and how the liquidity drain has impacted reserves + ON RRP. We also discuss the link to commercial banks.

Fed unrealized losses & IORB: we discuss Fed unrealized losses, how they work mechanically, and what would happen if the Fed were to stop paying IORB.

Table of Contents

Fed policy rates & tools	2
Target range for fed funds effective rate & primary tools	2
Detail on Fed policy target, key rates, & primary tools	3
Technical adjustments: IORB & ON RRP	11
Dynamics of the Fed funds market	12
Fed funds lenders	13
FF borrowers	14
Fed balance sheet and reserve dynamics	17
Fed balance sheet assets	17
Fed balance sheet liabilities	18
Fed QT: draining from reserves & ON RRP	21
Fed assets: redemption caps, \$5bn UST & \$35bn MBS	21
Fed liabilities: draining from reserves to ON RRP	22
Fed unrealized losses & negative equity	23
Appendix	27
Research Analysts	31

08 July 2025

Rates Strategy
United States

Mark Cabana, CFA
Rates Strategist
BofAS
mark.cabana@bofa.com

Katie Craig
Rates Strategist
BofAS
katie.craig@bofa.com

US Rates Research
BofAS
+1 646 855 8846

[See Team Page for List of Analysts](#)

See page 27 for acronym definitions.

Trading ideas and investment strategies discussed herein may give rise to significant risk and are not suitable for all investors. Investors should have experience in relevant markets and the financial resources to absorb any losses arising from applying these ideas or strategies.

BofA Securities does and seeks to do business with issuers covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

Refer to important disclosures on page 28 to 30.

12848443

Timestamp: 08 July 2025 07:00AM EDT

Fed policy rates & tools

The Fed sets monetary policy to promote its dual mandate of maximum employment and stable inflation.¹ The Fed primarily achieves these goals by managing the level of short-term interest rates and uses its balance sheet as a secondary tool.

In setting the level of short-term interest rates the Fed uses a 25bps range for its target effective federal funds rate (EFFR), which represents overnight unsecured interbank borrowing. To achieve the 25bps range, the Fed primarily relies on the interest rate on reserve balances (IORB). IORB serves as a “magnet” for other money market rates because it pays a rate of return that depository institutions will typically be hesitant to lend below.

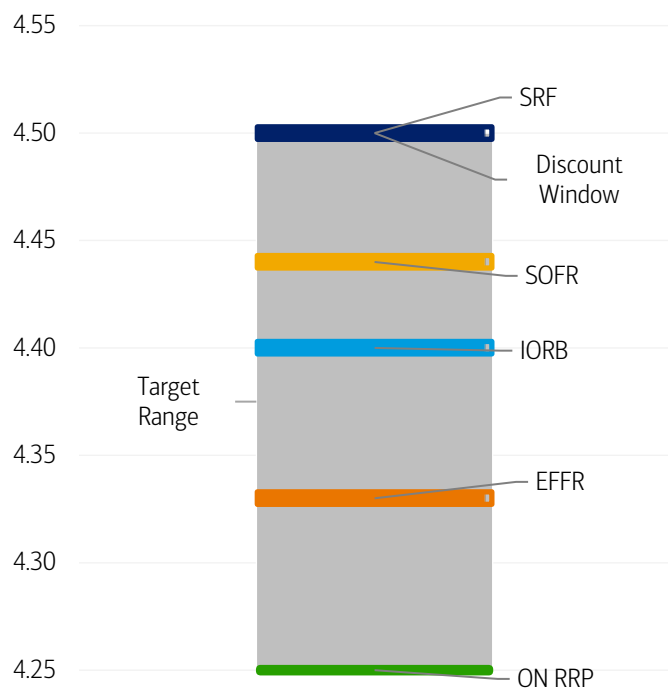
The Fed supplements IORB with two tools to ensure broader control over money markets: an overnight reverse repo facility (ON RRP) to prevent rates from moving too low and the standing repo facility (SRF) to prevent rates from moving too high (Exhibit 1). The Fed also has a backstop lending facility, the discount window.

The Fed’s official policy target is the EFFR but there are 2 other rates that receive special focus: overnight bank funding rate (OBFR) and secured overnight financing rate (SOFR). OBFR is similar to fed funds but includes a wider range of unsecured overnight bank borrowings. SOFR is a collateralized overnight repo rate.

We discuss the Fed’s policy target, other key rates, and tools in greater detail below.

Exhibit 1: Key interest rates relative to Fed target range

The Fed aims to control EFFR via IORB and ON RRP

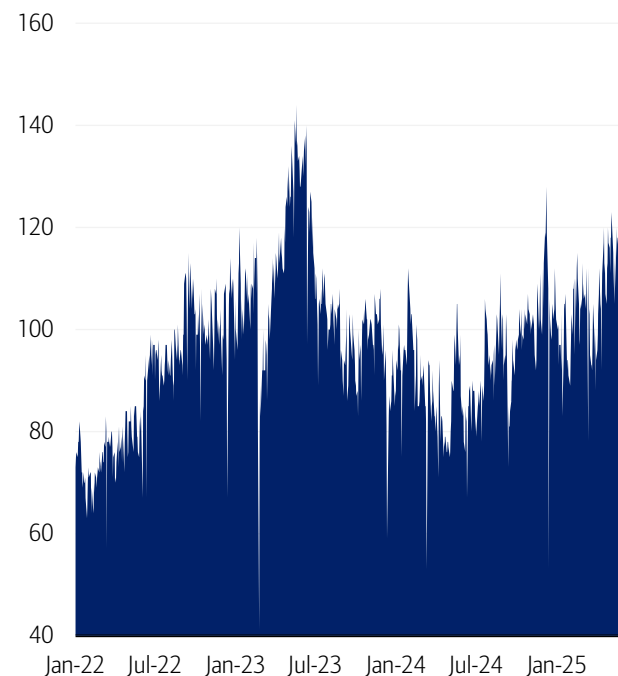


Source: BofA Global Research, Bloomberg. Data as of 7/1/25

BofA GLOBAL RESEARCH

Exhibit 2: Fed funds volumes (\$bn)

Fed funds volumes have averaged around \$105bn YTD as of Jul 1 '25



Source: BofA Global Research, FRBNY;

BofA GLOBAL RESEARCH

Target range for fed funds effective rate & primary tools

The Fed sets a 25bps range for the EFFR, which is its primary objective for policy implementation. The Fed’s key policy tools of IORB, ON RRP, and SRF can be set to any rate of interest to ensure that the EFFR remains squarely within the Fed’s target range.

¹<https://www.federalreserve.gov/monetarypolicy/monetary-policy-what-are-its-goals-how-does-it-work.htm>



- **IORB:** the Fed's primary tool for controlling money markets since it serves as a rate at which banks will be hesitant to lend below. Depository institutions receive this rate on reserves held at the Fed.
- **ON RRP:** intended to function as a floor for money market rates. ON RRP allows the Fed to drain cash out of the banking system when money market rates are too low.
- **SRF:** intended to act as a ceiling for UST secured funding. The SRF allows the Fed to add cash into the banking system when reserves are limited in relation to the amount of UST collateral outstanding. Although the SRF was only formalized in '21, the Fed has been operating a functional SRF / daily repo operation since '19.

Detail on Fed policy target, key rates, & primary tools

EFFR (effective Federal Funds Rate)

The EFFR is the primary monetary policy target for the Fed. According to the NY Fed, the EFFR *"consists of domestic unsecured borrowings in U.S. dollars by depository institutions from other depository institutions and certain other entities, primarily GSEs."* The EFFR is calculated as a volume-weighted median of overnight FF trades.

Daily volumes in the overnight EFFR market rose leading into and peaked at \$144b around the March '2023 bank stress events but have since declined to an average of \$105b YTD (Exhibit 2). The Fed changed the way they collect fed funds transactions in 2014, previously from brokered data, which only included transactions that went through four brokers, to FR2420, which allows individual institutions to submit their transaction data, therefore reflecting a broader range of activity. Today, we believe roughly 95% of all FF activity is driven by government sponsored enterprise (GSE), primarily FHLBs, lending to foreign banks (discussed further below in the Dynamics of the Fed funds market section).

OBFR (overnight bank funding rate)

The Fed publishes another broad overnight unsecured bank borrowing rate along with EFFR: the overnight bank funding rate (OBFR). This rate is not the Fed's policy target but it is a similar rate used to inform overnight unsecured borrowing activity.

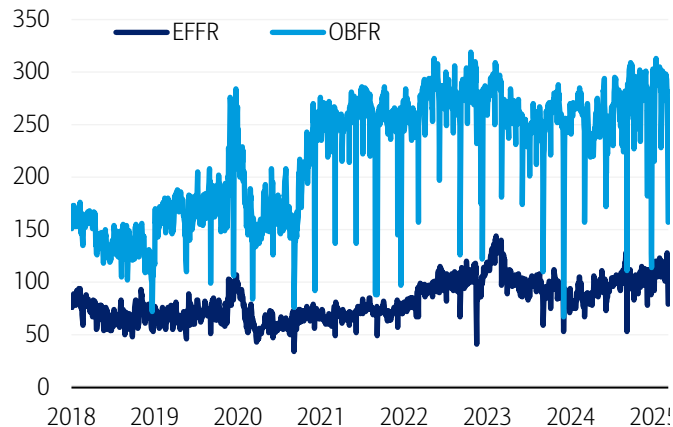
The OBFR consists of overnight FF, certain Eurodollar transactions, and, in 2018, was adjusted to also include domestic deposits reported as "selected deposits". According to the NY Fed, the *"Eurodollar market consists of unsecured U.S. dollar deposits held at banks or bank branches outside of the United States"* and *"U.S.-based banks can also take Eurodollar deposits domestically through international banking facilities."* Additionally, a selected deposit is defined as *"a deposit denominated in U.S. dollars, in an amount of \$1 million or more, that is issued in a U.S. office of the reporting institution on the report date... [and] issued with an original specified term to maturity of six or less days."*

Money market funds, corporations, foreign central banks, and other official accounts are all active lenders in the Eurodollar market which is encapsulated in OBFR. Essentially, the EFFR represents overnight unsecured lending activity from the GSEs while OBFR represents overnight unsecured lending from MMFs / corporates / official accounts / others. OBFR is also calculated as a volume-weighted median. Eurodollar activity has historically comprised around 62% of OBFR activity (Exhibit 3, Exhibit 4).



Exhibit 3: EFFR versus OBFR volumes (\$bn)

OBFR volumes have average around \$277bn YTD

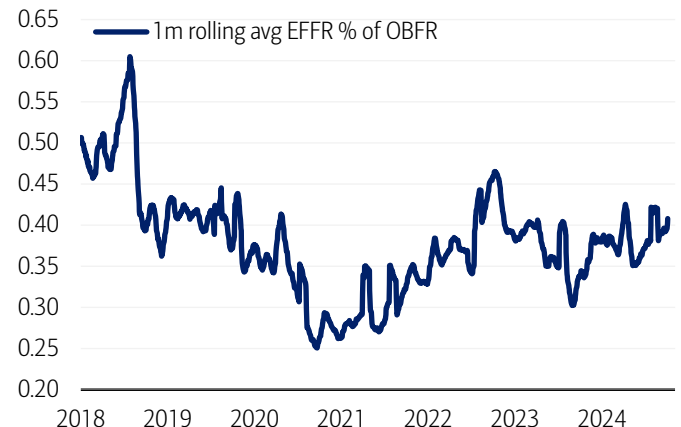


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 4: EFFR as % of OBFR

Fed funds volumes average around 38% of OBFR volumes YTD



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

SOFR (secured overnight financing rate)

The Fed publishes three Treasury collateralized repo rates daily. The broadest measure of these repo rates is SOFR, which is designed to measure the cost of borrowing cash overnight collateralized by Treasury securities in tri-party and bilateral repo markets. SOFR is not a Fed policy target, but it has special significance given its widespread adoption with LIBOR transition. If the Fed were to ever consider moving its policy target away from EFFR we expect SOFR would be the most logical replacement candidate.

Much more detail on SOFR and the repo market can be found in our primer (see report: [US Treasury repo primer: 2025 edition](#)).

IORB (Interest on Reserve Balances)

This is the main tool that the Fed uses to move the FF rate within the target range. It is the rate of interest paid to depository institutions for their balances held overnight at the Fed. It is set by the Board of Governors (not the FOMC). The Fed's ability to pay interest on reserves is a policy tool that was granted by Congress in fall 2008; IORB was not part of the Fed's pre-2008 toolkit.

The Fed used to have different requirements for interest on required (IOR) and interest on excess reserves (IOER), though the two always received the same interest rate. The Fed reduced its reserve requirement to zero in March of 2020 because of a shift to an abundant reserve regime that it established in January 2019; this change technically made all reserves excess. Given the conversion of the two rates, the Fed has changed the name to interest on reserve balances (IORB).

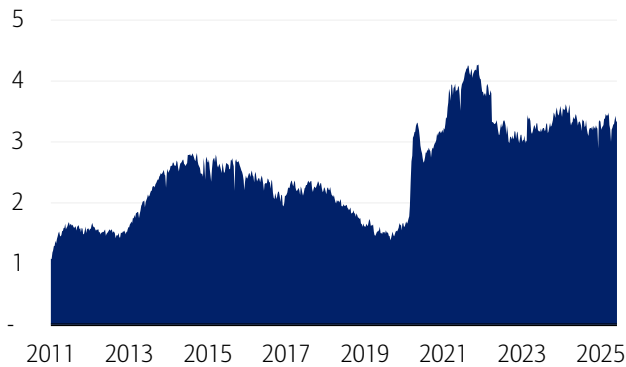
Reserve balances fluctuate with the expansion and reduction of the Fed's SOMA portfolio which holds assets such as Treasuries and mortgage-backed securities (Exhibit 5). Reserve balances have averaged \$3.3tn YTD and we forecast them declining to \$2.8tn by year end (if market conditions allow) through a process known as quantitative tightening; we discuss this reserve draining process in more detail below in the Fed QT: draining from reserves & ON RRP section.

IORB is only eligible for depository institutions and is not available to other entities that can transact in the fed funds market, such as GSEs. The EFFR generally trades below IORB when reserves are ample (Exhibit 6). This is because GSEs would prefer to earn a positive return by lending their excess cash to an entity willing to pay a positive rate of return (even if below IORB) instead of leaving these funds (1) on deposit with the Fed earning zero (2) in the Fed's overnight reverse repo facility. The inability for the GSEs to earn IORB drives most lending activity in the FF market when reserves are ample.



Exhibit 5: Reserve balances (\$tn)

Reserve balances have been steady despite QT

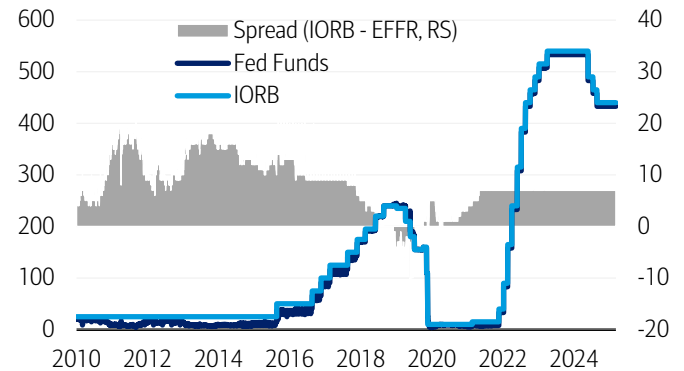


Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 6: IORB - EFR spread (bps)

EFFR typically prints below IORB when reserves are ample



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

ON RRP Facility (Overnight Reverse Repurchase Agreement)

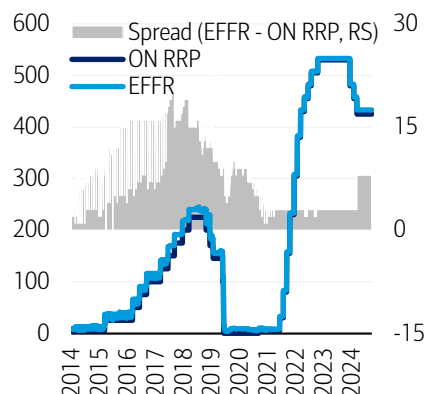
The Fed's ON RRP facility is a supplementary tool to prevent EFFR from trading below the bottom of the 25bps target range. Since the Fed introduced the ON RRP in 2013 it has served as a relatively firm floor for overnight Treasury repo and kept the EFFR above the bottom end of the Fed's 25 bps target range on all days except year-end 2015 (Exhibit 7). ON RRP does not perfectly hold money market rates in the target range.

ON RRP can be thought of as an investment option of last resort for eligible counterparties that cannot earn IORB. An ON RRP eligible counterparty would only invest with the Fed if there were no other readily available higher yielding alternative investments. In theory, entities that have access to this facility should not be willing to invest in overnight secured or unsecured markets at a rate below ON RRP since the Fed has better credit risk vs any private counterparty.

ON RRP does not provide a perfectly firm floor on all money market rates because (1) not all market participants have access to it (2) some investors may be willing to accept a modest discount vs ON RRP to maintain key money market relationships (3) relatively late timing of when cash is returned from the Fed vs other overnight negotiated investments. These factors explain why we have seen the Fed's broad Treasury repo rate and SOFR print below ON RRP at times (Exhibit 8). Similarly, short-tenor Treasury bill rates frequently trade through the bottom end of the Fed's target range, especially when bill supply is limited (Exhibit 9). We briefly discuss these factors below:

Exhibit 7: EFFR - ON RRP rates and spread (bps)

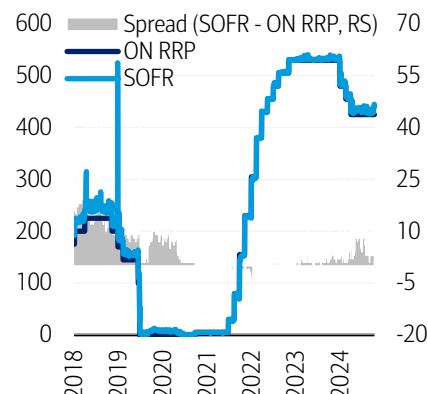
EFFR has traded above ON RRP every day except year-end 2015



Source: BofA Global Research, Bloomberg
BofA GLOBAL RESEARCH

Exhibit 8: SOFR - ON RRP rates and spread (bps)

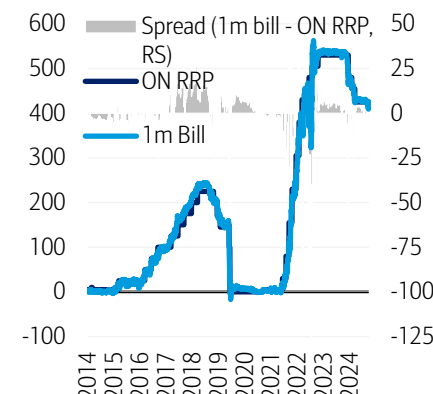
SOFR typically trades above ON RRP but has been printing below since the Fed began raising rates



Source: BofA Global Research, Bloomberg
BofA GLOBAL RESEARCH

Exhibit 9: 1m Bill - ON RRP rates and spread (bps)

1m bill typically trades below ON RRP when liquidity is abundant



Source: BofA Global Research, Bloomberg
BofA GLOBAL RESEARCH

Not all market participants have ON RRP access: there are currently over 177 eligible counterparties that have access to the Fed's ON RRP facility including primary dealers, banks, GSEs, and money market mutual funds. Most ON RRP usage has been driven by MMF, followed by GSEs, primary dealers, and banks (Exhibit 10, Exhibit 11). The large set of counterparties able to invest directly with the Fed both in terms of the number and share of money market activity explains why the ON RRP has proven to be such an effective floor on USD short-dated interest rates.

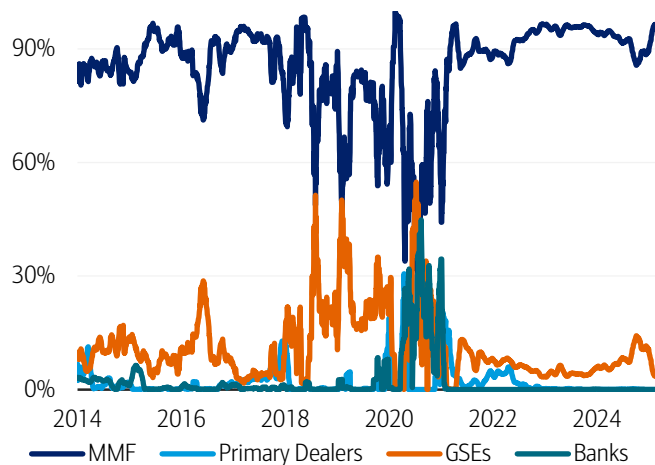
However, several key investors do not have access to Fed ON RRP including Treasury only MMF, corporates, state and local governments, or non 2a-7 regulated MMF. These investors may be more willing to invest directly in US front end rates at levels below ON RRP. These investors may prefer to invest directly at the US front end rather than allocating cash to MMF and pay any associated management fees.

The Fed currently has a \$160bn per counterparty limit per day for ON RRP operations. The MMF per counterparty limit applies to each fund that is eligible to access the ON RRP, not the broader fund family. The per-counterparty limit can be temporarily increased at the discretion of the Chair; this step might be taken if ON RRP usage was increasing amidst rapid Fed asset purchases or a flight to safety event.

The Fed has historically been willing to increase the per counterparty cap before it becomes binding. If the per counterparty cap were to bind broadly it would risk these funds investing directly in the front end & challenging the Fed's ability to maintain short rate control. The per counterparty cap does not currently bind though some funds have approached it when excess liquidity was elevated & ON RRP use very high (Exhibit 12).

Exhibit 10: Counterparty ON RRP usage as a % of total (1m MA)

MMFs make up roughly 92% of daily ON RRP take-up on average YTD



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 11: Eligible ON RRP Counterparties

MMFs make up most RRP counterparties

Type	Number	Avg % Usage YTD
GSEs	24	8%
Banks	16	0%
Primary Dealers	25	0%
MMFs	112	92%

Source: BofA Global Research, FRBNY

BofA GLOBAL RESEARCH

Exhibit 12: Top 10 MMFs' ON RRP use (\$bn)

MMF ON RRP take-up is currently concentrated amongst only a few large fund families

Fund	May Assets	May ON RRP	Apr ON RRP	Mar ON RRP	Feb ON RRP
Fidelity Cash Central Fund	54	43	47	47	39
Fidelity Govt Money Market	405	32	0	31	0
Fidelity Sec Lending Cash Central Fund	31	25	24	24	19
Vanguard Federal Money Mkt Fund	357	20	25	39	34
Fidelity Inv MM: Govt Port	232	17	0	16	0
Fidelity Inv MM: Treas Port	72	16	14	17	9
Vanguard Market Liquidity Fund	99	15	5	15	11
Fidelity Money Market	134	9	8	6	3
American Funds Central Cash	145	8	8	6	5
Fidelity Treasury Fund	44	8	8	13	7
Total of all MMFs		137	214	349	201

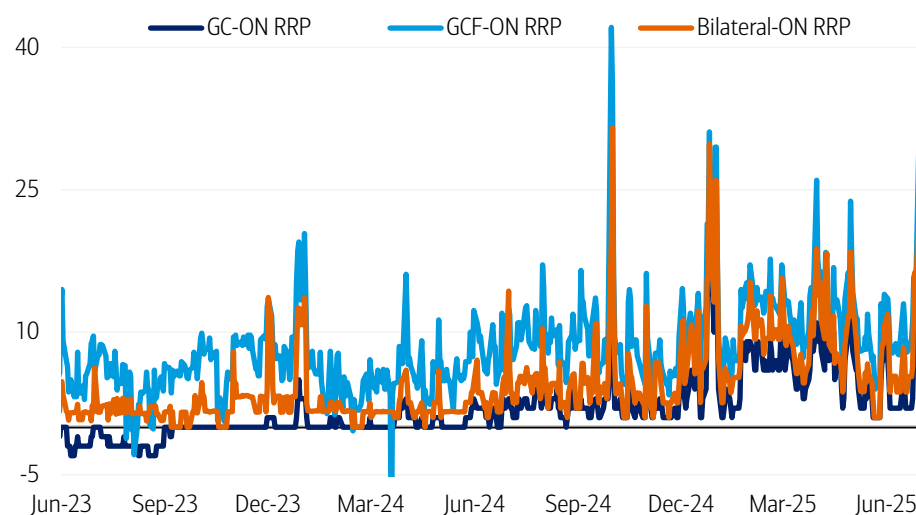
Source: BofA Global Research, Crane Data

BofA GLOBAL RESEARCH

Modest discount to maintain front end relationships: we believe some market participants with access to Fed ON RRP may be willing to invest at market rates slightly below ON RRP to maintain trading relationships. Specifically, we believe some MMF are willing to invest in ON UST GC repo with dealers at a rate slightly below ON RRP. This is consistent with the Fed's tri-party repo rate trading below ON RRP (Exhibit 13). Some MMF may perceive they have a "use it or lose it" access to dealer balance sheet.

Exhibit 13: Treasury repo rates relative to ON RRP (bps)

Tri-party GC repo typically trades below GCF and bilateral



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

MMF are likely aware that dealer repo balances are a scarce resource and that repo rates should trend above ON RRP over time. As a result, they are willing to remain invested with dealers at a discount to ON RRP to ensure this investment option is available in a higher repo rate environment.

Cash flow timing: money market rates can also trade below ON RRP due to the relatively late day timing of Fed cash flows. The Fed conducts ON RRP via tri-party repo infrastructure, which relies on BNY Mellon as a clearing and custodial agent. This infrastructure typically results in a late-day movement of cash flow on the date of initial ON RRP investment & associated unwind. The repo unwind typically does not occur until 3 PM on the day following ON RRP investment. A preference for an earlier return of cash may also be another reason certain investors prefer investing at levels below ON RRP.

Fed ON RRP utilization: higher use when money market rates are rich

Usage of the Fed's ON RRP facility is related to (1) amount of excess liquidity in the system (2) richness of money market rates. In recent years ON RRP use increased sharply as the Fed expanded its balance sheet and Treasury supplied a relatively small amount of money market supply. When Treasury collateral is scarce and repo rates are relatively low, usage of the Fed's ON RRP increases.

There are other technical drivers of ON RRP use. ON RRP use has spiked around month and quarter end reporting dates when some dealers and banks shrink their balance sheets, limiting overnight investment options for cash rich money market participants (Exhibit 14).

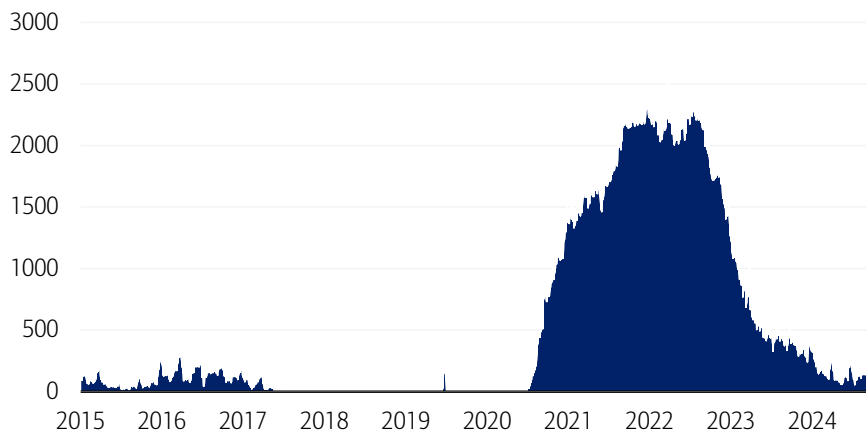
The Fed has stated it will use ON RRP *"only to the extent necessary and will phase it out when it is no longer needed to help control the federal funds rate"*. However, with the Fed's adoption of an "abundant reserve regime" for its longer-run monetary policy framework in January 2019² we expect the ON RRP to remain a permanent policy tool even if operating with minimal balances. Recent years have shown the macro & liquidity environment can change quickly which argues for keeping such tools operationally ready.

² [FOMC press release](#)



Exhibit 14: Fed overnight reverse repo take-up (\$bn)

Fed ON RRP take-up is primarily driven by cash rich MMFs



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Standing repo facility (SRF)

The Fed's overnight repo facility, now referred to as the standing repo facility, is a long-standing tool that allows primary dealers to borrow cash from the Fed in exchange for open market eligible collateral (including Treasury, agency debt, and agency MBS). The facility is simply a daily repo operation at a fixed rate with primary dealers and banks.

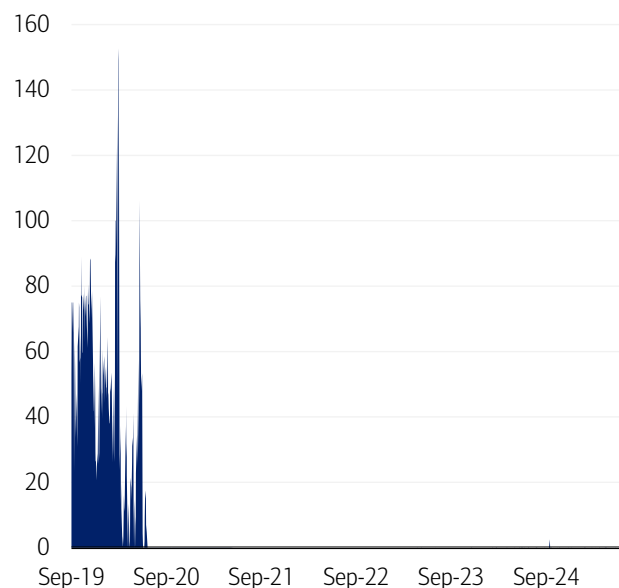
In 2020, the Fed expanded SRF counterparties from just primary dealers to include depository institutions. Before 2008, when reserves in the system were scarce, the Fed frequently used temporary ON RP and ON RRP operations to fine tune reserves in the banking system. This was done to offset changes in other Fed liabilities and ensure reserves were adjusted so the EFFR continued to trade at the desired level. The 2008 financial crisis brought about a substantial increase in reserves. This meant that the Fed no longer needed to micro-manage the level of reserves in the system and relied more heavily on IORB and ON RRP to keep Fed funds in the range. The Fed's repo operations were not used for many years following the 2008 financial crisis.

However, in mid-September 2019 front end funding markets experienced substantial stress as the Fed drained too many reserves in the banking system for banks to meet their desired liquidity requirements. On Sept 17 '19 the Fed restarted overnight repo operations to increase the amount of cash in the banking system and implemented term repo operations soon thereafter. Around March 2020 market volatility the Fed increased its repo offering sizes to support market functioning (Exhibit 15). The Fed continues to offer \$500bn in overnight repo each business day as well as regular term repo operations, but market take up declined as the Fed's QE program increased cash in the banking system and the Fed increased the minimum bid rate on the repo operations "given the substantial improvements in U.S. dollar funding market conditions" (Exhibit 16).

The facility now serves as a backstop - it is unlikely that investors will participate in the operations with market rates trading below the minimum bid level, but facility use will likely rise over coming months with higher bill supply & upward pressure on money market rates. We think of the SRF as an automatic stabilizer to add cash into the banking system which would ensure any spike in repo rates is confined to the Fed's target range. In the event of any large unexpected upward repo pressure, the Fed would likely increase the offering amount to ensure that overnight rates remain well contained.

Exhibit 15: Standing repo facility take-up (\$bn)

SRF has seen small take-up on quarter-end dates

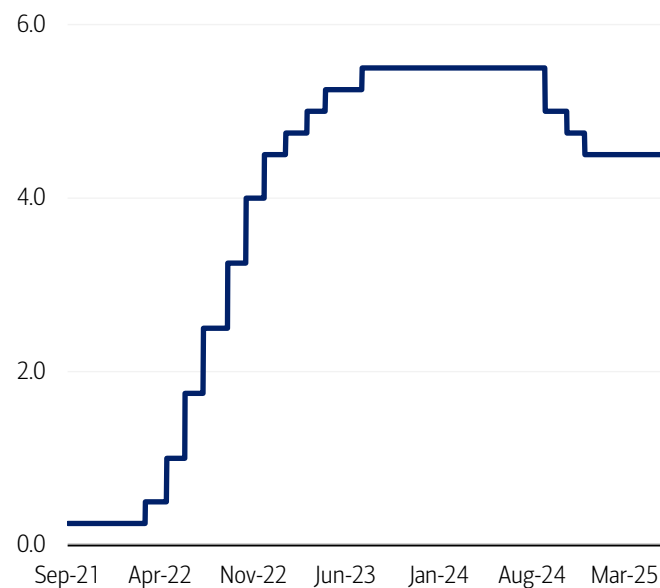


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 16: SRF minimum bid rate (%)

The Fed has set the SRF rate to the top of the target range



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 17: Summary of rates & tools used in Fed policy implementation

Levels as of 1-July-2025

Rate	Cash Flow	Lender	Borrower	Level	BBG ticker
Discount Window	Fed → Need borrower	Fed offers collateral loans	Banks in need of funding use the discount window as a last resort	4.50%	Volume: FARWOLPC Index Rate: DISCPRI Index
SRF	Fed → Bank /primary dealer	Fed lends cash in exchange for collateral on an overnight basis	Bank or PD in need of funding can use the SRF	4.50%	Volume: NYRPVOA Index Rate: NYRPROWT Index
IORB	Bank → Fed	Banks leave reserves at the Fed and earn interest	Fed holds reserves and pays interest	4.40%	Volume: (reserves) FARWBFRB Index Rate: IRRBIOER Index
EFFR	GSE → Bank	GSEs (mainly FHLBs) lend funds overnight	Domestic banks borrow funds when in need of liquidity. Foreign banks borrow funds to engaged in FF-IORB arb	4.33%	Volume: FEDLVOLU Index Rate: FEDL01 Index
OBFR	MMF/Corp → Bank	MMFs, corporations, foreign central banks and other official accounts lend in the ED market	Banks borrow funds	4.33%	Volume: OBFRVOLU Index Rate: OBFR01 Index
SOFR	MMF → Dealers → hedge funds	MMFs, sec lenders, asset managers, broker-dealers, hedge funds	Broker-dealers, hedge funds	4.44%	Volume: SOFRVOLU Index Rate: SOFRRATE Index
ON RRP	MMF → Fed	MMF lends cash to Fed with an agreement for the cash to be returned on a specified date	Fed sells security to counterparty and agrees to buy it back on a specified date	4.25%	Volume: TOMOREPO Index Rate: TOMOTCSO Index

Source: BofA Global Research, Bloomberg, FRBNY

BofA GLOBAL RESEARCH

The SRF is expected to act as an automatic stabilizer for elevated repo funding pressure but it is unlikely to serve as a firm ceiling on repo rates. Recent increases in repo rates have seen portions of the SOFR distribution trade above the SRF rate without meaningful facility use. We suspect that dealers will need to see elevated repo rates well above SRF to justify any facility stigma and associated balance sheet costs. We are sceptical commercial banks will ever be large SRF users due to stigma considerations.

The Fed has also made recent innovations around the timing of SRF operations. The NY Fed now offers 2 SRF operations each day, in the morning & afternoon. The morning SRF operation was recently added to address dealer concerns with daylight overdraft



(DOD, i.e. lock in borrowed cash from Fed early but unable to receive until later in the day). The morning operations run from 8:15-8:30 AM NY & generally settle within 30 min. The afternoon operations run from 1:30-1:45 PM NY & settle with standard tri-party repo conventions (i.e. cash not delivered until close to 4 PM). The morning SRF operation is likely to receive more use since it better aligns with standard money market trading times & is more DOD friendly.

Technical adjustments: IORB & ON RRP

The Fed uses its administered rates to ensure fed funds stays within the target range. The Fed has made multiple technical adjustments to their operating tools to continue to manage the federal funds rate at different levels of cash & collateral in funding markets. In periods where cash overwhelms collateral & overnight rates are pressured lower, the Fed keeps IORB & ON RRP relatively “high” in the target range. Conversely, when collateral overwhelms cash, the Fed keeps IORB & ON RRP relatively “low” in the range.

Today, the Fed keeps IORB & ON RRP in relatively mixed positions. The ON RRP rate is at the bottom of the target range & IORB is 15bps off the range bottom. The Fed places ON RRP at the range bottom as an incentive to limit facility use. As money market rates increase vs IORB, the Fed may move IORB 5bps lower in the target range.

Historical perspective: During the 2015-2018 hiking cycle the Fed set a relatively wide range for the IORB – ON RRP corridor. The Fed kept IORB at the top of the target range while ON RRP was set at or just above the bottom of the target range. The Fed kept a relatively wide spread of IORB – ON RRP because these tools were untested in their effectiveness to raise rates with a large balance sheet and elevated reserves.

The wide IORB – ON RRP range at the outset of the tightening cycle incentivized banks to engage in IORB arbitrage. Specifically, the wide spread provided a large amount of compensation for banks to borrow from the FHLBs and deposit this cash with the Fed at IORB. The Fed likely wanted a wide spread between these administered rates because they were uncertain how far EFFR might fall in the target range and did not want to risk EFFR setting near the bottom or on top of ON RRP.

The Fed eventually lowered IORB in the target range as the cash / collateral environment shifted and resulted in upward pressure on money market rates. This upward money market pressure occurred after the Fed launched QT in 2017 and there was a large increase in bill supply in 2018. These factors put upward pressure on money market rates & EFFR started trading higher in the range. To better control their monetary policy target the Fed made several “technical adjustments” to IORB (Exhibit 18, Exhibit 19).

At the June 2018 meeting the Fed first adjusted IORB 5bp lower in the target range to *“foster trading in the federal funds market at rates well within the FOMC’s target range.”* FOMC participants highlighted that adjusting IORB did not reflect a change in policy. They said *“the IOER rate is a helpful tool for implementing the FOMC’s policy decisions but does not, in itself, convey the stance of policy.”*

The Fed went on to adjust IORB lower four more times and adjusted the ON RRP below the bottom of the target range in Sept 2019. Then in early 2020 the Fed increased IORB and ON RRP once after they achieved improved control of money market rates with large scale repo operations and bill purchases. In Sept 2021 the Fed raised both ON RRP and IORB by 5bps to allow for money funds to earn interest above zero to help cover operating costs and ensure key money market rates did not trade negative (Exhibit 19, Exhibit 20).

In December '24 the Fed lowered ON RRP to the bottom of the target range. The Fed made the move to *“support effective monetary policy implementation and the smooth functioning of short-term funding markets”*. We suspect the Fed moved ON RRP lower in the range to incentivize cash to move out of the ON RRP & into other money markets.



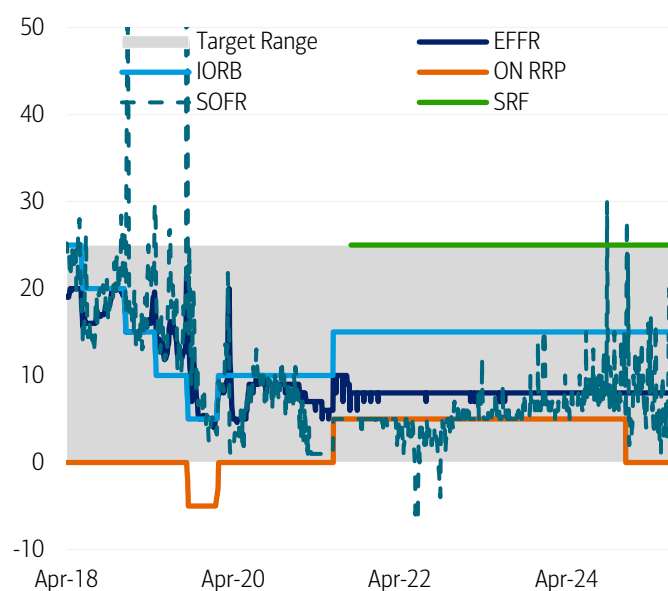
Historically before adjusting IORB, the EFFR has traded at least 5bps away from the top or bottom of the Fed funds target range. This is the same general rule we expect today. At current rate levels, we suspect the Fed would want to see EFFR reach 4.45% (5bps below the range top end) before shifting IORB lower in the target range.

Final point: the Fed seeks to implement monetary policy in the most effective manner and at the lowest cost to the taxpayer over time. Costs to the taxpayer have traditionally been overlooked as a consideration to Fed policy implementation. However, with Fed earnings negative today, it will likely be seeking to limit its expenses when possible.

Bottom line for technical adjustments: the Fed will adjust their key administered rates to ensure EFFR remains comfortably within the target range. The exact setting of IORB and ON RRP would be a function of money markets and the cash / collateral environment. Unlike EFFR, SOFR is not the Fed's policy target, and though the rate has printed below the target range recently the Fed did not shift administered rates higher.

Exhibit 18: Overnight rates and Fed tools within target range (bps)

The Fed adjusts ON RRP and IORB to keep EFFR within the range



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 19: IORB adjustments (bps)

The Fed has adjusted IORB 6 times to keep EFFR near middle of target range

	Target Range prior to FOMC meeting	EFFR prior to FOMC meeting	IORB adjustment
Jun-18	150-175	170	-5
Dec-18	200-225	220	-5
May-19	225-250	245	-5
Sep-19	200-225	225	-5
Jan-20	150-175	155	+5
Jun-21	0-25	6	+5

Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 20: ON RRP adjustments (bps)

The Fed has adjusted ON RRP 5 times

	Target Range prior to FOMC meeting	EFFR prior to FOMC meeting	ON RRP adjustment
Dec-15	0-25	15	-5
Sep-19	200-225	225	-5
Jan-20	150-175	155	+5
Jun-21	0-25	6	+5
Dec-24	450-475	458	-5

Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Dynamics of the Fed funds market

EFFR is the Fed's policy target but the fed funds market is highly idiosyncratic: lending is dominated by the Federal Home Loan Banks (FHLBs), while borrowing has historically been concentrated among foreign banks for IORB – fed funds arbitrage purposes.



Fed funds lenders

The FHLBs are the dominant lenders in the FF market. The NY Fed has indicated FHLBs comprise roughly 95% of total activity³. FHLBs are a GSE system of 11 independent regional cooperative banks that provide low cost, collateralized loans to support mortgage lending and related community investment amongst their member institutions. The FHLBs seek to have ample short-term liquidity to meet either the loan or advance needs of their member institutions or to withstand a stressed scenario of reduced market access. FHLBs use any daily excess cash to invest in positive yielding overnight instruments since they can't earn IORB. However, the FHLBs do have access to the Fed's ON RRP facility where they can earn interest by lending cash to the Fed.

The FHLBs appear to have three investments for their excess overnight cash: (1) fed funds (2) Treasury GC repo (3) bank deposits (Exhibit 21). Fed funds offers an early return feature that is unavailable through the more rigid triparty Treasury GC repo market, where cash is typically not returned until around 3 PM the next day. This early return feature of cash has been seen as a compelling reason for the FHLBs to lend uncollateralized in the FF market as opposed to investing in overnight repo markets. FHLBs can also deposit cash with commercial banks but the balances are <25% of their total unsecured credit exposure; the relatively small deposit balances are likely because some banks desire FHLBs to maintain a minimum balance which decreases the attractiveness of these deposits as a deep liquidity pool.

Exhibit 21: Unsecured credit exposure by investment type (\$mn)

Fed funds make up a large majority of FHLB investments

Carrying Value	31-Mar-25	31-Dec-24	31-Dec-23
Interest bearing deposits	27,982	27,246	24,163
Federal funds sold	78,255	51,590	57,860
Total	106,237	78,836	82,023

Source: FHLB Combined Financial Report

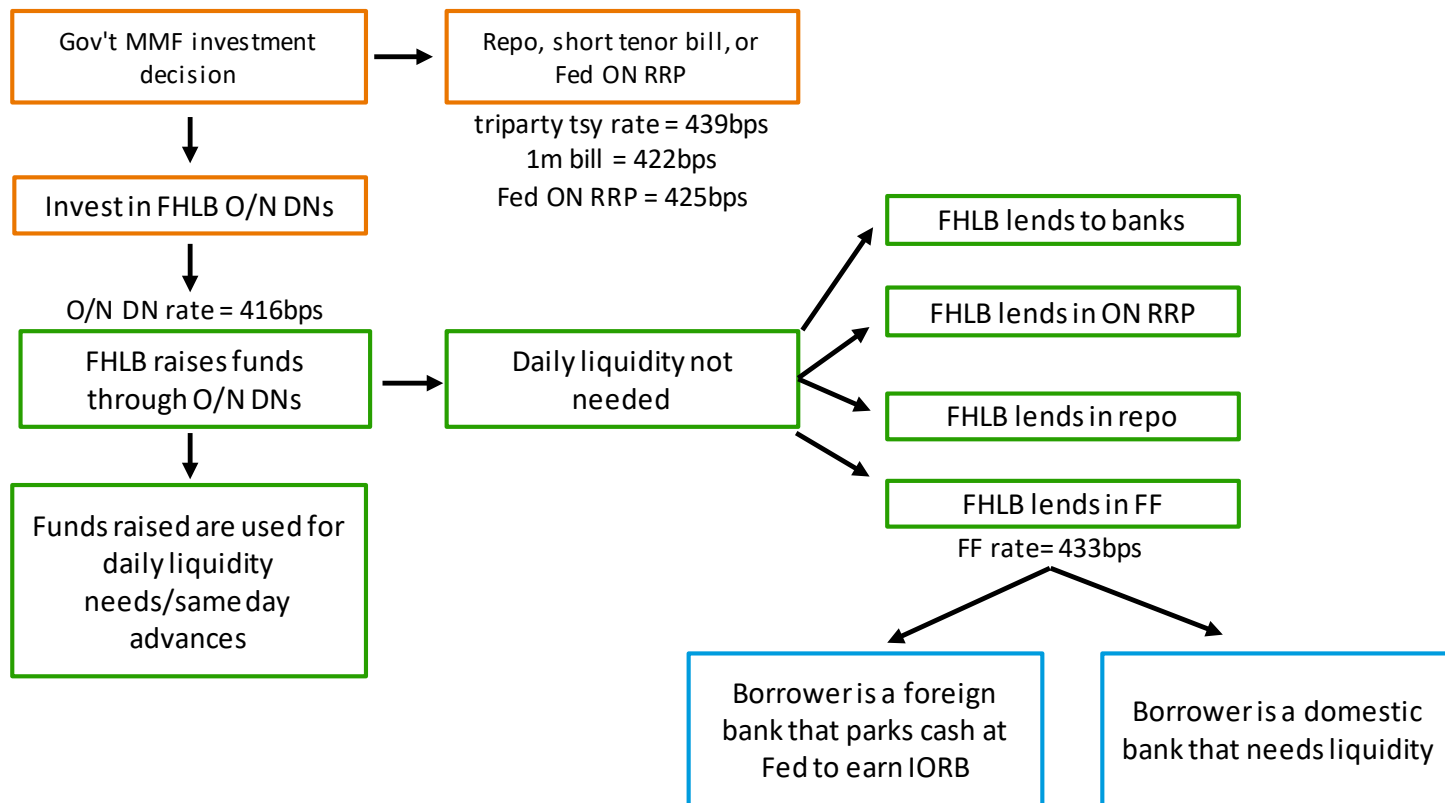
BofA GLOBAL RESEARCH

FHLBs have deposit accounts at the Fed which yield zero but are a very safe and intra-day liquid allocation option. Should the Fed ever return to the zero lower bound and EFRR fall to 2 to 3 bps or lower we anticipate that most FHLBs would stop their FF lending activity and simply park cash with the Fed. This could lead to a material decrease in EFRR trading volumes and might force the Fed to make technical adjustments to their administered rates to preserve FF volumes.

³ See Potter, "Confidence in the implementation of U.S. Monetary Policy Normalization"

Exhibit 22: FHLB and FF dynamics

FHLBs are the primary lender in FF market, foreign banks are the primary borrower



Source: BofA Global Research, Bloomberg. Levels as of July 1 2025

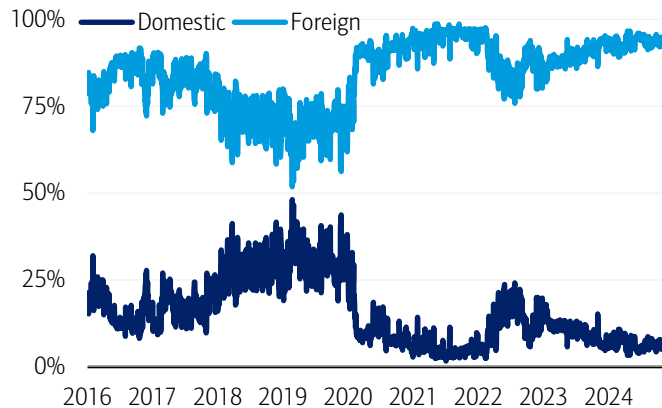
BofA GLOBAL RESEARCH

FF borrowers

Borrowing in the FF market has historically been dominated by foreign banks that can capitalize on IORB-FF arbitrage when EFFF trades below IORB (Exhibit 23). Activity slightly shifted toward domestic banks in 2018 as EFFF increased and the Fed's balance sheet unwind reduced cash in the banking system. More recently foreign banks have again increased their share of borrowing in the FF market as liquidity turned abundant and funding levels have declined versus IORB (Exhibit 24). We expect to see domestic borrowers increase FF borrowing as Fed QT continues to remove excess liquidity.

Exhibit 23: Domestic and Foreign bank borrowing as % of FF volume

Foreign banks comprise 93% of FF volumes as of year-end 2024



Source: Federal Reserve

BofA GLOBAL RESEARCH

Exhibit 24: Borrowers in the fed funds market

Foreign banks are larger borrowers when EFFF < IORB

Type	Motivation	Constraints	Level
Foreign banks	Arbitrage profits	FF-IORB spread	Below IORB
Domestic banks	Liquidity needs	FDIC insurance, SLR	Above IORB

Source: BofA Global Research, Federal Reserve

BofA GLOBAL RESEARCH



Foreign banks - High quality foreign banks with branches in the US were historically the most willing borrowers in the FF market since they could earn the largest IORB arbitrage spread. Specifically, foreign banks could borrow from the FHLBs in the FF market (or from a wider set of lenders in the Eurodollar market) below IOBR and then place this cash at the Fed to earn a risk-free rate of return.

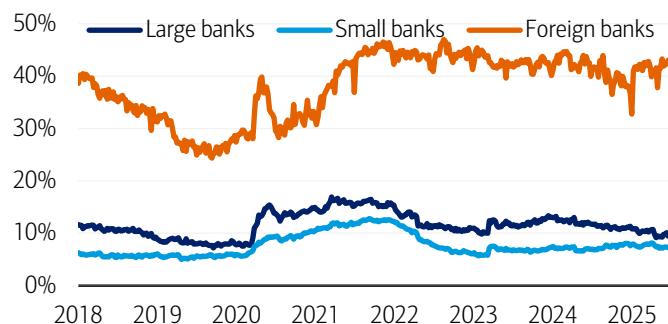
Foreign banks find this activity more profitable vs domestic banks since they are not subject to (1) FDIC insurance fees or supplemental capital charges, as their deposit base is primarily corporate / institutional clients that are not protected by the FDIC guarantee (2) leverage ratio requirements, since foreign bank branches operating in the US need only to be compliant with the less stringent leverage ratio rules stipulated by their home country regulator. The less stringent regulatory treatment for foreign banks allows them to more profitably engage in the IORB-FF trade and thus results in them accumulating a more sizeable share of reserves held at the Fed vs their large domestic counterparts, especially in relation to their total assets (Exhibit 25).

Domestic banks - Domestic banks borrow in the FF market to access funding for either regulatory or true liquidity demands. In 2018 and 2019 the most dominant domestic bank borrowers in the fed funds market were medium sized or smaller institutions that may have smaller liquidity buffers vs larger US banks. In Q1 2025 we see the largest player in the FF market is Northern Trust (Exhibit 26). The two dominant reasons domestic banks borrow in the fed funds market are:

- **Regulatory / LCR purposes:** Banks that borrow from the FHLBs receive favorable regulatory treatment under the liquidity coverage ratio (LCR). Under LCR, borrowings from FHLBs have a lower outflow rate because FHLBs are not considered “financial sector entities.” Our reading of LCR suggests that FHLB short term unsecured lending has at worst a 40% outflow assumption, and some interpretations of the rule may allow for an outflow rate as favorable as 25%. This means that for every \$100 borrowed from the FHLBs in FF, there is at worst a \$60 LCR benefit. For LCR constrained institutions, there are clear benefits to paying higher rates in FF with FHLB counterparties and the Fed has cited evidence that domestic banks are increasingly willing to do so. Stricter LCR requirements for smaller US banks could potentially see increased domestic FF borrowing demand.
- **Liquidity needs:** Domestic banks may be willing to borrow in FF to meet liquidity needs. In 2018 as the Fed gradually reduced the size of its balance sheet and cash in the banking system declined, we saw evidence of domestic banks increasing borrowing activity. If the Fed continues QT towards reserve scarcity, domestic borrowing activity will likely increase.

Exhibit 25: Bank cash/asset ratio (NSA)

Less stringent regulations for foreign banks allows them to more profitably engage in the IORB-FF trade



Note: cash assets include vault cash, cash items in process of collection, balances due

BofA GLOBAL RESEARCH

Exhibit 26: Top 10 domestic banks by Fed funds activity 1Q '25, \$bn

Domestic bank FF activity is relatively small

	Fed Funds purchased	Total Assets	FF % of total assets
ServisFirst Bank	2.4	18.6	13%
The Northern Trust Company	1.9	164.5	1%
Comerica Bank	0.8	77.7	1%
First Horizon Bank	0.8	81.2	1%
International Bank of Commerce	0.7	9.5	8%
First National Bank of Pennsylvania	0.6	48.8	1%
BOKF, National Association	0.6	50.3	1%
HSBC Bank USA, NA	0.5	166.2	0%
First National Bankers Bank	0.5	1.0	45%
United Bankers Bank	0.4	1.3	34%

Source: S&P Market Intelligence

BofA GLOBAL RESEARCH



FHLB liquidity: sources, uses, and FF volumes

Another key element in understanding FF dynamics is the source of FHLB liquidity. FHLB debt obligations are not guaranteed by the federal government but their GSE status allows them to raise funds at very favorable rates that are only slightly above USTs. The FHLBs have recently increased their reliance on short-term funding (Exhibit 27).

Exhibit 27: FHLB short term issuance as % of all debt

The FHLBs use of short-term funding has been slowly rising from its recent Feb '24 trough



Note: 397 eligible bonds; Source: FHLB Office of Finance

BofA GLOBAL RESEARCH

The FHLBs issue debt at a variety of tenors but rely on overnight funding as an important source of their liability mix. We believe it is reasonable to assume that FHLB overnight discount note (DN) issuance is a key funding source used to meet daily liquidity needs. When FHLB cash holdings exceed their liquidity needs, they seek to invest a portion of the remaining proceeds in the FF or other money markets. Therefore, FHLB overnight debt issuance ends up being a core source of funding for daily FF investments and contributes to overall FF market volumes.

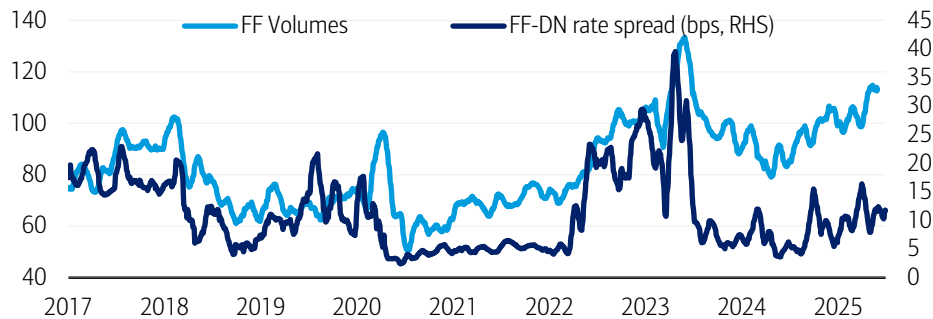
While the FHLBs are most concerned with ensuring they have adequate cash on hand to meet their member advance needs, they are also likely cognizant of where their overnight funding costs are in relation to their overnight investment alternatives. Some FHLBs may issue overnight DNs and invest in the FF market when the O/N DN to EFR spread is relatively wide. As the spread between the EFR and FHLB DNs widens, the FHLBs may issue more overnight DNs, which results in them lending more in the FF market and FF volumes increase. When the EFR to FHLB DN spread narrows, the FHLBs are likely to issue fewer overnight DNs and FF market volumes decrease. We see historical evidence of this dynamic by examining recent trends between (1) the EFR and FHLB overnight DN spread, and (2) FF volumes (Exhibit 28). The strength of this relationship appears to have weakened in recent years with increased focus on the core FHLB mission which may have driven more fed funds activity was likely done for true liquidity need.

Issuing fewer DNs and lending less in the FF market when the FF-DN spread is tight allows for either (1) richer DNs due to their relative scarcity (2) upward pressure on the EFR, since FHLBs would presumably concentrate their FF lending with those counterparties paying the highest rates.



Exhibit 28: FF to FHLB DN spread vs FF volumes (1m mo. avg.)

Until the COVID 19 pandemic, FF to DN spread moved with FF volumes



Note: spread is FF less Chicago FHLB overnight DN, 10D MA; Source: Bloomberg

BofA GLOBAL RESEARCH

Bottom line on fed funds: the fed funds market is highly idiosyncratic. It is dominated by FHLB lenders and foreign bank borrowers. We expect to see increased domestic bank borrowing as liquidity is drained and reserves become less abundant.

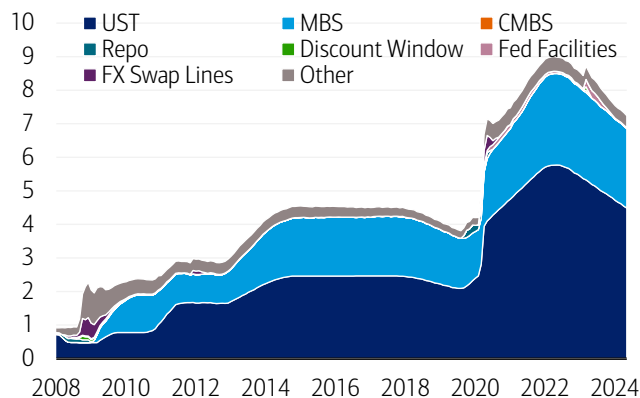
Fed balance sheet and reserve dynamics

The Fed's balance sheet has played a much larger role in monetary policy implementation over the last two economic cycles. The Fed has greatly expanded their balance sheet through a process known as quantitative easing or QE. Through QE, the Fed does large scale asset purchases of primarily US Treasuries and to a large but lesser extent, agency MBS. The securities purchased are typically longer tenor to ease financial conditions and improve market functioning.

As of June '22 the Fed began reducing its balance sheet in a process known as QT or quantitative tightening. This is intended to normalize the size of the balance sheet by allowing a certain amount of maturing securities to roll off each month without being reinvested. We will go into further detail regarding the process of QT see below in the Fed QT: draining from reserves & ON RRP section.

Exhibit 29: Federal reserve balance sheet assets (\$bn)

UST and MBS comprise most of the Fed's balance sheet

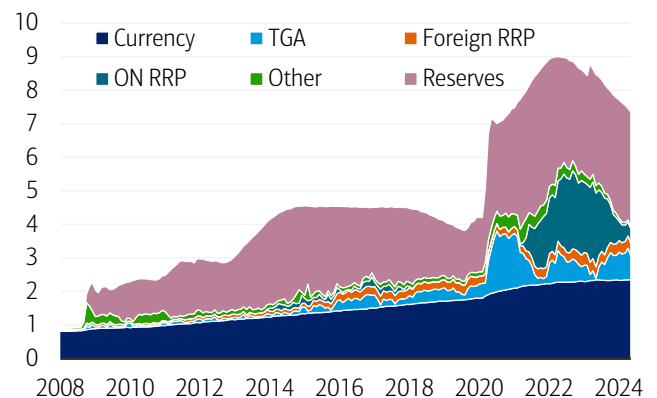


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 30: Federal reserve balance sheet liabilities (\$bn)

Reserves are the largest component of the Fed's liabilities



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Fed balance sheet assets

The Fed's balance sheet growth has primarily been driven by UST and MBS purchases during each of the Fed's 4 QE programs. The Fed conducts QE via purchases in the secondary market and transacts with primary dealers. The Fed's QE4 began in March 2020 at an unprecedented clip to improve market functioning before eventually slowing and finally ending in March 2022.



A large portion of the Fed's assets, primarily their Treasury and MBS holdings, are held in a portfolio called the System Open Market Account (SOMA). The SOMA's Treasury holdings consist primarily of Treasury notes and bonds, but also includes bills, FRNs, and inflation-protected securities (Exhibit 31, Exhibit 32).

Other balance sheet assets, such as FX swap lines, the discount window, and temporary Fed lending facilities make up a much smaller portion of the Fed's balance sheet. FX swap lines, provide US dollars from the Federal Reserve to five other major central banks. However, given the stability in US dollar funding markets, take-up has been minimal. The Fed's discount window provides access to funding to depository institutions. Take-up increased significantly at the onset of the COVID-19 pandemic and after early '23 regional bank stress but is now low. The Fed also set up several temporary facilities that provided short-term credit extensions to support financial markets during the COVID-19 pandemic. Several of these facilities have already been fully wound down with those remaining all set to end by 2026.

The Fed also introduced a new set of emergency lending programs after bank stress in March '23. These emergency lending programs have increased the size of Fed assets, including through new programs like the Bank Term Funding Program (BTFP). BTFP and other emergency Fed lending increased the amount of bank reserves and liquidity in the system to stem broader banking system stress. BTFP has now expired but is a potential tool for the Fed to rely on in similar instances of commercial bank liquidity stress.

Exhibit 31: Fed's SOMA holdings

Fed SOMA is made up of UST, MBS, and Agency securities

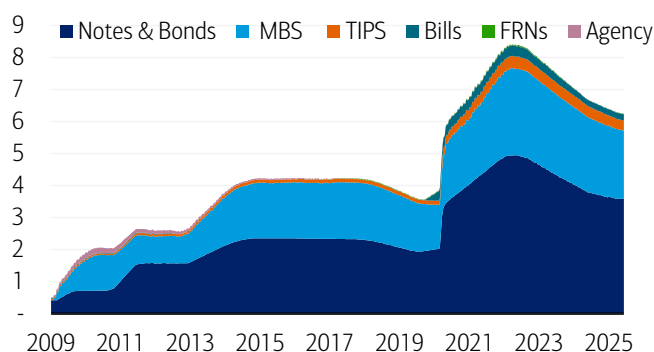
Security Type	Total (\$bn)	% of Total
US Treasury Bills (T-Bills)	195	3%
US Treasury Notes and Bonds (Notes/Bonds)	3,582	57%
US Treasury Floating Rate Notes (FRNs)	11	0%
US Treasury Inflation-Protected Securities (TIPS)	314	5%
Federal Agency Securities	2	0%
Agency Mortgage-Backed Securities	2,131	34%
Agency Commercial Mortgage-Backed Securities	8	0%
Total SOMA Holdings	6,242	

Source: BofA Global Research, FRBNY

BofA GLOBAL RESEARCH

Exhibit 32: SOMA Holdings (\$tn)

UST and MBS holdings increased dramatically during QEs



Source: BofA Global Research, Bloomberg, FRBNY

BofA GLOBAL RESEARCH

Fed balance sheet liabilities

On the liabilities side, reserves, or cash in the banking system, and ON RRP take-up increased as the Fed purchased securities post COVID. Fed QT has drawn down both reserves and ON RRP while other liabilities such as currency continue to grow. We provide more detail on the key liabilities on the Fed's balance sheet below:

- Reserves:** Reserves are cash balances held by depository institutions at the Fed. Depository institutions earn the current level of IORB on their reserves. Other institutions, such as GSEs, also hold deposits at the Fed but they do not earn interest on these holdings. When the Fed purchases USTs and MBS in the secondary market, those selling the assets receive cash in return, and cash in the banking system/reserves increase. We discuss the relationship between reserves and commercial banks in further detail below in the [Reserves and commercial banks section](#).
- Treasury cash balance (TGA):** the TGA is essentially the checking account for the US Treasury and is used for federal spending. The amount of cash in the Treasury's bank account is reflected through the cash balance. Treasury prefers to hold sufficient cash balances to meet five days of potential outflows (Exhibit 33, Exhibit 34). The 5-day average helps provide a buffer around periods of excess outflows.



- **Currency:** Currency in circulation reflects actual printed money in the system. This is differentiated from reserves, which may be considered digital cash. Currency in circulation typically follows seasonal and long-term trends but grew significantly during QE4. On average, currency has grown 7% y/y from 2008-2023 but has since slowed more meaningfully (Exhibit 36). Currency growth has likely slowed as higher money market rates represent a higher opportunity cost vs holding case.
- **Reverse repo:** Reverse repo activity on the Fed's balance sheet includes both the Fed's ON RRP and foreign RRP facilities. ON RRP: The Fed sells a security to an eligible counterparty with an agreement to repurchase that same security in the future. We discuss the Fed ON RRP facility see above in ON RRP Facility (Overnight Reverse Repurchase Agreement) section. Foreign RRP facility: certain foreign banks and official institutions have custodial accounts with the NY Fed and can invest overnight funds in repo directly with the Fed (Exhibit 38). According to the Fed, the rate paid on foreign RRP is "a rate generally equivalent to the Fed's ON RRP rate, although the NY Fed may vary the rate of return at any time" (Exhibit 39).

Inverse relationship between reserves and other Fed liabilities

The TGA, currency in circulation, reserves, and reverse repo all have an inverse relationship. If one of these liabilities increases (or decreases) by \$1 then another should decrease (or increase) by \$1, all else equal (Exhibit 35). An increase in cash in the Treasury's checking account, in printed cash, or cash invested in the reverse repo facility means there is less cash equivalent in the banking system.

Prior to the 2008 financial crisis when reserves were scarce, the Fed would need to actively offset changes in other Fed liabilities to ensure reserves remained relatively stable and the EFFR continued to trade in the target range. In the current abundant reserve framework the Fed does not need to actively manage the level of reserves.

Exhibit 33: Average Treasury 5 day outflows by year

The Treasury prefers to keep at least 5 days' worth of withdrawals in the TGA

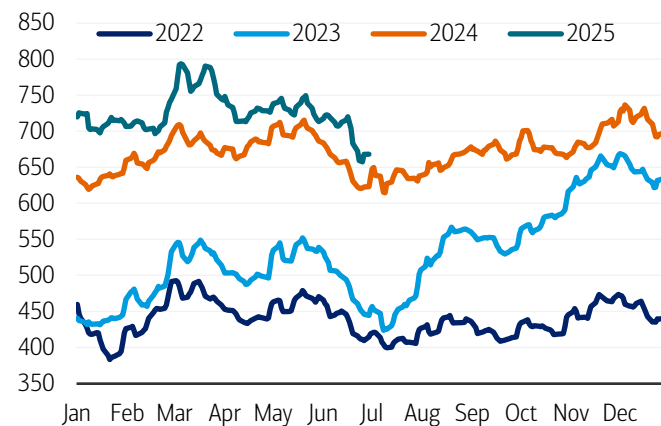
	2022	2023	2024	2025
Avg 5 day outflow	438,950	539,289	676,112	721,723

Source: BofA Global Research, Treasury, Haver Analytics

BofA GLOBAL RESEARCH

Exhibit 34: Treasury 5 day outflows (1 mo moving average)

Avg 5 days outflows in 2025 is \$722b YTD



Source: US Treasury, Haver Analytics

BofA GLOBAL RESEARCH

Exhibit 35: Treasury cash balance (\$bn)

If TGA is increasing, reserves and/or ON RRP are typically decreasing

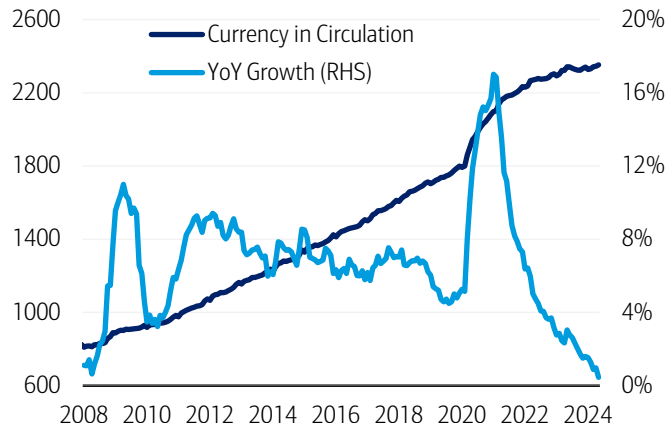


Source: US Treasury, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 36: Currency in circulation (\$bn)

Currency in circulation growth avg 1.9% YoY since Jan '23

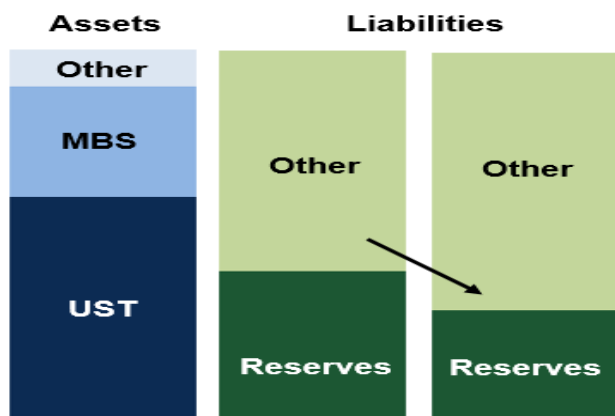


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 37: Fed b/s when other liabilities increase, all else equal

When other liabilities increase, reserves decrease

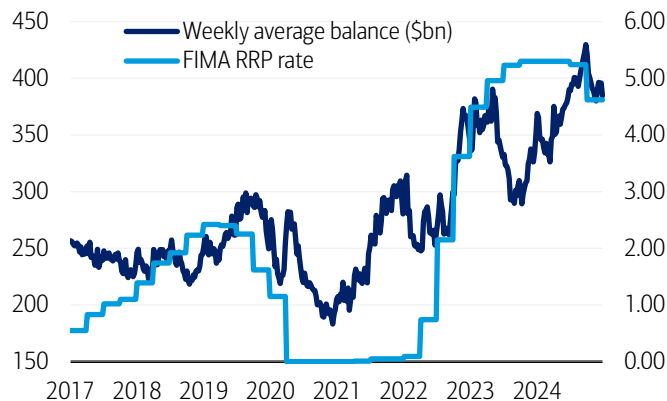


Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 38: Foreign reverse repo facility

Foreign repo pool weekly avg balance increased significantly in '21

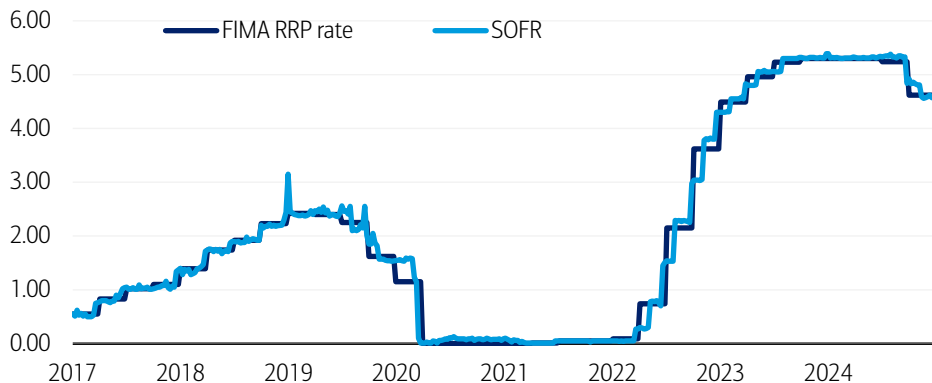


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 39: SOFR vs Foreign RRP rate (%)

Rate on foreign RRP and SOFR typically trade close in line



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH



Reserves and commercial banks

The Fed's QE is directly linked to commercial bank balance sheets through reserves. To purchase USTs and MBS, the Fed credits the institution that has purchased the securities, creating new cash. On the Fed balance sheet, this results in an increase in UST/MBS on the asset side and reserves on the liability side. On the commercial bank balance sheet it can either result in (1) unchanged total assets but an asset reallocation from USTs or MBS into reserves (2) increased total assets via more cash on the asset side and deposits on the liability side.

Notably, reserves are a closed system. This means that on aggregate, the amount of reserves across all commercial bank balance sheets cannot change. An individual bank may decide to shift cash into loans or securities but on aggregate reserves can only be increased or decreased by the Fed.

Fed QT: draining from reserves & ON RRP

Quantitative tightening (QT) is the reverse of quantitative easing (QE). In QT, the Fed allows asset holdings of TSY and MBS to decline, resulting in lower reserve & overnight reverse repo (ON RRP) levels on the liability side. QT can occur by the Fed allowing securities to mature without reinvestment which gradually shrinks holdings or can be implemented more actively through sales of securities. The Fed's current QT approach involves only the former, but with the option to perform sales in the future if necessary.

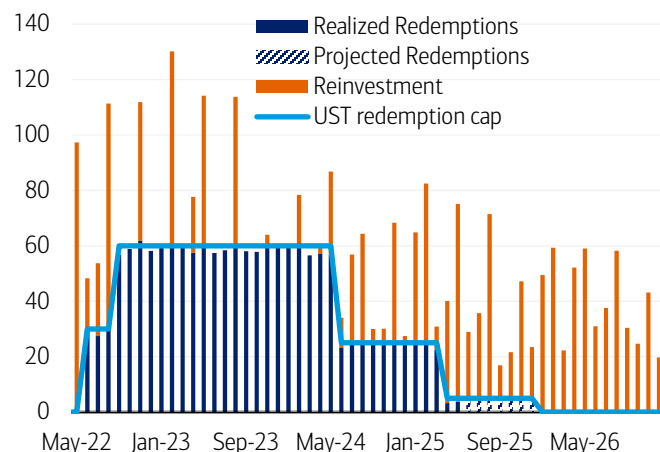
The Fed announced QT at their May '22 FOMC meeting and it began on June 1st '22. QT is the normalization of the Fed's balance sheet through the passive roll-off of Treasury and MBS held in the Fed's portfolio. The Fed does so by allowing a certain amount of redeeming securities, up to a redemption cap, to roll-off without being reinvested.

Fed assets: redemption caps, \$5bn UST & \$35bn MBS

Fed QT is driven by the pace of reduction in holdings on the asset side of its balance sheet. The Fed previously used a \$60bn redemption cap for Treasuries and \$35bn redemption cap for MBS (Exhibit 40, Exhibit 41). The Fed phased in cap sizes starting in June '22 before reaching terminal cap size in Sept. '22. The Fed lowered the UST redemption cap to \$25b in June '24 to slow the pace of QT as ON RRP has been depleted. The Fed further reduced the UST redemption cap starting on April 1 '25 from \$25 billion to \$5 billion to allow for a more gradual liquidity drain. The Fed uses redemption caps to allow for a controlled and steady decline in the balance sheet. MBS redemption caps have not been reached most months due to relatively high interest rates and slow prepayments.

Exhibit 40: UST coupon and bill redemptions under \$60bn cap (\$bn)

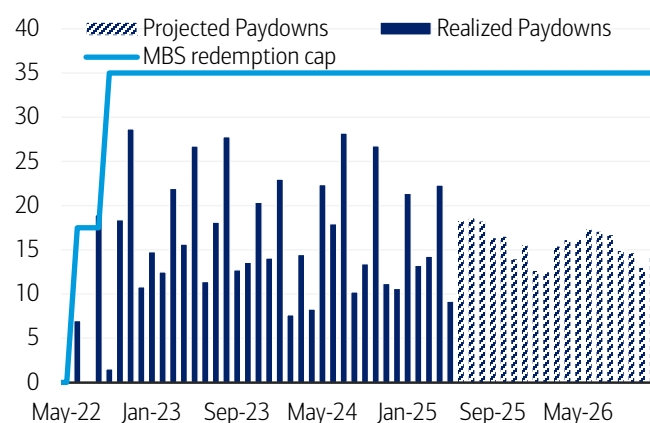
The Fed has lowered the redemption cap on UST from \$60b to \$25b to \$5b



Source: BofA Global Research, Federal Reserve; Note: This chart excludes UST reinvestments
BofA GLOBAL RESEARCH

Exhibit 41: MBS reinvestments & redemptions under \$35bn cap (\$bn)

MBS prepayments have slowed as mortgage rates have risen



Source: BofA Global Research, Federal Reserve

BofA GLOBAL RESEARCH



The Fed would allow UST coupons to roll-off at maturity if they fall under the redemption cap and reinvest any amount above the cap back into newly issued USTs (Exhibit 40). Similarly, MBS prepayments that fall below the cap will roll off but anything above (which is rare) will be reinvested into USTs (Exhibit 41). The only difference between the two is that for USTs, the Fed would use bills to “top-up” maturing coupons. Meaning, for any month that maturing coupons fall below the cap, the Fed would allow bills to roll-off up to the \$25bn cap. Most months would see \$25bn in USTs roll-off the Fed’s balance sheet to allow for a smooth and steady decline in the Fed’s balance sheet.

Fed liabilities: draining from reserves to ON RRP

Fed QT asset reduction must have an offsetting impact on the liability side of the balance sheet. The 3 most likely sources of Fed liability reduction are from reserves (commercial bank cash assets invested with the Fed), ON RRP (MMF excess cash invested with the Fed), or Treasury cash balance (US government deposits with Fed, aka TGA).

The vast majority of Fed QT liquidity drain has come from lower ON RRP levels (Exhibit 43). Reserve balances have increased since Fed QT as banks paid up to hold an extra cash buffer to buffer against (1) uncertain retail deposit stability (2) unrealized securities losses (3) enhanced liquidity requirements (Exhibit 44).

Our base case Fed QT stop is at end Dec '25, which is slightly earlier vs consensus. Our logic for earlier QT cessation: (1) ON RRP is likely to fall to zero with the upcoming TGA rebuild which should see higher repo funding pressure (2) banks are holding elevated liquidity buffers to guard against unrealized securities losses & may not want to see their cash holdings depleted.

As QT continues and more collateral is added to the system, we expect to see upward pressure on money market rates. Funding conditions have been benign over recent months but we think technical dynamics with the debt limit likely muted any signs of pressure. Specifically, the debt limit constrained UST debt issuance & resulted in a lower TGA, both which should serve to stabilize funding. The recent debt limit resolution should see higher bill supply, a TGA rebuild to around \$850b over a few months, & clearer signs of upward funding pressures. See our report: [Funding & debt limit: history lessons](#).

Exhibit 42: Fed Balance Sheet Projections (\$bn)

We forecast that going forward, 100% of the drain from QT will draw from ON RRP ex TGA until the ON RRP is depleted in 2025

	Asset				Liabilities					Total
	UST	MBS	Fed Facilities	Other	Currency	TGA	ON RRP	Other	Reserves	
Jun-25	4209	2147	6	350	2396	457	461	453	2946	6713
Jul-25	4204	2129	5	351	2402	575	311	455	2946	6689
Aug-25	4199	2110	4	352	2408	660	194	458	2946	6666
Sep-25	4194	2094	3	353	2414	850	0	460	2920	6644
Oct-25	4189	2077	0	354	2420	858	0	463	2880	6620
Nov-25	4184	2063	0	355	2426	867	0	465	2845	6602
Dec-25	4179	2048	0	356	2432	875	0	467	2809	6583
Jan-26	4191	2035	0	357	2438	883	0	470	2793	6584
Feb-26	4214	2023	0	358	2444	892	0	472	2787	6595
Mar-26	4239	2007	0	359	2450	900	0	475	2781	6606
Apr-26	4266	1991	0	360	2456	908	0	477	2775	6617
May-26	4292	1975	0	361	2462	917	0	480	2769	6628
Jun-26	4319	1957	0	362	2469	925	0	482	2763	6639

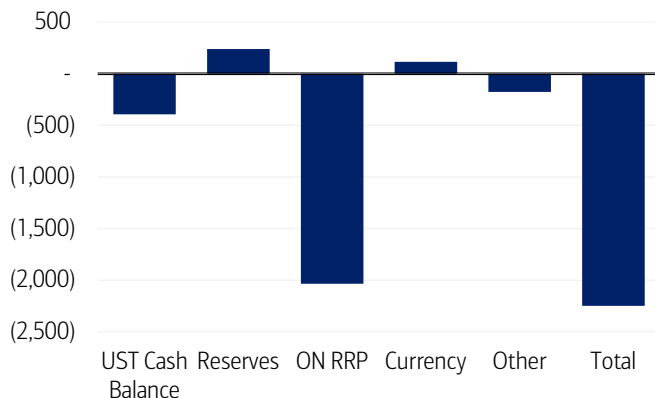
Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH



Exhibit 43: Change in Fed liabilities since the start of QT (\$bn)

ON RRP has taken the brunt of the Fed's balance sheet decline



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 44: Reserve balances in the banking system (\$bn)

Reserves had declined prior to Fed emergency bank lending



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Fed unrealized losses & negative equity

The Fed's financial position has been challenged due to large scale Fed QT with low rates and rapid rate hikes shortly thereafter. The Fed is currently running a negative print in their "other liabilities & capital" which suggests negative net interest margin (NIM) (Exhibit 45). Negative NIM represents the difference between liability costs and asset income. The Fed's negative NIM has limited direct impact on the monetary policy stance but it is mildly stimulative due to elevated unfunded IORB and ON RRP payments.

Fed negative NIM reflects higher payments on IORB & ON RRP vs income received from Fed securities holdings or loans. These costs are more likely to become a Fed political liability vs a monetary policy one. We provide background on: Fed negative NIM, impact on monetary policy implementation, and where it fits in the broader set of interest-bearing government liabilities.

Fed negative NIM: cost of QT & sharp tightening in monetary policy

The Fed can have negative equity under two circumstances: (1) IORB & ON RRP liability cost > Fed asset income (2) Fed sells assets at loss. We discuss each below.

The Fed has historically operated with positive NIM where the income from its asset holdings (mostly USTs & MBS) exceeds its liability costs; Fed NIM is remitted to UST.

IORB & ON RRP liability cost > Fed income: Fed assets are mostly UST & agency MBS, whose coupon payments drive Fed income. Fed interest bearing liabilities are mostly reserves and ON RRP; Fed non-interest liabilities are currency & Treasury cash balance.

Fed negative NIM occurs when reserve & ON RRP costs > asset income. We estimate the Fed is currently running a negative NIM of roughly \$8b annually, assuming Fed rate levels and balance sheet remains fixed (Fed assets have weighted average coupon of ~2.45%, while liabilities have a weighted average cost of 2.56%). Note: Fed interest bearing liabilities include reserves and reverse repo costs, not currency or Treasury cash.

Sell at loss: Fed negative NIM could also occur if assets were sold at a loss. This is relevant in context of potential MBS sales. The Fed has largely downplayed the possibility of such selling but it is possible.

For more detail see our report: [Fed Negative Equity: No Tightening Limit](#)

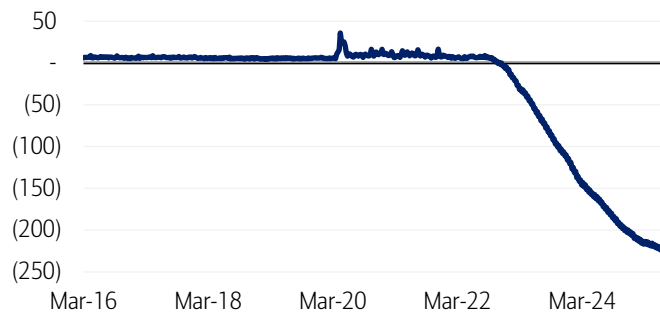
Negative NIM is reflected as "deferred asset"

Fed negative NIM or equity does not create insolvency and does not limit how much the Fed can tighten. Rather, a "deferred asset" is booked as a negative liability on the Fed's balance sheet (Exhibit 46). This debit balance represents the amount of future Fed net earnings that need to be paid down before remittances to UST can resume.



Exhibit 45: Fed other liabilities & accrued dividends (\$bn)

Fed other liabilities & accrued dividends has fallen sharply due to negative NIM from low asset yield & high liability cost



Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 46: Stylized Fed balance sheet including deferred asset

Fed negative liability is required to offset growth in other liabilities

Federal Reserve	
Assets	Liabilities
Treasuries	Reserves
MBS	Currency
Repo	Treasury Cash Balance
Discount Window	Reverse Repos
Other Facilities	Deferred Asset

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 47: Estimated WAC of the Fed's assets and liabilities

The Fed's negative NIM becomes less negative with Fed cuts and turnover in their securities holdings

Assets	WAC	\$bn	Liabilities	WAC	\$bn
UST	2.61%	4,212.06	Currency	0.00%	2,395.20
Agency	6.75%	2.35	RRP	4.25%	584.05
MBS & CMBS	2.50%	2,156.16	Reserves	4.40%	3,347.27
PPPLF & MSLP	1.00%	1.67	TGA	0.00%	334.58
Discount Window	4.50%	6.31	Other	0.00%	52.36
SRF	4.50%	0.02			
Other	0.00%	334.89			
Total	2.45%	6,713.46	Total	2.56%	6,713.46
NIM	-0.11%				

Source: BofA Global Research, FRBNT, Bloomberg

BofA GLOBAL RESEARCH

This accounting treatment allows the Fed to continue paying interest on reserve balances and at their RRP facilities even when their income does not cover the costs. While the payment of interest would typically lead to an increase in the Fed's total liabilities, the deferred asset is recorded as a negative liability and offsets this increase.

The US Treasury does not need to cover or fund the cost of this deferred asset. However, the Fed's deferred asset can increase UST funding needs. The higher funding need comes from the lack of Fed remittances which otherwise means a higher deficit and more UST issuance. The Fed had been remitting \$55-\$109bn per year since at least '13 and this shortfall forces Treasury to raising funding elsewhere.

Fed negative NIM doesn't limit inflation fight, but it risks political pushback

Fed negative NIM & the negative reading of "other liabilities & capital" has not been a material constraint in the Fed's recent inflation fight. The Fed has not and would not let its negative NIM restrict its ability or willingness to keep raising rates if needed.

The Fed can't be bankrupt from an accounting perspective, but it could be from a political one. The imposition of a "deferred asset" and no UST remittances may draw political scrutiny over time. The Fed likely wants to avoid such criticism but has little choice given the extent of financial condition tightening required to lower inflation.

If the Fed were to come under political criticism over its negative NIM, it can point to the cumulative large-scale remittances it has provided to Treasury in the past. Since 2011 we calculate the Fed had paid nearly \$1tn in total remittance payments to UST. These payments have subsequently reduced UST deficits and debt financing needs.



Fed negative NIM is marginally stimulative & contributes to higher deficits

Fed negative NIM is marginally stimulative, all else equal. The marginal stimulus stems from the higher interest payments to its debtors and the more limited inflows it is taking in from its creditors. Specifically, the Fed is paying more money to banks and MMF vs what its USTs or agency MBS are paying it.

The amount of stimulus provided to banks and ON RRP users is equivalent to the total “deferred asset” realized on the liability side of Fed balance sheet. To date, this stimulus has totaled ~\$234b and will likely continue to grow with elevated Fed rates.

Fed negative NIM also supports higher Treasury financing needs, all else equal. The higher financing need is driven by the lack of Fed remittance to UST. Lower remittances mean the funding needs are higher, which means more debt outstanding and higher interest payments. Larger UST deficits are generally viewed as stimulative.

Fed negative NIM is marginally stimulative because it results in greater payments to Fed creditors while also supporting higher UST deficits. Overall, negative Fed NIM is yet another cost from aggressive fiscal stimulus, high inflation, and elevated rates.

Potential elimination of IORB: low odds but big impact

In the early summer of '25 there were some DC discussions around potentially eliminating IORB (see our report: [Eliminating IORB: low odds but high impact](#)). We see low odds due to (1) strongly averted rates & allows for a simple & efficient transmission of policy. Banks like IORB because it provides an attractive return on cash that does not penalize them for holding prudent intra-day liquidity. The Fed’s “ample reserve” operating regime is built around IORB.

In practice, removing IORB has costs especially for Fed & banks:

Fed costs: if unable to earn IORB banks would shift “excess” reserves out of Fed & into money markets, resulting in downward rate pressure. The Fed would offset this pressure via RRP, faster QT, or asset sales. Each of these options would result in lower Fed remittances (higher RRP expense = lower remittances, smaller Fed B/S = lower interest income). We might guess banks move \$500b-\$1t+ of “excess” from reserves that would need to be absorbed by the Fed & see an equivalent reduction in remittances.

Bank costs: if unable to earn IORB banks would see (1) lower NIM (2) less optimal liquidity options. Lower NIM would come from the lost interest income of reserves kept with the Fed (banks would hold some Fed reserves for intraday liquidity need). Banks would have less optimal liquidity options via money market investments (RRPs, bills, short UST coupons, etc). These are less optimal b/c they are not intra-day liquid.

On net, the total government \$ benefit would equal lost bank NIM from non-renumerated Fed reserves. The government benefit would be further eroded by less optimal bank liquidity management practices, which raise banking system risks.

The removal of IORB will likely drive rates lower, but the question is to what extent. As banks shift “excess” out of reserves into money markets rates will decline and front-end spreads widen. ON RRP would likely be a very soft floor on interest rates and front-end rates could fall below the bottom of the target range without an adjustment.

The Fed would adjust RRP & their balance sheet to maintain rate control. The ON RRP has a counterparty limit of only \$160b and not all banks are signed up, but these constraints can be adjusted quickly and the aggregate limit of the facility is only limited by the value of SOMA Treasury holdings. The Fed could also do repos directly with dealers & potentially consider accelerating the repo clearing process. If repos were an ineffective tool, the Fed would likely sell assets to place upward pressure on money market rates & maintain interest rate control.

A highly simplified & stylized example of the Fed balance sheet response to IORB elimination is below (Exhibit 48).



Exhibit 48: Highly simplified & stylized Fed balance sheet in relation to IORB elimination

In response to IORB elimination, the Fed would initially rely on RRP's & likely eventually shrink its sheet

Fed B/S Today (\$tn)				Fed Initial B/S No IORB (\$tn)				Fed Eventual B/S No IORB (\$tn)			
A		L		A		L		A		L	
USTs	4	Currency	2.5	USTs	4	Currency	2.5	USTs	3	Currency	2.5
MBS	2	Reserves	3.5	MBS	2	Reserves	2	MBS	1	Reserves	2
Other	1	RRP	0.5	Other	1	RRP	2	Other	1	RRP	0
		Other	0.5			Other	0.5			Other	0.5
Total	7	Total	7	Total	7	Total	7	Total	5	Total	5

Source: BofA Global Research

BofA GLOBAL RESEARCH

Primer bottom line: The rates market starts at the front end of the curve. To understand the US front end it is critical to understand the plumbing, which includes the setting of Fed administered rates, the federal funds rate, and other key Fed rates. Fed plumbing is also directly influenced by Fed balance sheet dynamics and QT.

Fed QT is changing some of the key money market relationships as liquidity is drained from the banking system and collateral held by the private sector increases. Evidence of this shift should become more pronounced following debt limit resolution & TGA rebuild.

Fed rate hikes and QT have also created negative NIM and equity for the central bank. These dynamics don't limit the Fed's ability to tighten policy but are a political liability. Fed IORB elimination is low probability but high impact; it could reshape the Fed B/S.



Appendix

Acronyms and abbreviations defined below:

- DN – Discount Note
- EFFR – Effective Federal Funds Rate
- FF – Fed Funds
- FHLB – Federal Home Loan Bank
- FICC – Fixed Income Clearing Corporation
- FRN – Floating Rate Note
- GSE – Government Sponsored Enterprise
- IORB – Interest On Reserve Balances
- LCR – Liquidity Coverage Ratio
- MBS – Mortgage Backed Security
- MMF – Money Market Fund
- OBFR – Overnight Bank Funding Rate
- ON RP – Overnight Repo
- ON RRP – Overnight Reverse Repo
- QE – Quantitative Easing
- QT – Quantitative Tightening
- SOFR – Secured Overnight Financing Rate
- SRF – Standing Repo Facility
- TGA – Treasury General Account
- TIPS – Treasury Inflation Protected Security
- UST – US Treasury



Disclosures

Important Disclosures

Due to the nature of strategic analysis, the issuers or securities recommended or discussed in this report are not continuously followed. Accordingly, investors must regard this report as providing stand-alone analysis and should not expect continuing analysis or additional reports relating to such issuers and/or securities.

BofA Global Research personnel (including the analyst(s) responsible for this report) receive compensation based upon, among other factors, the overall profitability of Bank of America Corporation, including profits derived from investment banking. The analyst(s) responsible for this report may also receive compensation based upon, among other factors, the overall profitability of the Bank's sales and trading businesses relating to the class of securities or financial instruments for which such analyst is responsible.

BofA Securities fixed income analysts regularly interact with sales and trading desk personnel in connection with their research, including to ascertain pricing and liquidity in the fixed income markets.

Other Important Disclosures

Prices are indicative and for information purposes only. Except as otherwise stated in the report, for any recommendation in relation to an equity security, the price referenced is the publicly traded price of the security as of close of business on the day prior to the date of the report or, if the report is published during intraday trading, the price referenced is indicative of the traded price as of the date and time of the report and in relation to a debt security (including equity preferred and CDS), prices are indicative as of the date and time of the report and are from various sources including BofA Securities trading desks.

The date and time of completion of the production of any recommendation in this report shall be the date and time of dissemination of this report as recorded in the report timestamp.

This report may refer to fixed income securities or other financial instruments that may not be offered or sold in one or more states or jurisdictions, or to certain categories of investors, including retail investors. Readers of this report are advised that any discussion, recommendation or other mention of such instruments is not a solicitation or offer to transact in such instruments. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor for information relating to such instruments.

Rule 144A securities may be offered or sold only to persons in the U.S. who are Qualified Institutional Buyers within the meaning of Rule 144A under the Securities Act of 1933, as amended. SECURITIES OR OTHER FINANCIAL INSTRUMENTS DISCUSSED HEREIN MAY BE RATED BELOW INVESTMENT GRADE AND SHOULD THEREFORE ONLY BE CONSIDERED FOR INCLUSION IN ACCOUNTS QUALIFIED FOR SPECULATIVE INVESTMENT.

Recipients who are not institutional investors or market professionals should seek the advice of their independent financial advisor before considering information in this report in connection with any investment decision, or for a necessary explanation of its contents.

The securities or other financial instruments discussed in this report may be traded over-the-counter. Retail sales and/or distribution of this report may be made only in states where these instruments are exempt from registration or have been qualified for sale.

Officers of BofAS or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.

This report, and the securities or other financial instruments discussed herein, may not be eligible for distribution or sale in all countries or to certain categories of investors, including retail investors.

Refer to [BofA Global Research policies relating to conflicts of interest](#).

"BofA Securities" includes BofA Securities, Inc. ("BofAS") and its affiliates. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor if they have questions concerning this report or concerning the appropriateness of any investment idea described herein for such investor. "BofA Securities" is a global brand for BofA Global Research.

Information relating to Non-US affiliates of BofA Securities and Distribution of Affiliate Research Reports:

BofAS and/or Merrill Lynch, Pierce, Fenner & Smith Incorporated ("MLPF&S") may in the future distribute, information of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by the Financial Sector Conduct Authority; MLI (UK): Merrill Lynch International, regulated by the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA); BofASE (France): BofA Securities Europe SA is authorized by the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers (AMF). BofA Securities Europe SA ("BofASE") with registered address at 51, rue La Boétie, 75008 Paris is registered under no 842 602 690 RCS Paris. In accordance with the provisions of French Code Monétaire et Financier (Monetary and Financial Code), BofASE is an établissement de crédit et d'investissement (credit and investment institution) that is authorised and supervised by the European Central Bank and the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers. BofASE's share capital can be found at www.bofam.com/BofASEdisclaimer; BofA Europe (Milan): Bank of America Europe Designated Activity Company, Milan Branch, regulated by the Bank of Italy, the European Central Bank (ECB) and the Central Bank of Ireland (CBI); BofA Europe (Frankfurt): Bank of America Europe Designated Activity Company, Frankfurt Branch regulated by BaFin, the ECB and the CBI; BofA Europe (Madrid): Bank of America Europe Designated Activity Company, Sucursal en España, regulated by the Bank of Spain, the ECB and the CBI; Merrill Lynch (Australia): Merrill Lynch Equities (Australia) Limited, regulated by the Australian Securities and Investments Commission; Merrill Lynch (Hong Kong): Merrill Lynch (Asia Pacific) Limited, regulated by the Hong Kong Securities and Futures Commission (HKSF); Merrill Lynch (Singapore): Merrill Lynch (Singapore) Pte Ltd, regulated by the Monetary Authority of Singapore (MAS); Merrill Lynch (Canada): Merrill Lynch Canada Inc, regulated by the Canadian Investment Regulatory Organization; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y de Valores; BofAS Japan: BofA Securities Japan Co., Ltd., regulated by the Financial Services Agency; Merrill Lynch (Seoul): Merrill Lynch International, LLC Seoul Branch, regulated by the Financial Supervisory Service; Merrill Lynch (Taiwan): Merrill Lynch Securities (Taiwan) Ltd., regulated by the Securities and Futures Bureau; BofAS India: BofA Securities India Limited, regulated by the Securities and Exchange Board of India (SEBI); Merrill Lynch (Israel): Merrill Lynch Israel Limited, regulated by Israel Securities Authority; Merrill Lynch (DIFC): Merrill Lynch International (DIFC Branch), regulated by the Dubai Financial Services Authority (DFSA); Merrill Lynch (Brazil): Merrill Lynch S.A. Corretora de Títulos e Valores Mobiliários, regulated by Comissão de Valores Mobiliários; Merrill Lynch KSA Company: Merrill Lynch Kingdom of Saudi Arabia Company, regulated by the Capital Market Authority. This information: has been approved for publication and is distributed in the United Kingdom (UK) to professional clients and eligible counterparties (as each is defined in the rules of the FCA and the PRA) by MLI (UK), which is authorized by the PRA and regulated by the FCA and the PRA - details about the extent of our regulation by the FCA and PRA are available from us on request; has been approved for publication and is distributed in the European Economic Area (EEA) by BofASE (France), which is authorized by the ACPR and regulated by the ACPR and the AMF; has been considered and distributed in Japan by BofAS Japan, a registered securities dealer under the Financial Instruments and Exchange Act in Japan, or its permitted affiliates; is issued and distributed in Hong Kong by Merrill Lynch (Hong Kong) which is regulated by HKSF; is issued and distributed in Taiwan by Merrill Lynch (Taiwan); is issued and distributed in India by BofAS India; and is issued and distributed in Singapore to institutional investors and/or accredited investors (each as defined under the Financial Advisers Regulations) by Merrill Lynch (Singapore) (Company Registration No 198602883D). Merrill Lynch (Singapore) is regulated by MAS. Merrill Lynch Equities (Australia) Limited (ABN 65 006 276 795), AFS License 235132 (MLEA) distributes this information in Australia only to 'Wholesale' clients as defined by s.761G of the Corporations Act 2001. With the exception of Bank of America N.A., Australia Branch, neither MLEA nor any of its affiliates involved in preparing this information is an Authorised Deposit-Taking Institution under the Banking Act 1959 nor regulated by the Australian Prudential Regulation Authority. No approval is required for publication or distribution of this information in Brazil and its local distribution is by Merrill Lynch (Brazil) in accordance with applicable regulations. Merrill Lynch (DIFC) is authorized and regulated by the DFSA. Information prepared and issued by Merrill Lynch (DIFC) is done so in accordance with the requirements of the DFSA conduct of business rules. BofA Europe (Frankfurt) distributes this information in Germany and is regulated by BaFin, the ECB and the CBI. BofA Securities entities, including BofA Europe and BofASE (France), may outsource/delegate the marketing and/or provision of certain research services or aspects of research services to other branches or members of the BofA Securities group. You may be contacted by a different BofA Securities entity acting for and on behalf of your service provider where permitted by applicable law. This does not change your service provider. Please refer to the [Electronic](#)



[Communications Disclaimers](#) for further information.

This information has been prepared and issued by BofAS and/or one or more of its non-US affiliates. The author(s) of this information may not be licensed to carry on regulated activities in your jurisdiction and, if not licensed, do not hold themselves out as being able to do so. BofAS and/or MLPF&S is the distributor of this information in the US and accepts full responsibility for information distributed to BofAS and/or MLPF&S clients in the US by its non-US affiliates. Any US person receiving this information and wishing to effect any transaction in any security discussed herein should do so through BofAS and/or MLPF&S and not such foreign affiliates. Hong Kong recipients of this information should contact Merrill Lynch (Asia Pacific) Limited in respect of any matters relating to dealing in securities or provision of specific advice on securities or any other matters arising from, or in connection with, this information. Singapore recipients of this information should contact Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this information. For clients that are not accredited investors, expert investors or institutional investors Merrill Lynch (Singapore) Pte Ltd accepts full responsibility for the contents of this information distributed to such clients in Singapore.

General Investment Related Disclosures:

Taiwan Readers: Neither the information nor any opinion expressed herein constitutes an offer or a solicitation of an offer to transact in any securities or other financial instrument. No part of this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or any other person without the express written consent of BofA Securities.

This document provides general information only, and has been prepared for, and is intended for general distribution to, BofA Securities clients. Neither the information nor any opinion expressed constitutes an offer or an invitation to make an offer, to buy or sell any securities or other financial instrument or any derivative related to such securities or instruments (e.g., options, futures, warrants, and contracts for differences). This document is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of, and is not directed to, any specific person(s). This document and its content do not constitute, and should not be considered to constitute, investment advice for purposes of ERISA, the US tax code, the Investment Advisers Act or otherwise. Investors should seek financial advice regarding the appropriateness of investing in financial instruments and implementing investment strategies discussed or recommended in this document and should understand that statements regarding future prospects may not be realized. Any decision to purchase or subscribe for securities in any offering must be based solely on existing public information on such security or the information in the prospectus or other offering document issued in connection with such offering, and not on this document.

Securities and other financial instruments referred to herein, or recommended, offered or sold by BofA Securities, are not insured by the Federal Deposit Insurance Corporation and are not deposits or other obligations of any insured depository institution (including, Bank of America, N.A.). Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counterparty default risk and liquidity risk. No security, financial instrument or derivative is suitable for all investors. Digital assets are extremely speculative, volatile and are largely unregulated. In some cases, securities and other financial instruments may be difficult to value or sell and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance. Levels and basis for taxation may change.

BofA Securities is aware that the implementation of the ideas expressed in this report may depend upon an investor's ability to "short" securities or other financial instruments and that such action may be limited by regulations prohibiting or restricting "shortselling" in many jurisdictions. Investors are urged to seek advice regarding the applicability of such regulations prior to executing any short idea contained in this report.

This report may contain a trading idea or recommendation which highlights a specific identified near-term catalyst or event impacting a security, issuer, industry sector or the market generally that presents a transaction opportunity, but does not have any impact on the analyst's particular "Overweight" or "Underweight" rating (which is based on a three month trade horizon). Trading ideas and recommendations may differ directionally from the analyst's rating on a security or issuer because they reflect the impact of a near-term catalyst or event.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned in this report. Investors in such securities and instruments effectively assume currency risk.

BofAS or one of its affiliates is a regular issuer of traded financial instruments linked to securities that may have been recommended in this report. BofAS or one of its affiliates may, at any time, hold a trading position (long or short) in the securities and financial instruments discussed in this report.

BofA Securities, through business units other than BofA Global Research, may have issued and may in the future issue trading ideas or recommendations that are inconsistent with, and reach different conclusions from, the information presented herein. Such ideas or recommendations may reflect different time frames, assumptions, views and analytical methods of the persons who prepared them, and BofA Securities is under no obligation to ensure that such other trading ideas or recommendations are brought to the attention of any recipient of this information.

In the event that the recipient received this information pursuant to a contract between the recipient and BofAS for the provision of research services for a separate fee, and in connection therewith BofAS may be deemed to be acting as an investment adviser, such status relates, if at all, solely to the person with whom BofAS has contracted directly and does not extend beyond the delivery of this report (unless otherwise agreed specifically in writing by BofAS). If such recipient uses the services of BofAS in connection with the sale or purchase of a security referred to herein, BofAS may act as principal for its own account or as agent for another person. BofAS is and continues to act solely as a broker-dealer in connection with the execution of any transactions, including transactions in any securities referred to herein.

Copyright and General Information:

Copyright 2025 Bank of America Corporation. All rights reserved. IQdatabase® is a registered service mark of Bank of America Corporation. This information is prepared for the use of BofA Securities clients and may not be redistributed, retransmitted or disclosed, in whole or in part, or in any form or manner, without the express written consent of BofA Securities. This document and its content is provided solely for informational purposes and cannot be used for training or developing artificial intelligence (AI) models or as an input in any AI application (collectively, an AI tool). Any attempt to utilize this document or any of its content in connection with an AI tool without explicit written permission from BofA Global Research is strictly prohibited. BofA Global Research information is distributed simultaneously to internal and client websites and other portals by BofA Securities and is not publicly-available material. Any unauthorized use or disclosure is prohibited. Receipt and review of this information constitutes your agreement not to redistribute, retransmit, or disclose to others the contents, opinions, conclusion, or information contained herein (including any investment recommendations, estimates or price targets) without first obtaining express permission from an authorized officer of BofA Securities.

Materials prepared by BofA Global Research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of BofA Securities, including investment banking personnel. BofA Securities has established information barriers between BofA Global Research and certain business groups. As a result, BofA Securities does not disclose certain client relationships with, or compensation received from, such issuers. To the extent this material discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this material. BofA Global Research personnel's knowledge of legal proceedings in which any BofA Securities entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving issuers mentioned in this material is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, discussed with, and may not reflect information known to, professionals in other business areas of BofA Securities in connection with the legal proceedings or matters relevant to such proceedings.

This information has been prepared independently of any issuer of securities mentioned herein and not in connection with any proposed offering of securities or as agent of any issuer of any securities. None of BofAS any of its affiliates or their research analysts has any authority whatsoever to make any representation or warranty on behalf of the issuer(s). BofA Global Research policy prohibits research personnel from disclosing a recommendation, investment rating, or investment thesis for review by an issuer prior to the publication of a research report containing such rating, recommendation or investment thesis.

Any information relating to sustainability in this material is limited as discussed herein and is not intended to provide a comprehensive view on any sustainability claim with respect to any issuer or security.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

The information herein (other than disclosure information relating to BofA Securities and its affiliates) was obtained from various sources and we do not guarantee its accuracy. This information may contain links to third-party websites. BofA Securities is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this information and is not incorporated by reference. The inclusion of a link does not imply any endorsement by or any affiliation with BofA Securities. Access to any third-party website is at your own risk, and you should always review the terms and privacy policies at third-party websites before submitting any personal information to them. BofA Securities is not responsible for such terms and privacy policies and expressly disclaims any liability for them.

All opinions, projections and estimates constitute the judgment of the author as of the date of publication and are subject to change without notice. Prices also are subject to change without notice. BofA Securities is under no obligation to update this information and BofA Securities ability to publish information on the subject issuer(s) in the future is subject to applicable quiet periods. You should therefore assume that BofA Securities will not update any fact, circumstance or opinion contained herein.



Certain outstanding reports or investment opinions relating to securities, financial instruments and/or issuers may no longer be current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.

In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with BofAS or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies.

Neither BofA Securities nor any officer or employee of BofA Securities accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this information.



Research Analysts

Ralph Axel

Rates Strategist
BofAS
ralph.axel@bofa.com

Bruno Braizinha, CFA

Rates Strategist
BofAS
bruno.braizinha@bofa.com

Mark Cabana, CFA

Rates Strategist
BofAS
mark.cabana@bofa.com

Katie Craig

Rates Strategist
BofAS
katie.craig@bofa.com

Meghan Swiber, CFA

Rates Strategist
BofAS
meghan.swiber@bofa.com

Trading ideas and investment strategies discussed herein may give rise to significant risk and are not suitable for all investors. Investors should have experience in relevant markets and the financial resources to absorb any losses arising from applying these ideas or strategies.

