Fluctuations in the Treasury General Account and their effect on the Fed's balance sheet

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Abstract: The US government's money demand is large and volatile and takes the form of the Treasury General Account (TGA) at the Federal Reserve. I study the drivers of TGA volatility and the options available to the Federal Reserve for adjusting its balance sheet in response to this volatility. Using interest rate control, control of the Fed's overall policy stance, and communication as criteria, I argue that a policy of backing the TGA with Treasury bills (or other short-maturity assets) and adjusting bill holdings with TGA fluctuations performs better than the current ample reserves policy of letting the supply of reserves and overnight reverse repo balances adjust passively to changes in the TGA.

[1] Disclaimer: The views expressed herein are those of the author; they do not reflect those of the Federal Reserve Board or the Federal Reserve System. E-mail: annette.vissing-jorgensen@frb.gov. I thank Tom Barkin, Josh Gallin, Beth Hammack, Beth Klee, Lorie Logan, Julie Remache, Trevor Reeve, Jeremy Stein and conference participants at the Federal Reserve Bank of Richmond for very helpful feedback.

1. Introduction

The US government's money demand takes the form of Treasury General Account (TGA) balances which are the government's deposits held with the Federal Reserve. The TGA is used to facilitate payments to and from the government stemming from taxes, spending and debt issuance. It thus provides important payment services to the government and to the country. Over the past decade the US government's money demand has been large and volatile, with TGA balances reaching a high of $1.8T but with large swings as illustrated by the red line in Figure 1.

From the perspective of the Federal Reserve, the TGA is a liability, and it is one component of the Fed's money supply. Supplying money is one of the Fed's core tasks, with currency supplying payment services to households and firms, reserves supplying payment services to banks, and the TGA supplying such services to the government. The Fed also has other important tasks, notably monetary policy. When the TGA fluctuates on the Fed's balance sheet, something else must change on the asset side or on the liability side. On the liability side, the Fed could let reserves or overnight reverse repo (ON RRP) balances decline when the TGA increases (and conversely). On the asset size, the Fed could increase its securities holdings or its lending to the financial sector with increases in the TGA. However, these changes could affect the Fed's monetary policy stance. For example, changes to reserves may affect the market-clearing short-term interest rate, and changes to the Fed's holding of assets with duration or pre-payment risk will affect market-clearing longer-term interest rates. In this paper, I analyze how the Fed may best address fluctuations in the TGA given these interlinkages of its money supply and monetary policy tasks.

I propose three criteria for deciding between the various possibly approaches. The first is interest rate control, i.e., ensuring that short market rates clear squarely inside the target range. The second is avoiding effects of TGA fluctuations on the Fed's overall policy stance including the amount of stimulus provided via Fed holdings of assets with duration or pre-payment risk. The final criterium is how easy the policy is to communicate to the public, including whether the policy could be misperceived as the Fed reacting to fiscal policy.

In practice, since the global financial crisis, the Fed has followed an ample reserves policy of keeping the supply of reserves plus ON RRP balances large (on average) and not changing the Fed's assets systematically with the TGA. Instead, reserves plus ON RRP balances have been allowed to adjust to TGA fluctuations. I argue that this approach raises challenges with respect to all three criteria. Regarding interest rate control, I show that an ample reserves policy requires the Fed to have a larger balance sheet on average or accept more interest rate volatility than an approach of backing the TGA with bills. The reason is that an ample reserves policy does not actively adjust assets in response to fluctuations in the TGA. Therefore,

assets must under this approach be large enough at all times to ensure that any plausible increase in the TGA does not bring reserves below the ample level. As for the Fed's overall policy stance, an ample reserves policy can complicate quantitative tightening (QT, also called balance sheet normalization) if QT happens during a period with large TGA fluctuations. Specifically, if a debt ceiling episode or seasonal low in tax revenues implies a low TGA balance, there is a risk that the Fed may overdo QT, leading to reserve scarcity and interest rate volatility as the TGA increases to normal values. The problem is that when the TGA fluctuates, reserves plus ON RRP balance do not decline smoothly with balance sheet runoff, and may even increase temporarily despite QT. Reserve scarcity may then emerge once the TGA is returned to the Treasury's target level which tends to happen fast after the debt ceiling is raised or suspended as well as during periods with seasonally large tax revenues. If the Fed stops, slows or pauses QT due to a debt ceiling event, this implies that the Fed's overall policy stance is changed due to TGA fluctuations, not due to the underlying economic situation or outlook. A change to balance sheet normalization in reaction to potential TGA fluctuations also raises communication concerns because such decisions may be viewed by the public as fiscal policy affecting monetary policy, even if the effect is of a somewhat technical nature.

By contrast, an approach of *backing the TGA with Fed holdings of Treasury bills and adjusting these bill holdings with TGA fluctuations* would score well on the three policy design criteria. In terms of interest rate control, this policy would allow the supply of reserves plus ON RRP balances to be unaffected by TGA fluctuations, thereby lowering interest rate volatility for given average balance sheet size. This enables a lower average balance sheet size than under the ample reserves policy or lower interest rate volatility or a mix of both. As for the overall policy stance, with the TGA backed with bills, the Fed's holdings of longer-maturity assets would be unaffected by TGA fluctuations. This would insulate the Fed's overall policy stance from the TGA. For example, there would be no need to stop, slow or pause QT during a debt ceiling episode as reserves plus ON RRP balances would decline smoothly with QT regardless of the evolution of the TGA, thereby avoiding sudden fluctuations that could lead to unintended reserve scarcity. Finally, the new approach would be easy to communicate. The Fed accommodates *trends* in money demand (for currency, the TGA, and reserves). Backing the TGA with bills and adjusting bill holdings reactively would extend this principle to also accommodate *fluctuations*, specifically those arising from the government's money demand.

Overall, backing the TGA with bills would be a straightforward way for the Fed to provide banking services to the government while keeping one Fed job (being the government's bank) separate from another Fed job (monetary policy).

The paper is structured as follows. In section 2, I review the moving parts of the Fed's balance sheet followed in section 3 by a description of the TGA and the drivers of its level and volatility. Section 4

describes possible approaches for the Fed to address TGA fluctuations and lays out policy design criteria for evaluating them. Section 5 describes the challenges that arise with ample reserves policies and argues that a policy of backing the TGA with bills could help. Section 6 discusses possible effects on the Treasury bill market. Section 7 covers implementation issues and section 8 concludes.

2. Components of the Federal Reserve's balance sheet and their relation to Fed mandates

By way of background, Table 1 shows the Fed's balance sheet as of February 25, 2026. Omitting a few "other" categories, the balance sheet states that:

$$\text{Securities + Lending = Autonomous factors (Currency, TGA, other) + [Reserves+ON RRP balances]} \quad (1)$$

The balance sheet serves three purposes.

Money supply: The most basic task of the Fed is to supply money. All the Fed's liabilities are types of money. The Fed supplies the autonomous factors elastically to accommodate the prevailing demand (thus the name "autonomous"). The largest category within autonomous factors is currency followed by the Treasury General Account. The largest sub-category within other autonomous factors is the foreign repo pool which represents repo investments by foreign official and international accounts with the Fed as a counterparty. To supply the autonomous factors, the Fed purchases securities or lends.[2] As for reserves, they are liquid balances owned by banks and held with the Fed as a store of value, to clear payments, and to satisfy liquidity requirements (e.g., the Liquidity Coverage Ratio and intraday liquidity requirements under Regulation YY). Appendix A reviews the basics of banks' demand for reserves based on the framework of Lopez-Salido and Vissing-Jorgensen (2025). The reserve demand curve traces out the short market interest rate r (the federal funds rate) banks are willing to pay to borrow to obtain additional reserves, as a function of reserves held. This interest rate is given by bank's' net benefit of reserves which is the interest rate on reserves (IOR) plus the net convenience yield on reserves (the convenience yield from the liquidity services of reserves, net of the marginal balance sheet cost):

$$r = \underbrace{IOR + v_R'(Reserves, Deposits) - \varphi}_{\text{Net benefit of additional reserves}} \quad (2)$$

It follows that *r-IOR* (with *r* measured as the effective federal funds rate, EFFR) is a natural measure of the economic scarcity of reserves. It captures how much banks value reserves due to their net convenience yield, i.e., above and beyond the fact that they pay interest. An EFFR-IOR spread of zero or negative thus

[2] For example, suppose households or firms demand more currency. Banks order more currency from the Fed, paying by lowering banks' reserves at the Fed. The Fed can then buy securities, paying by increasing reserves. On net, reserves are unchanged, while currency and securities are higher.

indicates a sufficient (usually called "ample") supply of reserves from a money supply perspective. Values substantially below zero suggest that reserves are abundant. A reserve supply that sets the net convenience yield to zero is ample in the sense that it supplies what banks value for liquidity and regulatory purposes, with the last unit supplied having zero value.

Financial stability/lender of last resort: A second use of the Fed's balance sheet is to perform emergency lending to US financial institutions (via the discount window, standing repo operations, or other facilities) or to foreign banks (via central bank liquidity swaps), typically funded with additional reserves.

Monetary policy (conventional and quantitative easing): The third and crucial function of the Fed is to conduct monetary policy. On the liability side of the balance sheet, reserves and overnight reverse repo balances (repo investments by US non-banks with the Fed as a counterparty) serve this purpose. However, because the Fed pays interest on reserves (IOR), implementation of conventional monetary policy -- ensuring that the effective federal funds rate clears in the target range -- does not prescribe a particular supply of reserves (Goodfriend (2002), Vissing-Jorgensen (2023)). A given equilibrium short market rate can be reached with a low IOR (and thus low reserve demand) and high net convenience yield (which requires a low reserve supply), or with a high IOR and low net convenience yield (high reserve supply). Post-GFC, the Fed has chosen the latter, with a large reserve supply providing liquidity services to banks and funding for quantitative easing (QE) and market functioning purchases. At some points in the post-GFC period, reserve supply has been so large that EFFR would be substantially below IOR absent further facilities. To avoid this outcome, the Fed has used its overnight reverse repo (ON RRP) facility to reduce reserve supply for a given value of its asset holdings (Appendix A, Figure A2, middle panel).

Figure 2 Panel A shows the evolution of the Fed's assets over time. The various rounds of quantitative easing is visible in the asset total, as are the large market functioning purchases at the start of the COVID pandemic. Lending to domestic financial institutions is substantial during crisis, including during the Sillicon Valley Bank crisis in 2023. Figure 2 Panel B shows the various Fed liabilities over time. Among the autonomous factors, currency trends up smoothly in contrast to the TGA. Reserves and ON RRP balances fluctuate to supply ample reserves and fund securites and lending in excess of the autonomous factors, with ON RRP balances large during in the period after the pandemic.

3. Drivers of the Treasury General Account

Given the magnitude and volatility of the Treasury General Account, this section sheds light on its drivers. I highlight the role of the Treasury's target size for the TGA, debt ceiling episodes (which lead to TGA reductions and rebuilding), and surprises and seasonality in the Federal budget surplus/deficit.

a. Changes to the Treasury's target size for the TGA over time

In the years leading up to the financial crisis, TGA balances were near $5B, with modest volatility. Fluctuations in the Treasury's cash balance (due to differences between deficits and net debt issuance) were instead mainly reflected in the Treasury's accounts at private banks, the Treasury Tax and Loan Note Accounts (Santoro (2012)). This arrangement ensured that movements in the TGA did not cause substantial volatility in reserve supply which would have necessitated larger open market operations to stabilize reserves during the scarce reserves-regime used by the Fed pre-financial crisis.

The Federal Reserve started paying interest on reserves on October 9, 2008. This increased reserve demand, thereby keeping the effective federal funds rate from falling below the desired target range even with the large reserve supply resulting from emergency lending and QE during the financial crisis. From late 2008 and in the years following, EFFR cleared below IOR. This meant that the Treasury (taxpayers) would benefit from holding fewer deposits at private banks and more with the Fed. The Treasury would then forego interest at private banks (where government deposits earned less than EFFR, see again Santoro (2012)) but reserves would fall, and the Fed would pay less in interest on reserves and would remit higher profits to the Treasury. Accordingly, the Treasury changed its cash management policy to hold almost no deposits with private banks and instead rely mainly on the TGA. The resulting increase in the level and volatility in the TGA from October 2008 is visible in the TGA time series in Figure 1.

A second main change to the Treasury cash management policy was announced in the May 6, 2015, Quarterly Refunding Statement.[3] Citing several events occurring over the prior 15 years (the September 2001 attacks and Superstorm Sandy in October 2012), as well as the risk of cyber-attacks, the statement laid out a change in the Treasury's cash management policy to keep a higher TGA level: "To help protect against a potential interruption in market access, Treasury will hold a level of cash generally sufficient to cover one week of outflows in the Treasury General Account, subject to a minimum balance of roughly $150 billion." Over time, the Treasury's desired TGA level has evolved with updated estimates of outflows (it also appears to be adjusted down with the actual TGA level during debt ceiling episodes). The black line in Figure 1 shows the Treasury's projected level for the TGA at the end of the next quarter, collected from the Treasury's Marketable Borrowing Estimates issued quarterly. The latest value is $850B.

b. Debt ceiling dynamics

Clearly visible in Figure 1 are several periods during the past decade with downward spikes in the TGA, followed by rapid increases. These episodes relate to the debt ceiling, with the dashed vertical lines in the

[3] Quarterly Refunding Statement of Acting Assistant Secretary for Financial Markets Seth B. Carpenter | U.S. Department of the Treasury

figure marking dates on which the debt ceiling was either increased or suspended (I mark dates from 2015 onward only). When the debt ceiling is binding, the government cannot cover its deficit via debt issuance and instead continues to make payments by reducing the balance in the TGA. After an increase or suspension of the debt ceiling, the Treasury typically issues substantial amounts of debt to replenish the TGA to the desired level.

To be more precise about this, consider how the TGA changes from day to day. The TGA does not pay interest and evolves according to the relation:

$$TGA_t - TGA_{t-1} = \underbrace{Deposits_t - Withdrawals_t}_{Surplus_t}$$

$$+ \underbrace{Public\ Debt\ Cash\ Issues_t - Public\ Debt\ Cash\ Redemptions_t}_{Net\ Public\ Debt\ Cash\ Issues_t} \quad (3)$$

Equation (3) applies to the government's total cash balance including accounts with private banks. In a period with close to no holdings at private banks, it applies to the TGA. Deposits into the TGA come mainly from taxes while withdrawals are from both spending and interest payments on Treasury debt. Withdrawals exclude cash flows from debt issuance and redemption which are captured by the second line. Public debt *cash* issues and redemptions exclude changes to the intragovernmental holdings of Treasury debt which are part of the total public debt but do not generate cash flows to/from the TGA.[4] The second line in (3) can also be expressed as the change in the total public debt from date *t-1* to *t*, minus the change in the intragovernmental holdings from date *t-1* to *t.*[5]

Figure 3 Panel A plots the components of Equation (3) using rolling 90-day changes in the TGA and rolling 90-day sums for the surplus (Deposits-Withdrawals) and net public debt cash issues (Issues-Redemptions). It is constructed using daily data from the Daily Treasury Statement. Prior to 2015, the Treasury lined up net public debt cash issuance quite closely with deficits, resulting in modest changes in the TGA over time. By contrast, in the period since 2015, during which the Treasury has operated with a larger (on average) and more volatile TGA, the 90-day change in the TGA is often large, indicating that net public debt cash issuance is not lined up with deficits as tightly. Notably, when the debt ceiling binds, net public debt cash issuance is generally low, and the TGA tends to fall to cover the deficit (notice how the 90-day changes in the TGA are typically negative in the periods leading up to the debt ceiling suspensions/increases marked with the vertical lines). A subtlety here is that the debt ceiling applies to total public debt, including the intragovernmental holdings, and the Treasury has some flexibility to reduce the amount of

[4] For example, if the government compensates employees by giving them newly issued Treasuries in their pension plan, this type of Treasury issuance does not generate a cash inflow to the TGA.
[5] This ignores a few small categories. See the Daily Treasury Statement Table IIIB for details.

intragovernmental holdings when the debt ceiling binds.[6] One approach is to redeem existing investments of (and suspend new investments in) the Civil Service Retirement and Disability Fund and the Postal Service Retiree Health Benefits Fund. The Treasury can then keep issuing some (modest) amounts of marketable debt without exceeding the debt ceiling. Figure 3 Panel B illustrates debt issuance with a split into marketable and non-marketable debt (which is mainly intragovernmental holdings).[7] The pink line shows the 90-day net issuance of non-marketable debt. It is negative leading up to debt ceiling suspensions/increases, thus allowing the 90-day net issuance of marketable debt (the blue line) to exceed the 90-day net issuance of total Treasury debt (the black line) at these times. Nonetheless, with a sufficiently large deficit, the TGA still tends to fall while the debt ceiling binds and the TGA will eventually reach zero if the debt ceiling is not suspended or increased. At that point large debt issuance replenishes the TGA (and the above-mentioned retirement funds). This is visible in Figure 3 Panel A by the large net issuance and positive TGA changes in the periods after debt ceiling increases or suspensions. The quick replenishment of the TGA is also apparent in Figure 1.

The dynamics around the debt ceiling leads to a strong positive correlation between TGA changes and Treasury bill issuance, illustrated in Figure 3 Panel C. The Treasury uses net Treasury bill issuance as the buffer for overall net issuance, adjusting the net issuance of notes and bonds only gradually under its long-standing policy of keeping issuance of notes and bonds "regular and predictable" (Garbade (2007), Liang (2021), Cassidy and Mirani (2024)). Figure 3 Panel D shows 90-day net issuance for overall marketable Treasury debt, Treasury bills, and Treasury notes and bonds. There is a tight relation between the 90-day net issuance of overall marketable Treasury debt and 90-day net issuance of Treasury bills. The gradual change to issuance amounts (auction sizes) for notes and bonds is illustrated by the orange line which increases only gradually with higher borrowing needs (visible after the onset of the financial crisis and the COVID pandemic). As a result of the regular and predictable issuance policy, higher debt initially results in shorter average maturity even if the Treasury subsequently tends to lengthen average maturity (e.g., Greenwood, Hanson, Rudolph and Summers (2015)).

c. Seasonality and surprises to the federal surplus

A final contributor to volatility in the TGA is shocks to spending and taxes, as well as seasonal patterns around key tax and issuance dates.

As an example of a large shock, the end of June 2020 projection issued in the February 2020 Marketable Borrowing Estimates announcement was $400B, much below the realized value of about $1.7T. The high

[6] This is one of the Treasury's "extraordinary measures", see Description of the Extraordinary Measures.
[7] See the Monthly Statement of the Public Debt of the United States for details.

realized value resulted from lower-than-expected expenditures and higher-than-expected receipts in the second quarter of 2020 (according to the August 2020 Marketable Borrowing Estimates announcement) as well as from an increase in the planned June 2020 TGA value (stated in the May 2020 Marketable Borrowing Estimates announcement).

As for seasonality, Figure 4 illustrates the average path of 4-week TGA changes across weeks of the year. The TGA increases following tax deadlines on April 15, June 15, September 15 and December 15. The 4-week changes in the TGA line up quite closely with the seasonality in the 4-week total for the federal surplus, leaving only a modest seasonality in net public debt cash issuance. Table 2 Panel A presents regressions using the series from Figure 4. Across weeks of the year, one dollar of extra surplus leads to a 77-cent increase in the TGA and a 23-cent reduction in net public debt issuance. As shown in the last two columns of Table 2 Panel A, the change in net public debt issuance is all due to changes in Treasury bill issuance, with little seasonality Treasury note and bond issuance.

4. Approaches for the Fed to address TGA fluctuations

This section turns to the Federal Reserve's options for adjusting its balance sheet in response to TGA fluctuations and principles that may guide the choice between options.

a. The four possible approaches

Consider the Fed's balance sheet (omitting the "other" categories in Table 1).

Assets	**Liabilities**
Securities	Autonomous factors
Lending	Currency
	Treasury general account (TGA)
	Reserves
	Overnight reverse repo balances (ON RRP)

When the TGA fluctuates, something else must change on the Fed's balance sheet for it to balance. The Fed supplies currency in the amount demanded by households and firms so letting currency adjust is not an option. That leaves four variables that may adjust to TGA fluctuations: Reserves, ON RRP balances, securities or lending. I label the four corresponding approaches as follows.

1. *Ample reserves:* In this approach, reserves are kept high on average and reserves are allowed to adjust to changes in the TGA, in the opposite direction. Fed securities are passive in the sense of not being adjusted with TGA fluctuations. If reserve supply is sufficiently large, letting reserves fluctuate in response to TGA fluctuations will not generate much interest rate volatility because the equilibrium

moves around on a fairly flat part of the reserve demand curve. I illustrate this approach in Figure 5, Panel A which shows the effect of autonomous factor shocks on the equilibrium short market interest rate (EFFR). The chart is from Lopez-Salido and Vissing-Jorgensen (2025) (LSVJ).

2. *Ample reserves with positive ON RRP balances:* In this approach, Fed borrowing from financial institutions via the ON RRP facility adjusts to TGA fluctuations, in the opposite direction of the TGA. The ON RRP facility serves to prevent market rates from falling too far below the interest rate on reserves in situations with a very large Fed balances sheet (large securities holdings relative to what can be funded with the autonomous factors). When ON RRP balances are positive, if the Fed takes no action in terms of adjusting its securities holdings, fluctuations in ON RRP balances serve as a buffer that insulates reserves from TGA fluctuations, thereby limiting interest rate volatility.[8]

3. *Active securities:* Another option is to adjust Fed securities holdings in the same direction as the TGA and keep other Fed liabilities unaffected. I denote this an "active securities" approach. Figure 5, Panel B illustrates this approach. If the Fed's securities holdings are changed one-for-one with the TGA, then reserve supply is kept unchanged, as is the equilibrium short market rate. An active securities approach would adjust Fed securities holdings via changes to asset purchases or asset runoff or via traditional open market operations (including repo).

4. *Positive lending:* A final possibility is for the Fed to operate in a regime with positive lending. For example, it could lower the interest rate on its lending facilities to generate substantial lending balances. When lending is positive, fluctuations in lending (in the same direction as the TGA) can buffer reserves from TGA fluctuations.[9]

Since the global financial crisis, the Fed has mostly taken a passive approach to TGA balances, letting reserves plus ON RRP balances adjust rather than changing the overall balance sheet size. This is a mix of the ample reserves approach and the amples reserves with positive ON RRP balances approach. With large securities holdings driven by its QE and market functioning purchases, reserve supply has generally been ample or abundant, thus allowing the Fed to let reserves plus ON RRP balances adjust to TGA fluctuations without this generating substantial interest rate volatility. In periods with large ON RRP take-up, the ON RRP has served as a shock absorber, further limiting interest rate volatility. The FOMC clarified its policy in January 2019, stating: "The Committee intends to continue to implement monetary policy in a regime in which an ample supply of reserves ensures that control over the level of the federal funds rate and other short-term interest rates is exercised primarily through the setting of the Federal Reserve's administered

[8] The equilibrium with positive ON RRP balances is illustrated in the Appendix A, Figure A2 (middle panel).
[9] The equilibrium with positive lending is illustrated in the Appendix A, Figure A2 (bottom panel).

rates, and in which active management of the supply of reserves is not required."[10] The ability to let reserves plus ON RRP balances adjust passively to TGA fluctuations without resulting interest rate volatility has generally been viewed as one of the benefits of an ample or abundant reserve supply (e.g., Zobel (2022)). The ample reserves approach was confirmed in January 2022 prior to the most recent period of balance sheet normalization (QT) which started in the spring of 2022 and ended in December 2025: "Over time, the Committee intends to maintain securities holdings in amounts needed to implement monetary policy efficiently and effectively in its ample reserves regime."[11] Since December 2025, the Fed has conducted reserve management purchases (RMPs), thus ending QT and increasing balance sheet size to keep reserves ample. [12] The Federal Reserve Bank of New York has stated that RMPs will be high in the months leading up to the April tax deadline to prevent reserves falling below ample as the TGA grows after the tax deadline. RMPs are thus front-loaded relative to needs, with reserves still adjusting passively to the TGA after the tax deadline consistent with an ample reserves approach.

Figure 6 illustrates the strong negative correlation between changes in the TGA and changes to reserves plus ON RRP balances that results from the ample reserves/ample reserves with positive ON RRP balances approaches, especially in the second half of the sample. Panel A shows 13-week changes in reserves plus ON RRP balances and in the TGA. Reserves plus ON RRP balances have fluctuated with the need to fund quantitative easing and market functioning purchases and with TGA fluctuations. In the first half of the sample, QE effects dominate and the successive rounds of QE (initiated in 2008, 2010 and 2012) are visible in reserves plus ON RRP balances, while TGA balances pre-2015 were fairly stable. With the change in the Treasury's cash management policy in 2015 and large TGA fluctuations due to debt ceiling episodes, shocks and seasonality, the TGA becomes more volatile and is matched by opposing movements in reserves plus ON RRP balances. The movements in 2020 are an exception as market functioning and QE purchases in 2020 were so large that reserves plus ON RRP balances increased despite a sharp increase in the TGA. Figure 6 Panel B illustrates the strong negative correlation between reserves plus ON RRP balances and the TGA focusing on seasonal patterns across weeks of the year.

As for the active securities approach, this was used reactively in mid-September 2019 when an increase in the TGA occurring after a period of balance sheet runoff led to reserve scarcity (I expand on this episode below).

[10] Statement Regarding Monetary Policy Implementation and Balance Sheet Normalization
[11] Federal Reserve Board - Policy Normalization
[12] Statement Regarding Reserve Management Purchases Operations - FEDERAL RESERVE BANK of NEW YORK.

Fed lending tends to be modest, and an active lending approach has not been used as the main way to address TGA fluctuations at the Fed. Lending has, however, been used as a supplement to the ample reserves approach to limit interest rate volatility. In July 2021, the Fed added a new facility, the Standing Repo Facility (SRF) for this purpose. The SRF has broader eligibility than the discount window in that dealers (as opposed to only banks) have access. Furthermore, the SRF rate and the discount window rates are now at the top of the target range, as opposed to the discount window rate being 50 bps above the top of the range in September 2019. The Fed has furthermore emphasized operational readiness of potential borrowers in using its lending facilities, has removed the overall cap on facility take-up, and has renamed the facility to Standing Repo Operations (SRPs) to clarify that use should be viewed as part of normal liquidity management (as opposed to intended only for crisis times as may be implied by the word "facility").

b. Design principles for policy choice

When comparing approaches, the following design principles may be considered relevant.

Interest rate control: It is desirable to avoid reserve scarcity which could be associated with interest rate volatility.

Control of the Fed's overall policy stance: In addition to short market rates, the Fed's policy stance is affected by the amount of stimulus imparted by asset holdings acquired for QE or market functioning purposes. It is desirable to avoid effects of TGA fluctuations on the policy stance.

Communication: The Fed may not want to be perceived as changing its policy stance (short rates or longer rates) in response to fluctuations in the TGA. This could be perceived by the public as fiscal policy affecting monetary policy, even if the effect is of a somewhat technical nature.

c. A new angle on the active securities approach: Back the TGA with bills

In the next section, I will review the problems with ample reserves approaches and argue that a simple version of an active securities approach would score better on the above policy design criteria. The approach I put forward for consideration is to back the TGA with Treasury bills (or other short-maturity investments like repo) and adjust Treasury bill (or other short term) holdings with fluctuations in the TGA. Treasury bill holdings would be reduced when the TGA falls. This could be done by simply letting Treasury bills roll off, or via outright bill sales. Conversely, Treasury bill holdings would be increased when the TGA increases. This approach is effectively TGA "segregation" in the sense that part of the Fed's balance sheet would effectively be separated into a simple component which has only Treasury bills on the asset side and the TGA on the liability side.

Figure 7 Panel A illustrates how the Fed's balance sheet would evolve with the TGA under the approach of backing the TGA with bills. The figure is focused on what the balance sheet would look like in the absence of a need for QE, market functioning purchases or lender of last resort lending. One could refer to this as the Fed's "steady state" balance sheet or "money supply" balance sheet. This balance sheet is driven by the demand for Fed liabilities (i.e., money demand). Specifically:

$$\text{Fed assets} = \text{Currency \& other autonomous factors} + \text{TGA} + \text{Estimated ample reserves level} \quad (4)$$

$$\text{Reserves} = \text{Estimated ample reserves level} \quad (5)$$

On the liability side, the TGA as well as currency and other autonomous factors would fluctuate as they did historically, as illustrated in the right-hand chart. As for reserves, a desired degree of reserve scarcity would be chosen and maintained (roughly) over time. For example, reserves could be chosen to the smallest ample level defined as the level that sets reserve scarcity (EFFR-IOR) to zero. The ample reserve level will evolve over time with the banking sector's reserve demand. An estimate of the time series of the ample level of reserves is illustrated with the purple line in Figure 7 Panel A, right chart. The ample reserves estimation is taken from Lopez-Salido and Vissing-Jorgensen (2025). They assume that the convenience yield on reserves net of the marginal balance sheet cost is log-linear in reserves and liquid deposits,

$$v_R'(Reserves, Deposits) - \varphi = B + C * \ln(Reserves) + D * \ln(Liquid\ Deposits) + U \quad (6)$$

and thus estimate a reserve demand function of the form[13]

$$EFFR - IOR = B + C * ln(Reserves) + D * ln(Liquid\ Deposits) + U. \quad (7)$$

In (7), *C* is negative because the marginal value of reserves falls with additional reserve holdings, while *D* is positive because the marginal value of reserves is higher when the banking sector has more liquid deposits to manage. Defining ample reserves (the minimum level at which reserves are ample) as the level at which the EFFR-IOR spread is predicted to be zero, the ample reserves level is given by

$$0 = B + C * \ln(Reserves) + D * \ln(Liquid\ Deposits) \quad (8)$$

$$\Rightarrow\ Reserves^{Ample} = \exp\left(\frac{-B - D * \ln(Liquid\ Deposits)}{C}\right). \quad (9)$$

With a balance sheet driven by money demand, the development of the overall balance sheet will depend on the evolution of the demand for each of the liabilities. If the TGA balance changes, and the demand for the Fed's other liabilities (currency, other autonomous factors, reserves) is unchanged, then the TGA balance change would translate dollar-for-dollar to a change in the Fed's overall balance sheet size. This

[13] They account for the fact that the ON RRP facility implies a lower bound for $EFFR - IOR$ (see the paper for details).

would roughly be the case for TGA changes due to debt ceiling events since it is apparent from Figure 7 Panel A, right chart, that the ample level of reserves and currency & other autonomous factors do not decline during debt ceiling episodes (periods with a very low TGA in the chart). As for seasonal variation, Figure 8 shows that the seasonal variation in the ample level of reserves is negatively related to that in the TGA but modest in size. The approach of backing the TGA with bills would thus lead to a seasonal variation in the Fed's overall liabilities that is a bit smaller than the seasonal variation in the TGA.

On the asset side, illustrated in the left chart of Figure 7 Panel A, Treasury bill holdings held for the purpose of supplying the TGA would move with the TGA (the red line is the same in both charts). Additional assets (the blue line) would be held to supply the sum of currency, the other autonomous factors and reserves. I do not take a stand here on what the composition of those assets should be.[14]

In periods where QE, market functioning purchases or lender of last resort lending were needed, the balance sheet would be larger than that illustrated, or the asset composition may differ. For example, with a maturity extension program, asset size would be unaffected, but asset composition would change.

5. Challenges of ample reserves approaches and how backing the TGA with bills could help

This section compares the Fed's ample reserves approach where assets do not adjust actively to TGA fluctuations with an approach of backing the TGA with bills. The comparison is done along the dimensions of interest rate control, control of the Fed's overall policy stance, and communication.

a. Interest rate control

This sub-section lays out how the approach of backing the TGA with bills allows for a similar level of interest rate control with a smaller average balance sheet size than in an ample reserves approach.

In general, interest rate volatility can arise from reserve supply shocks driven by the autonomous factors or from reserve demand shocks. As is clear from Figure 5 Panel A, because of the convexity of the reserve demand curve, the effect of reserve supply shocks is larger at lower supply because the equilibrium then fluctuates on a steeper part of the demand curve. Furthermore, again due to reserve demand curve convexity, horizontal reserve demand shocks have a larger effect on the equilibrium short rate at lower levels of supply. Reserve supply and demand shocks may be linked in that a negative reserve supply shock may cause a

[14] I have argued elsewhere (Vissing-Jorgensen (2023)) that welfare may be higher if central banks supply money by holding assets that themselves do not have large convenience yields because a central bank supplying a steady amount of money does not benefit from the liquidity/safety of those assets. This argument would suggest supplying currency and other autonomous factors with assets other than Treasuries in times where Treasuries have convenience yields.

transitory positive demand shock to aggregate reserve demand until reserves have re-equilibrated across banks.[15]

A complicating factor is that the reserve demand function is not known perfectly in terms of its drivers and functional form, leading to uncertainty about the reserve level at which interest rate volatility may increase materially. Lopez-Salido and Vissing-Jorgensen (2025) make progress on this issue by providing a reserve demand function (described above) that appears to fit the post-GFC data well. They show that the predicted EFFR-IOR spread in their reserve demand model peaked in September 2019, the month of September 17, 2019, yield spike. This suggests that the predicted spread (which was 4 bps) can be used as a guide to the level of reserve ampleness or scarcity at which interest rate volatility may pick up. Balance sheet normalization can then be stopped before that predicted spread is reached. Or policymakers may want to play it a bit more safe by only letting reserves fall to the level where the predicted spread is a number below 4 bps (I use a 0 bps predicted spread when defining ample reserves throughout).

For any chosen level of the (maximum tolerated) predicted spread, policymakers have a choice in how to avoid reserves falling below the desired level. An approach of backing the TGA with bills is *a more efficient way to ensure reserves do not fall below ample than the Fed's current ample reserves approach*. For comparison with my approach as described in Figure 7 Panel A, I illustrate in Figure 7 Panel B what the Fed's "money supply balance sheet" would have looked like since 2015 under an ample reserves approach designed to (i) keep reserves ample even when the TGA was as its peak level and (ii) have Fed assets evolve passively in the sense of changing smoothly rather than adjusting in real time to TGA developments. Specifically, I construct the ample reserves balance sheet to satisfy:

$$\text{Fed assets} = \text{Currency \& other auto. factors} + \text{TGA peak level} + \text{Estimated ample reserves level} \quad (10)$$

$$\begin{aligned}\text{Reserves} &= \text{Fed assets} - \text{Currency \& other autonomous factors} - \text{TGA} \\ &= \text{Estimated ample reserves level} + [\text{TGA peak level} - \text{TGA}] \quad (11)\end{aligned}$$

The TGA peak level is the level that may be expected to occur over the foreseeable future. Based on the observed peak values of the TGA in Figure 1, Panel A, I set the TGA peak level to $450B from January 2015 to March 2020 and to $1000B from April 2021 to February 2026.[16] I assume that the high TGA value during COVID (April 2020 to March 2021) was not foreseeable and that the TGA peak level was adjusted with the actual TGA during this one year period. The red line in Figure 7 Panel B, right chart, shows the

[15] In the words of Dallas Fed President Lorie Logan: "When reserves drop sharply on a single day, the banks that initially loose reserves aren't necessarily those that value reserves the least. Until the reserves redistribute, there's a temporary increase in aggregate reserve demand." (Speech, August 25, 2025, Opening remarks for panel titled 'Post-Pandemic Challenges for Monetary Policy Implementation' - Dallasfed.org).

[16] I do not use the target level as the since the actual TGA at times exceeds the target – this tends to happen after seasonally high tax inflows.

time series for the assumed peak TGA level. In the ample reserves approach, reserves are equal to the ample level when the TGA is at its peak level but otherwise exceed the ample level by the shortfall of the TGA from the TGA peak level (equation (11)). As a result, reserves and overall fed assets and liabilities are higher under the ample reserves approach than a policy of backing the TGA with bills. Essentially, an ample reserves approach keeps assets large enough that any plausible increase in the TGA can be allowed to reduce reserves without any need to actively change assets in response to TGA fluctuations.

The comparison between the two approaches is illustrated in Figure 7, Panel C, for Fed assets (left) and reserves (right). The approach of backing the TGA with bills supplies the ample level of reserves at each date and does not supply more than that. This is possible by adjusting fed assets with the TGA. The dynamic adjustment of assets under this approach is visible in the left chart. By contrast, the ample reserves approach supplies more reserves than needed most of the time. Assets are not adjusted with the TGA, only with the TGA peak level, and fluctuations in the TGA are allowed to pass through to reserves. Comparing the two paths for reserves in the right chart, *reserves are on average $399B lower on average for the approach of backing the TGA with bills than the ample reserves approach over the post-COVID period* since April 2021 ($271B lower over the full period shown back to January 2015).[17]

These results illustrate how the approach of backing the TGA with bills allows for a similar level of interest rate control with a smaller average balance sheet size. The literature covers a range of potential welfare costs to large central bank balance sheets, including (1) reserves crowding out bank lending Diamond, Jiang and Ma (2024), and Chakraborty, Goldstein and MacKinley (2020)), (2) reserves crowding in bank deposits (with associated financial stability risks, if the deposits are uninsured, Acharya, Chauhan, Rajan and Steffen (2022)), (3) reductions in available convenient assets available to investors if central banks supply reserves via holdings of such asset (Vissing-Jorgensen (2023)), and (4) the risk of central bank losses from large balance sheets leading to threats to central bank independence and less headroom for future QE (Hauser (2022)). In an ample reserves approach, the last of these problems arising from large balance sheets could be overcome with central bank holdings of short-maturity assets like Treasury bills (thus allowing assets and liabilities to be duration matched). However, this does not overcome the other three issues arising from large balance sheets.

[17] A simple example may be helpful to see the difference in the average reserve levels: Suppose the TGA fluctuated between $\$0B$ and $\$1T$ with a mean of $500B and the Fed estimated that the estimated ample reserve level was $3T (at all times). Suppose currency and other autonomous factors were zero.
With an approach of backing the TGA with bills, reserves could be kept near $3T at all times because Fed assets would be adjusted with the TGA. Average Fed assets would be $3.5T.
By contrast, an ample reserves approach would plan to avoid reserves scarcity when the TGA was at its peak and would have reserves of $3T when TGA=$1T and reserves of $4T when TGA=0 for an average reserve supply of $3.5T and average Fed assets of $4T.

As an alternative to achieving a smaller average balances sheet size, policymakers could design the approach of backing the TGA with bills to have the same average balance sheet size as in an ample reserves approach in which case they could achieve a lower risk of interest rate volatility. With a reserve level $399B above the estimated level of ample reserves (EFFR-IOR=0), reserves would be closer to the abundant range at all times with very little risk of interest rate volatility. By contrast, under the ample reserves approach, reserves drop to less ample levels (the level associated with predicted EFFR-IOR=0 in my example) when the TGA is near its peak.

This analysis illustrates how the approach of backing the TGA will bills would allow for a smaller balance sheet size, a lower risk of substantial interest rate volatility, or a mix of the two. This would be the case regardless of which asset was used to back the TGA, but using bills has advantages that will be discussed below (it keeps the Fed's overall policy stance unaffected by the TGA and frees up bills for the private sector during debt ceiling episodes thus supporting interest rate control in money markets more broadly).

Related, the addition of the Standing Repo Facility in 2021 (renamed Standing Repo Operations in 2025) is helpful for limiting interest rate volatility from any unintended reserve scarcity regardless of which approach is used to manage TGA fluctuations. The approach of backing the TGA will bills has lower reserves on average and thus may be expected to lead to more frequent use of the Standing Repo Operations (SRPs) in response to reserve demand shocks not accounted for in the estimated ample reserve level.

b. Control of the Fed's overall policy stance: TGA fluctuations complicate quantitative tightening in ample reserves regimes

A further challenge when managing an ample reserves regime emerges if a debt ceiling episode takes place during a period of quantitative tightening or if quantitative tightening ends when the TGA is at a seasonal low. An approach of backing the TGA with bills helps avoid this problem.

Figure 9 illustrates the issue. Start at equilibrium 1 at which the Fed holds a particular amount of securities and the TGA is at the Treasury's desired normal value. Suppose the Fed is in a phase of quantitative tightening, reducing its security holdings gradually over time. Absent a debt ceiling event or TGA seasonality, the equilibrium would gradually move left from point 1 toward point 3, with reserves falling one for one with Fed securities holdings (once ON RRP balances go to zero, as is the case in the figure). Along the way, the Fed may decide to end QT before point 3 is reached if interest rate volatility increases more than intended. By contrast, suppose the debt ceiling becomes binding right as the equilibrium is at point 1 and that the Treasury funds the deficit by reducing the TGA (a similar problem occurs if the TGA drops due to seasonally high tax inflows). If the TGA (plus currency and other autonomous factors) declines faster than the Fed's securities holdings, then net securities (securities minus the autonomous factors) and

thus reserve supply will *increase* even though the Fed is doing QT. In this case, the equilibrium will move to the right over time, as illustrated by point 2 in the chart. Once the debt ceiling is raised or suspended, the Treasury quickly rebuilds the TGA back toward normal values over a few months, resulting in a fast transition from point 2 to point 3 (often called "snapback risk"). If point 3 involves reserve scarcity, the Fed has "overdone" QT because it did not receive any signal about reserve scarcity during the period where the debt ceiling was binding, yet it kept doing QT.

b.1 The experience from QT1

The Federal Reserve ended its first episode of QT at the end of August 2019. This is visible in Figure 2 Panel A where the black line bottoms out at this time. The yield spike in the days around September 17, 2019, emerged after this period of QT as the TGA normalized after a debt ceiling event and amid seasonal tax inflows.

To illustrate the moving parts, Figure 10 Panel A zooms in on the year 2019, with the solid vertical line marking the end of QT1 at the end of August. On August 30, 2019, the TGA was low, at $133B as a debt ceiling event had recently ended with a suspension of the debt ceiling on August 2, 2019. August is also a month of seasonal lows in the TGA. The TGA was much lower than the Treasury's planned target value of $410B by the end of the year. Both debt ceiling dynamics and seasonal variation in the TGA contributed to a subsequent large increase in the TGA. Substantial Treasury issuance on September 3 helped rebuild the TGA, as did large tax payments on September 13 and 16 prior to the September 16 deadline for estimated tax payments. Between August 30 and September 16, the TGA increased by about $170B, leading to a corresponding drop in reserves (ON RRP balances were close to zero at the time). The resulting spike in short market rates on September 16 to 18, 2019, is illustrated in Figure 10 Panel B for the effective fed funds rate relative to IOR.[18] Over the following days and months, the Fed injected reserves via Treasury bill purchases and repo lending, thus allowing reserves to increase by about $300B even as the TGA was further rebuilt to the Treasury's target level.

Mapping back to Figure 9, the QT1 experience illustrates the difficulty of ending QT during a period with a low TGA, due to the risk of reserves subsequently falling further as the TGA increases to normal values.

[18] The spike in repo rates was even larger, likely due to a mix of higher Treasury supply (which led to increased need for repo funding) and tax payments (which led to reduced money market fund assets and thus the supply of repo funding from money market funds), see e.g. Anbil, Anderson and Senyuz (2020).

b.2 Ending QT2 early amid worries of TGA rebuild

By QT2, the Fed appears to have become more cautious in the timing of ending QT. Knowing the risk of overdoing QT, the Fed may – when standing at a point such as point 1 in Figure 9 decide to slow QT, pause QT, or end QT earlier than it would have without a debt ceiling episode (or seasonal low) leading to a low TGA level. In its March 19, 2025, FOMC statement, the FOMC slowed QT, announcing a reduction in the monthly redemption cap on Treasury securities from $25 billion to $5 billion. The minutes stated that this was a "natural progression of the slowing decided at the May 2024 meeting" but also that "some participants noted that a slower pace of runoff would also help guard against reserve scarcity emerging with little advance notice during a period of potentially rapid increase in the TGA". Market commentary interpreted the slowing of QT as due to debt ceiling concerns as described in Figure 9 and Chair Powell recognized the role of TGA fluctuations in the post-meeting press conference:[19]

> VICTORIA GUIDO (Politico). […] if you wouldn't mind talking a little more about the balance sheet decision and what drove that. Did that have anything to do with expectations of how the debt ceiling—raising the debt ceiling might affect the reserve supply?
>
> CHAIR POWELL. In terms of the balance sheet—so, yeah, we—I think—I guess the way I'd say it is, you know, it was the flows in and out of the, the TGA that got us thinking about it, but as we, you know, as we thought about it, we really came to the view that this was a good time to, to make the move that we made. And, broadly, Committee came around—came around to the view that we, we would do the same thing we'd already done, which is, once we—I guess in June, we— was it June? Whenever it was, we, we lowered the pace of QT, and we're just going to do that again. […] And, of course, now, the TGA is emptying out, so reserves are, are higher now, so you can't really see the underlying signal. So we came around to the view, and, and it had a lot of appeal, and so we did it.

Figure 11 illustrates how concerns about the risk of reserve scarcity during a TGA rebuild could reasonably have been a factor in the FOMC's decision to slow runoff in March 2025. As of March 19, 2025, a debt ceiling episode was in progress. The TGA had been falling since early February, as is visible in the figure. Accordingly, reserves plus ON RRP balances had been increasing over the same period despite ongoing QT, visible in the figure as the uptick in the thin blue line leading up to March 19, 2025, which is the start of the light blue shaded area. Mapping back to Figure 9, March 19, 2025, is a bit to the right of point 1 toward point 2. To assess whether it is likely that reserves would fall below ample once the TGA returned to the Treasury's target level if QT was continued at an unchanged pace, the light blue shaded area of the figure provides projections under the assumption that balance sheet runoff had been continued with unchanged redemption caps ($25B/month for Treasuries and $35B/month for MBS). The thick blue line shows the hypothetical evolution of the value of reserves plus ON RRP balances after TGA rebuild

[19] Wall Street Journal, March 19, 2025, Fed Tweaks Its Balance-Sheet Approach as Debt Ceiling Looms - WSJ. Transcript of Chair Powell's Press Conference -- March 19, 2025.

(corresponding to point 3 in Figure 9). The line slopes down because the longer it may take for the debt ceiling to be raised/suspended and the TGA to be rebuilt, the more balance sheet runoff would be done in the meantime and thus the lower the value of reserves plus ON RRP balances at the time the TGA returned to the target level of $850B. The thick blue line is calculated as

$$\begin{aligned}(\text{Reserves} + \text{ON RRP balances})_t^{Hypothetical} \\ = (\text{Reserves} + \text{ON RRP balances})_{March\ 19,2025}^{Actual} - \left(\$850B - TGA_{March\ 19,2025}\right) \\ + (\#\text{Weeks, March 19, 2025, to } t) \\ * (\text{Weekly change in Fed assets} - \text{Weekly change in currency etc.})^{Hypothetical}\end{aligned} \quad (8)$$

where the last line estimates how much Reserves + ON RRP balances would change per week post-March 19, 2025, if there had been no change to redemption caps and assuming that weekly changes in currency etc. (i.e., currency and other autonomous factors excluding the TGA) would be roughly similar post-March 19, 2025, as in the recent past. The last line can be calculated as $(\text{Weekly change in Reserves} + \text{ON RRP balances}) + (\text{Weekly change in TGA})$ and is estimated using the averages over the period June 2024 to March 19, 2025, during which redemption caps were constant. The thin purple line in Figure 11 is an estimate of the level of ample reserves, defined as the value that would set the EFFR-IOR spread to 0 bps. This is the same line as the purple line in Figure 7 Panel A. The thick purple line extrapolates the ample reserves estimate, assuming the same slope as in the prior 6 months leading up to March 19, 2025.

From Figure 11, as of March 19, 2025, the actual value of Reserves + ON RRP balances was at $3.62T much above the estimated ample reserves level at $2.76T. While the ample reserves level is, of course, estimated with uncertainty, the difference between the two values is large and positive. However, as shown by the thick blue and thick purple lines, over time (1) the level of ample reserves would likely increase as it had done so in the recent past and (2) the level of Reserves + ON RRP balances after debt-ceiling resolution and rebuilding of the TGA would fall quite fast if the pace of runoff was not slowed. Unless the debt ceiling was raised or suspended soon after March 19, 2025, continuing QT at an unchanged pace would risk that reserve fell below ample. As of May 9, 2025, the Treasury estimated that the estimated X-date would likely be in August or later.[20] Adding about four months for the TGA to be rebuilt (based on the last few prior debt ceiling episodes), TGA rebuild may not have been expected to happen until late 2025. At that time Reserves+ON RRP balances (which at that point would likely only be reserves) may be below the ample reserves level. Notice how the thick blue and thick purple lines intersect before the end of 2025 which is the end of the light blue shaded area. Adding to this uncertainty about the true level of ample

[20] The X-date is the date on which the TGA was expected to hit zero. The projected timing is in Debt Limit Letter to Congress - May 9, 2025

reserves, and about the X-date, it is apparent that the decision to slow Treasury runoff could partly be motivated by a desire to avoid reserve scarcity as some participants noted according to the meeting minutes.

b.3 How backing the TGA with bills keeps scarcity signals continuous and thus allows more QT

The March 19, 2025, FOMC decision to continue balance sheet runoff at a slower pace reduced the risk of reserve scarcity emerging during a potential rapid increase in the TGA. By helping to ensure that reserves remain ample, the decision scores well on the first design principle of retaining interest rate control. However, with slower runoff, the Fed holds more Treasuries post-March 19, 2025, and thus more assets with duration risk (and convenience yields). In that sense, the ample reserves approach to managing TGA volatility scores less well on the second design principle since changes to assets affect the Committee's overall policy stance.

Under the alternative approach of backing the TGA with bills and adjusting bill holdings with TGA fluctuations, balance sheet runoff of Treasury notes and bonds and of MBS could have been continued without regard to the debt ceiling event. Looking at Figure 11, instead of Reserves + ON RRP balances starting to increase as the TGA started to fall in February and March, under the alternative approach Reserves + ON RRP balances would keep falling at the same pace as had the TGA stayed constant. This would be achieved by the combined reduction in bills (matching the decline in the TGA) and in notes and bonds (from QT). As a result, the approach of backing the TGA with bills and adjusting bill holdings with TGA fluctuations would help insulate both short and long interest rates from TGA fluctuations as QT could proceed as planned regardless of any debt ceiling episode. Backing the TGA with bills thus avoids effects of TGA fluctuations on the Fed's overall policy stance. Importantly, because this approach would provide a continuous flow of information about emerging reserve scarcity – and thus the ability to end QT only when needed – more QT would likely have been possible (thus leading to a smaller balance sheet) without risking a loss of interest rate control.

c. Communication

An ample reserves policy comingles the Fed's tasks, making Fed decisions more difficult to communicate. In particular, it may be difficult to communicate that adjusting the Fed's holdings of assets (with duration or prepayment risk) in expectation of or in response to fluctuations in the TGA is a technical issue rather than an effect of fiscal policy on monetary policy.

By contrast, backing the TGA with T-bills should be easy to communicate. It is a straightforward way to provide banking services to the government while keeping one Fed job (being the government's bank) separate from another Fed job (monetary policy). Historically, the Fed has always accommodated *trends* in

autonomous factor demand by increasing its assets, growing assets in line with demand trends. Backing the TGA with bills and adjusting bill holdings reactively would simply extend the historical approach to also address *fluctuations* in the government's banking needs. Furthermore, the change would have no effect on the TGA. The government would have the same ability to increase or decrease TGA balances as previously.

6. Potential effects on the Treasury bill market

While the Fed does not target Treasury bill yields directly, achieving a broad transmission of policy to short-term interest rates beyond fed funds rates is useful. This section considers how a change to an approach of backing the TGA with bills may affect bill markets in general, in debt ceiling episodes, and in terms of seasonality.

a. Smaller balance sheet, lower bill holdings

The Fed has not stated the precise plans for how its bill holdings will evolve under the ample reserves regime. However, the implementation note issued following the December 2025 FOMC meeting directed the Desk to make reserve management purchases in Treasury bills and short-term Treasury securities. This suggests that to the extent that the Fed's balance sheet will on average be larger under the ample reserves approach, so will the Fed's bill holdings. As a result, bill scarcity may on average be lower under an approach of backing the TGA with bills.

That said, the evolution of bill scarcity depends on whether the Treasury adjusts bill supply in response to Fed holdings. The Treasury's focus is on "privately held net marketable borrowing" which nets out effects of Fed holdings.[21] This reflects the fact that since the Fed transmits its profits to the Treasury, Treasuries held by the Fed do not generate a cash flow for the consolidated government. In making its issuance choices, the Treasury would thus naturally adjust its supply mix in response to any sustained change in Fed demand. If so, there may be little difference in bill scarcity across the two Fed approaches for managing TGA fluctuations.[22]

In general, issues related to Treasury bill scarcity may be less important going forward than in the past as the large Treasury supply in recent years has tended to lower Treasury convenience yields. Chumbo and Krishnamurthy (2025) document that the commercial paper-Treasury bill spread has been negative or close to zero since 2024. Comparing Treasury bills to Treasury notes and bonds, Figure 12 Panel A shows the 4-week and 13-week z spreads over time, based on the methodology of Greenwood, Hanson and Stein (2015).

[21] See, e.g., Treasury Announces Marketable Borrowing Estimates | U.S. Department of the Treasury

[22] It is important to note in this regard that a change in the Fed's Treasury bill/note/bond holdings in its steady state portfolio is different from a change for QE stimulus purposes in that the Treasury generally would not be expected to try to fully "undo" the latter.

They define the *n*-week z-spread $z_t^{(n)} = y_t^{(n)} - \hat{y}_t^{(n)}$ as the difference between the actual yield on *n*-week bills ($y_t^{(n)}$) and the predicted *n*-week yield ($\hat{y}_t^{(n)}$) based on a yield curve model estimated using only notes and bonds with remaining maturities greater than three months. The *n*-week z-spread thus captures how much lower the *n*-week bill yield is than one would expect based on extrapolation from on the rest of the yield curve. Negative z spreads thus correspond to positive Treasury bill convenience yields. The yield curve model used is the six-parameter model from Gurkaynak, Sack and Wright (2006), as updated on the board's webpage. The 4-week and 13-week (3-month) bill yield series are from FRED. As is clear from Figure 12 Panel A, relative to longer Treasuries bills appear to have lost their convenience yield since 2024. Any effects of higher Fed bill holdings (to the extent they are not offset by changes in Treasury issuance) may thus have smaller effects on bill yields than was the case on average historically.

b. Improved control over Treasury bill yields during debt ceiling episodes

Switching to an active securities regime in which the TGA is backed with bills could have some benefit in alleviating bill scarcity during debt ceiling episodes. During these episodes, the Treasury reduces bill supply if that is needed to keep the issuance of notes and bonds regular and predictable, implying that bill scarcity can emerge. A scarcity of safe Treasury bills can also emerge due to a reduction in the effective supply of convenient Treasury bills as securities maturing after the X-date are perceived as less safe or less liquid.

Stein and Wallen (2025) provide evidence that a scarcity of safe Treasury bills can lead to low bill rates during debt ceiling episodes, focusing on the 2023 debt ceiling episode. They study yield differences between Treasury bills and repo investments. T-bills that matured before the expected X-date had very low yields, followed by high bill yields near the X-date for bills maturing after the expected X-date.[23] Figure 12 Panel B replicates Stein and Wallen's fact for 2023 and adds more recent data to also cover the 2025 debt ceiling episode.[24] The yield on 1-month Treasury bills fell more than 100 bps below the expected 1-month repo rate in March and April of 2023 before increasing sharply above the expected 1-month repo rate from May 4 (the SVB crisis on March 10 likely also contributed to the drop in bill yields in March). This suggests that the market expected an X-date in early June, consistent with the Treasury stating on May 1 that it would be unable to meet its obligations by early June.[25] The low yield on 1-month bills maturing before the

[23] Cassidy and Mirani (2025) use the dynamics of Treasury bill issuance during debt ceiling events to construct three instruments for bill issuance. They document that lower bill issuance leads to larger convenience yields on bills, as well as downward pressure on short rates more generally and some increase in commercial paper issuance.

[24] ON RRP take-up falls to near zero during the extended period and market repo rates lifted off above the ON RRP rate. Therefore, I base the figure on TGCR as opposed to the ON RRP rate used by Stein and Wallen. I calculate the expected TGCR rate over the next month as of day t as: TGCR rate(t)+[1-month OIS(t)-effective fed funds rate(t)] where the OIS is based on the effective fed funds rate and the term in brackets measures the 1-month term premium.

[25] Secretary of the Treasury Janet L. Yellen Sends Letter to Congressional Leadership on the Debt Limit | U.S. Department of the Treasury

expected X-date likely emerged from an increase in the yield discount on safe and liquid securities amid a deterioration in the perceived safety or liquidity of bills (and possibly notes and bonds) maturing after the X-date. Stein and Wallen (2025) investigate why repo investments (at the Fed or in private markets) do not serve as a good substitute for Treasury bill investments, emphasizing that some investors prefer bills because they are used as collateral in derivatives and other transactions. Figure 12 Panel B provides related evidence for the 2025 debt ceiling episode. The 1-month bill yield fell about 20 bps in June 2025, with little change in the 1-month expected repo rate. The effect is thus less dramatic than for the 2023 episode, but present even during a period with generally lower bill convenience yields. The smaller yield effect may also be due to this event being resolved farther from the X-date which the Treasury projected to be in August 2025. As a result, the fraction of bills maturing after the expected X-date was smaller over the observed period of this event, leading to less downward pressure on bills that matured before the X-date.

An approach of backing the TGA with bills could be beneficial in alleviating the bill scarcity illustrated in Figure 12 Panel B. If the Fed's bill holdings fall when the TGA falls, this frees up more bills to hold for non-Fed holders. For example, the Fed could adjust its bill holdings with the TGA by letting some of its bills mature and not buying new bills to replace maturing ones. As the Treasury rolled over maturing bills into new ones, these could be purchased by sectors other than the Fed. Newly issued bills maturing before the X-date would be attractive to non-Fed buyers. Figure 13 provides an illustrative example to show how backing the TGA with bills and changing Fed Treasury bill holdings in response to TGA fluctuations would stabilize the path of private sector Treasury bill holdings during debt ceiling episodes.

> *Example:* The example contrasts three scenarios. One with no debt ceiling episode in an ample reserves regime (left charts in all panels in Figure 13), a debt ceiling episode in an ample reserves regime (middle charts), and a debt ceiling episode in a regime with the TGA backed with bills (right charts). Time is in months. Quantities are just examples and are not closely calibrated to the data.
>
> Assume that the government is running a deficit and debt increases (in fixed proportions of bills versus notes/bonds) unless the debt ceiling binds. The government keeps note and bond issuance regular and predictable, including being unaffected by debt ceiling episodes.
>
> For simplicity, assume that absent debt ceiling issues, the Fed's balance sheet and its components would all be stable over time (this is not central to the argument made). The Fed holds bills only in the regime of backing the TGA will bills. In this regime, the example assumes that total Treasury bill supply is higher by the peak amount of the TGA.
>
> With a debt ceiling event, suppose the debt ceiling starts to bind at date 3 and is increased or suspended on date 8 which is also the X-date. The TGA is rebuilt at date 9.

Reserves plus ON RRP balances: Absent a debt ceiling episode, the TGA is stable and reserves plus ON RRP balances are constant (Panel A left). With a debt ceiling episode, the TGA falls while the debt ceiling is binding (date 3 to 8) before being increased fast after the debt ceiling is increased or suspended (Panel A, middle and right). In an ample reserves regime, reserves plus ON RRP balances increase while the debt ceiling is binding, as the TGA declines while Fed assets are unchanged (Panel A, middle). By contrast, in a regime where the TGA is backed with bills, reserves plus ON RRP balances are isolated from TGA fluctuations (Panel A right) as the Fed's assets (specifically its bill holdings) adjust with the TGA.

Bill holdings of non-Fed investors: With a debt ceiling episode, bill supply is reduced to keep the supply of notes and bonds unaffected. In an ample reserves regime, bills held by non-Fed holders drop due to the lower supply (Panel B, middle chart). This is not the case if the TGA is backed with bills. Under this Fed policy, the Fed's bill holdings equal the TGA (the two lines overlap in Panel A right) which implies that fluctuations in Fed bill holdings buffer fluctuations in bill supply. When the debt ceiling binds, the Fed's bill holdings fall with the TGA, thus freeing up bills to hold for non-Fed holders. Once the debt ceiling is raised or suspended, the Fed buys part of the large amount of bills issued, leaving bill holdings of non-Fed holders to trend up smoothly through the debt ceiling episode (Panel B right). In fact, bill holdings of non-Fed holders evolve just as they would absent a debt ceiling episode (the green lines are identical in Panel B left and Panel B right). From when the debt ceiling binds and until the TGA is rebuilt, bill holdings of non-Fed holders are thus higher under the policy of backing the TGA with bills. This is beneficial to the extent that the extra bills mature before the X-date and thus have convenience yields from their safety and liquidity. That would be the case during the first months of a debt ceiling event. If the debt ceiling episode continues to the X-date, all Treasury bills mature past the X-date so at that point bills no longer provide convenience yields to their holders regardless of the Fed's decisions.

Notes and bonds: Due to the regular and predicable note and bond issuance policy, notes and bonds held by non-Fed holders are the same in all cases (illustrated by the green lines in Panel C).

Effects on the consolidated government's finances: In terms of the consolidated government's borrowing costs, how do the ample reserves approach and the approach of backing the TGA with bills compare during debt ceiling events? Consider non-Fed holders' bill holdings across approaches, the green lines in Figure 13 Panel B middle and right charts. In the ample reserves approach fewer bills will be issued to non-Fed holders during the debt ceiling event (possibly no bills, if the decline in bills in Figure 13 Panel B, middle chart, lines up with the amount of bills maturating). As a result of this lower bill supply, yields will be lower for new bills issued with

maturities before the X-date. The net effect on borrowing costs of rolling over fewer bills at lower yields is unclear, while rolling over fewer bills at high yields near the X-date is beneficial. Overall, from a straight budget perspective it is unclear which approach leads to lower borrowing costs for the consolidated government during debt ceiling events.[26]

c. Potential effects on the seasonality in Treasury bill yields

Turning to seasonality, an approach of backing the TGA with bills would, all else equal, increase the cyclicality in the bill supply available to the public. The Fed would buy bills when the TGA increased with seasonally high tax payments, given the modest offset from seasonality in the ample level of reserves (Figure 8).

Greenwood, Hanson and Stein (2015) document the causal effect of bill supply seasonality on yields using data from 1983-2009. They find that low bills supply following tax deadlines leads to higher bill scarcity as indicated by lower z spreads. The pre-GFC period was characterized by a stronger response of bill supply to the surplus (Table 2, Panel B). Fed bill buying lined up with changes in the TGA could bring back a stronger bill yield seasonality. A few observations on this issue. First, one may not see substantial bill yield seasonality emerge if Treasury bill convenience yields are generally low (as they were in the last few years and may remain given a Treasury issuance response to higher Fed bill holdings). Second, bill yield seasonality could be partly alleviated by using a mix of bills and repo, or a mix of bills and short-term Treasuries other than bills, for seasonal adjustments to Fed assets. Third, from an interest rate control perspective, reserve scarcity is worse than Treasury bill scarcity. Reserve scarcity leads to *upward* spikes in short market rates (EFFR, SOFR etc.) relative to IOR. By contrast, bill scarcity leads to *downward* spikes in bill yields relative to other short market rates (repo, predicted short rates as used in the z-spread etc.).[27] The former is more likely to lead to financial stability issues such as an unwind of levered trade if SOFR increases. It may thus be acceptable to have some bill yield seasonality in order to minimize seasonality in reserve supply.

[26] The discussion here focuses on differential effects across the two approaches to managing TGA fluctuations. Even with smooth public bill holdings there will likely be yield effects, just smaller ones. The Fed can add bill supply to the private sector, but some downward yield pressure will likely remain due to substitution from bills (and notes/bonds) maturing after the X-date.

[27] Intuitively, EFFR-IOR captures the convenience yield on reserves. If this convenience yield is large, EFFR has to increase as long as the Fed does not change the value of IOR. For bills, the predicted minus actual yield (i.e., the negative of the z-spread) captures the convenience yield on bills. When bills are scarce, this spread is large but that tends to emerge via lower bill yields, not increases in yields on less convenient assets, as seen for example in Figure 12 Panel B.

7. Implementation

Frequency of Treasury bill operations: From a practical perspective, with an approach of backing the TGA with bills, the Fed would need to how close to keep actual reserves to ample. With a bit of tolerance for deviations, weekly management of Fed bill holdings may be sufficient, perhaps supplemented with daily changes to Fed bill holdings on days with large tax payments. The Fed could design its bill portfolio with staggered maturities to allow some gradual bill reductions without outright sales, but some active buying and selling would likely be needed.

Magnitudes: As of February 25, 2025, the Fed holds $329B in T-bills. The latest target level for the TGA announced by the Treasury is $850B (Figure 1). A transition to TGA management via bills would thus suggest an increase in the Fed's bill holdings of about $521B. With MBS principal payments and reserve management purchases both directed to bills, the Fed will reach bill holdings of $850 over a period of a couple of years.

8. Conclusion

Via the Treasury General Account, the Federal Reserve provides important banking services to the government and thus the country. Since 2015, the government's money demand has increased and become more volatile. The higher TGA level provides the government a buffer to keep making payments for a week even in the event that Treasury issuance is paused due to a cyber attack, natural disaster, terror attack, or other crisis. Achieving this liquidity buffer is free to tax payers when it is supplied by the Fed: The Treasury issues additional securities and keeps the proceeds in the TGA. The Fed buys the additional securities and returns any interest payments to the Treasury via the Fed's remittances. The Fed is thus a natural supplier of deposits (money) to the government. However, the Fed also needs to achieve its monetary policy objectives, preferably without distortions from TGA fluctuations. A policy of backing the TGA with Treasury bills and adjusting bill holdings with the TGA achieves this. With this policy, the Fed could reduce the risk of interest rate volatility or the size of its balance sheet (or a mix of the two) and could manage its overall policy stance without interference from TGA fluctuations. Keeping the Fed's jobs separate should be easy to communicate to the public.

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Figure 1. The Treasury General Account balance: Time series of level and target level

The red line shows the TGA balance in daily data from January 2, 2007 to February 25, 2026, obtained from the Daily Treasury Statement. The black line is the Treasury's projected value of the TGA at the end of the next quarter from the Treasury's Marketable Borrowing Estimates. Vertical dashed lines mark dates on which the debt ceiling was increased or suspended, focusing on the period from 2015 onwards (the dates, collected from a variety of sources, are Oct 30 2015, Sep 8 2017, Feb 9 2018, Aug 2 2019, Oct 14 2021, Dec 16 2021, Jun 3 2023, and Jul 4 2025).

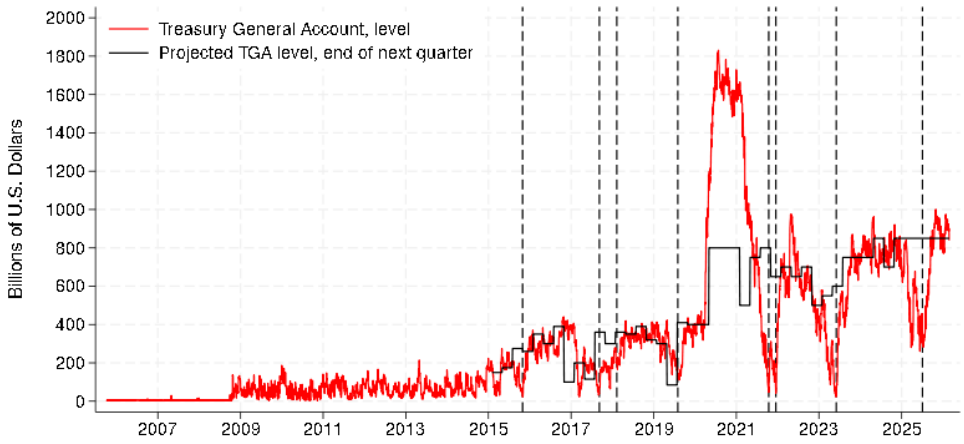
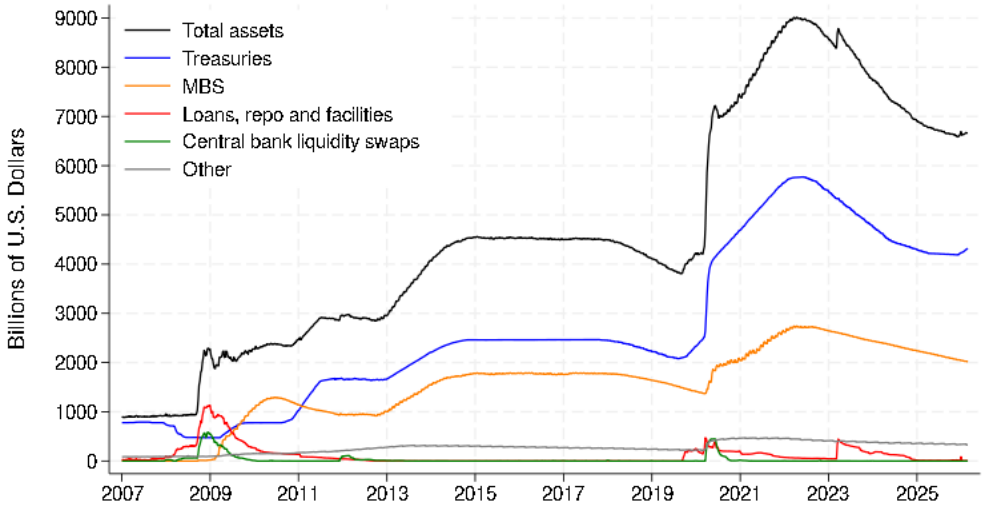


Figure 2. Federal Reserve assets and liabilities

Wednesday levels, January 3, 2007 to February 25, 2026. Source: H.4.1 release via FRED.

Panel A. Total assets and asset categories



Panel B. Liability categories

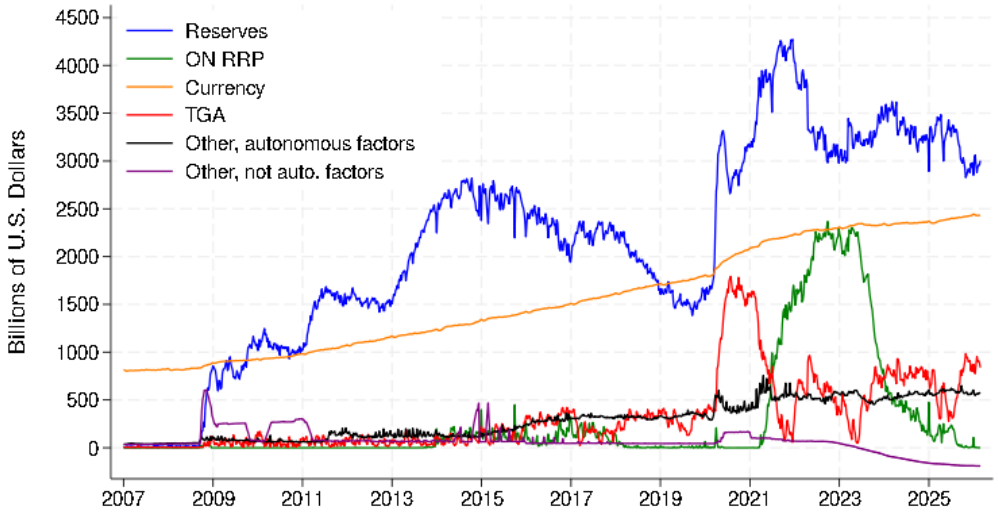
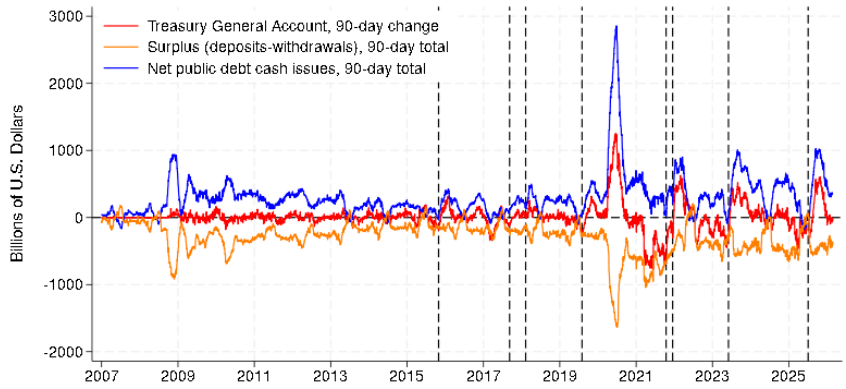
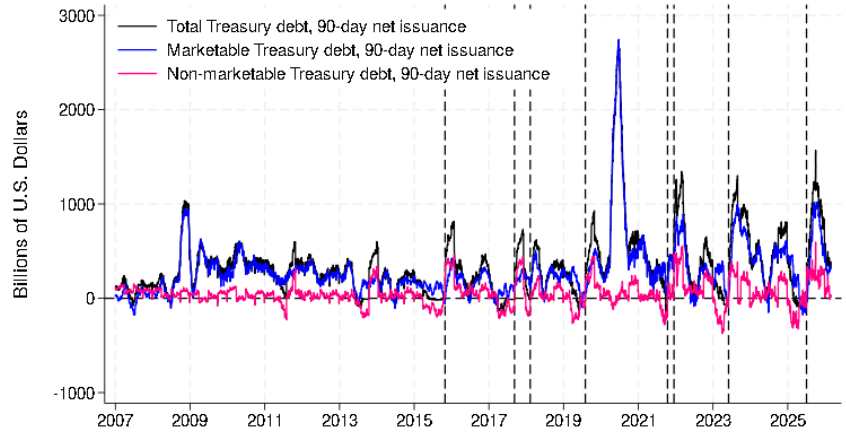


Figure 3. Debt ceiling episodes

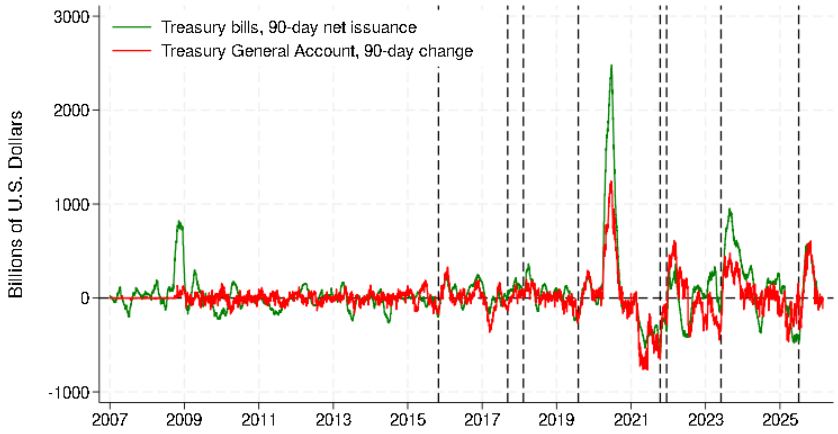
Panel A. Decomposing TGA changes into surplus and net public debt cash issues



Panel B. Components of total Treasury debt net issuance: Marketable and non-marketable debt



Panel C. Treasury bill net issuance and changes in the Treasury General Account balance



Panel D. Components of marketable Treasury debt net issuance: Notes, bonds and bills

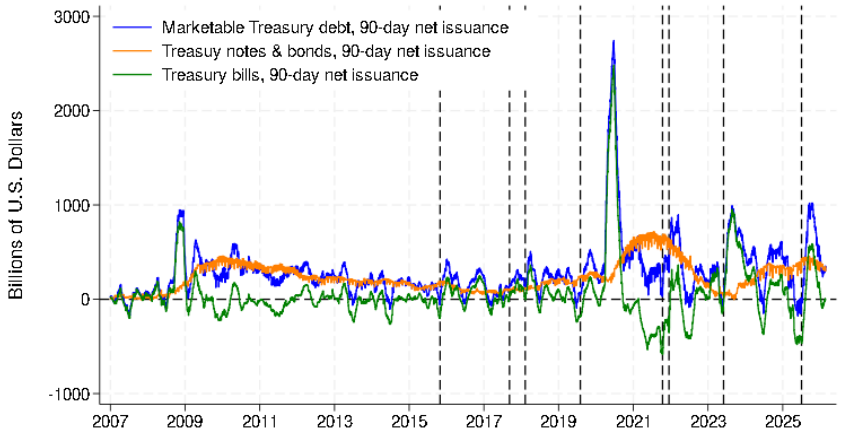


Figure 4. Seasonal patterns in the TGA, the federal surplus and net public debt cash issues

4-week changes in the TGA, the surplus, and net public debt cash issues, averaged by week of the year. The sample for this chart is May 1, 2015 to February 25, 2026.

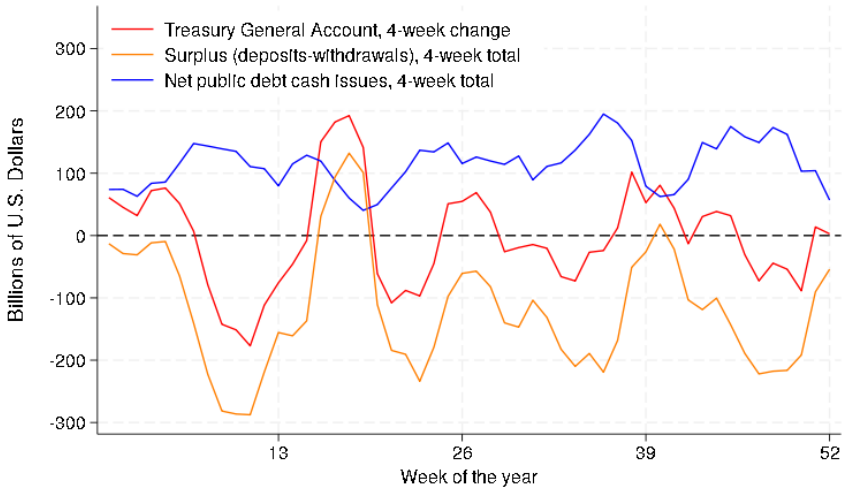
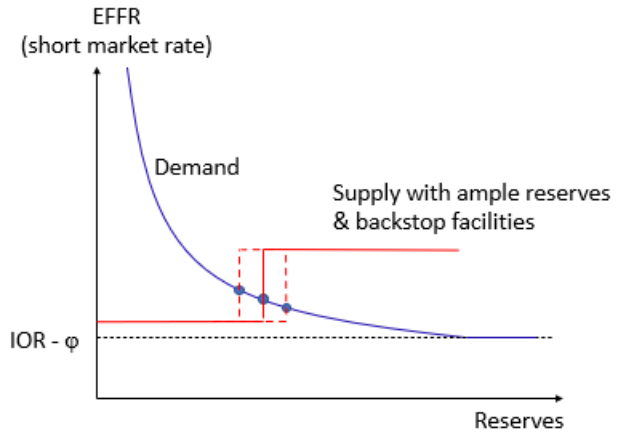


Figure 5. Effects of autonomous factor fluctuations on short market rates

Panel A. Effect of autonomous factor fluctuations in an ample reserves regime



Panel B. Managing autonomous factor fluctuations in an active securities regime

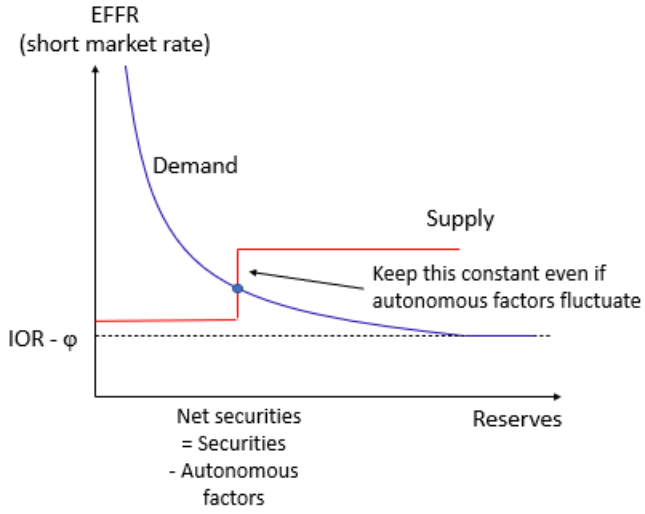
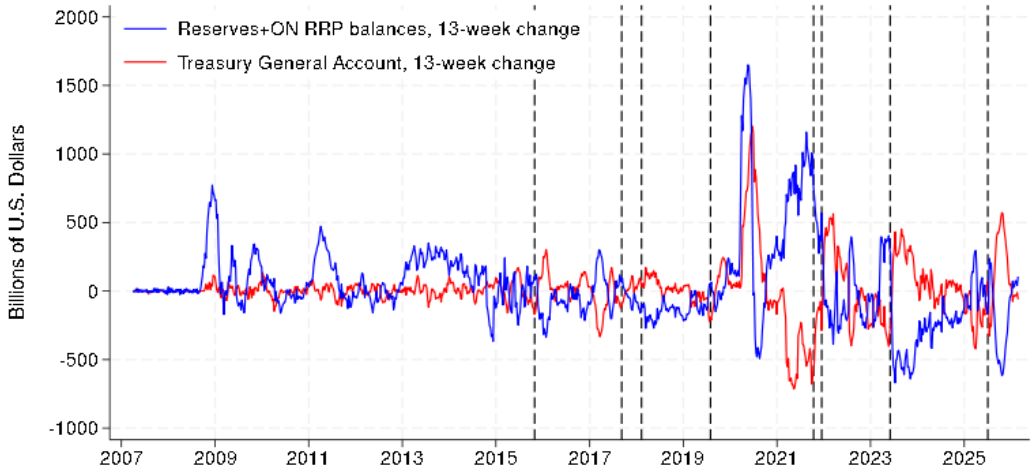


Figure 6. Reserves+ON RRP balances and their relation to the TGA

Data are from the H.4.1 release, Wednesday levels. Sample: January 3, 2007 to February 25, 2026.

Panel A. Time series of 13-week changes



Panel B. Seasonal patterns in TGA and Reserves+ON RRP balances

4-week changes, averaged by week of the year. Based on Wednesday data from FRED. Sample: May 1, 2015-February 25, 2026.

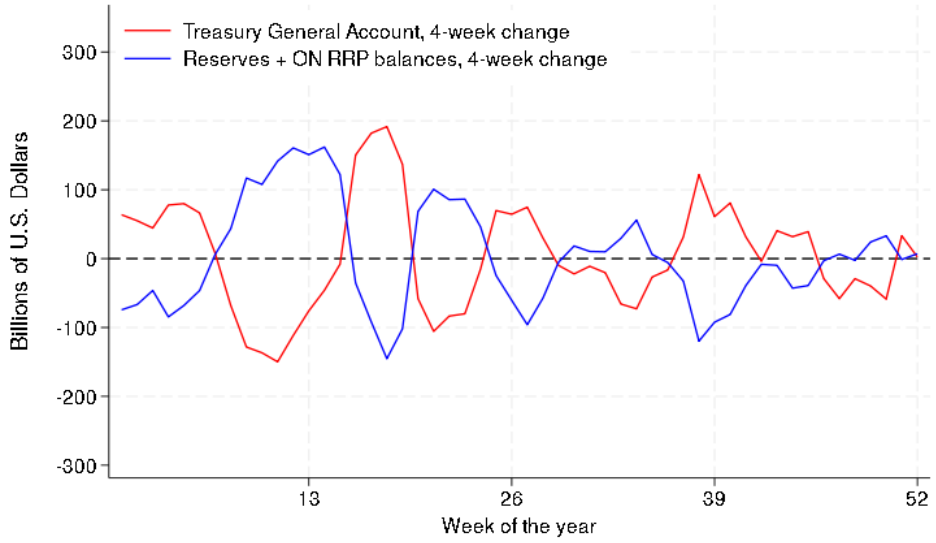
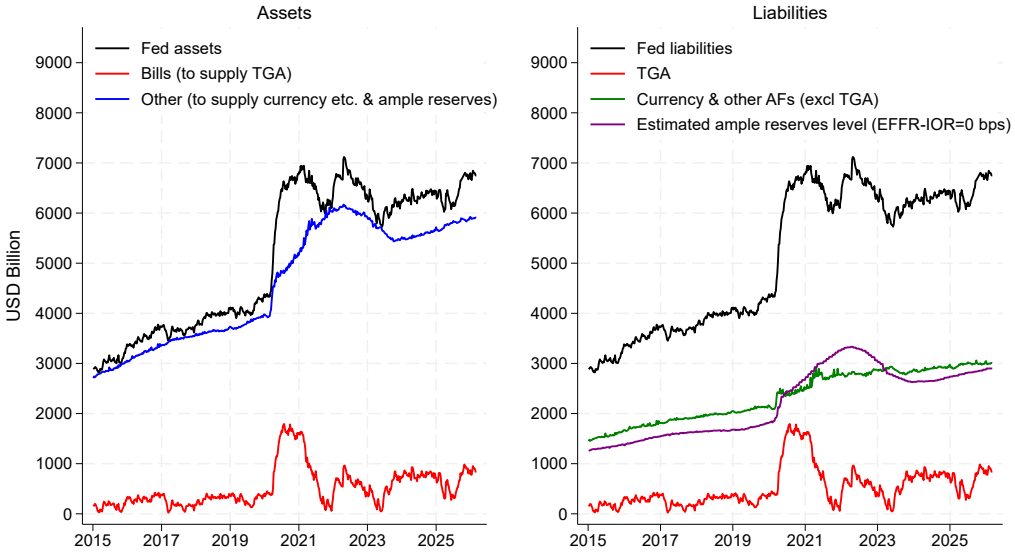


Figure 7. Hypothetical Fed balance sheet for money supply purposes

Based on weekly data to February 25, 2026.

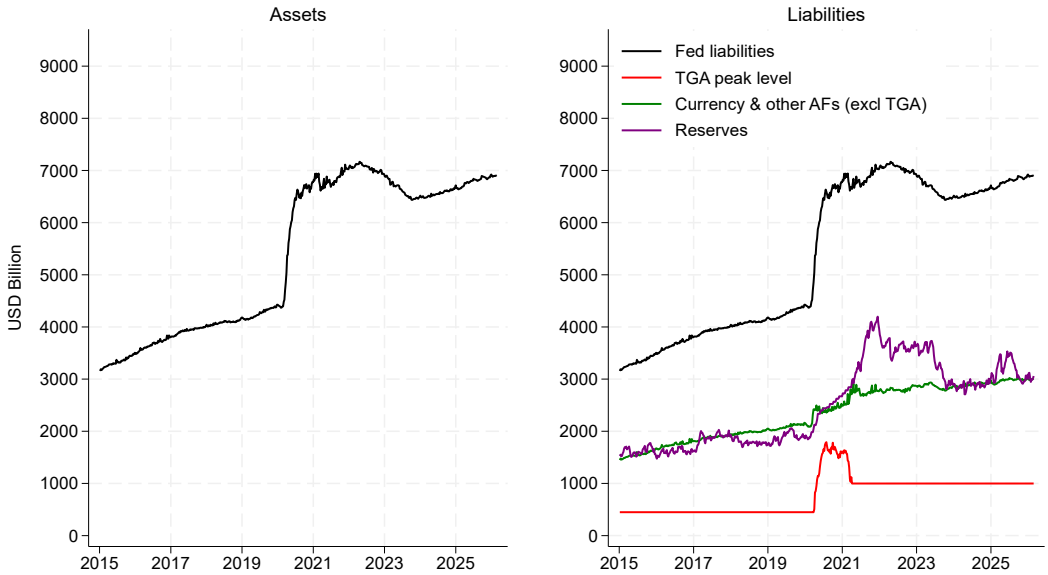
Panel A. TGA backed with bills approach

Fed assets = Currency & other autonomous factors + TGA + Estimated ample reserves level
Reserves = Estimated ample reserves level



Panel B. Ample reserves approach

Fed assets = Currency & other autonomous factors + TGA peak level + Estimated ample reserves level
Reserves = Fed assets - Currency & other autonomous factors - TGA
= Estimated ample reserves level + [TGA peak level - TGA]



Panel C. Comparison of Fed assets and reserves across the two approaches from Panel A and B

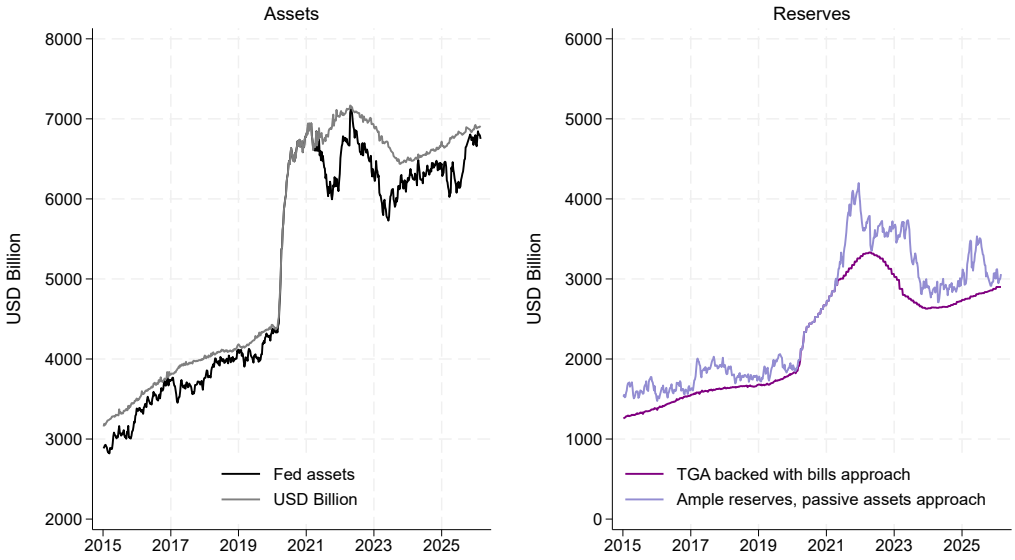


Figure 8. Modest seasonality in the level of ample reserves

4-week changes, averaged by week of the year. Sample: May 1, 2015-February 25, 2026.

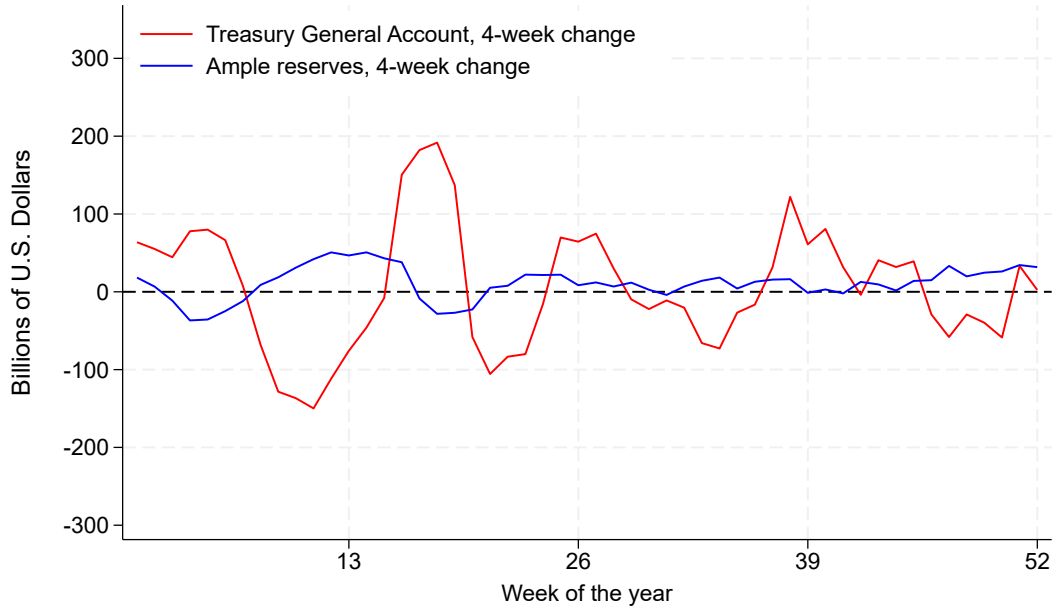
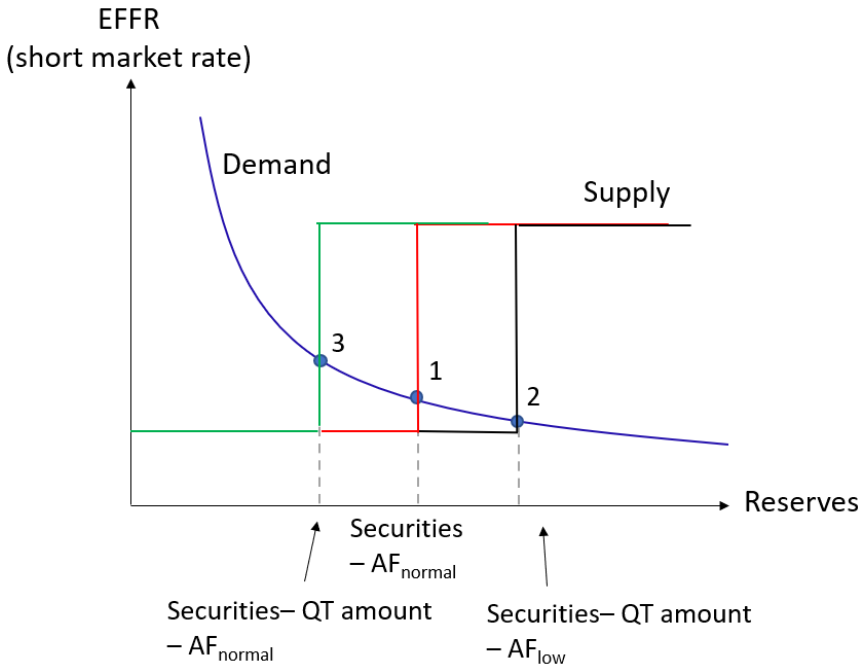


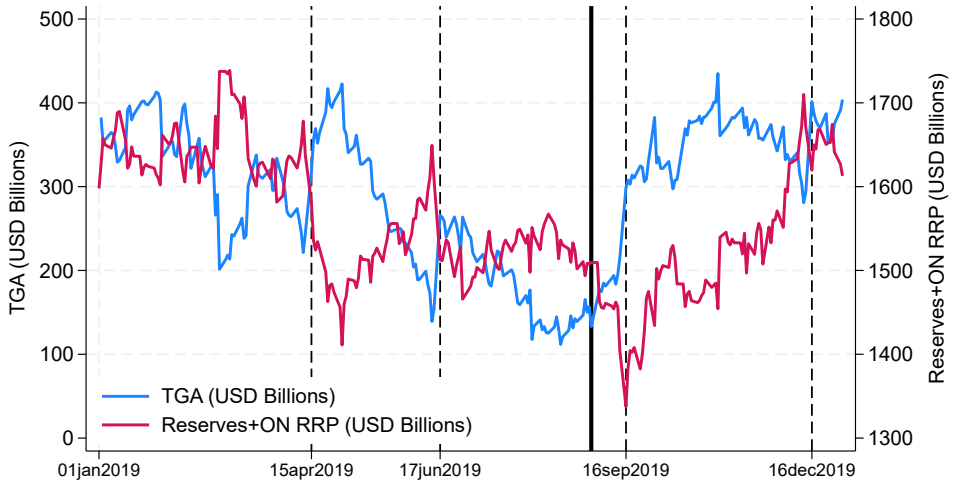
Figure 9. Effect of autonomous factor fluctuations during quantitative tightening in an ample reserves regime



"AF" denotes autonomous factors.

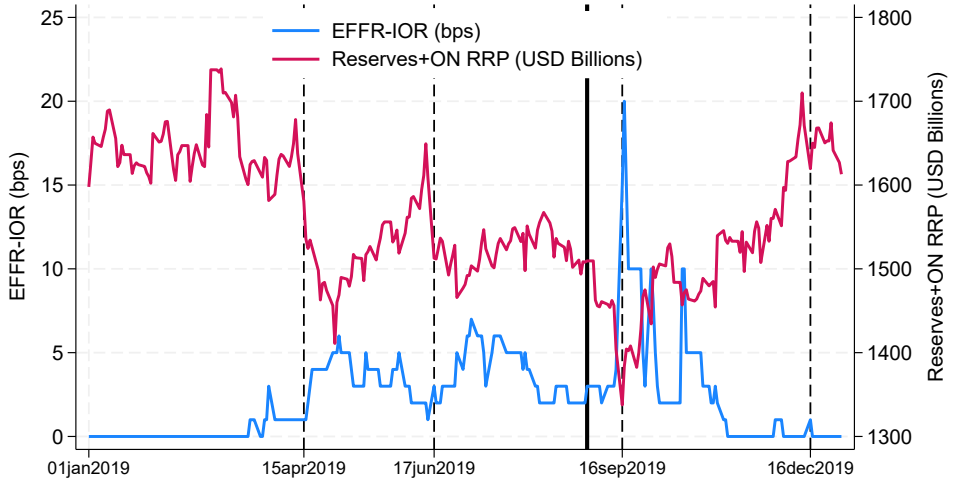
Figure 10. QT1, a debt ceiling episode and seasonal tax payments led to September 2019 yield spike

Panel A. The TGA and Reserves plus ON RRP balances over the year 2019



Note: Dashed vertical lines indicate key tax deadlines on 15apr2019, 17jun2019, 16sep2019 and 16dec2019.
The solid vertical line marks the end of QT1 at the end of August 2019.

Panel B. Reserves plus ON RRP balances and the EFFR-IOR spread over the year 2019



Note: Dashed vertical lines indicate key tax deadlines on 15apr2019, 17jun2019, 16sep2019 and 16dec2019.
The solid vertical line marks the end of QT1 at the end of August 2019.

Figure 11. Concerns about yield spike risk after a debt ceiling episode contributed to early end to QT2

The chart compares actual Reserves + ON RRP balances (blue line) to estimated ample reserve levels (purple line).

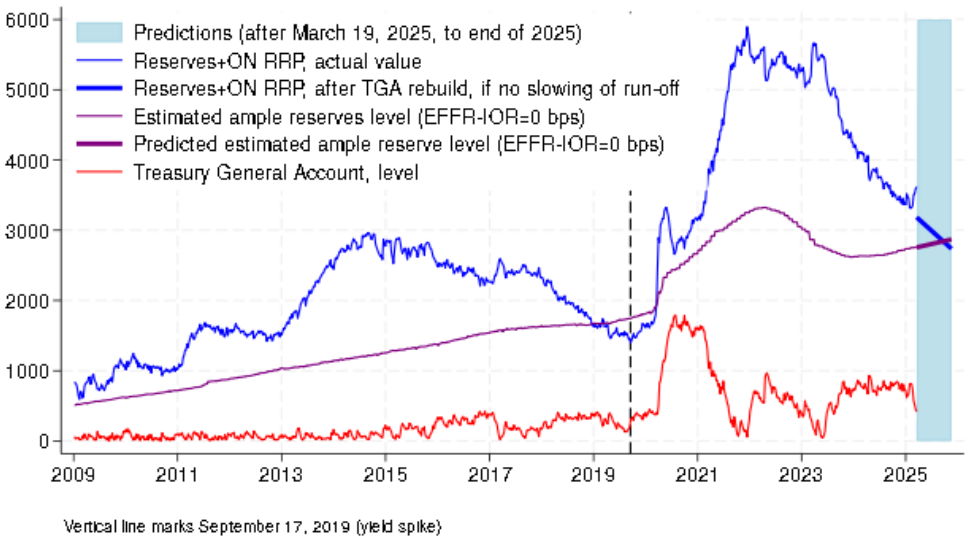
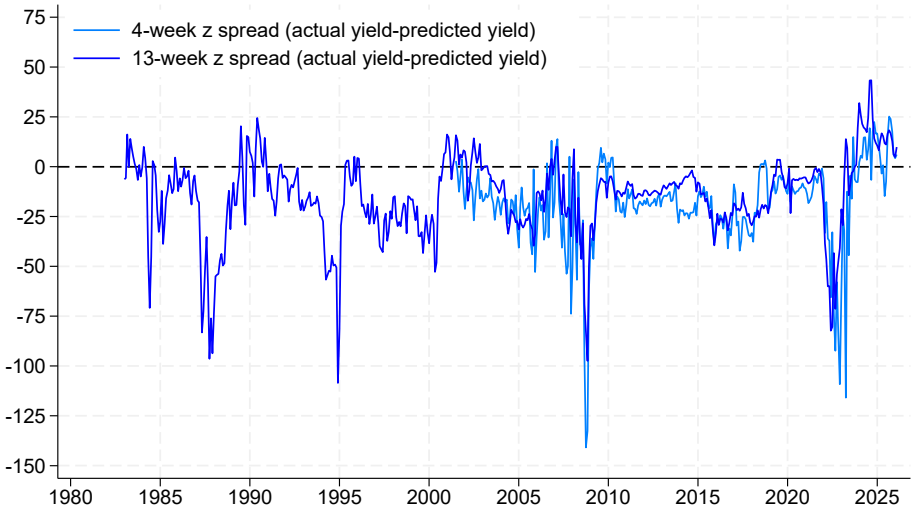


Figure 12. Treasury bill scarcity

Panel A. Bill scarcity relative to other Treasuries over time

Monthly averages, January 1983-February 2026



Panel B. Bill scarcity around debt ceiling events

Yields on 1-month bills and the 1-month expected repo rate

The figure shows the 1-month bill yield and the 1-month expected TGCR rate, both expressed on an annualized basis. Vertical lines mark June 3, 2023 (debt limit suspended) and July 4, 2025 (debt limit increased). The 1-month bill yield is from FRED (I use the 4-week yield and express it on an investment basis). The 1-month expected TGCR rate is calculated as TGCR rate(t)+[1-month OIS(t)-EFFR(t)], where the OIS is based on the effective fed funds rate and the term in square brackets thus measures the 1-month term premium. The TGCR and EFFR data are from FRED and the OIS series from Bloomberg. Sample: January 3, 2023-February 25, 2026.

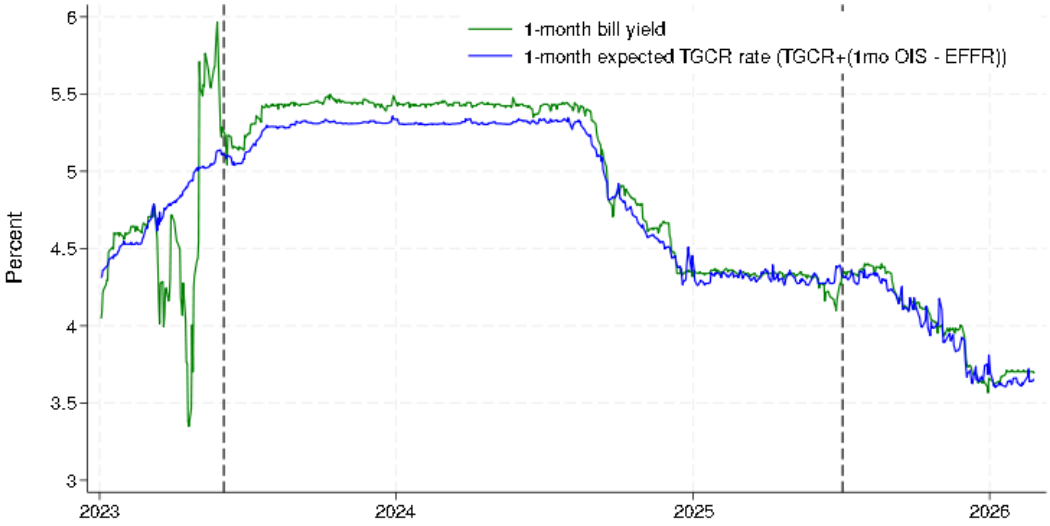


Figure 13. Hypothetical example of the evolution of quantities during a debt ceiling episode

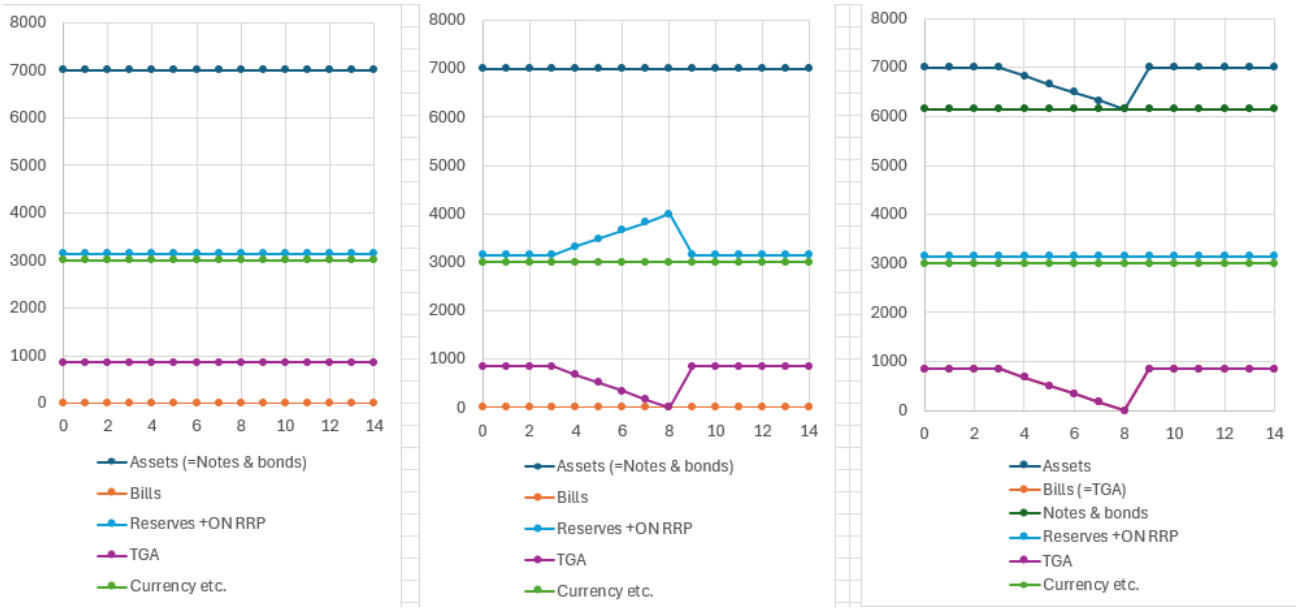
In the example, the debt ceiling binds from date 3 and is increased or suspended on date 8. The TGA is rebuilt at date 9.

Panel A. The Fed's balance sheet

No debt ceiling episode ample reserves regime

Debt ceiling episode, ample reserves regime

Debt ceiling episode, TGA backed with bills

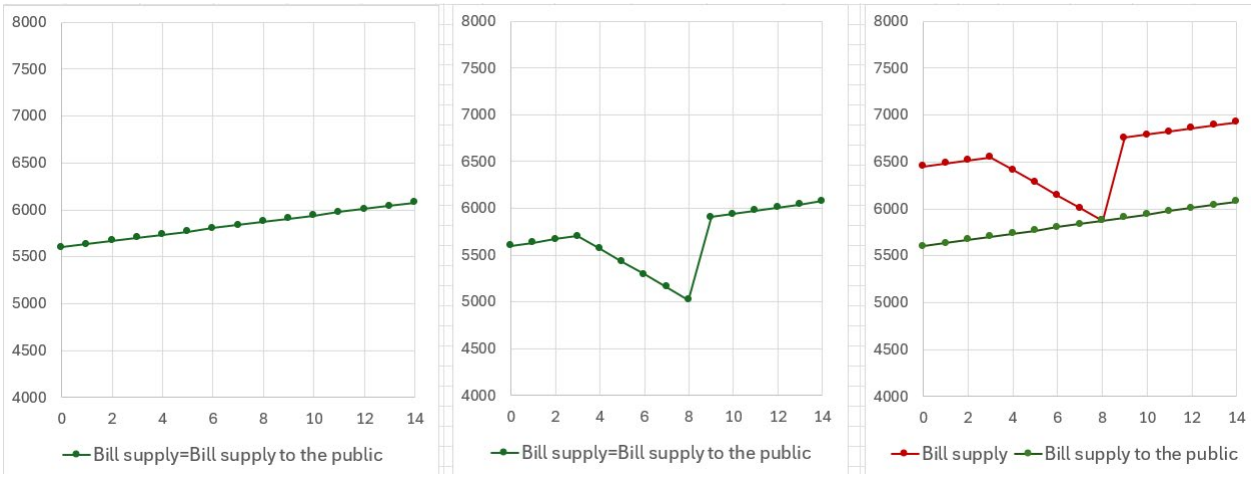


Panel B. Treasury bill supply

No debt ceiling episode ample reserves regime

Debt ceiling episode, ample reserves regime

Debt ceiling episode, TGA backed with bills

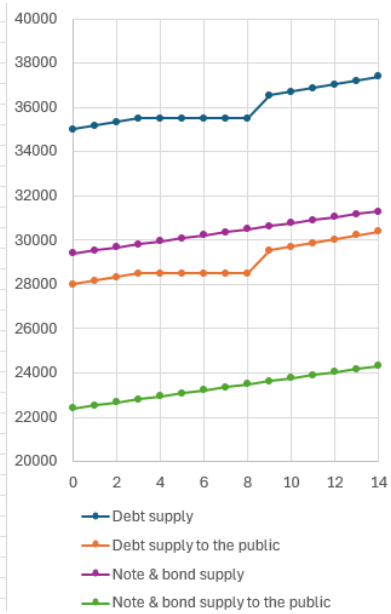


Panel C. Overall Treasury supply and note & bond supply

No debt ceiling episode
ample reserves regime



Debt ceiling episode,
ample reserves regime



Debt ceiling episode,
TGA backed with bills

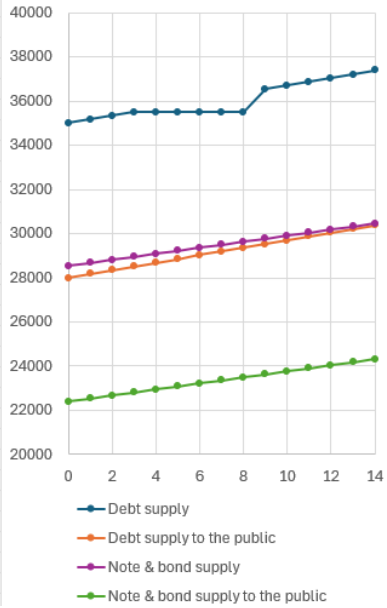


Table 1. Federal Reserve balance sheet, February 25, 2026

Source: H.4.1 release. Other assets includes unamortized premiums and discounts on securities held outright, other Federal Reserve assets, foreign currency denominated assets, gold stock, the special drawing rights certificate account, and Treasury currency outstanding. Other autonomous factors include the foreign repo pool (reverse repurchase agreements, foreign official and international accounts), Treasury cash holdings, foreign official deposits, other deposits. Other non-autonomous factors include the U.S. Treasury supplementary financing account, term deposits, Treasury contributions to credit facilities, and other liabilities and capital.

Assets		Liabilities	
Securities		Autonomous factors	
Treasuries	4,322	Currency	2,432
MBS (incl. agency debt)	2,013	Treasury general account	839
Lending		Other autonomous factors	579
Loans, repo and facilities	5	Reserves	3,004
Central bank liquidity swaps	0	Overnight reverse repo balances	1
Other	325	Other (not autonomous factors)	-191
	6,665		6,665

Table 2. Regressions based on weekly average data

All data are 4-week changes or totals, averaged by week of the year. t-statistics robust to autocorrelation up to order 3 in parentheses.

Panel A. May 2015 to February 2026

	Treasury General Account	Net public debt cash issues	Treasury bills	Treasury notes & bonds
	4-week change	4-week total	4-week net issuance	4-week net issuance
Surplus, 4-week total	0.77***	-0.23***	-0.23**	0.01
	(16.51)	(-4.92)	(-2.34)	(0.08)
Constant	87.97***	87.97***	2.45	84.66***
	(13.57)	(13.57)	(0.17)	(6.67)
N (weeks)	52	52	52	52
R^2	0.87	0.37	0.21	0.00

Panel B. November 2005 to September 2008

	Tax and Loan Note Accounts	Net public debt cash issues	Treasury bills	Treasury notes & bonds
	4-week change	4-week total	4-week net issuance	4-week net issuance
Surplus, 4-week total	0.32***	-0.67***	-0.64**	0.05
	(7.45)	(-14.46)	(-11.64)	(1.55)
Constant	5.36	5.25	-12.29**	11.96***
	(1.13)	(1.07)	(2.54)	(6.18)
N (weeks)	52	52	52	52
R^2	0.48	0.79	0.78	0.10

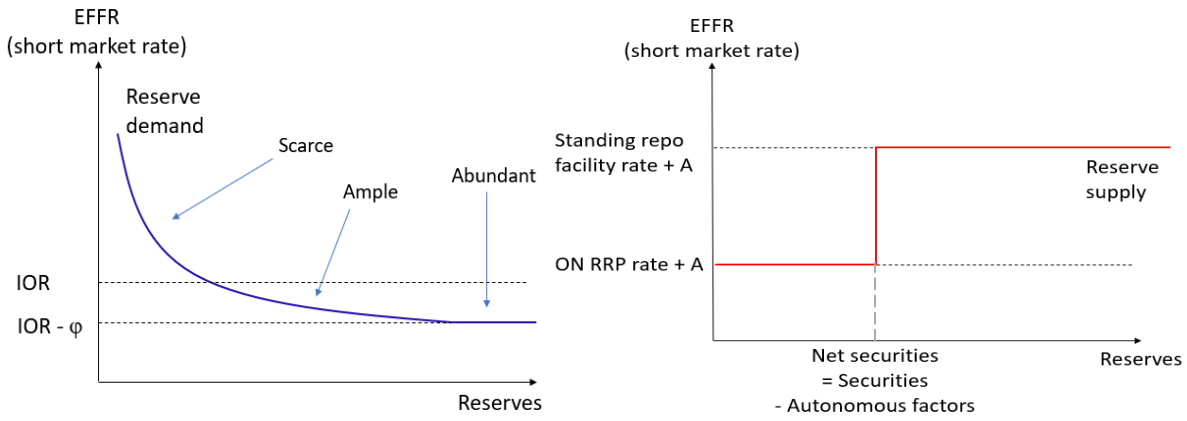
Appendix A. Reserve demand and reserve supply basics

This appendix provides a brief overview of reserve demand and supply based on Lopez-Salido and Vissing-Jorgensen (2025, henceforth LSVJ). The framework of LSVJ focuses on three drivers of a representative bank's demand for reserves at the Fed. First, reserves pay interest at the rate *IOR*, making them a useful store of value. Second, reserves have convenience benefits. Their liquidity is valuable because a bank that has sufficient reserves can make a payment (to a depositor withdrawing funds or to a borrower) without having to incur transactions costs selling illiquid assets and without payment delay. Convenience benefits may also stem from reserves' use for supervision & regulation purposes (the liquidity coverage ratio, intraday liquidity requirements, etc.). LSVJ use $v(Reserves, Liquid\ Deposits)$ to denote the convenience value (the expected savings on transactions costs/regulatory costs from reserves given the level of liquid deposits). The first derivative with respect to reserves, $v'_R(Reserves, Liquid\ Deposits)$, is the marginal convenience value of additional reserves and is called the convenience yield. It is decreasing in reserves (as additional reserves are less and less valuable for managing a given amount of liquid deposits) and increasing in the amount of liquid deposits the bank has to manage. Third, banks face a marginal balance sheet cost φ per $ of assets, related to capital requirements. These three features imply that the highest market rate, *r,* the bank is willing to pay to borrow to hold additional reserves is given by

$$\underbrace{r}_{\substack{\text{Highest rate bank is willing to pay}\\ \text{to borrow to hold additional reserves}}} = \underbrace{IOR + v'_R(Reserves, Deposits) - \varphi}_{\text{Net benefit of additional reserves}} \qquad \text{(A1)}$$

This first-order condition characterizes reserve demand, with the short market rate r (in practice, the effective federal funds rate) playing the role of the price. The figure below shows the resulting reserve demand function. The slope is negative because the convenience yield $v'_R(.)$ is declining in reserves. The level shifts up with the IOR and down with the balance sheet cost φ. The curve shifts out with higher deposits. The horizontal asymptote is $IOR - \varphi$.

Figure A1. Reserve demand and supply



Reserves are scarce in the sense that banks value them beyond the fact that they pay interest, if the net convenience yield $v_R'(.) - \varphi$ is positive. From equation (A1), $v_R'(.) - \varphi = r - IOR$, so scarce reserves correspond to the short market rate being above the IOR. Ample reserves refer to $v_R'(.) - \varphi \leq 0$ ($r - IOR \leq 0$) with $v_R'(.)$ still positive, while abundant reserves refers to reserves so large that the net convenience yield is zero, implying $v_R'(.) - \varphi = -\varphi$ and thus $r = IOR - \varphi$.

As for reserve supply, from the Fed's balance sheet

$$\text{Reserves} = \underbrace{\text{Net securities}}_{Securities-Autonomous\ factors} + \underbrace{\text{Lending}}_{\substack{Reserves\ borrowed \\ from\ the\ central\ bank}} - \underbrace{\text{ON RRP balances}}_{\substack{Reserves\ lent \\ to\ the\ central\ bank \\ by\ non-banks}} \quad \text{(A2)}$$

With no take-up at the Fed's lending facilities (the discount window and the Standing Repo Operations) or the Fed's ON RRP facility, reserve supply equals the Fed's securities holdings minus the amount that is funded with the autonomous factors. LSVJ denote Securities-Autonomous factors "net securities". The vertical part of the reserve supply curve is given by the value of net securities. The Fed's lending facilities generate a top flat part of the reserve supply curve, as the Fed stands ready to supply additional reserves elastically at the interest rate on the facilities.[28] Conversely, the ON RRP facility generates a bottom flat part of the reserve supply curve, as the Fed stands ready to let reserve supply be reduced by (crowded out by) take-up at the ON RRP facility.

Three types of equilibria emerge. When reserve demand intersects supply on the vertical part of supply, the Fed's facilities are not used and ON RRP balances and lending balances are zero (top chart in Figure A2). Positive ON RRP balances emerge when reserve demand intersects reserve supply on the bottom flat part of the supply curve (middle chart in Figure A2). Net securities are then funded with a mix of reserves and ON RRP balances. The reduction in reserves ensures that the market rate clears at point 2 rather than point 1, thus keeping the market rate from falling below the floor. Positive lending emerges when reserve demand intersects reserve supply on the top flat part of the reserve supply curve (bottom chart in Figure A2). The additional lending created via financial institutions' borrowing implies market clearing at point 2 rather than point 1, thus keeping the market rate from exceeding the ceiling. These descriptions ignore any stigma in using the Fed's facilities. With stigma, mainly relevant for the lending facilities, the ceiling may in practice be higher than illustrated.

[28] There is a subtlety in that EFFR is an uncollateralized rate which the Fed's lending and ON RRP rates are collateralized. Denoting by *A* the spread between uncollateralized and collateralized interest rates, the upper flat part of the reserve supply curve is at the lending facility rate plus *A*. Similarly, bottom flat part of the reserve supply curve is at the ON RRP facility rate plus *A*. See LSVJ for details.

Figure A2. Types of reserve market equilibria

