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THE PRICE OF THE FLOOR:

QUANTIFYING THE COST OF AMPLE RESERVES IN U.S. MONETARY POLICY IMPLEMENTATION

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ABSTACT

This paper reassesses the Federal Reserve's current monetary policy implementation regime, known as the ample reserves framework. Every system of monetary policy implementation brings benefits and costs, and while the benefits of today's regime have been extensively studied, less attention has been paid to its costs. Building on a detailed historical narrative, we develop a counterfactual consolidated balance sheet analysis to highlight two distinct benefits to the commercial banking sector: (i) the incremental deposit franchise value created by interest-bearing reserves funded by deposits yielding substantially less than the risk-free rate, and (ii) the uncompensated maturity transformation benefit that results when the System Open Market Account (SOMA) warehouses mark-to-market risk that would other- wise reside on private sector balance sheets. Quantitatively, the deposit-franchise value peaked at about $200 billion (or 1% of banking assets) in 2023.

Our findings complicate the prevailing view that ample reserves are distributionally neutral. The regime delivers enhanced control of short-term interest rates, but it also likely generates significant and new revenue for commercial banks. Understanding the scale of these effects is a prerequisite to judging whether the benefits of the current framework outweigh its drawbacks. We conclude by outlining alternative architectures—a return to a corridor system, a lean-ample system, and a tiered remuneration system—that could preserve policy agility while curbing implicit transfers.

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I. Introduction

Over its more than 100-year history, the Fed has often adjusted the methods of its policy implementation, adapting to changes in money markets and gaining insights on how its own tools have worked or failed.[1] For the first four decades of its existence, the Fed primarily used two tools to conduct monetary policy: its power to set the discount rate—the interest rate charged to banks for collateralized borrowings of reserves—and, on rare occasions, its authority to adjust the level of required reserves to affect the provision of credit.[2] In the 1950s, the Fed began to regularly inject and drain reserves through open market operations to set its policy rate. After a brief interlude of aggregate reserve targeting at the start of Chair Paul Volcker's tenure, the Federal Open Market Committee (FOMC) began formally targeting short-term interest rates to set the stance of monetary policy (Thornton 2006). In the 1990s and early 2000s, central banks around the world began to experiment with paying interest on reserve balances (IORB) to commercial banking institutions and certain other account holders, adjusting the rate the central bank paid to counterparties as a method of controlling short-term interest rates. After congressional authorization in 2006, the Federal Reserve began to pay IORB in the wake of the Global Financial Crisis (GFC). In 2019, the Federal Reserve officially adopted ample reserves, combining the payment of IORB with a historically large central bank balance sheet as the framework of monetary policy implementation (Powell 2019).

This paper is intended to reevaluate the costs and benefits of the ample reserves framework. It is well established that paying IORB can maintain a very high degree of interest rate control amidst large fluctuations in the size of the central bank balance sheet. This is clearly socially valuable. It was also arguably necessary in the heat and wake of the GFC given the urgency of the moment and the tools available at the time. But ample reserves is not a socially or economically neutral policy. Although alternative frameworks would not meaningfully change the fiscal impact of monetary policy implementation, they would change its political economy. Commercial banks and other financial institutions are beneficiaries of the ample reserves framework in its current administration. That value creation is mitigated or potentially eliminated by alternative frameworks. Policymakers may yet decide that ample reserves in its current form is optimal for monetary policy implementation—that the distributional consequences are appropriate to the benefits. Yet that debate has often lacked specificity and rigorous empirical grounding. This paper does not advocate for a specific alternative, but instead, offers a framework for thinking about the political economy of the current system.

Reserves are direct monetary liabilities of the Federal Reserve that can be used to settle interbank payments as well as for other purposes. Until recent years, the Fed required most commercial banking institutions in the United States to hold a portion of their deposit liabilities in the form of liquid reserve currency in an account at the Federal

[1] For a history of these changes between 1979 and 2019, see Hughes (forthcoming).

[2] The Fed experimented with open market operations in government debt in the 1930s, but did not rely on them for monetary policy implementation.

Reserve or in vault cash, ensuring that banks had an easily accessible source of funds to satisfy withdrawal demands.[3] Those reserves were, until 2008, non-interest bearing. Since the founding of the Fed, many banks and economists argued that the requirement to park these funds at the central bank functioned as a "tax," because those funds could not be invested in yield-bearing assets, thus muting financial gains. Although the subject of regular and robust debate, legislators throughout the 20th century were reluctant to authorize the central bank to pay interest directly to banks, given the cost to the central bank and the perception of a government handout. In 2006, Fed officials and bankers, who had been intensely advocating for over a decade, succeeded in securing from Congress authority for the Federal Reserve to pay IORB. Initially scheduled to go into effect in 2011, Congress accelerated the timeline in October 2008 in the midst of the GFC, giving the Fed the immediate power to pay IORB.[4]

Rather than merely compensating banks for modest reserve holdings as initially anticipated, IORB rapidly emerged as the Federal Reserve's *primary* monetary policy implementation tool. Because depository institutions can earn the risk-free IORB rate on reserves held at the Fed, they are strongly disincentivized from lending in money markets significantly below this rate, effectively establishing IORB as a floor for short-term interest rates.[5]

This framework fundamentally transformed monetary policy implementation. Under the previous system, the Fed needed to precisely calibrate open market operations to achieve desired changes in the effective federal funds rate (EFFR) through shifts in reserve supply. The IORB system eliminated this complexity while simultaneously allowing for a much more dynamic and potentially much larger central bank balance sheet. Policymakers could now directly adjust and control short-term rates using the administered IORB rate, with market rates following through arbitrage relationships. This decoupling of interest rate policy from reserve quantity management provided an additional degree of freedom: the central bank gained the ability to inject nearly unlimited liquidity during financial stress without compromising its interest rate target. In the turmoil of the 2008 crisis, Fed leaders believed they needed that flexibility to allow the Fed to act to support financial stability.

Alongside the use of IORB, the Fed began to use a second unconventional tool that would later become critical to ample reserves: large-scale asset purchases (LSAPs) in

[3] Reserve requirements were eliminated in March 2020, but had already become largely non-binding in the wake of post-crisis quantitative easing. After 2008, banks held such large quantities of excess reserves due to quantitative easing that they far exceeded any regulatory requirements, making the formal requirements effectively irrelevant for most banks.

[4] In the throes of the GFC, the Fed was anxious to acquire its new power, because it gave the central bank the ability to inject historic levels of liquidity into the financial system without affecting its monetary policy. The Fed only moved to the zero lower bound in December of 2008, three months after the collapse of the investment bank Lehman Brothers and the bailout of insurance giant AIG. In the intervening period, members of the FOMC feared that the emergency liquidity provision could spur inflation. By December, the profound depth of the crisis quieted those concerns. See Bernanke 2017.

[5] There are, of course, frictions to arbitrage, as well as some participants in money markets that do not earn IORB. Although this reduces the efficiency of IORB as a tool of interest rate control, it remains a powerful mechanism.

pursuit of quantitative easing (QE). In the wake of the GFC, the Fed lowered short-term interest rates to zero, a historically unprecedented move in the United States. The FOMC then opted to use LSAPs to spur lending (Bernanke, Reinhart, and Sack 2004). Bernanke and the FOMC used this tool aggressively during the most acute, opening phase of the crisis, purchasing over $1.7 trillion of mortgage-backed securities, federal agency debt, and long-term Treasuries. Nearly two years after the crisis, the economy was struggling to recover, and Fed officials were anxious to avoid a scarring depression. To that end, in 2010 the Federal Reserve announced a shift from its emergency liquidity programs to a "peacetime" policy of sustained purchases of Treasuries and mortgage-backed securities. The theoretical aim of these LSAPs was to stimulate private investment by lowering the cost of credit. This was to be achieved through two primary channels: a portfolio-balance effect, shifting investor preference toward longer-dated securities, and a signaling effect, reinforcing the Fed's commitment to an accommodative policy stance. Over the next few years, the Fed's balance sheet grew to $4 trillion as it acquired safe assets and replaced them with bank reserves. Because commercial banks served as the intermediaries for these transactions—often acquiring assets from non-bank institutions to sell to the Fed—their balance sheets expanded mechanically. This process significantly inflated the banking sector's assets and liabilities, independent of its own lending decisions. Total reserves in the commercial banking system increased from an average of $16 billion in 2007 to $2.8 trillion in the fourth quarter of 2014.[6]

Then, as the FOMC began to lay plans to raise interest rates, Fed officials decided to use their authority to pay IORB as the primary method of monetary policy implementation rather than returning to a scarce reserves regime relying on frequent open market operations. Doing so allowed the Fed to indefinitely delay a return to a balance sheet of pre-crisis size, preserving a commercial banking sector now awash in reserves.[7] To support the effort, the Fed created a new money market facility, the overnight reverse-repo facility (ON-RRP) which helps place a hard floor beneath overnight financing rates in money markets, just slightly below the IORB rate (Afonso et al. 2022). The Fed did meaningfully reduce the size of its balance sheet, and reserve levels gradually fell from 2014 to 2019. Yet, by that time, the new monetary policy framework *required* a level of reserves in the system well over $1 trillion—a more-than-tenfold increase from the pre-GFC size—to prevent excessive and potentially damaging volatility in short-term interest rates. By 2019, the Fed foresaw that it would soon need to inject additional reserves into the system, even in a period when it had recently been *raising* interest rates. Fearing that markets might misinterpret this move as an indication of their desire to loosen policy rather than a technical change related to monetary policy implementation, the FOMC agreed to permanently and publicly embrace the ample reserves framework. They announced it to the world just nine months before such an injection was required. In late 2025, the Fed again began providing additional reserves

[6] https://fred.stlouisfed.org/series/WLODLL. Including other items like vault cash, this increases to $43 billion on average in 2007. https://fred.stlouisfed.org/series/TOTRESNS.

[7] Officials insisted that they would reduce the size of the balance sheet over time, but fearing an inflationary cycle, they believed that it would take too long to raise rates by reducing the balance sheet size and returning to a "corridor" system of interest rate control via open market operations.

to the banking system, suggesting that the supply of reserves required to operate the ample reserves framework is in excess of $3 trillion (see also Afonso, et al. 2023b and Ennis and McMillan 2023).[8]

The official view, articulated by Federal Reserve policymakers and many economists, is that the ample reserves framework is distributionally neutral and lacks significant political economy implications (Logan 2023; Nelson 2024; Afonso et al. 2020b). Fed policymakers and economists often acknowledge that the "optics" of paying IORB to banks are "not ideal," but they believe sophisticated analysts understand that the new framework does not meaningfully change the nature of the American banking system.[9]

This consensus rests on two intellectual pillars: an efficiency claim rooted in the Friedman Rule and a public finance claim based on the government's consolidated balance sheet. The first, famously articulated by Milton Friedman, posits that since the central bank can create reserves at no social cost, the optimal quantity of money is achieved when the private opportunity cost for banks to hold them is zero (Friedman 1969). Paying a roughly market rate of IORB achieves this efficient outcome. The second argument analytically imagines the balance sheets of the central bank and the Treasury[10] as a single entity. Viewed through this lens, the choice to maintain a large, central bank balance sheet with interest-bearing liabilities is simply a matter of public debt management with only a minor fiscal impact (Schulhofer-Wohl 2025).

This paper argues that the Federal Reserve's ample reserves framework, while effective at controlling short-term interest rates, is not distributionally neutral and creates significant value to the private sector, particularly commercial banks. The fact that large banks hold reserves far beyond strict regulatory requirements—often described by policymakers as distributional frictions between global and local levels of liquidity—indicates that it is economically palatable, if not advantageous, for them to retain these large balances even when alternative money market instruments offer more attractive returns (Logan 2022, Powell 2024).[11] The question then becomes: How exactly is this value created, and how can it be measured? Using a counterfactual analysis of the consolidated banking sector's balance sheet, we identify and quantify two separate channels through which this value is generated.

The first is a **deposit franchise channel**, which arises from the expansion of bank balance sheets required by the ample reserves framework. Banks earn the risk-free

[8] Work by Afonso, Kim, Martin, Nosal, Potter, and Schulhofer-Wohl (2023) indicates that reserves start to become scarce when they are below roughly 10% of total banking system assets, which would suggest a minimum of $2.1 trillion based on total assets of $21.5 trillion in domestically chartered commercial banks. https://fred.stlouisfed.org/series/TLADCBW027NBOG. See also Ennis and McMillan 2023.

[9] For instance, see transcripts of the FOMC's November 2018 meeting (Federal Open Market Committee [FOMC] 2018, 14, 22, 38, 39, 42, 48) and the FOMC's January 2019 meeting (FOMC 2019, 59, 63).

[10] Although the Treasury does not have a "balance sheet" in the formal sense, one could imagine its stock of liabilities, consisting almost entirely of Treasury securities, supporting synthetic assets in the form of tax receivables.

[11] As Chair Powell put it: "Liquidity is not evenly distributed in a system. And there can be times when, in the aggregate, reserves are ample or even abundant, but not in every part." (Powell 2024).

policy rate on their reserve assets while paying a fraction of that rate to depositors, capturing a spread determined by the deposit beta. While the value of a low-beta deposit franchise is well-established, the sheer scale of the reserves required by the current framework—well over $2 trillion, a significant increase from historic levels—has magnified this effect. Notably, this effect can be substantial even when policy rates are near the zero lower bound (ZLB) and grows as interest rates rise. We estimate the value created through this channel peaked at roughly $200 billion in 2023.

The second is a more indirect **maturity transformation channel**, which functions as a valuable service of volatility mitigation. This mechanism is theoretically symmetric: losses on the Fed's System Open Market Account (SOMA) portfolio represent a transfer from the public to the private sector, while gains have the opposite impact. In practice, however, the Fed's QE programs are typically initiated when policy rates are low, leading it to acquire long-term securities preferentially at historically low yields. Empirically, we note that the distribution of future outcomes is asymmetrically skewed toward central bank losses. By holding these securities as rates rise—often by more than was priced into bond markets during the active phases of QE—the Fed absorbs any resulting mark-to-market losses, assuming duration risk that would otherwise have been held by commercial banks and other private sector financial institutions. We note, however, that the direct acquisition of securities by the Fed likely benefits banks more so than other private actors. Using banks as intermediaries to source securities from the market (i.e., with banks acting as agent) instead of relying on supervisory and other levers to force or incentivize commercial banks to buy Treasuries themselves (i.e., as principal) is a choice rather than a necessity. This choice protects commercial banks against capital erosion due to losses on their securities portfolio. As seen in the 2023 collapse of Silicon Valley Bank, those shocks can be very destabilizing.

Our arguments are analytically distinct from existing critiques that emphasize asset-pricing distortions and central bank politicization concerns. Some scholars, for instance, argue that a large central bank balance sheet—required by the ample reserves framework—distorts asset pricing and capital allocation (Borio 2023). Another line of critique worries that the large central bank balance sheet signals to legislators the willingness of the central bank to shoulder the costs of higher deficit spending (Warsh 2025). Finally, some claim that the ample reserves framework generates a vicious cycle of reserve demand which distorts the incentives of banks and financial market participants (Nelson 2022).

Because operating frameworks are chosen rather than fated, their distributional effects should be weighed alongside their operational efficiency. Many approaches have been tried in the past, from real bills, to targeting monetary aggregates, to corridors and floors. Each comes with various costs and benefits, both in terms of the efficiency of policy transmission as well as economic, financial, and political considerations. Our goal is not to attempt to come to firm conclusions on the optimal mechanism to implement monetary policy, but rather to inform that debate by tracing the history of IORB and demonstrating that ample reserves creates meaningful value for commercial banks.

This paper begins with a review of the historical debate over IORB and the circumstances that led to its adoption and implementation. Next, we describe how the ample reserves framework works. We illustrate the two channels of value creation from the public to the private sector detailed above. We then consider the interaction of the ample reserves framework with liquidity regulations. Finally, we consider changes to the existing ample reserves system that could mitigate or eliminate the costs of the current framework.

II. The history of interest on reserves

For nearly a century after the Fed's founding, bankers, policymakers, and members of Congress debated whether the central bank should have the authority to pay interest on reserves held at the central bank. Bankers and some Fed officials believed the payment of IORB made membership in the Fed system less costly and more fair, while members of Congress were largely wary of a perceived handout to financial interests.

Understanding the contours of this long-running debate sheds light on the contemporary political economy of the ample reserve system. Today, Fed officials often claim that there are few, if any, distributional and political implications to the use of such a system. Historically speaking, this is an unusual position: there have always been disagreements about the political economy of IORB, and this remains true today.

Debates about the potential need to pay interest on reserve balances go back to the legislative discussions that led to the founding of the Federal Reserve System in 1913. Born out of the Panic of 1907, the Fed was originally conceived as a decentralized network of numerous largely autonomous central banks under the control of an independent federal agency. It was designed to alleviate the rigidities and frequent crises that had plagued the national banking system since it was created during the Civil War (see e.g., Warburg 1907; Sprague 1910; Kemmerer 1910). By focusing on discounting bills of exchange to mitigate seasonal volatility, the Federal Reserve brought stability to the national currency and integrated money markets across the country, making the dollar more attractive to foreign investors. Bankers in large cities, particularly New York, gained stability and access to more markets as a result of a newly integrated national system (Broz 2009).

The payment of interest on required reserves was a matter of controversy during the creation of the Federal Reserve. In 1912, Senator Nelson Aldrich, a prominent senator and the chair of the National Monetary Commission, recommended an explicit prohibition against interest on central bank reserves. During the presidential campaign of 1912, the Aldrich plan was denounced as a creature of Wall Street interests, and the final version of the Federal Reserve Act signed by President Woodrow Wilson in 1913 contained a number of concessions to smaller banks and interior regions of the country. Among these concessions was the omission of any explicit prohibition against interest on reserves. Bankers warned that forcing banks to hold non-earning reserves would amount to a "reserve tax," and legislators, sensitive to the concern, reduced reserve ratio requirements. At the same time, the new law did not explicitly empower the reserve

banks to pay IORB. This ambiguity ensured that the question would remain contentious in the first decades of the Fed's existence (Warburg 1930, 265-266; "Reserve Banks May Bid for Deposits" 1914).

In the early years, country banks were particularly vocal advocates for the Fed to pay IORB. These small institutions, which held state charters, were not required to join the Fed system. Doing so gave them access to the Fed's emergency lending during cash shortfalls, enabling them to lend more aggressively and to make seasonal credit commitments with confidence. But they also paid a price. In exchange for participation in the new system, banks had to shift some of their assets from interest-bearing investments into reserve balances, an implicit tax on those reserves which no longer bore interest (Federal Reserve Bank of Richmond 1920). In 1916, two years after the Fed began operations, only 34 out of 20,000 state banks had joined the Federal Reserve System (Meltzer 2003, 78).[12]

The leadership of the early Fed was steadfast in its refusal to pay IORB. Benjamin Strong, the outspoken governor of the Federal Reserve Bank of New York, claimed in private correspondence, perhaps hyperbolically, that paying IORB might lead to "the destruction of the system." Doing so, he worried, would require the Reserve Banks to pay out so much in interest that it would threaten their solvency (Strong 1917). Early Fed resistance did not stop country banks from continually pushing for the Fed to pay IORB. Over the course of the 1920s, legislators continued to debate the idea. Eleven bills were introduced in the House or Senate authorizing the payment on reserves. None passed, which is not terribly surprising given the perilous state of Reserve Bank finances at the time (see e.g., Menand and Younger 2025). But the issue did not fade in importance to smaller banks until the Great Depression, when many banks struggled to survive and monetary policy receded in importance as a driver of their profitability (Board of Governors of the Federal Reserve System [Board of Governors], Legal Division 1978).

In the decades after the Second World War, advocates of IORB increasingly employed theoretical arguments.[13] Fed Chair William McChesney Martin, Jr., began to focus on the use of monetary policy to stabilize aggregate demand. In pursuit of that goal, Martin's Fed began to use ongoing open market operations, draining reserves from the system by selling its own assets and injecting reserves in downturns, thereby managing the quantity of reserves in the banking system.

The ongoing and extensive use of open market operations was novel, and policymakers and economists debated various alternative ways, including IORB, to manage the money supply. The Yale economist James Tobin made the case—for the first time in American history—for using the payment of IORB as a primary method of monetary policy implementation. Open market operations required the delicate and inexact work of estimating how much a drain or addition to reserve balances would affect commercial

[12] The numbers did, however, gradually grow. By 1919, many of the larger state banks had joined, so that Fed members controlled 40% of the assets of all state-chartered banks (Meltzer 2003, 85).
[13] For an overview of the post-war changes in the field of economics, see Shenk 2016.

banks' lending decisions and deposit creation.[14] By contrast, the central bank's decision to pay IORB could function as a floor, precisely setting interest rates for short-term credit across the economy. Tobin specifically imagined that the Fed would pay member banks the discount rate on reserve balances held in excess of required levels. This would mean that banks would not need to turn to non-monetary sources of short-term credit assets like Treasury bills. As Tobin put it: "Although bank holdings of excess reserves would increase, their holdings of short-term Treasury securities, which banks now use as secondary reserves, would be diminished. These securities and the interest they bear would be absorbed by the Fed." Tobin believed that this system would simplify the Fed's actions in Treasury markets, giving it "the most powerful tool in the central banker's kit, and a very powerful tool indeed" (Tobin 1960). He was mindful of the political economy implications of meaningfully shifting the owner of Treasury debt to the central bank but felt that enhanced efficiency merited the change.

Around the same time, monetarist economists also advocated for the payment of IORB, reaching the same conclusion as Tobin for different reasons. The agricultural economist George Tolley, who had trained at the University of Chicago, wrote in 1957 that the Fed's requirement that member banks hold reserves with no interest payment was effectively a "tax," because these reserves would otherwise be used to purchase yield-bearing assets (Tolley 1957). Milton Friedman, a colleague and friend of Tolley's, built on these arguments in a 1960 book, published the same year as Tobin's article (Friedman 1960).[15] Friedman outlined three reasons the central bank should be able to pay IORB in a fractional reserve banking system. First, he believed it was "inefficient" for Treasuries to bear interest and cash to offer no return. He reasoned that because non-interest-bearing money imposes a private opportunity cost that society does not bear, people keep smaller cash balances than is optimal and invest simply to economize on money holdings.[16] Second, Friedman argued that IORB made regulation more effective. Without a yield penalty on deposits, bankers and their customers gain nothing by dressing up higher-yielding assets as quasi-checking accounts. Finally, he made the case on the grounds of equity. Why should the government pay some lenders—those able to purchase government securities—a positive rate of interest, while lenders to the commercial banking sector, i.e., depositors, received no payment? Despite the academic support for the idea, policymakers did not prioritize the change.

[14] This is known colloquially as the money multiplier. Banks make real-time decisions about how much to lend based on the size of their balance sheet. These decisions are based on assessment of money market conditions and future demand.

[15] Friedman imagined a narrow banking system where the central bank would precisely control the amount of money circulating in the economy. In a narrow banking system, banks could only hold safe, liquid assets, such as deposits at the Federal Reserve or Treasuries, against their deposits. Friedman preferred a system where all bank deposits were held at the central bank. Treasuries could fluctuate in value based on market demand, but reserves were, by definition, always at par, meaning that deposits in Friedman's system would be always available for redemption at any time with no market risk.

[16] Later in the decade, in an essay published in his collection *The Optimum Quantity of Money,* Friedman argued that individuals inefficiently economize on cash balances because they face the real cost of foregone interest when holding it. Paying interest on bank reserves would lead people to hold the optimal amount of money by eliminating the incentive to hold short-term credit instead.

In the 1970s and 1980s, these academic debates gave way to more practical concerns about the stability of the financial system. Much higher market interest rates exacerbated the opportunity cost of holding non-interest-bearing reserves. Under pressure, banks gradually began to leave the Federal Reserve System, no longer seeing membership as financially viable. The Fed saw the proportion of deposits issued by banks under its jurisdiction fall, raising concerns about the ability of the System to effectively manage the money supply (Federal Deposit Insurance Corporation 1977). Staff at the Federal Reserve began researching whether the institution *already* had the legal authority to pay IORB, concluding in a 1976 memo, updated in 1978, that Congress had left the decision up to the discretion of the Fed (Board of Governors, Legal Division 1978, 820-843). Fed officials did not, however, move forward unilaterally. The House and Senate began to hold hearings on the idea of paying IORB, which would work as a "carrot" to incentivize banks to stay in the Federal Reserve System by minimizing the cost of the reserve requirements.

In a Senate hearing on the topic in 1977, William Proxmire, Chair of the Senate Banking Committee at the time, expressed deep skepticism at the idea on the grounds of political economy:

> Now it's one thing to propose a program that would provide more money to welfare mothers or handicapped citizens or the infirm elderly. Frankly, I would oppose those programs too at this time. But how then could I support this new program to hand out hundreds of millions of dollars of money from the Treasury to the banks?…We have, to this country's credit, never paid interest on required reserves, for the very good reason that to require reserves is a small price to pay for the immense benefit banks enjoy with their charter, their authority to lend, their protection from competition through limited access to banking (U.S. Congress, Senate, Committee on Banking, Housing, and Urban Affairs 1979, 2–3).

Proxmire claimed he would only support the proposal if it were paired with meaningful other changes to the banking system. Eventually, Congress chose the stick over the carrot. The Monetary Control Act of 1980 required all U.S. deposit-taking institutions to follow the Fed's reserve requirements. Leaving the Federal Reserve System no longer allowed banks to avoid these costs: They still had to hold reserves at the Fed, but received no interest or compensation for doing so (Volcker 1980).

By the 1990s and early 2000s, Congress was increasingly focused on meeting the needs of financial sector actors, preferring carrots over sticks. Support for paying IORB grew. Like in the 1970s, lawmakers became concerned about a precipitous fall in the stock of bank reserves in the Fed system. In the mid-1990s, banks were legally barred from paying interest on corporate deposit accounts, but they were allowed to move funds out of checking accounts and into interest-bearing accounts.[17] Technological advancements and Fed policy decisions made it increasingly common for banks to use "sweep accounts" to move deposits out of cash accounts at the end of the day and into

[17] Banks received the authority to pay interest on demand deposits only in 2011 as part of the Dodd-Frank legislation.

interest-bearing accounts overnight. Overnight interest-bearing balances did not generally require the same level of reserves as non-interest-bearing deposits. Any funds moved into interest-bearing accounts could be later swept back into deposit accounts, earning a yield for corporate depositors and a fee for the banks.[18] In 1994, the Fed clarified that banks could create interest-bearing "sub accounts" tied to the checking account and use software to automate the debits back into checking accounts, making it possible for customers to see a single seamless checking balance. With fewer deposits on hand overnight, the bank had to hold fewer reserves, opening up those funds to be invested in interest-bearing assets. These sweep accounts had the dual advantage of enhancing the return for depositors—with no sacrifice in liquidity—while also minimizing the reserves that the commercial bank was required to park overnight at the Federal Reserve.

In 1995, Donald Kohn, then secretary of the FOMC, and several governors grew concerned that reserve requirements could be bypassed altogether as sweep accounts became more popular. At a meeting of the FOMC in September, Kohn told policymakers: "If we were able to pay a market rate of IORB, that would remove the incentive for sweeps."[19] The following year, he published an article explaining his concern (Kohn 1996). With a diminishing reserve base, even modest liquidity shocks could translate into volatile price movements in money markets more generally.

By 1997, reserve balances were 50% lower than they were three years prior,[20] and Congress began to consider legislation to combat the problem (Seiberg 1997). Fed Chair Alan Greenspan came out in enthusiastic support of enabling the Fed to pay interest on bank reserves held at the central bank. In September, he wrote to Congress arguing that doing so would "eliminate a significant distortion in the financial markets that places small businesses at a particular disadvantage." Moreover, he believed it would "assist us in our implementation of monetary policy."[21] If banks earned IORB, Greenspan argued, they would have diminished incentives to sweep funds out of checking accounts and into interest-bearing assets overnight. Of course, Congress could have outlawed sweep accounts or shifted the frequency of sweeps or disclosure requirements, but the era of using regulatory sticks to compel banks to limit their creativity had faded.

Despite Greenspan's support, it took another decade before Congress authorized IORB. The last remaining roadblock was the Clinton Treasury Department. The Fed remits its profits above a certain level to the Treasury each year, but paying IORB would reduce those profits—effectively transferring a portion of the seigniorage previously earned by taxpayers to the owners of bank equity. The Congressional Budget Office's early estimates projected costs of $660 million over five years (McConnell 1998a).

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[18] Banks could only sweep funds back into the checking account six times a month, a result of Fed oversight in the late 1970s, codified in the 1982 Garn-St Germain Act. For an overview, see Anderson and Rasche 2000.
[19] FOMC 1995, 2.
[20] See https://fred.stlouisfed.org/series/LDTOTD.
[21] Greenspan to Rep. Jack Metcalf, Sept 26, 1997, quoted in Seiberg 1997.

Robert Rubin, Treasury secretary from 1995-1999, opposed the policy on these fiscal grounds (quaint though the amounts may seem by current standards). In the meantime, a survey of the nation's 44 largest banks conducted in May 1998 found that, even if the Fed were to pay IORB, the vast majority would continue to actively use sweep accounts (Board of Governors 1998; McConnell 1998b). The effort stalled.[22]

The election of Republican George W. Bush to the presidency brought new leaders to the Treasury. In 2002, a bipartisan group of Senators introduced a bill that would expand the number of "sweeps" banks could conduct. To counteract the threat to system reserve levels, the bill, which failed to gain support in that legislative session, would also give banks the ability to pay interest in corporate checking accounts and empower the Fed to pay interest on bank reserves ("Legislative Update" 2002). The same year, Fed economist Marvin Goodfriend published a widely cited report, arguing that the payment on IORB could be used as a tool of monetary policy implementation, not just as a defensive effort to prevent reserve drain (Goodfriend 2002). Goodfriend, a conservative economist in the tradition of Friedman, did not acknowledge the Keynesian James Tobin who had pioneered the idea a half century before. In 2003, a Bush Treasury department official said the administration was "sympathetic" to the idea, but stopped short of throwing its full weight behind it (Heller 2003).

Meanwhile, other Bush administration officials were working with banking leaders to develop a list of seventy-eight legal changes to reduce the regulatory burden on banks. Officials across agencies narrowed the list over time to twelve leading ideas, including the authorization to pay IORB (Bergman 2005). The CBO again estimated the cost at $2.5 billion over 10 years, but legislators sidestepped these concerns by delaying the authorization to take effect by five years to 2011 (Congressional Budget Office 2005). (Under the PAYGO scoring rules then in force, any decrease in Treasury receipts within the first five fiscal years had to be offset elsewhere in the bill or with separate legislation.) The Financial Services Regulatory Relief Act, passed in October 2006, contained hundreds of provisions meant to streamline banking law in the United States. The bill reduced the frequency of bank examinations, simplified the designation of brokers, and gave the Fed the ability to meaningfully lower some reserve requirements, in some cases to zero. It also enabled the Fed to pay IORB, starting in 2011.[23]

Between the passage of that legislation and early 2008, the forces that eventually led to the GFC picked up steam. A working group inside the Fed began to consider how it might use its new authority in 2007, but their project took on significantly greater urgency in March 2008 as the investment bank Bear Stearns collapsed, requiring emergency funds from the Fed to underwrite a fire sale. That led to concerns that further liquidity injections could weaken the ability of the Fed to control short-term interest rates (Ip 2008; Federal Reserve Staff 2008). Just weeks later, the FOMC

[22] The Bank Modernization Act of 2000 included the provision, and the CBO once again scored it. Even so, there was no legislative momentum for it to become law. https://www.congress.gov/bill/107th-congress/house-bill/974/text.
[23] Public Law 109-351. 120 Stat. 1966. https://www.congress.gov/109/statute/STATUTE-120/STATUTE-120-Pg1966.pdf.

discussed five options for how IORB might enhance its control over monetary policy, particularly in moments of crisis. Bernanke, interested in gaining a tool that would enable the Fed to inject emergency liquidity into the market without disrupting the stance of monetary policy, began to actively lobby Congress to accelerate the authority from 2011 to 2008 ("Bernanke Asks Congress" 2008). The Fed included its request to advance the authority in its July 2008 report to Congress (Board of Governors 2009, 86).[24] Bush Treasury Secretary Hank Paulson also supported the move, and in the wake of the collapse of Lehman Brothers and emergency bailout of AIG, Congress acceded to Bernanke's request. Legislators included the provision in the bill that authorized the federal government to acquire equity stakes in commercial banks, familiarly known as the Troubled Asset Relief Program (TARP). Within the week, the Fed began paying IORB for the first time in its nearly century-long history.

What began as a plea from country banks for equal treatment had become a macro-prudential tool designed to enhance the Fed's effectiveness in an age of relentless financial innovation. A long and winding saga had seemingly come to a close, but legislators had little idea how this new authority would soon transform the financial system.

III. How the ample reserves framework works today

The current monetary policy implementation framework was formalized in 2019 when the FOMC announced its commitment 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 rates" (Powell 2019).[25] By supplying ample reserves sufficient to obviate the need for frequent open market operations to maintain interest rate control, the FOMC committed to relying on its administered rates as the primary tools of monetary policy implementation.

The Federal Reserve now steers overnight interest rates through two administered rates. IORB is paid to banks on the reserve balances they hold at the Fed. IORB alone is not sufficient, however, to create a floor under short-term money market rates. It is, in practice, a "leaky" floor because there are certain large financial actors who hold reserves but, unlike banks, are not entitled to earn interest on those balances. The most prominent of these institutions are government-sponsored enterprises (GSEs), including the Federal Home Loan Banks (FHLBs), Freddie Mac, and Fannie Mae. Counterparties, predominantly foreign banks, discovered that they could borrow cheaply from GSEs and

[24] "[O]ur liquidity provision had begun to run ahead of our ability to absorb excess reserves held by the banking system, leading the effective funds rate, on many days, to fall below the target set by the Federal Open Market Committee," Bernanke said in a speech a few months later (Bernanke 2008).
[25] Powell's announcement clarified earlier comments about the Committee's intention to "reduc[e] the quantity of reserve balances, over time, to a level appreciably below that seen in recent years but larger than before the financial crisis." (FOMC 2017)

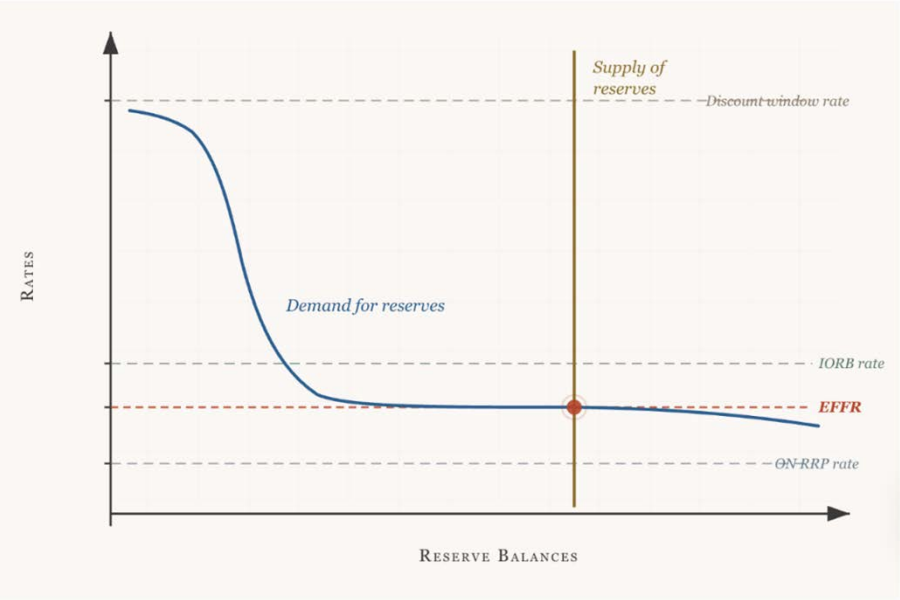
park the funds overnight in Fed accounts to earn an arbitrage spread (Afonso, Entz, and LeSueur 2013; Afonso et al. 2023).

To support the IORB in maintaining interest rate control, the Fed uses the Overnight Reverse Repurchase Agreement (ON-RRP) facility. The facility borrows cash from money-market funds, GSEs, and primary dealers against Treasury collateral on an overnight basis. By putting a firmer floor on money market rates, the Fed has become the borrower of last resort in money markets, offering a fixed rate that competes with other market actors.

In the pre-GFC scarce reserves regime, the Fed drained and injected reserves to shift the equilibrium interest rate in overnight money markets along a demand curve. Today, the Fed no longer conducts these operations to actively manage interest rates. Instead, the FOMC and Board of Governors manage the administered rates that the System pays its counterparties. The FOMC does not focus on targeting a specific reserve balance informed by the stance of monetary policy, but rather ensures the supply of reserves stays in a comfortable “ample” zone so that the administered rates remain efficient as the sole determinants of market pricing.

Neither the FOMC nor the Board of Governors has officially defined what level of reserves is “ample” (Board of Governors 2019, 2022). But economists both within the System and external to it have contextualized the level using a framework of reserve demand originally developed by Poole (1968). The clearing price of reserves, which is the short-term overnight interest rate as expressed today by the EFFR, depends on the location of supply along an inverted S-shape curve characterizing bank demand for reserves (LeSueur et al. 2024). When reserves are scarce, banks will borrow reserves at any price up to the cost of emergency lending facilities like the discount window or, more recently, the facility formerly known as the Standing Repo Facility (SRF; now known simply as “standing repo operations”) (Afonso et al. 2022). In an extreme scenario, the Fed ensures that prices cannot exceed this ceiling by offering abundant funds at the high rate. As the supply of reserves increases, the overnight price of credit falls until it hits the administered IORB and ON-RRP rates. The price of credit once again becomes unresponsive to short-term fluctuations in supply. The term “ample” is often taken to describe the amount of reserves in the banking system that ensures that the equilibrium sits on the modestly elastic or “gently sloping” portion of the demand curve (Afonso et al. 2025; Perli 2024a,b; Williams 2025). Any Fed decision to add or subtract reserves has a small but non-negligible impact on the policy rate.

Figure 1: A schematic of the price elasticity of reserve demand



The demand curve itself is, however, not only unobservable in practice, but it is also prone to shifts (Afonso et al. 2024). Horizontal shifts reflect the underlying drivers of bank demand for reserve balances. These drivers can be economic—such as a desire to hold zero duration risk-free assets—or regulatory—such as statutory requirements or liquidity risk management. Vertical shifts, however, happen when the price banks are willing to pay for every given quantity moves up or down, even though their quantity preference itself has not changed.

This opacity has led researchers to develop multiple metrics intended to measure the ampleness of reserve supply, including the pricing differential between the EFFR and IOR, measures of the short-term price elasticity of the federal funds market, the timing of interbank payments, the participation of domestic banks in federal funds markets, and the pricing of repurchase agreement transactions (see e.g., Perli 2024b; Afonso et al. 2024; Clouse et al. 2025). These real-time indicators are used to estimate the lowest comfortable level of reserves, which the Fed defines as "the lowest dollar level of reserves that their bank would feel comfortable holding before taking actions to maintain or increase its reserve balances."[26] Estimates of the current needed supply vary, but range from $2.5 to $3 trillion (Ennis and MacMillan 2023; Haubrich 2025).

This framework has been remarkably successful in maintaining interest rate control. Since 2008, the EFFR has been firmly within the target range on all but a handful of occasions. That includes significant shocks like the European sovereign debt crisis, the COVID market panic, and the collapse of Silicon Valley Bank (Clarida et al. 2021).

[26] See e.g., Board of Governors 2024a. That document clarifies, "'Taking action' is defined in the survey as taking active steps to intervene and raise funds to replenish reserves."

IV. A counterfactual framework for estimating the value creation of ample reserves

In order to identify how the ample reserves framework creates value for the commercial banking sector, we use a counterfactual balance sheet analysis to imagine a scenario where the Federal Reserve implemented monetary policy without the expansion of reserves required by the ample reserves framework. Imagining this counterfactual enables us to pinpoint how today's operating system for monetary policy changes the commercial banking sector. Our counterfactual balance sheet analysis considers how the Federal Reserve's provision of reserves affects both sides of banks' balance sheets. We identify two channels of value creation: the deposit franchise channel and the maturity transformation channel.

Deposit franchise channel

When the Fed expands reserves, it mechanically increases the size of the banking system's balance sheet as banks intermediate the sale of securities from non-bank institutions to the Fed. The deposit franchise channel reflects the net economic value created by this expansion. Its value can be calculated as the difference between the expected returns on reserve assets and the expected cost of supporting liabilities over time.

The Fed's balance sheet grows for three distinct reasons (Remache 2024). First, autonomous factors like currency in circulation (i.e., the Federal Reserve notes in a person's wallet) respond to demand for physical transactional currency. That growth has historically been quite steady and rarely has responded to shocks (Haasl et al. 2018). Second, various standing and emergency liquidity programs, including discount window lending, central bank liquidity swaps, and other emergency lending programs, increase the size of the balance sheet (Labonte 2020; Dwyer et al. 2024). These expansions tend to be large but temporary and in response to severe exogenous shocks. Third, LSAPs conducted during QE involve purchases of long-term Treasury and federal agency securities (primarily mortgage-backed securities) as a tool of non-traditional monetary policy (Gagnon et al. 2011; Kim et al. 2023; Bernanke 2020). LSAPs tend to be held over long durations and therefore should be considered an expansion of reserve supply for an extended period.

Our focus is on LSAPs conducted during QE, which are primarily intended to suppress long-term interest rates by removing duration risk from the private market. In these operations, the Fed purchases long-term Treasuries and agency MBS, typically from non-banks. When the initial purchase occurs, a new deposit liability is created at a commercial bank, and the Fed issues reserves to the commercial bank. Empirical work suggests that, on a consolidated basis, reserves retained by the banking system tend to be deposit funded (see e.g., Castro et al. 2022; Emmons 2022; Acharya et al. 2023). We believe it is reasonable to assume that reserves are funded by deposits for this work.

To better understand this mechanism, we can consider a series of simple T-charts. When a non-bank sells securities, it receives a new deposit at its commercial bank,

which represents a new liability for the bank. The bank, which cannot refuse its role in this payments process, in turn receives an equivalent reserve balance at the Fed, a new, risk-free asset. The result is that the non-bank financial institution exchanges securities for deposits, while the bank's balance sheet expands on both sides—reserves as assets and deposits as liabilities. In aggregate, QE therefore migrates securities out of the non-bank sector and into the Fed, while simultaneously enlarging the banking system's balance sheet through the creation of new central bank reserves and corresponding commercial bank deposits. This dynamic is illustrated in the simple T-charts below (see also Cipriani et al. 2022).

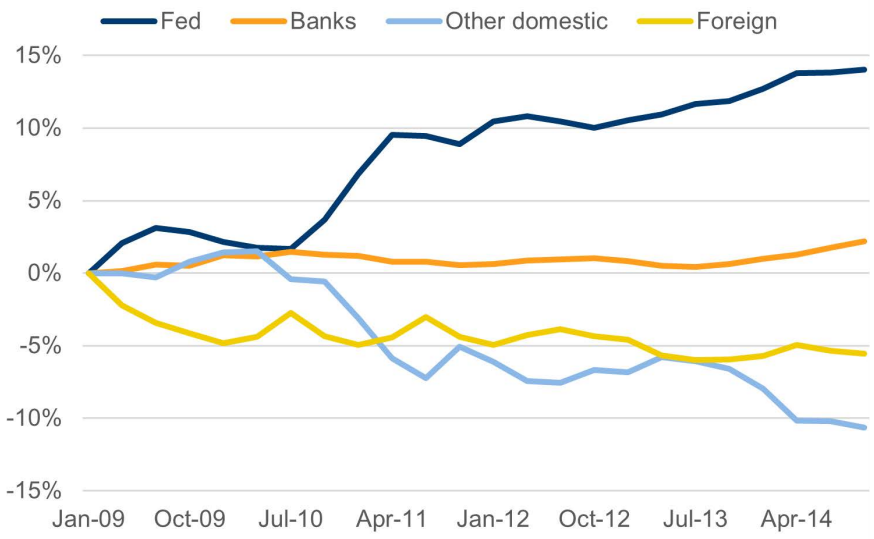
Federal Reserve Banks	
Assets	Liabilities
+$100 Treasuries	+$100 Reserves

Commercial Banks	
Assets	Liabilities
+$100 Reserves	+$100 Deposits

Non-Bank Financial Institutions	
Assets	Liabilities
-$100 Treasuries	
+$100 Deposits	

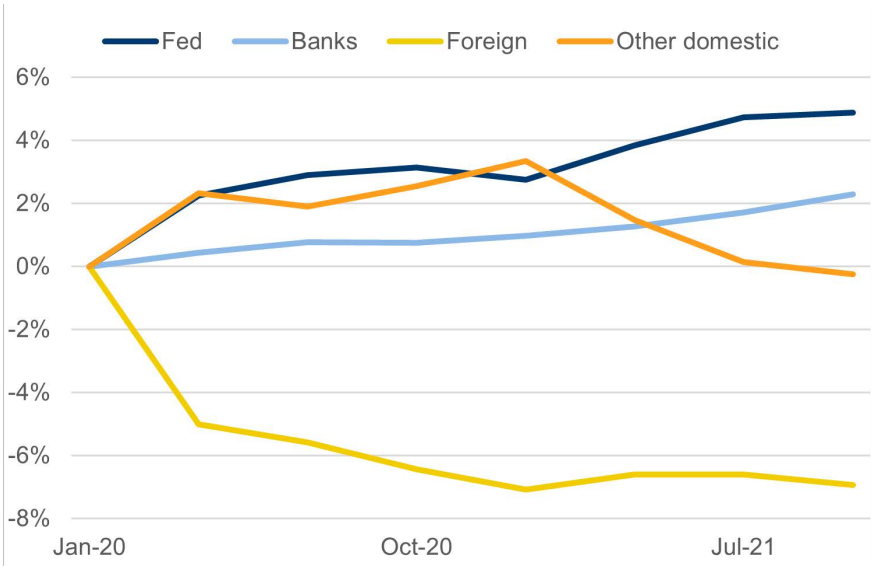
Flow of funds data collected by the Fed show a sharp increase in the Fed's ownership share of the Treasury market starting in mid-2010, which is mirrored by a drop in holdings by domestic non-bank institutions. Banks, meanwhile, held their share approximately constant (Figure 2). LSAPs conducted during the COVID pandemic exhibit a similar pattern of Fed purchases from non-banks. However, in this case the principal source is foreign investors rather than domestic non-banks (Figure 3). The LSAPs of QE incentivize the migration of certain securities from non-banks to banks, only to be subsequently transformed into reserves by the Federal Reserve.

Figure 2: Net change in Treasury holdings by holder type; percent of marketable Treasury securities outstanding



Source: FRB Z.1, author's calculations

Figure 3: Net change in Treasury holdings by holder type; percent of marketable Treasury securities outstanding



Source: FRB Z.1, author's calculations

In a simple model of this activity, we assume reserve assets R_t are remunerated at a risk-free rate r_t. Interest rates vary with time reflecting hikes or cuts in the target policy rate, and reserve balances vary depending on the Fed's desire for QE or its opposite, quantitative tightening (QT). We also define liabilities $L_t = R_t$ which are directly attributable to reserves supplied by the Federal Reserve banks and bear interest at a rate $\beta(r_t)r_t$. The rate paid on these liabilities equals a deposit beta that can depend on

the policy rate, times the policy rate. The classic deposit beta of $0 \leq \beta(r) \leq 1 \; \forall \, r$ is potentially a function of interest rates (see e.g., Luck et al. 2023; Greenwald et al. 2023). For simplicity of calculation, we define $R_t = R_0 \, e^{-\alpha t}$ where α is the assumed decay (or growth) rate (the half-life would be $\ln 2/\alpha$). Importantly, this reserve balance excludes the proceeds of discount window borrowings, which will be funded by liabilities that earn roughly the risk-free rate.[27] In a steady state, that growth rate encodes the assumed attrition rate of deposits, typically taken to be approximately five to seven years on average (Office of the Comptroller of the Currency 2024).

The creation of new reserves can introduce new costs, including higher capital costs. The larger balance sheet resulting from LSAPs enlarges the bank's balance sheet, potentially requiring the bank to raise more capital to keep up with regulatory requirements, some of which are size-dependent and risk-agnostic. These costs can be material, because the bank is forced to hold a new, low-yielding asset in the form of reserves, but must fund a small portion of it with high-cost equity. Capital costs, however, are not explicit but rather reflect the estimated rate of return expected by the providers of that capital—namely, common equity shareholders (see e.g., Kovner and van Tassel 2018, 2022, and references therein). In that sense, they are not a cost in the context of exploring distributional outcomes as we are primarily interested in value created for bank employees and shareholders (which we refer to simply as "banks" for brevity).

It is also important to consider the binding constraint on most banks in evaluating capital costs. There are many potential binding constraints in addition to capitalization requirements, including liquidity requirements, stress testing, and other factors. But increased reserve holdings will only incur additional capital costs if leverage is the binding constraint on bank activity. The Supplementary Leverage Ratio (SLR) in particular has occasionally been binding.[28] However, there are two reasons why this constraint is not particularly relevant to our analysis. First, it only affects a subset of banks which together hold only about 30% of total reserves (Afonso et al. 2023a). Second, regulators have recently adjusted some aspects of SLR so as to make it much less likely to be binding in the future.[29]

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[27] Discount window loans have historically been priced at the primary credit rate which for much of the history of the Fed has been set at a penalty relative to the policy target rate. More recently, primary credit has been priced closer to the top of the policy rate management band and has been made available for longer terms. Generally speaking, and for our purposes, we consider discount window loans to be priced at approximately the overnight risk-free rate.

[28] "The agencies estimate that, in the period from Q2 2021 to Q4 2024, the supplementary leverage ratio requirement was the binding tier 1 capital requirement 60 percent of the time, on average, for seven out of the eight GSIBs. In the same period, the supplementary leverage ratio requirement was the binding tier 1 capital requirement 87 percent of the time, on average, for ''major'' depository institution subsidiaries of GSIBs." (Board of Governors 2025, 46).

[29] "The proposed modifications would help ensure that the enhanced supplementary leverage ratio standards serve as a backstop to risk-based capital requirements rather than as a constraint that is frequently binding over time and through most points in the economic and credit cycle, thus reducing potential disincentives for GSIBs and their depository institution subsidiaries to participate in low-risk, low-return businesses." (Board of Governors 2025, 2). "Because banks play an essential intermediation role

In addition to capital costs, the deposits created to support reserve growth introduce additional operating costs. Operating costs for the deposit franchise are dominated by salaries and benefits, technology, marketing, branch maintenance and acquisition, compliance, and payment processing. As a general matter, studies have found that a sizeable fraction of operating costs associated with servicing demand deposit accounts are fixed and do not scale with balances (Osborne, 1982). Further, because the operating costs that scale with balances arise from the provision of services (e.g., payment processing fees, fraud and disputes, headcount, credit card servicing) that are related to account activity, it stands to reason that non-operational accounts are less likely to incur such costs. Banks make additional payments to the FDIC's deposit insurance fund, but outside of special assessments the amount is minimal–typically less than 0.1% on a consolidated basis.[30] Hirtle and Plosser (2025) find that non-interest expenses as a fraction of total assets among U.S. banks declined noticeably over the course of the 2020-22 QE program.[31] This all suggests that, for the specific case of marginal deposit creation directly related to increased reserve supply, it is reasonable to assume variable costs are small compared to the net interest margin—particularly in a high interest rate regime.

Bringing the components together, we arrive at a simple expression for the value of the deposit franchise, which parallels the standard approach to valuing a bank's deposit franchise:

$$S_B = R_0 \int_0^{\infty} (1 - \beta_t) r_t e^{-(r_t + \alpha)t} dt$$

This is analogous to the now familiar exercise in valuing the overall deposit franchise of a traditional bank (Drechsler et al. 2017; Drechsler et al. 2024; Greenwald et al. 2023). For illustration, we can simplify this expression to assume a constant deposit beta ($\beta_t = \beta$) and risk-free rate ($r_t = r$). This yields:

$$S_B = R_0(1 - \beta)\frac{r}{r + \alpha}$$

When rates are at the zero lower bound, and banks are both earning and paying almost nothing in interest, the value of this channel is zero. Additionally, faster runoff in reserve balances, either through institution-specific deposit attrition or active Fed balance sheet policy, reduces its value, and vice versa for slower attrition.

Interest rates typically vary with time. This is implied by the slope of the yield curve, or differences in yield for Treasury securities (or derivatives) with different underlying maturities. As many have discussed, the slope of the yield curve is determined by a

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in the Treasury market, we want to ensure that the leverage ratio does not become regularly binding and discourage banks from participating in low-risk activities, such as Treasury market intermediation" (Powell 2025). "As I will discuss in greater detail shortly, regulators must act quickly to address the growing problems with increasingly binding leverage ratios" (Bowman 2025).

[30] https://www.fdic.gov/deposit-insurance-assessments/fdic-assessment-rates.

[31] See Hirtle and Plosser 2025, figures 4(a), 4(b) and IA24.

combination of forward-looking expectations for the forward path of short-term interest rates as well as a so-called term premium which reflects uncertainty and risks around that expectation (see e.g., Kim and Wright 2005; Adrian, Crump & Moench 2013). We can therefore relax our assumptions and allow r_t to vary with time. For illustrative purposes, we define two overnight short-term interest rates: $r_t = r_i$ for $t = [0, t_f)$ and $r_t = r_f$ for $t = [t_f, \infty)$. Revisiting the above expression, we have:

$$S_B = R_0(1-\beta)\left[\frac{r_i}{r_i+\alpha}\left(1-e^{-(\alpha+r_i)t_f}\right)+\frac{r_f}{r_f+\alpha}e^{-(\alpha+r_f)t_f}\right]$$

We can then return to the ZLB, setting $r_i = 0$. So long as $r_f > 0$—in other words, when the yield curve is upward sloping—the deposit franchise channel still has value despite the lack of immediate remuneration on those balances. It is also more generally the case that the steeper the yield curve, and therefore the larger the difference between r_i and r_f, the larger the value created. Likewise, if the yield curve is inverted ($r_i > 0$ and $r_i > r_f$), that value is lesser, all else equal. This two-period model is purposefully reductive, but it illustrates the value of a counterfactual rather than a cash flow analysis in valuing this channel. As we will see, this has important implications for the relationship between the Fed and the banking system.

Finally, it is worth returning to remunerating reserve balances in the first instance. The Fed has, of course, been adjusting the size of its balance sheet and reserves supplied to the banking system since its founding. There have been many occasions during which reserves were supplied in excess of statutory requirements or those related to interbank payments. The First and Second World Wars are clear case studies to this effect (see e.g., Garbade 2012; Garbade 2020; Menand & Younger 2023). Those reserve balances, however, were non-interest bearing. In the above formulation, that would mean $S_B < 0 \; \forall \; r > 0$. Because banks would be forced to increase their interest expense to support non-interest-bearing assets, reserve supply would act as a tax on the banking system, fueling the recurring argument for the payment of IORB. Unless the deposits that support reserves are remunerated at the same rate ($\beta = 1$), this tax becomes a source of value.

The value of the deposit franchise channel is the net economic value that commercial banks receive through QE. QE expands the size of the consolidated commercial banking balance sheet. As banks gain new assets in the form of interest-earning reserves at the Fed, they simultaneously fund those assets with new liabilities in the form of customer deposits. The value creation arises because banks earn more on these reserves than they pay out in interest on the corresponding deposits. Unless banks pass on the full interest rate from the Fed to their depositors (meaning a deposit beta, β, of 1), this difference between interest income and interest expense creates value for the banking system.

Maturity transformation channel

In addition to the deposit franchise channel, the Fed is creating value for the private sector via maturity transformation. Unlike the deposit franchise channel, this channel can result in reduced remittances to the Treasury (for an overview, see Cavallo et al. 2019).

Reserves are always valued at par, while securities fluctuate in value, sometimes significantly. Mark-to-market valuations theoretically should show approximately symmetric gains and losses—over the long run, markets are just as likely to overestimate as underestimate future changes in interest rates. Put differently, if interest rates are mean reverting, then over a long enough horizon, the expected value of Fed remittances to the Treasury should be zero, if not positive. Unlike commercial banks, the Fed faces no risk of a run, because it can carry securities at cost and does not need to liquidate to meet withdrawals. That has led some to argue that fluctuations in the market value of its portfolio simply shift the timing of its income without affecting its long-run fiscal contribution.

A claim that Fed remittances to the Treasury have a positive expected value rests on two assumptions about how interest rates behave over time. First, it assumes that large-scale asset purchases (LSAPs) are undertaken independently of the level of interest rates or the term premium. Second, it assumes that short-term interest rates reliably revert to their long-run average much faster than the maturity of the Fed's asset portfolio (the SOMA portfolio's weighted-average maturity, or WAM). While both assumptions are reasonable in theory, there are reasons to doubt that either holds consistently in practice.

First, LSAPs are not randomly timed with respect to the interest-rate environment. Although policymakers often describe balance-sheet policy as distinct from interest-rate policy, LSAPs are typically deployed precisely when short-term interest rates are constrained by the zero lower bound (Cavallo et al. 2019). Empirical evidence suggests that when the Fed eventually lifts rates from the ZLB, long-term yields tend to rise sharply—and by more than markets had priced in beforehand (Gürkaynak et al. 2005; Hanson & Stein 2015; Schmeling, Schrimpf, & Steffensen 2022). Similarly, LSAPs tend to reduce the term premium, which potentially exacerbates this dynamic (Gagnon et al. 2011). By several measures, the term premium was negative during prior QE programs (Kim & Wright, 2005; Adrian, Crump & Moench, 2013). The implication is that the Fed is most likely to have a large balance sheet precisely when it is asymmetrically exposed to mark-to-market losses and forward-looking negative net income.

Second, the timing of mean reversion matters because the Fed expands its balance sheet actively during QE but allows it to shrink only gradually through passive runoff during QT. For remittances to be positive over the long run, the Fed's cost of funds—well proxied by the policy rate—must fall back toward its long-run average faster than the average maturity of the assets it holds. If short-term rates remain elevated for too long, the Fed can be left financing a large, long-duration portfolio at high rates, generating sustained periods of negative net income. A simple estimate shows a mean reversion half-life for federal funds rate of 3.5 years for 1961-2025 and 4.3 years for

2010-2025, while the weighted average maturity of Treasury debt has ranged from four to six years since the early-1980s.[32] That argues for caution in assuming the expected value of Fed remittances is positive over the long run.

This asymmetry is, importantly, specific to the current framework. Prior to 2008, purchases for the SOMA were driven mostly by so-called autonomous factors, specifically the growth of currency in circulation. Absent extreme moves in interest rates, currency demand has not historically responded to shocks and other macroeconomic factors (Haasl et al. 2018). Further, a sizeable fraction of Federal Reserve notes, especially $100 bills, are held abroad (and have been for some time; Porter and Judson 1996; Bertaut et al. 2025). Thus the asymmetry in expected future value of growing the SOMA portfolio created by greater reliance on LSAPs as a monetary policy tool is a relatively recent development tied to the formulation and formalization of the ample reserves framework.

To quantify the value of this channel, we examine net gains and losses on the System Open Market Account (SOMA). The large size of the Fed's balance sheet and a significant increase in interest rates have led to substantial mark-to-market losses on the Fed's portfolio. Although those losses are not immediately realized, over time they may represent a real cost to taxpayers through a persistent decline in remittances to the Treasury. Interest income on the SOMA portfolio has historically been used, first and foremost, to fund Fed personnel, facilities, and other operational expenses, and any residual income is by statute remitted to the Treasury on an annual basis. At times, these remittances have been quite large, peaking in late 2021 at over $100 billion (Board of Governors 2021). But when the Fed incurs losses on SOMA holdings, income is used to decrement the resulting "deferred asset" (for details, see Faria-e-Castro, et al. 2023 and Labonte 2025). The Fed thus pays itself back through interest income before making any new remittances to the Treasury. Through that mechanism, the Treasury remains the ultimate bearer of losses on the SOMA portfolio, representing a transfer from taxpayers to the private sector.[33]

Schulhofer-Wohl (2025) observes that reserves and short-dated Treasury securities function as interchangeable instruments, since both create similar interest rate expenses for the government and are perceived by the market as nearly risk-free. From a consolidated balance sheet perspective, this means that QE essentially represents an

[32] We estimate the mean-reversion half-life using quarterly average data and an AR(1) process using FRED data for the Federal fund rate. This is, of course, only a crude estimate and more sophisticated term structure models (e.g., Adrian, Crump and Moench 2013) include an implicit estimate of mean reversion timescales for policy that would be more precise and better capture the time series statistics. Based on data provided by J.P. Morgan.

[33] In this context we are defining the channel rather than taking a view on its likely value. We leave that to empirical data. Some have argued that interest rates tend to be mean-reverting over the long run and therefore today's value creation will be tomorrow's tax. In other words, the SOMA portfolio is just as likely to have MTM gains as it is to have losses, and over the long run, those two factors should be offset. One could alternatively argue that the Fed tends to expand its balance sheet when policy rates are near the ZLB and therefore is biased towards buying Treasuries and other securities when rates are low. That argues for a net positive value transfer on average over time. For the purposes of this piece, we are content to simply demonstrate the fact of value created via this channel and leave its likelihood to further research.

implicit decision regarding the management of government debt, rather than causing a substantial change in the interest expense of the federal government.

However, there are two notable qualifications to this view. First, QE is initiated by the central bank, not the Treasury, and this distinction has important consequences for the maturity structure of government liabilities. The mark-to-market gains and losses on securities purchased for the System Open Market Account (SOMA) as part of QE can be interpreted as gains or losses for taxpayers, arising from deviations from the debt management approach set explicitly by the Treasury. Given the central bank's independence, it is important to assess the fiscal and distributional impacts of QE separately, since the program may not align with the preferences or risk tolerance of Treasury officials.

Second, reserves and the RRP are remunerated at a rate determined by the central bank, which is fixed and set administratively. In contrast, yields on Treasury securities are largely established by market forces. This divergence can lead to substantial differences between administered rates and market yields, especially during periods of market stress.[34]

This value transfer affects the private sector writ large, not just commercial banks. However, it is worth noting that there are reasons to believe commercial banks benefit in an asymmetric way. The central bank does not need to acquire securities directly using bank-affiliated dealers as intermediaries (i.e., have banks act as agent, or traditional QE). It could use supervisory or regulatory levers to require or otherwise push commercial banks towards buying Treasuries for their own portfolios (i.e., as principal, or quasi-QE). The latter approach has been used several times in the past, most notably during the First World War (Menand and Younger 2023) and with the introduction of the Liquidity Coverage Ratio (LCR; BCBS 2013). The key distinction from a value transfer standpoint is that the latter exposes banks to mark-to-market fluctuations on the value of their securities portfolio.

Unlike the deposit franchise channel, the maturity transformation channel introduces a distinct fiscal cost by reducing payments from the Fed to the Treasury. While gains and losses may balance over the very long run, the asymmetric timing of QE operations means losses are concentrated and realized through years of foregone remittances, creating a measurable fiscal drag that represents a real transfer from taxpayers to the private sector.

[34] Based on data provided by J.P. Morgan, since the beginning of 2009, three-month Treasury bills averaged 5 bp below maturity-matched swaps linked to EFFR. After adjusting for the fact that EFFR tends to set well below IORB, this is equivalent to roughly -13 bp. It has also been as large as -50 bp during periods of acute stress like the COVID pandemic.

V. Quantifying value creation under ample reserves

We estimate the value of the deposit-franchise—the portion of banking activity related to Federal Reserve liabilities—by treating deposits as fixed-maturity liabilities with a five-to-seven-year weighted-average maturity liability, consistent with common industry practice. Earlier sections used an exponential-decay profile to build intuition. Here, we adopt straight-line attrition over that horizon to bound the sensitivity to functional-form assumptions and to map cleanly into duration-equivalent metrics. For the policy-rate path and discount factors, we use the USD overnight index swap (OIS) curve. An OIS contract exchanges a fixed rate set at trade for a floating leg tied to the EFFR.[35] From that curve we compute forward one-year par rates and interpret them as market-implied averages of EFFR over the corresponding one-year forward periods. These forwards provide the term structure used to project reserve costs and to discount cash flows for the reserve-funded leg, and by extension, for the deposit-franchise and maturity-transformation valuations.

Perhaps the most important variable to estimate is the deposit beta, β. Critically, this is the marginal β associated with deposit creation directly attributable to Fed purchases. Given the composition of non-bank ownership of Treasuries and MBS, we would *ceteris paribus* expect reserves accumulated by non-bank sales of those securities to the Fed to be associated with institutional deposits. The conventional wisdom is that the interest rate on these deposits tracks market rates more closely than retail deposits, because those institutions are more aware of alternatives like money market funds. As this marginal β approaches unity, the value of those marginal deposits to the commercial bank converges to zero.

Yet in practice, the marginal β does not clearly approach unity. During QE programs, non-bank institutional investors are not necessarily replacing their Treasuries and agency MBS with bank deposits. In fact, those investors are incentivized to respond to lower returns from compressing term premium on risk-free assets by seeking out higher yielding investments like corporate credit. This so-called "portfolio balance" channel (Tobin 1965, 1969; Friedman, 2000) is thought to be the primary channel through which QE influences credit conditions (Gagnon et al. 2011; Williams 2011; Bernanke 2012; Carlson et al. 2020).[36] There is further evidence from the pricing of corporate credit during the 2012-14 QE program that suggests increased demand for corporate credit.[37] When non-bank investors

[35] The EFFR and IORB typically trade with a small gap, or basis. This is not typically large or variable, though it can shift from time to time. More violent shifts have occurred occasionally; they also tend to be short-lived as the Fed can easily supply reserves to cure any temporary scarcity. See e.g., Logan (2019).

[36] This was stated clearly by Bernanke (2012): "Imperfect substitutability of assets implies that changes in the supplies of various assets available to private investors may affect the prices and yields of those assets. Thus, Federal Reserve purchases of mortgage-backed securities (MBS), for example, should raise the prices and lower the yields of those securities; moreover, as investors rebalance their portfolios by replacing the MBS sold to the Federal Reserve with other assets, the prices of the assets they buy should rise and their yields decline as well. Declining yields and rising asset prices ease overall financial conditions and stimulate economic activity through channels similar to those for conventional monetary policy." Carlson et al. (2020) made a similar assertion: "A central objective of BSPs is to encourage investors to rebalance their portfolios toward riskier assets."

[37] Many factors influence corporate credit. But the 2012-14 LSAPs were notable for not being initiated during a period of acute macroeconomic or market stress. The spread between 10-year Baa corporate bonds and Treasuries compress by more than 100 bp between the summer of 2012 and late 2014. https://fred.stlouisfed.org/series/BAA10Y.

sell their Treasuries to the Fed and then reinvest the proceeds in corporate credit, the deposits generated by that process are transferred to another, presumably less price-sensitive counterparty. Intuitively, this process will repeat until QE-related deposits have been recycled down to the counterparty willing to offer banks the cheapest funding—i.e., the lowest β.

To complement this conceptual argument, there is empirical evidence that, in equilibrium, the marginal β associated with Fed balance sheet growth is meaningfully below unity. Bank surveys show low betas paid on wholesale deposits even during recent periods of rate hikes. It appears that, in equilibrium, QE-related deposits are not exclusively non-operational but rather a mix of various types, including lower beta products like operational wholesale and retail balances. Imperfect competition and regulatory factors (like the LCR) give banks pricing power, allowing them to keep deposit rates down even when reserves increase. For the sake of brevity, we summarize that evidence in Appendix A.

Taken together, this suggests a $\beta < 1$ is appropriate to describe marginal deposit creation associated with QE. We believe that a $\beta \approx 0.65$ is a defensible estimate. That is roughly consistent with SFOS Survey Results from May 2023 considering the likely mix of marginal deposits associated with QE (importantly, not entirely non-operational wholesale; see Appendix). That figure is also somewhat higher than the beta of the total interest expense of the consolidated deposit book, which data collected by the Federal Deposit Insurance Corporation (FDIC) suggests has realized $\beta \approx 0.4$ over the past five years.[38] A more dynamic approach incorporating the rate sensitivity of deposit betas would be more accurate, but we believe using that value of $\beta \approx 0.65$ is sufficient for our purposes.

We can then calculate the approximate value of the deposit franchise channel as:

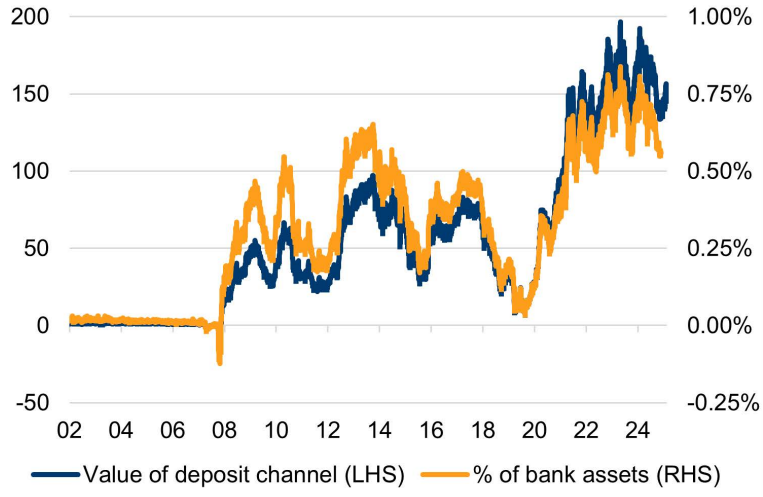
$$S = R_0(1-\beta)\sum_{t=0}^{t=M}\frac{r_t}{(1+r_t)^t}\max\begin{Bmatrix}1-t/M\\0\end{Bmatrix}$$

where t is in years, r_t are 1-year OIS swap rates with starting date t and $M = 10$ assumes a 10-year effective maturity with straight-line amortization (and 5-year weighted average maturity).

The results are summarized in Figure 4. We find value created via the deposit franchise channel peaked at around $200bn, or 1.0% of total bank assets, in 2023. It is, however, worth noting that, along the lines of the above discussion, the deposit franchise channel was far from trivial when policy rates, and therefore the spot rate of remuneration on reserve balances, was zero.

[38] See *Historical Bank Data* at https://www.fdic.gov/analysis/bank-data-statistics.

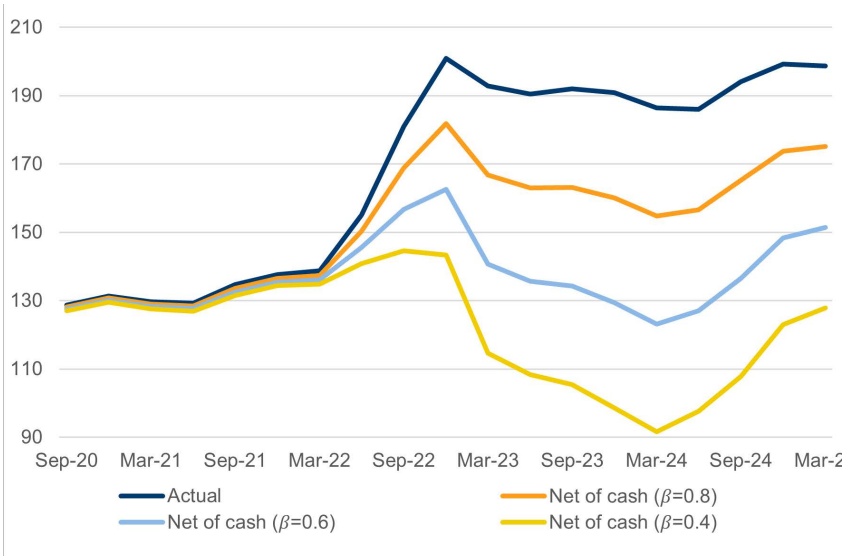
Figure 4: Value of deposit channel value in $ billions and as a percent of bank assets



Source: J.P. Morgan, FRB H.4.1, FRB H.8, author's calculations

Some might argue that these figures do not show up in bank profits. English and Kohn (2025), for example, argue that the lack of obvious excess profits among banks cautions against any value transfer in practice. While we are sympathetic to that argument, myriad factors affect bank revenue and profit margins, making it difficult to isolate the role of reserves. One clean way to do so would be to focus on net interest income. Data collected by the FDIC, for example, shows that even at a high beta, a substantial fraction of net interest income growth in 2020-22 was attributable to cash items (the vast majority of which are balances at Federal Reserve banks) supported by deposits (Figure 5).

Figure 5: Net interest income for banks, reported and net of reserves*



Note: Data provided by the FDIC includes all "cash items," but those are almost entirely reserve balances.
Source: FDIC, author's calculations

VI. Non-economic drivers of demand for reserves

Beyond typical economic factors, banks also demand reserves for non-economic reasons, even if those reserves don't bear interest and thus have zero present value for incremental banking business (S_B). Maturity transformation benefits (S_M) would remain unchanged. Two key non-economic drivers are:

1. **Liquidity Benefit** (S_L)**:** Reserves are essential for interbank payment obligations, clearinghouse margin posting, and other settlement activities. Banks need to hold a portion of their assets in reserves because they are often the preferred, or only, instrument for these purposes.
2. **Regulatory Benefit** (S_R)**:** Various regulations require banks to hold reserves for specific purposes, creating financial value in doing so.

Considering a scenario with static rates, exponential runoff, and no outstanding discount window lending, the total value of holding reserves (*S*) can be expressed as:

$$S = S_B + S_M + S_R + S_L$$

Therefore, in the extreme where the IORB is removed but statutory reserve requirements are not reinstated, banks will continue to hold reserves so long as the remaining liquidity and regulatory value is greater than the value lost due to this change. In other words:

$$S_L + S_R > -\beta R_0 \frac{r}{r+\alpha} + R_0 \overline{\delta_B}(\overline{r_B} - r)$$

We now consider the determinants of S_L and S_R, drawing on data collected by the Federal Reserve such as the September 2024 Senior Financial Officer Survey (SFOS). The Fed asked more than one hundred financial institutions to describe the determinants of changes in their minimum reserve demand (LCLoR, defined above) (Board of Governors 2024a,b). The results suggest S_R and S_L are significant and can be reasonably explained.

S_L is primarily driven by interbank payment activity. Reserves are the sole instrument for settling interbank payments. Daily gross payment activity often significantly exceeds net obligations, leading to substantial intraday fluctuations in a bank's reserve balance due to even minor timing differences between incoming and outgoing payments (Afonso and Shin 2011; McAndrews and Kroeger 2016; Afonso et al. 2022; Copeland et al. 2025). This can result in banks lacking sufficient reserves for outgoing payments.

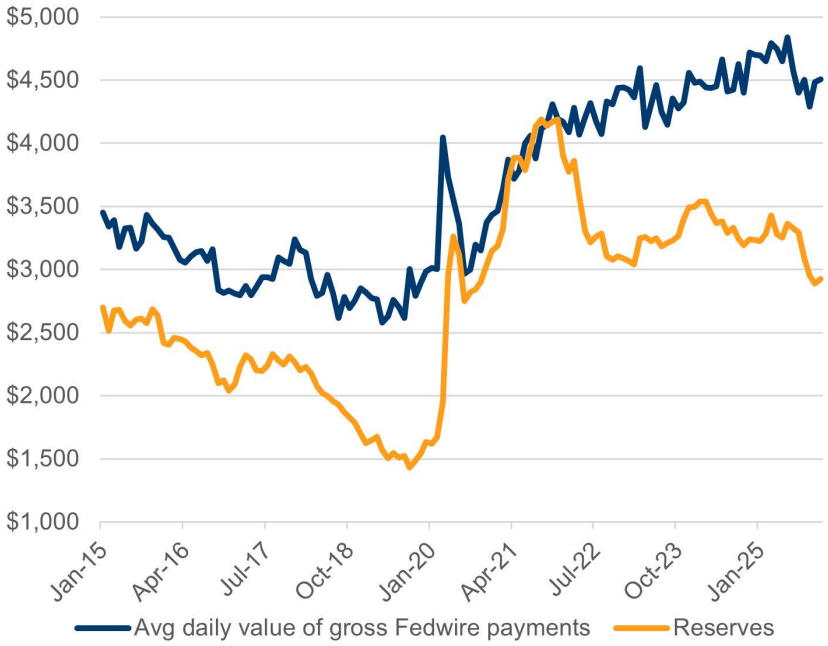
While tactical delays can help banks manage intraday liquidity and avoid negative balances, their effectiveness is inherently limited. The Federal Reserve provides daylight overdraft facilities to support payment flows, either on an unsecured basis

(subject to a fee) or through collateralized overdrafts at no explicit financial cost.[39] Since the introduction of collateralized overdrafts in March 2011, they have accounted for more than 90% of daylight overdraft usage, playing an important role in maintaining payment system stability during periods of stress.[40] Even so, some banks continue to view use of these facilities as stigmatizing (Nelson and Waxman 2021).

This reluctance is reflected in industry survey evidence. Respondents to the Senior Financial Officer Survey identify "changes in assumptions for routine intraday payment or settlement needs" as a significant determinant of their reserve demand. As a result, increases in payment volumes or greater intraday volatility raise the liquidity value of reserves. This effect becomes more pronounced as aggregate reserve balances decline, tightening intraday liquidity conditions across the system.

Federal Reserve data shows a steady increase in payment volumes since 2020, even as reserve balances have decreased (see Figure 6). If this trend continues, S_L will continue to increase over time.

Figure 6: Payment volume versus reserve balances ($bn)



Source: Fedwire Funds Service, FRB H.4.1

[39] See the "Guide to the Federal Reserve's Payment System Risk Policy on Intraday Credit" at https://www.federalreserve.gov/paymentsystems/files/psr_guide.pdf.
[40] See the following description of payment system risk policy:
https://www.federalreserve.gov/newsevents/pressreleases/other20080228a.htm;
https://www.federalreserve.gov/newsevents/pressreleases/other20081219a.htm;
https://www.federalreserve.gov/newsevents/pressreleases/other20100930a.htm;
https://www.federalreserve.gov/paymentsystems/psr_dlod.htm.

Turning to defining the regulatory benefit, S_R, before the Global Financial Crisis, regulatory demand was almost entirely determined by statutory reserve requirements, which mandated banks to hold a portion of their assets as deposits at a Federal Reserve bank. These requirements persisted through the Fed's balance sheet expansion post-2008, though they were not binding in practice. In March 2020, the Federal Reserve Board of Governors formally eliminated these requirements, meaning reserve demand is no longer explicitly mandated by law.[41] Despite this, other, often binding, rules continue to strongly incentivize banks to hold reserve balances significantly beyond what is needed for setting payments. For example, following a period of money market volatility in 2019, Jamie Dimon, CEO of J.P. Morgan Chase, pointed to two specific regulations that severely restricted his bank's ability to lend out reserves despite a clear and compelling economic rationale to do so (Copeland et al. 2025).[42] These regulations mainly concern managing deposit outflows during periods of stress. Consistent with Dimon's observations, stressed outflows from short-term liabilities (including deposits and off-balance sheet exposures) were identified as the most critical driver of changes in LCLoR and management buffers for banks in the SFOS.[43]

First, Regulation QQ mandates large banks to prepare resolution plans ("living wills") to ensure "rapid and orderly resolution in the event of their material financial distress … or failure."[44] Subsequent guidance from the Board of Governors specifically instructed firms to limit their reliance on Federal Reserve credit. This led to strict limits on how much banks were willing to draw down their cash balances intraday. Although regulators later issued a clarifying comment softening these requirements, this remains a crucial consideration in asset-side bank liquidity management and, consequently, their demand for reserves.[45]

Second, Regulation YY requires large banks to conduct stress tests of their ability to meet deposit outflows and other cash demands under "adverse market conditions" and after an "idiosyncratic stress event."[46] These tests must cover at least overnight, 30-day, and 90-day planning horizons. While banks can assume some access to Federal Reserve credit (e.g., the discount window or standing repo operations), they must demonstrate an ability to "monetize a representative portion of its [unencumbered] HLA

[41] https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315b.htm.
[42] On a call with analysts discussing the firm's third quarter 2019 earnings, Dimon said: "Last year [2018] we had more cash than we needed for regulatory requirements. So when repo rates went up, we went from the checking account, which was paying IORB into repo. Obviously makes sense, you make more money. But now the cash in the account, which is still huge. It's $120 billion in the morning and goes down to $60 billion during the course of the day and back to $120 billion at the end of the day. That cash, we believe, is required under resolution and recovery and liquidity stress testing. And therefore, we could not redeploy it into repo market, which we would have been happy to do." (Copeland et al. 2025, 25).
[43] Specifically: "Changes in retail deposit outflows;" "Changes in wholesale liability outflow assumptions;" and "Changes in assumptions regarding off-balance-sheet exposures (for example, outflows related to credit and liquidity facilities, unconsolidated net outflows related to derivative exposures and other collateral requirements)."
[44] 12 U.S.C. Part 243
[45] https://www.federalreserve.gov/supervisionreg/resolution-plans-faqs-domestic-liscc-firms.htm.
[46] 12 U.S.C Part 252.35

[highly liquid assets], by asset class, in private markets through periodically conducting either actual (versus assumed) sales or repo transactions."[47] This specifically excludes non-highly liquid assets like loans and lower-grade securities, which can be pre-positioned as collateral at the discount window or FHLBs. Reserves often fare better in these tests than other assets because they do not require monetization. Therefore, Regulation YY encourages banks to hold larger reserve balances than they would otherwise need for typical payment and settlement activity.

VII. Conclusion

This paper argues that the ample reserves framework creates significant value for the holders of bank equity and the financial sector. No framework is perfectly optimal—monetary policy inevitably requires a certain amount of informed guesswork and tradeoffs. Policymakers may yet conclude that the benefits of ample reserves outweigh its costs, but that can only be done after a full accounting of both the costs and their distributional consequences. This paper intends to inform that debate, not end it.

There are alternatives to the ample reserves framework that allow for control over short-term interest rates, flexible balance sheet policy in the event of an unforeseen shock, and sufficient liquidity in the financial system.

Perhaps the simplest option would be to continue to operate an ample reserve system with a significantly smaller Fed balance sheet. Reserve demand is partially driven by prophylactic liquidity risk management and supervisory and regulatory requirements. The regulatory apparatus could be modified to allow banks to substitute short-term Treasuries and other instruments for reserves, in principle allowing for a smaller equilibrium balance sheet. In this option, rate control would continue through administered rates with a balance sheet significantly smaller than today. The Fed would rely on the use of facilities like the Discount Window, standing repo operations, and daylight overdraft for rate control, but more frequent usage of those facilities is consistent with the Fed's stated preference to destigmatize Federal Reserve credit in money markets. In the meantime, the ON-RRP would continue to ensure rate control was maintained in the event of a major shock that required liquidity injections or QE.

A second option would be to pay interest only on a minimal level of required reserves (see e.g., Duffie at al. 2026, and references therein). The Fed would tier the remuneration of reserve balances, and banks would be required to determine the quantity of reserves they believe they need to hold to meet regulatory requirements. Although model driven and institution specific, supervisors could evaluate the means by which banks developed those estimates and revise the requirements where appropriate. Anything up to those minimal required amounts would earn IORB; reserves in excess of those levels would be non-interest bearing. Banks could then decide between holding a material reserve buffer to accommodate unforeseen shocks, locking up a certain portion of their assets in non-interest-bearing reserves. Alternatively, banks could create procedures to tap Federal Reserve liquidity in the event additional reserves are needed.

[47] https://www.federalreserve.gov/supervisionreg/legalinterpretations/reg-yy-frequently-asked-questions.htm.

Those borrowings would incur a cost at the time, but avoid the ongoing cost of holding non-interest-bearing assets. This framework would be similar to the “repo-led” framework currently being pursued by the Bank of England (Saporta 2024).[48]

A tiered approach offers two potential benefits compared to the current framework. First, and most importantly, it would provide valuable information. The banks themselves would be forced to evaluate their true liquidity needs to justify estimates submitted to supervisors for evaluation. Banks’ incentive would be to develop more effective policies to economize on and make maximal use of those holdings. Regulators would likewise gain access to critical information about liquidity demand via a more market-driven mechanism. That shift would mark a decisive improvement over the current survey-based system, which tolerates wide variation in banks' interpretations while imposing no financial or other adverse consequences for misestimating their liquidity needs.

Only paying interest on required reserves would not necessarily improve the fiscal impact of a large Fed balance sheet, if the Federal Reserve continued to operate its overnight reverse-repo facility. Excess reserves would likely migrate into the ON-RRP, where they would earn roughly the same rate as interest on required reserves. Whether that recycling is desirable is fundamentally a debt-management question.

Alternatively, the Fed could stop paying IORB. Eliminating IORB would create strong incentives for banks to economize on reserve balances, with a clear hit to net interest income, especially at large institutions that hold a disproportionate share of reserves. To mitigate transition risks, the change could be paired with targeted regulatory adjustments—for example, to resolution planning assumptions, internal liquidity stress testing, and the LCR—to promote substitution toward market-rate asset-side liquidity (Treasury bills, repo) rather than reserves. Greater reliance on daylight overdraft and the discount window would likely follow, reducing stigma and aligning practice with how the Fed operated for much of its history.

Rate control could be maintained with the ON-RRP facility providing a floor even with a large balance sheet. Keeping ON-RRP as the floor would route more cash through money-market funds. As an intermediary, their expense ratio of 5 to 20 bps is far smaller than banks’ typical deposit spread. While the EFFR would likely be more volatile, the Secured Overnight Financing Rate (SOFR) would remain well anchored. In aggregate, the economically more consequential benchmark would stay under tight control even if the operating target (EFFR) were noisier. As an aside, switching the operating target rate to SOFR, as some have proposed (Logan and Schulhofer-Wohl 2025), would likely be desirable under these circumstances.

A fourth option would be to return to the scarce reserves, corridor-based system in place prior to the Global Financial Crisis. Before the implementation of ample reserves, the Federal Reserve lost control of the short-term interest rate in rare and

[48]To improve the efficiency of bank liquidity planning, it would be desirable to carve those facilities out of capital requirements such as the Supplementary Leverage Ratio (SLR) and GSIB surcharge so as to avoid unwanted frictions.

extreme circumstances.[49] Volatility in the federal funds market could be elevated at times, particularly at quarter-end, but even in those periods, market disruption was minimal. The Fed was able to set and manage the short-term policy rate effectively. That arrangement would make price signals in the interbank lending market much more valuable for monitoring the functioning of money markets than they are today. The FOMC could also keep the ON-RRP facility in place as a firm floor on rates in the event they need to increase the size of the balance sheet quickly.

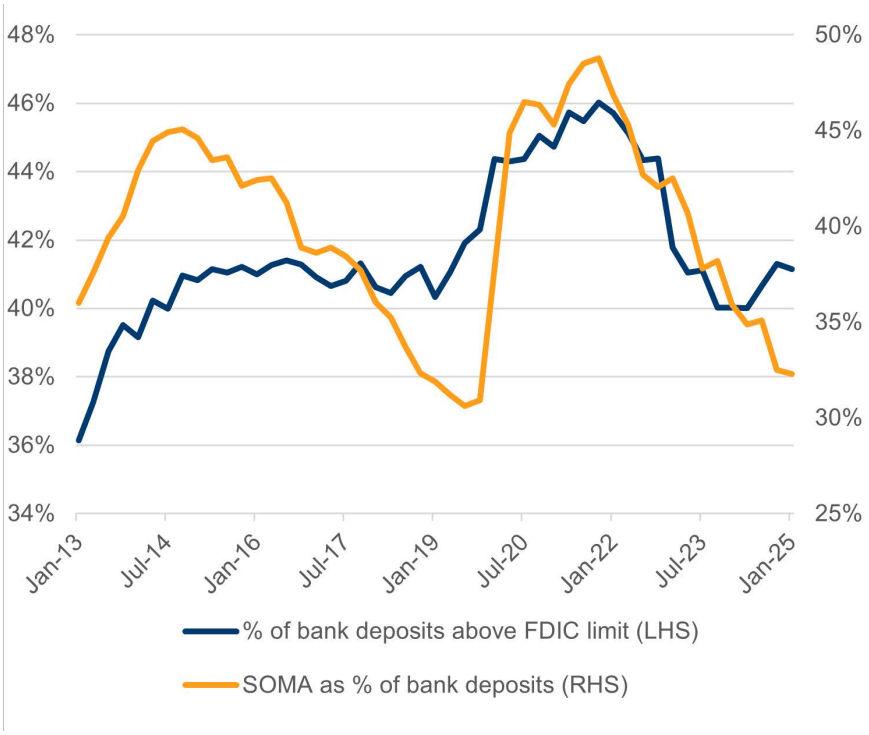
Returning to a scarce reserves framework would mean a radical reduction in the size of the balance sheet. One important effect of such a change could be a reduction in broad money supply. That deposit drain would likely disproportionately affect accounts with large balances. Federal Reserve data show, for example, that as SOMA grows, the share of deposits sitting above the FDIC insurance cap rises in tandem (see Figure 7).[50] Those very large balances include some retail wealth, but the bulk are corporate and institutional accounts created to settle wholesale payments. Regulatory compliance reporting suggests that a sizable fraction—roughly 40% of institutional deposits and 20% of all deposits—are non-operational.[51] These balances exceed the amounts that customers, including large multi-national corporations and financial institutions, need for day-to-day transactions. Instead, they function as a savings instrument—otherwise inactive funds parked at banks as a near-money asset because reserves are plentiful and risk-free. Empirical analysis of the aggregate deposit base reflects this change, in line with the adoption of ample reserves.

[49] Most notably, the Fed lost control of interest rates in the ten days following the terrorist attacks of September 11, 2001, when money market rates dipped as low as 1.25%, even though the target rate remained at 3% (McAndrews and Potter, 2002). Similarly, money market rates broke the target band in the wake of Lehman's bankruptcy in September 2008. But these extreme moments of disruption have also occurred in the ample reserves framework. In September 2019, the SOFR jumped more than 2.5% overnight, breaking the band.

[50] Data on deposits not covered by FDIC insurance can be complicated by changes in the limit and other factors. For that reason we restrict the timeframe for this comparison.

[51] Based on LCR disclosures from the eight Globally Systematically Important Banks (GSIBs).

Figure 7: Uninsured deposits versus SOMA as percent of bank assets



Source: FRB Z.1, FRB H.4.1, author's calculations

Draining reserves would presumably cause those large depositors to migrate to Treasury bills and money-market funds, reducing the stock of deposits that deliver little transactional utility yet benefit from ample reserves. Money creation is socially valuable when it supports payments and credit intermediation (Pigou 1920; Baumol 1972). By contrast, deposits held simply as a high-yield cash surrogate offer few external benefits. Shrinking reserves trims a component of money for which the social return is low.

In each of the frameworks outlined above, the Federal Reserve has tools to retain precise control over overnight rates. The question for policymakers is which tools of monetary policy implementation best serve the public. A scarce-reserves corridor framework might restore the price signals that can alert policymakers to brewing strains in money markets. A leaner ample-reserves system, anchored by IORB and ON-RRP but with a significantly smaller balance sheet, would preserve an elastic backstop without normalizing large value transfers from the public to the private sector. A tiered remuneration scheme would force banks to internalize the liquidity they actually demand. None of these designs is cost-free, yet all avoid the use of public resources to create value for shareholders of banks and other private sector financial institutions that accompanies today's ample reserves framework. Policymakers must evaluate the trade-offs between these frameworks to ensure monetary policy implementation is at once effective and fair.

Appendix: Evidence for low marginal deposit betas

Neoclassical models suggest that banks would compete away a low deposit beta, but extensive research has documented the persistence of a less-than-unity marginal QE-related deposit beta for commercial banks in the United States.

Perhaps the simplest and clearest evidence is what banks themselves report. The Senior Financial Officer Surveys (SFOS) from 2022 to 2024 asked respondents to estimate their realized deposit beta for different categories of deposits. The May 2022 Survey results showed 70% of domestic bank respondents paid a beta of less than 60% on wholesale non-operational deposits. Two thirds paid a beta of less than 40%.[52] A year later, deposit betas had risen somewhat with policy rates (as expected; see e.g., Greenwald et al. 2023), but more than 70% of domestic bank respondents still reported a cumulative wholesale non-operational beta below 60%. Almost a third were less than 40%.[53] It is also notable that the May 2023 survey was conducted only a few weeks after the collapse of Silicon Valley Bank triggered broader runs on regional banks. That event could have created an incentive to report higher deposit betas than otherwise, particularly on uninsured deposits. The SFOS for September 2023 and March 2024, which reported only banks' average cumulative betas, reinforce the evidence of persistent less-than-unity betas. The average cumulative beta for responding domestic banks' non-operational wholesale deposits was 0.68 from March 2022 to September 2023[54] and 0.69 from March 2022 to March 2024.[55]

There is also evidence for imperfect competition among banks in deposit markets. Work by Duffie and Krishnamurthy (2016), Egan, Hortaçsu, and Matvos (2017), Egan, Lewellen, and Sunderam (2021), Drechsler et al. (2017), Li et al. (2023), and Kho (2025) finds that banks with more deposit market power tend to pay smaller betas on their deposits. Egan, Hortaçsu, and Matvos (2017) put it succinctly: "Equity holders earn rents from the intermediation of deposits because they offer differentiated goods and the market is not perfectly competitive." Abe et al. (2025) similarly find that pass-through of policy rate increases to depositors by U.S. banks was highly heterogeneous. In many cases, depositors prioritize convenience or familiarity with known banks, preferring to accept non-market interest rates on deposit balances to minimize the friction of comparison shopping or housing different financial products at different institutions.

A third category of evidence comes from banks' own Earnings-at-Risk (EaR) modeling. EaR—defined by the OCC as the sensitivity of one or more major earnings categories to standardized shocks—is a short-horizon interest-rate risk measure built from structured assumptions, including a deposit-pricing rule.[56] EaR can be thought of as a

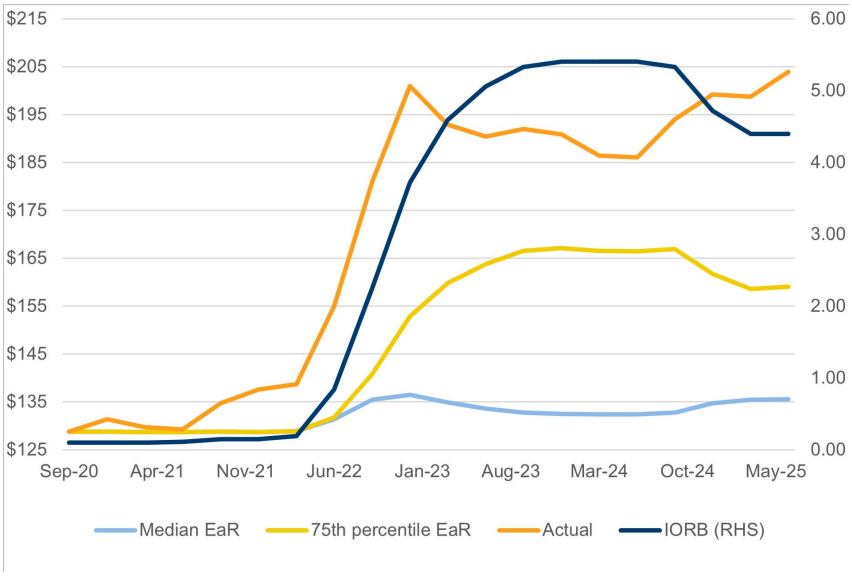
[52] https://www.federalreserve.gov/data/sfos/may-2022-senior-financial-officer-survey.htm Part 2 Question 5(A)(iii).
[53] https://www.federalreserve.gov/data/sfos/may-2023-senior-financial-officer-survey.htm Question 10(1)
[54] https://www.federalreserve.gov/data/sfos/september-2023-senior-financial-officer-survey.htm Part 3, Question 10.
[55] https://www.federalreserve.gov/data/sfos/march-2024-senior-financial-officer-survey.htm Part 3, Question 11.
[56] https://www.occ.treas.gov/publications-and-resources/publications/comptrollers-handbook/files/interest-rate-risk/index-interest-rate-risk.html.

modelled sensitivity measure, which asks something along the lines of: “If short-term interest rates rise or fall by a specified amount today, how would our next 12 months of net interest income change?” Banks run these models with structured assumptions, including how deposit pricing will react to a rate shock.

The OCC has published semiannual Interest Rate Risk Statistics since late 2020 that place banks’ EaR metrics on a common footing, reporting medians and interquartile ranges for the sensitivity of next-year NII to standardized interest-rate shocks. Using the October 2020 cross-section, we map the actual path of short-term policy rates into an implied trajectory for EaR-estimated sector-wide NII and compare that to what banks actually earned between 2020Q3 and 2023Q2.

Figure A1 shows the result: Realized net interest income rose far more than even the optimistic EaR profiles—those at the 75th percentile—would have predicted. The most straightforward interpretation is that banks’ deposit pricing estimates turned out to be too conservative; they overestimated how much they would have to pay depositors to retain balances. Deposit rates did not move one-for-one with policy rates, and deposit betas remained materially below one. Other channels—asset-mix shifts, securities runoff, and loan-yield pass-through—also contributed, but the size and direction of the gap are exactly what persistent sub-unity deposit betas generate. This is consistent with the idea that marginal, QE-era deposits continued to carry low betas during the tightening cycle.

Figure A1: Actual Net Interest Income versus Extrapolations Based on EaR

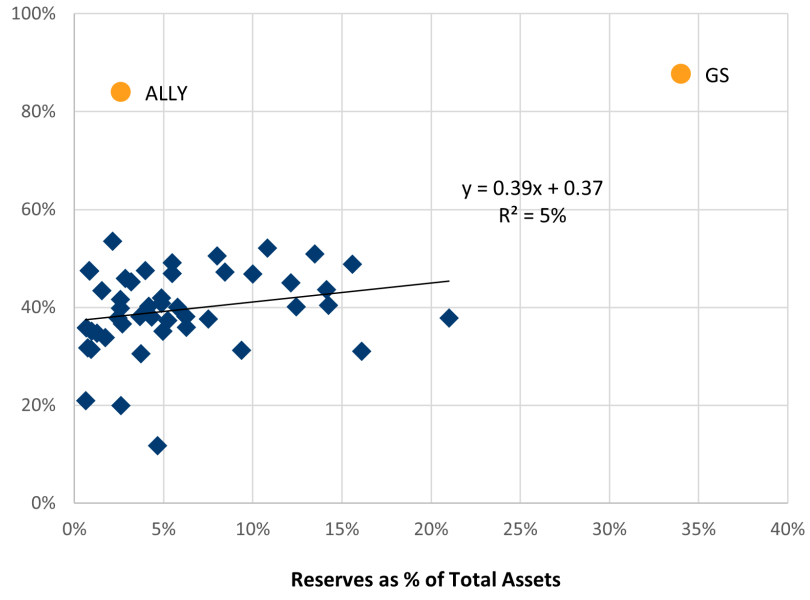


Note: EaR reflect the estimated sensitivity of 1-year forward NII to an instantaneous shock to short-term interest rates from -200 to +400 bp in 100 bp increments. We specifically focus on banks with assets >$10 billion as of the October 2020 Interest Rate Risk Statistics Report. Extrapolations are based on a quadratic fit to the median and 75th percentile responses and reflect quarterly realized IORB levels. Actual NII from the FDIC Quarterly Banking Survey.
Source: FDIC, OCC, author’s calculations

A further piece of evidence comes from balance-sheet mechanics. From end-2019 to end-2021, cash and equivalents at the four largest U.S. Globally Systematically Important Banks (GSIBs) rose by about $803 billion, of which roughly $644 billion (~80%) were reserves (FFIEC Call Reports). Over the same period, disclosed non-operational deposits increased by about $420 billion (LCR disclosures). Even if we were to attribute all of that non-operational deposit growth to QE-related inflows, the remaining increase in reserves must have been supported by operational wholesale and retail deposits—categories that typically carry lower betas. Consistent with this, the share of deposits labeled wholesale non-operational for these banks was essentially flat—about 18% in 2021 versus 17% in 2019—even as total deposit balances expanded nearly three times as fast as nominal GDP. In short, the composition shift needed for high marginal betas did not materialize in equilibrium.

We can cross-check this with a simple cross-section. Using deposit-beta estimates from Drechsler, Savov, and Schnabl (2017; updated 2023) for a broad set of depositories as of 2022:Q4, we relate bank-level betas to reserve-to-asset ratios. If the marginal deposits associated with QE were higher-beta than other funding, institutions holding a larger share of assets as reserves should exhibit higher betas. In the data, we find no statistically significant positive relationship (Figure A2; excluding outliers of Goldman Sachs and Ally Financial leaves the result unchanged). This cross-sectional null is hard to reconcile with the “QE-deposits are high-beta” view and is consistent with low marginal deposit betas.

Figure A2: Deposit beta versus reserves as a % of total assets



Note: Data as of 2022 Q4. Includes the 50 largest banks by total assets as of the reporting period. Linear regression as indicated. ALLY and GS are excluded from the fit as outliers but included in the chart and labeled. Includes Silicon Valley Bank and Signature Bank which were put into receivership in March 2023 (after the reporting period).
Source: Drechsler et al. (2017), FFIEC 041/051

Finally, at least part of the variability in the pass-through rate might also be driven by variation in the regulatory constraints on different institutions, creating further frictions in deposit markets. J.P. Morgan, for example, very publicly attempted to reduce its exposure to non-operational deposits in 2015, citing the Liquidity Coverage Ratio (LCR). *The Wall Street Journal* wrote a fitting headline: "Big Banks to America: We Don't Want Your Cash" (Chung and Krouse 2015). When the biggest, most constrained banks tried to shed certain deposits because of the LCR, the deposits flowed to banks that weren't trying to push them away. Those receiving banks suddenly faced a friendlier market: more would-be depositors knocking on the door, and fewer powerful competitors bidding up rates. The destination banks had more pricing power, enhancing their ability to hold deposit rates lower and still attract depositors.

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