FHLB as Lender of *First* Resort: The Good, the Bad and the Ugly *

Yudong Rao
Washington University in St. Louis
rao.y@wustl.edu

June 30, 2025

Abstract

This paper investigates the dual role of Federal Home Loan Banks (FHLBs) during banking crises, focusing on their impact on bank survival, managerial incentives, and financial stability. Using a bank run model, we compare three funding regimes: no external lending, FHLB advances, and discount window borrowing. As major borrowers from money market funds and the largest lenders in the fed funds market, FHLBs can act as "the good, the bad, and the ugly," depending on bank fundamentals. FHLB funding is beneficial for well-capitalized banks, providing critical liquidity. However, for weaker banks, FHLB advances may delay failure, benefiting bank managers and FHLBs at the expense of the Deposit Insurance Fund and uninsured depositors. Our findings highlight that the policy effectiveness of FHLBs hinges on the capital strength of recipient banks.

Keywords: *Bank runs; Lender of* first *resort; Funding stability; Financial crises; Federal Home Loan Banks*

I Introduction

The failures of Silicon Valley Bank (SVB), Signature Bank, and First Republic Bank during the 2023 banking crisis brought *"the elephant in the room"*—the Federal Home Loan Bank (FHLB) — into the spotlight, sparking debates about its role. This paper primarily answers the key policy question of whether the Federal Home Loan Banks are "good" or "bad." It shows that the answer depends on how well capitalized the banks are.

En particulier, the significant lending activities of FHLBs to these failed banks have placed the FHLBs under scrutiny. On the eve of their failures, the three banks collectively borrowed $70 billion in collateralized loans from their respective FHLBs (see Figure 1). At the beginning of 2023, SVB and First Republic Bank were the two largest borrowers from the Federal Home Loan Bank of San Francisco (FHLBSF), holding 17% and 16%, respectively, of FHLBSF's total outstanding advance balances (GAO, 2024). Similarly, Signature Bank was the fourth-largest borrower from the Federal Home Loan Bank of New York (FHLBNY), accounting for approximately 10% of FHLBNY's total outstanding advance balances.

Beyond individual instances, the Federal Home Loan Banks (FHLBs) have played a pivotal role in providing liquidity to U.S. commercial banks. Between the first quarter of 2003 and the first quarter of 2024, the average ratio of FHLB advances to total borrowings by U.S. commercial banks was 33%. The FHLBs frequently supply liquidity in routine or preemptive situations. Notably, two peaks in this ratio are particularly striking: approximately 55% in January 2023—far surpassing the Federal Reserve's 0.8%—and around 45% in July 2008, both

*I would like to thank Professor Philip Dybvig and Professor Anjan Thakor for their guidance. All errors are my own.

corresponding to periods of bank runs (see Figure 2). Furthermore, since the third quarter of 2008, the FHLBs have become the primary lenders in the federal funds market, accounting for over 90% of lending (see Figure 3 and Figure 4). In effect, the FHLBs have supplanted the traditional role of the federal funds market. Consequently, before resorting to the conventional lender of last resort—the Federal Reserve's discount window—banks have increasingly relied on the FHLBs as seemingly both a lender of *first* and *last* resort. For instance, during the banking crisis in 2023, Silicon Valley Bank (SVB) only turned to the Fed's discount window on the eve before the failure day, obtaining 5 billion USD, which was far less than the total of $100 billion that was scheduled to go out the door on the failure day (March 10) (see Figures 5) .[1]

The lending patterns of Federal Home Loan Banks (FHLBs) during the Global Financial Crisis (GFC) and the banking crisis of March 2023 display remarkable similarities. During the GFC, FHLB advances to U.S. commercial banks surged from $640 billion in June 2007 to a peak of $1.0 trillion in September 2008. Notably, Washington Mutual—the largest bank failure at the time—was among the three most active FHLB borrowers prior to its collapse. A comparable pattern emerged in the recent crisis, with FHLB advances increasing from $335 billion in January 2022 to a peak of $1.0 trillion in January 2023 (see Figures 6). Silicon Valley Bank (SVB), under the jurisdiction of the Federal Home Loan Bank of San Francisco (FHLBSF), became the second-largest bank failure in U.S. history.

These two peaks correspond to significant losses in the Federal Deposit Insurance Corporation's (FDIC) Deposit Insurance Fund (DIF) (see Figure 7). In the 2023 banking crisis, the DIF experienced a loss of $18.4 billion, while simultaneously, the net income of FHLBs was $6.7 billion (see Figure 8). From 2014 to 2022, FHLBs maintained stable profits and dividends, averaging around $5 billion annually. However, 2023 witnessed a sharp rise: the net income of FHLBs reached $6.8 billion, and cash and stock dividends amounted to $3.3 billion, far exceeding the figures from the past decade (see Figure 9).

Between 2006 and 2023, 541 banks failed, of which 366 (67%) had outstanding FHLB advances at the time of failure. Collectively, these banks held $185.3 billion in FHLB advances. Of this amount, the FDIC ultimately repaid $52.7 billion in principal and interest on behalf of failed institutions, in addition to $535 million in prepayment fees (see Figure 10 and Figure 11). Notably, in 2023 alone, five bank failures accounted for $69.3 billion in FHLB advances, of which $41.5 billion was repaid by the FDIC, showing the outsized impact that a small number of large failures can exert on the Deposit Insurance Fund. Among these repayments, Silicon Valley Bank alone represented $30.0 billion in principal, $149 million in interest, and $285 million in prepayment fees, while Signature Bank accounted for $11.2 billion in principal, $188 million in interest, and $0.3 million in fees (see Figure 12, Figure 13,and Figure 14). These recurring patterns raise the question of whether history is repeating itself due to systemic issues within the FHLB framework.

In this paper, we argue that FHLB funding embodies "the good, the bad, and the ugly." The ugly aspect arises in fundamentally unsound banks, where FHLB funding delays failure but creates opportunities for bank managers to extract rents, fostering collusion that ultimately rips off the Deposit Insurance Fund (DIF) and uninsured inactive depositors. The bad as-

[1] See more details at News Article.

pect occurs in banks with intermediate fundamentals; here, loose monitoring associated with FHLB funding induces a dual equilibrium with an elevated risk of depositor runs. In contrast, for these banks, switching to discount window funding—despite its more stringent monitoring—eliminates the run equilibrium, ensuring survival without imposing losses on the DIF and depositors. Finally, the good aspect is manifested in highly fundamentally sound banks, where FHLB lending provides essential liquidity and effectively serves as both a lender of *first* and *last* resort.

In particular, this paper is motivated by the recent empirical evidence that Cipriani, Eisenbach, and Kovner (2024) utilize high-frequency interbank payment data to track deposit flows during March 2023, identifying 22 banks with significant net liquidity outflows between March 9 and March 14. Despite widespread stress, only SVB and Signature Bank failed. This aligns with our conclusion that FHLB advances can save highly financially sound banks from failure. Additionally, Cipriani et al. (2024) demonstrate a hierarchy in banks' borrowing practices, showing a preference for funds from the Federal Home Loan Banks (FHLBs) rather than the Federal Reserve's emergency facilities. Their research indicates that although all banks facing liquidity crises utilize FHLB loans, only a select few turn to the Federal Reserve's discount window and Bank Term Funding Program (BTFP), and those banks typically borrow substantial amounts. Luck, Plosser, and Younger (2023) analyze confidential weekly H8 data to reveal that banks counteract deposit losses by securing funds from FHLBs, noting that funds withdrawn from super-regional banks predominantly end up in the largest banks. Their findings support the characterization of FHLBs as lenders of *first* resort, underscoring the importance of FHLBs' existence and behavior in bank survival and failure.

This paper contributes to three strands of literature: (1) theoretical and empirical studies of bank failures; (2) research on regulators' roles—particularly the discount window; and (3) the role of Federal Home Loan Banks (FHLBs) in the financial system.

On the theoretical side of bank failures, the phenomenon of bank runs and the mechanisms to prevent them have been extensively examined. For instance, Diamond and Dybvig (1983), Goldstein and Pauzner (2005), and Ennis and Keister (2009) have made significant contributions to this field. Diamond and Dybvig (1983) provides a foundational framework for understanding bank runs by focusing on liquidity mismatch in banking. Their model illustrates how even financially "healthy" banks can fail due to liquidity issues, leading to the recall of loans and the termination of productive investments. Extending this framework, this paper demonstrates that the fair value of a bank's assets significantly influences whether a bank run culminates in failure.

Gertler and Kiyotaki (2011) explore how banks' funding capabilities, influenced by agency problems and regulatory constraints, are intrinsically linked to their capital levels. They describe how downturn-induced portfolio losses deplete bank capital, especially under conditions of high leverage. This erosion impairs banks' ability to secure new funding, leading to runs precipitated by failures to obtain necessary liquidity. The resulting reduction in capital and assets increases credit costs, slows economic activity, and further depresses asset prices and bank capital, creating a self-reinforcing downturn cycle.Empirical research also sheds light on the causes of bank runs and failures. For instance, Correia, Luck, and Verner (2024), Iyer,

Puri, and Ryan (2016), and Goldstein and Pauzner (2005) examine factors leading to bank distress.

Regarding the regulator's role and discount window policies, the literature highlights multiple dimensions. Boot and Thakor (1993) models bank regulation and suggests that regulators may pursue self-interest rather than social welfare. Specifically, regulators' desires to build reputations as effective monitors can distort bank closure policies and inflate deposit insurance fund liabilities. Complementing this perspective, Antinolfi and Keister (2006) analyze optimal discount window policy within an economy characterized by linear investment technology and aggregate liquidity shocks. They demonstrate that while unrestricted discount window lending can mitigate banking crises from large liquidity shocks, it also leads to equilibrium indeterminacy. Empirically reinforcing these insights, Ennis and Klee (2024) find that discount window borrowing closely correlates with banks' balance sheet compositions. Notably, banks holding fewer reserves, those burdened by expensive and fragile liabilities, and institutions possessing less marketable collateral are more frequent and extensive users of the Fed's discount window.

This paper also adds to the literature on FHLBs. Ashcraft, Bech, and Frame (2010) note the peak in FHLB lending during 2008 and highlight the role of FHLBs in extending liquidity to banks during the 2008–2009 financial crisis, concluding that the FHLB system serves as the lender of next-to-last resort. In the post-2008 financial crisis period, studies by Sundaresan and Xiao (2018) and Narajabad and Gissler (2018) investigate how FHLBs interact with Basel III liquidity requirements and recent money market reforms. They find that FHLB advances are extracted for compliance purposes but unintentionally create potential liquidity fragility. Zhang (2020) emphasizes the FHLBs' unique role in providing equal funding access to banks of different sizes and improving bank lending by reducing market concentration. Even before 2008, Bennett et al. (2005) posed the question in 20 years ago, "Should the FDIC Worry About the FHLB?" and advised that the FDIC should appropriately price FHLB-related exposures.

II Institutional Setting

Established in 1932, the Federal Home Loan Banks (FHLBs) are government-sponsored enterprises and lesser-known counterparts to Fannie Mae and Freddie Mac. Initially designed to function as a Federal Reserve-style discount window, the FHLBs provided liquidity to thrifts and insurance companies primarily financing home mortgages during periods of financial stress (Gissler and Narajabad , 2017). Following the savings and loan crisis of the 1980s, Congress enacted legislation in 1989 that allowed commercial banks to join the FHLB system, despite their existing membership in the Federal Reserve.

Over time, the mission of the FHLB system has expanded beyond its original focus on home mortgages and community development. It has transitioned into offering broad liquidity support to the banking sector, effectively functioning as a "second central bank" and beyond its traditional ties to housing finance and community development. The FHLBs have become prominent lenders in the federal funds market and substantial borrowers from money market funds (MMFs) (see Figures 15, 16, and 17). Notably, the FHLBs have increased their short-term

borrowings, especially from MMFs, using these funds to offer longer-term loans (advances) to commercial banks, credit unions, and other financial institutions. This practice has heightened the risks associated with increased maturity transformation (Gissler et al., 2023).

The primary mechanism by which the FHLBs provide liquidity to their members is through long-term and short-term loans called *advances*. An advance is a fully *collateralized loan* from an FHLB to one of its members. Beyond the explicit collateral and a member's capital subscription, the FHLBs possess a priority claim—often described as a "super-lien"—over the assets of a defaulting member, ranking above depositors and almost all other creditors, including the Federal Deposit Insurance Corporation (FDIC). This preferential status provides the FHLBs with an additional layer of security in the event of a member's default, something that would not be available to other lenders.

The lower cost of government-sponsored liquidity provided by the FHLBs partly explains the lack of discount window lending at the outset of the liquidity crisis in 2008 (Ashcraft et al., 2010). A particular source of comfort for member banks is the absence of risk premiums on FHLB advances. The FHLBs do not increase the interest rates on advances to risky members because their debt is implicitly backed by the federal government, and their advances are explicitly backed by high-quality collateral. In essence, access to FHLB funding enables banks—especially community banks—to take on additional risk without incurring higher borrowing costs (Stojanovic et al., 2000).

III A Model of Bank Runs

We present a one-period model with two discrete time points, $t \in \{1, 2\}$. All asset positions are fully liquidated at time $t = 2$. Three types of agents are always in the model: depositors, a bank, and a Deposit Insurance Fund (DIF). We also introduce two liquidity backstops: the Federal Home Loan Bank (FHLB) as a lender of *first* resort and the Fed's discount window as a lender of *last* resort.

III.0.1 Depositors

There is a continuum of depositors of total mass $D > 0$, of four exogenous types. Only active uninsured depositors make a strategic choice at $t = 1$; all others' behaviors are hardwired. At $t = 2$, *all* depositors withdraw and the game ends.

- **Active uninsured depositors** (mass A): At time $t = 1$ each active depositor i chooses a withdrawal indicator

  $$W_I^A \in \{0, 1\}$$

  in a simultaneous-move game. Total withdrawals at time $t = 1$ by actives are

  $$W^A = \int_0^A W_I^A \, di.$$

- **Transient depositors** (mass T)): Always withdraw at time $t = 1$.

- **Insured depositors** (mass G): Never withdraw at time $t = 1$.
- **Inactive uninsured depositors** (mass I) : Never withdraw at time $t = 1$.

Therefore, the total mass of deposits is $D = A + G + I + T$, and the total mass of withdrawals at time $t = 1$ is

$$W = W^A + T = \int_{i=0}^{A} W_i^A di + T \tag{1}$$

Since the mass of T of transient depositors all withdraw, while the insured and in active depositors do not. An active depositor i has a payoff given by

$$V_a = W_i^A V_w + \left(1 - W_i^A\right) V_s = \max\left(V_w, V_s\right) \tag{2}$$

where the payoffs if withdrawing or staying, V_w and V_s respectively, are determined in equilibrium.

At $t = 2$, all remaining depositors withdraw:

$$D - W \tag{3}$$

III.0.2 The Bank

The bank's portfolio comprises liquid assets with mark-to-market value $a_L > 0$, which can be liquidated at either $t = 1$ or $t = 2$, and illiquid assets that mature at $t = 2$ with mark-to-market value $a_I > 0$ upon survival but zero liquidation value at $t = 1$. If the bank fails at $t = 2$, illiquid assets pay off zero irrespective of borrowing from the Federal Home Loan Bank. By contrast, failure after discount-window borrowing raises the liquidation value to Δ, where

$$\Delta > D + r\left(W - a_L\right)^+ - a_L$$

implying

$$\Delta + a_L \geq D + r\left(W - a_L\right)^+$$

This premium reflects the value of Federal Reserve monitoring, which preserves projects that would otherwise be expropriated by bank management; such benefits arise only in adverse states (i.e., when failure occurs at $t = 2$).

The bank fails if liquid assets a_L plus available borrowing F from either the FHLB or the Fed's discount window are insufficient to cover withdrawals. In this case, liquid assets are immediately divided.

If the bank does not fail immediately, it is liquidated at time $t = 2$. In the liquidation, the Federal Home Loan Bank has the highest priority, followed by the Fed discount window, then insured depositors, and finally, the uninsured deposits have the lowest priority. Any residual then goes to the bank. Any shortfall in payments to insured depositors is fully covered by the DIF. The bank fails at $t = 1$ if it is unable to pay withdrawals. Then, we let f_1 be the indicator for the bank's failure in period 1, defined as:

$$f_1 = \begin{cases} 1 & a_L + F < W \\ 0 & \text{otherwise.} \end{cases} \tag{4}$$

The bank fails at $t = 2$ if it is unable to pay all depositors and interests if borrowing from FHLB or Fed's discount window. Then, we let f_2 be the indicator for the bank's failure in period 2, defined as:

$$f_2 = \begin{cases} 1 & a_L + a_I \leq D + r\,(W - a_L)^+ \cdot (h + d) \\ 0 & \text{otherwise.} \end{cases} \tag{5}$$

where h and d are indicators defined in equation (7) and equation (10):

$$h = \begin{cases} 1, & \text{if the FHLB is available,} \\ 0, & \text{otherwise.} \end{cases}$$

$$d = \begin{cases} 1, & \text{if the discount window is available,} \\ 0, & \text{otherwise.} \end{cases}$$

where we analyze three models:

- $h = d = 0$: Neither the FHLB nor the discount window is available;
- $h = 1, d = 0$: The FHLB is available;
- $h = 0, d = 1$: The discount window is available.

III.0.3 Deposit Insurance Fund (DIF)

The Deposit Insurance Fund (DIF) is the third type of agent, which incurs losses if the bank fails and cannot fulfill its obligations to insured depositors .

III.0.4 Lender of *First* Resort (FHLBs)

If the Federal Home Loan Banks (FHLBs) are available, the bank requests funding from the FHLB in the amount of $F \geq 0$. Without loss of generality, we assume that internal funds are used first (since banks prefer to avoid interest expenses) and that the bank prioritizes staying afloat when its cash flows remain unchanged. Additionally, without loss of generality, the bank requests an amount F bigger than zero that for which the loan will be granted and zero otherwise. The Federal Home Loan Banks (FHLBs) provide liquidity to member banks through fully collateralized long-term and short-term loans known as "advances." An advance is granted only when a member bank faces withdrawals that exceed its liquid assets and has sufficient collateral, specifically when $0 < W - a_L \leq a_I$, where W denotes total withdrawals, a_L represents liquid assets, and a_I stands for illiquid assets.

A key aspect of FHLB funding is its advantageous terms. The FHLBs typically offer a super-lien, giving them priority in bank resolution. This preferential treatment motivates looser

monitoring of borrowers, allowing even banks with weak fundamentals to access funding. Furthermore, the lack of transparency surrounding FHLB lending terms shields this relaxed oversight from public scrutiny, which, in turn, creates an environment conducive to managerial rent-seeking. In this setting, bank managers can appropriate part of the funding benefit (or "rents"), rents that they would forgo if subjected to stricter oversight. Thus, banks with managers capable of extracting significant rents tend to prefer FHLB funding.

For simplicity, we assume that the interest rate on FHLB advances is a fixed rate r. This assumption is reasonable because the FHLB provide low cost and stable interest rate to its members, as their debt is implicitly backed by the federal government and their advances are explicitly secured by high-quality collateral. The amount of funding F (face value) that the FHLB lends to the bank is defined as:

$$F = \begin{cases} (W - a_L)h, & \text{if } 0 < W - a_L \leq a_I, \\ 0, & \text{otherwise.} \end{cases} \tag{6}$$

with

$$h = \begin{cases} 1, & \text{if the FHLB is available,} \\ 0, & \text{otherwise .} \end{cases} \tag{7}$$

Additionally, if the bank borrows from the FHLB, its effective illiquid assets are the same as under no external funding, i.e.:

$$a_I = \begin{cases} 0, & \text{if } f_2 = 1, \\ a_I, & \text{if } f_2 = 0. \end{cases} \tag{8}$$

III.0.5 Lender of *Last* Resort: the Fed Discount Window

We now introduce the discount window as a separate liquidity provider. When the bank borrows from the discount window, it does so under conditions similar to those for the FHLB, as all discount window loans must be collateralized to the satisfaction of the lending Reserve Bank.

Let $F \geq 0$ denote the funding amount from the discount window. If available, the bank can borrow

$$F = \begin{cases} (W - a_L)\, d, & \text{if } 0 < W - a_L \leq a_I, \\ 0, & \text{otherwise.} \end{cases} \tag{9}$$

with

$$d = \begin{cases} 1, & \text{if the discount window is available,} \\ 0, & \text{otherwise.} \end{cases} \tag{10}$$

A distinguishing feature of discount-window funding is the enhanced oversight provided by the Federal Reserve. In our model, the stigma associated with discount-window borrow-

ing arises from this more stringent regulatory process. For example, borrowers face more frequent examinations by bank supervisors and reduced opportunities for managerial rent extraction—costs that managers find particularly onerous, even if they expect no further Fed intervention. This intensified monitoring effectively increases the bank's illiquid asset base by a fixed amount Δ, which satisfies

$$\Delta > D + r\,(W - a_L)^+ - a_L,$$

in the event of failure following discount-window borrowing. Thus, if the bank uses the discount window, its effective illiquid

$$a_I = \begin{cases} \Delta, & \text{if } f_2 = 1, \\ a_I, & \text{if } f_2 = 0. \end{cases} \tag{11}$$

This additional value, Δ under the discount window, reflects the operational benefit of enhanced monitoring, which curtails managerial rent extraction. In other words, by reducing the scope for managers to appropriate rents, the discount window preserves more of the bank's value for shareholders and depositors.

Moreover, discount window funding is typically available only to banks with sound fundamentals, whereas FHLB funding is extended even to banks with weak fundamentals. As a result, banks with minimal managerial rent opportunities prefer the discount window because it lowers funding costs without sacrificing value to rent-seeking, while banks with significant rent extraction potential tend to favor FHLB funding.

Borrowing from the discount window still requires the bank to repay at the fixed rate r, so at $t = 2$ the bank's net asset position is adjusted accordingly.

III.1 The Choice Problem of the Model

In this section, we characterize the decision problems faced by the active depositors and we solve for symmetric pure-strategy Nash equilibria in the simultaneous-move game played by active depositors, who decide whether to "withdraw" or "stay" based on their expected payoffs.

An active depositor i chooses a withdrawal indicator $W_i^A \in \{0, 1\}$ to maximize their payoff as shown in Equation (2):

$$V_a = W_i^A V_w + \left(1 - W_i^A\right) V_s = \max\left(V_w, V_s\right)$$

where V_w and V_s denote the payoffs from withdrawing and staying, respectively.

$$V_w = f_1 \cdot \frac{(a_L - G)^+}{D - G} + (1 - f_1) \cdot 1 \tag{12}$$

$$V_s = f_1 \cdot \frac{(a_L - G)^+}{D - G} + (1 - f_1) \min\left(\frac{\left(a_I(1 - f_2) + d\Delta f_2 + a_L - W - G - r\,(W - a_L)^+\right)^+}{D - W - G}, 1\right) \tag{13}$$

where $\Delta > 0$ represents the additional effective increase in the bank's illiquid asset base attributable to the enhanced monitoring that accompanies discount window borrowing, r is the fixed interest rate, and $(x)^+ = \max\{x, 0\}$. The depositor's optimal decision is

$$W_i^A = \begin{cases} 1, & \text{if } V_w > V_s \\ 0, & \text{if } V_w \leq V_s \end{cases} \tag{14}$$

In the indifference case (i.e., when $V_w = V_s$), the depositor opts to remain with the bank due to the nuisance cost associated with moving out.

The other depositor types behave exogenously: insured depositors (total mass G) and inactive depositors (total mass I) do not withdraw ($W_i^G = 0$ and $W_i^I = 0$), while transient depositors (total mass T) always withdraw ($W_i^T = 1$). Thus, the aggregate withdrawals W in the economy are given by Equation (1):

$$W = \int_{i=0}^{A} W_i^A di + T$$

The bank's funding need is determined by the shortfall $W - a_L$, where a_L denotes the bank's liquid assets. The bank can finance this shortfall through external borrowing. In our model, borrowing is available from two sources: either the Federal Home Loan Banks (FHLBs) or the Fed discount window. The external funding amount:

$$F = \begin{cases} (W - a_L)h + (W - a_L)d, & \text{if } 0 < W - a_L \leq a_I, \\ 0, & \text{otherwise.} \end{cases} \tag{15}$$

where h and d are indicators defined in equation (7) and equation (10):

$$h = \begin{cases} 1, & \text{if the FHLB is available,} \\ 0, & \text{otherwise.} \end{cases}$$

$$d = \begin{cases} 1, & \text{if the discount window is available,} \\ 0, & \text{otherwise.} \end{cases}$$

The bank will to fail in period 1 if its available liquidity plus funding is insufficient to cover withdrawals. f_1 is an indicator variable for failure in period 1 defined in equation (4):

$$f_1 = \begin{cases} 1, & \text{if } a_L + F < W \\ 0, & \text{otherwise} \end{cases}$$

The bank fails at $t = 2$ if it is unable to pay all depositors and interests if borrowing from FHLB or Fed's discount window. f_2 is an indicator variable for failure in time 2 defined in equation (5):

$$f_2 = \begin{cases} 1 & a_L + a_I \leq D + r\,(W - a_L)^+ \\ 0 & \text{otherwise.} \end{cases}$$

The equilibrium values for the various agents in the model are as follows. The Deposit

Insurance Fund (DIF) incurs losses if the bank fails, while the bank's net payoff depends on its asset liquidation values and funding costs.

Payoff of an Insured Depositor:

$$V_g = 1 \tag{16}$$

Payoff of an inactive depositor (same as V_s in equation (13)):

$$V_s = f_1 \cdot \frac{(a_L - G)^+}{D - G} + (1 - f_1) \min\left(\frac{\left(a_I(1-f_2) + d\Delta f_2 + a_L - W - G - r\left(W - a_L\right)^+\right)^+}{D - W - G}, 1\right)$$

Payoff of a Transient Depositor (same as V_w in equation (12):

$$V_w = f_1 \cdot \frac{(a_L - G)^+}{D - G} + (1 - f_1) \cdot 1$$

Payoff of the Bank:

$$V_{bank} = (1 - f_1)\left(a_L + a_I - D - r\left(W - a_L\right)^+\right)^+ \tag{17}$$

Payoff of DIF:

$$V_{DIF} = f_1\left[-\left(G - a_L\right)^+\right] - (1 - f_1)\left[G - \left(a_I(1-f_2) + d\Delta f_2 + a_L - W - r\left(W - a_L\right)^+\right)^+\right]^+ \tag{18}$$

Payoff of the FHLB:

$$V_{FHLB} = h \cdot \min\left\{r\left(W - a_L\right)^+, \left(a_I - \left(W - a_L\right)\right)^+\right\} \tag{19}$$

Because the advance is fully secured, the FHLB cannot lose principal and its interest recovery is capped by available collateral.

IV Who Gains? Who Pains?

In this section, we analyze the symmetric pure-strategy Nash equilibrium of our depositor-run game under three distinct funding regimes: (i) no external lenders are available; (ii) funding is provided by the Federal Home Loan Banks (FHLBs); and (iii) funding is available via the Fed discount window. The detailed equilibrium derivations are presented in Appendix, and no *sequential service constraints* are imposed.

We focus on a parameter region characterized by

$$T < a_L < D - G - I \leq a_I + a_L \quad \text{and} \quad a_I + a_L < D, \tag{20}$$

which captures a bank whose liquid assets are insufficient to cover withdrawals but whose combined liquid and illiquid assets are adequate to secure external funding. Despite this collateral, the bank is fundamentally unsound since its total asset value falls short of covering all deposits.

Proposition IV.1 (When and How Depositors and the DIF Are Ripped Off)**.** For fundamentally unsound banks satisfying condition (20) and lacking access to the discount window, borrowing from the FHLBs delays failure until $t = 2$. However, the favorable terms of FHLB advances—such as a super-lien and loose monitoring—enable bank managers to extract substantial rents. Consequently, although active depositors eventually recover their full deposits due to the delayed run, the combination of FHLB interest payments and managerial rent extraction inflicts significantly higher losses on uninsured inactive depositors and the Deposit Insurance Fund (DIF).

Proof . Under condition (20), the bank's liquid assets a_L are insufficient to cover total withdrawals W but sufficient to cover transient depositors T; however, its overall asset base (a_L+a_I) falls short of total deposits D, rendering the bank fundamentally unsound.

Case 1 (No External Lenders): Without external funding, the bank relies solely on a_L to meet withdrawals and fails immediately at $t = 1$. Uninsured depositors thus receive $(a_L - G)^+$ and the DIF incurs a loss of $-(G - a_L)^+$.

Case 2 (FHLB Funding): When FHLB funding is available, the bank secures an advance that delays failure until $t = 2$. The favorable lending conditions-such as the super-lien-and inherently loose monitoring create an environment in which managers can extract substantial rents. Under stricter oversight (as with discount-window funding), the bank's effective illiquid asset base would be a fixed amount Δ, satisfying

$$\Delta > D + r\,(W - a_L)^+ - a_L$$

if the bank fails at $t = 2$. This value results from the stringent monitoring associated with the Fed's discount window. In the FHLB scenario, loose monitoring leads managers to misappropriate illiquid assets, leaving the bank with zero illiquid assets. Consequently, although active depositors eventually recover their full deposits, uninsured (inactive) depositors lose everything, and the Deposit Insurance Fund (DIF) must cover all insured deposits.

Case 3 (Discount Window Funding): Discount-window advances are extended only to fundamentally sound banks under rigorous monitoring; therefore, they will not be available in this regime.

By comparing these cases, we conclude that for fundamentally unsound banks without access to the discount window, reliance on FHLB funding not only delays bank failure but also incentivizes managerial rent extraction. The resulting prolonged survival, coupled with intensified rent-seeking behavior, can inflict significant losses on the Deposit Insurance Fund (DIF) and produce adverse outcomes for uninsured depositors. In this environment, managers are driven to choose FHLB advances, inadvertently fostering a collusive arrangement that further extracts rents at the expense of both the DIF and uninsured depositors. □

Table 1 summarizes the equilibrium outcomes:

Assumptions	Equilibrium Outcome
1. No External Lenders	Unique equilibrium: Run; bank fails at $t = 1$
2. FHLB Funding Available	Unique equilibrium: Run; bank fails at $t = 2$
3. Discount Window Funding	Unique equilibrium: Run; bank fails at $t = 1$

Table 1: Equilibrium outcomes under condition (20).

V Lender of *First* or *Last* Resort?

In this section, we explain why, when facing liquidity needs, more banks initially turn to the Federal Home Loan Banks (FHLBs) rather than the Fed discount window, and we explore the welfare implications of an earlier shift to discount window funding. We focus on fundamentally sound banks that experience a shortfall between depositor withdrawals and liquid assets. Specifically, we first consider banks satisfying

$$T < a_L < T + A \leq a_I + a_L \quad \text{and} \quad a_I + a_L \geq D, \tag{21}$$

where D represents total deposits, G insured deposits, I inactive deposits, a_L liquid assets, and a_I illiquid assets. Although these banks have enough collateral to secure external funding, their overall asset base barely covers total deposits, and they exhibit varying degrees of fundamental soundness. For clarity, we classify these banks as follows:

1. **Fundamentally Sound:** $a_I + a_L \geq D$.
2. **Intermediate fundamentals:** $D \leq a_I + a_L < D + r\,(T + A - a_L)$.
3. **Highly Fundamentally Sound:**

$$a_I + a_L \geq D + r\,(T + A - a_L).$$

We now compare the equilibrium outcomes of our depositor-run game under three scenarios: (i) no external lenders, (ii) FHLB funding, and (iii) discount window funding.

Proposition V.1 (Funding Choice and Equilibrium Outcomes)**.** For fundamentally sound banks, FHLB funding serves as a reliable lifeline for highly fundamentally sound banks, ensuring survival by acting as both a lender of *first* and *last* resort. In contrast, for banks with intermediate fundamentals, loose monitoring by the FHLB fosters managerial rent extraction and produces a dual equilibrium with depositor-run risk, thereby destabilizing the system. In such cases, switching to discount-window funding eliminates the run equilibrium and secures bank survival without imposing losses on the Deposit Insurance Fund (DIF) or uninsured depositors.

For fundamentally sound banks satisfying condition (21), full results are reported in the appendix tables, the following hold:

1. Highly fundamentally sound banks (i.e., $a_I + a_L \geq D + r\,(T + A - a_L)$) benefit from FHLB funding, which serves as both a lender of *first* and *last* resort, ensuring bank survival in a unique no-run equilibrium.

2. Banks with intermediate fundamentals (i.e., $D \leq a_I + a_L < D + r\,(T + A - a_L)$): It is socially optimal to turn to discount-window funding rather than the FHLB. The strict oversight imposed by the discount window removes managers' rent-seeking incentives and effectively maintains the illiquid asset base at Δ, thereby eliminating the adverse (run) equilibrium. Consequently, these banks survive without causing additional losses to the DIF or to depositors.

Proof . We analyze the equilibrium outcomes for fundamentally sound banks satisfying condition (21) by examining three cases.

Case 1 (No External Lenders): In the absence of external funding, the bank must rely solely on its liquid assets a_L to meet depositor withdrawals. Because withdrawals exceed a_L, the bank fails immediately at $t = 1$ in at least one equilibrium. Specifically, if active depositors coordinate on a run, the bank liquidates only a_L, yielding a payoff of $(a_L - G)^+$ for uninsured depositors and incurring a loss of $-(G - a_L)^+$ for the Deposit Insurance Fund (DIF). However, if depositors expect the bank to survive, a no-run equilibrium may also emerge. Thus, two equilibria are possible.

Case 2 (FHLB Funding): When FHLB funding is available, the bank can cover a portion of its liquidity shortfall, delaying failure until $t = 2$. If the bank is *highly fundamentally sound*, i.e.,

$$a_I + a_L \geq D + r\,(T + A - a_L)\,,$$

the total assets at the time point 2 is sufficiently large that even the worst-case run does not trigger failure; hence, a unique no-run equilibrium exists, and the bank is rescued. In contrast, if the bank with *intermediate fundamentals*, that is,

$$D \leq a_I + a_L < D + r\,(T + A - a_L)\,,$$

the additional liquidity provided by the FHLB postpones failure to $t = 2$; however, the favorable terms (e.g., the super-lien) and the corresponding loose monitoring allow managers to extract rents. This managerial rent extraction generates a dual equilibrium: one in which depositors run (leading to failure at $t = 2$) and one in which no run occurs (and the bank survives). The rent-seeking behavior increases the losses borne by the DIF and adversely affects uninsured depositors.

Case 3 (Discount Window Funding): Discount-window advances are available only to fundamentally sound banks and are subject to strict Fed oversight. This oversight effectively maintains the bank's illiquid asset base at a fixed increment $\Delta > D + r\,(W - a_L)^+ - a_L$. Thus, under strict monitoring, the effective fundamental is

$$\begin{cases} \Delta + a_L, & \text{if the bank fails at } t = 2, \\ a_I + a_L, & \text{if the bank survives at } t = 2, \end{cases}$$

which yields

$$\Delta + a_L \geq D + r\big(D - G - I - a_L\big).$$

The enhanced collateral ensures a unique no-run equilibrium and bank survival.

In summary, for fundamentally sound banks:

- Highly sound banks benefit from FHLB funding as it serves as both lender of *first* and *last* resort, ensuring survival via a unique no-run equilibrium.
- For banks in the intermediate range, it is socially optimal to borrow from the discount window as its stringent oversight (captured by Δ) eliminates the adverse (run) equilibrium and secures survival without additional costs. In contrast, FHLB lending tends to destabilize banks.

□

The analysis reveals that for banks that are highly fundamentally sound, FHLB funding serves as a reliable safety net, functioning as both a lender of *first* and *last* resort. In contrast, for intermediate fundamentally sound banks, reliance on FHLB funding incentivizes managerial rent-seeking and leads to a dual equilibrium, where delayed failure amplifies losses for the Deposit Insurance Fund (DIF) and uninsured depositors. For these banks, the stricter monitoring imposed by discount window funding eliminates the run equilibrium, ensuring survival without further ripping off the DIF and depositors, thereby mitigating systemic risk.

Table 2 summarizes the equilibrium outcomes:

Assumptions	**Parameter Restrictions**	**Equilibrium Outcomes**
1. No External Lenders	$D \leq a_I + a_L$	Two equilibria: (i) Run equilibrium (bank fails at $t = 1$); (ii) No-run equilibrium (bank survives).
2.a. FHLB Funding	$D \leq a_I + a_L <$ $D + r(T + A - a_L)$	Two equilibria: (i) Run equilibrium (bank fails at $t = 2$); (ii) No-run equilibrium (bank survives).
2.b. FHLB Funding	$a_I + a_L \geq D + r(T + A - a_L)$	Unique no-run equilibrium (bank survives).
3.a. Discount Window Funding	$D \leq a_I + a_L <$ $D + r(T + A - a_L)$	Unique no-run equilibrium (bank survives).
3.b. Discount Window Funding	$a_I + a_L \geq D + r(T + A - a_L)$	Unique no-run equilibrium (bank survives).

Table 2: Equilibrium outcomes under condition (21).

VI Distinguishing the Lender of *Last* Resort Role from Diamond and Dybvig (1983)

This section examines how Federal Home Loan Banks (FHLBs) serve as lenders of last resort differently from the model presented in Diamond and Dybvig (1983). Specifically, we analyze scenarios in which transient depositors significantly exceed a bank's liquid assets, as might occur during natural disasters or public health emergencies.

In such extreme circumstances, where the mass of transient depositors (T) surpasses available liquid assets (a_L) and the bank has sufficient collateral ($T + A - a_L \leq a_l$), we evaluate how FHLB funding impacts bank survival and equilibrium outcomes contingent on bank fundamentals.

Case 1 (No External Lending): In the absence of external funding, the bank inevitably experiences a unique run equilibrium, failing immediately at time $t = 1$, due to insufficient liquid assets to meet transient depositors' withdrawals.

Case 2 (FHLB Funding): FHLBs can be classified into three distinct roles—*good*, *bad*, and *ugly*—based on bank fundamentals:

- **Good (Sound Fundamentals)**: For banks meeting the condition $a_I + a_L \geq D + r(T + A - a_L)$, FHLB advances provide crucial liquidity support, eliminating the run equilibrium. Hence, FHLBs effectively function as both lenders of first and last resort, ensuring bank survival.

- **Bad (Intermediate Fundamentals)**: When bank fundamentals satisfy $D + r \cdot (T - a_L) \leq a_I + a_L < D + r(T + A - a_L)$, FHLB funding creates dual equilibria: (i) a run equilibrium, resulting in bank failure at $t = 2$, and (ii) a no-run equilibrium, enabling bank survival. Consequently, FHLB advances delay potential failure, benefiting bank management and FHLBs but imposing costs on uninsured depositors and the Deposit Insurance Fund (DIF).

- **Ugly (Unsound Fundamentals)**: For banks with fundamentals satisfying $a_I + a_L < D + r \cdot (T - a_L)$, FHLB funding again postpones failure (to $t = 2$) in a unique run equilibrium. This delay notably benefits bank managers and FHLBs but results in substantial losses for uninsured depositors and the DIF.

Case 3 (Discount Window Funding): In contrast, discount window funding generally promotes stability across a broader spectrum of bank fundamentals:

- For banks satisfying $a_I + a_L \geq D$, discount window borrowing yields a unique no-run equilibrium, immediately stabilizing the bank.

- Importantly, even with weaker (intermediate or marginally unsound) fundamentals, discount window lending ensures a unique no-run equilibrium, avoiding delays in bank survival.

- However, when fundamentals are extremely weak ($a_I + a_L < D$), the discount window's primary credit program does not extend funding, leading to immediate bank failure at time $t = 1$.

Thus, FHLBs provide essential liquidity support distinct from the lender-of-last-resort model in Diamond and Dybvig (1983). Specifically, under shocks such as natural disasters, liquidity from FHLBs serves as a critical safety net, mitigating bank runs triggered by large-scale withdrawals.

Table 3 summarizes the equilibrium outcomes:

Assumptions	Parameter Restrictions	Equilibrium Outcomes
1. No External Lenders	No	Unique run equilibrium (bank fails at t=1).
2.a. FHLB Funding	$a_I + a_L \geq D + r(T + A - a_L)$	Unique no-run equilibrium (bank survives).
2.b. FHLB Funding	$D + r \cdot (T - a_L) \leq a_I + a_L < D + r(T + A - a_L)$	Two equilibria: (i) Run equilibrium (bank fails at $t = 2$); (ii) No-run equilibrium (bank survives).
2.c. FHLB Funding	$a_I + a_L < D + r \cdot (T - a_L)$	Unique run equilibrium (bank fails at t=2).
3.a. Discount Window Funding	$a_I + a_L \geq D + r(T + A - a_L)$	Unique no-run equilibrium (bank survives).
3.b. Discount Window Funding	$D + r \cdot (T - a_L) \leq a_I + a_L < D + r(T + A - a_L)$	Unique no-run equilibrium (bank survives).
3.c. Discount Window Funding	$D < a_I + a_L < D + r \cdot (T - a_L)$	Unique no-run equilibrium (bank survives).
3.d. Discount Window Funding	$a_I + a_L < D$	Unique run equilibrium (bank fails at t=1).

Table 3: Equilibrium outcomes under a large mass of transient depositors

VII Conclusion and Policy Discussion

In this paper, we contend that FHLB funding embodies "the good, the bad, and the ugly" in the context of liquidity crises. Our analysis shows that for highly fundamentally sound banks, FHLB advances provide vital, low-cost liquidity, effectively serving as both a lender of first and last resort and ensuring bank survival. However, for banks that are highly moderate fundamentally sound, the loose monitoring inherent in FHLB lending creates incentives for managerial rent extraction. This opportunistic behavior leads to a dual equilibrium: one outcome features a depositor run with delayed failure, while the other yields survival. In the delayed-failure outcome, the extended period before resolution amplifies losses borne by the Deposit Insurance Fund (DIF) and adversely affects uninsured inactive depositors. The most problematic scenario arises in fundamentally unsound banks, where FHLB funding postpones failure yet creates even greater opportunities for collusive rent extraction between bank managers and FHLBs, resulting in significant transfers from the DIF and inactive depositors.

Our findings further suggest that, for banks with intermediate fundamentals, a strategic shift from FHLB funding to discount-window funding—despite its more stringent monitoring requirements—can eliminate the run equilibrium. This shift is socially optimal and eliminates the rent-seeking opportunity for bank management.

Policy implications from our study are multifaceted. Regulators should focus on enhancing the transparency and monitoring of FHLB lending practices to reduce the scope for managerial opportunism. Furthermore, it may be beneficial to design incentive-compatible mechanisms that align bank management's objectives with the broader goal of financial stability. In ad-

dition, promoting a hybrid approach to liquidity provision—one that encourages banks that are highly moderate fundamentally sound to seek discount window funding—could alleviate the detrimental effects of rent extraction and reduce systemic risk. Overall, while FHLB funding plays a critical role in crisis management, targeted regulatory reforms are essential to balance the trade-off between the benefits of low-cost liquidity and the potential for adverse externalities stemming from delayed bank failure.

References

Antinolfi, Gaetano and Keister, Todd. Discount Window Policy, Banking Crises, and Indeterminacy of Equilibrium. *Macroeconomic Dynamics*, Cambridge University Press, vol. 10, issue 1, pages 1-19, February 2006.

Ashcraft, Adam, Bech, Morten L., and Frame, W. Scott. The Federal Home Loan Bank System: The Lender of Next-to-Last Resort? *Journal of Money, Credit and Banking*, June 2010, Vol. 42, No. 4, pp. 551-583. Published by: Wiley. Stable URL: `https://www.jstor.org/stable/40732603`

Bagehot, Walter. Lombard Street: A Description of the Money Market. *History of Economic Thought Books*, McMaster University Archive for the History of Economic Thought, number bagehot1873.

Baumol, William J., Panzar, John C., and Willig, Robert D. Contestable markets and the theory of industry structure. *Harcourt Brace Jovanovich*, 1982.

Bennett, Rosalind L., Vaughan, Mark D., and Yeager, Timothy J. Should the FDIC Worry about the FHLB? The Impact of Federal Home Loan Bank Advances on the Bank Insurance Fund. *FDIC Center for Financial Research Working Paper No. 2005-10*, July 2005.

Boot, Arnoud W. A. and Thakor, Anjan V. Self-Interested Bank Regulation. *American Economic Review*, American Economic Association, vol. 83(2), pages 206-212, May 1993.

Cipriani, Marco, Eisenbach, Thomas M., and Kovner, Anna. Tracing Bank Runs in Real Time *Federal Reserve Bank of New York Staff Reports*, (1104), 2024.

Correia, Sergio, Luck, Stephan, and Verner, Emil. Failing Banks. *Federal Reserve Bank of New York Staff Reports*, (1117), 2024. `https://doi.org/10.59576/sr.1117`

Diamond, Douglas W. and Dybvig, Philip H. Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*, 91(3):401–419, 1983.

Domanski, Dietrich, Moessner, Richhild, and Nelson, William. Central banks as lenders of last resort: experiences during the 2007-10 crisis and lessons for the future. *BIS Papers*, 79:29–43, 2014.

Drechsler, Itamar, Savov, Alexi, Schnabl, Philipp, and Wang, Olivier. Deposit franchise runs. *SSRN Working Paper*, April 5, 2023. Available at SSRN: `https://ssrn.com/abstract=4411127` or `http://dx.doi.org/10.2139/ssrn.4411127`.

Dybvig, Philip H. and Fu, Yishu. Tigers and Flies: Conflicts of Interest, Discretion, and Expertise in a Hierarchy. *Washington University in Saint Louis and Southwestern University of Finance and Economics*, February 5, 2025.

Ennis, Huberto M. and Keister, Todd. Bank Runs and Institutions: The Perils of Intervention. *American Economic Review*, 99(4):1588–1607, September 2009.

Ennis, Huberto M. and Klee, Elizabeth. The Fed's Discount Window in Normal Times. *Finance and Economics Discussion Series 2021-016r1*, Board of Governors of the Federal Reserve System, Washington, 2024. https://doi.org/10.17016/FEDS.2021.016r1

Freixas, Xavier, Parigi, Bruno M., and Rochet, Jean-Charles. The lender of last resort: A 21st century approach. In *Proceedings of the Second Joint Central Bank Research Conference*, 1999.

Gertler, Mark and Kiyotaki, Nobuhiro. Financial Intermediation and Credit Policy in Business Cycle Analysis. In *Handbook of Monetary Economics*, Volume 3B, edited by Benjamin Friedman and Michael Woodford, pages 547-599. Amsterdam: Elsevier Science, North-Holland, 2011.

GAO, U.S. Government Accountability Office. *Federal Home Loan Banks: Actions Related to the Spring 2023 Bank Failures*. GAO-24-105232, April 2024.

Gissler, Stefan and Narajabad, Borghan. The Increased Role of the Federal Home Loan Bank System in Funding Markets, Part 1: Background. *FEDS Notes*, 2017.

Gissler, Stefan, Narajabad, Borghan, and Tarullo, Daniel K. Federal Home Loan Banks and Financial Stability. *Journal of Financial Regulation*, Volume 9, Issue 1, April 2023, Pages 1–29, https://doi.org/10.1093/jfr/fjad002.

Goldstein, Itay and Pauzner, Ady. Demand-deposit contracts and the probability of bank runs. *Journal of Finance*, 60:1293–1327, 2005.

Iyer, Rajkamal, Puri, Manju, and Ryan, Nicholas. A Tale of Two Runs: Depositor Responses to Bank Solvency Risk. *The Journal of Finance*, 71(6):2687–2725, December 2016. Published by Wiley for the American Finance Association. Stable URL: https://www.jstor.org/stable/44155403

Khwaja, Asim Ijaz and Mian, Atif. Rent Seeking and Corruption in Financial Markets. *Annual Review of Economics*, Annual Reviews, vol. 3(1), pages 579-600, September 2011.

Layton, Donald H. The GSE Public-Private Hybrid Model Flunks Again: This Time It's the Federal Home Loan Bank System *NYU Furman Center*, 2024.

Luck, Stephan, Plosser, Matthew, and Younger, Josh. Bank funding during the current monetary policy tightening cycle. *Liberty Street Economics Blog*, May 11, 2023.

Myers, Stewart C. and Majluf, Nicholas S. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13:187–221, 1984.

Narajabad, Borghan and Gissler, Stefan. Supply of Private Safe Assets: Interplay of Shadow and Traditional Banks. *SSRN Electronic Journal*, 2018, https://doi.org/10.2139/ssrn.number.

Stojanovic, Dusan, Vaughan, Mark D., and Yeager, Timothy J. Is Federal Home Loan Bank Funding A Risky Business For The FDIC? *Federal Reserve Bank of St. Louis Review*, October 01, 2000.

Sundaresan, Suresh M. and Xiao, Kairong. Unintended Consequences of Post-Crisis Liquidity Regulation. *SSRN Electronic Journal*, 2018, https://doi.org/10.2139/ssrn.number.

Zhang, Dayin. Essays in Financial Intermediation and Household Finance. *UC Berkeley Electronic Theses and Dissertations*, University of California, Berkeley, Spring 2020, https://escholarship.org/uc/item/4pc7w2vn.

VIII Appendix

Condition (Liquidity vs. Fundamentals)	Equilibria Outcome	W_i	V_G	V_A	V_T	V_I	Bank Net Payoff	DIF Payoff
1. $T+A \leq a_L$ and $a_I + a_L \geq D$	Unique eq.: No run, no failure	0	1	1	1	1	$a_L + a_I - D > 0$ (Bank never fails)	0
2. $T+A \leq a_L$ and $a_I + a_L < D$	Unique eq.: Run, bank fails later	1	1	1	1	$\frac{(a_L - D + I)^+}{I} < 1$	0 (Bank fails in time point 2)	$-\left[G - (a_L - D + G + I))^+\right]^+$
3. $T > a_L$	Unique eq.: Run, bank fails now	1	1	$\frac{(a_L-G)^+}{D-G} < 1$	$\frac{(a_L-G)^+}{D-G} < 1$	$\frac{(a_L-G)^+}{D-G} < 1$	0 (Bank fails in time point 1)	$-(G - a_L)^+$
4. $T+A > a_L > T$ and $a_I + a_L \geq D$	Two eq.:(i) No run, no failure; (ii) Run, fail now	0 ; 1	1 ; 1	1 ; $\frac{(a_L-G)^+}{D-G} < 1$	1 ; $\frac{(a_L-G)^+}{D-G} < 1$	1 ; $\frac{(a_L-G)^+}{D-G} < 1$	$a_L + a_I - D > 0$ (Bank never fails); 0 (Bank fails in time point 1)	0; $-(G - a_L)^+$
5. $T+A > a_L > T$ and $a_I + a_L < D$	Unique eq.: Run, bank fails now	1	1	$\frac{(a_L-G)^+}{D-G} < 1$	$\frac{(a_L-G)^+}{D-G} < 1$	$\frac{(a_L-G)^+}{D-G} < 1$	0 (Bank fails in time point 1)	$-(G - a_L)^+$

Table 4: Equilibrium Outcomes in the No-Lender case

Condition (Liquidity vs. Fundamentals)	Equilibria Outcome	Is FHLB involved?	W_i	V_G	V_A	V_T	V_I	Bank Net Payoff	DIF Payoff	FHLB Economic Profits
1. $T+A \leq a_L$ and $a_L + a_I \geq D$	Unique eq.: No run, no failure	No	0	1	1	1	1	$a_L + a_I - D > 0$ (Bank never fails)	0	0
2. $T+A \leq a_L$ and $a_I + a_L < D$	Unique eq.: Run, bank fails later	No	1	1	1	1	$\frac{(a_L - D + I)^+}{I} < 1$	0 (Bank fails in time point 2)	$-\left[G - (a_I - D + G + I))^+\right]^+$	0
3a. $T > a_L$ and $a_I + a_L \geq D + r(T + A - a_L)$	Unique eq.: No run, no failure	Yes	0	1	1	1	1	$a_L + a_I - D - r(T - a_L) > 0$ (Bank never fails)	0	$(T - a_L) \cdot r$
3b. $T > a_L$ and $D + r \cdot (T - a_L) \leq a_I + a_L < D + r(T + A - a_L)$	Two eq.:(i) No run, no failure; (ii) Run, fail later	Yes	0 ; 1	1 ; 1	1 ; 1	1 ; 1	1; 0	$a_L + a_I - D - r(T - a_L) > 0$; 0 (Bank fails in time point 2)	0; $-G$	$(T - a_L) \cdot r$; $\min((T + A - a_L)^+ r, (a_I + a_L - D + G + I)^+)$
3c. $T > a_L$ and $a_I + a_L < D + r \cdot (T - a_L)$	Unique eq.: Run, bank fails later	Yes	1	1	1	1	0	0 (Bank fails in time point 2)	$-G$	$\min((T + A - a_L)^+ r, (a_I + a_L - D + G + I)^+)$
4a. $T < a_L < T + A \leq a_L + a_L$ and $a_I + a_L \geq D + r(T + A - a_L)$	Unique eq.: No run, no failure	Yes	0	1	1	1	1	$a_L + a_I - D > 0$ (Bank never fails)	0	0
4b. $T < a_L < T + A \leq a_I + a_L$ and $D \leq a_I + a_L < D + r(T + A - a_L)$	Two eq.:(i) No run, no failure; (ii) Run, fail later	Yes	0 ; 1	1 ; 1	1 ; 1	1 ; 1	1; 0	$a_L + a_I - D > 0$; 0 (Bank fails in time point 2)	0; $-G$	0; $\min\left((T + A - a_L)^+ r, (a_I + a_L - D + G + I)^+\right)$
5a. $T < a_L < T + A \leq a_I + a_L$ and $a_I + a_L < D$	Unique eq.: Run, bank fails later	Yes	1	1	1	1	0	0 (Bank fails in time point 2)	$-G$	$\min\left((T + A - a_L)^+ r, (a_I + a_L - D + G + I)^+\right)$
5b. $T + A > a_I + a_L$ and $T < a_L$	Unique eq.: Run, bank fails now	No	1	1	$\frac{(a_L-G)^+}{D-G} < 1$	$\frac{(a_L-G)^+}{D-G} < 1$	$\frac{(a_L-G)^+}{D-G} < 1$	0 (Bank fails in time point 1)	$-(G - a_L)^+$	0

Table 5: Equilibrium Outcomes in the existence of FHLBs case

Condition (Liquidity vs. Fundamentals)	**Equilibria Outcome**	**Is Fed's discount window involved?**	$\mathbf{W_i}$	$\mathbf{V_G}$	$\mathbf{V_A}$	$\mathbf{V_T}$	$\mathbf{V_I}$	**Bank Net Payoff**	**DIF Payoff**
1. $T+A \leq a_L$ and $a_L + a_I \geq D$	Unique eq.: No run, no failure	No	0	1	1	1	1	$a_L + a_I - D > 0$ (Bank never fails)	0
2. $T+A \leq a_L$ and $a_I + a_L < D$	Unique eq.: Run, bank fails later	No	1	1	1	1	$\frac{(a_L - D + I))^+}{I} < 1$	0 (Bank fails in time point 2)	$-\left[G-(a_I - D + G + I))^+\right]^+$
3a. $T > a_L$ and $a_I + a_L \geq D + r(T + A - a_L)$	Unique eq.: No run, no failure	Yes	0	1	1	1	1	$a_L + a_I - D - r(T - a_L) > 0$ (Bank never fails)	0
3b. $T > a_L$ and $D + r \cdot (T - a_L) \leq a_I + a_L < D + r(T + A - a_L)$	Unique eq.: No run, no failure	Yes	0	1	1	1	1	$a_L + a_I - D - r(T - a_L) > 0$ (Bank never fails)	0
3c. $T > a_L$ and $D < a_I + a_L < D + r \cdot (T - a_L)$	Unique eq.: No run, no failure	Yes	0	1	1	1	1	$a_L + a_I - D - r(T - a_L) > 0$ (Bank never fails)	0
3d. $T > a_L$ and $a_I + a_L < D$	Unique eq.: Run, bank fails now	No	1	1	$\frac{(a_L - G)^+}{D-G} < 1$	$\frac{(a_L - G)^+}{D-G} < 1$	$\frac{(a_L - G)^+}{D-G} < 1$	0 (Bank fails in time point 1)	$-(G - a_L)^+$
4a. $T < a_L < T + A \leq a_L + a_L$ and $a_I + a_L \geq D + r(T + A - a_L)$	Unique eq.: No run, no failure	Yes	0	1	1	1	1	$a_L + a_I - D > 0$ (Bank never fails)	0
4b. $T < a_L < T + A \leq a_I + a_L$ and $D \leq a_I + a_L < D + r(T + A - a_L)$	Unique eq.: No run, no failure	Yes	0	1	1	1	1	$a_L + a_I - D > 0$ (Bank never fails)	0
5a. $T < a_L < T + A \leq a_I + a_L$ and $a_I + a_L < D$	Unique eq.: Run, bank fails now	No	1	1	$\frac{(a_L - G)^+}{D-G} < 1$	$\frac{(a_L - G)^+}{D-G} < 1$	$\frac{(a_L - G)^+}{D-G} < 1$	0 (Bank fails in time point 1)	$-(G - a_L)^+$
5b. $T + A > a_I + a_L$ and $T < a_L$	Unique eq.: Run, bank fails now	No	1	1	$\frac{(a_L - G)^+}{D-G} < 1$	$\frac{(a_L - G)^+}{D-G} < 1$	$\frac{(a_L - G)^+}{D-G} < 1$	0 (Bank fails in time point 1)	$-(G - a_L)^+$

Table 6: Equilibrium Outcomes in the existence of Fed's discount window case

Figures

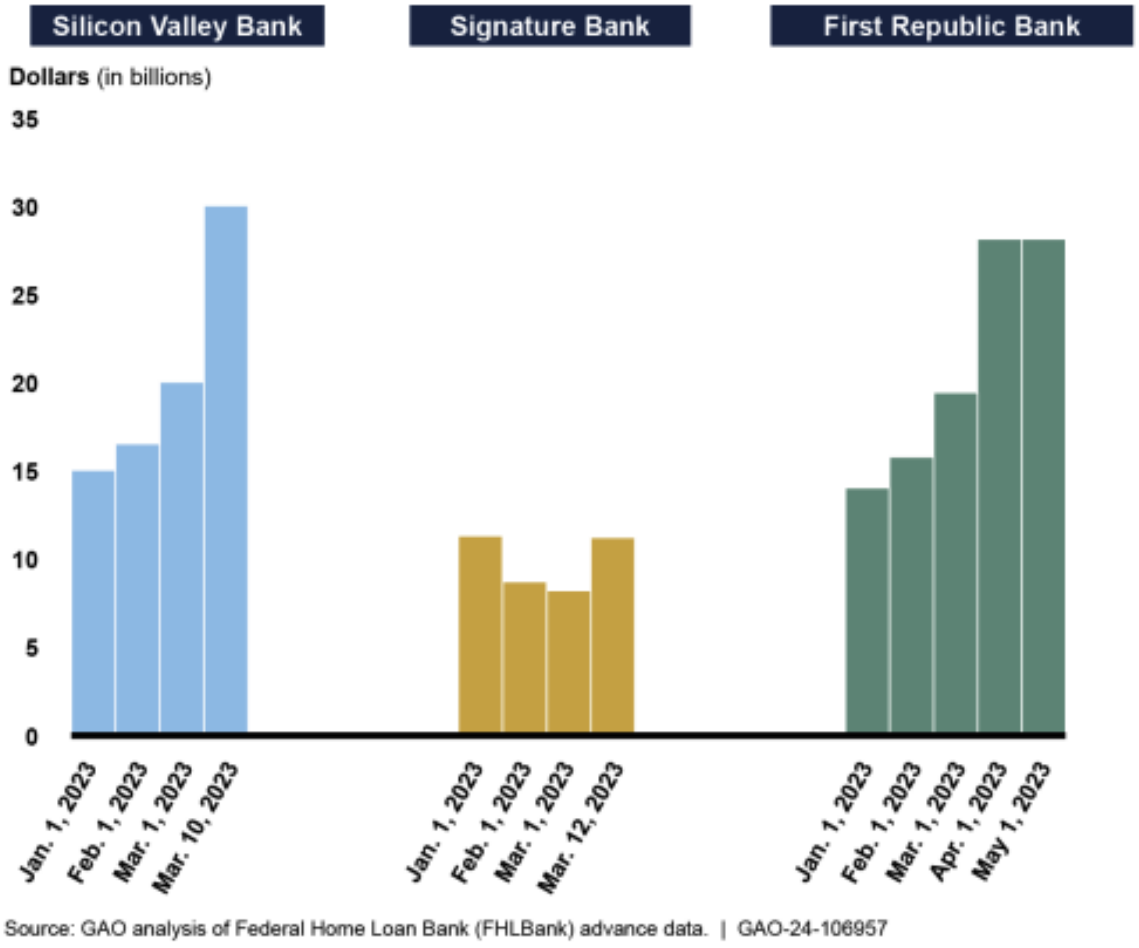


Figure 1: Failed Banks' Total Outstanding FHLBank Advances, Jan. 1, 2023, to Failure

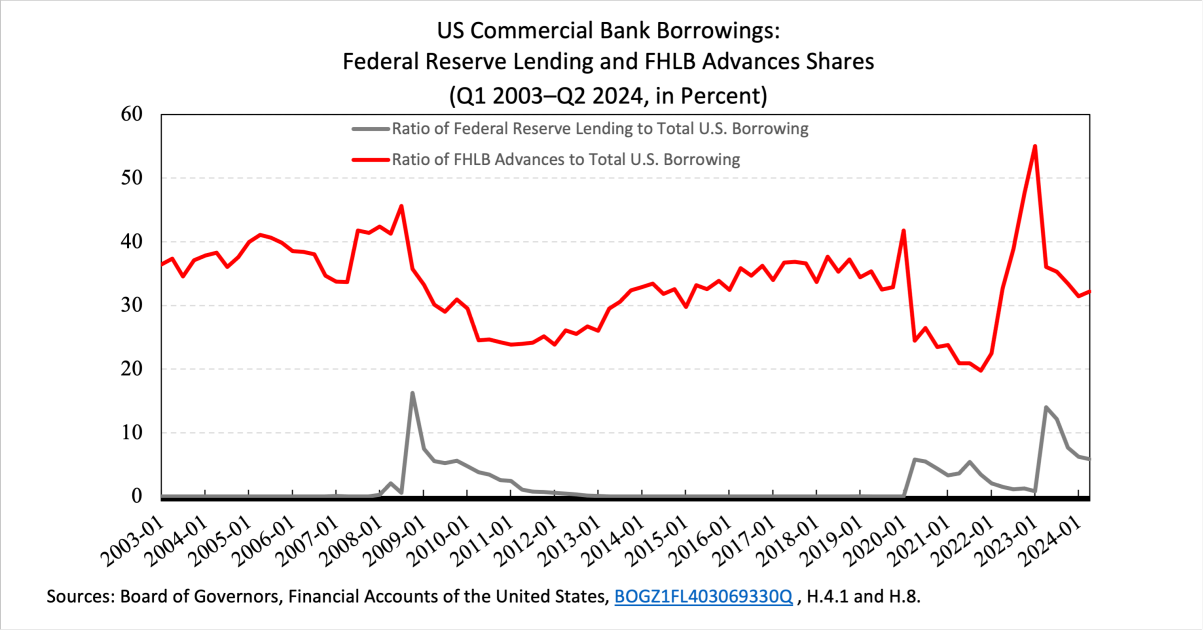


Figure 2: FHLB Advances to U.S. Commercial Banks Over Time

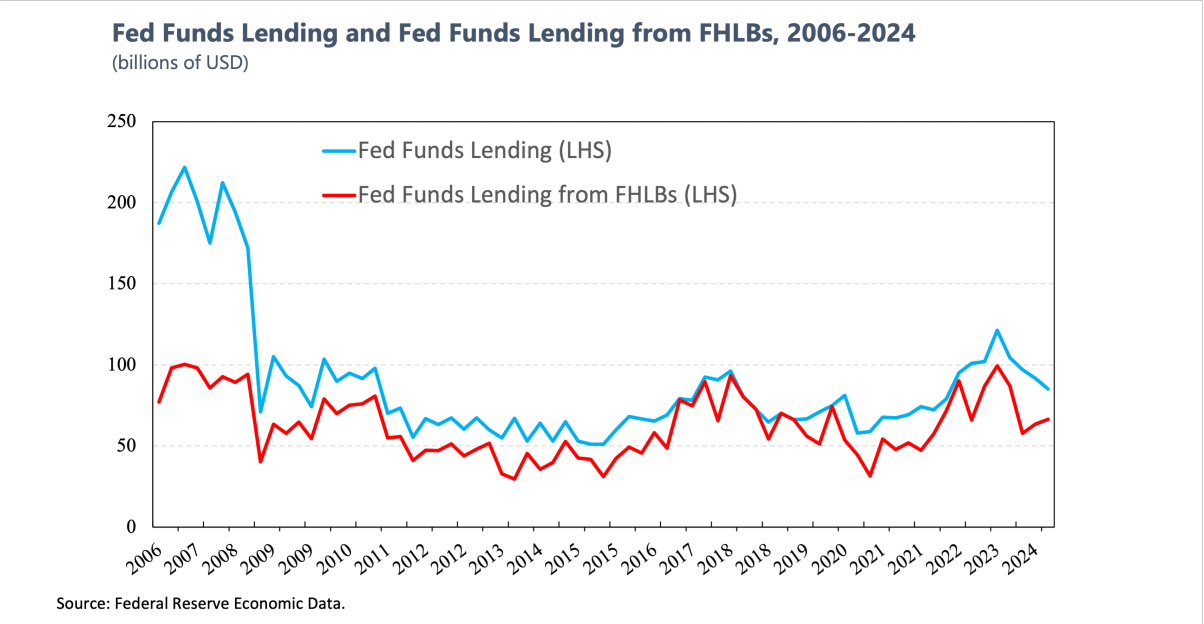


Figure 3

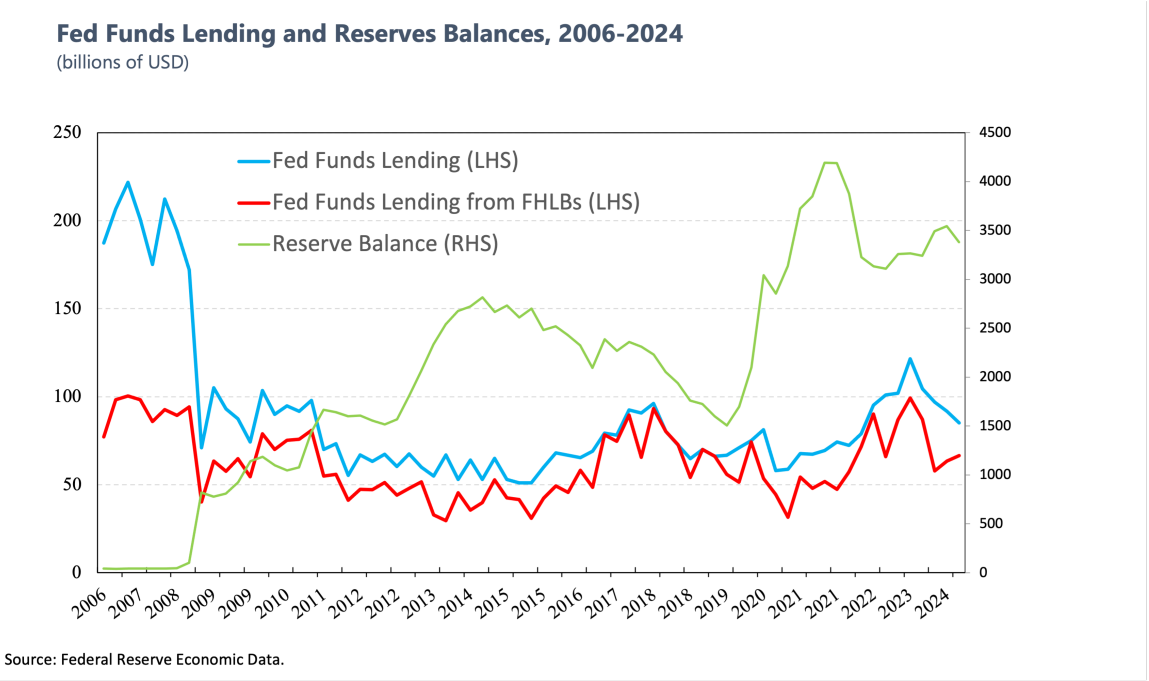


Figure 4

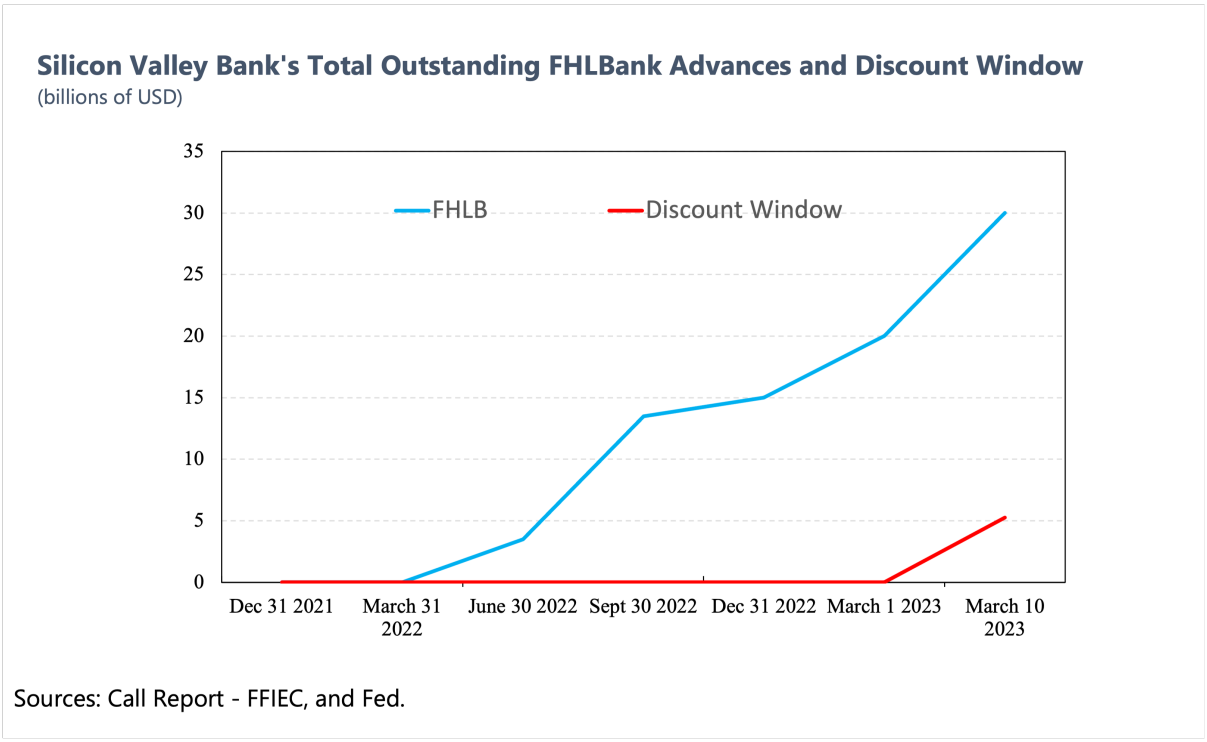
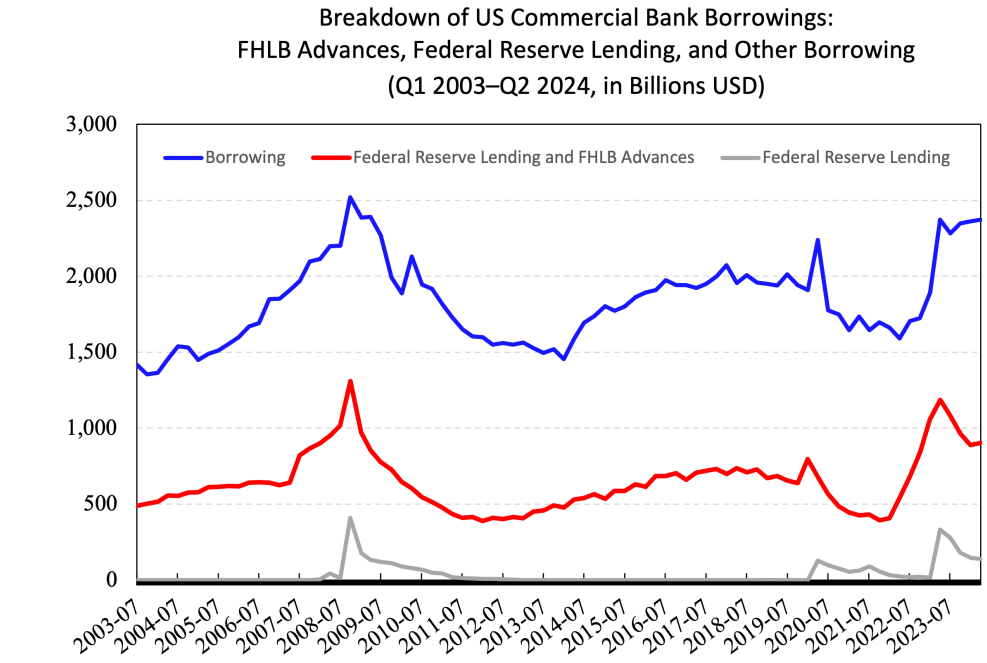
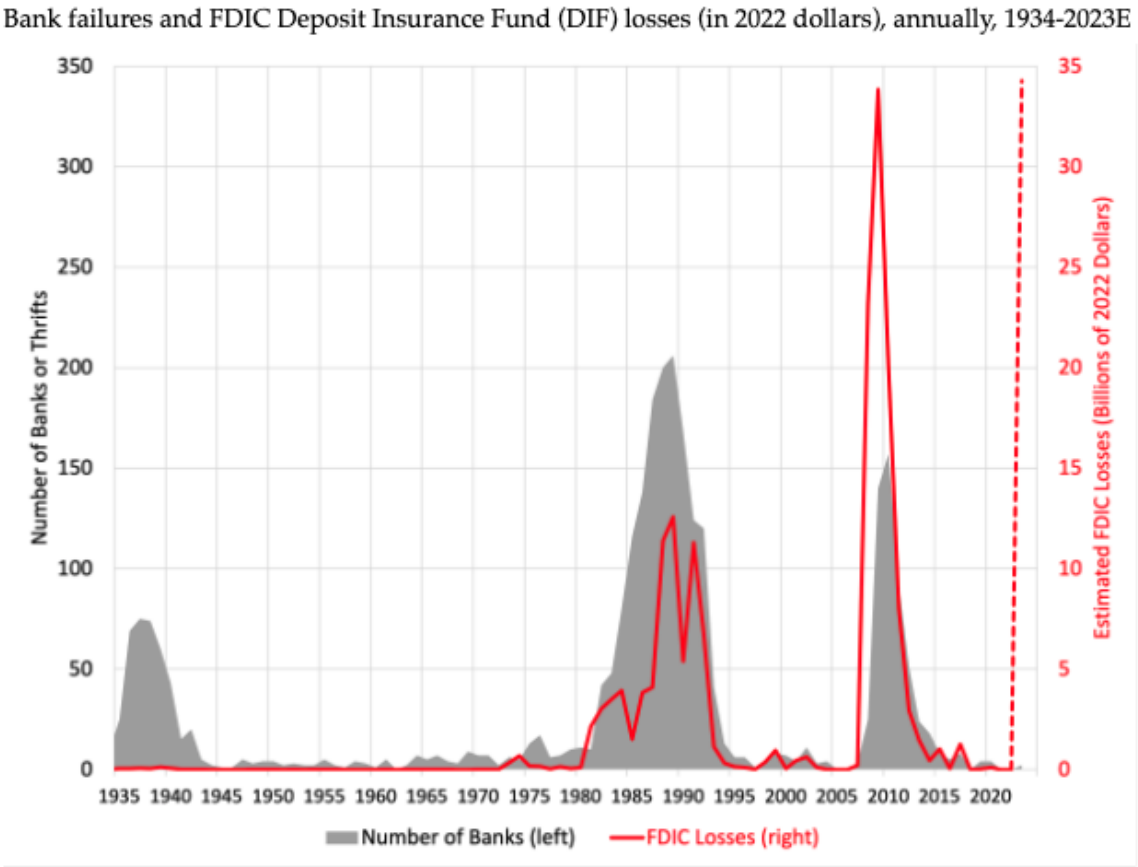


Figure 5



Sources: Board of Governors, Financial Accounts of the United States, BOGZ1FL403069330Q , H.4.1 and H.8.

Figure 6: U.S. Commercial Bank Borrowing from FHLB and Federal Reserve



Note: The dashed line red line is an estimate (as of May 1, 2023) of the 2023 losses of the deposit insurance fund based solely on the expected resolution costs of First Republic, Silicon Valley and Signature banks. Losses are deflated using the PCE chained price index (2022=100).
Sources: FDIC 2022 Annual Report, FRED and authors' 2023 estimate.

Figure 7: Bank failures and FDIC Deposit Insurance Fund (DIF) losses

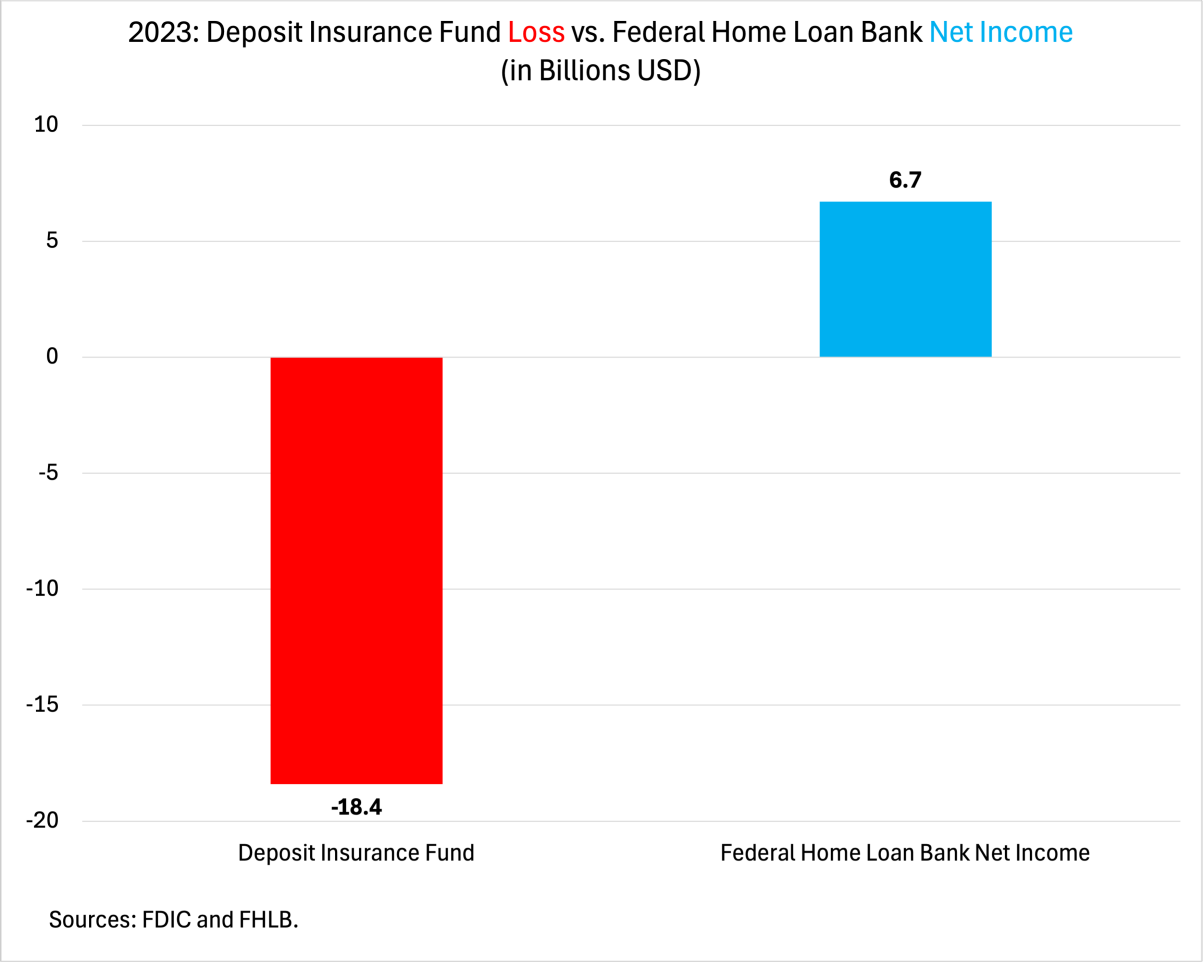


Figure 8: FHLB Profits and Dividends During the 2023 Bank Crisis

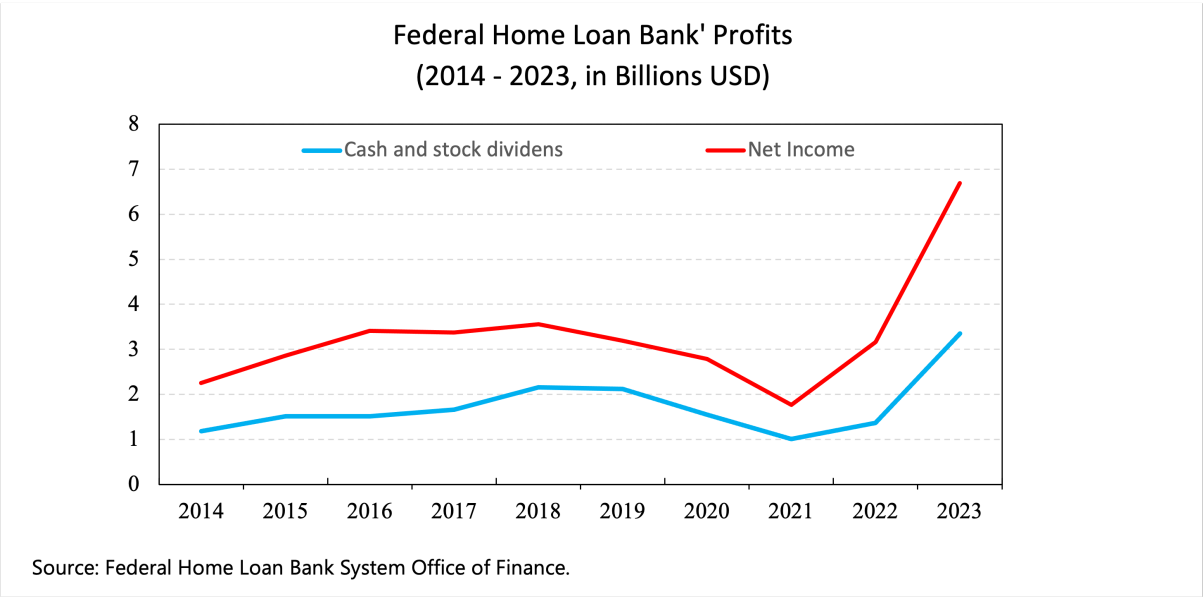


Figure 9: FHLB Profits and Dividends During the 2023 Bank Crisis

Federal Home Loan Bank (FHLB) Advances to Banks that Failed from 2006 through December 31, 2023

Year	# of Bank Failures	# with FHLB Advances	Total FHLB Advances at time of failure (millions of USD)	Advances Assumed by Acquiring Institution (millions of USD)	FDIC Payment to FHLB Principal and Interest (millions of USD)	FDIC Payment to FHLB Prepayment Fee (millions of USD)	Notes
2006	0	0	-	-	-	-	
2007	3	0	-	-	-	-	
2008	25	20	80,099.1	74,205.3	5,806.2	37.0	A
2009	140	100	21,668.1	20,524.4	1,146.2	47.8	
2010	157	108	9,358.7	6,293.0	3,078.4	77.9	
2011	92	72	2,786.2	2,711.9	74.3	1.2	
2012	51	28	395.2	283.0	113.6	8.7	
2013	24	12	668.0	110.4	557.6	69.1	
2014	18	9	139.0	46.5	92.7	7.5	
2015	9	3	550.7	550.7	-	-	
2016	1	1	1.4	1.4	-	-	
2017	8	4	316.2	51.2	265.3	0.3	
2018	0	0	-	-	-	-	
2019	4	2	9.8	1.8	8.0	0.0	
2020	4	2	7.0	5.8	1.2	-	
2021	0	0	-	-	-	-	
2022	0	0	-	-	-	-	
2023	5	5	69,332.6	28,139.4	41,530.7	285.5	B
	541	366	185,332.16	132,924.93	52,674.33	534.97	C

NOTES:

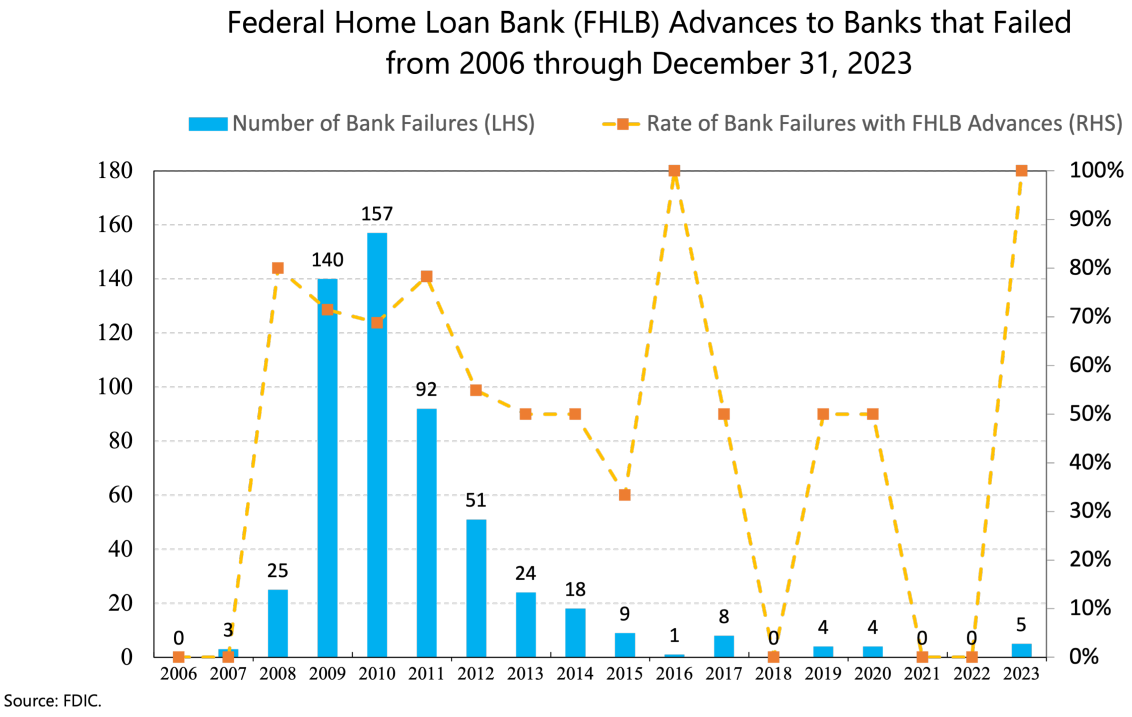
(A) At the time of failure on September 25, 2008, Washington Mutual Bank had $64,576,890,061 in FHLB advances. The acquiring institution assumed this in its entirety.

(B) Prepayment fees include waiver fees paid to the FHLB related to the Silicon Valley Bank failure.

(C) During the period beginning January 1, 2006 through December 1, 2023, 366 of the 544 failed banks, or 67 % had an FHLB advance.

Source: FDIC

Figure 10



Source: FDIC.

Figure 11

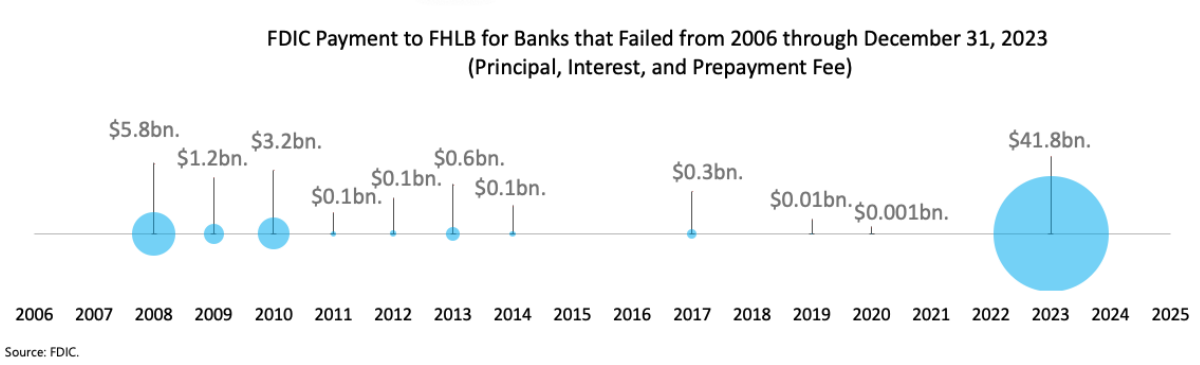
Federal Home Loan Bank (FHLB) Advances
Largest FHLB Advances Paid by FDIC to Banks that Failed from 2006 through December 31, 2023

Failed Bank	Date of Failure	Advances Repaid by FDIC to FHLB (millions of USD)	Interest on Advances Repaid by FDIC to FHLB (millions of USD)	Prepayment Fee Paid by FDIC to FHLB (millions of USD)	Notes
Silicon Valley Bank	3/10/2023	30,000.0	149.0	285.3	A
Signature Bank	3/12/2023	11,183.7	188.4	0.3	B
IndyMac Bank, FSB	7/11/2008	4,287.0	0.7	0.0	C
R-G Premier Bank	4/30/2010	1,241.8	2.5	15.9	
Franklin Bank, S.S.B.	11/7/2008	929.5	0.6	28.7	
WesternBank Puerto Rico	4/30/2010	925.0	2.9	8.9	
First National Bank - Texas	9/13/2013	555.2	0.1	69.1	
First Bank of Beverly Hills	4/24/2009	320.0	1.2	12.4	
First NBC Bank	4/28/2017	265.0	0.3	0.3	
CF Bancorp	4/30/2010	258.9	6.0	0.3	
Cape Fear Bank	4/10/2009	196.7	0.4	6.0	
Shore Bank	8/20/2010	194.2	0.1	24.2	
EuroBank	4/30/2010	152.7	0.8	9.0	
Silver State	9/5/2008	106.7	0.3	0.8	
Omni National Bank	3/27/2009	105.2	0.1	9.3	
1st Centennial Bank	1/23/2009	103.5	0.0	1.6	
Premier Bank	10/15/2010	103.1	0.0	9.4	
Maritime Savings Bank	9/17/2010	86.6	0.0	9.7	
The Columbian Bank and Trust	8/22/2008	79.7	0.2	1.0	
Valley Bank, IL	6/20/2014	67.5	0.2	6.1	
Riverside Bank of the Gulf Coast	2/13/2009	65.3	0.0	8.6	
Integrity Bank	8/29/2008	65.0	0.4	2.6	
Premier Bank	3/23/2012	62.3	0.0	5.7	
Bank of Clark County	1/16/2009	62.0	0.0	0.6	
First Arizona Savings, FSB	10/22/2010	58.6	0.2	6.2	

NOTES:
(A) At the time of failure,Silicon Valley Bank had $30 billion in advances from the FHLB. When the FDIC established Silicon Valley Bridge Bank, the FDIC repaid the advances before it was sold to First Citizens Bank & Trust Company.
(B) At the time of failure, Signature Bank had $11.2 billion in advances from the FHLB. When the FDIC established Signature Bridge Bank, the FHLB advances were transferred to the Bridge Bank. The FDIC as Receiver repaid the advances after the Signature Bridge Bank was sold to Flagstar Bank, N.A.
(C) At the time of failure, IndyMac had $ 10.1 billion in advances from the FHLB. When the FDIC established IndyMac Bridge Bank, the FDIC immediately repaid $4.3 billion in advances to the FHLB. When the FDIC sold the bridge bank in March 2009, the remaining $5.8 billion in FHLB advances were assumed by OneWest.

Source: FDIC

Figure 12



Source: FDIC.

Figure 13

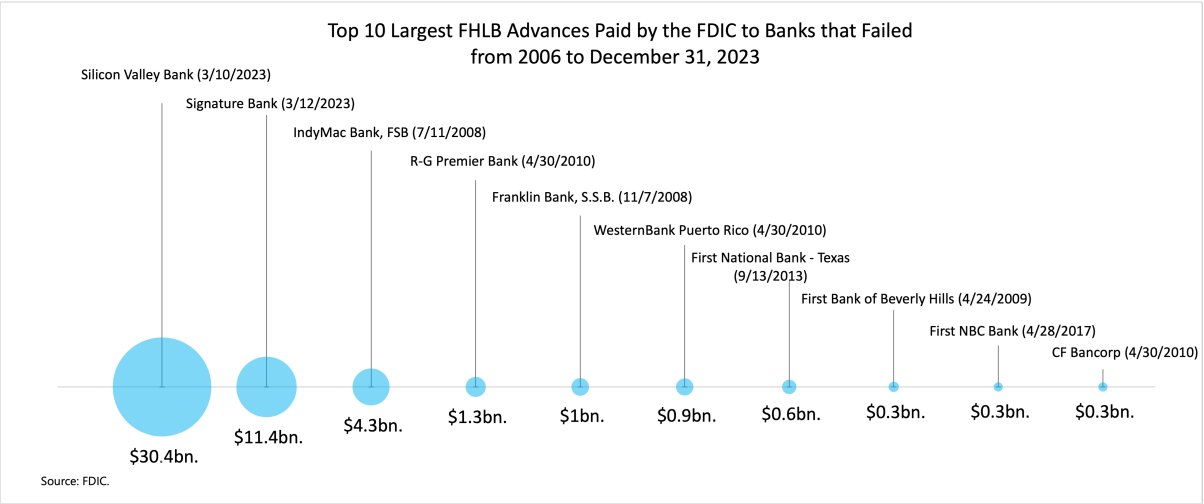


Figure 14

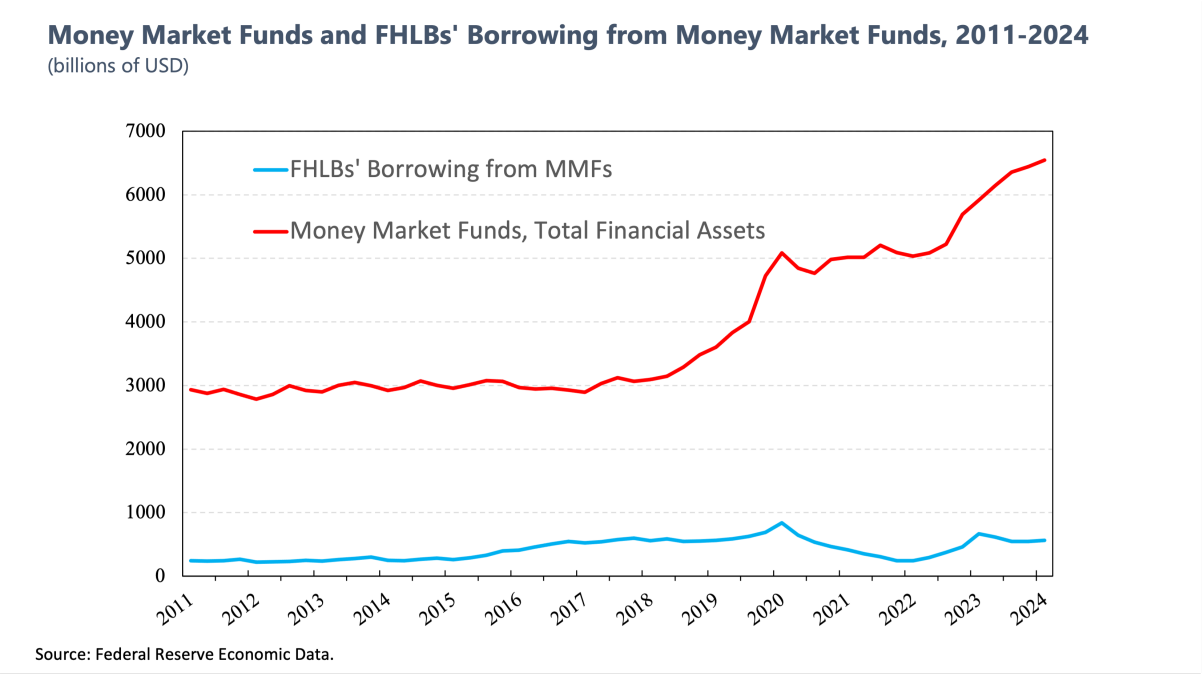


Figure 15

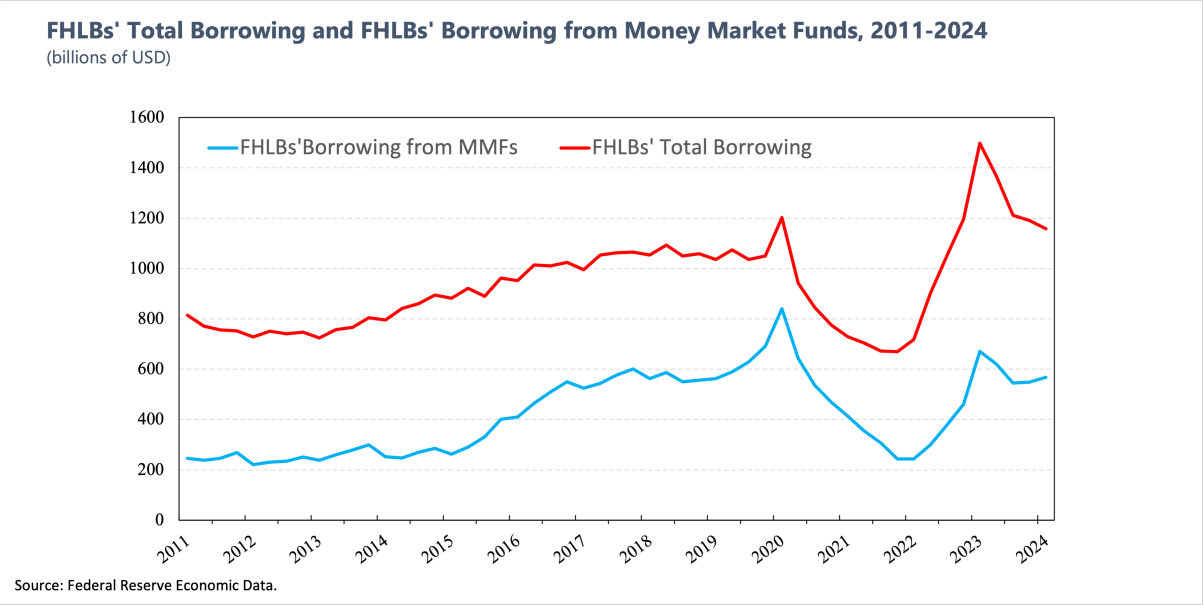


Figure 16

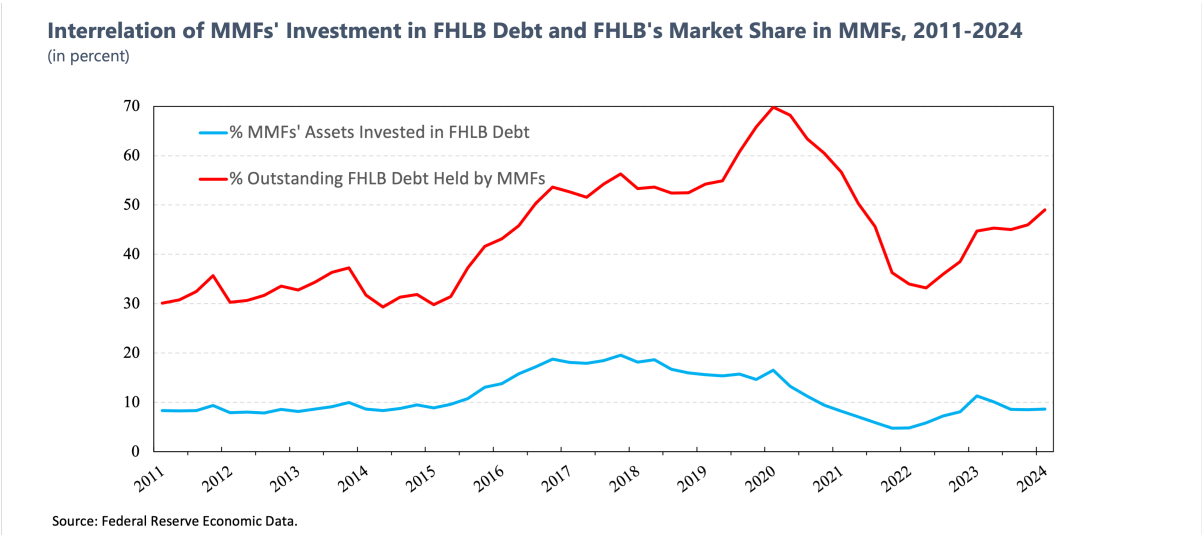
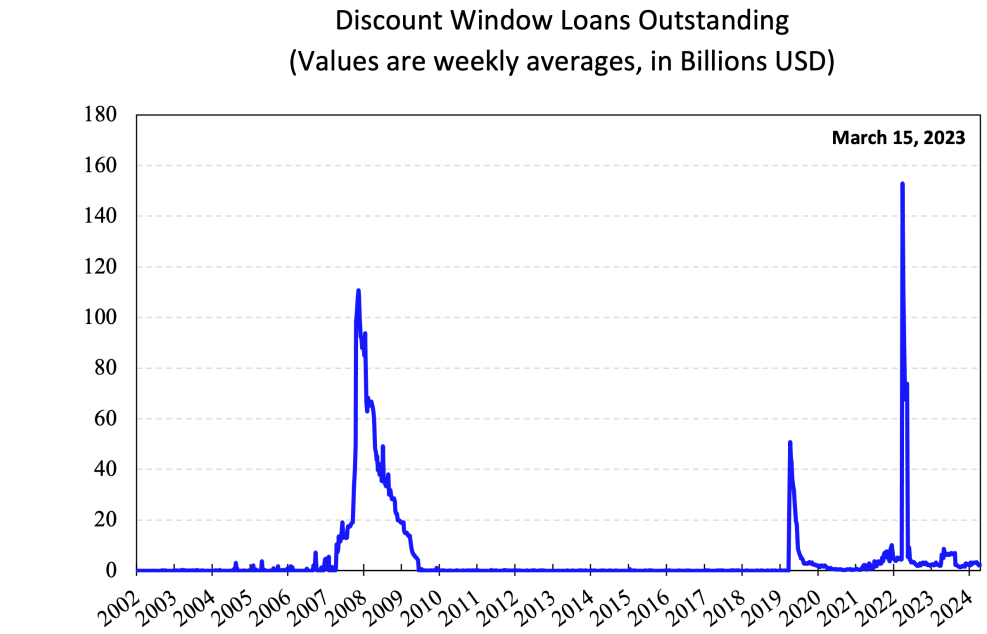


Figure 17



Source: Federal Reserve Economic Data (FRED).

Figure 18