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BOOK VALUE RISK MANAGEMENT OF BANKS: LIMITED HEDGING, HTM ACCOUNTING, AND RISING INTEREST RATES

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ABSTRACT

We document that faced with rising interest rates in 2022, banks mitigated interest rate exposure of the accounting value of their assets but left the vast majority of their long-duration assets exposed to interest rate risk. Data from call reports and SEC filings shows that only 6% of U.S. banking assets used derivatives to hedge their interest rate risk, and even heavy users of derivatives left most assets unhedged. Instead of hedging against the risk of asset market value declines, banks used the held-to-maturity (HTM) accounting to reduce the impact of rising interest rates on their book capital, reclassifying an additional $1 trillion in securities as HTM as rates began to rise. More vulnerable banks, particularly those supervised by less stringent state regulators, were more likely to use HTM classification. We use a simple model to study the interaction between capital regulation, accounting rules and incentives to hedge asset interest rate risk or recapitalize banks. Capital regulation can help mitigate run risk, especially when bank equity holders are reluctant to address it through hedging or recapitalization. While HTM accounting can allow strong banks to avoid the deadweight costs of overly tight capital requirements, it also enables weaker banks to window-dress their capital positions leaving them vulnerable to runs. Including deposit franchise value in regulatory capital calculations without considering run risk could weaken capital regulation's ability to prevent runs. Our findings have implications for regulatory capital accounting and risk management practices in the banking sector.

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1. Introduction

The Federal Reserve's sharp interest rate hikes in 2022, undertaken to combat high inflation, led to significant declines in the value of long-duration assets held by banks. These losses exposed solvency run risks at hundreds of institutions and contributed to the collapses of Silicon Valley Bank (SVB) and First Republic, the largest U.S. bank failures since the Great Recession (Jiang et al., 2024). These events raised urgent questions about how banks manage interest rate risk and whether regulatory and accounting frameworks inadvertently discouraged appropriate hedging.

This paper uses the 2022 tightening episode as a lens to examine how banks responded to rising rates and managed their interest rate exposure. We present new evidence that, from a market value perspective, banks largely did not hedge the interest rate risk on their assets. Instead, they reduced the interest rate sensitivity of their book assets by reclassifying securities as held-to-maturity (HTM)—a strategy that shielded regulatory capital from mark-to-market losses. We then develop a model to analyze how accounting rules shape banks' incentives to hedge or recapitalize, and conclude with implications for the regulatory framework. [2]

We utilize three complementary data sources to illuminate the scale and significance of banks' hedging activities. The first source is SEC Edgar's 10K and 10Q filings for all publicly traded bank holding companies, covering 258 banks in 2022, including SVB and First Republic. Since hedging information is not consistently reported across banks, we manually collect and standardize the data. The second source is bank call report data, which includes FDIC-insured banks with assets exceeding $5 billion. These banks report the notional value of non-trading interest rate swaps, offering broad coverage of nearly 94% of all bank assets, including private banks, but is limited to swaps. Last, we gather asset duration information from 62 publicly traded banks that disclosed this data in their 2021 and 2022 10Ks. This allows us to assess banks' total exposure to interest rate risk, combining asset risk and derivative usage.

In the first part of the paper, we document very limited use of interest rate hedging by banks. This result indicates that even with derivatives, banks' total asset value was significantly exposed to interest rate risk at the end of 2021, just before the monetary tightening. In our most comprehensive sample, over three-quarters of reporting banks disclosed no material use of interest rate swaps at the end of 2021. Interest rate swap usage is concentrated among larger banks, which hedge only a small portion of their assets. While swap users represent about three-quarters of total bank assets, they hedge, on average, only 4% of their assets and about one-quarter of their securities. Similar results emerge from the 258 publicly traded (larger) banks, which also report the use of derivative instruments other than interest rate swaps to hedge interest rate risk. Over 60% of banks report no

[2] While there is some literature examining banks' exposure to interest rate and credit risk, most of it focuses on periods prior to the 2022 monetary tightening and does not directly analyze how banks manage interest rate risk through accounting choices. See, for example, Begenau et al. (2015), Kelly et al. (2016), Drechsler et al. (2017, 2021), Egan et al. (2017), Atkeson et al. (2018), Begenau and Stafford (2019), and Xiao (2020).

hedges. The largest banks that do hedge cover only about 9% of their assets and less than one-third of their securities. Overall, the largest banks hedge the most, but the majority of their interest rate risk remains unhedged.

We confirm that banks' assets are significantly exposed to interest rate risk, even after accounting for hedging strategies, using data from 62 banks that disclose the duration of their total assets, including derivatives. They report an average duration of 4.6. Thus, a two-percentage point increase in the 10-year Treasury yield—similar to what was observed during our sample period—would imply a 9.2% loss in asset value. Applied across the entire banking sector, with total assets of $24 trillion, this equates to approximately $2 trillion in losses. These estimates align closely with those calculated by Jiang et al. (2024), indicating that hedging strategies and interest rate derivatives were largely insufficient to offset the majority of these losses.

One possibility is that hedging is limited because it is primarily employed by banks that are most vulnerable—those particularly exposed to asset declines or susceptible to bank runs. We find little evidence that the banks most vulnerable to asset declines or solvency runs were more likely to hedge interest rate risk before the 2022 monetary tightening. Although these riskier banks were somewhat more likely to use interest rate swaps, the amounts were minimal. In fact, using more comprehensive hedging data from 10-K filings, we find that riskier banks, if anything, hedged less than their peers before the tightening. Overall, banks at higher risk, such as SVB, hedged their interest rate risk to a similar extent as other banks prior to the rate increases.

Another potential reason for limited hedging is that banks hedge minimally on average but tend to increase their hedging activities as risks escalate. We find the opposite: riskier banks actually reduced their hedging activity during the period of monetary tightening. A case study of the failed Silicon Valley Bank (SVB) illustrates this pattern—at the end of 2021, SVB hedged roughly 12% of its securities portfolio; by the end of 2022, that figure had fallen to just 0.4%. We speculate that some vulnerable banks deviated from standard risk management practices in a "gamble for resurrection". As interest rates rose, selling profitable hedges allowed weaker banks to bet that interest rate would soon start declining—a risk that could benefit the bank if interest rates dropped but could ultimately translate into losses borne by the FDIC if interest rates continued to climb. This behavior is consistent with a "gambling for resurrection" strategy, which prioritized short-term gains at the expense of long-term financial stability.

In the second part of the paper, we demonstrate that banks used accounting treatments to shield the book value of their assets from interest rate fluctuations. In other words, while banks did little to hedge the market value of their assets, they significantly reduced the sensitivity of their book asset values to interest rate risk. Because certain explicit and implicit capital requirements are tied to banks' book values, the discretion to classify assets strategically can weaken incentives to hedge interest rate risk.

Banks can classify securities on their balance sheets as either Available-for-Sale (AFS) or Held-to-Maturity (HTM). The book value of AFS securities must reflect their market value, meaning any decline in market value due to rising interest rates is also reflected in their book value. By classifying securities as HTM, banks declare both the ability and intent to hold them until maturity. This classification allows banks to avoid reporting unrealized mark-to-market losses on their balance sheets and comprehensive income statements.

We document that banks made extensive use of HTM accounting before monetary tightening and increased its use as interest rates began to rise. By early 2022, approximately one-third of the $6 trillion in securities held by commercial banks were valued using HTM accounting. During 2021 and 2022, banks transferred nearly $1 trillion of their AFS securities to HTM. By the end of 2022, the share of securities valued using HTM rose to 45%, or $2.75 trillion. Our estimates suggest that U.S. banks avoided recognizing $175 billion in losses during subsequent quarters through these reclassifications. Rather than hedging against interest rate risk affecting the market value of their assets, banks focused on shielding the book value of their assets and their statements of comprehensive income from the impact of declining market prices.

These reclassifications enabled many banks to shield their regulatory capital from the impact of rising interest rates. For example, large banks subject to "advanced approaches" capital rules—and any bank seeking access to FHLB funding—faced requirements that did not exclude unrealized losses on AFS securities from capital calculations. More broadly, Gopalan and Granja (2024) show that supervisors treated unrealized losses on AFS and HTM securities differently when assessing the need for corrective action, suggesting that banks had incentives to reclassify assets to avoid supervisory scrutiny and intervention.

Consistent with these incentives, we find that the least healthy and most financially fragile banks were more likely to reclassify securities to HTM. Banks with lower capital ratios, a higher share of run-prone uninsured deposits, and longer-duration securities were particularly inclined to reclassify securities from AFS to HTM during 2021 and 2022. For example, only 1% of banks reclassified securities if uninsured deposits made up less than 20% of their total funding, whereas over 10% of banks with uninsured deposits exceeding half of their funding did so. This suggests that banks more exposed to asset value declines and with more fragile funding structures used HTM reclassification to obscure losses from rising interest rates.

One pertinent question is why fragile banks were allowed to use the HTM reclassification, which requires that banks be able to hold these securities until maturity. While a full analysis of this issue is beyond the scope of this paper, we provide suggestive evidence that regulatory scrutiny, rather than auditor oversight, plays a significant role. Banks audited by Big-4 firms were not significantly less likely to reclassify securities. However, banks regulated solely by national authorities were less likely to reclassify securities compared to those also overseen by state banking departments, even after controlling for size and other factors. This aligns with prior research (Agarwal et al.,

2014; Granja and Leuz, 2023), which finds that state regulators tend to enforce rules less rigorously than their federal counterparts. These findings suggest that stricter regulatory oversight may lead to more consistent enforcement of HTM accounting rules, potentially preventing banks from using this classification to obscure their true financial condition.[3]

Overall, our empirical findings indicate that banks did not hedge most of their interest rate exposure in terms of market value. Instead, they relied on HTM accounting and reclassification rules to protect the book value and regulatory capital of their assets as interest rates rose, thereby mitigating the impact of capital requirements.

To explore this further, we develop a simple stylized framework to interpret our findings and draw implications for bank regulation. We extend the solvency-based bank run model of Jiang et al. (2024) by incorporating capital requirements and allowing shareholders to hedge interest rate risk. This extension allows us to explore how accounting rules impact the effectiveness of capital regulations when risk-free interest rates rise. Our analysis explores the conditions under which bank solvency runs may occur and evaluates the incentives for bank owners to hedge interest rate risk or raise additional capital. In doing so, we highlight how capital raising incentives—and capital regulation—interact with banks' hedging strategies and HTM accounting decisions.

Our model offers several insights. First, we show that limited liability and external financing frictions can discourage bank equity holders from eliminating run risk by hedging interest rate exposure or recapitalizing—even when the bank's equity is positive in the good equilibrium (e.g., due to a valuable deposit franchise). In this sense, banks engage in a "gambling for resurrection" strategy —underinsuring their assets or avoiding raising substantial capital, hoping the run equilibrium does not occur. This behavior aligns with our empirical findings, which show that banks did not insure a significant portion of their interest rate risk exposure.

Second, the model highlights the trade-off in how unrealized losses are treated in regulatory capital. When such losses are included—as under AFS accounting—capital requirements can become overly binding for otherwise "strong" banks with high asset values. These banks may recapitalize beyond what is necessary to prevent runs, incurring deadweight costs. In contrast, when banks use HTM accounting to shield regulatory capital from unrealized losses, they hedge sufficiently to avoid runs in high-interest-rate environments but reclassify assets as HTM to meet capital requirements at lower cost. "Weak" banks—those with low asset values—use HTM accounting more opportunistically. They "window dress" their capital positions to appear compliant while remaining exposed to run risk. This behavior is consistent with our empirical findings, which document widespread HTM reclassifications by banks during recent periods of

[3] Hedging HTM securities requires banks to recognize changes in the value of these assets (held at cost) and report the effects on the income statement, which may reduce the incentive to hedge. These accounting disincentives do not apply to AFS securities, where mark-to-market adjustments are already recognized. A back-of-the-envelope calculation suggests that hedge accounting standards for fixed-rate instruments were unlikely to materially constrain most banks' decisions to hedge interest rate risk.

monetary tightening. In our framework, these reclassifications likely served to obscure the adverse impact of rising rates on asset values, reducing incentives to hedge or raise capital. More broadly, we show that the effectiveness of capital regulation hinges on how regulatory capital is defined and enforced.

Last, our framework also suggests that including the deposit franchise value (in the absence of a run) in regulatory capital calculations can weaken the effectiveness of capital regulation in incentivizing banks to prevent run risk and insolvency. Given that uninsured deposits are particularly vulnerable to runs, the regulatory capital condition could incorporate the solvency run threshold proposed by Jiang et al. (2024), ensuring that banks have sufficient capital to withstand runs by uninsured depositors.

Related Literature:

Our paper is related to a vast literature on bank risk and specifically their interest rate risk management practices that we cannot fully cover here. Within this literature, Begenau et al. (2015), Kelly et al. (2016), Drechsler et al. (2017, 2021), Egan et al. (2017), Atkeson et al. (2018), Begenau and Stafford (2019), and Xiao (2020) provide recent assessments of U.S. banks' exposure to credit and interest rate risk in periods preceding the 2022 monetary tightening episode we focus on. We differ from this literature in several ways. A significant portion of prior research in this domain has concentrated on periods characterized by relatively low and stable interest rates. In contrast, we focus on a period marked by a substantial increase in interest rates and study the adjustment of banks' practices to these increases. A notable exception is McPhail et al. (2023) who uses confidential regulatory data and confirms our findings that interest rate swap positions are not economically significant in hedging the interest rate risk of bank assets. Importantly, we show that although economic hedging is minimal, the "hedging" of accounting interest rate risk is substantial.

We also differ from this literature by providing a framework that studies the impact of capital requirement accounting (HTM vs. AFS) in a bank run setting. From a modeling perspective, our paper is most closely related to Jiang et al. (2024). We extend their self-fulfilling solvency bank run model by incorporating capital requirements and allowing shareholders to hedge interest rate risks. This enables us to explore the potential for solvency runs and assess owners' incentives to hedge interest rate risks or raise capital, while highlighting the interaction between capital regulation and HTM accounting decisions. In doing so, we contribute to the literature on deposit franchise market power in the deposit market.[4] We specifically examine how existing accounting standards for capital requirements shape the incentives to hedge when the deposit franchise itself is fragile.

[4] See, for example, Hannan and Berger (1991); Neumark and Sharpe (1992); Drechsler et al. (2017); Egan et al. (2017); Xiao (2020), Drechsler et al. (2021), and Egan et al. (2022).

We also provide a theoretical framework that analyzes the impact of capital requirement accounting—specifically the treatment of HTM versus AFS securities—within a bank run setting. In this sense, the paper is also related to a theoretical literature that studies the optimal design of prudential regulations and accounting standards (e.g., Bertomeu, Mahieux, and Sapra 2023; Kostić, Laux, and Muthsam 2024). Unlike these papers, we do not study optimal ex-ante regulation and standard setting. Instead, we focus on how the interaction of existing capital rules and accounting standards affects banks' hedging and recapitalization incentives during episodes of monetary tightening. Our model adds to this literature by suggesting that banks with greater exposure to interest rate risk and weaker deposit franchises are more likely to use the discretion in accounting valuation models to reclassify assets to HTM.

Our paper also relates to a broader accounting literature that empirically examines how the valuation of securities under accounting rules interacts with capital regulation. This literature overwhelmingly finds that banks exploit the discretion in the accounting rules governing the valuation of securities to bolster their regulatory prudential ratios. Chircop and Nowotny-Farkas (2016) and Kim, Kim, and Ryan (2019) show that the Basel III requirement to include unrealized gains and losses on AFS securities in regulatory capital prompted banks to reclassify investment securities as HTM. Kim, Kim, and Ryan (2023) further show that certain banks reversed this classification in response to the tailoring rules that reinstated their eligibility to apply the prudential filter. Bischof, Brüggemann, and Daske (2023) find that banks with tighter capital ratios take advantage of a post-crisis change in international accounting standards that permitted reclassification from fair-value to amortized cost. Finally, Bischof, Laux, and Leuz (2021) find that prudential filters dampen banks' incentives to take timely corrective action following fair value losses. Our paper confirms the above findings but also finds that banks with more fragile sources of funding and that are more exposed to interest rate risks are more likely to transfer securities to the HTM classification. This behavior may be problematic in light of Bischof, Laux, and Leuz's (2021) conjecture that a bank's funding structures may be more relevant than managerial intent in determining its ability to hold securities to maturity.

Finally, our work is also related to emerging body of work that addresses the 2023 regional banking crisis. In addition to the study by Jiang et al. (2024), other papers in this literature include, among others, the contributions by Amador and Bianchi (2024), Acharya et al. (2024), Cookson et al. (2023), Drechsler et al. (2023), Haddad et al. (2023), Flannery and Sorescu (2023), Gopalan and Granja (2024), Kim, Kim, and Ryan (2023), Koont et al. (2023), and Jiang et al. (2025).

2. Background: Accounting for Hedges

We provide a brief overview of bank accounting for securities and derivatives, the two primary asset categories relevant in hedging transactions. We briefly address why book values of bank assets may not reflect asset values when these are held to maturity, and how hedging some assets may lead to additional fluctuations in earnings.

When banks report assets in their financial disclosures, two categories are relevant to hedging transactions: debt securities and derivatives. Debt securities can be classified at management discretion based on their intent as either available for sale ("AFS") or held to maturity ("HTM").[5] AFS securities can be sold at the bank discretion, and their value is marked to market (fair value) with unrealized gains and losses reported in "other comprehensive income." HTM assets are designated to be held to maturity, with the bank planning to collect the cash flows. HTM are recorded and held at cost, with differences between cost and fair value disclosed in footnotes. Hedging HTM securities would require banks to acknowledge changes in the value of these assets (which are held at cost) and reflect them directly on their income statement. This accounting treatment reduces banks' incentives to hedge HTM securities if they perceive such fluctuations in reported earnings as costly. Because AFS securities are marked to market, such accounting disincentives to their hedging do not exist.

Banks account for derivatives at their fair value with changes in their value over the year recorded in earnings. Management can instead elect "hedge accounting" with derivatives. This is the case if the derivatives hedge either fair value risk or cash flow risk of an asset. Broadly, interest rate swaps are classified as fair value hedges with offsetting gains and losses (from both the derivative and hedged item) accounted for in earnings.

The actual disclosures of hedges come with several complications, which somewhat complicate the computation of banks' hedging. Hedges need only be disclosed in footnotes for derivative instruments (and other transactions) that management assesses as "material". Disclosures must provide financial statement users an idea about the volume of derivative activity (e.g., notional dollar amounts), but there is variation across banks in the amount of detail that is disclosed. Moreover, not all derivatives (including swaps) are designated as hedges. Generally, there are categories of derivatives, "derivatives used for hedging", "derivatives not used for hedging", and "derivatives used for customer-related activities". Some of these derivatives will effectively serve as hedges for each other or other assets / liabilities of the bank. But they will not be designated as hedges for accounting purposes. This further complicates any accounting of bank hedging.

3. Data, Sample, and Measurement

We use multiple data sources to study the scale and importance of banks' hedging activity and use of HTM accounting. First, we use bank Call Report data to analyze interest rate swap activity. Banks with total assets over $5 billion are required to report, in Schedule RC-L, the notional amounts of interest rate swaps held for non-trading purposes, including a breakdown of positions where the bank pays a fixed rate.[6] This reporting structure allows us to directly observe the

[5] Debt securities can also be classified as "trading", a third classification that's typically relevant only for specific banking models, such as Credit Suisse.

[6] In Schedule RC-L, there is a category called, "total gross notional amount of derivative contracts held for purposes other than trading." The specific item under this category we are using is "RCON/RCFD A589," called "interest rate swaps where the bank has agreed to pay a fixed rate."

direction of swap contracts—specifically, positions in which banks pay fixed and receive floating rates, a common hedging arrangement. Additionally, some banks below the $5 billion threshold either report these positions voluntarily or are required to do so by their primary federal regulator. In total, there are 1,271 banks reporting interest rate swaps. Table 1 shows that the group of banks reporting the notional value of their interest rate swaps comprise about 95% of the total assets in the banking system.

All banks must report information about the total amortized cost and fair value of securities classified as HTM or AFS at the end of each quarter. But no field in the call reports directly indicates the value of securities that banks decide to reclassify or relabel from the AFS to the HTM portfolio. Instead, the call reports provide a group of variables that collectively allow us to identify if a bank reclassified AFS securities from their AFS to the HTM portfolios and to reasonably estimate the value of all securities that a bank reclassified from the AFS to the HTM portfolio. Appendix B offers additional details about the procedure that we use to identify reclassifications from the call report data. Finally, we use regulatory call reports to calculate other bank characteristics for the analysis, such as capitalization levels and reliance on uninsured deposits.

We collect data on banks' hedging activities, the average duration of their investment securities portfolios, and the use of held-to-maturity (HTM) accounting from 10-K and 10-Q filings submitted to the Securities and Exchange Commission (SEC) by publicly traded bank holding companies for fiscal years ending in 2021 and 2022. This data source enhances our ability to measure both the extent of hedging and the reclassification of available-for-sale (AFS) securities as HTM among SEC-filing banks. Importantly, we expand our analysis beyond interest rate swaps to include other hedging instruments such as futures, forwards, and options. We also quantify the value of securities reclassified from AFS to HTM portfolios.

Because disclosures related to hedging and security reclassification are not standardized, we manually extract this information from the notes to consolidated financial statements and standardize it to ensure comparability across banks. Additional methodological details are provided in Appendix B. We link these SEC filings to call report data using the CRSP-FRB link table provided by the Federal Reserve Bank of New York.

From these data sources, we construct several metrics to assess hedging behavior. At the extensive margin, we define an indicator for whether a bank uses interest rate swaps for non-trading purposes. At the intensive margin, we compute a primary hedging ratio by dividing the notional value of interest rate swaps by total assets. We also construct alternative measures, such as the ratio of interest rate swap notional amounts to total securities or total AFS securities.

We supplement these call-report-based measures with hand-collected data from 10-K and 10-Q filings, which include the notional value of all derivative instruments used for hedging interest rate

risk and the average duration of investment securities portfolios at year-end 2021 and 2022. These additional metrics provide a more comprehensive view of banks' interest rate exposure and hedging intensity.

As shown in Figure A1, both data sources cover the largest banks across the size distribution. All banks with assets above $5 billion are subject to the disclosure requirements underlying the call report data. Moreover, the largest U.S. bank holding companies are publicly traded, meaning our 10-K and 10-Q measures capture a substantial share of total assets in the banking system.

Finally, we compute measures that reflect banks' use of HTM accounting. Here, our focus is on learning about banks' deliberate decisions to reclassify securities that had been previously labeled as AFS. We compute both an indicator variable for whether a bank reclassified securities to HTM between 2021 and 2022 and a measure of the intensive margin of reclassification, which is the ratio between the value of reclassified securities and total assets. For large public banks and a few other banks that publicly disclose their annual reports, we compute these measures using hand-collected information from their 10-K, 10-Q, and annual report filings. For all other banks, we supplement these measures by using a group of variables in the call reports that collectively allow us to identify a reclassification of securities from AFS to HTM.

4. Banks' Use of Interest Rate Hedging prior to Monetary Tightening

4.1 Descriptive Evidence

We begin our empirical analysis by providing basic descriptive statistics about banks' use of interest rate hedges. In Table 1 and Figure 1, we show that few banks hedged their interest rate exposure prior to the monetary tightening. Only 290 of 1,271 banks report using interest rate swaps for non-trading purposes. Therefore, over three quarters of all reporting banks report no use of interest rate swaps. The predominant users of swaps are large banks, which also represent the majority of assets held at U.S. banks. Banks representing $17 trillion or 77% of all assets in the U.S. banking system report some use of interest rate swaps. But the notional amount of the interest rate swaps held by these banks represent, on average, only about four percent of their assets. Overall, about 94% of aggregate assets in the U.S. banking system are not hedged by interest rate swaps (Figure 1B). By contrast, Jiang et al. (2024) show that more than 70% of bank assets were exposed to interest rate risk over this time period. Even if we ignore loans and restrict our attention to securities, we find that the interest rate swaps of these banks cover, on average, only between one fifth to one fourth of the mark-to-market value decline in the value of their securities. In sum, the extent of hedging seems insufficient to significantly protect banks' balance sheets against the rise of interest rates.

Banks use derivative instruments other than interest rate swaps to hedge interest rate risk. In Table 1 and Figure 1A, we use information obtained from voluntary disclosures in 10-Ks and 10-Qs to provide further descriptive statistics about banks' hedging activities. These statistics consider all

derivative instruments that banks use to hedge their interest rate risks. In this group of banks, over 60% do not report on hedging activities and only 62 banks report their duration. Among banks that choose to report hedging, banks below $250 billion in assets hedge about 5% of their total assets whereas banks whose assets exceed $250 billion hedge almost 9% of their total assets, or about 30% of their security holdings. In other words, even banks that choose to report their hedging activity do not hedge the interest rate exposure of most of their securities, let alone loans and other assets.

The idea that banks' assets are exposed to substantial interest rate risk after hedging is corroborated on the sample of 62 banks that report the duration of their total assets, including derivatives. With an average duration of 4.6 (and ignoring convexity) the implied losses for a two percentage points increase in the 10-year Treasury yield that occurred during the recent monetary tightening would add up to more than 9% of asset value. Jiang et al. (2024) find that marked-to-market bank assets declined by an average 10% across all banks during that period, about $2 trillion in the aggregate, not accounting for risk hedges. This evidence further supports the notion that the size of banks' hedging activity was not large enough to offset most of the $2 trillion loss in the value of U.S. banks' assets.

By failing to adequately hedge their assets, including loans, against rising interest rates before the 2022 monetary tightening, how did banks shield their reported balance sheets from mounting losses in securities, which are easier to value than loans? The answer likely lies in the current accounting standards governing the valuation of securities. Banks can avoid recording unrealized mark-to-market losses in their balance sheets and statements of comprehensive income if they classify their securities as HTM. In Figure 2A, we show that in the beginning of 2022, only about one-third or about $2 trillion out of the $6 trillion of securities held by U.S. banks were valued using HTM accounting. This breakdown between AFS securities and HTM securities in the aggregate balance sheet of the banking system changed drastically during the monetary tightening period. By the end of 2022, U.S. banks still held approximately $6 trillion in securities but 45% of those securities, or $2.75 trillion were now valued using HTM accounting.

This large shift in the breakdown between AFS and HTM securities during 2022 indicates that banks actively sought to insulate their balance sheets and statements of comprehensive income from recognizing declining security prices during 2022. We show in Figure 2B that banks reclassified almost $1 trillion of their existing AFS securities to HTM during 2021 and 2022. These reclassifications fully account for the reallocation between AFS and HTM securities that occurred between 2021 and 2022 and allowed banks to avoid recording accounting losses on these assets simply by slapping a new label upon their existing securities. During 2021, U.S. banks reclassified about $220 billion in securities with JPMorgan Chase alone accounting for $104.5 billion of the total amount. The reclassification activity accelerated considerably as the Federal Reserve began raising interest rates during the first and second quarters of 2022 with banks reclassifying more than half a trillion of securities during these two quarters.

Figure 3 shows that banks' deliberate reclassification of large portions of their securities portfolios as HTM enabled them to avoid recognizing substantial accounting losses in the quarters that followed. We estimate the amount of losses that banks avoided by reclassifying securities to HTM following the methodology in Jiang et al. (2024). We obtain asset maturity and repricing data from the call reports and we use exchange-traded mortgage-backed securities and treasury indices to estimate the value of the securities that were transferred to the HTM category. Figure 3A shows that the estimated losses on reclassified securities increase steadily during 2022 and amounted to approximately $175 billion in the fourth quarter of 2022. To put this amount in perspective, we show that the CET1 capital (prior to adjustments) of the group of banks that reclassified securities was about $1.05 trillion at the end of 2022. The estimated losses on securities reclassified from AFS to HTM would wipe out more 15% of these banks' capital if these accounting losses were to impact regulatory capital. In Figure 3B, we show significant heterogeneity in the severity of these estimated losses as a percentage of each bank's CET1 capital at the end of 2022. The estimated "hidden" losses account, on average, for 20% of the CET1 capital of reclassifying banks. But for more than ten percent of reclassifying banks, we estimate that they avoided recognizing losses representing more than half of their equity capital.[7]

4.2 Cross-sectional Evidence

We find that U.S. banks hedge only a small fraction of their asset exposure to interest rate risk. It is nonetheless possible that the most fragile banks could have had incentives to make their balance sheets more resilient by hedging a greater portion of their assets prior to the monetary tightening.

We find little evidence that banks whose assets were most exposed to interest rate risk or whose liabilities were most fragile hedged a much larger fraction of their assets at the end of 2021. In Figure 4, we split our call report sample into twenty equal-sized bins based on different measures of interest rate risk exposure. We explore how hedging varies across measures of capitalization (Figure 4A), reliance on uninsured deposits as a measure of deposit fragility (Figure 4B), and the share of long-term securities as a measure of exposure to interest rate risks (Figure 4C). The plots indicate that banks with lower capitalization, that rely more on uninsured deposits, and whose assets were more vulnerable to rising interest rates did not hedge a significantly larger proportion of their assets than other banks. The interest rate swaps of the group of banks with the most uninsured leverage cover, on average, less than 2.5% of their assets whereas swaps account for about 1.5 percent of assets for the group of banks with median uninsured leverage.

[7] We make two conservative assumptions in estimating the book losses that banks avoided by reclassifying securities as HTM: (i) securities are assumed to be transferred to HTM at the end of the quarter, and (ii) the composition of securities reclassified—including the share of Treasuries versus MBS, as well as the maturity and repricing structure—mirrors that of the bank's overall securities portfolio. These assumptions likely understate the unrealized losses avoided through reclassification. The first assumption limits our estimates to market value declines occurring after the quarter of reclassification. The second is conservative because banks may have stronger incentives to reclassify longer-duration, higher-risk securities—such as those highlighted in Fuster, Paligorova, and Vickery (2025).

The difference between the hedging intensity of the group of banks with the most fragile deposit structure and that of other banks is, therefore, economically small and driven almost entirely by differences in the extensive margin. We find similar results when we turn our attention to the hedging data voluntarily disclosed by public bank holding companies in their SEC filings in Figure 5. Although the relationship between these measures and the extent of hedging is slightly negative in this sample, the economic magnitude of these differences is again small. Overall, we conclude that more fragile banks did not hedge a significantly larger proportion of their assets.

In Figure A3, we explore how the extensive margin of hedging varies across the three measures of interest rate risk exposures. Panel A indicates that banks with lower levels of capitalization, specifically those with lower Equity to Asset ratios, were slightly more inclined to hedge at least some of their assets. Panels B and C suggest that banks relying more heavily on uninsured deposits and holding a greater share of long-term securities were more likely to hedge at least some of their assets. But when we focus on the relation between these measures of bank fragility and the intensive margin of hedging in Figure A4, we find that, conditional on hedging at least some assets, banks hedge a very small percentage of their assets and that this hedging intensity, though related to their risk exposure, is not economically meaningful.

Figure A5 shows that, if anything, there is a negative relation between exposure to interest rate risk and use of HTM accounting prior to the monetary tightening. Panel A shows that weakly capitalized banks classified a smaller fraction of their assets as HTM. The results of Panels B and C are more ambiguous and point to weak relation between asset exposure to interest rate risks and the share of securities classified as HTM prior to the monetary tightening.

Overall, our cross-sectional evidence on banks' use of hedging is noisy and does not reveal a clear or economically significant relationship between interest rate exposure and hedging activity prior to the monetary tightening cycle. One potential explanation for the lack of a strong positive relationship is that banks with greater interest rate risk may have classified a larger share of their securities as held-to-maturity (HTM). These banks may have had weaker incentives to hedge, as the HTM classification shields their balance sheets and accounting income from mark-to-market losses, and interest rate hedges on these securities would not qualify for hedge accounting under current standards. However, we do not find evidence consistent with the notion that banks most exposed to interest rate risk failed to hedge simply because they relied more heavily on HTM accounting.

5. Bank Hedging during the Monetary Tightening of 2022

5.1 Changes in Hedging Behavior

Next, we document how banks adjusted their hedging activities during the period of monetary tightening. A case study of the recently failed Silicon Valley Bank (SVB) is illustrative. SVB hedged about 12% of all its securities at the end of 2021. By the end of 2022, it had reduced these

hedges to 0.4%. In other words, as interest rates rose, SVB reduced its hedging of interest rate risk. Unwinding those hedges increased the duration of its assets from 3.7 to 5.6 years, leaving the bank significantly more exposed to further interest rate increases, which ultimately materialized. Given that the bank would have retained the profits if interest rates had declined, while its creditors including the FDIC would absorb most of the losses in the event of failure, SVB's actions are reminiscent of classic "gambling for resurrection."

We show that the case of SVB was not an exception. As Figure 6 shows, more than a quarter of the publicly traded banks that reported hedging derivatives experienced declines in various hedging ratios. We divide all publicly traded banks that reported hedging derivatives into four groups based on their hedging ratio adjustments from 2021:Q4 to 2022:Q4. The bottom (top) quartile includes banks that experienced the largest decline (increase) in their hedging ratios. We then plot the evolution of average hedging ratios in each group over the course of 2022. For banks in the bottom quartile, the share of total assets that are covered by hedging derivatives declined by about 3 percentage points (p.p.) from 2021:Q4 to 2022:Q4 (Figure 6A). This is a large change. The best way to observe this is to look at the decline in hedging derivatives scaled by total securities or AFS securities. Banks in the bottom quartile see a decline in hedging ratios by -30 p.p. and -40 p.p., respectively (Figure 6B and 6C).

We next dig deeper into the heterogeneity across banks. Selling (or closing) hedges during 2022 was more likely for banks with fragile funding structures. On the liabilities side, banks with a higher uninsured leverage, i.e., more fragile funding, were more likely to sell (or close) hedges (Figure 7A). The magnitude is substantial, with swap coverage decreasing by several percentage points of assets. Banks with lower capitalization also reduced their hedging intensity to a greater extent than other banks (Figure 7B). On the asset side, we show that banks with greater ex-ante exposures to interest rate risk through their holdings of long-term securities decreased their use of interest rate swaps to a greater extent than other banks (Figure 7C).

We find a similar pattern of reduced hedges when examining the overall duration of bank assets for the limited set of banks that reported this information (including SVB). During 2022, these banks increased the duration of their assets from 4.6 to 5.1 (Figure 8A). The duration increases were largest for banks with the highest uninsured leverage such as SVB, although the SVB case was extreme even among banks with very fragile funding (Figure 8B). In other words, one might imagine that banks, which were more exposed to solvency runs would have mitigated those runs by increasing their hedging. Instead, they sold or reduced their hedges, exposing themselves to more interest rate risk. Changes in hedging among these banks suggests that SVB was likely not the only bank potentially engaged in gambling for resurrection.

5.2 Reclassification of Securities to the HTM category

The evidence presented thus far begs the question of how these fragile banks escaped outside scrutiny that would expose their deteriorating capital positions. We argue that the accounting rules

governing the valuation of securities and, in particular, the use of the HTM accounting to value securities at least partly explains why banks were able to avoid significant pushback from investors, regulators, and other stakeholders. Again, the case of SVB is illustrative of the forces at play. At the end of 2021, SVB held $125 billion in securities out of which 78% or $98 billion were valued using HTM accounting. By the end of the second quarter of 2022, SVB had unrealized losses of $10 billion on these HTM securities and at the end of the third quarter these losses had escalated to $16 billion. These unrealized losses remained unrecognized in the financial statements of SVB and, at the end of the third quarter of 2023, amounted to the entire common equity tier 1 capital of SVB. Because of HTM accounting, SVB did not have to adjust the value of these securities in their balance sheet and financial statements at any point during 2022 and it was not until the first quarter of 2023 that swirling concerns about SVB's financial condition precipitated a massive run (e.g., Cookson et al., 2023) that led to its inevitable demise.

Most banks did not use the HTM classification to the same extent as SVB. But as we have shown previously, U.S. banks collectively reclassified almost $1 trillion dollars in securities to the HTM category effectively insulating U.S. banks from recording estimated losses of $175 billion in their balance sheets. In this section, we ask whether these reclassifications were operated mostly by strong banks that had both the intent and ability to hold these securities until their maturity or if, on the contrary, reclassifications of AFS securities into HTM were predominantly made by fragile banks that purposefully wanted to "hide" the impact that potential losses would have on their already-frail balance sheets.

We explore the relationship between measures of exposure to interest rate risk and banks' proclivity to reclassify securities from AFS to HTM in Figure 9. Figure 9A shows a strong negative relation between levels of regulatory capital and the propensity to reclassify assets from AFS to HTM. Similarly, Figure 9B indicates a strong positive relation between the banks' exposure to interest rate risks through their holdings of long-duration assets and the propensity to transfer assets from AFS to HTM. Figure 9C repeats the analysis using the share of uninsured deposits at the bank as a measure of fragile deposit funding. The plot shows that banks with greater reliance on run-prone uninsured depositors were also more likely to reclassify securities to HTM during 2021 and 2022.

Finally in Figure 9D, we repeat the analysis in Figure 9C after splitting the sample between below- and above-median share of long-term securities. The idea is to assess whether banks that are more exposed to interest rate risk and are also financed primarily by run-prone uninsured depositors are incrementally more likely to transfer assets from AFS to HTM. We find a significantly stronger association between the significance of uninsured deposits in bank funding and asset reclassification when banks have significant asset exposures to interest rate risks. Overall, the results of Figure 9 strongly indicate that more fragile banks were more likely to reclassify securities from AFS to HTM during this period.

We further probe the relation between these bank characteristics and their decisions to transfer securities from AFS to HTM in Table 2. We estimate cross-sectional regressions in which the dependent variable is a dummy variable that takes the value of one if the bank reclassified securities from AFS to HTM during 2021 and 2022 and the main variables of interest are the measures of capitalization, less stable funding, and exposure to interest rate risk. We also include asset percentile dummies to control non-parametrically for the impact of bank size. We cluster standard errors at the level of the bank's state headquarters.

The results in Table 2 further support the idea that more fragile banks were also more likely to reclassify securities from AFS to HTM. Column (1) indicates that a one-standard deviation increase in the capital ratio is associated with a 7 p.p. lower likelihood of reclassification. The results of Column (2) suggest that a bank that is 100% financed by uninsured deposits would be 8.6 p.p. more likely to reclassify securities into HTM than a bank with no uninsured deposits. In Column (3), the results show that banks with higher exposure to interest rate risks through their holdings of high-duration longer term securities are also significantly more likely to reclassify assets.

Column (4) shows that the interaction between the exposure to run-prone depositors and the exposure to interest rate risk matters. Banks with a high share of exposure to uninsured deposits are incrementally more likely to reclassify if they also have greater exposures to longer-term securities. In Column (5), we show that that the explanatory power of each of these variables is not subsumed when we include them together in a multivariate specification and when we add additional controls for the ratio of securities to total assets in each bank and for the percentage of securities that is classified as AFS at the beginning of 2021. In Panel B, we use as dependent variable a measure of the percentage of securities that each bank reclassified to HTM between 2021 and 2022. We find similar results when using this measure, which accounts for the intensive margin of asset reclassification.

6. Regulatory Framework and Use of HTM Accounting

The evidence above suggests that the least healthy and stable banks used HTM accounting to conceal their asset losses, raising important questions about the effectiveness of the current regulatory and supervisory framework in curbing or enabling such behavior. While a full analysis of these issues is beyond the scope of this paper, we present several relevant facts in this section.

The collapse of SVB brought increased scrutiny to the accounting rules governing the valuation of government bonds and mortgage-backed securities. HTM accounting allows banks to avoid marking securities to market if they intend and are able to hold them until maturity. If they lack this intent or ability, they must use AFS accounting, which requires marking securities to market and recognizing unrealized losses in their comprehensive income statements. The key challenge in enforcing HTM rules lies in assessing whether banks truly meet the criteria to hold long-term securities until maturity (e.g., Bischoff, Laux, and Leuz, 2021). When enforcement is weak or

absent, financially unstable banks may exploit the HTM classification to conceal potential losses, avoiding external scrutiny and buying time to "gamble for resurrection."

HTM accounting rules appear to have been weakly enforced during the 2022 monetary tightening. Our empirical evidence shows that the banks least able to hold securities until maturity were the most likely to reclassify large portions of their portfolios to HTM, contrary to both the letter and spirit of the rules. This suggests that many gatekeepers, including auditors and supervisors, likely failed to properly assess the reasonableness of banks' claims about their ability to hold reclassified securities until maturity. This raises an important question: is this pattern a flaw in the system, or an inherent feature of the HTM classification option? Can stricter enforcement by auditors and supervisors salvage the HTM option, or should it be eliminated altogether, as some policymakers have proposed (e.g., Group of Thirty, 2023), due to the inherent difficulty in verifying intent and ability to hold to maturity?

To contribute to this debate, we draw on extensive literature that highlights significant heterogeneity in how different gatekeepers enforce the same rules (e.g., Agarwal et al., 2014). We investigate whether more fragile banks were less likely to reclassify securities into HTM when subject to stricter oversight. Specifically, we examine whether banks audited by the Big-4 firms (Deloitte & Touche, Ernst & Young, KPMG, and PricewaterhouseCoopers) were less likely to reclassify securities compared to those audited by other firms. Additionally, we assess whether the likelihood of reclassifying securities to HTM varied based on the identity of the primary bank regulator. Following prior work by Agarwal et al. (2014) and Granja and Leuz (2023), we ask whether banks were less likely to reclassify securities when solely supervised by federal agencies, as opposed to being jointly supervised by less stringent state banking departments and the FDIC or FED.

In column (1) of Table 3, we estimate cross-sectional regressions, similar to Table 2, to investigate whether weak banks audited by Big-4 firms are less likely to reclassify securities. The results indicate that Big-4 audited banks were not statistically less likely to reclassify securities in 2021 and 2022. This finding suggests that auditors may take a back seat to bank supervisors in enforcing accounting rules in the banking industry (e.g., Nicoletti, 2018).

In column (2), we examine how OCC supervision relates to the likelihood of reclassification. Consistent with the idea that OCC-supervised banks are more strictly regulated than those jointly supervised by state banking agencies, we find that while regular banks have a similar likelihood of reclassification, fragile OCC banks are significantly less likely to reclassify securities. This finding suggests that stricter enforcement of accounting standards could potentially curb the use of the HTM classification by weak banks.[8]

[8] These empirical results should be interpreted with caution, as the selection of a private auditor or primary regulator is likely endogenous. Unobserved factors—such as a bank's underlying compliance culture—may influence both its choice of auditor or regulator and its adherence to accounting standards. To address this concern, we implement a

Another important question regarding the recent crisis is whether existing regulations weakened banks' incentives to protect their balance sheets against interest rate risks. Accounting standards have been criticized for contributing to this issue. Under current rules, a derivative qualifies for hedge accounting only if the underlying securities are marked to market on the bank's balance sheet and income statement (ASC 815-20-25-12(d), 15(f), -42(c)(2), and -43(d)(2)). If a security is classified as HTM, its hedge does not qualify for hedge accounting, as changes in the value of the derivative would not offset any mark-to-market fluctuations in the security's valuation. In other words, hedging interest rate risk on HTM securities is fundamentally inconsistent with the HTM classification.

We explore whether the use (and potential abuse) of the HTM classification hindered banks' hedging activities and could partially explain why banks hedged such a small fraction of their assets. A quick "back-of-the-envelope" calculation suggests that accounting standards for hedging fixed-rate instruments were unlikely to be a binding constraint on most banks' hedging decisions. As shown in Table 1, the notional amount of hedging instruments accounts, on average, for less than 50% of the value of AFS securities held by large publicly listed banks. Nevertheless, we formally investigate whether HTM accounting weakened banks' incentives to hedge interest rate risks. Specifically, we (i) use cross-sectional variation to assess whether banks that classify a larger share of their securities as HTM hedge a smaller fraction of their assets, (ii) use within-bank variation to examine whether increases in HTM classifications are associated with declines in the share of assets protected by hedges, and (iii) explore whether reclassifications from AFS to HTM lead banks to remove or sell hedges on those securities.

We present the results of this analysis in Table 4, which consistently show that the share of securities classified as HTM is statistically unrelated to the ratio of interest rate swaps to assets used by banks. This null result holds whether we examine cross-sectional variation in the share of HTM securities, within-bank changes in the share of assets classified as HTM, or changes driven by the reclassification of securities from AFS to HTM. Overall, our findings suggest that hedge accounting is, at best, a convenient scapegoat for banks' low use of derivatives to hedge interest rate risk.

7. A Stylized Banking Framework with Interest Rate Risk, Capital Regulation, HTM Accounting, and Recapitalization Option

Our findings suggest that banks did not hedge the vast majority of their interest rate exposure and utilized HTM accounting rules to conceal asset-side losses. This practice could potentially enable them to mitigate the impact of explicit and implicit capital requirements. In this section, we present a simple stylized framework to interpret these findings and derive some implications for bank

matching procedure based on Iacus et al. (2012) in the appendix, which ensures covariate balance in key dimensions such as bank size and the share of securities held, both across banks with and without a Big Four auditor and across those overseen by different primary regulators.

regulation. We examine how accounting rules affect banks' ex-ante incentives to hedge interest rate risk and their ex-post incentives to recapitalize in response to interest rate changes. In our framework, the close linkage between hedging and recapitalization decisions implies that limited incentives to insure against interest rate risk ex-ante also translate into weak incentives to raise capital ex-post. We highlight a central trade-off in HTM classifications: while they help strong banks avoid the deadweight costs associated with overly stringent capital requirements, they also allow weaker banks to evade regulatory pressure and underinsure against interest rate risk, increasing their vulnerability to runs.

7.1 Setup

We build on the model of self-fulfilling solvency runs on franchise value from Jiang et al. (2024), extending it to incorporate bank capital requirements and the ability of shareholders to inject additional capital. Specifically, capital requirements are enforced after interest rates are set but before sunspots occur, giving the bank an opportunity to recapitalize and avoid a run. This extension enables us to examine how accounting rules influence the effectiveness of capital regulation in the face of rising risk-free interest rates, as well as the incentives for bank owners to proactively hedge interest rate risk or raise additional capital.

We consider a monopoly bank with long-dated assets and liabilities (deposits) already in place before a risk-free rate shock occurs. All else being equal, rising rates increase the range over which the bank becomes vulnerable to a self-fulfilling run on its franchise value. Our analysis focuses on the incentives of bank owners to hedge asset risk in order to eliminate the possibility of a run equilibrium. Simultaneously, owners can opt to classify assets as HTM. The core premise of our model's timing is that as rates increase, owners have the opportunity to recapitalize the bank; however, once a run is underway, it is too late to intervene. Formally, timing is as follows:

- Initial Stage:
    - Bank starts with a given asset and liability structure and summarized by (d, r) facing an uncertain interest rate realization r_f equal to r_f^l with probability (1 - p) and r_f^h with probability p, where $r_f^h \geq r_f^l$, which is an absorbing state.
    - Before the interest rate is realized, bank equity holders choose what fraction of the bank's assets to classify as HTM and whether to hedge against interest rate risk.
    - Capital requirements are enforced by the central bank.

- Run Stage (after realization of interest rate risk):
    - Regulators enforce capital requirements.
    - Sunspot realizes and depositors decide whether to withdraw their deposits.

7.1.1 Bank Assets and Liabilities

Assets: Bank assets are normalized to a historical cost value of 1. They are invested in risk-free liquid perpetuities (e.g., T-bonds with infinite maturity) with an average coupon of r. The assets are completely liquid: the bank can always sell them at their present value of coupons discounted at the risk-free rate. At the realized risk-free rate r_f, the market value of bank assets is given by $\frac{r}{r_f}$.

Liabilities: The bank's existing liabilities comprise uninsured deposits[9] with face value d. The bank therefore has (book) capital $e_b = 1 - d$. Existing depositors can keep their deposits with the bank or withdraw them to invest in outside goods such as a money market fund or deposits at other banks, which earn $\mu(r_f) < r_f$. The external rate increases in the risk-free rate $1 > \mu'(r_f) > 0$. On the other hand, if the bank fails, depositors realize a positive cost of failure. In other words prevailing rates do not compensate depositors if they think the bank will fail for sure. This payoff structure captures the idea that depositors are willing to pay to obtain deposit services and want to use these services if the bank is sound, but depositors prefer to withdraw their funds to keeping them in the bank, if the bank will fail. In this setting, banks have market power in the deposit market, which may give rise to franchise value.[10]

There is a deadweight cost of raising equity capital, τ per dollar of external equity.

7.1.2 Capital Regulation and Accounting Rules

Banks are subject to capital regulation. The bank's regulatory capital, e_r, must meet or exceed the minimum capital requirement, $\bar{e} \geq 0$, that is $e_r \geq \bar{e}$. If regulatory capital falls below this threshold, regulators close the bank, resulting in zero value for shareholders. Notably, capital requirements exclude the franchise value of deposits, so the face value of deposits serves as the relevant measure for deposit liabilities in capital calculations.

We consider capital requirements that are based on a regulatory capital ratio, e_r, that is tied to the market value of assets and face value of deposits, except for assets classified as hold-to-maturity (HTM) that are valued at their book value. Large "advanced approaches" banks, as well as banks seeking liquidity from the FHLB, are subject to capital regulations of this form. More broadly, as Gopalan and Granja (2024) show, supervisors tend to place greater weight on unrealized losses in AFS securities when evaluating whether to initiate corrective actions. This practice effectively creates a regulatory distinction between AFS and HTM securities, even when the accounting treatment is not explicitly different under capital rules. If the bank classifies a share of its assets as the HTM assets, then, for a given realization of interest rate, its regulatory capital equals to:

[9] Extending the model to include insured deposits is straightforward.
[10] See, among others, Hannan and Berger (1991), Neumark and Sharpe (1992), Drechsler et al. (2017), and Egan et al. (2017) for evidence of bank market power in the deposit market.

$$e_r = \underbrace{\boldsymbol{a}}_{HTM} + \underbrace{(1-\boldsymbol{a})\left(\frac{r}{r_f}\right)}_{Market\ value\ of\ AFS} - \underbrace{d}_{Face\ value\ of\ deposits} \quad (1)$$

The assets classified as HTM are recorded at their book value of 1, and the AFS assets at their market value of $\frac{r}{r_f}$. To classify one unit of assets to HTM accounting has a cost θ. This cost could represent the elimination of option value following the commitment to carry an asset classified as HTM until its maturity (Kim, Kim, and Ryan 2019; Kim, Kim, and Ryan, 2023) or other costs associated with the decision to disclose gains and losses in the footnotes rather than recognizing them in the balance sheet.

We further assume that $\frac{r}{r_f^l} - d \geq \bar{e}$, implying that under a low-interest-rate realization, the bank remains adequately capitalized to meet regulatory requirements even if all of its assets are classified as AFS.

7.1.3 Sunspot Distribution

As in Jiang et al (2024) and related models, there is a possibility of multiple equilibria, which arise from uninsured depositors' strategic complementarity where a "sunspot" serves as a coordination device that is uncorrelated with fundamentals of the economy. To evaluate incentives to hedge the "bad equilibria" ex ante, we explicitly define the probability distribution over sunspots. A "good" sunspot arises with probability $1-\epsilon$, and a "bad" sunspot arises with probability ϵ.

7.2 Equilibrium

We characterize the equilibrium by first analyzing depositors' run decisions, following the framework of Jiang et al. (2024), and then examining bank equity holders' choices regarding hedging and the classification of assets as HTM.

7.2.1 Uninsured depositor run choice

We begin by examining uninsured depositors' decision on whether to run if the bank assets are not hedged. As we later show, the only motivation for insuring assets (or recapitalizing ex post) is to prevent the emergence of a run equilibrium. Because by assumption $\frac{r}{r_f^l} - d \geq \bar{e} \geq 0$ the run equilibrium can only occur in the high-interest rate realization state. As shown in Jiang et al. (2024), we have the following equilibrium structure of the run subgame for a high realization of r_f. Define the value of the bank in the absence of a run in the high-interest rate state as $e_m^{No\ Run} = \frac{r}{r_f^h} - d\left[\frac{\mu(r_f^h)}{r_f^h}\right]$

(i) If $\frac{r}{r_f^h} - d \geq 0$, the bank is fundamentally sound: there is a unique no-run equilibrium.

(ii) If $\frac{r}{r_f^h} - d < 0 \leq e_m^{No\ Run}$ two possible equilibria exist: a no run equilibrium and the market value of equity is $e_m^{No\ Run}$; a run equilibrium when the market value of equity is zero.

(iii) If $e_m^{No\ Run} < 0$, the bank is fundamentally insolvent: there is a unique run equilibrium

In our analysis that follows, our attention will focus on r_f^h such that the two conditions outlined in (ii) are fulfilled. Specifically, this implies that in the high-interest-rate state, in the absence of a run, the market value of bank equity remains positive; however, an equilibrium with a solvency-induced bank run is still plausible.

Asset Hedging Decision

We next analyze the incentives of bank equity holders to hedge assets ex-ante. We begin by examining the bank's hedging decision in the absence of capital requirements. We then show that AFS-only accounting eliminates run equilibria entirely but may increase the risk of bank failure. When capital requirements are strictly enforced and set "too high," AFS accounting can lead some banks to over-hedge. We then consider HTM accounting and demonstrate that, while it can reduce the cost of excessive hedging for strong banks, it also relaxes capital constraints for weaker banks—thereby increasing their vulnerability to failure.

7.2.2 Benchmark: Insurance Choice without Capital Requirements

We begin with a benchmark that examines equity holders' incentives to hedge bank assets in the absence of capital requirements. The motivation for asset insurance is to prevent bank runs, which as we discussed above occur only in the high-interest rate state. To eliminate the run risk in that state, the bank needs a capital injection of $\left(d - \frac{r}{r_f^h}\right)$. We therefore consider the bank equity holders incentives to buy an insurance contract, that pays the bank exactly $\left(d - \frac{r}{r_f^h}\right)$ in the high-interest rate state. To finance this contract, the bank equity holders need to raise $p(1+\tau)\left(d - \frac{r}{r_f^h}\right)$ capital ex-ante where τ>0 is the cost of insurance above its actuarially fair value. This markup captures administrative expenses, unmodeled risk aversion, or solvency constraints faced by insurers.

Shareholders must decide whether to purchase insurance that eliminates run risk or to forgo hedging altogether. [11] Since hedging has no impact on the bank's ex-post equity value in the low-interest-rate state, equity holders will opt to insure only if the expected equity value in the high-

[11] Excess capital increases the deadweight cost of hedging without providing the benefit of reducing the likelihood of a run. Any positive capital issuance that fails to eliminate the run does not affect its probability, as the likelihood of a sunspot is independent of fundamentals. Thus, such issuance offers no benefits to equity holders, only additional costs.

interest-rate state—net of the ex-ante hedging cost—exceeds the equity value without hedging in that state:

$$p\underbrace{\left[e_m^{No\ Run}+\left(d-\frac{r}{r_f^h}\right)\right]}_{\substack{Equity\ value\ with\ hedging\\ when\ rates\ are\ high}}-\underbrace{p(1+\tau)\left(d-\frac{r}{r_f^h}\right)}_{Hedging\ cost}\geq p\underbrace{(1-\epsilon)e_m^{No\ Run}+\epsilon\times 0}_{\substack{Equity\ value\\ absent\ hedging\ when\ rates\ are\ high}} \quad (2)$$

In other words, the bank will choose to hedge if the expected benefit of preserving the franchise value in the high-interest-rate state exceeds the net cost to shareholders:

$$e_m^{No\ Run}\geq\frac{\tau}{\epsilon}\left(d-\frac{r}{r_f^h}\right) \quad (3)$$

The probability of a run triggered by a bad sunspot plays a central role in determining the threshold at which private insurance becomes worthwhile. If the likelihood of a run is sufficiently low in the absence of hedging, shareholders may prefer to leave the bank exposed rather than incur the cost of insurance.

7.2.3 AFS and Excessive Capital Requirements

Suppose, instead, banks are subject to an AFS capital requirement, i.e. all assets are valued at market value and the capital requirement is enforced after interest rates change, which is equivalent to enforcing $a = 0$ in the condition (1). The AFS equilibrium is very stark. First, all runs are eliminated: banks either hedge ex-ante to prevent a run or are closed by regulators. This section highlights the central trade-off associated with raising AFS-based capital requirements. On one hand, such requirements create incentives for banks to hedge interest rate risk or, as we show later, to recapitalize ex post. On the other hand, overly stringent requirements can lead to excessive hedging or recapitalization and may force the closure of banks that would have chosen to hedge or recapitalize under more moderate capital requirements.

To see why AFS capital requirements eliminate runs, note that weakly positive capital requirement, $\bar{e} \geq 0$, implies that $e_r = \frac{r}{r_f^h} - d \geq 0$. As we show above, this is equivalent to a bank being fundamentally sound and thus not subject to runs. This stark result arises because, once the interest rate is realized, the model features no fundamental uncertainty—so a fundamentally sound bank with $e_r = 0$ AFS capital always survives.

Moreover, AFS strictly positive capital requirements, $\bar{e} > 0$ can also eliminate runs, but at an additional deadweight "hedging" cost of $\tau p \bar{e}$. In that sense, AFS capital requirements are excessive.

The benefit of AFS capital requirements is that they strengthen banks' incentives to hedge asset risk. Equity holders weigh the cost of insurance against the expected equity value of the bank in the high-interest-rate state and will choose to insure if:

$$\underbrace{p\, e_m^{No\ Run} + p\left(d - \frac{r}{r_f^h} + \bar{e}\right)}_{\substack{Equity\ value\ with\ hedging \\ when\ rates\ are\ high}} - \underbrace{p\,(1+\tau)\left(d - \frac{r}{r_f^h} + \bar{e}\right)}_{Hedging\ cost} \geq 0$$

$$e_m^{No\ Run} \geq \tau\left(d - \frac{r}{r_f^h} + \bar{e}\right)$$

If bank failures occur, they do so when the regulator closes banks for being undercapitalized. As long as the capital requirement is not too stringent, specifically, if $\bar{e} < \frac{(1-\epsilon)}{\epsilon}\left(d - \frac{r}{r_f^h}\right)$, then more banks choose to hedge their assets than would in the absence of a capital requirement. However, when capital requirements are positive, some banks—those for whom $\tau\left(d - \frac{r}{r_f^h} + \bar{e}\right) > e_m^{No\ Run} \geq \frac{\tau}{\epsilon}\left(d - \frac{r}{r_f^h}\right)$, opt not to hedge and instead remain exposed to run risk. They would have hedged at a lower capital requirement and would have had sufficient capital to avoid runs.

7.2.4 HTM Accounting

As noted above, when capital requirements are enforced after adverse interest rate shocks, AFS accounting can impose two main costs. First, banks may "over-insure," ending up with more capital than is necessary to prevent runs and incurring excessive deadweight hedging costs. Second, some banks that would have opted to eliminate run risk under a lower capital requirement may instead choose to exit. We next show that banks can broadly use HTM accounting for two distinct purposes. "Strong" banks use it to meet overly stringent capital requirements while avoiding unnecessary capital infusions beyond what is needed to prevent runs. In contrast, "weak" banks use HTM accounting to "window dress" their capital positions—complying with requirements without hedging underlying asset risk—leaving them exposed to runs.

Proposition 1: Consider banks, which can satisfy the regulatory capital constraint if they follow HTM accounting for all their assets ($1 - d = \bar{e}$) and classifying assets to HTM is cheaper than hedging cost, $\theta < p\tau$. Then equilibrium strategies are the following:

(i) Fold: If $e_m^{No\ Run} < \frac{\theta}{(1-\epsilon)p}$ the bank will not hedge its assets nor engage in HTM accounting classification and will be closed by regulators in the high-rate state.

(ii) "Window dress" if $\frac{\tau}{\epsilon}\left(d - \frac{r}{r_f^h} - \frac{(1-a^*)\theta}{\tau p}\right) > e_m^{No\ Run} \geq \frac{\theta}{(1-\epsilon)p}$. The bank will not hedge and will classify all its assets to HTM accounting.

(iii) "Hedge and partially reclassify" if $e_m^{No\ Run} \geq \frac{\tau}{\epsilon}\left(d - \frac{r}{r_f^h} - \frac{(1-a^*)\theta}{\tau p}\right)$ the bank will hedge receiving $\left(d - \frac{r}{r_f^h}\right)$ of capital in the high interest rate state and will classify $(\frac{1-d}{1-\frac{r}{r_f^h}})$ of its assets to HTM accounting, where $a^* = \frac{1-d}{\left(1-\frac{r}{r_f^h}\right)}$.

Proof: Directly follows from our discussion above.

To see the intuition, consider the tradeoff facing a bank, which classifies its assets to HTM. It does not eliminate the run, so the equity holders are only repaid if the run sunspot does not materialize. The equity holders also incur the cost of classifying all assets to HTM, with an expected payoff of $p(1-\epsilon)e_m^{No\ Run} - \theta$, which is profitable when the costs of HTM accounting are small relative to franchise value of a bank in the absence of a run: $e_m^{No\ Run} \geq \frac{\theta}{(1-\epsilon)p}$. Alternatively, the bank can hedge and receive $\left(d - \frac{r}{r_f^h}\right)$ of capital in the high-rate state and classify a share of its assets (a^*) to HTM accounting to satisfy its capital constraint. The hedging will eliminate the risk of runs and relax the regulatory capital constraint. This strategy yields the following value to shareholders:

$$pe_m^{No\ Run} - \underbrace{p\tau\left(d - \frac{r}{r_f^h}\right)}_{Net\ cost\ of\ hedging} \underbrace{-\theta \times a^*}_{Cost\ of\ partial\ HTM\ reclassification}. \tag{9}$$

Two key insights emerge from this condition. First, capital requirements—particularly under AFS accounting—tend to induce higher levels of capitalization.[12] The requirements can be overly stringent for "strong banks,"—those with high *r* and thus high asset values. These banks hedge beyond what is necessary for avoiding runs. Under HTM-based capital requirements, these banks still hedge sufficiently to prevent runs but classify a portion of their assets as HTM to meet capital thresholds more efficiently. Notably, these banks can feasibly hold the reclassified securities to maturity under all sunspot realizations. This result resembles that in Kostić, Laux, and Muthsam (2024) who also find that loosening accounting rules can, under certain conditions, result in more cost-effective bank capital management policies. In contrast, "weak" banks, those with low *r* and thus low asset values, use HTM accounting to circumvent capital regulation. They engage in "window dressing" by reclassifying assets as HTM, avoid hedging their interest rate risk, and remain vulnerable to runs. As shown in condition (ii) of Proposition 1, the likelihood that weak banks adopt HTM accounting increases with the probability of a high interest rate realization (i.e., as *p* rises)

7.3 Implications

[12] The model does allow for the possibility of capital requirements being so high that banks choose to close rather than hedge.

The stylized framework outlined above carries several implications that we discuss below and confront with our empirical findings. First, bank equity holders may have insufficient incentives to eliminate run risk by hedging interest rate exposure—even when the bank has positive equity in the good equilibrium, for instance due to a valuable deposit franchise. Second, bank capital regulation can eliminate run risk by providing banks with more incentives to hedge, but it crucially depends on how regulatory capital is defined. In this regard, the option of HTM accounting can dilute the effects of capital regulation resulting in positive run risk. Finally, including deposit franchise value in the no run equilibrium in the regulatory capital calculation can weaken the effects of capital regulation on bank incentives to hedge to prevent run risk.

7.3.1 Limited Incentives for Recapitalization to Avert Bank Runs

Our stylized model shows that limited liability, combined with positive hedging costs, can weaken bank equity holders' incentives to mitigate run risk. In our framework, our emphasis was on ex-ante hedging decisions. It is straightforward to reinterpret our analysis as also offering insights into ex-post recapitalization. Within our framework, ex-post capital injections can be seen as equivalent to basic ex-ante insurance, provided that the expected net costs of recapitalization are comparable to the net costs associated with hedging.

To illustrate this equivalence in a simple example, suppose that after the high interest rate state is realize the banks can raise $\left(d - \frac{r}{r_f^h}\right)$ additional capital to prevent the bank run at the net "external financing" cost of $\tau\left(d - \frac{r}{r_f^h}\right)$. Note that the ex-ante cost of this strategy is $p\tau\left(d - \frac{r}{r_f^h}\right)$. Alternatively, as in our main framework the bank equity holders can buy the insurance contract, paying the bank $\left(d - \frac{r}{r_f^h}\right)$ in the high-interest rate states to eliminate the risk of runs, which also has a net cost of $p\tau\left(d - \frac{r}{r_f^h}\right)$. Given that the expected recapitalization costs are the same, the next expected benefits of ex-ante hedging or ex-post recapitalization to equity holders are also identical. In other words, for any insurance cost, there is an equivalent recapitalization cost τ that delivers the same benefit. Hence, the conditions we derived above for whether bank would want to hedge ex-ante, would be identical to the ones governing the ex-post capitalization decision.

This insight aligns with our empirical findings that many banks chose not to hedge their interest rate risk. It is also consistent with the limited capital injections observed during the recent monetary tightening (Figure A6). Overall, our model illustrates how equity holders, protected by limited liability, may rationally engage in "gambling for resurrection"—underinsuring their assets and/or avoiding meaningful recapitalization in the hope that a run equilibrium does not materialize.

7.3.2 HTM Accounting Dilutes the Impact of Capital Regulation for Bank Stability

Our model demonstrates that bank capital requirements can effectively mitigate run risk by enhancing banks' incentives to hedge their assets or bolster their capital. However, the efficacy of such regulations is contingent upon the definition of regulatory capital. Our framework highlights that banks might exploit the option of HTM accounting to mitigate the impact of capital regulations (explicit or implicit), leading to a potentially positive run risk. This finding is consistent with our empirical analysis, which documents widespread use of HTM accounting classifications by banks during the recent period of monetary tightening. In our framework, such strategic reclassifications may have been used to obscure the adverse impact of rising interest rates, thereby reducing pressure to formally hedge or raise additional capital to guard against run risk.

7.3.3 Cross-Sectional Implications

It is straightforward to extend our framework to study the bank incentives to hedge or raise capital in relation to their initial capitalization and asset duration. This could be done by formally separating the bank's assets into cash and long-term assets, as in Jiang et al. (2024). We could also incorporate the mix of uninsured/insured deposits into our framework, as in Jiang et al. (2024). As shown by Jiang et al. (2024), all else equal, banks with lower initial capitalization, longer duration assets, and higher share of uninsured depositors will be more susceptible to bank runs.

This extension of our model has several implications. Firstly, institutions facing such susceptibility may exhibit increased incentives to hedge or raise capital or secure a portion of their assets to mitigate exposure to run risk. However, our model reveals that banks exposed to runs may lack sufficient incentives to eliminate run risk by hedging their asset exposure or raising capital. This finding may provide insights into our cross-sectional results, where we observe some weak evidence that banks potentially more exposed to runs (lower capitalization, longer-duration assets, higher share of uninsured deposits) appear to hedge their assets to a certain extent. Nevertheless, these effects are generally modest in the aggregate, with the majority of banking assets remaining unhedged.

Secondly, banks with lower initial capitalization and longer-duration assets are more exposed to interest rate–induced losses and therefore have stronger incentives—under comparable conditions—to use HTM accounting to shield their regulatory capital from these losses. This is consistent with our empirical findings, which show that banks exhibiting characteristics associated with run risk are more likely to reclassify assets as HTM. Finally, for these weaker banks, the incentive to adopt HTM accounting grows with the perceived likelihood of rising interest rates. This may help explain the surge in HTM classifications at the onset of recent monetary tightening, when the risk of higher rates became more salient.

7.3.4 Implications for Bank Capital Regulation

Our model does not directly delve into the welfare implications of bank capital regulation, as such analysis goes beyond the scope of our simple stylized framework. Nonetheless, our framework offers several insights that could be pertinent in this context.

First, our model offers a rationale for HTM accounting that departs from the traditional justification of offsetting asset value fluctuations with deposit franchise value. In our framework, HTM accounting serves as a tool for easing capital requirements when hedging and recapitalization are costly. However, strong and weak banks use this flexibility differently: strong banks employ it to avoid unnecessary hedging or capital raising, while weak banks exploit it to circumvent regulatory constraints.

It may be desirable for regulators to incentivize bank equity holders to hedge or raise more capital than they would choose on their own, particularly given the externalities associated with bank failures or underpriced deposit insurance (e.g., see Calomiris et al. 2019). Capital requirements can help achieve this goal. However, as discussed above, the effectiveness of such regulation critically depends on how regulatory capital is defined.

We briefly discuss another alternative of computing capital requirements, which accounts for the franchise value of the bank. Using the market value of equity in the case of no run, $e_m^{No\ Run}$, can dilute the effects of bank capital requirements on incentives to raise capital. To understand it in the simple example, consider the case when the deposit franchise value perfectly hedges the asset value changes due to higher interest rates (similar to Dreschler et al. 2021). Then, the regulatory bank capital will be invariant to interest rates, despite increased run risk. What is critical therefore is an assessment that compares marked-to-market value of all bank assets with the book value of its non-equity liabilities, $\frac{r}{r_f} - d$, which represents the bank run threshold. In the refined version of our model, where a portion of deposits is not runnable (such as insured deposits and some uninsured ones), the run condition would involve comparing the market value of bank assets and the remaining deposit franchise value with the face value of runnable (uninsured) deposits, as outlined by Jiang et al. (2024). However, implementing such assessments in practice can be challenging, as it is difficult to accurately determine the remaining deposit franchise value during a partial run.

Finally, our analysis shows that HTM accounting can dilute the effects of such capital regulation when banks are afforded discretion in determining the valuation of their assets (e.g., book vs market value). It suggests that strengthening regulations governing the utilization of HTM accounting practices could therefore enhance the effectiveness of bank capital requirements in mitigating the risk of bank runs.

8 Conclusion

We examine how banks managed interest rate risk during the 2022 monetary tightening, which triggered a sharp rise in rates and a corresponding decline in the value of long-duration assets.

Using data from call reports and SEC filings, we find that banks primarily relied on HTM accounting and asset reclassification to shield book capital from the impact of rising rates, rather than hedging against the fall in market asset values. We show that the trade-off associated with HTM accounting depends on asset strength: strong banks use it to avoid overly stringent capital requirements, while weak banks use it to "window dress" their capital positions—leaving them exposed to run risk.

More broadly, our model underscores that capital requirements can prevent bank runs if they are rigorously and dynamically enforced—particularly in the wake of interest rate increases. However, the definition of regulatory capital is equally critical. Our analysis raises several considerations that extend beyond the formal scope of the model. While accounting standards permit HTM classification only when banks intend and are able to hold assets to maturity, our framework highlights how weak banks may exploit HTM accounting to "window dress" capital positions—especially when regulators are unable or unwilling to enforce this criterion. In a run scenario, such banks would be unable to hold HTM assets to maturity, exposing the fragility behind the accounting treatment.

If regulators could identify banks vulnerable to runs and restrict their ability to classify assets as HTM, it would curb the perverse incentives to under-hedge or under-capitalize. Implementing this would require credible screening criteria—such as those proposed by Jiang et al. (2024) or similar measures. [13] At the more radical end of the policy spectrum, one might consider eliminating HTM accounting entirely. However, our model also shows that AFS-based capital requirements come with their own costs, particularly for strong banks that may be forced to overcapitalize or over-hedge.

[13] Such capital and risk-management regulations should also take into account ability of banks to finance their loans off balance sheets through loan sales and non-bank institutions (shadow banks) that provide several services like banks and have gained market share that reflects in part the regulatory actions on banks as well as (see Buchak et al. 2018, 2024). These institutions are predominantly financed with short-term uninsured debt, but they are also significantly better capitalized than banks on average (Jiang et al. 2020). See Corbae and D'Erasmo (2021), Begenau and Landgvoit (2022), and Buchak et al. (2024), for recent quantitative studies of impact of regulatory policies on banks.

References

Acharya, V., M. Gopal, M. Jager, and S. Steffen, (2024), Shadow Always Touches the Feet: Implications of Bank Credit Lines to Non-Bank Financial Intermediaries, working paper.

Amador, M., and J. Bianchi, 2024, Bank Runs, Fragility, and Credit Easing, *American Economic Review* 114, 2073–2110.

Agarwal, S., D. Lucca, A. Seru, and F. Trebbi, 2014, Inconsistent Regulators: Evidence from Banking, *Quarterly Journal of Economics* 129, 889–938.

Begenau, J, and T. Landgvoit, 2022, Financial Regulation in a Quantitative Model of the Modern Banking System, *Review of Economic Studies* 89, 1748–1784.

Bertomeu, J., L. Mahieux, and H. Sapra, 2023, Interplay between Accounting and Prudential Regulation, *Accounting Review* 98, 29-53.

Bischof, J., U. Brüggemann, and H. Daske, 2023, Asset Reclassifications and Bank Recapitalization during the Financial Crisis, *Management Science* 69, 75-100.

Bischof, J., C. Laux, and C. Leuz, 2021, Accounting for Financial Stability: Bank Disclosure and Loss Recognition in the Financial Crisis, *Journal of Financial Economics* 141, 1188-1217.

Buchak, G., G. Matvos. T. Piskorski, and A. Seru, 2018, Fintech, Regulatory Arbitrage, and the Rise of Shadow Banks, *Journal of Financial Economics* 130, 453-483.

Buchak, G., G. Matvos. T. Piskorski, and A. Seru, 2024, Beyond the Balance Sheet Model of Banking: Implications for Bank Regulation and Monetary Policy, *Journal of Political Economy* 132, 616-693.

Calomiris, C.W., and M. Jaremski, 2019, Stealing Deposits: Deposit Insurance, Risk-Taking, and the Removal of Market Discipline in Early 20th-Century Banks, *Journal of Finance* 74, 711-754.

Corbae, D., and P. D'Erasmo, 2021, Capital Buffers in a Quantitative Model of Banking Industry Dynamics, *Econometrica* 89, 2975–3023.

Drechsler, I., A. Savov, and P. Schnabl, 2017, The Deposits Channel of Monetary Policy, *Quarterly Journal of Economics* 132, 1819-1876.

Drechsler, I., A. Savov, and P. Schnabl, 2021, Banking on Deposits: Maturity Transformation without Interest Rate Risk, *Journal of Finance* 76, 1091-1143.

Drechsler, I., A. Savov, P. Schnabl, and O. Wang, 2023, Banking on Uninsured Deposits, working paper.

Egan, M., Matvos, G., Hortacsu, A., 2017, Deposit Competition and Financial Fragility: Evidence from the US Banking Sector, *American Economic Review* 107, 169-216

Egan, M., S. Lewellen, and A. Sunderam, 2022, The Cross-section of Bank Value, *Review of Financial Studies* 35, 2101-2143.

Flannery, M. J., and S. M. Sorescu, 2023, Partial Effects of Fed Tightening on U.S. Banks' Capital, working paper.

Gopalan, Y., and J. Granja, 2023, How (In)effective was Bank Supervision During the 2022 Monetary Tightening?, working paper.

Granja, J., and C. Leuz, 2023, The Death of a Regulator: Strict Supervision, Bank Lending and Business Activity, working paper.

Haddad, V., B. Hartman-Glaser, and T. Muir, 2023, Bank Fragility When Depositors Are the Asset, working paper.

Hannan, T. H., and A. N. Berger, 1991, The Rigidity of Prices: Evidence from the Banking Industry, *American Economic Review* 81, 938–945.

Iacus, S. M., G. King, and G. Porro, 2012, Causal Inference without Balance Checking: Coarsened Exact Matching, *Political Analysis* 20, 1–24.

Jiang, E., G. Matvos, T. Piskorski, and A. Seru, 2020, Which Banks are (Over) Levered? Insights from Shadow Banks and Uninsured Leveraged, NBER working paper.

Jiang, E., G. Matvos, T. Piskorski, and A. Seru, 2024, Monetary Tightening and U.S. Bank Fragility in 2023: Mark-to-Market Losses and Uninsured Depositor Runs?, *Journal of Financial Economics* 159, 103899.

Jiang, E., G. Matvos, T. Piskorski, and A. Seru, 2025, Monetary Tightening, Commercial Real Estate Distress, and US Bank Fragility, forthcoming in the *Journal of Political Economy: Macroeconomics*.

Kim, S., S. Kim, and S. G. Ryan, 2019, Economic Consequences of the AOCI Filter Removal for Advanced Approaches Banks, *Accounting Review* 94, 309-335.

Kim, S., S. Kim, and St. G. Ryan, 2023, The Reinstatement of the AOCI Filter under the Tailoring Rules and Banks' Motivations for Designating Securities as Held to Maturity, working paper.

Koont, N., T. Santos, and L. Zingales, 2023, Destabilizing Digital 'Bank Walks', working paper.

Kostic, N., C. Laux, and V. Muthsam, 2024, Accounting Changes and Enforcement of Bank Capital Requirements in a Crisis, working paper.

McPhail, L., P. Schnabl, and B. Tuckman, 2023, Do Banks Hedge Using Interest Rate Swaps, working paper.

Neumark, D., and S. A. Sharpe, 1992, Market Structure and the Nature of Price Rigidity: Evidence from the Market for Consumer Deposits, *Quarterly Journal of Economics* 107, 657–680.

Xiao, K., 2020, Monetary Transmission through Shadow Banks, *Review of Financial Studies* 33, 2379-2420.

Table 1: Summary Statistics

The top panel of the table shows aggregate statistics based on banks' hedging activity in 2021:Q4. The samples are based on call reports and 10Ks/10Qs. The bottom two panels of the table present the statistics using average values of all the banks in each category as of 2021:Q4. The numbers in parentheses are standard deviations. The second panel uses call reports. The first three rows in this panel are based on a sample of banks that are required to report rate swaps. The last three rows in this panel are based on a sample of banks that report non-zero interest rate swaps. The third panel uses 10K/10Q filings. It is based on a sample of publicly traded banks that report hedges in their 10K/10Q filings. We remove outliers by winsorizing the full sample at 5th and 95th percentiles. Column 1 shows these statistics for all the banks, column 2 for banks with assets below 10 billion, column 3 for banks with assets above 10 billion but below 250 billion, and column 4 for banks with assets above 250 billion. Data Sources: Bank Call Reports, 10Qs, and 10Ks.

	(1) All Banks	(2) Asset <10B	(3) Asset [10B,250B]	(4) Asset >250B
Assets of FDIC-insured banks	23.5T	3.4T	6.9T	13.2T
Assets of banks required to report rate swap	22.2T	1.8T	6.9T	13.2T
# Banks required to report rate swap	1,271	1,117	141	13
Assets of banks w/ non-zero rate swap	16.9T	0.7T	3.8T	12.4T
# Banks w/ non-zero rate swap	290	203	76	11
Assets of publicly traded banks w/ hedge	7.4T	0.3T	2.8T	4.4T
# Publicly traded banks w/ hedge	98	48	44	6
Assets of publicly traded banks reported duration	5.0T	0.1T	1.5T	3.4T
# Publicly traded banks reported duration	62	27	31	4
Rate Swap/Asset	0.9	0.7	2.1	3.0
	(2.1)	(1.9)	(2.8)	(2.9)
Rate Swap/Security	5.7	4.6	13.1	16.8
	(14.4)	(13.1)	(19.9)	(20.1)
Rate Swap/AFS Security	7.7	6.1	17.8	24.9
	(19.9)	(18.0)	(27.3)	(28.2)
Rate Swap/Asset | Non-Zero Rate Swap	3.8	3.8	3.8	3.6
	(2.7)	(2.7)	(2.7)	(2.8)
Rate Swap/Security | Non-Zero Rate Swap	24.3	24.6	24.2	19.9
	(20.7)	(20.5)	(21.5)	(20.4)
Rate Swap/AFS Security | Non-Zero Rate Swap	31.8	31.6	32.8	29.4
	(29.4)	(29.5)	(29.7)	(28.4)
Hedge/Asset	5.4	5.3	5.0	8.7
	(4.8)	(4.8)	(4.7)	(3.7)
Hedge/Security	36.1	43.9	28.4	30.6
	(40.5)	(47.6)	(32.7)	(15.8)
Hedge/AFS Security	44.9	52.2	36.6	46.9
	(46.4)	(52.6)	(39.8)	(31.3)
Duration	4.6	4.6	4.5	5.9
	(1.4)	(1.2)	(1.0)	(3.6)

Table 2: Bank Fragility and Reclassification into HTM

This table reports the coefficients of OLS regressions examining the relation between measures of bank fragility and banks' decision to transfer assets from AFS to HTM. The dependent variable in Panel A is a dummy variable that takes the value of one if the bank reclassified assets from AFS to HTM between 2021 and 2022. The dependent variable in Panel B is the ratio between the total amount of transferred securities and total securities in the AFS and HTM portfolios. Tier 1 Capital Ratio is Tier 1 capital divided by total assets. % Uninsured Deposits is the ratio between uninsured deposits and total deposits. % Long Term securities is the ratio between total securities with maturity or repricing exceeding 15 years and the total securities. Baseline controls include a set of indicator variables for asset percentile and controls for the share of AFS securities in banks' securities portfolios and for the percentage of securities in total assets. Standard errors are presented in parentheses and are clustered at the state level. ***, **, and *, represent statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A: Dummy Variable for Reclassification to HTM

	(1)	(2)	(3)	(4)	(5)
	I(Reclassification to HTM)=1				
Tier 1 Capital Ratio	-0.007***				-0.019***
	(0.002)				(0.005)
% Uninsured Deposit		0.086***		0.019	0.099***
		(0.024)		(0.024)	(0.029)
% Long Term Securities			0.109***	-0.024	0.098***
			(0.019)	(0.038)	(0.018)
% Long Term Securities × % Uninsured Deposits				0.332***	
				(0.098)	
Share of AFS Securities					0.009
					(0.007)
Securities (% Assets)					0.109***
					(0.020)
Observations	5027	4978	4850	4818	4818
Adjusted R^2	0.097	0.099	0.109	0.116	0.120
Asset Percentile	Yes	Yes	Yes	Yes	Yes

Panel B: % Assets Reclassified to HTM

	(1)	(2)	(3)	(4)	(5)
	% Assets Reclassified to HTM				
Tier 1 Capital Ratio	-0.005***				-0.010***
	(0.002)				(0.003)
% Uninsured Deposit		0.058**		0.020	0.060**
		(0.028)		(0.027)	(0.028)
% Long Term Securities			0.064***	-0.002	0.060***
			(0.015)	(0.027)	(0.015)
% Long Term Securities × % Uninsured Deposits				0.163**	
				(0.061)	
Share of AFS Securities					0.009
					(0.007)
Securities (% Assets)					0.032*
					(0.016)
Observations	4853	4821	4850	4818	4818
Adjusted R^2	0.014	0.016	0.020	0.023	0.023
Asset Percentile	Yes	Yes	Yes	Yes	Yes

Table 3: External Scrutiny and Reclassification into HTM

This table reports the coefficients of OLS regressions examining how auditors and supervisory agencies mediate the relation between measures of bank fragility and banks' decision to transfer assets from AFS to HTM. The dependent variable in Panel A is a dummy variable that takes the value of one if the bank reclassified assets from AFS to HTM between 2021 and 2022. The dependent variable in Panel B is the ratio between the total amount of transferred securities and total securities in the AFS and HTM portfolios. The main variables of interested are dummy variables that take the value of one if the banks is audited by a big-4 auditing firm or if the bank is primarily regulated by the OCC, FDIC, and Federal Reserve. Fragile Bk is a dummy that takes the value of one if the bank is in the top decile of the distribution of the share of uninsured deposits and of the distribution of the share of long-term securities, Baseline controls include a set of indicator variables for asset percentile and controls for the share of AFS securities in banks' securities portfolios and for the percentage of securities in total assets. Standard errors are presented in parentheses and are clustered at the state level. ***, **, and *, represent statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A: Dummy Variable for Reclassification to HTM

	(1)	(2)	(3)	(4)
Big4Auditor	-0.012			
	(0.041)			
Big4Auditor × Fragile Bk.	0.145			
	(0.179)			
OCC		-0.009		
		(0.006)		
OCC × Fragile Bk.		-0.190**		
		(0.078)		
FDIC			0.009*	
			(0.005)	
FDIC × Fragile Bk.			0.100	
			(0.082)	
Federal Reserve				0.012
				(0.008)
Federal Reserve × Fragile Bk.				0.117
				(0.137)
Observations	1964	4818	4818	4818
Adjusted R^2	0.134	0.121	0.121	0.121

Panel B: % Assets Reclassified to HTM

	(1)	(2)	(3)	(4)
Big4Auditor	-0.042***			
	(0.015)			
Big4Auditor × Fragile Bk.	0.001			
	(0.081)			
OCC		-0.005		
		(0.005)		
OCC × Fragile Bk.		-0.073**		
		(0.034)		
FDIC			-0.001	
			(0.005)	
FDIC × Fragile Bk.			0.031	
			(0.057)	
Federal Reserve				0.013
				(0.008)
Federal Reserve × Fragile Bk.				0.061
				(0.117)
Observations	1964	4818	4818	4818
Adjusted R^2	0.040	0.024	0.023	0.024

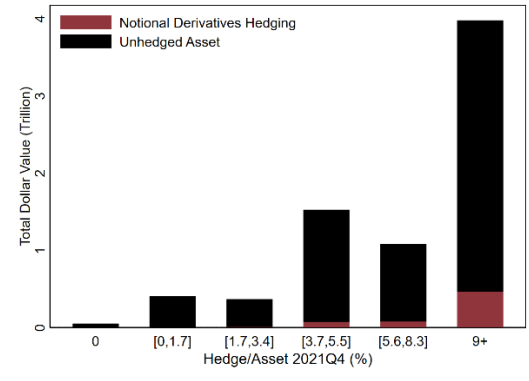
Table 4: Hedging and HTM Security

This table reports the coefficients of OLS regressions examining the relation between hedging and banks' holding of HTM securities. The dependent variable is interest rate swap to asset ratios. Share of HTM Securities measures the share of securities classified as HTM out of total securities. Reclassification to HTM takes the value of one if the bank reclassified assets from AFS to HTM between 2021 and 2022. % Assets Reclassified to HTM is the ratio between the total amount of reclassified securities and total securities in the AFS and HTM portfolios. Tier 1 Capital Ratio is Tier 1 capital divided by total assets. % Uninsured Deposits is the ratio between uninsured deposits and total deposits. % Uninsured Deposits is the ratio between uninsured deposits and total deposits. % Long Term securities is the ratio between total securities with maturity or repricing exceeding 15 years and the total securities. Securities (% Assets) is the security to asset ratio. Baseline controls include a set of indicator variables for asset percentile. Standard errors are presented in parentheses and are clustered at the state level. ***, **, and *, represent statistical significance at 1%, 5%, and 10% levels, respectively.

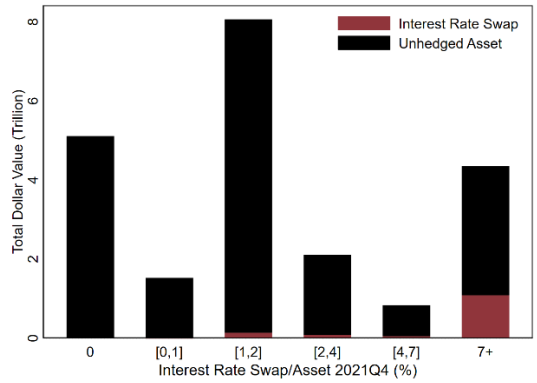
	(1)	(2)	(3)	(4)
	Interest Rate Swap / Asset			
Share of HTM Securities	0.006	0.009		
	(0.019)	(0.009)		
Reclassification to HTM			0.003	
			(0.005)	
% Assets Reclassified to HTM				-0.000
				(0.003)
Securities (% Assets)	-0.039	0.072*	0.073**	0.073**
	(0.025)	(0.036)	(0.036)	(0.036)
Tier 1 Capital Ratio	-0.022*	-0.041*	-0.041	-0.040
	(0.011)	(0.024)	(0.024)	(0.024)
% Uninsured Deposits	-0.034**	-0.065	-0.066	-0.068
	(0.013)	(0.046)	(0.045)	(0.045)
% Long Term Securities	0.026	-0.027	-0.025	-0.026
	(0.021)	(0.031)	(0.030)	(0.030)
Observations	2392	2386	2386	2386
Adjusted R^2	0.019	0.799	0.799	0.799
Asset Ptile Dummies	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes

Figure 1: Aggregate Hedged and Unhedged Asset Value – 2021

This figure plots the aggregate hedged and unhedged asset values based on 2021:Q4 10Ks and 10Qs (Panel a) and 2021:Q4 call reports (Panel b). In Panel (a), the red bars indicate the notional value of hedges of all banks in each hedging ratio bucket. The black bars indicate the total unhedged asset value of all banks in each hedging ratio bucket, where unhedged asset value is calculated as total assets minus the notional value of hedge. The first bucket includes banks with zero notional value of hedge, and the remaining hedging ratio buckets are constructed by dividing banks with non-zero hedging into 5 equal-sized groups based on their notional value of hedge to total asset ratio in 2021:Q4. In Panel (b), the red bars indicate the total notional value of interest rate swaps of all banks in each hedging ratio bucket. The black bars indicate the total unhedged assets of all banks in each hedging ratio bucket, where unhedged assets are calculated as total assets minus the notional value of interest rate swaps. In Panel (b), the first bucket includes banks with zero interest rate swaps, and the remaining hedging ratio buckets are constructed by dividing banks into 5 equal-sized groups based on their interest rate swap to total asset ratio in 2021:Q4. *Data Sources*: Bank Call reports and 10Ks and 10Qs.



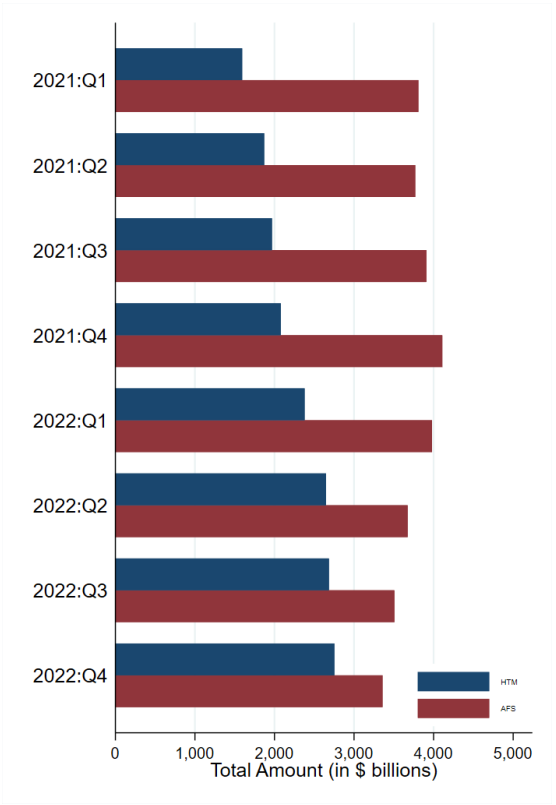
(a) Hedge/Asset (10K)



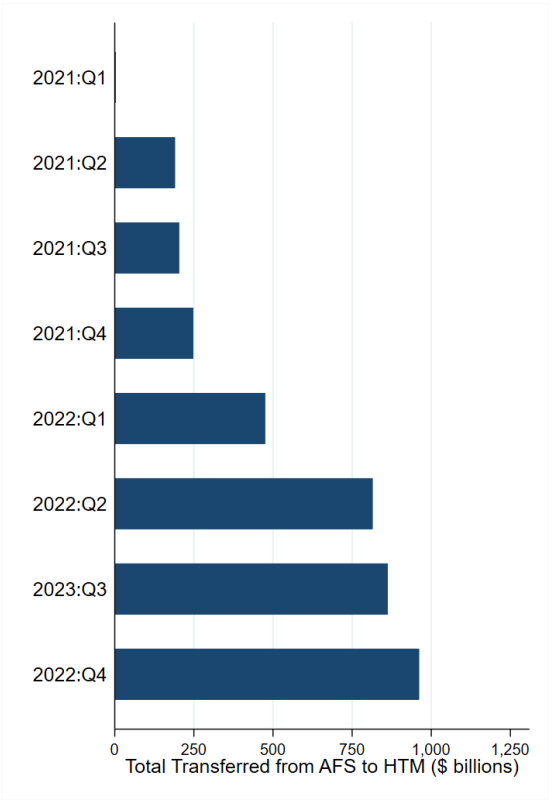
(b) Interest Rate Swap/Asset (call reports)

Figure 2: Aggregate Securities Classified as Held-to-Maturity (HTM) and Available-for-Sale (AFS)

This figure plots the breakdown of Total Securities between HTM and AFS (Panel A) and the total amounts of securities being reclassified from AFS to HTM by U.S Banks (Panel B). *Data Sources:* Bank Call reports, bank holding company 10Qs, and 10Ks.



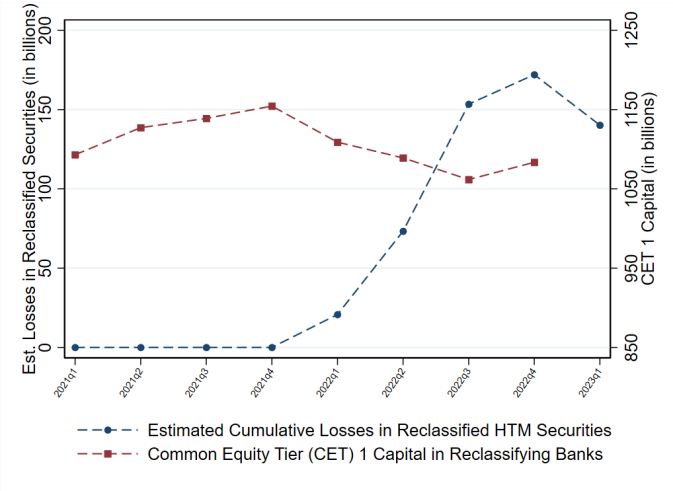
(a) Total AFS and HTM securities



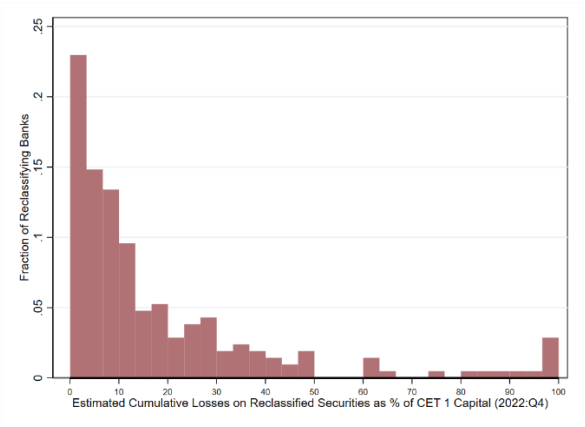
(b) Total amounts reclassified

Figure 3: Estimated Losses on Reclassified Securities

This figure presents the estimated losses on reclassified securities. Panel A shows the time series of the estimated cumulative losses on reclassified HTM securities and the common equity tier (CET) 1 capital of banks that reclassified their securities. Panel B shows the histogram of the estimated losses on reclassified securities for each bank as a fraction of their respective CET1 capital at the end of 2022. *Data Sources:* Bank call reports.



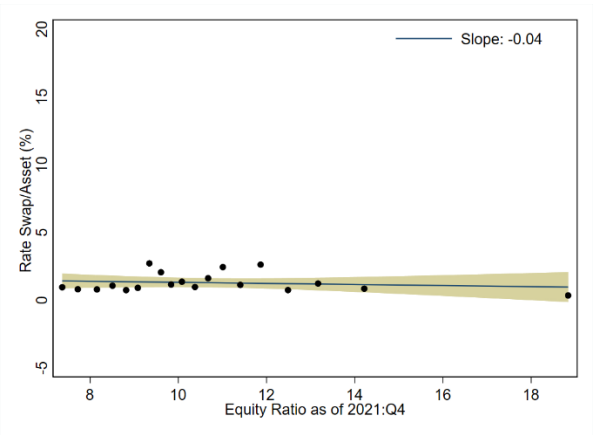
(a) Time Series



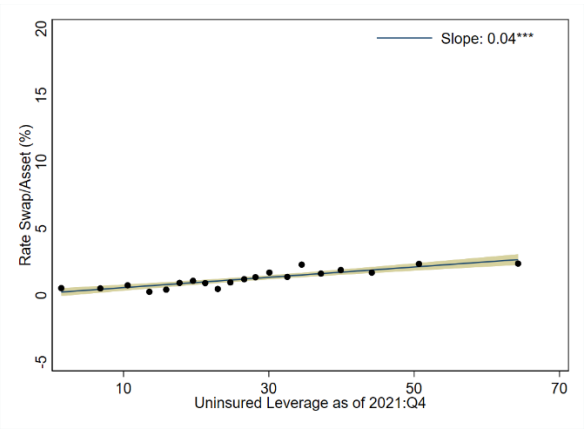
(b) Histogram

Figure 4: Bank Use of Interest Rate Swaps --- Net Margin

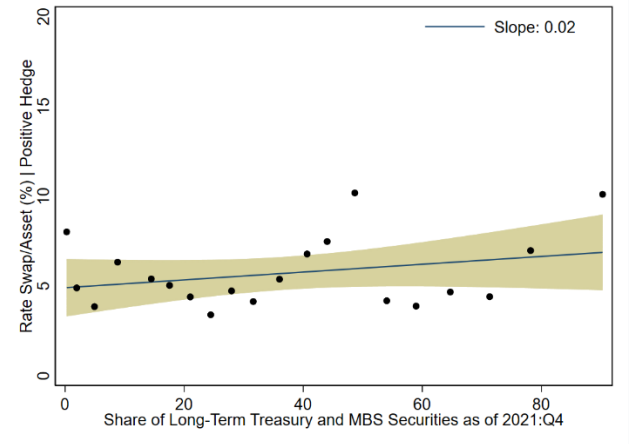
This figure presents binned scatterplot of 2021Q4 hedging against equity ratio (Panel A), uninsured leverage ratio (Panel B), and long-term security ratio (Panel C) as of 2021:Q4. Uninsured leverage is calculated as uninsured deposit divided by total asset as in Jiang et al. (2020). Long-term security ratio is the ratio between total securities with maturity or repricing exceeding 15 years and the total securities. The underlying sample includes all banks that are required to report their use of interest rate swaps in 2021Q4. We divide sample into 20 equal-sized bins and plot the average interest rate swaps to asset ratio in each bin against the average equity ratio, uninsured leverage ratio, and long-term security ratio in that bin, respectively. The shaded area shows the 95% confidence interval. The slope and statistical significance are reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources*: Bank call reports in 2021:Q4.



(a) Equity/Asset



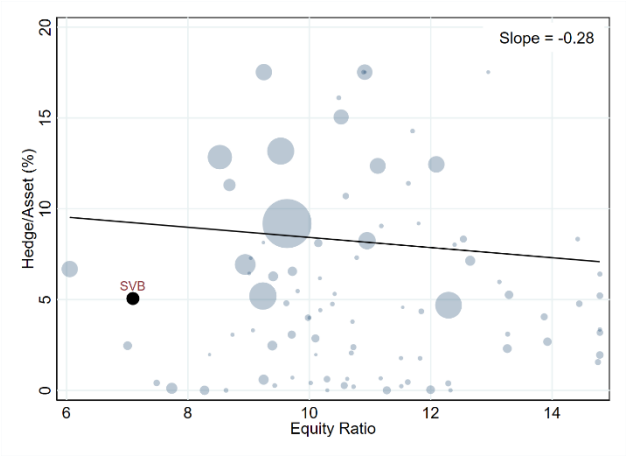
(b) Uninsured Leverage



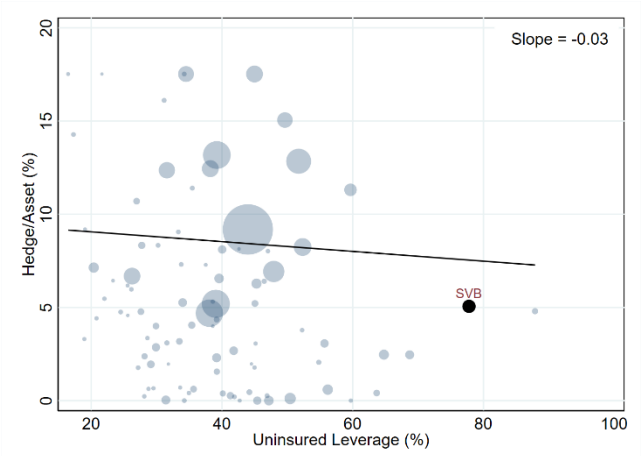
(c) Long-Term Security/Asset

Figure 5: Hedging Ratios and Bank Exposure to Interest Rate Risk- 2021

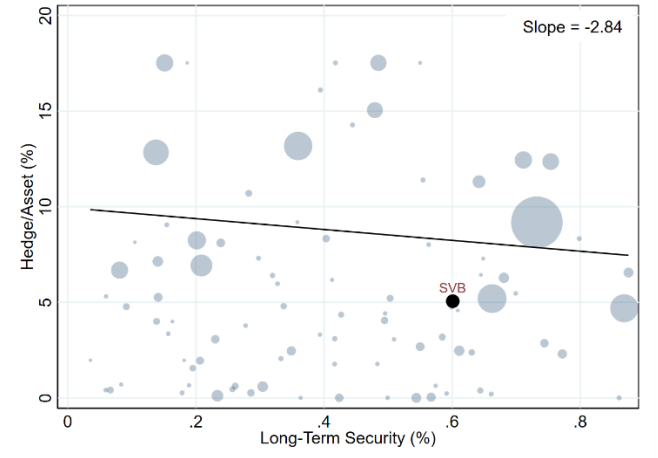
This figure plots hedging ratio for publicly traded banks calculated using information in 10K and 10Q against two measures of bank exposure to interest rate risk. Panel (a) plots hedge to asset ratio against equity ratio as of 2021:Q4. Panel (b) plots hedge to asset ratio as of 2021:Q4 against uninsured leverage ratio as of 2021:Q4. Panel (c) plots hedge to asset ratio as of 2021:Q4 against long-term security to asset ratio as of 2021:Q4. . Uninsured leverage is calculated as uninsured deposit divided by total asset. Long-term security ratio is the ratio between total securities with maturity or repricing exceeding 15 years and the total securities. In all panels, the bubble size indicates the asset size. The lines in each panel are the best fit lines based on weighted least squares. The slope and statistical significance are reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources*:10Ks and 10Qs and bank call reports.



(a) Equity/Asset



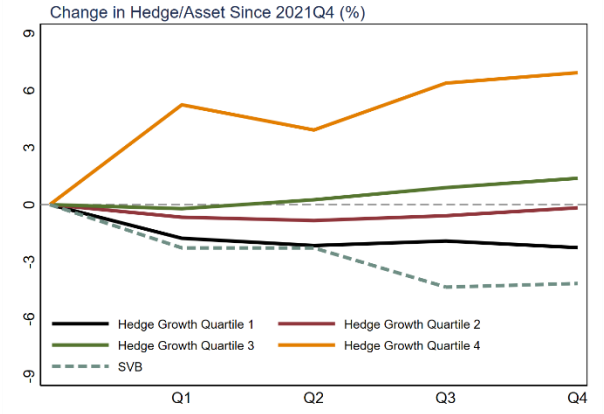
(b) Uninsured Leverage



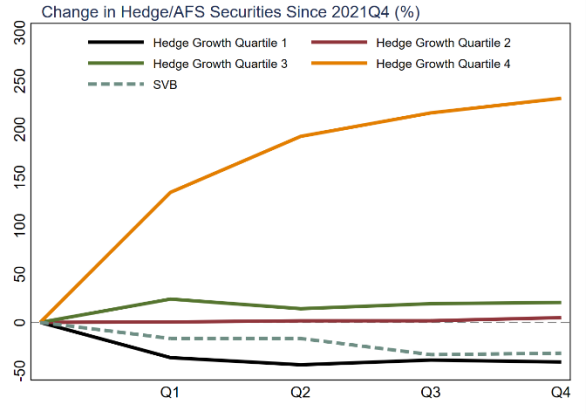
(c) Long-Term Security/Asset

Figure 6: Time Series Change in Hedges – 10K and 10Q

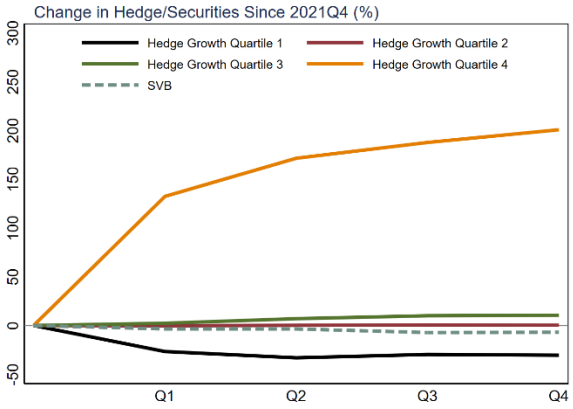
This figure plots quarterly hedging growth relative to 2021:Q4 using hedging information from 10K and 10Q. It plots the growth from 2022:Q1 till 2022:Q4. Hedging growth is calculated as change in notional value of hedging ratios obtained from publicly traded banks' 10Ks and 10Qs. In Panel (a), we divide banks into four equal-sized bins based on their hedge/asset growth from 2022:Q1 to 2022:Q4 and plot the average value of banks in each bin every quarter. In Panel (b), we divide banks into four equal-sized bins based on their hedge/AFS security growth from 2022:Q1 to 2022:Q4 and plot the average value of banks in each bin every quarter. In Panel (c), we divide banks into four equal-sized bins based on their hedge/security growth from 2022:Q1 to 2022:Q4 and plot the average value of banks in each bin every quarter. We do the same exercise for SVB and plot the evolution of its hedging ratios over the same time period. *Data Sources:* 10Ks and 10Qs.



(a) Hedge/Asset



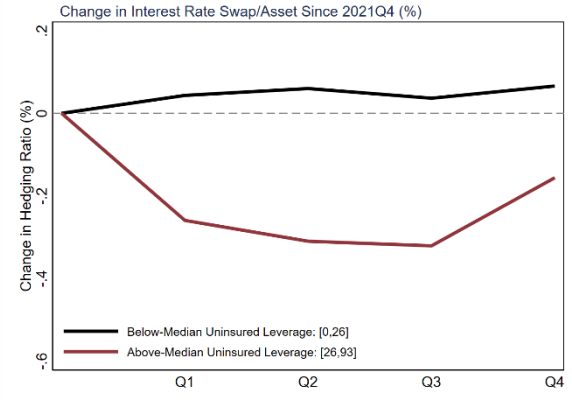
(b) Hedge/AFS Security



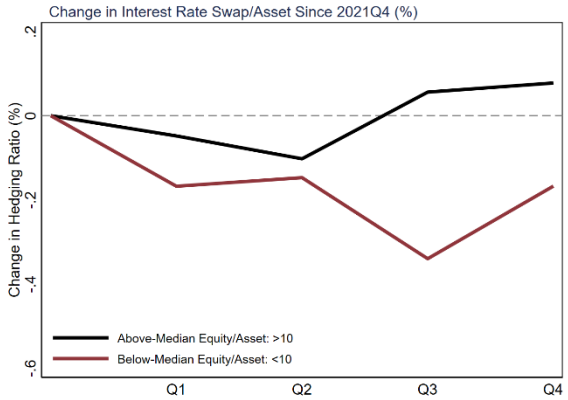
(c) Hedge/Security

Figure 7: Change in Hedging by Bank Balance Sheet Characteristics

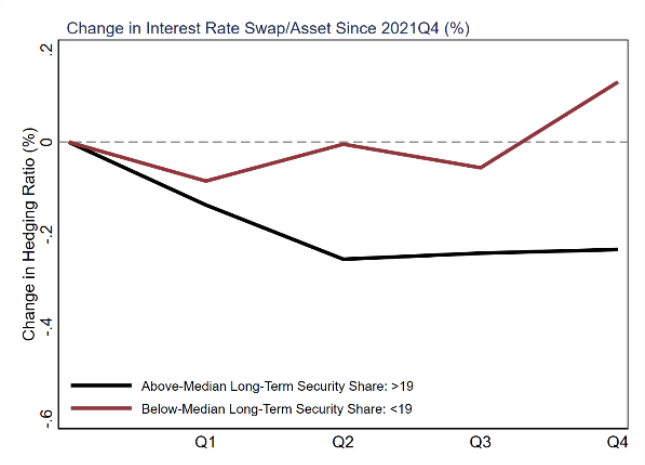
This figure plots quarterly hedging growth relative to 2021:Q4 using interest rate swap to asset ratio. It plots the growth from 2022:Q1 till 2022:Q4. In Panel (a), we divide banks into two equal-sized bins based on their uninsured leverage ratios in 2021:Q4. In Panel (b), we divide banks into two equal-sized bins based on their equity to asset ratio in 2021:Q4. In Panel (c), we divide banks into two equal-sized bins based on their long-term security to asset ratio in 2021:Q4. In all panels, we plot the mean value of banks in each bin. *Data Sources:* Bank call reports.



(a) Uninsured Leverage



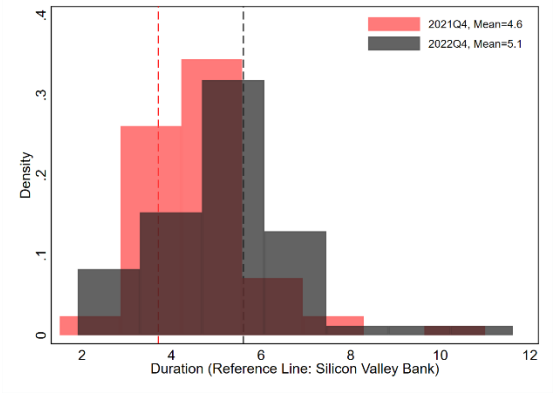
(b) Equity/Asset 2021Q4



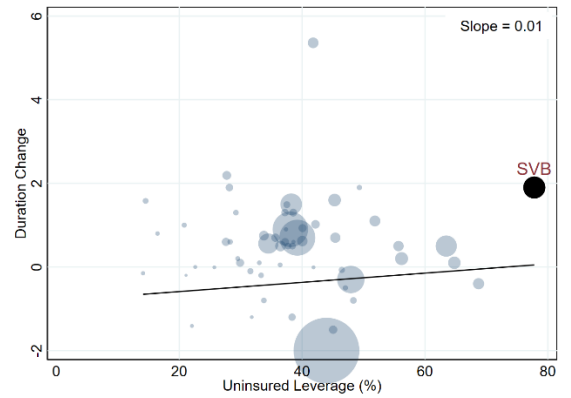
(c) Long-Term Security/Asset

Figure 8: Duration

This figure plots duration of assets of publicly traded banks as reported in their 10K and 10Q. Panel (a) plots the histograms (density) of asset duration in 2021:Q4 and 2022:Q4. The reference lines in Panel (a) indicate Silicon Valley Bank's (SBV) values. SVB's duration in 2021:Q4 is 3.7 and in 2022:Q4 is 5.6. Panel (b) plots the change in asset duration from 2021:Q4 to 2022:Q4 against uninsured leverage ratio in 2021:Q4. In Panel (b), the bubble size indicates bank asset size in 2021:Q4. SVB is labeled in the plot. The line in panel(b) is the best fit lines based on weighted least squares. The slope and statistical significance are reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources:* Bank call reports and 10Ks and 10Qs



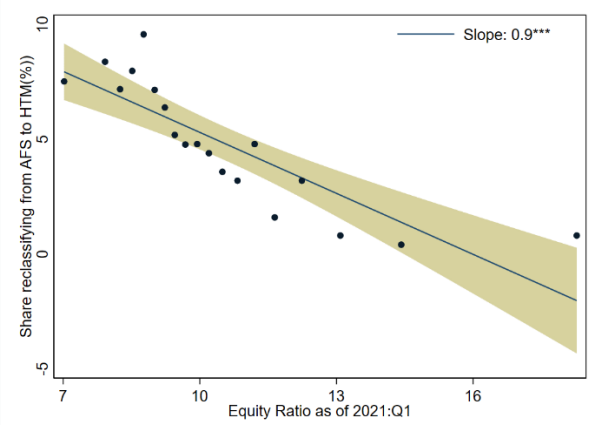
(a) Duration Distribution



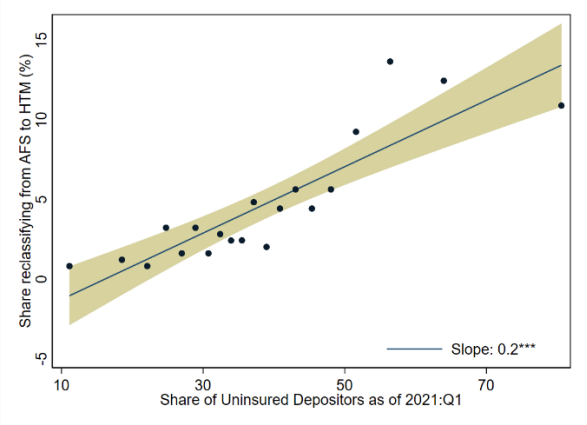
(b) Change in Duration

Figure 9: Bank Fragility and Reclassification of Securities to HTM

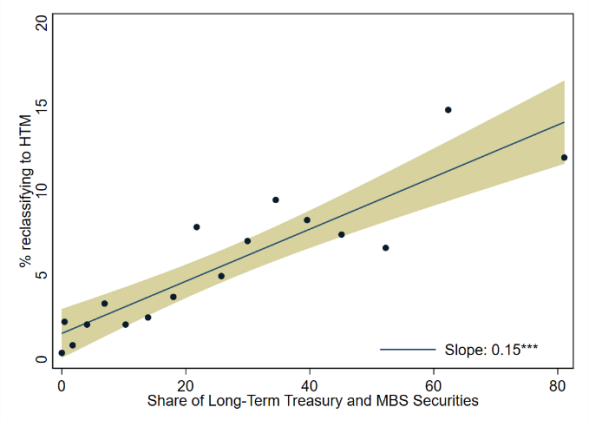
This figure presents binned scatterplot of the propensity to reclassify assets from AFS to HTM against equity ratio (Panel A), uninsured leverage ratio (Panel B), and long-term security ratio (Panel C) in 2021Q1. We divide sample into 20 equal-sized bins and plot the share of reclassifying banks in each bin against the average equity ratio, uninsured leverage ratio, and long-term security ratio in that bin, respectively. The shaded area shows the 95% confidence interval. The slope and statistical significance are reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources*: Bank call reports in 2021:Q4.



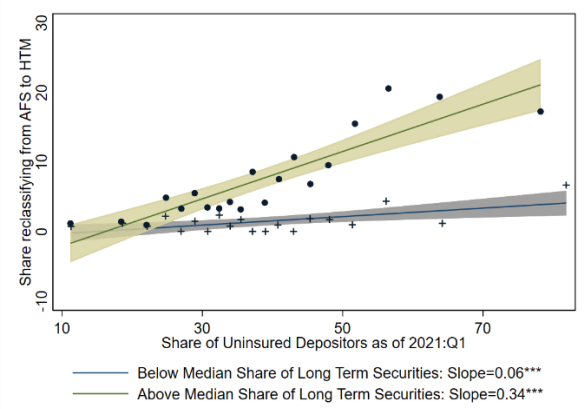
(a) Equity/Asset



(b) Uninsured Leverage



(c) Long-Term Security/Asset



(d) Long-Term Security/Asset x Uninsured

Appendix

Table A1: Summary Statistics – 2022

The top panel of the table shows aggregate statistics based on banks' hedging activity in 2022:Q4. The samples are based on call reports and 10Ks/10Qs. The bottom two panels of the table present the statistics using average values of all the banks in each category as of 2022:Q4. The numbers in parentheses are standard deviations. The second panel uses call reports. The first three rows in this panel are based on a sample of banks that are required to report rate swaps. The last three rows in this panel are based on a sample of banks that report non-zero interest rate swaps. The third panel uses 10K/10Q filings. It is based on a sample of publicly traded banks that report hedges in these filings. We remove outliers by winsorizing the full sample at 5th and 95th percentiles. Column 1 shows these statistics for all the banks, column 2 for banks with assets below 10 billion, column 3 for banks with assets above 10 billion but below 250 billion, and column 4 for banks with assets above 250 billion. *Data Sources*: Bank Call Reports, 10Qs, and 10Ks.

	(1) All Banks	(2) Asset <10B	(3) Asset [10B,250B]	(4) Asset >250B
Assets of FDIC-insured banks	23.6T	3.4T	7.1T	13.1T
Assets of banks required to report rate swap	22.0T	1.8T	7.1T	13.1T
# Banks required to report rate swap	1,218	1,060	145	13
Assets of banks w/ non-zero rate swap	16.3T	0.7T	4.0T	11.7T
# Banks w/ non-zero rate swap	270	180	80	10
Assets of publicly traded banks w/ hedge	7.6T	0.2T	3.0T	4.4T
# Publicly traded banks w/ hedge	97	44	47	6
Assets of publicly traded banks reported duration	5.1T	0.1T	1.7T	3.3T
# Publicly traded banks reported duration	65	27	34	4
Rate Swap/Asset	0.9	0.6	2.4	3.9
	(2.2)	(1.9)	(3.3)	(3.5)
Rate Swap/Security	5.4	3.9	14.4	19.9
	(13.9)	(11.9)	(20.5)	(20.1)
Rate Swap/AFS Security	7.6	5.4	19.7	41.6
	(19.3)	(16.3)	(27.7)	(34.2)
Rate Swap/Asset | Non-Zero Rate Swap	4.0	3.7	4.4	5.1
	(3.2)	(3.1)	(3.4)	(3.1)
Rate Swap/Security | Non-Zero Rate Swap	23.6	22.4	25.9	25.8
	(20.4)	(20.1)	(21.4)	(19.2)
Rate Swap/AFS Security | Non-Zero Rate Swap	32.4	29.7	35.6	54.1
	(28.2)	(27.5)	(28.7)	(28.4)
Hedge/Asset (10K)	6.5	6.1	6.4	11.0
	(6.3)	(6.3)	(6.4)	(4.2)
Hedge/Security (10K)	39.9	44.0	36.0	41.0
	(39.1)	(43.4)	(37.3)	(16.5)
Hedge/AFS Security (10K)	59.9	61.4	53.4	101.0
	(56.4)	(60.6)	(50.9)	(58.5)
Duration	5.1	4.9	5.1	5.7
	(1.6)	(1.4)	(1.6)	(2.8)

Table A2: Descriptive Statistics on AFS and HTM Assets

The top panel of the table shows aggregate statistics about available-for-sale (AFS) and held-to-maturity (HTM) securities and loans in 2022:Q4. The bottom panel of the table presents the statistics using average values of all the banks in each category as of 2022:Q4. The numbers in parentheses are standard deviations. The samples are based on call reports. Column 1 shows these statistics for all the banks, column 2 for banks with assets below 10 billion, column 3 for banks with assets above 10 billion but below 250 billion, and column 4 for banks with assets above 250 billion. *Data Sources:* Bank Call Reports.

	(1) All Banks	(2) Asset <10B	(3) Asset [10B,250B]	(4) Asset >250B
Assets of FDIC-insured banks	23.6T	3.4T	7.1T	13.1T
Aggregate AFS Security	2.9T	612B	1.0T	1.2T
Aggregate HTM Security	2.8T	128B	538B	2.1T
Aggregate AFS Loan	0.1T	20B	31B	62B
Aggregate HTM Loan	11.9T	2.2T	4.4T	5.3T
AFS Security/Asset	20.5	20.7	15.3	14.6
	(15.9)	(15.9)	(12.9)	(12.9)
HTM Security/Asset	3.8	3.7	6.8	15.1
	(9.4)	(9.4)	(9.5)	(11.6)
AFS Loan/Asset	0.3	0.3	0.5	0.4
	(2.5)	(2.5)	(2.3)	(0.6)
HTM Loan/Asset	60.0	60.0	63.3	39.1
	(18.6)	(18.6)	(16.9)	(19.4)
Number of Banks	4723	4565	145	13

Table A3: External Scrutiny and Reclassification into HTM

This table reports the coefficients of OLS regressions examining how auditors and supervisory agencies mediate the relation between measures of bank fragility and banks' decision to transfer assets from AFS to HTM. The empirical specifications and variables are defined similarly to Table 3 except that we coarsen-exact match (Iacus et al., 2012) the sample to achieve covariate balance between the size and securities portfolio composition across banks with and without big-4 auditing and different types of regulators. Standard errors are presented in parentheses and are clustered at the state level. ***, **, and *, represent statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A

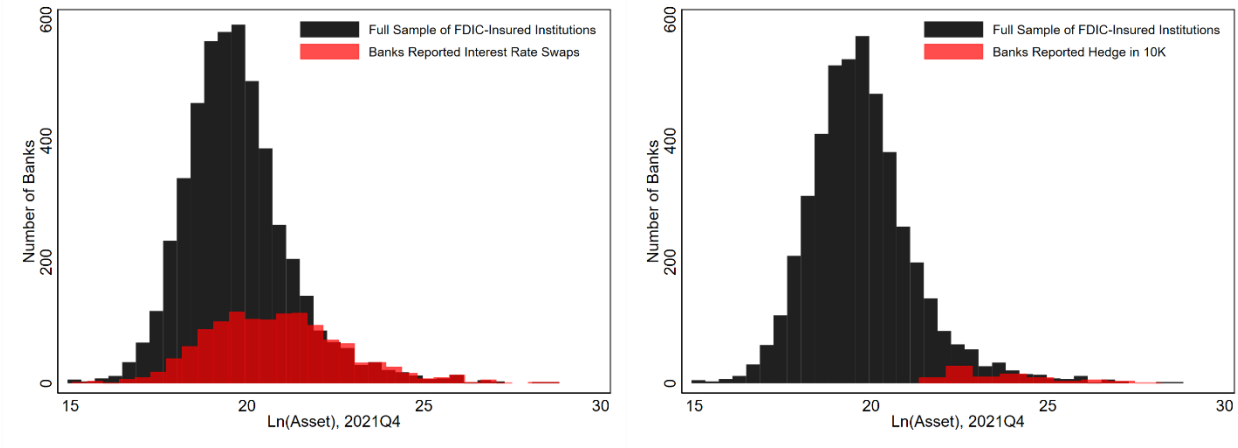
	(1)	(2)	(3)	(4)
Big4Auditor	0.004			
	(0.058)			
Big4Auditor × Fragile Bk.	0.180			
	(0.223)			
OCC		-0.032**		
		(0.015)		
OCC × Fragile Bk.		-0.249**		
		(0.097)		
FDIC			0.019**	
			(0.009)	
FDIC × Fragile Bk.			-0.077	
			(0.207)	
Federal Reserve				0.008
				(0.016)
Federal Reserve × Fragile Bk.				0.173
				(0.252)
Observations	1702	1892	1921	1882
Adjusted R^2	0.176	0.185	0.120	0.159

Panel B

	(1)	(2)	(3)	(4)
Big4Auditor	-0.038*			
	(0.020)			
Big4Auditor × Fragile Bk.	0.076			
	(0.065)			
OCC		-0.015		
		(0.009)		
OCC × Fragile Bk.		-0.096*		
		(0.054)		
FDIC			0.002	
			(0.009)	
FDIC × Fragile Bk.			-0.106	
			(0.172)	
Federal Reserve				0.004
				(0.009)
Federal Reserve × Fragile Bk.				0.122
				(0.185)
Observations	1702	1892	1921	1882
Adjusted R^2	0.052	0.059	0.036	0.040

Figure A1: Data and Sample

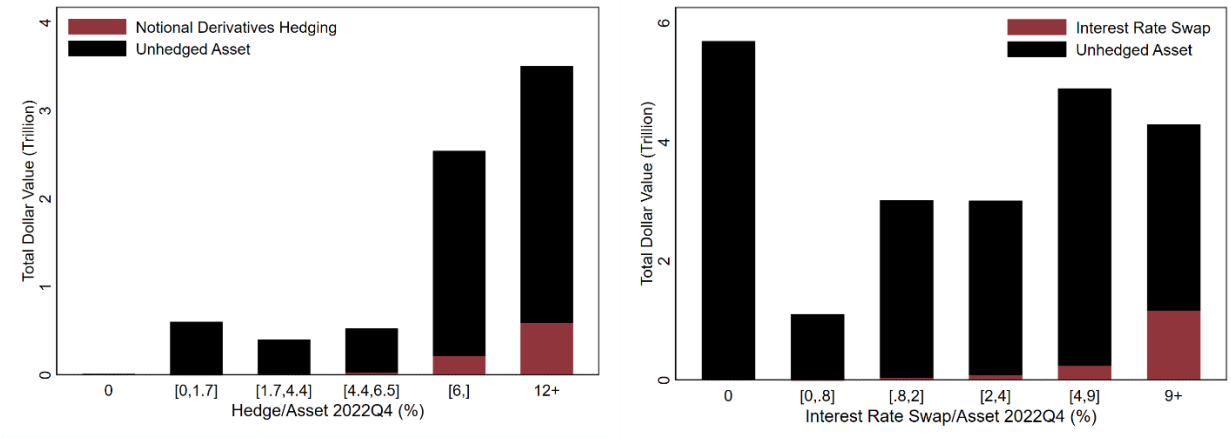
This figure compares our sample coverage to the full sample of FDIC-insured financial institutions in 2021:Q4 call report data. Panel (a) plots the histogram (frequency) of the logarithm of asset values for banks in the full sample as well as banks that are required to report their use of interest rate swaps. Panel (b) plots the histogram (frequency) of the logarithm of asset values for banks in the full sample as well as the publicly traded banks that report notional value of hedge in 2021. In panel (a) the assets of sample analyzed is close to 95% of the assets of all the FDIC insured institutions. In panel (b) the assets of sample analyzed is 68% of the assets of all the FDIC insured institutions. *Data sources*: bank call reports and 10Ks and 10Qs.



(a) Call Report (b) 10K

Figure A2: Aggregate Hedged and Unhedged Asset Value - 2022

This figure plots the aggregate hedged and unhedged asset values based on 2022:Q4 10Ks (Panel a) and 2022:Q4 call reports (Panel b). In Panel (a), the red bars indicate the notional value of hedges of all banks in each hedging ratio bucket. The black bars indicate the total unhedged asset value of all banks in each hedging ratio bucket, where unhedged asset value is calculated as total assets minus the notional value of hedge. The first bucket includes banks with zero notional value of hedge, and the remaining hedging ratio buckets are constructed by dividing banks with non-zero hedging into 5 equal-sized groups based on their notional value of hedge to total asset ratio in 2022:Q4. In Panel (b), the red bars indicate the total notional value of interest rate swaps of all banks in each hedging ratio bucket. The black bars indicate the total unhedged assets of all banks in each hedging ratio bucket, where unhedged assets are calculated as total assets minus the notional value of interest rate swaps. In Panel (b), the first bucket includes banks with zero interest rate swaps, and the remaining hedging ratio buckets are constructed by dividing banks into 5 equal sized groups based on their interest rate swap to total asset ratio in 2022:Q4. *Data Sources*: Bank Call reports and 10Ks and 10Qs.

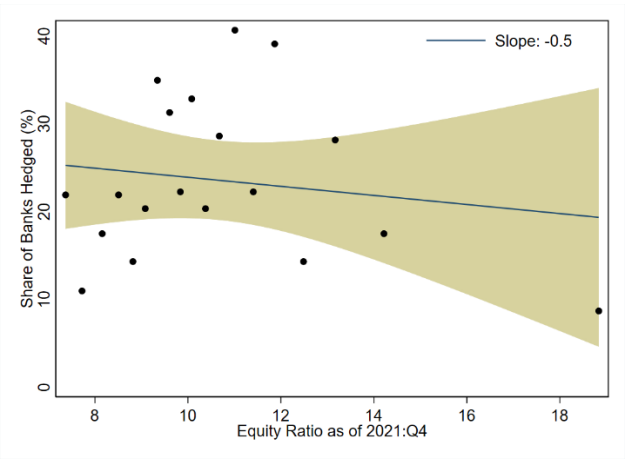


(a) Hedge/Assets (10K)

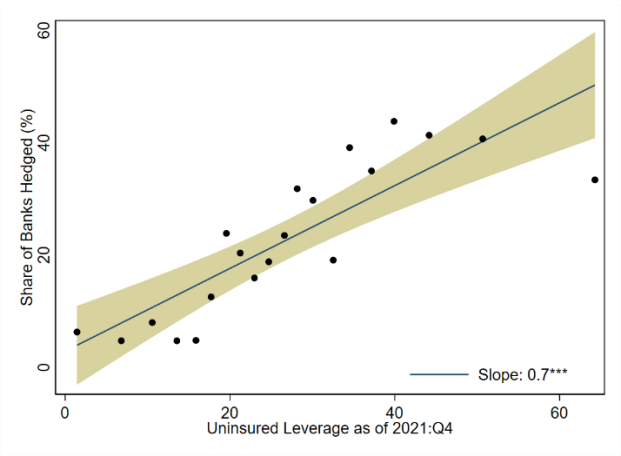
(b) Interest Rate Swaps/ Assets (Call Report)

Figure A3: Bank Use of Interest Rate Swaps --- Extensive Margin

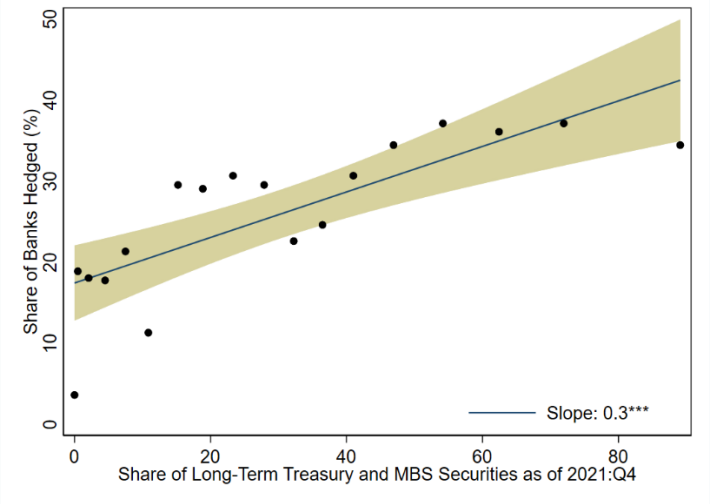
This figure presents binned scatterplot of 2021:Q4 hedging against equity ratio (Panel A), uninsured leverage ratio (Panel B), and long-term security ratio (Panel C) as of 2021:Q4. Uninsured leverage is calculated as uninsured deposit divided by total asset. Long-term security ratio is the ratio between total securities with maturity or repricing exceeding 15 years and the total securities. The underlying sample includes all banks that are required to report their use of interest rate swaps in 2021:Q4. We divide sample into 20 equal-sized bins and plot the share of banks with positive interest rate swaps in each bin against the average equity ratio, uninsured leverage ratio, and long-term security ratio in that bin, respectively. The shaded area shows the 95% confidence interval. The slope and statistical significance are reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources:* Bank call reports in 2021:Q4.



(a) Equity/Asset



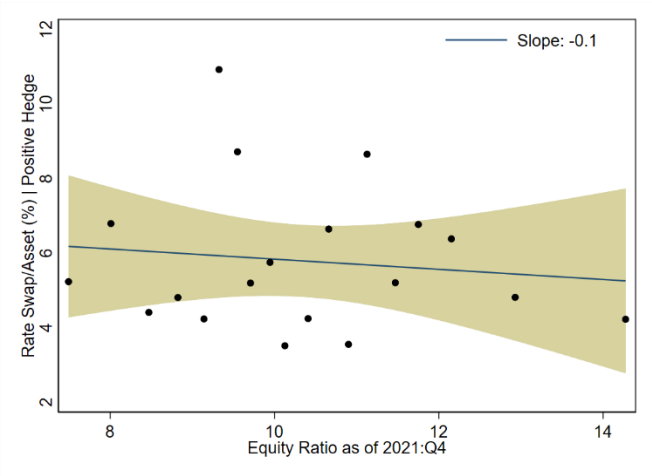
(b) Uninsured Leverage



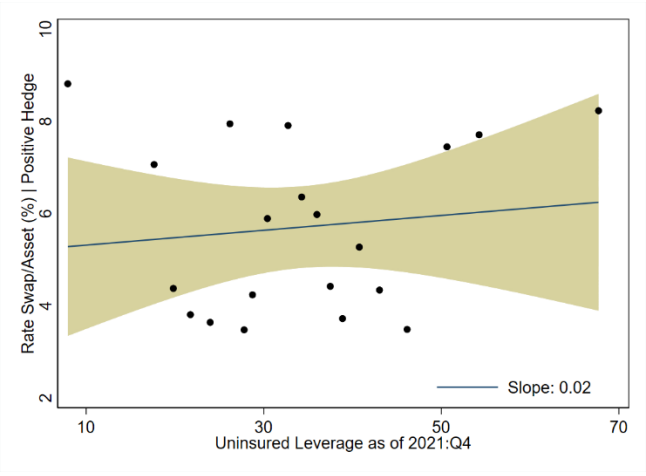
(c) Long-Term Security/Asset

Figure A4: Bank Use of Interest Rate Swaps --- Intensive Margin

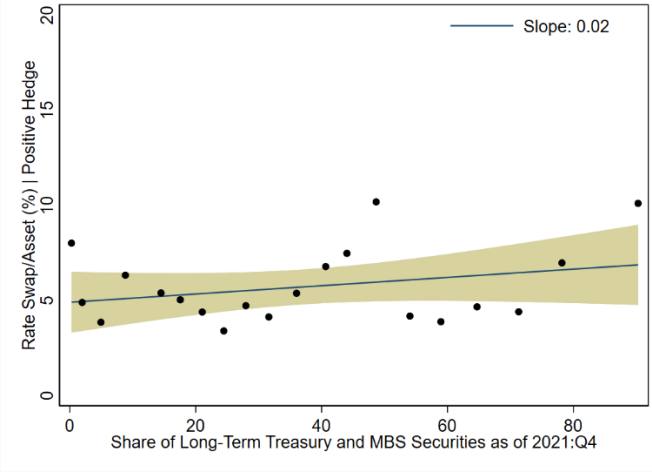
This figure presents binned scatterplot of 2021Q4 hedging against equity ratio (Panel A), uninsured leverage ratio (Panel B), and long-term security ratio (Panel C) as of 2021:Q4. Uninsured leverage is calculated as uninsured deposit divided by total asset. Long-term security ratio is the ratio between total securities with maturity or repricing exceeding 15 years and the total securities. The underlying sample includes all banks that reported positive interest rate swaps in 2021Q4. We divide sample into 20 equal-sized bins and plot the average interest rate swaps to asset ratio in each bin against the average equity ratio, uninsured leverage ratio, and long-term security ratio in that bin, respectively. The shaded area shows the 95% confidence interval. The slope and statistical significance are reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources:* Bank call reports in 2021:Q4.



(a) Equity/Asset



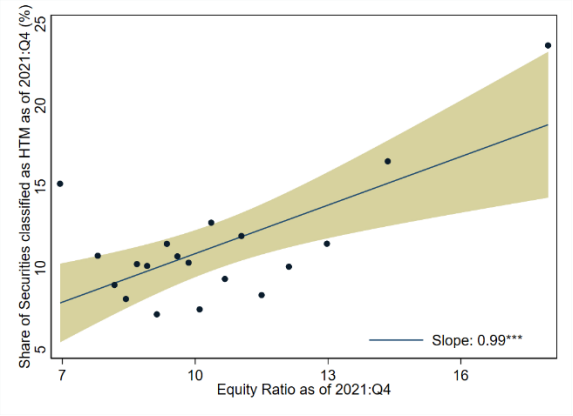
(b) Uninsured Leverage



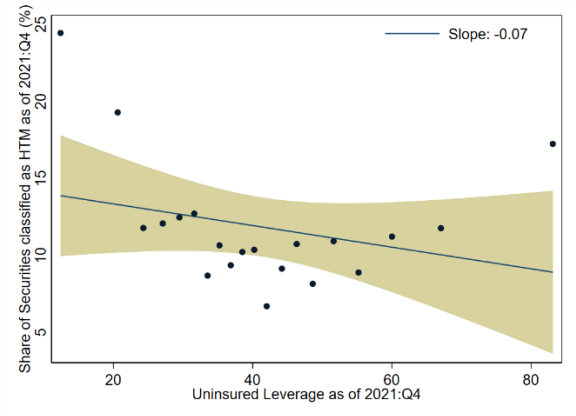
(c) Long-Term Security/Asset

Figure A5: Share of Securities Classified as HTM

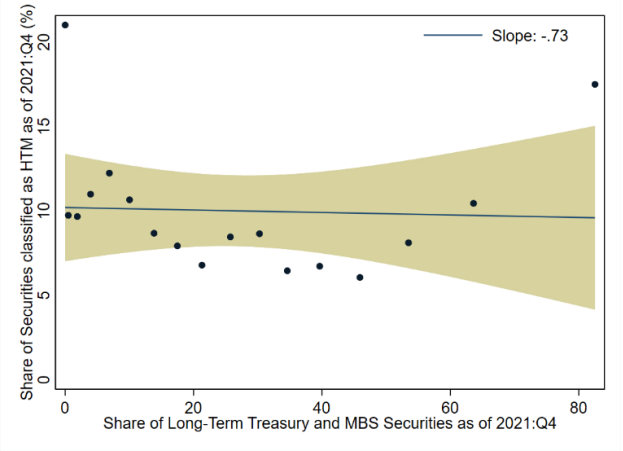
This figure presents binned scatterplot of 2021Q4 share of securities classified as HTM against equity ratio (Panel A), uninsured leverage ratio (Panel B), and long-term security ratio (Panel C). The underlying sample includes all banks that filed call reports in 2021Q4. We divide sample into 20 equal-sized bins and plot the average share of securities classified as HTM in each bin against the average equity ratio, uninsured leverage ratio, and long-term security ratio in that bin, respectively. The shaded area shows the 95% confidence interval. The slope and statistical significance are reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). Data Sources: Bank call reports in 2021:Q4.



(a) Equity/Asset



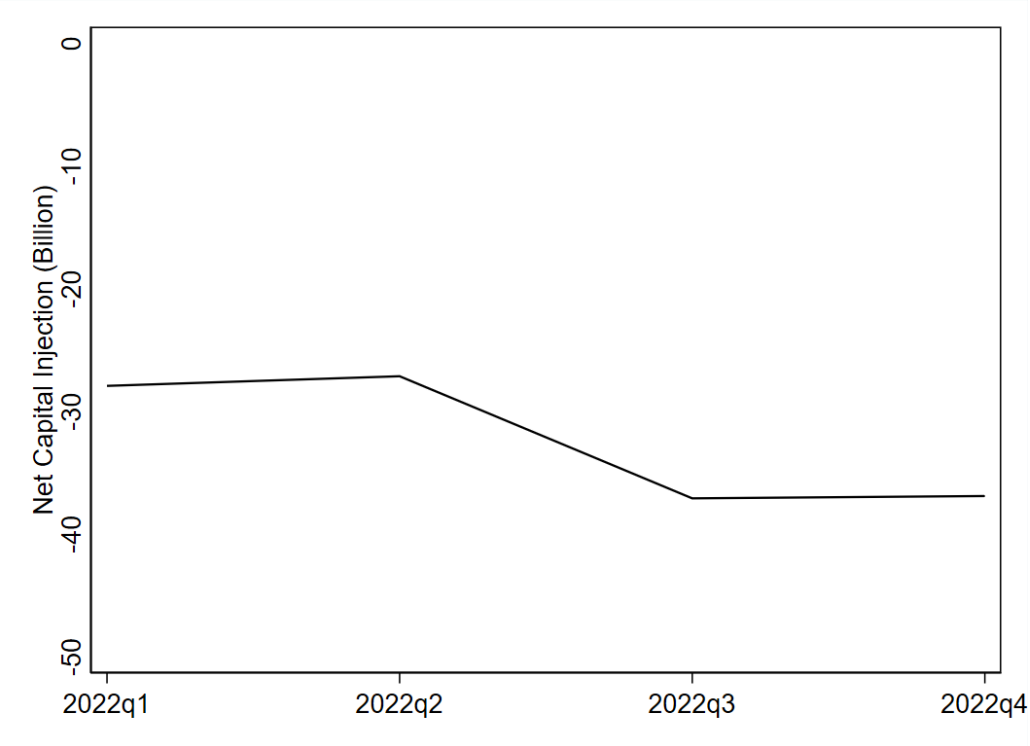
(b) Uninsured Leverage



(c) Long-Term Security/Asset

Figure A6: Aggregate Capital Injection (Net of Dividend) in 2022

This figure plots the quarterly aggregate bank capital injection net of dividends in 2022. We add up sale, conversion, acquisition, or retirement of capital stock, cash dividends declared on preferred stocks, and cash dividends declared on common stocks. The negative values indicate net reduction in equity. *Data sources: Bank call reports.*



Appendix B: Data Collection

We describe our manual data collection process in this appendix. We obtain the list of publicly traded banks from Compustat Bank Fundamentals Annual and download their 10-K and 10-Q filings from SEC EDGAR. 255 banks filed 10-K and 10-Q reports in 2022, where we are able to merge 240 of them with bank call report data using the link table provided by the Federal Reserve Bank of New York. We manually collect the following pieces of information from these banks' 10-K and 10-Q reports.

1. Hedging Data

Most information about hedging is recorded under "Item 8: Financial Statements and Supplementary Data."

1.1 Available-for-sale (AFS) and held-to-maturity (HTM) security values

We collect these values by the end of 2022 and 2021 from the consolidated balance sheets. For example, Figure 1 presents the consolidated balance sheet from SVB Financial Group's 10-K report for 2022. We record SVB's AFS security (at fair value) as 26,069 million for the year 2022 and 27,221 million for the year 2021. We record SVB's HTM security (at amortized cost basis) as 91,321 million at the end of 2022 and 98,195 million at the end of 2021. . We further record its fair value of HTM securities as 76,169 million and 97,227 million at the end of 2022 and 2021, respectively.

In some cases, banks do not directly include the consolidated balance sheets in their 10-K reports. Instead, they include a reference link to a report on their detailed financial statements. As an example, under "Item 8. Financial Statements and supplementary data" of Wells Fargo & Company's 10-K report for 2022, it states that "Information in response to this Item 8 can be found in the 2022 Annual Report to Shareholders under 'Financial Statements,' under 'Notes to Financial Statements' and under 'Quarterly Financial Data.' That information is incorporated into this item by reference." Figure 2 presents the consolidated balance sheet from Wells Fargo & Company's 2022 annual report. We collect the same set of information as described above from the balance sheet.

SVB FINANCIAL GROUP AND SUBSIDIARIES
CONSOLIDATED BALANCE SHEETS

(Dollars in millions, except par value and share data)	December 31, 2022	2021
Assets		
Cash and cash equivalents	$ 13,803	$ 14,586
Available-for-sale securities, at fair value (cost of $28,602 and $27,370, respectively, including $530 and $61 pledged as collateral, respectively)	26,069	27,221
Held-to-maturity securities, at amortized cost and net of allowance for credit losses of $6 and $7 (fair value of $76,169 and $97,227, respectively)	91,321	98,195
Non-marketable and other equity securities	2,664	2,543
Total investment securities	120,054	127,959

Figure 1: Consolidated balance sheet, SVB Financial Group, 10-K report for 2022.

Wells Fargo & Company and Subsidiaries

Consolidated Balance Sheet

(in millions, except shares)	Dec 31, 2022	Dec 31, 2021
Assets		
Cash and due from banks	$ **34,596**	24,616
Interest-earning deposits with banks	**124,561**	209,614
Total cash, cash equivalents, and restricted cash	**159,157**	234,230
Federal funds sold and securities purchased under resale agreements	**68,036**	66,223
Debt securities:		
Trading, at fair value (includes assets pledged as collateral of **$26,932** and $13,304)	**86,155**	88,265
Available-for-sale, at fair value (amortized cost of **$121,725** and $175,463, net of allowance for credit losses)	**113,594**	177,244
Held-to-maturity, at amortized cost, net of allowance for credit losses (fair value **$255,521** and $272,386)	**297,059**	272,022
Loans held for sale (includes **$4,220** and $15,895 carried at fair value)	**7,104**	23,617
Loans	**955,871**	895,394
Allowance for loan losses	**(12,985)**	(12,490)

Figure 2: Consolidated balance sheet, Wells Fargo & Company, 2022 Annual Report attached in the 10-K report for 2022.

1.2 Notional value of hedging derivatives

We collect data on **total derivatives designated as hedging instruments at the notional or contractual amount** from banks' 10-K and 10-Q reports whenever such information is available. Banks usually report this information in the section "Note — Derivative Instruments." We collect this information from 10-Q reports for 2022 Q1 to 2022 Q3 and combine them with the same information obtained from banks' 10-K reports in 2022. In 10-K reports, we collect the corresponding information at the end of 2021 and 2022, respectively. For banks with fiscal year end in June (or September), We collect the data from 10-Q reports for 2022 Q1, Q3, and Q4 (or Q1, Q2, and Q4) and then use the information obtained from the bank's 10-K reports as the data for Q2(or Q3).

Figure 3 provides an example of the data we collect from SVB Financial Group's 10-Q and 10-K reports for 2022. More specifically, the first three tables are reported under the "Part 1- Financial Information, Item 1, Note 8 – Derivative Financial Instruments" section of SVB's 10-Q report for 2022 Q1 to 2022 Q3, while the last table is presented under the "Note 16 – Derivative Financial Instruments" section of SVB's 10-K report for 2022. After summing up each row's value under the "Notional or Contractual Amount" column within each table, we document that the total derivatives designated as hedging instruments in notional amount for SVB Financial Group are 1,944 million by the end of the year 2021, 5,900 million at the end of both 2022 Q1 and Q2, 1,546 million at the end of 2022 Q3 and 10,700 million by the end of the year 2022, respectively.

	March 31, 2022			December 31, 2021		
	Notional or Contractual Amount	Fair Value		Notional or Contractual Amount	Fair Value	
(Dollars in millions)		Derivative Assets (1)	Derivative Liabilities (1)		Derivative Assets (1)	Derivative Liabilities (1)
Derivatives designated as hedging instruments:						
Interest rate risks:						
Interest rate swaps (2)	$ 5,900	$ =	$ –	$ 10,700	$ 18	$ –
Interest rate swaps	=	–	=	=	–	=

	June 30, 2022			December 31, 2021		
	Notional or Contractual Amount	Fair Value		Notional or Contractual Amount	Fair Value	
(Dollars in millions)		Derivative Assets (1)	Derivative Liabilities (1)		Derivative Assets (1)	Derivative Liabilities (1)
Derivatives designated as hedging instruments:						
Interest rate risks:						
Interest rate swaps (2)	$ 5,900	$ =	$ –	$ 10,700	$ 18	$ –

(Dollars in millions)	September 30, 2022 Notional or Contractual Amount	Fair Value Derivative Assets (1)	Fair Value Derivative Liabilities (1)	December 31, 2021 Notional or Contractual Amount	Fair Value Derivative Assets (1)	Fair Value Derivative Liabilities (1)
Derivatives designated as hedging instruments:						
Interest rate risks:						
Interest rate swaps (2)	$ —	$ —	$ —	$ 10,700	$ 18	$ —
Currency exchange risks:						
Foreign exchange contracts	1,546	94	—	—	—	—
Total derivatives designated as hedging instruments		94	—		18	—

The total notional or contractual amounts and fair value of our derivative financial instruments at December 31, 2022, and December 31, 2021, were as follows:

(Dollars in millions)	December 31, 2022 Notional or Contractual Amount	Fair Value Derivative Assets (1)	Fair Value Derivative Liabilities (1)	December 31, 2021 Notional or Contractual Amount	Fair Value Derivative Assets (1)	Fair Value Derivative Liabilities (1)
Derivatives designated as hedging instruments:						
Interest rate risks:						
Interest rate swaps (2)	$ 550	$ —	$ —	$ 10,700	$ 18	$ —
Currency exchange risks:						
Foreign exchange contracts	778	17	—	—	—	—
Foreign exchange contracts	616	—	56	—	—	—
Total derivatives designated as hedging instruments		17	56		18	—

Figure 3: Total derivatives designated as hedging instruments in notional amount. SVB Financial Group, 10-K report for 2022 and, 10-Q reports for Q1-Q3 2022.

Some banks only report the total derivatives at the notional or contractual amount, without reporting the total derivatives designated as hedging instruments and non-hedging instruments separately. Under such cases, we also collect the data for the total derivatives at the notional amount and make a note to distinguish those cases from others. As an example, Figure 4 presents the table reported under the "Note 16 – Derivative Financial Instruments" section of HSBC USA Inc.'s 10-K report for 2022, which summarizes the notional values of derivative contracts without reporting the derivates designated as hedging instruments or non-hedging instruments explicitly. In this case, we record HSBC USA Inc.'s total derivatives at the notional amount as 1,327,929 million for the year 2022 and 1,395,345 million for the year 2021. We also collect the same information from HSBC USA Inc.'s 10-Q reports for 2022 Q1 to 2022 Q3 and make detailed notes to clarify that this data only represents the notional values of total derivatives instead of derivatives for hedging only.

Notional Value of Derivative Contracts The following table summarizes the notional values of derivative contracts:

At December 31,	2022	2021
	(in millions)	
Interest rate:		
Futures and forwards	$ 30,764	$ 44,686
Swaps	120,560	177,876
Options written	5,855	10,842
Options purchased	5,740	12,688
Total interest rate	162,919	246,092
Foreign exchange:		
Swaps, futures and forwards	968,847	974,725
Options written	39,969	28,577
Options purchased	40,026	28,678
Spot	26,809	31,319
Total foreign exchange	1,075,651	1,063,299
Commodities, equities and precious metals:		
Swaps, futures and forwards	58,371	60,054
Options written	1,643	5,873
Options purchased	9,689	11,800
Total commodities, equities and precious metals	69,703	77,727
Credit derivatives	18,547	7,023
Other contracts[1]	1,109	1,204
Total	$ 1,327,929	$ 1,395,345

Figure 4: Total derivatives in notional amount. HSBC USA Inc., 10-K report for 2022

1.3 Duration

We collect data on the effective average duration[14] of investment security portfolios by the end of 2021 and 2022 whenever such information is available. Slightly different from the securities data and derivatives data, for most banks that report the average duration on their securities portfolio, the information is reported under "Item 7: Management's Discussion and Analysis of Financial Condition and Results of Operations." We also manually check the entire 10-K reports for the keyword "duration" or "life" in case such information is reported under other items or sections. Figure 5 provides an example showing how SVB Financial Group reports the average duration of its investment securities portfolio in its 10-K report for 2022. More specifically, the paragraph of the discussion can be found under "Item 7, Consolidated Financial Condition, Investment Securities" on page 66 of SVB's 2022 10-K report. We record the average duration of SVB's investment security portfolios as 5.6 years for 2022 and 3.7 years for 2021, respectively (i.e., "the weighted-average duration of our total fixed income securities portfolio including the impact of fair value swaps" as described in Figure 5).

Portfolio duration is a standard measure used to approximate changes in the market value of fixed income instruments due to a change in market interest rates. The measure is an estimate based on the level of current market interest rates, expectations for changes in the path of forward rates and the effect of forward rates on mortgage prepayment speed assumptions. As such, portfolio duration will fluctuate with changes in market interest rates. Changes in portfolio duration are also impacted by changes in the mix of longer versus shorter term-to-maturity securities. The estimated weighted-average duration of our fixed income investment securities portfolio was 5.7 and 4.0 years at December 31, 2022, and December 31, 2021, respectively. The weighted-average duration of our total fixed income securities portfolio including the impact of our fair value swaps was 5.8 years at December 31, 2022, and 3.7 years December 31, 2021. The weighted-average duration of our AFS securities portfolio was 3.6 years at December 31, 2022, and 3.5 years at December 31, 2021. The weighted-average duration of our AFS securities portfolio including the impact of our fair value swaps was 3.6 years and 2.4 year at December 31, 2022, and December 31, 2021, respectively. The weighted-average duration of our HTM securities portfolio was 6.2 years at December 31, 2022, and 4.1 years at December 31, 2021.

Figure 5: Average duration of security portfolio reported. SVB Financial Group, 10-K report for 2022.

We notice that some banks only report the average duration of portfolios by the end of the year 2022 without mentioning the information on the duration of their portfolios by the end of the year 2021 in their 2022's 10-K reports. For those banks, we also search their 2021 10-K reports to collect their duration information for the year 2021.[15] To give an example, Figure 6 presents how BankUnited Inc. reports the average duration of its investment securities portfolio in its 10-K report for 2022, which only states that the effective duration of the portfolio was 2.0 years for 2022 without providing any information on the data for 2021. Therefore, we also look through BankUnited Inc.'s 10-K report for 2021. As shown in Figure 7, we find that the effective duration of its portfolio was 1.5 years by the end of 2021 from its 2021 10-K report.

Our investment strategy has focused on insuring adequate liquidity, maintaining a suitable balance of high credit quality, diverse assets, managing interest rate risk, and generating acceptable returns given our established risk parameters. We have sought to maintain liquidity by investing a significant portion of the portfolio in high quality liquid securities including U.S. Treasury and U.S. Government Agency and sponsored enterprise securities. Investment grade municipal securities provide liquidity and attractive tax-equivalent yields. We have also invested in highly rated structured products, including private-label commercial and residential MBS, collateralized loan obligations, single family real estate-backed securities and non-mortgage asset-backed securities that, while somewhat less liquid, provide us with attractive yields. Relatively short effective portfolio duration helps mitigate interest rate risk. Based on the Company's assumptions, the estimated weighted average life of the investment portfolio as of December 31, 2022 was 4.9 years and the effective duration of the portfolio was 2.0 years.

Figure 6: Average duration of security portfolio reported. BankUnited, Inc., 10-K report for 2022.

[14] Banks use different words to disclose their effective average duration of investment security portfolios in their 10-K reports. Some most common word combinations include "average duration of the investment portfolio was xxx years", "with an effective duration of xxx years", "The weighted-average duration was xxx years", etc.

[15] There are a total of 12 banks reporting their average duration of security portfolios by the end of 2022 without mentioning the duration by the end of 2021. For those 12 banks, we search through their 2021 10-K reports and find 8 of them reporting their average duration of portfolios in their 2021's 10-K reports. The remaining four banks do not report such information in their 2021's 10-K reports.

Our investment strategy has focused on insuring adequate liquidity, maintaining a suitable balance of high credit quality, diverse assets, managing interest rate risk, and generating acceptable returns given our established risk parameters. We have sought to maintain liquidity by investing a significant portion of the portfolio in high quality liquid securities including U.S. Treasury and U.S. Government Agency and sponsored enterprise securities. Investment grade municipal securities provide liquidity and attractive tax-equivalent yields. We have also invested in highly rated structured products, including private-label commercial and residential MBS, collateralized loan obligations, single family real estate-backed securities and non-mortgage asset-backed securities that, while somewhat less liquid, provide us with attractive yields. Relatively short effective portfolio duration helps mitigate interest rate risk. Based on the Company's assumptions, the estimated weighted average life of the investment portfolio as of December 31, 2021 was 4.2 years and the effective duration of the portfolio was 1.5 years.

Figure 7: Average duration of security portfolio reported. BankUnited, Inc., 10-K report for 2021.

2. Reclassification of Available for Sale securities as HTM

The regulatory call reports that all U.S. banks file with the banking regulators do not contain a field indicating the total value of securities that a bank reclassified from the AFS to the HTM portfolios. For publicly-listed banks, we hand-collected the total amounts of securities transferred from the AFS to HTM from the annual reports of all publicly listed U.S. banks and bank holding companies and we merged this data to the banks' call reports using the New York Fed's CRSP-FRB link. These amounts are not reported in a standard footnote, so we collected them on a best-effort basis by searching for the terms “transfer”, “reclassification” and “HTM"” and reading the passages of the footnotes to the consolidated financial statements of the 2022 and 2021 that indicated the amounts that were transferred from AFS to HTM. Most reclassifying banks do not indicate in which quarter they transferred the securities from AFS to HTM. For each public bank that reclassified securities from the AFS to the HTM portfolio, we allocate the amounts transferred during the year to the quarter in which we observe a greater increase in HTM securities and a decline in AFS securities.

Private banks that are not registered with the SEC do not file annual reports and do not have to report the amounts of securities transferred from AFS to HTM in their regulatory call reports. The call reports, nevertheless, provide a group of variables that collectively allow for reasonable identification of banks that transferred a large fraction of their AFS portfolio to HTM. We define a bank reclassification of AFS securities into the HTM portfolio for private banks using two different criteria. The first set of criteria defines a bank-quarter as a reclassification quarter if the following conditions are jointly met:

- Increase in the amortized cost of held-to-maturity securities that exceeds 15% of the total amortized cost of AFS and HTM securities in the previous quarter,
- Increase in the sum of the amortized costs of held-to-maturity and available for sale securities that does not exceed 7.5% of the total amortized cost of AFS and HTM securities in the previous quarter, and
- a non-zero change in the absolute value of the net unrealized gains (losses) on held-to-maturity securities that are included in Accumulated Other Comprehensive Income (AOCI)

The first two conditions ensure that there is a substantial increase in the book value of HTM securities that is at least partly offset by a decline in the book value of AFS securities. The third condition takes advantage of the fact that banks that opted out of including their accumulated other comprehensive income (AOCI) in the computation of regulatory capital must report the unamortized balance of the unrealized gain (loss) that existed at the date of transfer of a debt

security from AFS into HTM, net of applicable income taxes. This is an important condition because it indicates that banks reclassified securities from AFS to HTM during that quarter and that the reallocation between HTM and AFS portfolios is not entirely driven by sale or redemption of AFS and subsequent purchase of HTM securities. Because 99% of US banks have opted out from including AOCI in the computation of their regulatory capital, we can assess this condition for the near universe of banks in the United States. For the remaining one percent of banks that did not opt out of including AOCI in their regulatory capital, we define a bank-quarter as a reclassification based on the two other conditions alone. We measure the amounts of securities transferred from AFS to HTM during a reclassification quarter as the increase in the amortized cost of HTM securities during bank quarters.

A potential problem with the previous set of criteria is that it might exclude some asset reclassifications that are large in terms of absolute size but do not comprise more than 15\% of the total amortized cost of AFS and HTM securities in the previous quarter. Because of this, we use the following alternative set of criteria to define a bank-quarter as a reclassification quarter:

- Increase in the amortized cost of held-to-maturity securities that exceeds 5\% of the total amortized cost of AFS and HTM securities in the previous quarter,
- Increase in the sum of the amortized cost of held-to-maturity and available for sale securities that does not exceed 2.5% of the total amortized cost of AFS and HTM securities in the previous quarter, and
- An absolute change in the absolute value of the net unrealized gains (losses) on held-to-maturity securities that are included in Accumulated Other Comprehensive Income (AOCI) that exceeds 0.25% of the total amortized cost of AFS and HTM securities in the previous quarter

In this alternative set of criteria, we admit a lower amount of portfolio reallocation between AFS and HTM provided that there is an meaningful change in the net unrealized gains (losses) on held-to-maturity securities that are included in Accumulated Other Comprehensive Income (AOCI). Similar to above, we define the amounts of securities transferred from AFS to HTM during a reclassification quarter as the increase in the amortized cost of HTM securities during bank quarters.

We manually inspected the AFS and HTM portfolios of all banks in the United States for possible cases of reclassifications of securities from AFS to HTM that we had not caught using the procedure above. In the rare cases, in which there was a significant increase in HTM and decline in AFS that was not flagged the classification criteria, we searched for the bank's annual reports in the company websites to further examine if there were reclassifications during 2021 and 2022. We

found ten cases of private banks or banks listed in the Pink Sheets that provided annual reports in their websites and that mentioned having reclassified securities from AFS to HTM.[16]

Finally, we also considered that some banks reclassified securities when there was a change in the amounts of AFS and HTM that met the criteria that defined above but the change in the absolute value of the net unrealized gains (losses) on held-to-maturity securities that are included in Accumulated Other Comprehensive Income (AOCI) occurred only in the following quarter or during the last quarter of the year. We surmised that some smaller banks are unsophisticated and might have misreported this item in the quarter that they reclassified their securities. It is likely that these banks only corrected their misreporting in the last quarter of the year when their financial statements were audited.

[16] These banks were: Canandaigua National Bank, Commercial and savings bank of Millersburg, Juniata Valley Financial Corp., Bank of Idaho, Morris State Bancshares, Farmers & Merchants Bank of Central California, BankFirst Financial Services, American Riviera Bank, John Marshall Bank, and River Bank & Trust.