Revenge of the S&Ls:
How Banks Lost a Half Trillion Dollars during 2022*

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October 29, 2025

Abstract: At year-end 2022, U.S. banks reported $620 billion in unrealized losses on their investment securities portfolios, as the Federal Reserve Board raised its target interest rate by 400 basis points to combat inflation. These losses are strikingly similar in character to the losses on residential mortgages experienced by savings & loan (S&L) institutions in the early 1980s when the Federal Reserve Board raised interest rates to combat inflation—despite subsequent regulatory reforms that were ostensibly put into place to prevent such crises. In this study, we analyze the role of interest rate risk in losses in bank securities investments. We show that banks used RMBS to "reach for yield" during 2020–2022, and we show the losses that ensued. We find that the equities market for publicly traded bank holding companies failed to price this risk. We use publicly available data to show these results, raising the question of why neither bank shareholders nor regulators responded to the interest rate threat that was "hiding in plain sight."

Keywords: bank failure, interest rate risk, mortgage, mortgage-backed securities, uninsured deposits, unrealized losses
JEL Classifications: G01, G21, G28

* Earlier versions of this paper were presented at the 2025 International Risk Management Conference held in Bari, Italy, June 23–24, 2025; the 2025 Annual Meetings of the American Real Estate and Urban Economics Association (AREUEA) held in San Francisco, FL, USA, Jan. 03–05, 2025; the 2024 Annual Meetings of the Southern Finance Association held in Palm Beach Gardens, FL, USA, Nov. 20–23, 2024; the 2024 Annual Meetings of the Southern Economics Association held in Washington, DC, USA, Nov. 18–20, 2024; the Old Dominion University Real Estate Symposium held in Norfolk, VA USA, October 10–11, 2024; the 23rd Annual FDIC Bank Research Conference held in Arlington, VA USA, Sep. 19–20, 2024; and the 2024 Annual Meetings of the American Real Estate Society held in Orlando, FL, USA, Mar. 20–23, 2024. We would like to thank Zifeng Feng (ODU discussant), Mark Flannery (FDIC discussant), Andrea Heuson (AREUEA discussant), and Anna-Leigh Stone (SFA Discussant) for comments on earlier drafts of this manuscript.

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1. Introduction

Bank regulators have focused on credit risk since the Global Financial Crisis hit during 2008. However, interest-rate risk was the cause of the half-trillion-dollar securities loss in the banking crisis of 2023.[6] While the extent of losses has been documented (Jiang et al., 2024),[7] we show the sources of these losses. We also show that the risk of these losses' occurring was "hiding in plain sight" on publicly available bank balance sheets. The sharp rise in interest rates that began in March 2022 was the proximate cause of the losses.

However, banks' investments in long-duration securities -- predominantly existing and new residential mortgage-backed securities (RMBS) -- was the underlying cause of the losses. Acharya et al. (2023) and Koont et al. (2024), among others, point to the role of social media in helping to propagate the bank runs of 2023, and Jiang et al. (2024) and Cipriani et al. (2024) point to the role of uninsured deposits; but unrealized losses were necessary, if not sufficient, to trigger these runs. We uncover the disproportionate losses in supposedly liquid RMBS -- the asset class with the most exposure to interest rate risk

Hanson and Stein (2015) show that in an environment of low interest rates, banks attempt to raise their yield, by investing in assets with longer maturities. The mismatch of maturities can trigger losses when interest rates rise, if asset values deteriorate more than liability values rise. This issue is newly salient as the failure of Silicon Valley Bank prompted a banking-system-wide temporary de facto extension of deposit insurance to prevent destabilizing bank runs (Arfaoui and Uhlig, 2025).

[6] There were $620 billion in unrealized losses in banks' investment securities portfolios reported as of year-end 2022. The amount of losses fluctuated quarterly as long-term interest rates oscillated throughout 2022-2024. Losses were $478 billion as of year-end 2023 and $482 billion as of year-end 2024.

[7] Jiang et al. (2024) estimate the overall losses -- from loans as well as from securities -- that were incurred by the banking system as a result of the interest rate rise at about $2 trillion.

Here we contribute to the literature by providing, for the first time, evidence on the underlying asset losses that caused banks to lose a half trillion dollars in investment securities in 2022. We show the extent to which these losses were due to banks' actively responding to the low-interest-rate environment of 2020-2021 by taking on more interest rate risk – particularly in residential mortgage-backed securities. We also show that the potential for these losses was readily apparent in publicly available data; but neither bank regulators nor shareholders brought pressure on bank managers to halt the rise in interest-rate risk.

The consequences of this shortfall in oversight were substantial: During the spring of 2023, U.S. prudential bank regulators closed three of the 20 largest commercial banks in the U.S. amid runs by uninsured depositors and concerns about contagion among regional banks.[8] These three bank failures were the second, third, and fourth largest in U.S. history in terms of assets – behind only the 2008 failure of Washington Mutual.

Silicon Valley Bank (SVB) was the first bank to fail, following a massive $40 billion outflow of uninsured deposits on March 9, 2023, that was triggered by concerns about its solvency. However, the size of the unrealized securities losses relative to its equity capital were readily apparent in its Q2, Q3, and Q4 2022 balance sheets. By Q3 2022, SVB was reporting unrealized losses that exceeded its total equity capital. This information was available to investors in SVB's 10-Q filing and in its regulatory Call Report -- both of which were available in November 2022, several months prior to the bank run of March 9, 2023.[9]

[8] The California Department of Financial Protection & Innovation closed Silicon Valley Bank (SVB) on the morning of Friday, March 10. The New York State Department of Financial Services closed Signature Bank over the weekend of March 11–12, which was vulnerable to uninsured deposit runs. The California Department of Financial Protection & Innovation closed First Republic Bank (FRB) on May 1. FRB suffered from unrealized losses in its held-to-maturity securities, which it had to reclassify as available for sale as discussed below.

[9] The Federal Deposit Insurance Corporation (FDIC) estimated the costs of the three bank failures (SVB, Signature, and FRB) to the Bank Insurance Fund at almost $40 billion.

In response to the failure of SVB, Barr (2023) reports that SVB's supervisors had been warning of its mismanagement of interest-rate risk for more than a year and that remedial actions had been planned for the spring of 2023. It is notable that the U.S. bank stress tests at the time did not include (and still do not) the possibility of interest rate rises.[10] In contrast, as discussed in Kick et al. (2023), as part of Basel Pillar II, Germany and many other countries have regulations in place that require banks to incorporate interest rate risk – for decreases or *increases* in interest rates – in compliance stress tests.

In this study, we focus on investment securities. We do so because these assets expand rapidly when deposits rise. Because bank-level data on these assets were (and are) readily available both to investors and to regulators, these data could (in theory) provide the basis for disciplining excessive risk taking.[11] Despite this, neither of the two potential sources of discipline – market discipline by investors; and/or mandated restrictions by regulators – prevented many banks from increasing their interest-rate-risk, in a period of low rates, even as inflation was rising.

There have been three major banking crises during the last 50 years. Besides the 2008 Global Financial Crisis (GFC) and the accompanying foreclosure tsunami that resulted from credit risk, there was an earlier credit-risk crisis: During the late 1980s and early 1990s, more than 1,000 commercial banks failed in the U.S. Two decades later, during the GFC, more than 500 U.S. banks failed (see Figure 1). In both of those crises, credit risk was to blame for losses

[10] Further, unlike for credit risk, where there are specific capital requirements for specific categories of risky assets, there are no explicit capital requirements for interest-rate risks. Instead, the bank regulatory system relies on supervisory guidance and discretion for determining allowable levels of banks' exposure to interest-rate risk and for determining the appropriate capital levels that should accompany that exposure.

[11] The interest-rate shock also adversely impacted the value of bank loans. Flannery and Sorescu (2023) and Jiang et al. (2024). examine the overall impact of interest-rate risk on bank balance sheets.

on mortgages. Basel III and, in many countries, macro-prudential policies are now in place to guard against systemic crises due to excessive credit risk.

However, the potential for systemic crises that are triggered by interest-rate risk is underestimated. Analogous to the current crisis, a third banking crisis occurred in the late 1970s and early 1980s, when a sharp rise in interest rates caused massive losses and, ultimately, the failure of more than 1,000 thrift institutions (savings & loan associations and savings banks) that had invested heavily in fixed-rate residential mortgages.[12] That episode is commonly known as the "S&L Crisis."[13] During that episode (similar to 2022) losses on bank investments were incurred in a period of rapidly rising interest rates caused by the Federal Reserve's policies to fight inflation.[14] Further (and again similar to 2022), a majority of the losses then were due to long-dated mortgage loans, which in this case were held in portfolio. When interest rates rise, long-dated assets, including bonds and bond-like investments (e.g., municipal bonds, fixed-rate mortgages, and securities that are backed by such mortgages) lose value. As banks write down their investments in such assets, their capital is depleted, triggering runs; when banks' write-downs exceed their equity capital, bank regulators are forced to step in and close those banks.[15]

Due to the known perils of interest-rate risk, banks shifted away from holding mortgages in portfolio. Despite this and precisely due to their interest-rate risk, banks' exposure to long-dated assets, and particularly RMBS, played an important but previously undocumented role in the March 2023 bank failures.

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[12] Thrift institutions were required by law to invest a substantial proportion of their assets in real-estate-related assets, including mortgages and mortgage-backed securities.

[13] In an internet appendix, we provide a detailed discussion of the parallels between the S&L Crisis and the 2022 – 2023 banking crisis.

[14] From 1977–1981, the Federal Reserve Board (FRB) raised the benchmark Federal Funds Rate (FFR) from less than 5% to almost 20%. During 2022–2023, the FRB raised the FFR from around zero to above 5% at the fastest pace in the history of the FRB.

[15] Liquidity issues contribute to bank fragility, as we discuss below.

While the series of events during 2023 leading to bank failures is now widely acknowledged, the literature has not identified the role of bank, investor, and regulatory actions (or lack thereof) in how these losses occurred—particularly in the light of information that was readily and publicly available. In this study, we address this void in the literature.

First, we contribute to the "reaching for yield" literature by examining the degree to which duration risk increased in the run-up to the 2023 crisis and the extent to which banks modified their portfolio allocations into longer duration assets. We show the salience of reaching for yield during Covid, as in previous low-interest-rate periods. We find that between 2019 and 2021 banks increased their holdings of debt securities -- especially long-dated securities – by more than 50%. Increased holdings of RMBS accounted for half of the overall increase in banks' securities holdings.

The literature on reaching for yield shows that banks increase the duration of their securities investments when yields are low, attributing this to banks' efforts to boost cash flow. The recent literature offers an alternative explanation. Most prominently, Drechsler et al. (2021) develop a model that shows that the low "deposit beta"[16] on deposit withdrawals implies that banks earn a higher spread between the rate that they pay on deposits and the rate that they can receive on investing those deposits as rates rise. To hedge against lower cash flows in low-interest-rate environments, banks increase their exposure to long-duration securities investments.

DeMarzo et al. (2024) on the contrary show that whether this is an effective hedge against franchise value shifts depends on whether banks' franchise value has negative duration, which they argue is not the case.[17] Nonetheless, regulatory guidance and banks' own

[16] The "deposit beta" is the sensitivity of a bank's deposit rate to changes in short-term market interest rates.
[17] Whether franchise value has a positive or negative duration depends on operating costs as a share of cash flow as well as on the estimated betas on deposit withdrawals, as will be discussed further in the literature review below.

expectations may be based on this belief, which thus explains the observed lengthening of securities investment duration.

Second, we identify the losses incurred by type of security as a consequence of the sharp increase in interest rates that began in March 2022. We find that, as of year-end 2024, RMBS accounted for over 70% of the embedded securities losses present in U.S. banks.

Third, we test for the new importance of noninsured deposits in bank behavior. Banks with a larger share of uninsured deposits are more "flighty" and more illiquid.[18] We find that banks that were more subject to illiquidity were more likely to reach for yield. We show that securities losses as a share of assets increased with bank illiquidity, as measured by share of uninsured depositors.

Fourth, we contribute to the market-efficiency research literature by examining equity-market responses to the prior risk-taking by banks on their balance sheets when SVB announced its losses and was closed during March 2023. We determine the extent to which equity markets recognized: (i) interest-rate risks in banks' securities portfolios; (ii) banks' liquidity risks due to the presence of (runnable) uninsured deposits; and (iii) the embedded security-portfolio losses that were present for banks that had earlier reached for yield. By doing so, we test for whether, and the degree to which, equity markets generally recognized banks' exposures to these three major categories of risk.

[18] The fragility of banks with large unrecognized losses is also due to accounting rules. Banks are subject to the risk that long-dated securities may need to be transferred at a loss from "hold to maturity" (HTM) to "available for sale" (AFS) assets. Such banks may have an additional motive to "reach for yield." These losses are "unrecognized," due to standard accounting rules that allow a bank (for reporting on its balance sheet) to value on an amortized-acquisition-cost basis its debt securities that the bank intends to hold to maturity (HTM). Banks are also required to report in footnotes those HTM securities' current market values. Most other securities (except for those that are categorized as "Trading" and are fully marked to market) are categorized as "available for sale" (AFS) and are marked to market for the bank's balance sheet but not for earnings reports nor for regulatory capital measurements. The difference between the acquisition-cost value and the current market value for these HTM and AFS categories are the "unrecognized" losses. See Kim et al. (2023).

We implement this test by identifying how equity investors responded to the failure of Silicon Valley Bank (SVB)—which was the first very public manifestation of these losses. We estimate publicly traded bank holding companies' abnormal returns around SVB's March 10, 2023, failure. Next, we regress these abnormal returns against measures of banks' exposures to uninsured deposits, unrealized securities' losses, and repricing risk. We find that only the liquidity risk from uninsured deposits was priced by equity investors.

2. Background

There was no 2020 or 2021 banking crisis in response to the Covid-19 pandemic. During 2020, unemployment spiked to nearly 15% and remained elevated for several months, and GDP declined for several quarters; but the Federal Government propped up consumers, businesses, and the U.S. economy with massive funding from a wide array of relief programs. As shown in Figure 2, this fiscal stimulus resulted in $6 trillion in deficit spending during 2020 and 2021, rising by an additional $3 trillion, into 2022 and 2023 as the economy strongly rebounded.

When the pandemic began during early 2020, the Fed responded by cutting its policy rate from about 2.5% to near zero (0% - 0.25%). The Fed also injected money into the economy through the purchase of debt securities; the Fed's holdings of securities rose by almost 120%, from $3.8 trillion in Feb. 2020 to $8.3 trillion in Dec. 2021.[19]

As shown in Figure 5, rising inflation followed. Initially, inflation was viewed as "transitory," and the hope was that it would quickly subside. Instead, it accelerated during the first half of 2022, peaking at 9.1% (on a year-over-year basis for the consumer price index [CPI]) in June. This forced the Fed to act in a decisive manner.

[19] Fed securities holdings peaked at $8.5 trillion in May 2022 and since then steadily declined to $6.5 trillion at the end of 2024. See: https://fred.stlouisfed.org/series/WSHOSHO.

As shown in Panel A of Figure 6, beginning in March 2022, the Fed raised the target Federal Funds Rate from 0.08% to 3.25% in September 2022 and to 5.33% in August 2023. This was the fastest rate increase in the Fed's history. As shown in Panel B of Figure 6, the Treasury-bond market already had been responding to rising inflation during 2021. The yield on the 10-Year Treasury bond had risen from a low of 0.5% in August 2020 to 2.0% before the first Fed rate hike in March 2022. Subsequently, it rose to a high of 5.0% in October 2023, fell to as low as 3.6% in September 2024 and then oscillated between 4.0% and 4.8% through mid-2025. Residential mortgage rates for 30-year fixed-rate mortgages (as reported by Freddie Mac[20]) rose from a low of 2.77% (in the week of 8/5/2021) to 4.67% in March of 2022 and to a peak of 7.79% in the week of 10/26/2023 before falling to around 6.25% in late 2025.y.[21]

The deposit inflows amounted to more than $5 trillion, of which about $2 trillion went into cash and $2 trillion into securities, with a far lesser amount -- $0.7 trillion -- invested in loans. The amount of long-dated investment securities held by banks increased by more than half -- from $3.9 trillion in 2019 to $6.2 trillion in 2021.While a massive increase in bank deposits, shown in Figure 3, was inevitable, the share placed into long-dated assets was a bank choice, and a decision that was subject, at least in principle, to regulatory oversight.[22]

We examine losses by type of security–losses that were predictable as observable risk exposure increased. Table 1 shows unrealized losses by type of investment security as of Q4 2024. The bank Call Reports provide details on seven categories of securities, which we have consolidated to five: Treasury securities; municipal government securities (Munis); residential

[20] See https://www.freddiemac.com/pmms/docs/historicalweeklydata.xlsx .
[21] The rate was 6.26% in the week of September 18, 2025.
[22] During 2020, total deposits grew by more than $3 trillion: from $13 trillion to $16 trillion. During 2021, deposits grew by another $2 trillion to $18 trillion. Banks invested more than $2 trillion of these $5 trillion in deposit inflows into various types of securities. As is shown in Figure 4 (and in Appendix Table A-4), much of this increase was in the form of banks' larger holdings of RMBS and Treasuries.

mortgage-backed securities (RMBS); commercial mortgage-backed securities (CMBS); and all other debt securities (ODS).

As of year-end 2024, RMBS accounted for 46.6% of the $5.76 trillion in total securities, and for 70.4% of the $482 billion in unrealized losses. Treasuries accounted for 26.2% of total securities, but for only 11.5% of unrealized losses. Munis accounted for 5.6% of total securities but for 6.6% of total losses. CMBS accounted for 7.2% of total securities and for 7.0% of losses. ODS accounted for about 14.5% of total securities but for only about 4.6% of total losses. Hence, we see that RMBS disproportionately accounted for losses, while Treasuries, the second largest securities investment after RMBS, were under-represented among losses. More than three years later, the unrealized losses that initially occurred during 2022 largely remain on bank balance sheets.

3. Literature Review

Banks intermediate both credit risk and interest-rate risk.[23] The literature shows that banks take on *additional* investment risks to boost returns in low interest-rate environments. (Borio and Zhu, 2012; Silverstein and Cole, 2023; Vickery et al., 2024). Financial risk taken by financial intermediaries negatively affects the general financial stability of the banking sector (Claessens et al., 2017; Hanson and Stein, 2015; Jiménez et al., 2014; Rajan, 2006).

The literature refers to this increase in risk-taking as "reaching for yield" and identifies its occurrence through measures of bank asset duration, showing that this typically arises in

[23] The fundamental risk-management strategy using duration measures is to match the interest-rate sensitivities of assets and liabilities (while respecting future liquidity needs) so as to reduce interest-rate risk. This type of interest-rate-risk management reduces overall firm risk and is used by financial intermediaries (Babbel and Klock, 1994; Lamm-Tennant, 1989; Leibowitz, 1986; Bookstaber and Gold, 2015). Diamond and Dybvig (1986), the foundational work, establishes the risks associated with maturity transformation.

prolonged low-rate environments, which distort the economics of disintermediation (Rajan, 2006; Diamond & Rajan, 2009; Campbell & Sigalov, 2022; Drechsler et al., 2018; Grimm et al., 2023; Jimenez et al., 2014; Maddaloni & Peydró, 2010; Paligorova et al., 2017). In line with the literature, we use the weighted average repricing maturity as a proxy for banks' asset duration (Drechsler et al., 2021; Jiang et al., 2024).[24]

Cole and Silverstein (2023) document the increasing duration gap of banks during the 2020 pandemic. McPhail et al. (2023) show that U.S. banks did not use interest-rate swaps to offset their interest-rate risks. Vickery et al. (2024) document that even the largest banks—those required to file detailed Y14 data to regulators—did not hedge. Jiang et al. (2024) show the aggregate embedded losses as of Q1 2023 due to interest rate increases and the degree to which bank fragility as measured by uninsured deposits contributed to such losses.[25] Their estimate of $2.2 trillion in total embedded losses is an amount that is almost equal to the entire banking industry's $2.4 trillion in equity capital as of year-end 2024.[26] Flannery and Sorescu (2023) estimate embedded interest-related losses as of year-end 2022 at $623 billion for securities and $466 for loans, totaling almost $1.1 trillion. They calculate that almost half of all banks would fail to meet regulatory capital requirements if these unrealized losses were recognized.

[24] The duration measure of a security is an accurate measure of the interest-rate risk (sensitivity) embedded in a security and can be used to quantify interest-rate risk (Bierwag, 1977; Bierwag et al., 1983; Reitano, 1992; Mantilla-Garcia et al., 2022).
[25] Haddad et al. (2023) show that, when interest rates are high, uninsured deposits are prone to runs.
[26] Since debt securities are about one quarter of bank assets, the unrealized investment security losses that we report align with the loss estimates of Jiang et al. (2024).

The literature has suggested the potential for banks' interest-rate risk to be concentrated in agency RMBS and Treasury securities (Fuster and Vickery, 2018).[27] Both types of securities allow banks to extend the duration of their security portfolios without incurring credit risk.[28,29]

We contribute to the literature by estimating the increase in duration risk and by showing the role of reaching for yield in the run-up to the 2023 banking crisis and showing how much of this increase in interest rate risk was due to investment in RMBS, the pure interest rate asset. [30]

How markets recognize the interest-rate, prepayment, and liquidity risks taken by individual banks that reach for yield is not well understood. There is a long literature on the opaqueness and difficulty of pricing bank portfolio risk (e.g., Morgan, 2002). Nonetheless, English, Van den Heuvel, and Zakrajsek (2018) use high-frequency intraday stock return data of bank holding companies (BHCs) in an event study and find that the level and slope of the yield curve around the time of FOMC announcements are associated with a significant change in bank equity values. They also find evidence that FOMC announcements do provoke equity value

[27] While banks may also take on interest-rate risk in making whole-mortgage loans (both commercial and residential), these are generally made as part of customer cultivation and their business purpose to evaluate risk and extend loans based on this risk, as well as to extend lending based on local risk and their knowledge of local and regional markets. Banks may seek additional risk premiums in the $4.0 trillion municipal bond market in a reach for yield. However, municipal bonds are generally federal and state tax exempt and are issued as serial maturities, which means that banks can use them to match maturity risk. Community and regional banks may extend loans that are in the form of bonds that are issued by local (municipal) borrowers, based on the banks' knowledge of local and regional markets, as they do with mortgages.

[28] The risk is entirely interest-rate risk stemming from these securities' long durations, augmented (for RMBS) by prepayment risk that comes with the optionality of the standard American mortgage (Green and Wachter, 2005). RMBS consist almost entirely of "agency" securities (which are those that are issued by Fannie Mae, Freddie Mac, and Ginnie Mae) and therefore have no default (credit) risk, as they are implicitly or explicitly insured by the Federal government (Wachter, 2018).

[29] The additional compensation for bearing prepayment risk makes RMBS attractive for banks seeking yield beyond that offered by Treasuries (Becketti, 1989; Diep, Eisfeldt, and Richardson, 2021)The prepayment risk embedded in agency RMBS causes them to have negative convexity, bringing higher yield, while posing additional risk-management considerations for yield-seeking banks (Duarte, Longstaff, and Yu, 2007; Hanson, Shleifer, Stein and Vishny, 2015; Aytek, Mueller, Vendolin, and Venter, 2016). Unlike Treasury securities, as interest rates rise, the embedded prepayment risk will cause the duration of the RMBS to increase (interest-rate related price risk) as the likelihood of prepayments falls when rates rise. Similarly, mortgage borrowers may exercise their right to prepay as rates fall, lowering the RMBS's duration.

[30] The Jiang et al. (2024) estimate does not identify the disproportionate role of RMBS as they focus on median bank losses as seen in their Table 1.

changes, showing that when salient, investors do price risk. We add to this literature with an event study that tests whether bank equity values responded to embedded interest rate losses with the announcement of the SVB takeover.

4. Data and Methodology

4.1 Data

The data we use come from the Federal Financial Institutions Examination Council (FFIEC) Reports of Condition and Income, commonly referred to as the "Call Reports." These data are the publicly available quarterly financial reports that U.S. banks are required to file with their regulatory agencies.[31] In addition to these data, we also use data from the Center for Research in Security Prices (CRSP), for stock return data for the subsample of publicly traded bank holding companies (BHCs). To match bank regulatory data with CRSP stock price data, we use the Federal Reserve Bank of New York's CRSP-FRB link table.[32]

The bank-level variables that we employ in our analyses are sometimes expressed as levels, or ratios with respect to the bank's common equity, or ratios to total assets. In regressions, we use the natural logarithms of the bank-level variables when we use levels. We limit the effects of outliers by winsorizing the data at the 0.01 and 0.99 levels, for each quarter-year of the sample period.

[31] These data are publicly available for download from the FFIEC's central-data-repository website: https://cdr.ffiec.gov/public/PWS/DownloadBulkData.aspx.

[32] These links are utilized to obtain the subsample of BHCs that fit our research design. We select those BHCs with pricing data that match our sample period and conduct further analysis to ensure accurate matching between bank regulatory data and stock-market pricing data. This link table is available from the website of the FRB-New York: https://www.newyorkfed.org/research/banking_research/crsp-frb

4.2 Methodology

We identify the sources of unrealized losses on banks' securities portfolios and the timing of the market's recognition of these losses. First, we show the increase in bank' securities portfolios from Q1 2017 through Q2 2023 and the evolution of losses on those securities portfolios during the same period. We then compare banks with high- and low-unrealized losses on their securities portfolios and show what types of bank assets were disproportionately present in the portfolios of the high-loss group of banks relative to the low-loss group of banks.

We utilize regression models to provide evidence on the determinants of banks' unrealized securities losses. We estimate a set of OLS regressions where the dependent variable is the natural logarithm of the unrealized securities losses (for bank *i* as of year-end 2024) and the explanatory variables are the natural logarithms of that bank's portfolio allocations of its securities assets as of year-end 2021 to different types of securities:

$$\ln(loss_i) = \beta_0 + \beta_1 \ln(treasec_i) + \beta_2 \ln(munisec_i) + \beta_3 \ln(rmbs_i) + \beta_4 \ln(cmbs_i) + \beta_5 \ln(othdsec_i) + e_i \quad (1)$$

where:

$loss_i$ is the unrealized dollar-amount security losses of bank i as of year-end 2024;

$treasec_i$ is the dollar amount of Treasury securities held by bank i as of year-end 2021;

$munisec_i$ is the dollar amount municipal securities held by bank i as of year-end 2021;

$rmbs_i$ is the dollar amount residential mortgage-backed securities (RMBS) held by bank i as of year-end 2021;

$cmbs_i$ is the dollar amount of commercial mortgage-backed securities (CMBS) held by bank i as of year-end 2021;

$othdsec_i$ is the dollar amount of other debt securities held by bank i as of year-end 2021; and

e_i is an i.i.d error term.

In our main regressions, we first measure banks' unrealized losses as of December 31, 2024,[33] and their securities portfolio allocations as of year-end 2021 (prior to the FOMC rate hikes that began in March 2022). For robustness, we measure each of our explanatory variables at two additional points in time -- as of year-ends 2020 and 2019 -- so as to capture the banks' portfolio allocations at even earlier dates.[34]

4.3 The Market Reaction to the Failure of Silicon Valley Bank

We test for whether the major declines in bank stock values that occurred around the failure of Silicon Valley Bank on March 10, 2023, reflect the disproportionate losses of banks that were heavily exposed to interest-rate risk and to uninsured deposits. First, we estimate the abnormal returns around the SVB failure date by regressing daily stock returns for publicly traded bank holding companies (BHCs) against the returns on the S&P 500 market index. We estimate abnormal returns by two methods: a one-factor (CAPM) model, and a three-factor Fama-French model.

Next, we use the daily abnormal returns (ARs) from these two regression models as the dependent variable in a second-stage "difference-in-differences" analysis where the failure of SVB is our exogenous shock. We split our sample of publicly traded bank holding companies (BHCs) into three groups: (i) upper and lower quartile repricing maturity;[35] (ii) upper and lower

[33] For robustness, we also measure the banks' losses as of year-end 2023 and year-end 2022. These results appear in our internet appendix.

[34] Losses in these regressions are represented as positive numbers. Where a bank's securities losses were zero or there were net gains (which would be a negative number in our formulation), we instead substitute the value "1". As shown in Appendix Table A-2, there were less than 100 banks for which losses were non-negative in each of these measurement periods. For robustness, we also estimate a series of inverse hyperbolic sine regressions, which do not require a transformation for zero or negative values. The results of these hyperbolic sine regressions are quite similar to our base-case log-log regressions and are available from the authors upon request.

[35] We estimate repricing maturity using the bank Call Report data, which allocates securities into maturity "buckets." We use the midpoints of each maturity bucket and calculate a weighted average maturity for each bank each quarter.

quartile ratios of uninsured deposits to total deposits; and (iii) upper and lower quartile ratios of unrealized securities losses to total assets.

5. Results

5.1 Univariate Analysis

5.1.1 Evolution of Bank Securities Portfolios during 2017 – 2024

Panels A – C of Figure 7 document the evolution of bank total securities portfolios as percentages of "common-equity Tier 1" (CET1) capital and of total assets by bank size during the period 2017 Q1 through 2024 Q4. Panel A presents the evolution for banks with less than $10 billion in assets, which account for more than 95% of the approximately 5,000 commercial banks operating in the U.S. during this period but only 15 percent of bank assets. From 2017 Q1 through 2020 Q1, we see a steady decline in the size of the securities portfolio relative to both capital and assets. Once the pandemic hits in 2020 Q1, the size of the securities portfolio rises sharply -- from 18% of assets to 24% of assets -- each quarter through 2022 Q1, when the FOMC announces the first increase in its target Federal Funds Rate. From 2022 Q1 through 2024 Q4, the size of the securities portfolio falls from 24% of assets to 20% of assets.

Panel B presents the evolution for the approximately 150 banks with $10–100 billion in assets that account for about 15% of aggregate bank assets. From 2017 Q1 through 2020 Q1, we again see a steady decline in the size of the securities portfolio relative to both capital and assets. Once the pandemic hits in 2020 Q1, the size of the securities portfolio rises sharply each quarter through 2022 Q1—from 18% of assets to 22% of assets. From 2022 Q1 through 2023 Q4, the size of the securities portfolio falls from 22% of assets to 19% of assets.

Panel C presents the evolution for the approximately 40 banks with more than $100 billion in assets that account for about 70% of aggregate bank assets. From Q1 2017 through Q1

2020, we again see a steady decline in the size of the securities portfolio relative to both capital and assets. Once the pandemic hits during Q1 2020, the size of the securities portfolio rises sharply each quarter through Q1 2022—from 21% of assets to 26% of assets. From 2022 Q1 through 2024 Q4, the size of the securities portfolio falls from 26% of assets to 22% of assets.

Because RMBS account for about 70% of the unrealized securities losses, we repeat this analysis in Panels A – C of Figure 8 but focus on the evolution of bank RMBS portfolios as percentages of "common-equity Tier 1" (CET1) capital and of total assets by bank size during the period 2017 Q1 through 2024 Q4. The findings are qualitatively similar to what we document in Figure 7.

5.1.2 Evidence on "Reaching for Yield" During the Pandemic

In line with the recent banking literature, we calculate the weighted-average repricing (in years) as a proxy for the duration of banks' securities portfolios (Drechsler et al., 2021; Jiang et al., 2024). This widely used measure of interest-rate risk captures how responsive are the values of securities to movements in interest rates.

Figure 8 shows the estimated duration/repricing (in years) of bank security portfolios for small banks (< CRA Breakpoint,[36] ~ $1.34 billion), medium banks (> CRA Breakpoint & < $100 billion), and large banks (> $100 billion) for each quarter during the period 2018 - 2024. CRA breakpoint is adjusted each year for inflation from $1 billion as of 2005. (Appendix Tables A-3.1 – A-3.4 present this information in tabular format by year.) All three groups begin to increase duration during 2019 and continue through 2021—just before the FOMC began raising the Fed Funds Rate in Mar. 2022—but starting from different levels. Small banks started at about 6.5

[36] This is the Community Reinvestment Act threshold for "large" banks.

years and peaked at more than 8.0 years; medium banks started at about 7.5 years and peaked at about 9.5 years; and large banks started at about 8.5 years and peaked at about 10.0 years. Once the FOMC began raising rates, each group began reducing its duration and continued to do so through 2023; small banks fell to around 7.0 years; medium banks to about 8.5 years; and large banks to about 9.0 years.

5.1.3 Evolution of Unrealized Gains/Losses on Bank Securities Portfolios during 2017–2023

Panels A – C of Figure 9 document the evolution of the percentage of unrealized gains/losses on bank securities portfolios by type of security and bank size during the period Q1 2017 through Q2 2023. In each panel, we show the percentage of gains/losses on the total securities portfolio and on each of the four components – Treasuries, Munis, RMBS, and CMBS – where the largest losses occurred. Panels A, B, and C present the evolution for banks with less than $10 billion in assets, $10 billion to $100 billion in assets, and $100 billion to $250 billion in assets, respectively.

In general, the three charts are very similar; consequently, we focus our discussion on the largest banks. From Q1 2017 to Q3 2018, there were losses on each of the four types of securities, reaching 3% of the securities portfolio. These reversed from Q3 2018 through Q2 2020.and turned into a percentage gain of about 4%. From Q2 2020 through Q4 2021, these gains were erased. From Q4 2021 to Q3 2022, losses accelerated to -10% and then recovered slightly from Q3 2022 to Q2 2023 but remained down by 9%. By type of security, losses were greatest on RMBS (-11%) and CMBS (-10%) and smallest on Treasuries (-6%) and municipal securities (-7%).

5.1.4 Descriptive Statistics on Unrealized Securities Losses and Bank Holdings

Table 2 presents descriptive statistics for our sample of 4,542 banks based on the financial data that they provided to their regulators as of December 31, 2024. Panel A presents dollar values, while Panel B presents percentages of total assets. Focusing on the latter, we see that the average bank reported unrealized securities losses equal to 2.0 percent of total assets with a range from a gain of 1.5 percent to a loss of 20.0 percent.[37] On average, banks invested 2.8 percent of assets in Treasuries, 6.5 percent in Munis, 7.0 percent in RMBS, 1.0 percent in CMBS, and 5.1 percent in all other debt securities.

5.1.5 Evidence on Bank Losses by Asset Size

Table 1 of Jiang et al. (2024) presents the median share of unrealized losses on bank securities (classified into two groups of securities—RMBS and "Treasury and Other") as a percentage of unrealized losses on all assets. These shares indicate that, for all banks and for small banks, more than half of the unrealized losses on securities were attributable to "Treasury and Other." For large banks, however, median losses on RMBS were more than five times that of losses on "Treasury and Other."

We think that these statistics are incomplete for two reasons. First, they are based upon medians rather than averages. Second, the category "Treasury and Other" pools six different Call Report categories of securities—Treasuries, Munis, CMBS, ABS, GSE, and "other debt securities" (primarily corporate bonds). Hence, in Figure 10, we provide a more granular

[37] It is important to keep in mind that these unrecognized losses are reported by banks only for their securities portfolios. It is likely that other long-dated loan assets of banks—such as residential mortgage loans ("whole loans") and commercial real estate mortgage loans—experienced decreases in values that are comparable to the reported losses on securities; but banks are not required to compute or report the unrecognized losses on these direct mortgage loans. Jiang et al. (2024) estimate that the overall mark-to-market losses on all bank assets as of Q1 2023 were about $2.2 trillion, which was about four times the size of the reported aggregate unrealized losses on just the banks' securities.

analysis, breaking down unrealized losses on securities into five major categories: RMBS, Treasuries, Munis, CMBS, and "other," which we define as ABS, GSE, and "other debt securities." We do this for essentially the same three bank size groups as do Jiang et al. (2024) -- community banks (< CRA Breakpoint, ~ $1.34 billion), regional banks (> CRA Breakpoint & < $100 billion), and large banks (> $100 billion).

For all banks, RMBS account for 65% of unrealized losses. Among the remaining 35% of losses, Treasuries account for 14%, while Munis account for 6%, CMBS for 8%, and "other" for 7%.

For community banks, RMBS account for only 38% of unrealized losses. Among the remaining 62% of losses, Treasuries account for only 6%, while Munis account for 31%, CMBS for 5%, and "other" for 20%. Community banks account for only 6% of the total unrealized losses of $478 billion.

For regional banks, RMBS account for 57% of unrealized losses. Among the remaining 42% of losses, Treasuries account for only 5%, while Munis account for 13%, CMBS for 12%, and "other" for 13%. Regional banks account for 21% of the total unrealized losses of $478 billion.

For large banks, RMBS account for 70% of losses. Among the remaining 30% of losses, Treasuries account for 18%, while Munis account for 2%, CMBS for 6%, and "other" for 4%. Large banks account for 73% of the total unrealized losses of $478 billion, with one bank (Bank of America) accounting for more than $101 billion.

5.1.6 Differences in Means

Table 3 presents differences in means for two groups of banks based upon the median ratio of unrealized securities losses to assets for Q4 2024. The difference in means is statistically

significant at better than the 0.1 percent level for every variable in the table. The average allocation of assets to Treasury securities for high-loss banks was 2.2 percent while it was 3.3 percent for low-loss banks. For Munis, the average allocation by high-loss banks was 10.6 percent but 2.5 percent for low-loss banks. For RMBS, the average allocation by high-loss banks was 11.1 percent but 3.0 percent for low-loss banks. For CMBS, the average allocation by high-loss banks was 1.5 percent but 0.5 percent for low-loss banks. And for All Other Debt Securities, it was 6.8 percent vs. 3.4 percent.[38]

5.2 Multivariate Analysis

5.2.1 Cross-Sectional Regression Analysis on Bank Losses

Table 4A presents the results from estimating a series of three ordinary-least-squares regression models where the dependent variable is the ratio of unrealized securities losses to total assets (as of December 31, 2024) and the explanatory variables are bank portfolio allocations of their assets to different types of securities measured as of three different points in time prior to the first Fed announcement of interest-rate increases in March 2022:[39] in the first column, the security allocations are as of 2021 Q4; in the second column, the security allocations are as of 2020 Q4; and in the third column, the securities allocations are as of 2019 Q4

In each of the three models, we include all five explanatory variables. In column 1, the coefficient on each of the five securities variables is positive and significant at better than the 0.001 level. The coefficients indicate the percentage increase in unrealized losses for a one

[38]Appendix Table A-5 shows the correlations among our analysis variables. In column 3 are the correlations of each security variable with the ratio of securities losses to assets. The positive correlations are highest for municipal securities (0.614), followed by RMBS (0.561), CMBS (0.228), and all other debt securities (0.255). The correlation between losses and Treasuries is negative and statistically significant: -0.106.

[39] As we report in the text below, regressions that involve alternative dates when the banks' losses are measured or when the banks' investment positions are measured yield qualitatively similar results.

percent increase in the securities variable. The coefficient on **lnrmbs** is 0.407, indicating that unrealized losses increase by 0.407% for each 1.0% increase in RMBS. The coefficient on **lnmunisec** is 0.194, indicating that unrealized losses increase by 0.194% for each 1.0% increase in RMBS. The coefficient on **lncmbs** is 0.105, indicating that unrealized losses increase by 0.105% for each 1.0% increase in CMBS. The coefficient on **lnothersec** is 0.161, indicating that unrealized losses increase by 0.161% for each 1.0% increase in all other debt securities. The coefficient on **lntreasec** is 0.046, indicating that unrealized losses increase by 0.046% for each 1.0% increase in Treasury securities.

As we go back in time to security allocations as of year-end 2020 (column 2) and year-end 2019 (column 3), the results are substantially the same. Each of the five securities variables remain positive and statistically significant at better than the 0.01 level. The explanatory power of the models, as measured by the adjusted R-squared, drops only slightly—from 0.86 in column 1 to 0.81 in column 2 and to 0.78 in column 3.[40]

In Table 4B, we repeat the analysis shown in Table 4A but split the sample into two subsamples based upon the median ratio of uninsured deposits to total equity capital. Most notable is our finding that the coefficient on **lnrmbs** is larger in magnitude for the banks with higher exposures of uninsured deposits and that the differences are statistically significant for 2021 and 2020. Thus, it was the banks that were more exposed to liquidity risks (with larger ratios of uninsured deposits) that took greater interest rate risks and subsequently experienced greater losses.

[40] In an Internet Appendix, we repeat the analysis in Table 4A but with loss data that are measured at two earlier dates and by bank size (relative to our base case of 2024 Q4): as of 2023 Q4 (Appendix Table A-6.1); and as of 2022 Q4 (Appendix Table A-6.2). Each of these regressions yields results that are qualitatively similar to those that we show in Table 4A and that we discussed in the text above.

5.2.2 Event Study Analysis of the Failure of Silicon Valley Bank

Regional bank stock prices were pummeled by the failure of Silicon Valley Bank (SVB). As shown in Figure 12, the S&P Regional Bank Index dropped by about 25%, whereas the overall S&P 500 Index barely reacted. The regional bank index then underperformed the overall market through the rest of 2023 and even through 2024, as concerns about the health of regional banks lingered.

To assess the impact of the failure of SVB, we examine daily abnormal returns for publicly traded bank-holding-company (BHC) stocks with less than $250 billion in assets sorted by interest-rate risk, embedded losses, and liquidity risk (as measured by the ratio of uninsured deposits to overall deposits).[41] These were the potential risks that led to the run by uninsured depositors at SVB, which then spread contagion to most of the publicly traded regional banks. Hence, we test for whether the abnormal returns were more negative for BHCs with greater exposures to these three categories of risks.

Our initial sample consists of 281 BHCs, from which we use the top and bottom quartiles sorted by interest-rate risk and liquidity risk to test the parallel-trend assumption. We define March 9, 2023, as the event date (day 0).[42] The estimation period to derive parameters for estimating the expected returns surrounding the SVB failure is 150 trading days before the event to 15 trading days before the SVB failure. A minimum of 90 days of non-missing daily returns is required for inclusion in the sample of abnormal returns. We then match the abnormal return data to the banks in each top and bottom quartile of the respective risk factor.

[41] We exclude the 15 BHCs with more than $250 billion in assets as we expect investors to consider these banks "too big to fail." However, as we show in Appendix Table A-7, when these large BHCs are included in the regressions, the results are quite similar.

[42] Because SVB was closed on March 10, 2023, and Signature Bank was closed two days later—March 12, 2023—we exclude both banks from all of the analyses in Figures 9 and 10 and in Table 6.

Figures 13 and 14 present the trends in average daily abnormal returns for the top and bottom quartiles of our sample of publicly traded bank holding companies estimated using the market model split by interest rate risk and liquidity risk, respectively.

Figure 13 plots abnormal returns for the two groups of banks based upon interest rate risk: those in the top (high interest-rate risk) and bottom (low interest-rate risk) quartiles of securities-repricing maturities reported for Q4 2022. For the high interest-rate-risk group, we see negative and highly significant abnormal returns of -4.0 percent on Thursday, March 9, and of -8.0 percent on Monday, March 13. Surprisingly, there was an insignificant abnormal return on March 10: the day that the FDIC closed SVB. For the low interest-rate-risk group, we see a negative and significant abnormal return of -4.0 percent (similar to the high interest-rate-risk group) on Thursday, March 9, and only -6.0% (as compared to the -8.0% for the high interest-rate-risk group) on Monday, March 13. Apparently, the market, on March 9, was sensitive to interest-rate risk generally but, on March 13, was differentiating between banks with high and low levels of interest-rate risk. We also calculate a *t*-test for statistically significant differences in the daily mean abnormal returns of the high and low interest-rate risk quartiles. We find a significant difference only on March 13.

Figure 14 also plots abnormal returns for two groups of BHCs but based upon liquidity risk: those in the top (high liquidity risk) and bottom (low liquidity risk) quartiles of the ratio of uninsured deposits to total deposits. For the high liquidity-risk group, we see negative and highly significant abnormal returns of -4.0 percent on Thursday, March 9, and of -9.9 percent on Monday, March 13. There was a small but significant abnormal return of -2.0 percent on March 10: the day that the FDIC closed SVB. For the low liquidity-risk group, we see a negative and significant abnormal return of only -2.1 percent on Thursday, March 9, of -1.9 percent on Friday, March 10, and only -5.6% on Monday, March 13. Clearly, the market was differentiating

between banks with high and low levels of liquidity risk on that Thursday and again the following Monday. We also calculate a *t*-test for statistically significant difference in the daily mean abnormal returns of the high and low liquidity-rate risk quartiles. We find a significant difference on both March 9 and March 13.

Finally, we conduct a "difference-in-differences" regression analysis of the abnormal returns during the 90 trading days before through the 15 trading days after the March 8, 2023, loss announcement by Silicon Valley Bank. The results are shown in Table 5. The dependent variable in models (1), (3), (5), and (7) is the BHC daily abnormal return estimated using the CAPM (multiplied by 100), while, in models (2), (4), (6), and (8), the dependent variable is the BHC daily abnormal return estimated using the Fama-French three-factor model (multiplied by 100). *Post SVB* equals one from March 9, 2023, through March 31, 2023, and zero before this period.

In columns (1) and (2), the focal explanatory variable is *High Int Risk*, which equals one if the repricing maturity of the BHC security portfolio was in the top quartile of all bank holding companies and zero otherwise (based upon December 31, 2022 Call Report data). In columns (3) and (4), the focal explanatory variable is *High Uninsured Dep*, which equals one if the percentage of uninsured deposits of the BHC was in the top quartile of all bank holding companies, zero otherwise (based upon December 31, 2022 Call Report data). In columns (5) and (6), the focal explanatory variable is *High Unrealized Losses*, which equals one if the unrealized security losses of the BHC security portfolio was in the top quartile of all bank holding companies and zero otherwise (based upon December 31, 2022 Call Report data).

In the subsequent six columns of Table 5—columns (7) through (12)—we include alternative pairings of our three categories of potential explanations for market reactions to the

events around March 8, 2023. Finally, in columns (13) and (14) we include all three categories simultaneously.

There are a number of results that emerge clearly from Table 5: First—and most important for our purposes—only high liquidity risk (as measured by *High Uninsured Dep*) was considered as an important (statistically significant) negative factor by the market – and only after March 8. This holds true when liquidity risk is alone on the RHS of the regressions, when liquidity risk is paired with either of the other two RHS variables, and when liquidity risk is included with both of the other RHS variables. The coefficients on liquidity risk are economically large, negative, and statistically significant across all of the regressions and are roughly consistent in magnitudes (averaging 25-30 basis points per day for 23 days) and significant in all of the regressions.

Second, although the market generally appeared to react unfavorably to high interest-rate risk after March 8, none of the *High Int Risk* coefficients in any of the regressions are statistically significant at the 5 percent level.

Third, the market appears to have been wholly uninterested in the embedded (unrealized) securities losses in the banks—both before and after March 8.[43] The *High Unrealized Losses* coefficients in all of the regressions are comparatively small and vary in sign, and the t-statistics are always comparatively small and lack statistical significance.

Fourth, the overall effect of the SVB announcement and subsequent closure were economically large, negative, and statistically significant, as can be seen in all of the regressions

[43] This is consistent with the well-known fact that the *unrealized* losses in SVB's securities portfolio exceeded its net worth by the third quarter of 2022, as was revealed in its 10-Q financial report for the third quarter that was publicly available as of November 2022. See, for example, Acharya et al. (2023) and Kim et al. (2023).

from the coefficients on the variable *Post SVB Failure*. The coefficients imply that returns were lower on average by 60 – 80 basis points per day for 23 days.

In summary, we find no evidence that equity-market investors priced interest rate risk or unrealized losses on securities but that they did (negatively) price banks' exposures to uninsured deposits during the period after SVB's failure.[44]

6. Summary and Conclusions

The bank-related events of the spring of 2023—when regulators closed three medium-size commercial banks in the United States, amid concerns about depositor runs and contagion and with substantial costs to the Federal Deposit Insurance Corporation (FDIC) —have focused policy attention on the oversight of U.S. commercial banks.

In this study, we first document the massive bank deposit inflows during the pandemic as the U.S. Government distributed trillions in pandemic-related transfer payments from the Treasury to the public. Much of this deposit funding was invested by the banks in securities. Second, we document how banks "reached for yield" by lengthening the duration of their securities portfolios." Third, we quantify the unrealized losses on these securities that resulted from the Fed's fastest tightening cycle in its history. These losses were the immediate consequence of the sharp increase in interest rates that began in the spring of 2022 together with prior decisions to take on and increase exposure to these assets, in the prior period of low but rising interest rates.

[44] Using a different methodology, Fischl-Lanzoni et al. (2024) find evidence that investors priced not only uninsured deposits but also unrealized losses on securities. Rather than estimate abnormal returns, they estimate post-SVB "betas" over the period March 1 – May 5, 2023, which also includes the failure of First Republic Bank (FRB) on May 1, 2023. We do not examine the period after March 15, 2023, because there are many potentially confounding events that occurred between the failures of SVB and FRB.

We focus on the reported embedded securities losses on banks' balance sheets as of year-end 2024. Using Call Report data, we show that these losses are positively associated with banks' holdings of residential mortgage-backed securities (RMBS), municipal bonds, and Treasury securities—but the losses are much more strongly associated for banks with the greatest RMBS holdings. Moreover, we find that the effect of RMBS on losses was greatest for banks with greater exposures to uninsured deposits – and thus to depositor runs. These losses rose with the FOMC announcements of increases in the Federal Funds rate, starting in March 2022.

Finally, using daily stock-price-return data, we test for whether markets recognized the potential losses of the banks that were heavily exposed to securities with embedded interest-rate risk and with unrecognized losses on their balance sheets, as well as exposures to liquidity risks from potential runs by uninsured depositors: We specifically test for whether the major decline in bank stock values that occurred around March 8, 2023 (when SVB first announced losses, which led to two days of massive depositor runs and to the bank's failure on March 10) reflected the potential losses of banks that were heavily exposed to interest-rate risk and to unrecognized losses as well as to the liquidity risks of potential withdrawals by uninsured depositors. We find that the financial markets did not respond to the potential losses of banks with larger securities exposures to interest-rate risk nor to banks' embedded securities losses from their earlier "reach-for-yield" investments. But the markets did respond to the potential withdrawals by uninsured depositors.

The banking problems of 2023 were not a rerun of the credit-risk banking difficulties of the late 1980s and early 1990s nor of the credit-risk banking problems of the late 2000s and early 2010s.

Instead, these problems are reminiscent of the interest rate risk problems of the S&L industry of the late 1970s and early 1980s: Too many banks in the early 2020s invested heavily in long-dated securities—especially RMBS—and then suffered large losses as a consequence of the general increase in interest rates that began in March 2022.

The massive unrealized security losses that have been present in the U.S. banking system since early 2022 are indicative of the large interest-rate "bets" that U.S. banks made in the low-interest-rate environment of 2020 and 2021—without (apparently) arousing substantial supervisory concerns. And the unrealized securities losses are a substantial understatement of the losses that banks have experienced on their longer-term loans more generally (Jiang et al., 2024).

Banks—in their publicly reported balance sheets and in their calculations of their "capital" for regulatory purposes—can ignore current values and report historical values if the bank declares that it has no intention of selling a security before that security matures. As part of the compromise in reporting rules that occurred in the 1990s, the current market values of these "held-to-maturity" securities must be reported in a publicly traded bank's financial statements—but not in the formally reported balance sheet itself nor in the calculation of regulatory capital.

It was this kind of practice that allowed SVB to portray itself as well capitalized (despite its embedded losses on its long-term securities holdings)—both on its publicly reported balance sheet and with respect to its regulatory capital—until a few days before it was closed by the FDIC. Nonetheless, the embedded losses were readily observable. However, markets did not respond to these easily observable losses – perhaps because the markets perceived that a bailout was on its way.

In the absence of market discipline, the all-the-more-important regulatory oversight was absent as well.

References

Acharya, V. V., Checcetti, S. G., Schoenholtz, K. L., & White, L. J. (2023). Underlying macroeconomic causes of recent banking stress. In Acharya, V.V., Richardson, M.P., Schoenholtz, K.L., & Tuckman, B., eds. *SVB and Beyond: The Banking Stress of 2023* (pp. 15-34) Stern, NYU.

Ang, A., Bhansali, V., & Xing, Y. (2010). Taxes on tax-exempt bonds. *Journal of Finance*, *65*(2), 565-601.

Arfaoui, J. & Harald Uhlig, H. (2025) Maturity risks and bank runs. NBER Working Paper 33955

Babbel, D. F., & Klock, D. R. (1994). Measuring the interest rate risk of property/casualty insurer liabilities. *Insurance, risk management, and public policy: Essays in memory of Robert I. Mehr* (pp. 49-74) Springer.

Bagley, J., Gissler, S., Hiteshew, K., & Ivanov, I. (2023). Pushing bonds over the edge: monetary policy and municipal bond liquidity. *Available at SSRN 4330602*.

Barr, Michael S. 2023. Review of the Federal Reserve's supervision and regulation of Silicon Valley Bank. Federal Reserve Board of Governors.

Becketti, S., & Sellon Jr., G. H. (1989). Has financial market volatility increased? *Economic Review-Federal Reserve Bank of Kansas City*, *74*(6), 17.

Bernanke, B. S., & Kuttner, K. N. (2005). What explains the stock market's reaction to Federal Reserve policy? *Journal of Finance*, *60*(3), 1221-1257.

Bierwag, G. O. (1977). Immunization, duration, and the term structure of interest rates. *Journal of Financial and Quantitative Analysis, 12*(5), 725-742.

Bierwag, G. O., Kaufman, G. G., & Toevs, A. (1983). Duration: Its development and use in bond portfolio management. *Financial Analysts Journal, 39*(4), 15-35.

Bookstaber, R., & Gold, J. (2015). In search of the liability asset. *Financial Analysts Journal, 71*(1), 18-28.

Borio, C., & Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism? *Journal of Financial Stability*, *8*(4), 236-251.

Cipriani, M., Eisenbach, T. & Kovner, A. (2025). Tracing bank runs in real time. FRB of New York Staff Report, (1104).

Claessens, S. (2017). Global banking: Recent developments and insights from research. *Review of Finance*, *21*(4), 1513-1555.

Curry, T., & Shibut, L. (2000). The cost of the savings and loan crisis: Truth and consequences. *FDIC Banking Review*, *13*, 26.

DeMarzo, P. M., Krishnamurthy, A., & Nagel, S. (2024). Interest Rate Risk in Banking. NBER Working Paper 33308.

Diamond, D., & Dybvig, P. (1986). Banking theory, deposit insurance, and bank regulation. *Journal of Business*, 59(1), 55-68.

Diep, P., Eisfeldt, A. L., & Richardson, S. (2021). The cross section of MBS returns. *Journal of Finance*, *76*(5), 2093-2151.

Drechsler, I., Savoy, A., and Schnabl, P. (2021). Banking on deposits: Maturity transformation without interest rate risk. *Journal of Finance*, 76(3), 1819-1876.

Duarte, J., Longstaff, F. A., & Yu, F. (2007). Risk and return in fixed-income arbitrage: Nickels in front of a steamroller? *Review of Financial Studies*, *20*(3), 769-811.

English, W. B., Van den Heuvel, S. J., & Zakrajšek, E. (2018). Interest rate risk and bank equity valuations. *Journal of Monetary Economics*, *98*, 80-97.

Federal Deposit Insurance Corporation. (2023). Options for deposit insurance reform. May 1.

Fischl-Lanzoni, N., Hiti, M., Kaplan, N. & Sarkar, A. (2024). Investor attention to bank risk during the spring 2023 bank run. *FRB of New York Staff Report*, (1095).

Flannery, M. & Sorescu, S. (2023). Partial effects of Fed tightening on U.S. banks' capital

(April 19, 2023). SSRN working paper, available at: http://dx.doi.org/10.2139/ssrn.4424139

Fuster, A., & Vickery, J. I. (2018). Regulation and risk shuffling in bank securities portfolios. *FRB of New York Staff Report*, (851).

Green, R., & Wachter, S. M. (2005). The American mortgage in historical and international context. *Journal of Economic Perspectives*, 19 (4), 93-114.

Gürkaynak, R. S., Sack, B., & Swanson, E. (2005). The sensitivity of long-term interest rates to economic news: Evidence and implications for macroeconomic models. *American Economic Review*, *95*(1), 425-436.

Hanson, S. G., Shleifer, A., Stein, J. C., & Vishny, R. W. (2015). Banks as patient fixed-income investors. *Journal of Financial Economics*, *117*(3), 449-469.

Hanson, S. G. & Stein, J. C. (2015). Monetary policy and long-term real rates. *Journal of Financial Economics*, *115*(3), 429-448.

Jiang, E. X., Matvos, G., Piskorski, T., & Seru, A. (2024). Monetary tightening and U.S. bank fragility in 2023: Mark-to-market losses and uninsured depositor runs? *Journal of Financial Economics*, *159*, 1-18.

Jiménez, G., Ongena, S., Peydró, J., & Saurina, J. (2014). Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? *Econometrica, 82*(2), 463-505.

Kane, E. J. (1989) *The S&L insurance mess: How did it happen*? Washington, DC. Urban Institute Press.

Kelly, S. & Rose, J. (2025). Rushing to judgement and the banking crisis of 2023. Federal Reserve Bank of Chicago Working Paper No. 2025-04.

Kick, T. K., Schaeck, K. & Nguyen, H. (2023). Interest rate risk regulation and bank lending: A regression discontinuity approach. *Available at SSRN 4811267*.

Kim, S., Kim, S., & Ryan, S.G. (2023). Expanding mark-to-market accounting for banks' debt investment securities and regulatory capital. In Acharya, V.V., Richardson, M.P., Schoenholtz, K.L., & Tuckman, B., eds. *SVB and Beyond: The Banking Stress of 2023* (pp. 137-159) Stern, NYU.

Koh, W.T., Mariano, R.S., Pavlov, A., Phang, S.Y., Tan, A.H.H. & Wachter, S.M. (2005). Bank lending and real estate in Asia: Optimism and asset bubbles. *Journal of Asian Economics*, *15*(6), 1103-1118.

Koont, N., Santos, T., & Zingales, L. (2024). Destabilizing digital 'bank walks.' NBER Working Paper 32601.

Lamm-Tennant, J. (1989). Asset/liability management for the life insurer: Situation analysis and strategy formulation. *Journal of Risk and Insurance*, 501-517.

Leibowitz, M. L. (1986). The dedicated bond portfolio in pension Funds—Part II: Immunization, horizon matching and contingent procedures. *Financial Analysts Journal, 42*(2), 47-57.

Longstaff, F. A. (2011). Municipal debt and marginal tax rates: Is there a tax premium in asset prices? *The Journal of Finance*, *66*(3), 721-751.

Malkhozov, A., Mueller, P., Vedolin, A., & Venter, G. (2016). Mortgage risk and the yield curve. *The Review of Financial Studies*, *29*(5), 1220-1253.

Mantilla-Garcia, D., Martellini, L., Milhau, V., & Ramirez-Garrido, H. E. (2022). Improving interest rate risk hedging strategies through regularization. *Financial Analysts Journal, 78*(4), 18-36.

McPhail, L., Schnabl, P. & Tuckman, B., 2023. Do banks hedge using interest rate swaps? (No. w31166). National Bureau of Economic Research.

Morgan, D. P. (2002). Rating banks: Risk and uncertainty in an opaque industry. *American Economic Review*, *92*(4), 874-888.

Rajan, R. G. (2006). Has finance made the world riskier? *European Financial Management, 12*(4), 499-533.

Reitano, R. R. (1992). Non-parallel yield curve shifts and immunization. *Journal of Portfolio Management, 18*(3), 36-43.

Sheng, A. (1996). Bank restructuring: lessons from the 1980s.

Silverstein, B., & Cole, R. A. (2023). Reaching for yield by commercial banks. *Available at SSRN 4592718*.

Vickery, J., Fuster, A., & Paligorova, T. (2025). Underwater: Strategic trading and risk management in bank securities portfolios. working paper (March 20, 2025). SSRN working paper, available at: https://dx.doi.org/10.2139/ssrn.4991701.

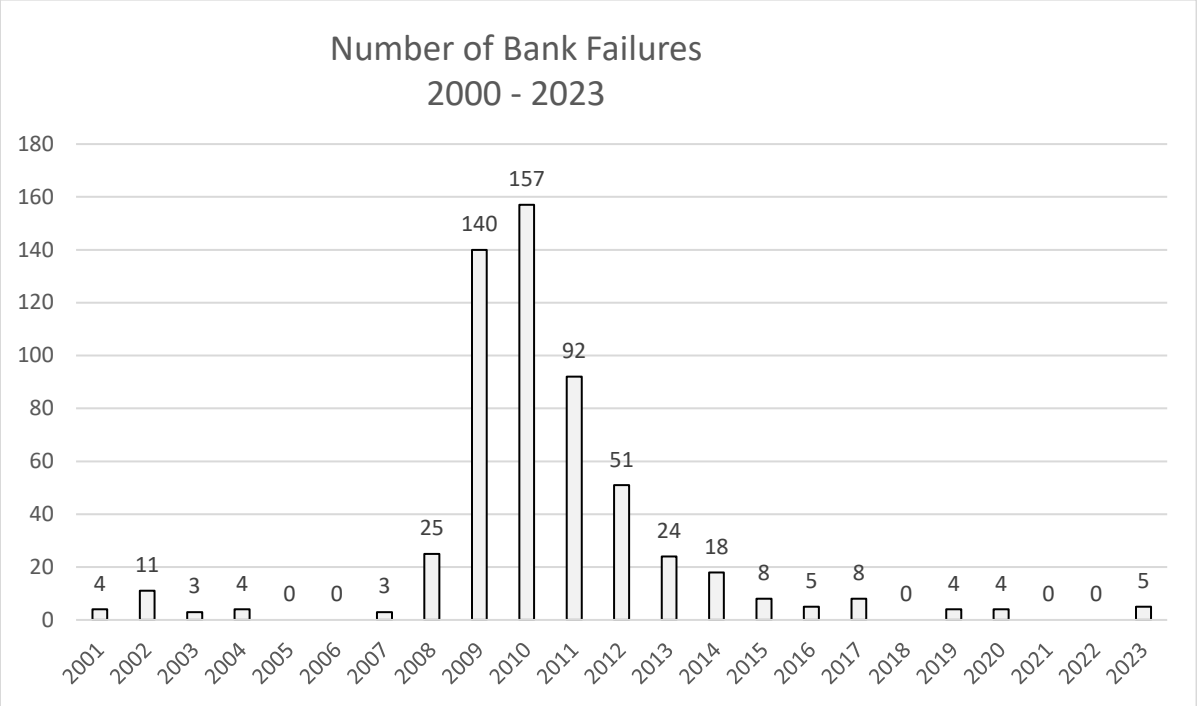
Wachter, S. M. (2018). Credit risk transfer, informed markets, and securitization. *Federal Reserve Bank of New York Economic Policy Review*, *24*(3), 117-137.

Wang, J., Wu, C., & Zhang, F. X. (2008). Liquidity, default, taxes, and yields on municipal bonds. *Journal of Banking & Finance*, 32(6), 1133-1149.

White, L. J. (1991). *The S&L debacle: Public policy lessons for bank and thrift regulation*. New York: Oxford University Press.

Tables and Figures

Figure 1:
Number and Assets of Failed U.S. Commercial Banks
2000–2023



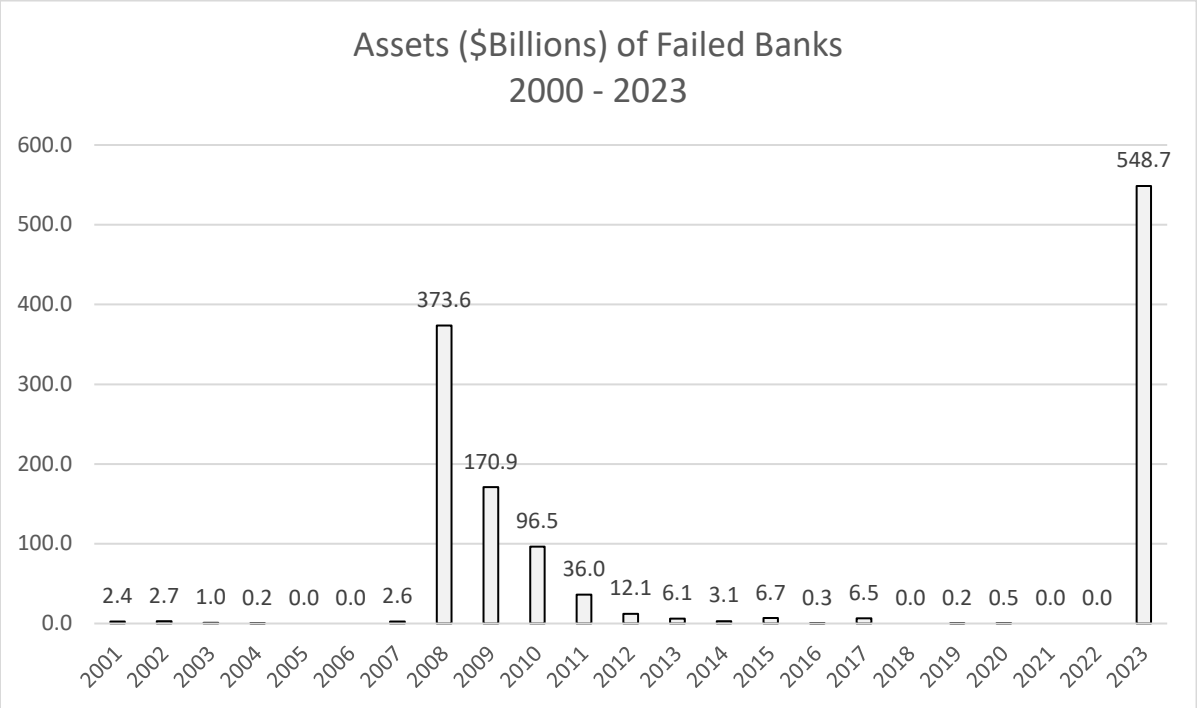
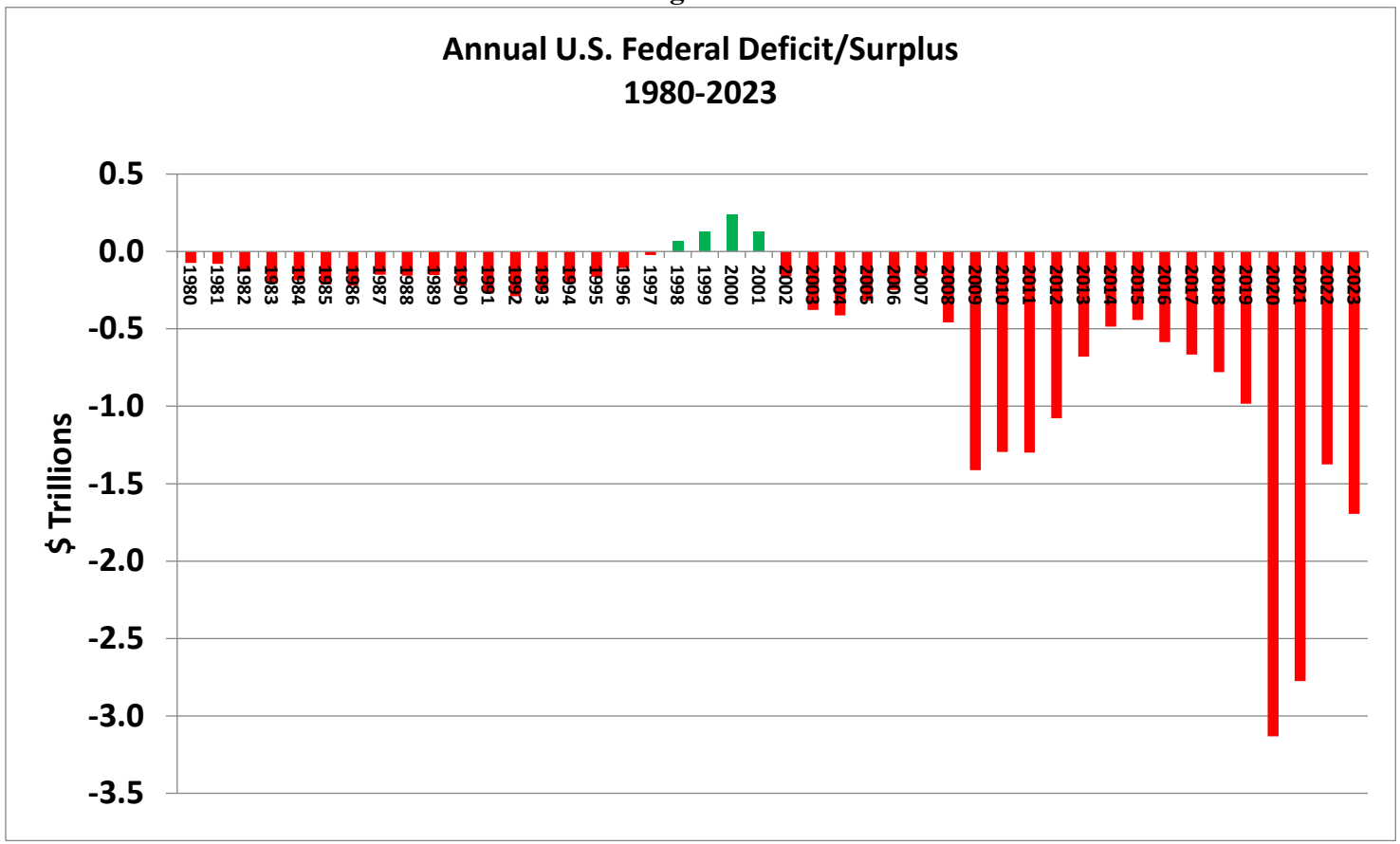


Figure 2:


Annual U.S. Federal Deficit/Surplus
1980-2023
$ Trillions
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
1980
1981
1982
1983
1984
1985
1986
1987
1988
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2022
2023

Figure 3:
Annual Change in Deposits and Securities Held by U.S. Commercial Banks
2011–2024

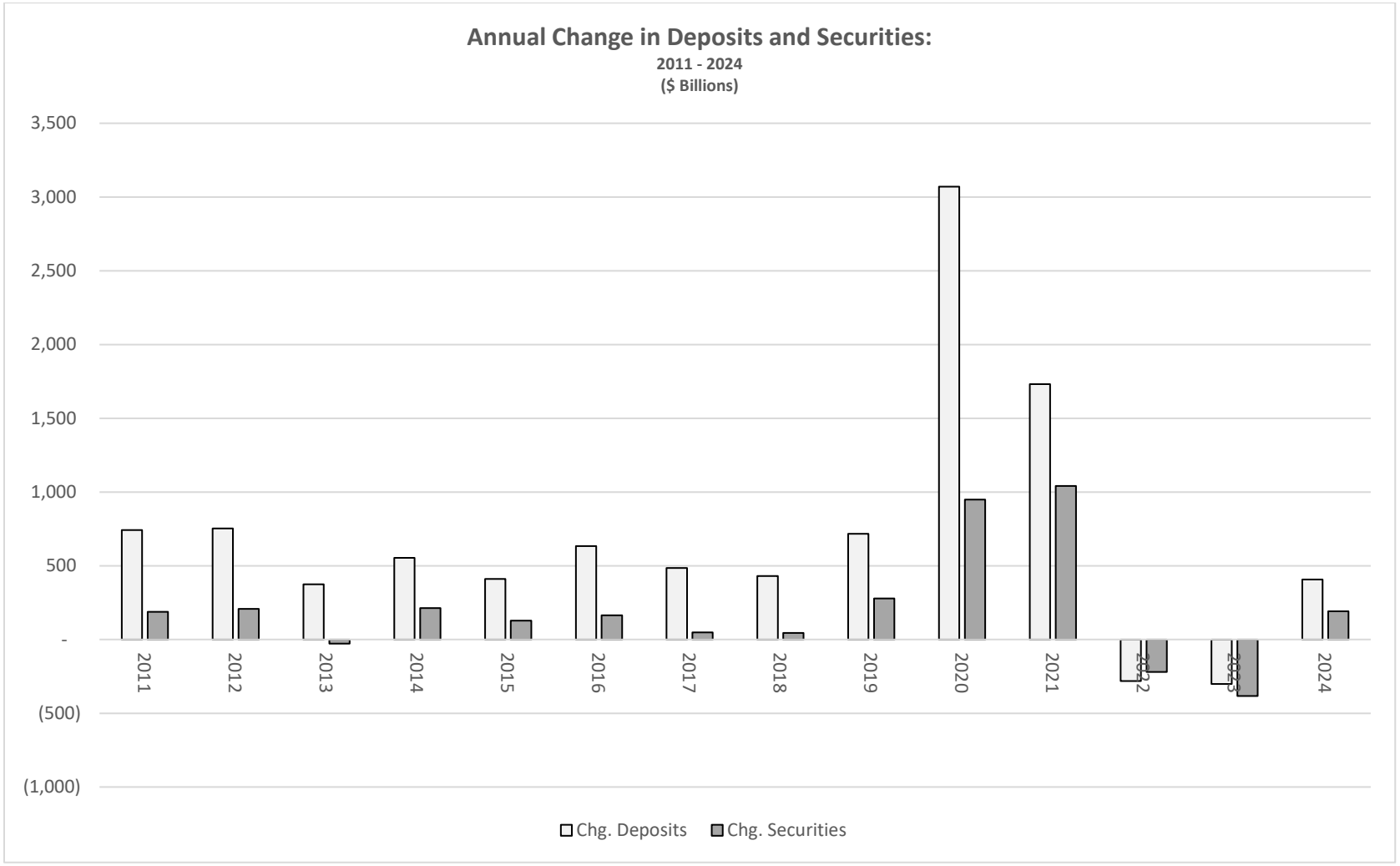


Figure 4:
Security Holdings of U.S. Commercial Banks 2019 – 2024
By Type

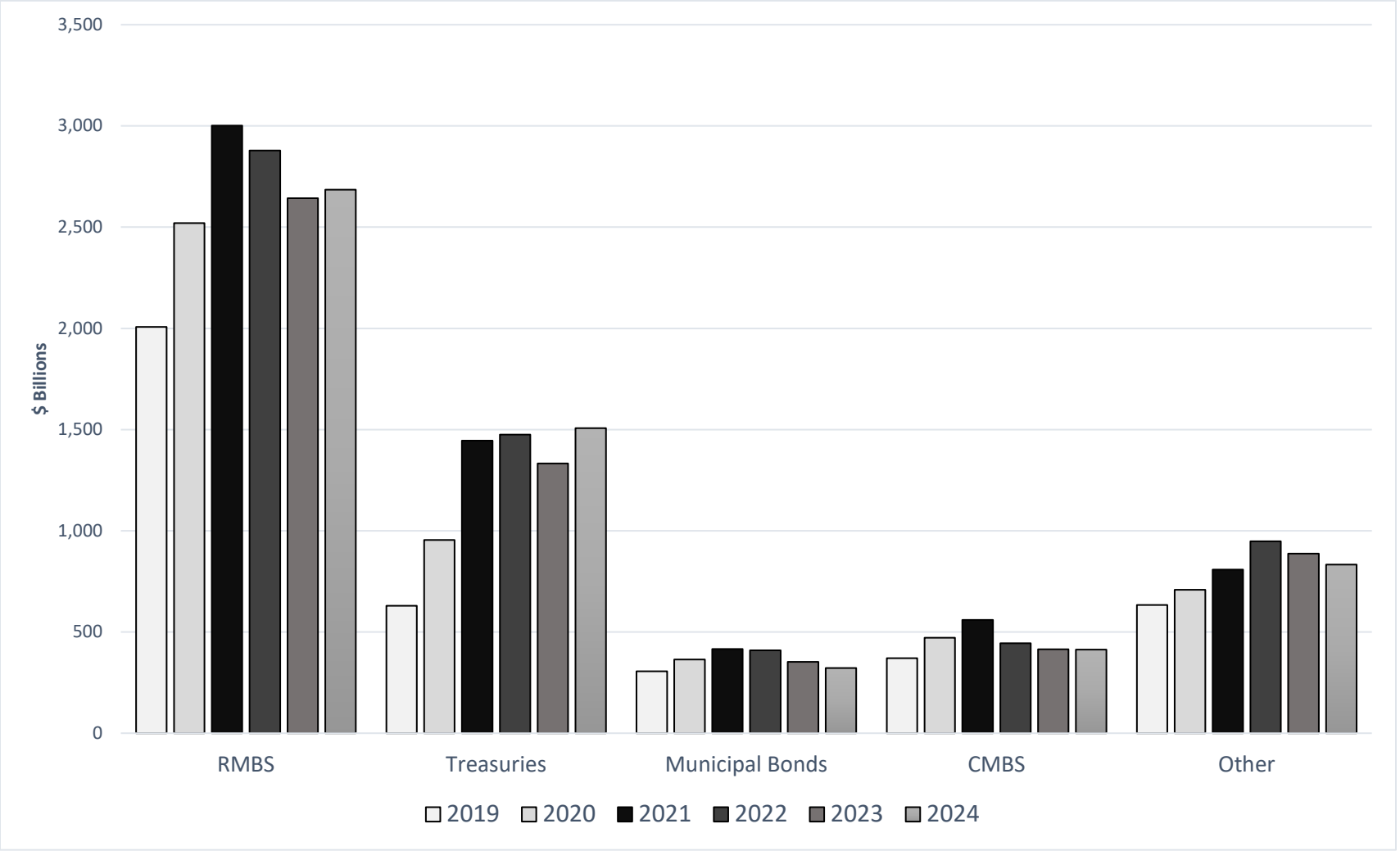


Figure 5:

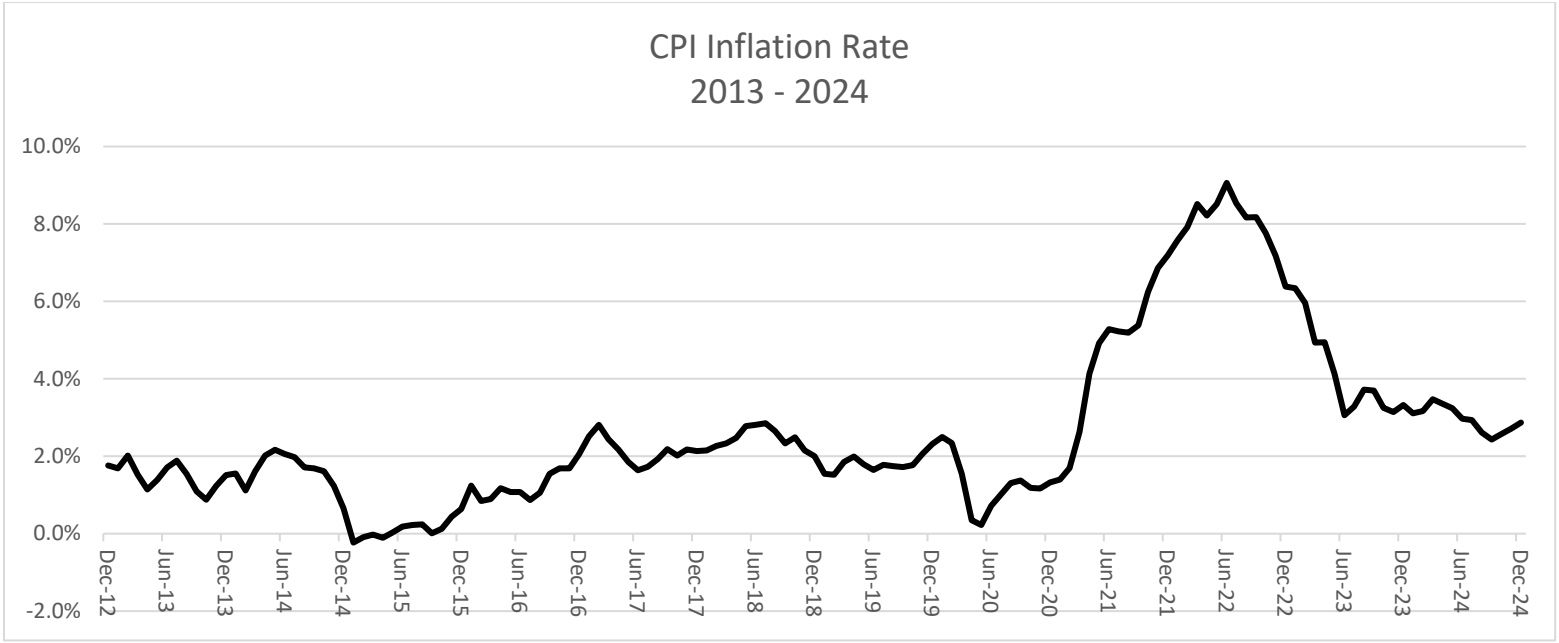
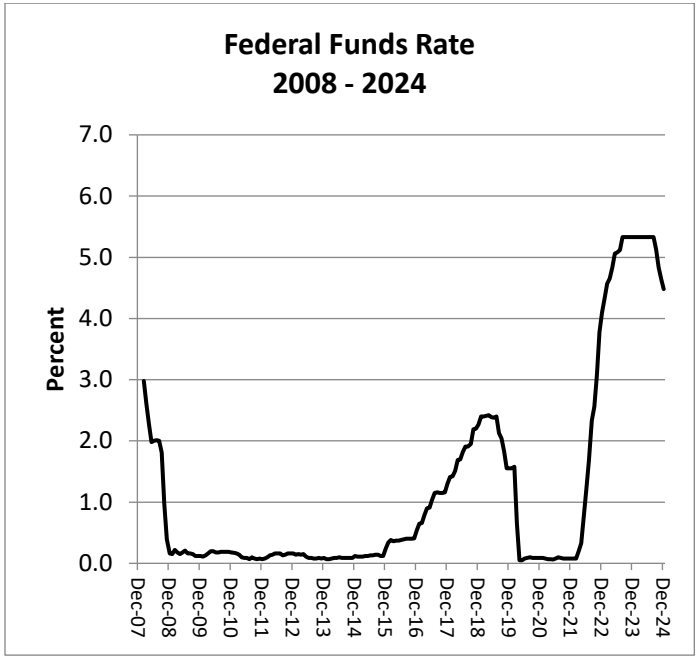

CPI Inflation Rate
2013 - 2024
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
Dec-12
Jun-13
Dec-13
Jun-14
Dec-14
Jun-15
Dec-15
Jun-16
Dec-16
Jun-17
Dec-17
Jun-18
Dec-18
Jun-19
Dec-19
Jun-20
Dec-20
Jun-21
Dec-21
Jun-22
Dec-22
Jun-23
Dec-23
Jun-24
Dec-24

Figure 6:
U.S. Interest Rates

Panel A

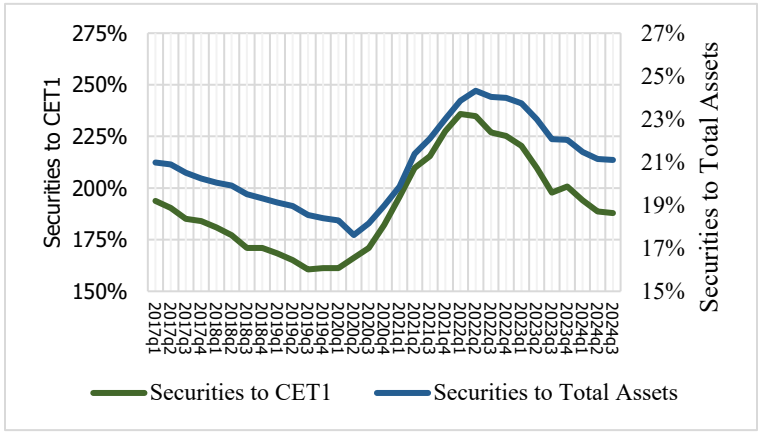


Panel B: Yield on 10-Year Treasury Bonds

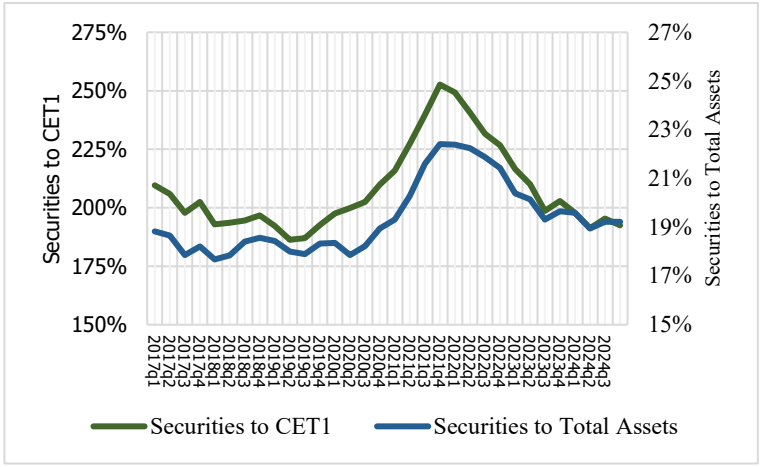
x

Figure 7:
Bank Securities Portfolio Size to CET1 and Total Assets
2017 Q1 – 2024 Q4, By Bank Size

Panel A: Banks under $10B in Assets



Panel B: Banks with assets $10B - $100B



Panel C: Banks with assets > $100B

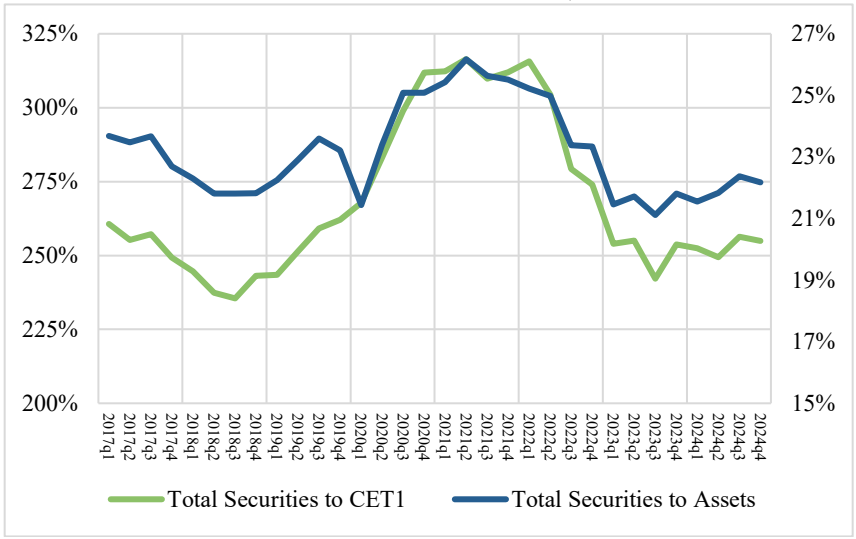


Figure 8:
Estimated Duration of Bank Securities Portfolios by Asset Size, 2018 - 2022.

This chart shows the estimated duration/repricing (in years) of bank securities portfolios for small banks (< CRA Breakpoint, ~ $1.34 billion), medium banks (> CRA Breakpoint & < $100 billion), and large banks (> $100 billion) for each quarter during the period 2018 - 2024. CRA breakpoint is adjusted each year for inflation from $1 billion as of 2005. The pandemic period (2020 Q1 – 2021 Q4) preceding the first increase of the Federal Funds Rate in 2022 Q2is shaded in light blue.

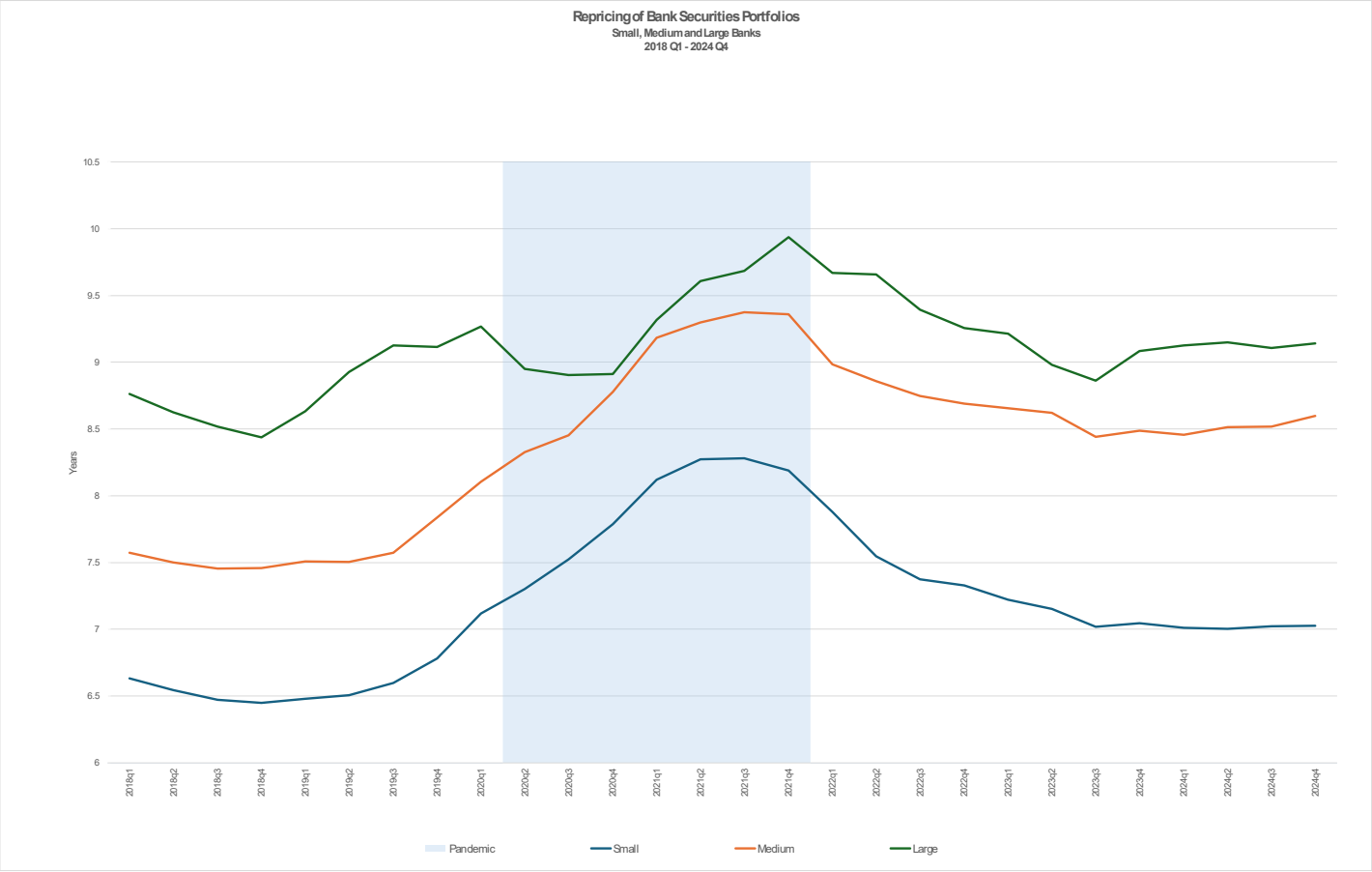
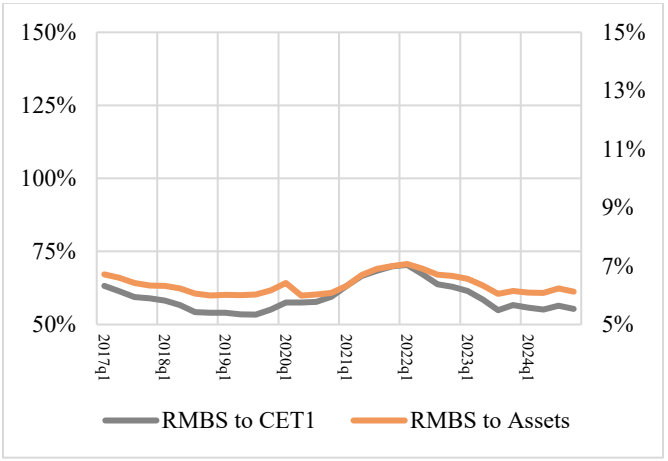
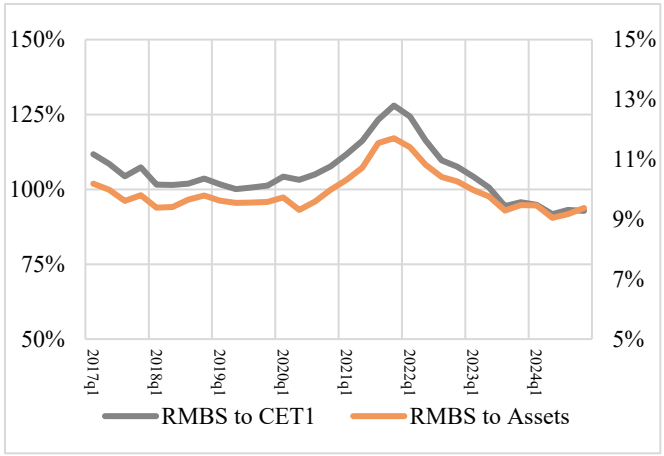


Figure 9
Bank RMBS Portfolio Size to CET1 and Total Assets
2017 Q1 – 2024 Q4
By Bank Size

Panel A: Banks with < $10B in Assets



Panel B: Banks with $10B - $100B in Assets



Panel C: Banks with > $100B in Assets

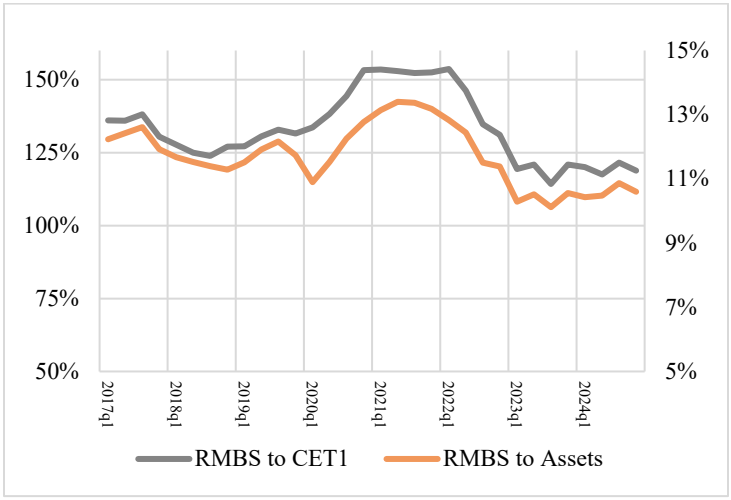
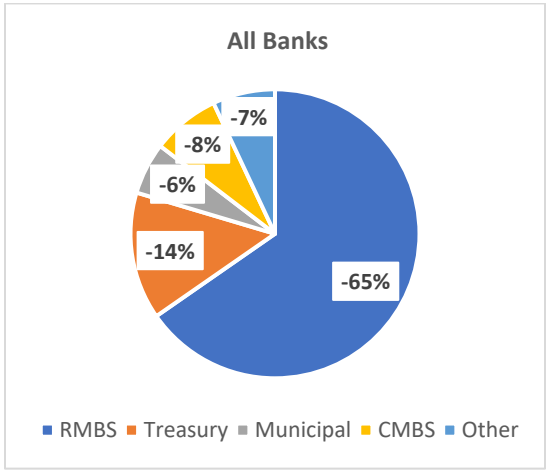
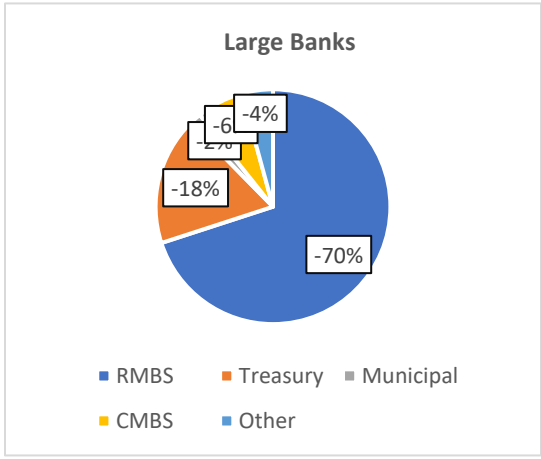
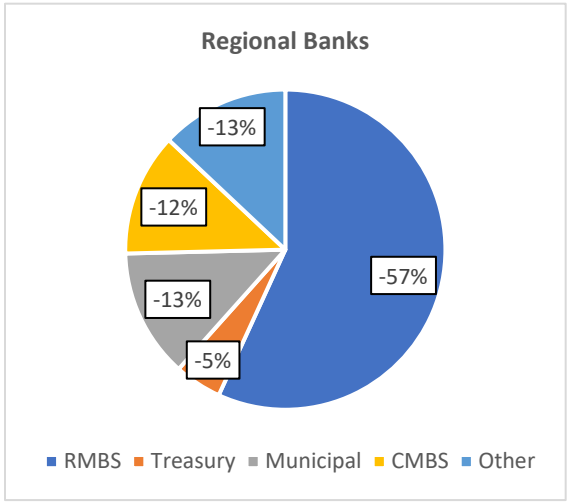


Figure 10:
Bank Securities Losses by Asset Size

This chart shows the unrealized losses on different categories of bank securities portfolios as a percentage of total unrealized losses on securities for three asset-size groups of bank: small banks (< CRA Breakpoint, ~ $1.34 billion), medium banks (> CRA Breakpoint & < $100 billion), and large banks (> $100 billion) based upon data for Q2 2022. CRA breakpoint is adjusted each year for inflation from $1 billion as of 2005. Losses are measured as of year-end 2023







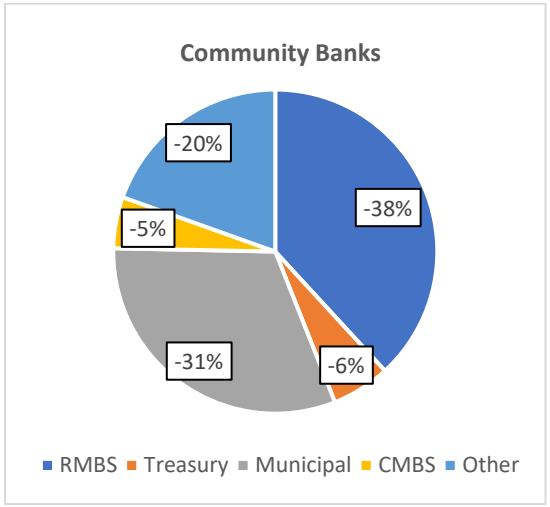
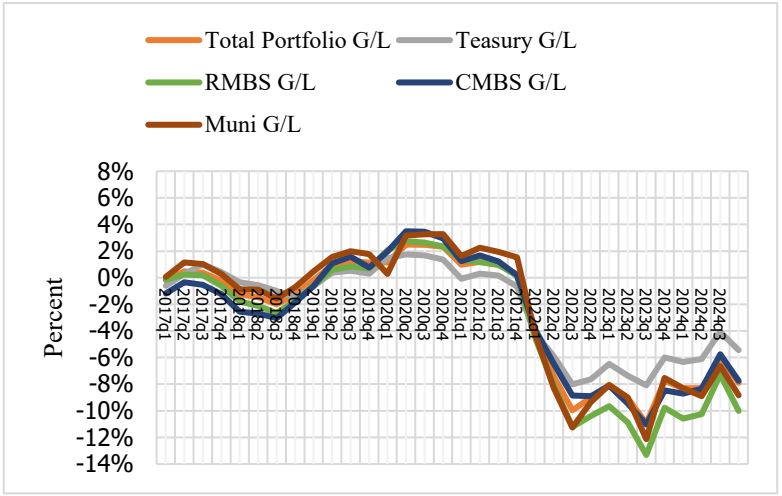
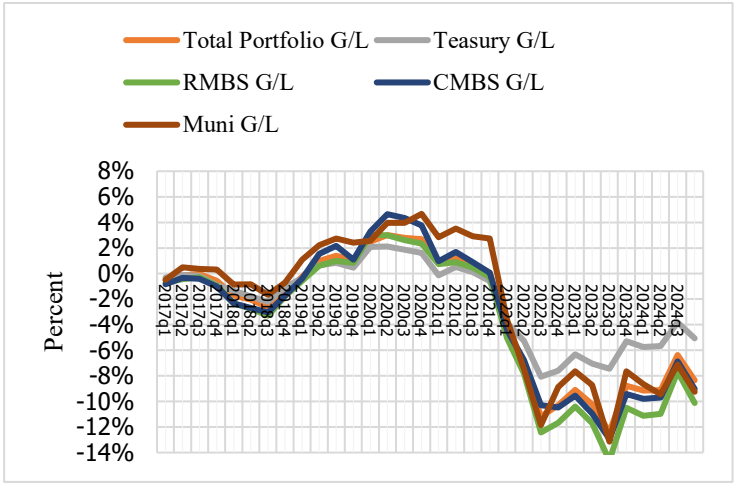


Figure 11:
Percentage Gain/Loss on Bank Securities Portfolios
By Bank Size
2017 Q1 – 2024 Q4

Panel A: Banks with < $10B in Assets



Panel B: Banks with $10B - $100B in Assets



Panel C: Banks with $100B - $250B in Assets

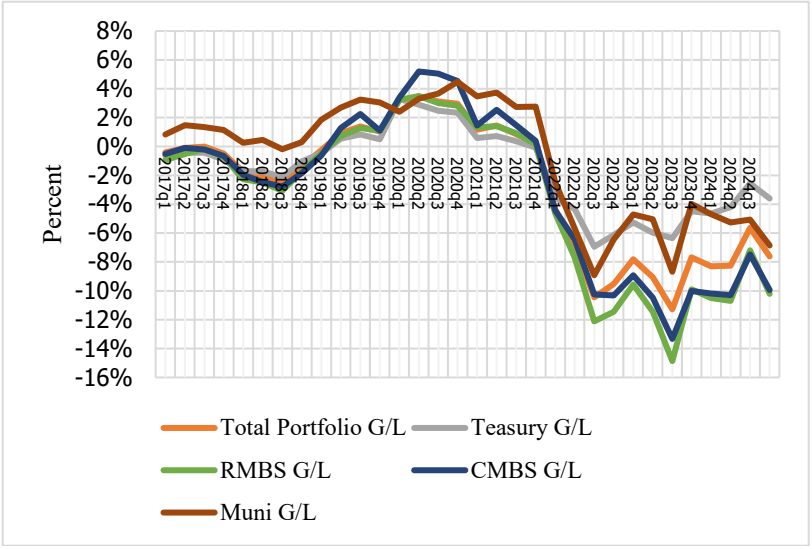


Figure 12:
Relative Performance of the S&P Regional Bank Index versus S&P 500 Index
(01/2017 through 12/2024)

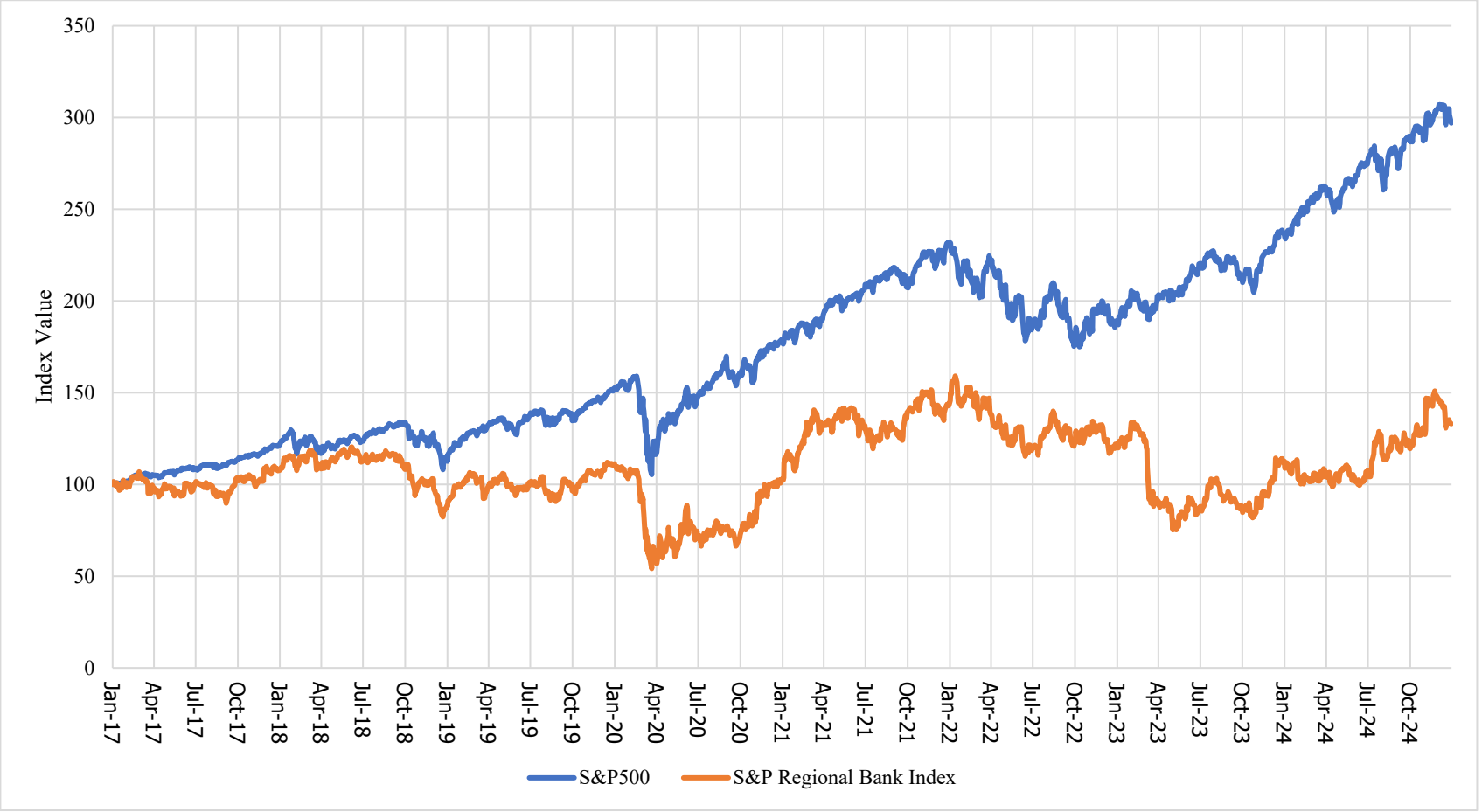


Figure 13:
Average Daily Abnormal Returns of Bank Holding Companies (BHCs)
with High- and Low-Interest-Rate Risk in Their Security Portfolios

High (low) interest rate risk BHCs are estimated using the top (bottom) quartile of security repricing maturities reported by BHCs for the fourth quarter of 2022. Average abnormal returns are estimated using a market model. On March 8, 2023, Silicon Valley Bank announced a $1.8 billion loss on the sale of securities, including its holdings of Treasury and mortgage bonds, which had lost significant value over the previous year due to an aggressive series of interest rate hikes at the Federal Reserve. The FDIC closed SVB on March 10, 2023 and closed Signature Bank on March 12, 2023. Both banks are excluded from the data used in Figure 11.

Figure 14:
Average Daily Abnormal Returns of Bank Holding Companies (BHCs)
with High and Low Liquidity Risk in Their Deposit Structure

High (low) and low liquidity risk BHCs are estimated using the top (bottom) quartile of the ratio of uninsured deposits to total deposits reported by BHCs for the fourth quarter of 2022. Low uninsured deposits BHCs are those in the bottom quartile. Average abnormal returns are estimated using a market model. On March 8, 2023, Silicon Valley Bank announced a $1.8 billion loss on the sale of securities, including its holdings of Treasury and mortgage bonds, which had lost significant value over the previous year due to an aggressive series of interest rate hikes at the Federal Reserve. The FDIC closed SVB on March 10, 2023 and closed Signature Bank on March 12, 2023. Both banks are excluded from the data used in Figure 12.

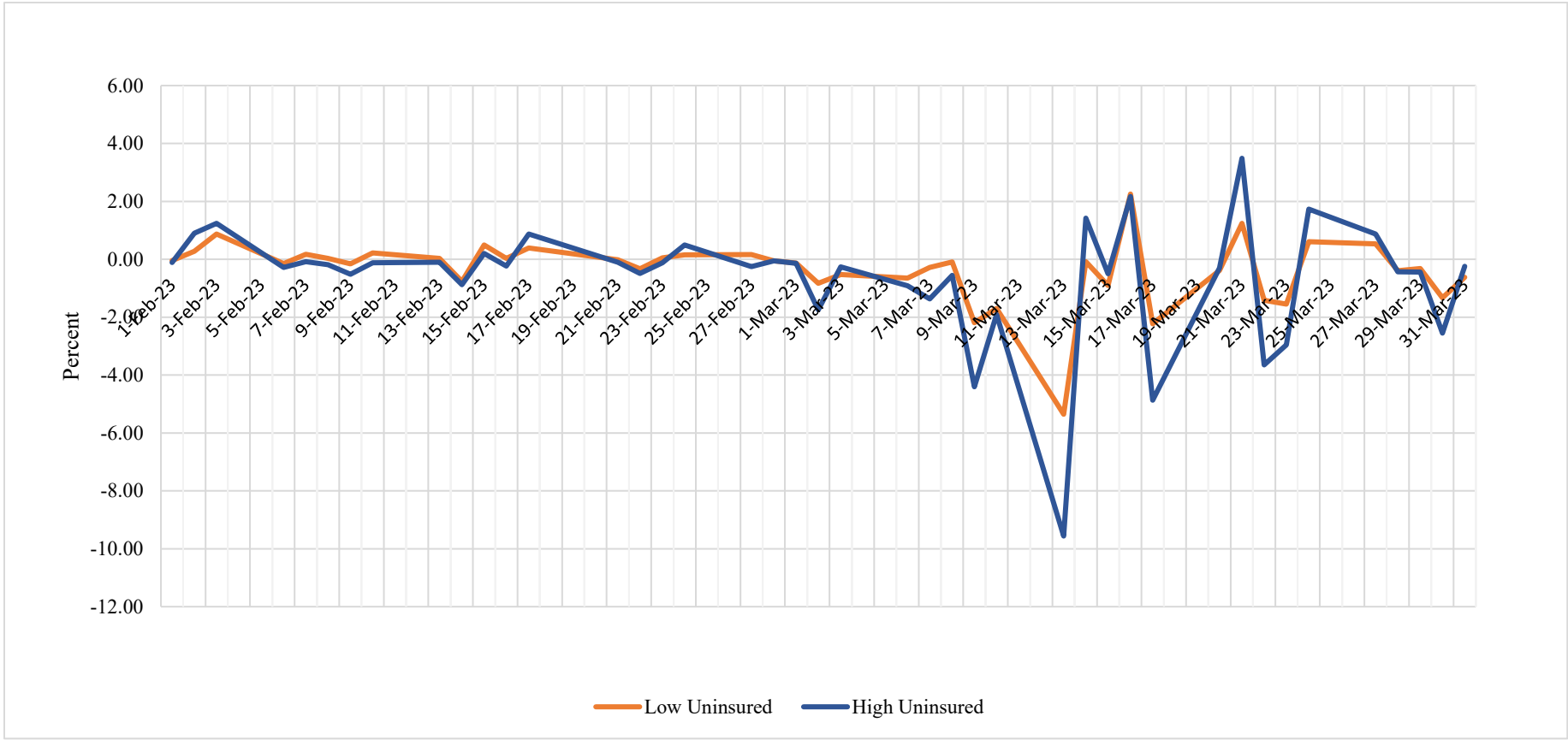


Table 1:
Descriptive Statistics: Aggregate Banking System (2024)

This table shows the distribution of the aggregate banking system's investment securities and unrealized losses by type of security as of year-end 2024. It also shows the percentage of total securities and percentage of unrealized losses by type of security.

Variable	Amount Securities ($Billions)	% Total Securities	Amount Loss ($Billions)	% Total Loss
Total Securities	5,759.3	100.0%	-482.4	100.0%
Treasury Securities	1,506.6	26.2%	-55.4	11.5%
Muni Securities	322.5	5.6%	-31.8	6.6%
RMBS	2,684.9	46.6%	-339.5	70.4%
CMBS	412.5	7.2%	-33.6	7.0%
Other Debt Securities	832.9	14.5%	-22.0	4.6%

Table 2:
Descriptive Statistics: Individual Banks Q4 2024

This table shows descriptive statistics for the following variables. In Panel A, **secloss** is unrealized loss on securities. **treasec** is the total value of treasury securities. **munisec** is the total value of municipal government securities. **rmbs** is the total value of residential mortgage-backed securities. **cmbs** is the total value of commercial mortgage-backed securities. **othersec** is the total value of all other securities, as is explained in the text. Panel B shows the same variables scaled by total bank assets. These statistics are based upon quarterly financial data reported by 4,542 U.S. commercial banks for Q4 2024.

Panel A: Total Value of Securities (in $million)

Variable	Label	Mean	Std. Error	Min	p25	p50	p75	Max
secloss	**Security Losses**	-106.2	29.2	-111,178	-15.2	-5.1	-1.3	89
treasec	**Treasury Securities**	331.7	116.6	0	0	1	11.1	343,838
munisec	**Municipal Securities**	71	9.8	0	1.5	12.6	39.5	27,697
rmbs	**Residential MBS**	591.1	146.5	0	1.7	15.2	58.3	486,011
cmbs	**Commercial MBS**	90.8	19.2	0	0	0	5	46,832
othersec	**All Other Securities**	183.4	45.3	-0.07	1.7	9.8	32.7	152,434

Panel B: Total Value of Securities as a Percent of Assets

Variable	Label	Mean	Std. Error	Min	p25	p50	p75	Max
seclossta	**Security Losses to Assets**	-0.02	0	-0.2	-0.029	-0.014	-0.005	0.015
treasecta	**Treasury Securities to Assets**	0.028	0.001	0	0	0.004	0.028	0.863
munisecta	**Municipal Securities to Assets**	0.065	0.001	0	0.004	0.033	0.097	0.72
rmbsta	**Residential MBS to Assets**	0.07	0.001	0	0.007	0.046	0.102	0.77
cmbsta	**Commercial MBS to Assets**	0.01	0	0	0	0	0.009	0.585
othersecta	**All Other Securities**	0.051	0.001	0	0.006	0.025	0.064	0.802

Table 3:
Differences in Means between Low-Loss and High-Loss Banks as of Q4 2024

This table shows the differences in means when banks are grouped according to whether they were below or above the median ratio of unrealized losses to assets, as of Q4 2024. **seclossta** is the ratio of unrealized loss on securities to assets. **treasecta** is the ratio of the total value of treasury securities to assets. **munisecta** is the ratio of the total value of municipal government securities to assets. **rmbsta** is the ratio of the total value of residential mortgage-backed securities to assets. **cmbsta** is the ratio of the total value of commercial mortgage-backed securities to assets. **othersecta** is the ratio of the total value of all other securities to assets, as is explained in the text. These statistics are based upon quarterly financial data reported by 4,542 U.S. commercial banks for Q4 2024. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Security Losses to Assets								
		Low		High		Difference		
Variable	Label	Mean	Std. Error	Mean	Std. Error	in Means	t-Statistic	
seclossta	**Security Losses**	0.006	0.0001	0.034	0.0004	-0.0284	-68.88	***
treasecta	**Treasury Securities**	0.033	0.0016	0.022	0.001	0.011	5.83	***
munisecta	**Municipal Securities**	0.025	0.0009	0.106	0.002	-0.0809	-36.89	***
rmbsta	**Residential MBS**	0.03	0.0009	0.111	0.0006	-0.0813	-75.16	***
cmbsta	**Commercial MBS**	0.005	0.0003	0.015	0.0019	-0.0097	-5.04	***
othersecta	**Other Securities**	0.034	0.0012	0.068	0	-0.0345	-28.75	***

Table 4A:
2024 Q4 Security Losses with Explanatory Variables as of 2021 Q4, 2020 Q4, & 2019 Q4
Log-Log Regression Analysis

This table shows the results from a series of Log-Log regressions where the dependent variable is **lnsecloss,** which is the natural logarithm of unrealized securities losses (expressed as a positive value). Explanatory variables include: **lntreasec** is the natural logarithm of treasury securities. **lnmunisec** is the natural logarithm of municipal government securities. **lnrmbs** is the natural logarithm of residential mortgage-backed securities. **lncmbs** is the natural logarithm of commercial mortgage-backed securities. **lnothersec** is the natural logarithm of all other securities, as is explained in the text. These regressions are based upon quarterly financial data reported by 4,542 U.S. commercial banks for Q4 2024. Explanatory variables are based upon quarterly financial data reported by 4,887 banks for Q4 2021, 5,505 banks for Q4 2020, and 5,227 banks for Q4 2019, respectively in specifications (1), (2), and (3). t-statistics appear in parenthesis. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Variable	(1)	(2)	(3)
lntreasec	0.046***	0.072***	0.069***
	(8.131)	(8.769)	(7.746)
lnmunisec	0.194***	0.212***	0.225***
	(32.842)	(30.481)	(28.721)
lnrmbs	0.407***	0.412***	0.416***
	(69.898)	(59.632)	(55.569)
lncmbs	0.105***	0.109***	0.108***
	(14.869)	(12.945)	(11.515)
lnothersec	0.161***	0.157***	0.157***
	(26.097)	(21.700)	(19.776)
Constant	-0.107***	0.055***	0.113***
	(-6.128)	(2.873)	(5.638)
Observations	4,504	4,493	4,485
R-Squared	0.855	0.813	0.784

Table 4B:
2024 Q4 Security Losses by Low/High Uninsured Deposits with Explanatory Variables as of 2021 Q4, 2020 Q4, & 2019 Q4
Log-Log Regression Analysis

This table shows the results from a series of Log-Log regressions by low versus high uninsured deposits to equity for banks that report uninsured deposits. The dependent variable is **lnsecloss**, which is the natural logarithm of unrealized securities losses (expressed as a positive value). Explanatory variables include: **lntreasec** is the natural logarithm of treasury securities. **lnmunisec** is the natural logarithm of municipal government securities. **lnrmbs** is the natural logarithm of residential mortgage-backed securities. **lncmbs** is the natural logarithm of commercial mortgage-backed securities. **lnothersec** is the natural logarithm other securities classified as other on FDIC call reports. These regressions are based upon quarterly financial data reported by U.S. commercial banks for Q4 2024. Explanatory variables are based upon quarterly financial data of banks who report uninsured deposits, which include 690 banks for Q4 2021, 678 banks for Q4 2020, and 638 banks for Q4 2019, respectively in specifications (1) through (6). t-statistics appear in parenthesis. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

	2021				2020				2019			
	Low		High		Low		High		Low		High	
Variable	(1)		(2)		(3)		(4)		(5)		(6)	
lntreasec	0.065		0.08	***	0.094		0.105	***	0.106	***	0.11	***
	(3.16)		(5.20)		(3.27)		(5.25)		(3.49)		(4.78)	
lnmunisec	0.141	***	0.081	***	0.177	***	0.126	***	0.184	***	0.156	***
	(6.37)		(3.95)		(6.71)		(5.18)		(6.25)		(5.24)	
lnrmbs	0.508	***	0.564	***	0.421	***	0.528	***	0.426	***	0.471	***
	(18.02)		(22.32)		(13.72)		(17.35)		(12.67)		(13.66)	
lncmbs	0.058	*	0.081	***	0.09	**	0.083	***	0.087	**	0.087	**
	(2.47)		(3.99)		(3.23)		(3.44)		(2.85)		(3.24)	
lnothersec	0.09	***	0.044		0.072	**	0.015		0.063		0.05	
	(3.60)		(1.86)		(2.63)		(0.49)		(1.95)		(1.57)	
Constant	0.126		0.217		0.717	***	0.623	***	0.808	***	0.716	***
	(0.88)		(1.78)		(4.73)		(4.50)		(4.56)		(4.63)	
Obs.	345		345		339		339		319		319	
R-Squared	0.723		0.845		0.651		0.792		0.61		0.764	

Table 5:
Difference-in-Differences Estimation of Daily Abnormal Returns during the First Quarter of 2023.

The dependent variable in models (1), (3), (5), (7), (9), (11), and (13) is the BHC daily abnormal return using the CAPM (multiplied by 100). The dependent variable in models (2), (4), (6), (8), (10), (12), and (14) is the daily abnormal return using the Fama-French three-factor model (multiplied by 100). **High Int Risk** equals one if the repricing maturity of the bank holding company's security portfolio was in the top quartile of 281 publicly traded bank holding companies, zero otherwise as of December 31, 2022. **High Uninsured Dep** equals one if the percentage of uninsured deposits of the bank holding company's total deposits was in the top quartile of 281 publicly traded bank holding companies, zero otherwise as of December 31, 2022. **High Unrealized Losses** equals one if the unrealized securities losses in the bank holding company's security portfolio was in the top quartile of 281 publicly traded bank holding companies and zero otherwise as of December 31, 2022. **Post SVB Failure** equals one from March 9, 2023, through March 31, 2023, and zero before this period. The sample of BHCs excludes those with assets greater than $250 billion, which may be considered to be "too big to fail." The estimation period runs from Feb. 1, 2023 through Mar. 31, 2023 (42 trading days). t-Statistics are presented in parenthesis below the coefficients. Standard errors are clustered by bank holding company. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
High Int Risk x Post SVB Failure	-14.62	-13.92					-11.73	-11.71	-15.05	-13.50			-12.61	-11.67
	(-1.35)	(-1.42)					(-1.08)	(-1.19)	(-1.38)	(-1.36)			(-1.15)	(-1.17)
High Int Risk	0.729	0.884					1.55	1.50	0.22	0.56			0.93	1.10
	(0.11)	(0.14)					(0.23)	(0.24)	(0.03)	(0.09)			(0.13)	(0.17)
High Uninsured Dep x Post SVB Failure			**-31.77** ***	**-24.56** **			**-30.66** ***	**-23.45** **			**-32.26** ***	**-24.33** **	**-31.28** ***	**-23.43** **
			(-2.94)	**(-2.45)**			**(-2.826)**	**(-2.375)**			**(-2.97)**	**(-2.46)**	**(-2.87)**	**(-2.36)**
High Uninsured Dep			-8.58	-6.41			-8.72	-6.55			-9.09	-6.75	-9.16	-6.84
			(-1.25)	(-1.02)			(-1.264)	(-1.042)			(-1.31)	(-1.07)	(-1.32)	(-1.08)
High Unrealized Losses x Post SVB Failure					0.36	-4.77			2.68	-2.68	4.10	-1.94	5.93	-0.25
					-0.03	(-0.491)			-0.25	(-0.273)	-0.38	(-0.199)	-0.55	(-0.025)
High Unrealized Losses					3.25	2.11			3.21	2.03	4.30	2.90	4.17	2.74
					-0.48	-0.34			-0.47	-0.32	-0.63	-0.47	-0.60	-0.44
Post SVB Failure	**-83.48** ***	**-62.45** ***	**-79.33** ***	**-59.87** ***	**-87.11** ***	**-64.61** ***	**-76.77** ***	**-57.31** ***	**-84.06** ***	**-61.87** ***	**-80.25** ***	**-59.44** ***	**-77.90** ***	**-57.26** ***
	(-15.70)	**(-12.91)**	**(-14.94)**	**(-12.38)**	**(-16.26)**	**(-13.26)**	**(-13.19)**	**(-10.82)**	**(-14.50)**	**(-11.73)**	**(-13.77)**	**(-11.20)**	**(-12.61)**	**(-10.18)**
Constant	-12.84 ***	-5.68	-10.59 ***	-3.92	-13.49 ***	-6.00	-10.93 ***	-4.25	-13.53 ***	-6.12	-11.55	-4.57	-11.73	-4.77
	(-3.80)	(-1.85)	(-3.13)	(-1.27)	(-3.96)	(-1.94)	(-2.95)	(-1.26)	(-3.67)	(-1.82)	(-3.12)	(-1.35)	(-2.98)	(-1.33)
R-Squared	0.03	0.021	0.032	0.022	0.03	0.021	0.032	0.022	0.03	0.021	0.032	0.022	0.032	0.022
Observations	11,634	11,634	11,634	11,634	11,634	11,634	11,634	11,634	11,634	11,634	11,634	11,634	11,634	11,634

Internet Appendix

The Savings & Loan Industry Experience:
Parallels and Differences

There are important parallels between the experience of the U.S. banking industry in the early 2020s and the experience of the U.S. savings & loan (S&L) industry in the late 1970s and early 1980s. Accordingly, we provide a summary of the latter.[45]

Thrift institutions were a large category of federally insured depositories from the 1930s to the 1990s. As late as 1990, the aggregate assets of the S&L industry were about 40% of the size of the assets of the commercial-banking industry. By statute, S&Ls generally were required to be focused on providing residential mortgage finance for single-family home buyers and for multi-family construction and ownership. Until the late 1970s and early 1980s, they were tightly restricted as to the other kinds of loans that they could originate. And they were generally prevented from originating adjustable-rate mortgages (ARMs). S&Ls were thus restricted largely to originating long-term, fixed-rate residential mortgages and holding these loans as assets on their balance sheets, while financing these loans with relatively short-term deposits.

This asset/liability structure was not a problem in a stable interest-rate environment or even in the environment of the slowly rising interest rates through the early 1960s. During the mid-1960s, however, interest rates began to rise more noticeably, which began to cause stress in the S&L industry;[46] in the late 1970s, interest rates again rose—this time much more sharply.[47]

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[45] A much more extensive discussion can be found in White (1991). A more recent comparison between the S&L experience and specifically the SVB episode can be found in Acharya et al. (2023).

[46] In an effort to ease that stress, the Congress extended "Regulation Q" – the 1933 provision that authorized the Federal Reserve to impose interest rate ceilings on bank deposits – to S&L deposits in 1966; and in 1970, the Treasury increased the minimum size of Treasury security that retail investors could buy from $1,000 to $10,000, so as to restrict the alternative investments for many S&L depositors. See White (1991).

[47] From 1977 to 1981, the FOMC raised the Fed Funds Rate from less than 5 percent to more than 19 percent and the rate on 30-year fixed rate mortgages rose from 9 percent to 18 percent.

The higher interest rates had predictable consequences for the S&Ls' assets: Their mortgages lost value. This was true even though the standard accounting conventions at the time—which still hold true today—allowed the S&Ls to maintain the original values of these mortgages on their balance sheets. Making matters worse, S&L depositors now had a close deposit-like alternative: money-market mutual funds (which had come into existence only in 1972). Depositors began to leave the S&Ls to gain access to the higher yields offered by the money funds. This forced the thrifts to sell "under-water" mortgages in order to accommodate the deposit withdrawals, which was financially painful for the industry.

During the early 1980s, in response to the weakened state of the S&L industry, Congress and the S&Ls' federal regulator (the Federal Home Loan Bank Board [FHLBB]) provided substantially greater "deregulation" flexibility for the industry's operations. There was also decreased prudential regulatory scrutiny of the industry when, because of the expanded moral hazard incentives and opportunities for risk-taking, there should have been sharply increased prudential regulatory scrutiny.[48]

The outcome was the "S&L debacle" of the late 1980s, when more than 1,000 S&Ls became insolvent and failed.[49] The costs of this debacle have been estimated at about $150 billion (in 1990 dollars). This would be about $370 billion in 2024 dollars.[50]

[48] It is accepted in the banking regulation literature that inadequate prudential regulation allowed the S&Ls in the early 1980s to expand substantially and take excessive credit-risk "bets." See Kane (1989) and White (1991). Also, the hedging opportunities for the S&Ls were far more limited than was true in the 2020s for the banks (which nevertheless generally refrain from hedging).

[49] This led to the failure of the federal deposit insurance fund for the S&L industry (the Federal Savings and Loan Insurance Corporation [FSLIC]). The FSLIC was merged into the FDIC, with the Congress's legislating funds to cover the FSLIC's obligations to the failed S&Ls' depositors.

[50] By comparison, the FDIC estimated that its aggregate costs of closing three large insolvent banks were "only" $38 billion. However, as we discuss in the main text, there are still large unrecognized securities losses on bank balance sheets. As of year-end 2024, these totaled $482 billion, and the unrealized losses on banks' residential and commercial real estate mortgages have yet to be recognized. Loss rates on CMBS and RMBS indicate that these unrealized mortgage losses are likely to be as large as or larger than the unrealized losses on investment securities.

Risk-management failures at all levels—including management of interest-rate risk—contributed to the collapse of hundreds of S&Ls (Curry and Shibut, 2000; Sheng, 1996; White, 1991). In response to the massive losses of approximately $150 billion and the need to restore confidence and stability in the banking system, new regulations and laws were enacted, including the Federal Deposit Insurance Corporation Improvement Act (1991), the Financial Institutions Reform, Recovery and Enforcement Act (1989), and the Basel Capital Accord (1988).[51]

The primary parallel between the S&L experience of the late 1970s and the banking experience of the early 2020s is the maturity mismatch between long-dated assets and short-term liabilities. However, for the S&Ls of the 1970s, this was a legal requirement; for the banks of the early 2020s this was a strategic choice. In response to the maturity mismatch, regulators in the late 1970s and early 1980s allowed thrifts to originate ARMs and to originate and distribute interest-rate risk through securitization. Fannie Mae and the newly formed Freddie Mac and Ginnie Mae (the "Agencies") were and continue to be the securitization vehicles for this offloading of interest-rate risk. Nonetheless, in the main text we document the interest-rate bets that banks took particularly on RMBS and ask what allowed the banking industry in the early 2020s to take on these excessive interest-rate risks.[52]

There is one important difference, however, that we explore in our empirical work in the main text: During the S&L industry's difficulties, more than 90% of deposits were federally insured, and depositor runs were rarely a concern of the FHLBB. By contrast, the current banking industry has about 40% of its deposits uninsured; in the case of Silicon Valley Bank,

[51] See Curry & Shibut (2000) and White (1991, pp. 196-197). In 1997, regulators added the "S" component to the CAMEL supervisory framework (more formally, the Uniform Financial Institutions Rating System or UFIRS), where "S" stands for "sensitivity to market risk."

[52] We specifically address accounting conventions, which constitute the fundamental information system on which regulators and financial markets rely.

over 90% of its deposits were uninsured (and were rapidly leaving the bank after it announced substantial losses on March 8, 2023).[53]

[53] This relatively sizable percentage of uninsured deposits (up from around 20% in the early 1990s) makes one segment of the banking industry (regional banks) more prone to runs and thus more fragile.

Appendix Table A-1.1
Commercial Bank Aggregate Holdings of Investment Securities (2023)

This table shows the distribution of the aggregate banking system's investment securities and unrealized losses by type of security as of year-end 2023. It also shows the percentage of total securities and percentage of unrealized losses by type of security.

Variable	Amount Securities ($ Billions)	% Total Securities	Amount Loss ($ Billions)	% Total Loss
Total Securities	5,629.6	100.00%	-477.6	100.00%
Treasury Securities	1332.2	23.70%	-68.1	14.30%
Muni Securities	351.8	6.20%	-27.7	5.80%
RMBS	2,643.3	47.00%	-312	65.30%
CMBS	415.3	7.40%	-36.3	7.60%
Other Debt Securities	887.0	15.80%	-33.5	7.00%

Appendix Table A-1.2
Commercial Bank Aggregate Holdings of Investment Securities (2022)

This table shows the distribution of the aggregate banking system's investment securities and unrealized losses by type of security as of year-end 2022. It also shows the percentage of total securities and percentage of unrealized losses by type of security.

Variable	Amount Securities ($ Billions)	% Total Securities	Amount Loss ($ Billions)	% Total Loss
Total Securities	6,154.8	100.00%	-620.4	100.00%
Treasury Securities	1474.5	24.00%	-99.5	16.00%
Muni Securities	409.9	6.70%	-44.2	7.10%
RMBS	2,877.7	46.80%	-379	61.10%
CMBS	444.8	7.20%	-43.2	7.00%
Other Debt Securities	947.8	15.40%	-54.6	8.80%

Appendix Table A-2
Number of Banks with Non-Negative Security Losses
By Year

This table presents the number of banks reporting non-negative losses on their investment securities portfolios as of year-ends 2019, 2020 and 2021.

	2021	2020	2019
2024 Q4 Losses	91	90	88
2023 Q4 Losses	67	65	64
2022 Q4 Losses	26	26	25

Appendix Table A-3.1 (TOTAL)
Distribution of Securities by Repricing Buckets
As of Year-Ends 2020, 2021, and 2022

This table presents the distribution of aggregate banking industry securities by six repricing buckets that are reported by banks on their quarterly Call reports with the corresponding average repricing maturity.

	Under 3 months	3-12 Months	1 to 3 years	3 to 5 years	5 to 15 years	Over 15 years	Average
2018 Q4	7.3%	9.1%	18.3%	20.6%	34.0%	10.7%	6.6
2019 Q4	7.9%	9.1%	18.9%	17.1%	33.3%	13.7%	6.9
2020 Q4	7.5%	6.7%	16.7%	14.6%	36.0%	18.5%	7.9
2021 Q4	5.6%	4.6%	14.3%	19.6%	35.9%	19.9%	8.4
2022 Q4	5.6%	7.3%	18.9%	20.2%	30.7%	17.3%	7.6
2023 Q4	7.3%	9.0%	19.1%	18.8%	28.7%	17.2%	7.3
2024 Q4	7.7%	9.3%	19.2%	18.3%	27.5%	17.9%	7.3

Appendix Table A-3.2 (CRA Small)
Distribution of Securities by Repricing Buckets
As of Year-Ends 2020, 2021, and 2022

This table presents the distribution of aggregate banking industry securities for small banks **below the CRA breakpoint**. The six repricing buckets are reported by banks on their quarterly Call reports with the corresponding average repricing maturity.

	Under 3 months	3-12 Months	1 to 3 years	3 to 5 years	5 to 15 years	Over 15 years	Average
2018 Q4	6.9%	9.6%	18.9%	19.9%	34.8%	9.9%	6.4
2019 Q4	7.7%	9.6%	19.2%	16.6%	34.2%	12.7%	6.8
2020 Q4	7.2%	7.2%	16.9%	14.0%	37.3%	17.4%	7.8
2021 Q4	5.3%	5.0%	14.7%	19.4%	37.1%	18.5%	8.2
2022 Q4	5.3%	7.8%	19.7%	19.7%	31.7%	15.9%	7.3
2023 Q4	7.0%	9.5%	20.0%	18.2%	29.7%	15.7%	7.0
2024 Q4	7.6%	9.9%	20.1%	17.7%	28.5%	16.3%	7.0

Appendix Table A-3.3 (CRA Medium)
Distribution of Securities by Repricing Buckets
As of Year-Ends 2020, 2021, and 2022

This table presents the distribution of aggregate banking industry securities for medium sized banks **above the CRA breakpoint but less than $100 Billion** in total assets. The six repricing buckets are reported by banks on their quarterly Call reports with the corresponding average repricing maturity.

	Under 3 months	3-12 Months	1 to 3 years	3 to 5 years	5 to 15 years	Over 15 years	Average
2018 Q4	9.6%	5.7%	14.0%	25.5%	29.3%	15.9%	7.5
2019 Q4	9.9%	5.4%	16.9%	20.3%	28.0%	19.6%	7.8
2020 Q4	9.6%	3.8%	15.3%	17.2%	29.4%	24.7%	8.8
2021 Q4	7.2%	2.9%	12.5%	20.6%	30.3%	26.5%	9.4
2022 Q4	7.3%	4.5%	14.9%	22.6%	26.2%	24.5%	8.7
2023 Q4	9.1%	6.1%	14.6%	21.7%	23.9%	24.7%	8.5
2024 Q4	8.8%	6.2%	14.8%	21.6%	22.8%	25.9%	8.6

Appendix Table A-3.4 (CRA Large)
Distribution of Securities by Repricing Buckets
As of Year-Ends 2020, 2021, and 2022

This table presents the distribution of aggregate banking industry securities for large sized banks with **over $100 Billion in total assets**. The six repricing buckets are reported by banks on their quarterly Call reports with the corresponding average repricing maturity.

	Under 3 months	3-12 Months	1 to 3 years	3 to 5 years	5 to 15 years	Over 15 years	Average
2018 Q4	10.5%	3.5%	10.8%	31.4%	16.9%	26.9%	8.4
2019 Q4	8.5%	4.8%	15.0%	25.1%	16.7%	29.9%	9.1
2020 Q4	6.8%	6.9%	15.5%	25.3%	16.7%	28.8%	8.9
2021 Q4	4.8%	2.8%	13.3%	28.1%	17.9%	33.0%	9.9
2022 Q4	5.3%	7.2%	13.7%	26.2%	17.5%	30.1%	9.3
2023 Q4	6.9%	7.2%	13.1%	28.0%	14.0%	30.7%	9.1
2024 Q4	6.6%	6.9%	15.7%	26.3%	12.8%	31.8%	9.1

Appendix Table A-4
Bank Securities Holding by Type
As of Year-Ends 2019 – 2024

This table presents the aggregate allocations of bank security portfolios by security type, measured in billions of dollars, as of year-ends 2019-2024.

	2019	2020	2021	2022	2023	2024
RMBS	2,007	2,520	3,002	2,878	2,643	2,685
Treasuries	630	954	1,445	1,475	1,332	1,507
Municipal Bonds	306	364	416	410	352	322
CMBS	371	472	559	445	415	413
Other	633	708	808	948	887	833
Total	3,947	5,018	6,230	6,155	5,630	5,759

Table A-5:
Correlation Matrix

This table shows the correlation coefficients for the following variables. **seclossta** is the ratio of unrealized loss on securities to assets. **treasecta** is the ratio of the total value of treasury securities to assets. **munisecta** is the ratio of the total value of municipal government securities to assets. **rmbsta** is the ratio of the total value of residential mortgage-backed securities to assets. **cmbsta** is the ratio of the total value of commercial mortgage-backed securities to assets. **othersecta** is the ratio of the total value of all other securities to assets, as is explained in the text. These statistics are based upon quarterly financial data reported by 4,542 U.S. commercial banks for Q4 2024.

Variable	Label	seclossta	treasecta	munisecta	rmbsta	cmbsta	othersecta
seclossta	Security Losses to Assets	1.000					
treasecta	Treasury Securities to Assets	-0.106	1.000				
munisecta	Municipal Securities to Assets	0.614	-0.068	1.000			
rmbsta	Residential MBS to Assets	0.561	-0.116	0.134	1.000		
cmbsta	Commercial MBS to Assets	0.228	-0.071	0.052	0.208	1.000	
othersecta	Other Securities	0.255	-0.030	0.075	-0.051	0.008	1.000

Table A-6.1:
2023 Q4 Security Losses with Explanatory Variables as of 2021 Q4, 2020 Q4, & 2019 Q4
Log-Log Regression Analysis

This table shows the results from a series of Log-Log regressions where the dependent variable is **lnsecloss,** which is the natural logarithm of unrealized securities losses (expressed as a positive value). Explanatory variables include: **lntreasec** is the natural logarithm of treasury securities. **lnmunisec** is the natural logarithm of municipal government securities. **lnrmbs** is the natural logarithm of residential mortgage-backed securities. **lncmbs** is the natural logarithm of commercial mortgage-backed securities. **lnothersec** is the natural logarithm of all other securities, as is explained in the text. These regressions are based upon quarterly financial data reported by 4,640 U.S. commercial banks for Q4 2023. Explanatory variables are based upon quarterly financial data reported by 4,887 banks for Q4 2021, 5,505 banks for Q4 2020, and 5,227 banks for Q4 2019, respectively in specifications (1), (2), and (3). t-statistics appear in parenthesis. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Variable	(1)	(2)	(3)
lntreasec	0.074***	0.093***	0.095***
	(13.511)	(11.671)	(10.980)
lnmunisec	0.164***	0.186***	0.203***
	(28.731)	(27.735)	(26.666)
lnrmbs	0.388***	0.395***	0.398***
	68.806	59.123	(54.594)
lncmbs	0.101***	0.108***	0.107***
	(14.818)	(13.188)	(11.748)
lnothersec	0.199***	0.196***	0.191***
	(33.411)	(28.026)	(24.854)
Constant	-0.053***	0.114***	0.164***
	(-3.181)	(6.233)	(8.435)
Observations	4,611	4,600	4,592
R-Squared	(0.859)	(0.818)	(0.788)

Table A-6.2:
2022 Q4 Security Losses with Explanatory Variables as of 2021 Q4, 2020 Q4, & 2019 Q4
Log-Log Regression Analysis

This table shows the results from a series of Log-Log regressions where the dependent variable is **lnsecloss,** which is the natural logarithm of unrealized securities losses (expressed as a positive value). Explanatory variables include: **lntreasec** is the natural logarithm of treasury securities. **lnmunisec** is the natural logarithm of municipal government securities. **lnrmbs** is the natural logarithm of residential mortgage-backed securities. **lncmbs** is the natural logarithm of commercial mortgage-backed securities. **lnothersec** is the natural logarithm of all other securities, as is explained in the text. These regressions are based upon quarterly financial data reported by 4,756 U.S. commercial banks for Q4 2021. Explanatory variables are based upon quarterly financial data reported by 4,887 banks for Q4 2021, 5,505 banks for Q4 2020, and 5,227 banks for Q4 2019, respectively in specifications (1), (2), and (3). t-statistics appear in parenthesis. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Variable	(1)	(2)	(3)
lntreasec	0.100***	0.115***	0.114***
	(19.236)	(15.130)	(13.717)
lnmunisec	0.180***	0.205***	0.216***
	(32.961)	(31.613)	(29.249)
lnrmbs	0.376***	0.384***	0.389***
	69.802	59.488	(54.937)
lncmbs	0.083***	0.091***	0.093***
	(12.742)	(11.563)	(10.630)
lnothersec	0.227***	0.226***	0.224***
	39.912	33.573	(30.051)
Constant	0.049***	0.226***	0.278***
	(3.090)	(12.925)	(14.823)
Observations	4,738	4,726	4718
R-Squared	(0.874)	(0.834)	(0.804)

Table A-6.3:
2024 Q4 Security Losses by Bank Size with Explanatory Variables as of 2021 Q4, 2020 Q4, & 2019 Q4
Log-Log Regression Analysis

This table shows the results from a series of Log-Log regressions by bank size where the dependent variable is **lnsecloss**, which is the natural logarithm of unrealized securities losses (expressed as a positive value). Explanatory variables include: **lntreasec** is the natural logarithm of treasury securities. **lnmunisec** is the natural logarithm of municipal government securities. **lnrmbs** is the natural logarithm of residential mortgage-backed securities. **lncmbs** is the natural logarithm of commercial mortgage-backed securities. lnothersec is the natural logarithm of all other securities, as is explained in the text. These regressions are based upon quarterly financial data reported by 4,542 U.S. commercial banks for Q4 2024. Explanatory variables are based upon quarterly financial data reported by 4,887 banks for Q4 2021, 5,505 banks for Q4 2020, and 5,227 banks for Q4 2019, respectively in specifications (1), (2), and (3). t-statistics appear in parenthesis. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

	2021			2020			2019		
	< $10B	$10-100B	>$100B	< $10B	$10-100B	>$100B	< $10B	$10-100B	>$100B
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
lntreasec	0.002	0.098***	0.112**	0.015	0.067*	0.063	0.017	0.108**	0.106
	(0.287)	(3.465)	(2.420)	(1.532)	(1.923)	(0.801)	(1.653)	(2.293)	(0.913)
lnmunisec	0.226***	0.112***	0.015	0.235***	0.147***	0.049	0.245***	0.155***	0.1
	(38.432)	(3.575)	(0.320)	(33.377)	(4.019)	(0.678)	(31.090)	(3.050)	(1.182)
lnrmbs	0.378***	0.565***	0.547***	0.386***	0.506***	0.325**	0.393***	0.331***	0.297 *
	(67.141)	(10.516)	(4.596)	(55.925)	(7.683)	(2.162)	(52.547)	(3.769)	(2.011)
lncmbs	0.074***	0.084**	0.038	0.082***	0.097**	0.144	0.088***	0.142***	0.223
	(10.183)	(2.246)	(0.498)	(9.102)	(2.365)	(1.297)	(8.896)	(2.675)	(1.738)
lnothersec	0.176***	-0.059 *	-0.001	0.175***	-0.049	0.003	0.173***	-0.06	-0.076
	(29.311)	(-1.679)	(-0.018)	(24.342)	(-1.176)	(0.036)	(22.065)	(-1.031)	(-0.573)
Constant	-0.088***	0.525	1.682**	0.058***	1.077**	3.394***	0.118***	2.227***	3.084**
	(-5.206)	(1.617)	(2.425)	(3.031)	(2.530)	(3.169)	(5.848)	(4.172)	(2.510)
Obs.	4,359	115	30	4,361	104	28	4,366	93	26
R-Squared	0.826	0.750	0.872	0.768	0.621	0.682	0.737	0.501	0.693

Table A-7:

Difference-in-Differences Estimation of Daily Abnormal Returns during the First Quarter of 2023.

The dependent variable in models (1), (3), (5), (7), (9), (11), and (13) is the BHC daily abnormal return using the CAPM (multiplied by 100). The dependent variable in models (2), (4), (6), (8), (10), (12), and (14) is the daily abnormal return using the Fama-French three-factor model (multiplied by 100). **High Int Risk** equals one if the repricing maturity of the bank holding company's security portfolio was in the top quartile of 296 publicly traded bank holding companies, zero otherwise as of December 31, 2022. **High Uninsured Dep** equals one if the percentage of uninsured deposits of the bank holding company's total deposits was in the top quartile of 296 publicly traded bank holding companies, zero otherwise as of December 31, 2022. **High Unrealized Losses** equals one if the unrealized securities losses in the bank holding company's security portfolio was in the top quartile of 296 publicly traded bank holding companies and zero otherwise as of December 31, 2022. **Post SVB Failure** equals one from March 9, 2023, through March 31, 2023, and zero before this period. The sample of BHCs includes those with assets greater than $250 billion, which may be considered to be "too big to fail." The estimation period runs from Feb. 1, 2023 through Mar. 31, 2023 (42 trading days). t-Statistics are presented in parenthesis below the coefficients. Standard errors are clustered by bank holding company. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
High Int Risk x Post SVB Failure	-13.01	-11.87					-10.29	-9.78	-13.06	-10.92			-10.80	-9.23
	(-1.22)	(-1.23)					(-0.96)	(-1.01)	(-1.21)	(-1.11)			(-1.00)	(-0.94)
High Int Risk	0.59	0.90					1.38	1.49	-0.05	0.47			0.62	0.98
	(0.09)	(0.15)					(0.20)	(0.24)	(-0.01)	(0.08)			(0.09)	(0.16)
High Uninsured Dep x Post SVB Failure			**-31.64** ***	**-24.42** **			**-30.74** ***	**-23.57** **			**-31.80** ***	**-23.90** **	**-31.03** ***	**-23.25** **
			(-2.99)	(-2.54)			(-2.89)	(-2.44)			(-2.99)	(-2.47)	(-2.91)	(-2.39)
High Uninsured Dep			-8.73	-6.50			-8.85	-6.64			-9.24	-6.86	-9.28	-6.93
			(-1.30)	(-1.06)			(-1.31)	(-1.08)			(-1.36)	(-1.11)	(-1.37)	(-1.12)
High Unrealized Losses x Post SVB Failure					-1.85	-7.34			0.30	-5.54	1.47	-4.84	3.17	-3.39
					(-0.18)	(-0.77)			(0.03)	(-0.57)	(0.14)	(-0.51)	(0.30)	(-0.35)
High Unrealized Losses					3.77	2.58			3.77	2.51	4.73	3.30	4.63	3.15
					(0.57)	(0.43)			(0.56)	(0.41)	(0.71)	(0.54)	(0.68)	(0.51)
Post SVB Failure	**-83.58** ***	**-62.78** ***	**-79.04** ***	**-59.71** ***	**-86.21** ***	**-63.75** ***	**-76.81** ***	**-57.59** ***	**-83.64** ***	**-61.61** ***	**-79.37** ***	**-58.61** ***	**-77.42** ***	**-56.94** ***
	(-16.09)	(-13.29)	(-15.19)	(-12.62)	(-16.44)	(-13.37)	(-13.49)	(-11.12)	(-14.79)	(-11.98)	(-13.88)	(-11.27)	(-12.81)	(-10.36)
Constant	-13.09 ***	-5.92	-10.84 ***	-4.14	-13.89 ***	-6.36	-11.14 ***	-4.46	-13.88 ***	-6.45	-11.91	-4.88	-12.02	-5.06
	(-3.959)	(-1.970)	(-3.275)	(-1.375)	(-4.164)	(-2.095)	(-3.074)	(-1.354)	(-3.857)	(-1.971)	(-3.274)	(-1.476)	(-3.126)	(-1.447)
R-Squared	0.030	0.021	0.032	0.022	0.030	0.021	0.032	0.022	0.030	0.021	0.032	0.022	0.032	0.022
N	12,012	12,012	12,012	12,012	12,012	12,012	12,012	12,012	12,012	12,012	12,012	12,012	12,012	12,012