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INTEREST RATE RISK AND BANK STABILITY: INSIGHTS FROM THE 2023 BANKING CRISIS AND THE COLLAPSE OF SILICON VALLEY BANK

MARIE-ZOE TESCHAUER

Work project carried out under the supervision of:

Professor Tim Eisert

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Abstract

Risk management failure, a high percentage of uninsured deposits, and significant exposure to long-term, low-yield bonds amid rapid Federal Reserve interest hikes triggered the collapse of Silicon Valley Bank (SVB). Rapid deposit inflows during the low-interest-rate environment caused SVB to expand its long-term bond holdings, which suffered heavy devaluation as rates increased. Simultaneously, reduced venture capital activity slowed deposit inflows, while corporate clients withdrew funds in search of higher returns. This research investigates the interplay between interest rates, bond valuation, and liquidity pressures, emphasizing the critical role of asset-liability mismatches, concentrated depositor bases, and inadequate hedging in SVB's failure.

Keywords: *Silicon Valley Bank (SVB), interest rates, long-term bonds, asset-liability management, duration mismatch, uninsured deposits, yield curve, bank failure*

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1. Introduction

The 2023 collapse of Silicon Valley Bank marked one of the most significant banking failures in modern U.S. history, exposing critical vulnerabilities in the financial sector and challenging long-standing assumptions about risk management and stability. The event serves as a reminder that even in an era of advanced regulatory frameworks and lessons from the 2008 financial crisis, no institution is immune to collapse when systematic vulnerabilities intersect with adverse macroeconomic conditions. The 2023 banking crisis stands out as a unique event compared to historical financial disruptions due to its underlying causes, rapid progression, and specific challenges. Unlike earlier crises driven by speculative bubbles, such as the 2008 subprime mortgage collapse, the 2023 banking crisis was triggered by sharp and rapid increases in interest rates aimed at combating inflation.

For years, banks considered long-term, low-yield bonds as "safe" assets. However, the rapid pace of interest rate hikes in 2022 and 2023, among the fastest in decades, dramatically devalued these bonds, creating billions in unrealized losses across the sector. Hence, the situation offers an opportunity to dive into the vulnerabilities of modern banking in an era of economic uncertainty. While existing research has explored the relationship between interest rate risk and banking stability, this paper provides a fresh perspective by examining why SVB was uniquely fragile despite facing similar macroeconomic pressures as its peers. This research investigates explicitly the relationship between interest rates and the value of fixed-income securities, focusing on the unrealized losses that arise as interest rates increase. Additionally, by comparing SVB to other U.S. banks, ranging from large, diversified institutions to smaller regional players, this research highlights critical differences in portfolio strategies, depositor composition, and risk management. From more effective hedging strategies to a greater focus on depositor diversification, the findings offer actionable lessons for banks seeking to navigate today's volatile economic landscape.

Understanding the relationship between interest rate risk and bank stability is essential for identifying weaknesses, improving regulatory frameworks, and ensuring that banks remain resilient in an increasingly volatile economic environment.

SVB's collapse resulted from a convergence of vulnerabilities that exposed critical weaknesses in its risk management, asset allocation, and deposit structure. At the core of the bank's instability was its significant exposure to interest rate risk, stemming from its heavy investments in long-term, low-yield bonds. As interest rates rose sharply in 2022, these bonds lost substantial value, creating large unrealized losses and straining SVB's ability to maintain liquidity without substantial financial damage. A mismatch between the bank's long-term assets and short-term liabilities further exacerbated the problem. This problem exposed SVB to rising interest rates and reduced its financial flexibility during times of stress. Although the bank initially hedged against interest rate risk, it unwound a substantial portion of its hedging instruments in 2022 to secure short-term profits, leaving the bank vulnerable to further rate hikes. Compounding these issues was SVB's overreliance on uninsured deposits, which accounted for the vast majority of its funding base. These deposits, primarily sourced from tech and venture-backed firms, were highly concentrated in a single, volatile sector. When economic pressures increased and alternative investment opportunities with higher returns became available, depositors began withdrawing their funds at an accelerated rate. SVB's limited access to stable retail deposits, which are typically insured and less prone to sudden withdrawals, left it unprepared to manage this outflow. The rapid withdrawal of funds forced the bank to sell its Available-for-Sale[1] (AFS) securities at a loss, further depleting its liquidity and sparking a severe bank run.

[1] AFS securities are financial assets, that banks or institutions intend to sell before maturity. Source: Corporate Finance Institute

In comparison to other banks, SVB's vulnerabilities were evident. While other mid-sized and large banks maintained diversified portfolios, robust hedging strategies, and balanced depositor bases, SVB's asset allocation and funding strategy were narrowly focused and highly concentrated. Thus, among other banks, SVB's reliance on long-term bonds and uninsured deposits was particularly pronounced, making the bank an outlier among its peers.

This analysis underscores the broader significance of the 2023 banking crisis. It challenges long-standing assumptions about the stability of traditionally low-risk assets, such as government bonds, in a rapidly changing economic environment. Furthermore, it highlights how macroeconomic conditions, such as sharp monetary tightening, can destabilize financial institutions and create ripple effects throughout the financial system. The crisis serves as a wake-up call for the industry and a blueprint for identifying and mitigating risks that threaten banking stability in a rapidly evolving economic landscape.

2. Literature Review

Interest rate fluctuation is one of the key indicators that can threaten the stability of banking institutions. Recent events, particularly the collapse of SVB in 2023, highlight critical insights into how interest rate risks can destabilize a bank.

The relationship between interest rate fluctuations and bank stability has been a central focus in financial literature, particularly in how banks manage interest rate risk and liquidity under changing market conditions. Interest rate risk is the sensitivity of a bank's profits and capital to fluctuations in market interest rates. While it is intrinsic to banking and can improve profitability, excessive interest rate risk may threaten a bank's financial stability, making it crucial for banks to monitor and manage this exposure actively (Kaufman 1984). The financial sector, particularly banks, can benefit from rising interest rates due to increased profitability through the spread between the interest charged on loans and the interest paid on deposits.

Banks, therefore, take advantage of the wider margin in increasing their net interest income and are well-positioned for growth in an environment with high rates.

However, the extent of this advantage depends largely on the bank's portfolio composition and deposit base, which can either amplify or limit its ability to navigate such market conditions effectively (Kirsch 2024). Banks with well-diversified portfolios and shorter-duration[2] assets generally adjust better to rising rates. In contrast, institutions holding large amounts of long-term bonds face considerable valuation risks (Acharya et al. 2023).

Monetary policies are essential for the stability of banks, especially during financial crises. Unconventional monetary policies (UMPs), such as quantitative easing[3] or low interest rates, have prevented disruptions in the economic system, particularly during the Covid-19 pandemic in 2020-2021. While UMPs help stabilize the financial system in the short term, they can create challenges in the long run by encouraging risky behavior (Albertazzi et al. 2020). There is a strong negative relationship between the level of interest rates and bank risk-taking behavior, especially in low-interest environments. The effect is stronger for banks with a low level of equity capital, as they have a greater incentive to shift toward a riskier strategy to compensate for their reduced profitability (Delis and Kouretas 2010). Therefore, many banks lean toward long-duration, low-yield bonds, which makes their asset portfolio and lending practices riskier. As rates increase, the market value of these assets declines, leading to losses that are especially severe for banks with large portfolios of long-duration bonds. The 2022-2023 period saw historically high unrealized losses compared to previous cycles (Ahmed, Miranda, and Patel 2023). In particular, banks with a "liability-sensitive" balance sheet—where liabilities reprice more quickly than assets—are more vulnerable to rising rates (Ligon 2005). The issue is compounded by the preferential treatment of government bonds in balance sheets.

[2] Measures an asset's price sensitivity to interest rate fluctuations and indicates the weighted average time required to receive all cash flows from the asset. Source: Corporate Finance Institute

[3] Pandemic-era Quantitative Easing was the Federal Reserve's policy of buying government bonds to lower interest rates and boost economic stability during COVID-19. Source: Investopedia

Traditionally considered low-risk, government bonds were classified by many banks as 'Held-to-Maturity' (HTM) assets[4], which limited their liquidity in times of financial distress.

The overreliance on such assets and rising interest rates severely damage a bank's ability to meet withdrawal demands, triggering a liquidity crisis (Idziak 2023). Thus, while low interest rates can stimulate economic growth, they can also fuel risk-taking behaviors and asset price bubbles, leading to weaknesses in the financial system (Porcellacchia 2020). These findings support the hypothesis that banks with a high proportion of long-term bonds face higher interest rate risk due to unrealized losses.

Furthermore, a significant mismatch between assets and liabilities can severely undermine a bank's resilience. Effective liquidity management is critical for the survival of banks, enabling them to meet their financial obligations promptly (Bianchi and Bigio 2013). Asset-liability management is a crucial risk management tool banks use to balance the relationship between assets and liabilities, aiming to mitigate interest rate, liquidity, credit, and market risks while ensuring profitability. Banks manage interest rate risk by adjusting asset maturities[5], particularly in low-rate environments. They extend asset maturities to offset declining interest income, which, although beneficial in the short term, increases exposure to rate changes (Abdymomunov, Gerlach, and Sakurai 2023).

Therefore, a positive relationship exists between asset-liability mismatch and the losses incurred in bank failures (Mamonov, M. 2022). Internal factors, such as a bank's business model and balance sheet composition, are critical in exacerbating this mismatch, making some banks more prone to financial difficulties than others.

Larger mismatches are linked to bigger losses during bank failures, as these banks often experience hidden losses that regulators may miss (Mamonov 2022).

[4] HTM securities are debt instruments, such as bonds, that a bank or institution commits to holding until maturity. Source: Investopedia

[5] Refers to the length of time until a financial asset, like a bond or loan, is fully repaid or reaches the end of its term. Source: Investopedia

Additionally, banks with significant mismatches between the durations of their assets and liabilities are more exposed to interest rate risk. A duration mismatch occurs when a bank's assets (e.g., long-term loans or bonds) have a different sensitivity to interest rate changes compared to its liabilities (e.g., short-term deposits) (Flannery and James 1984). During the extended period of low interest rates and low inflation, banks have expanded the duration of their assets (Abdymomunov, Gerlach, and Sakurai 2023). When interest rates rise, the value of long-duration assets declines more significantly than shorter-term liabilities (Zhou 2024). This results in losses for banks with mismatched durations, as their liabilities may reprice faster than their assets, leading to a squeeze on net interest margins and potential capital erosion. These dynamics heighten liquidity risks, especially when depositors withdraw funds in search of better returns elsewhere. In severe cases, they can trigger bank runs[6] and systematic instability (Zhou 2024). This underscores the second hypothesis that banks with significant mismatches between the durations of their assets and liabilities are more vulnerable to interest rate increases.

Moreover, uninsured depositors played a crucial role in the banking crisis of 2023, as banks with higher proportions of uninsured deposits were inherently riskier and more vulnerable to market fluctuations (Chang, Cheng, and Hong 2023).

Uninsured deposits, defined as funds exceeding the federal insurance limit of $250.000[7], expose depositors to potential losses if a bank fails, making these funds highly sensitive to perceived instability (Drechsler et al. 2023).

While these banks with high levels of uninsured deposits experienced higher profitability and faster growth in the pre-crisis period, the sharp rise in interest rates in 2022 triggered significant outflows of uninsured deposits, leading to declines in profitability and stock price drops.

[6] A bank run occurs when a large number of individuals take their money from a bank at the same time, because they fear it might run out of funds. Source: Corporate Finance Institute

[7] Federal insurance means that the government protects depositors' money in banks up to a certain limit, so they will not lose it if the bank fails. Source: Federal Deposit Insurance Corporation

Particularly because uninsured depositors tend to be more responsive to perceived instability, such as negative earning reports, due to their heightened sensitivity to risk and lack of deposit insurance protection (Chang, Cheng, and Hong 2023). As interest rates climbed, banks faced rising funding costs, especially as competition for deposits intensified in 2022. Deposit rates initially lagged behind market rates, temporarily allowing banks to maintain higher margins. However, as deposit betas[8] increased later in the cycle, banks faced growing pressure to offer competitive deposit rates to retain customers, which compressed net interest margins[9] (NIM) in early 2023 (Ahmed, Miranda, and Patel 2023). Hence, this dynamic highlights the fragile balance between risk and profitability in banks that rely on uninsured deposits. While these deposits can enhance bank profitability during stable periods, they significantly amplify risks during financial stress (Chang, Cheng, and Hong 2023). This highlights the third hypothesis that banks with higher proportions of uninsured deposits are more vulnerable to liquidity crises during periods of rising interest rates.

Rising interest rates have created contrasting outcomes for different banking segments. Investment banking, which relies heavily on activities like underwriting and debt issuance, has been adversely affected, with revenues dropping significantly. In particular, declines in merger and acquisition (M&A) activity and debt issuance have hurt profits as higher rates make financing more costly and less attractive for firms (The Economist 2022).

In contrast, retail banking has benefited from the rate increases, as higher loan interest rates, coupled with strong demand for consumer and business credit, have driven growth in net interest income (NII). While banks have benefited from rising rates through increased NII, the broader economic environment poses challenges.

[8] The sensitivity of deposit rates to market rates. Source: Federal Reserve Bank of St. Louis

[9] The difference in interest a bank generates on loans and investments against the interest it pays on deposits and other borrowings, represented as a percentage of total earning assets. Source: Corporate Finance Institute

Higher rates combined with inflationary pressures reduce consumer spending and demand for loans, impacting banks' future growth (The Economist 2022).

Notably, smaller banks and those less adept at hedging interest rate risk show stronger reactions to policy rate changes (Gomez et al. 2020). In particular, smaller banks show a significant increase in risk across assets and liabilities, indicating exposure on both sides of the balance sheet. In contrast, larger banks exhibit a more stable asset risk, but liabilities contribute significantly to their overall interest rate sensitivity (Bednar and Elamin 2014).

As a result, rising interest rates can lead to bank runs, even when bank assets are fully liquid. Banks with significant asset losses, low capital, and high uninsured leverage are particularly vulnerable. The monetary tightening that began in Q1 2022 resulted in a decline of approximately $2 trillion in the market value of U.S. bank assets by March 2023, compared to their book value. This decline and a high proportion of uninsured deposits at certain banks compromised their stability and increased the likelihood of solvency runs.

Estimates indicate that, without regulatory intervention, dozens to hundreds of banks could have faced solvency runs contingent on the withdrawal decisions of uninsured depositors.

The decline in asset values has significantly heightened the fragility of the U.S. banking system to such runs (Jiang et al. 2023).

3. Methodology

The analysis leverages a comprehensive dataset containing macroeconomic indicators, market-level data, firm-specific data, and data from the broader U.S. banking sector, sourced from authoritative databases and publications, including Bloomberg, Wharton Research Data Services, S&P Global, the U.S. Treasury, CBNC, Trading Economics, the Federal Reserve Bank, the Federal Deposit Insurance Corporation and annual reports from SVB and different U.S. banks.

The macroeconomic dataset includes key indicators such as interest rates, inflation, yield curves, 10-year treasury yields, and 2-year-treasury yields. Market-specific data consists of venture capital activity and risk appetite among U.S. investors. Firm-specific data for SVB and other U.S. banks entails balance sheets, income statements, hedging strategies, bond portfolio compositions, deposit structures, and key financial ratios.

Multiple linear regressions and t-tests were conducted to explore key relationships and identify significant differences relevant to this analysis. The first regression evaluated whether rising interest rates and 10-year treasury yields had a negative effect on SVB's price-to-book ratio, with data from Bloomberg. The following two regressions analyzed the impact of rising interest rates and 10-year treasury yields on unrealized gains and losses in HTM and AFS securities, using data from the Federal Reserve Bank. The final regression assessed the relationship between SVB's deposit growth and venture capital activity, drawing on SVB's annual reports and data from Statista.

Moreover, three t-tests were performed to determine whether SVB was statistically significantly different from other U.S. banks. The first t-test compared SVB's HTM securities investments as a percentage of total assets to those of other small, mid-sized, and large U.S. banks. The second t-test analyzed whether SVB's deposit growth was significantly higher than that of the U.S. banking sector. The final t-test assessed whether SVB's uninsured deposit levels significantly differed from other U.S. banks. For the t-tests, data was collected from the Federal Reserve Bank and annual reports from different U.S. banks.

In addition, the study investigates SVB's asset-liability management and potential duration mismatches. The analysis focused on the maturity structure of the bank's HTM portfolio and its alignment with short-term liabilities, assessing the extent of interest rate sensitivity. Lastly, this paper evaluates SVB's interest rate hedging strategies, comparing them with those of other U.S. banks to understand how hedging practices differed in mitigating interest rate risk.

4. Silicon Valley Bank´s Performance

Silicon Valley Bank emerged as a critical player in the technology and life sciences sectors, overcoming the challenges of the 1980s when traditional financial institutions were hesitant to back early-stage, high-risk ventures (Ryan 2018). In the early 2000s, the rapid growth in VC activity provided a surplus of liquidity for the bank as startups deposited funds from equity investments and reduced the demand for loans. Over the years, SVB became the go-to financial partner for innovation-driven companies, supporting their growth through tailored banking and investment services (Milligan 2022).

Despite weathering economic downturns, such as the dot-com bubble and the 2008 financial crisis, SVB consistently expanded its services and client base, becoming a significant player in the global financial landscape by acquiring firms and growing its wealth management and investment banking expertise. Its strategic moves positioned it as a leader in supporting the innovation ecosystem on a global scale, enabling it to become the **16th largest bank** in the U.S. by 2022 (Milligan 2022). Between 2019 and 2021, SVB experienced remarkable growth, tripling its total assets due to exceptional client liquidity. The total assets surged from $71 billion in 2019 to **$211 billion** in 2021 **(Exhibit 1)**, primarily influenced by a low-interest-rate environment that encouraged more frequent client funding events. SVB's focus on venture capital and startup clients played a crucial role in the expansion, as large deposits were often invested in long-term securities. While the broader banking industry also saw asset growth, SVB outperformed significantly, with a **271%** increase from 2018 to 2021, compared to **29%** for the industry **(Exhibit 2)**. Additionally, SVB's income statement during this period further reflects impressive growth, driven by an expanding loan portfolio, securities investments, and diversified non-interest income sources **(Exhibit 3)**. While SVB's growth strategy had positioned it as a leader in the innovation economy, this approach also played a significant role in the collapse.

The strategy, which had fueled SVB's rapid expansion and the broader venture capital ecosystem, exposed the bank to significant vulnerabilities as macroeconomic conditions changed dramatically. The following section will examine how interest rate risk contributed to the bank's collapse in March 2023.

5. Results and Discussion

5.1 Macroeconomic Environment and Interest Rate Dynamics

During the Covid-19 pandemic, the Federal Reserve reduced interest rates drastically to near-zero levels to support the economy through the crisis. This low-interest rate environment persisted through 2020 and 2021, promoting borrowing and investment activity across various sectors. However, as inflation pressures set in 2022 **(Exhibit 4)**, the Fed shifted its stance, implementing one of the fastest rate hikes in decades **(Exhibit 5)**. By 2023, the Fed Funds Rate had risen above **5%**, a significant increase from the near-zero rates of the pandemic years, reshaping the economic landscape and affecting investment strategies across industries.

When central banks implement tighter monetary policies, investments in assets such as treasury bills and agency-backed mortgage securities tend to lose value over time. The annual returns on 10-year U.S. treasury bonds peaked at approximately **11%** in 2020 before dropping sharply to **-17,83%** in 2022 **(Exhibit 6)**. The correlation between bond prices and interest rates explains this phenomenon, as rising interest rates reduce bond prices, negatively affecting fixed-income portfolios. For example, the yield on the two-year treasury note increased sharply from **0,73%** at the beginning of 2022 to **4,33%** by the year's end **(Exhibit 7)**.

The yield curve[10] illustrates this change, which is typically sloping upward to compensate investors for the increased uncertainty of holding longer-term bonds.

[10] The yield curve shows interest rates on U.S. treasury bonds across different maturities, highlighting the cost of borrowing over time. Source: J.P. Morgan

However, in July 2022, the yield curve inverted **(Exhibit 8)**, with the yield on two-year treasuries exceeding that of 10-year bonds **(Exhibit 7)**. The inversion, a significant market anomaly, meant short-term bonds offered higher yields than longer-term ones. The inverted yield curve implied that SVB's long-term bonds, purchased at much lower interest rates, lost significant market value (Wessel & Kovalski, 2018). Since the bank held these bonds in its HTM portfolio, it could only sell them with realizing massive losses, creating a liquidity trap for the bank. Meanwhile, the risk in short-term rates made it more expensive to attract deposits, further straining SVB's financial position. The bank was stuck with low-yielding, long-term bonds while being forced to offer higher rates to retain depositors, leading to a severe mismatch in its asset-liability structure. This mismatch contributed to SVB's sharply declining price-to-book ratio throughout 2022 as interest and treasury yields rose. A regression analysis confirms this relationship, showing that interest rates had a significant negative impact on SVB's price-to-book ratio, with a coefficient of -0,76008 (p-value = $2{,}72e^{-268}$).

Meanwhile, the 10-year treasury yield had a significant positive effect, with a coefficient of 0,47009 (p-value = $3{,}69e^{-58}$) **(Exhibit 9)**.

While the regression results suggest SVB benefited from the 10-year treasury yield before 2022, its sharp rise likely indirectly devalued SVB's long-duration bond holdings, contributing to the observed decline in its price-to-book ratio **(Exhibit 10)**. Nonetheless, rising interest rates primarily drove SVB's price-to-book ratio devaluation.

5.2 Bond Portfolio Composition and Risk Exposure

During the period of low-interest rates, SVB expanded its HTM portfolio significantly, from **$16,5 billion** in 2020 to **$98,2 billion** in 2021 **(Exhibit 11)**, reflecting SVB's strategy of securing long-term, low-yield bonds.

Many banks, including JPMorgan Chase, Wells Fargo, U.S. Bank, and Charles Schwab Bank, also show an increase in their held-to-maturity portfolios after March 2020 (**Exhibit 12**).

Low interest rates decreased the immediate cost of liabilities, making it appealing for SVB and other banks to invest in longer-duration bonds. SVB's strategy allowed the bank to capitalize on the higher yields that long-term bonds offered compared to short-term investments, leveraging historically low rates to lock in what seemed to be stable and substantial returns over an extended period (**Exhibit 7**).

However, the yield on earning assets, a critical measure of the average return generated by a bank's interest-earning assets, highlights inefficiencies in SVB's asset management. By 2022, SVB's yield stood at **2,77%**, considerably below the industry benchmark of **3,50%**, reflecting the challenges of holding long-term bonds that generated lower returns and could not quickly adjust to rising rates. Similarly, SVB's return on assets dropped sharply from **1,65%** in 2019 to **0,96%** in 2022, underperforming the benchmark of **1,12%**. This decline reflects a deterioration in asset utilization efficiency, likely driven by the pressure of rising interest rates on its bond-heavy portfolio **(Exhibit 13)**. Compounding these challenges, the 'Provision for Credit Losses' increased by **241,46%** in 2022, reflecting SVB's estimation of significantly higher potential losses due to credit risk. This sharp increase signals growing concerns about loan defaults and the deteriorating quality of its lending portfolio. Additionally, the 'return on average SVBFG common stockholders' equity fell by **29,01%,** indicating a significant decline in profitability and shareholder returns. The bank's 'Tangible Common Equity to Risk-Weighted Assets ratio' decreased by **9,36%**, reflecting a diminished capital buffer and limited ability to absorb financial shocks **(Exhibit 14)**.

When comparing SVB to other large and mid-sized banks, SVB stands out as a clear outlier regarding asset allocation. A t-test comparing SVB's HTM securities as a percentage of total assets to the combined average of other U.S. banks confirms a significant difference.

The results show a highly significant difference between the two groups, with a p-value of 0,00098786, indicating strong statistical evidence against the null hypothesis.

The confidence interval of [10,1305; 30,7021] does not include zero, confirming that SVB's HTM securities ratio was significantly higher than its peers. With 95% confidence, the true difference in HTM securities ratios lies between 10,13 and 30,70 percentage points. The test statistic of 4,3247 highlights the substantial magnitude of this difference **(Exhibit 15)**.

Notably, the interval average among the other banks ranges from 1% to 15%, whereas SVB's mean ratio stands at 27%, further underscoring SVB's outsized concentration in HTM securities compared to other banks. By 2022, SVB held **57%** of its total assets in bonds, with 43% in HTM and 14% in AFS bonds **(Exhibit 16)**. HTM bonds comprised a substantial portion of SVB's balance sheet, far exceeding those of large and other mid-sized banks, which maintained a more diversified portfolio with a balanced mix of loans and AFS bonds. As seen by their more stable asset allocations throughout the years before 2022, these banks were better equipped to withstand interest rate changes since a lower portion of their portfolios were invested in long-duration bonds **(Exhibit 17)**.

Due to substantial investments in long-term treasury bonds, SVB experienced a significant rise in unrealized losses between 2021 and 2022, with AFS securities increasing by approximately **$2,09 million** and HTM securities facing a staggering **$90,29 million** in unrealized losses **(Exhibit 18)**. Initially, the bank's portfolio showed stable values in the years before 2021 **(Exhibit 19)**. However, the drastic devaluation in 2022 turned seemingly secure investments into significant losses. Notably, SVB was not the only bank dealing with unrealized losses. Across the entire banking sector, unrealized losses surged to record levels in 2022, which significantly devalued low-yield securities **(Exhibit 20)**. A deeper analysis confirms the impact of rising interest rates and bond yields on SVB's portfolio.

A regression analysis of unrealized gains and losses in HTM portfolios across U.S. banks confirms that interest rates had a significant negative effect, with a coefficient of **-34,041** (p-value = 0,0007). The 10-year bond yield also exerted a substantial adverse impact, with a coefficient of **-24,642** (p-value = 0.0228) **(Exhibit 21)**. Similarly, a regression analysis of AFS portfolios reveals that both rising interest and 10-year bond yields had an even stronger significant negative impact. Interest rates exhibited a coefficient of **-36,418** (p-value = $6{,}5e^{-05}$), while the 10-year bond yield had a coefficient of **-38,2601** (p-value = 0,0001) **(Exhibit 22)**. These findings highlight how rising interest rates and bond yields significantly contributed to unrealized losses across both HTM and AFS portfolios in the broader U.S. banking sector.

The stronger impact on AFS securities reflects their exposure to mark-to-market accounting[11], which makes such losses immediately visible. Conversely, HTM unrealized losses, though substantial, are not reflected on the balance sheet, meaning investors may be unaware of the true extent of those losses. Banks record HTM bonds at their amortized cost based on the original interest rate when issued rather than their fair market value. Hence, this issue becomes significant if a bank faces a liquidity crisis and must sell these bonds at a much lower market value than the balance sheet reflects. Therefore, this creates a gap between perceived and actual asset values and intensifies financial risk.

Although, compared to the broader banking sector, SVB faced disproportionately high losses in its HTM portfolio, reflecting its limited ability to diversify risk **(Exhibit 19 & 20)**.

By 2022, the U.S. banking industry had accumulated **$620 billion** in unrealized losses on their balance sheets, mainly from low-yield bonds (Buhayar et al. 2023).

Nonetheless, the analysis reveals that small and mid-sized banks suffered more and faced greater pressure from unrealized losses **(Exhibit 23)**.

[11] Method of valuing assets and liabilities based on their current market price rather than their original purchase cost. Source: Federal Reserve Bank St. Louis

For instance, Charles Schwab Premier Bank reported an alarming **329%** of unrealized losses relative to its equity, highlighting the increased risk among small and mid-sized institutions. SVB's **100%** unrealized losses indicate that the market value of its bond portfolio had fallen entirely below its original purchase price, meaning the unrealized losses were equal to the total book value of these assets. Since these losses were unrealized, indicating the assets had not yet been sold, SVB was not required to recognize them on its income statement immediately.

Larger institutions like Bank of America, with **65%** unrealized losses, are more secure due to their size and the perceived stability of being "too big to fail." Most banks can handle their unrealized losses, but investors and depositors are still nervous about banks holding large amounts of money. As people gradually move their money to other investments, banks face pressure to pay more for funding. At the same time, low-interest bonds limit their earnings, reducing lending and slowing the economy.

Thus, the lack of diversification in SVB's portfolio and its outsized investment in HTM bonds made it more susceptible to market fluctuations and ultimately played a crucial role in its financial instability compared to its peers.

5.3 Asset-Liability Mismatch

The problem becomes further evident when considering the size and duration of SVB's HTM portfolio, which was significantly more extensive and had longer durations than its liabilities. The duration mismatch between long-term assets and short-term liabilities became more problematic as rising rates increased the costs of liabilities while reducing the market value of SVB's bond holdings.

The extended duration of the portfolio, reaching **6,2 years** by 2022, exposed the bank to extreme interest rate sensitivity. In contrast, the duration of the HTM portfolio was notably shorter in prior years, such as 3,9 years in 2019 and 4 years in 2021 **(Exhibit 11)**.

Long-duration bonds are particularly vulnerable to interest rate increases because the present value of future bond payments decreases more sharply for bonds with longer maturities.

A significant portion of SVB's **$91,3 billion** HTM portfolio in 2022 consisted of long-term, agency-guaranteed mortgage-backed securities, with **$56,6 billion** maturing in 10 years or more (Form 10-K 2022, SVB). While these bonds were highly creditworthy, they were exceptionally sensitive to interest rate fluctuations.

On the liability side, SVB's deposit base was not aligned with the long-term nature of its assets. Approximately **92%** of SVB's loans were variable-rate, meaning they adjust more quickly to changes in interest rates (Form 10-K 2022, SVB). However, the mismatch arose because SVB held short-term liabilities while locking its assets into long-duration bonds. As a result, the bank kept short-term funds available for customer withdrawals, but most of its money remained tied up in long-term investments. Moreover, the low yields displayed in both HTM and AFS portfolios further exacerbated SVB exposure. The weighted average yield was **1,66%** for the HTM portfolio and **1,56%** for the AFS portfolio **(Exhibit 24 & 25)**, both significantly lower than the **4%** yield on 10-year treasury bonds in March 2023. The low yields on these bonds forced the bank to hold depreciating assets while offering suboptimal returns, which made sustaining profitability and liquidity more challenging.

5.4 Hedging Strategy Failure

Although SVB initially implemented measures to hedge against interest rate risk, the analysis reveals that these efforts ultimately failed to offer sustained protection as interest rates rose.

By the end of 2021, SVB had implemented **$15,26 billion** in interest rate swaps to hedge against potential rate hikes and mitigate the associated risks to its AFS bond portfolio.

However, in 2022, as profitability declined, the bank unwound[12] **$11 billion** of these hedges, securing a short-term gain of approximately **$500 million** in the first half of the year (Form 10-K 2021 SVB). By year-end, only **$563 million** of the original hedges remained **(Exhibit 26)**. This decision reflects SVB's shift toward prioritizing immediate financial gains over long-term protection against rising interest rates. Interest rate swaps are designed to offset the impact of increasing rates. They do this by converting fixed-rate investments[13], which lose value when rates go up, into floating-rate investments[14], which can adjust and maintain their value as rates rise. However, by unwinding many of these swaps, SVB damaged this protection. The desire to boost short-term profitability, strengthen financial statements, and meet shareholders' expectations likely drove this decision, as the bank faced declining earnings in 2022.

In contrast, other banks implemented more resilient hedging strategies to manage interest rate risk effectively. For example, Bank of America used a combination of interest rate swaps to convert fixed-rate exposures to floating-rate ones and routinely adjusted its portfolio based on simulation models that projected different rate environments. JPMorgan also employed a robust strategy, using a mix of cash flow and fair value hedges alongside comprehensive treasury oversight to balance interest-sensitive assets and liabilities. Wells Fargo leveraged derivatives and natural hedges within its mortgage servicing portfolio to protect against rate fluctuations **(Exhibit 27)**.

These diversified and consistent approaches underscore a more comprehensive commitment to long-term risk management, allowing these banks to withstand the impact of rising interest rates better compared to SVB's narrower, short-term focus.

[12] Refers to terminting the interest rate swap contracts before their maturity. Source: Corporate Finance Institute
[13] Fixed-rate investments pay the same interest rate all the time, no matter how market rates change. Source: Investopedia
[14] Floating-rate investments are assets that pay interest rates that change over time based on current market rates, so their payments go up when interest rates rise. Source: Investopedia

5.5 Deposit Structure and its Role in Liquidity Risk

Furthermore, the deposit growth at Silicon Valley Bank from Q1 2020 to Q4 2022 demonstrates a drastic contrast from the broader U.S. banks.

The pandemic-era Quantitative Easing policy, designed to inject liquidity into the economy through large-scale asset purchases, substantially increased bank deposits. During the Covid-19 pandemic, U.S. banks experienced a **$5,4 trillion** surge in deposit inflows, but only around **15%** of these funds were allocated to lending, with the majority being invested in securities (Castro, Cavallo, and Zarutskie 2022). At the onset of the pandemic in early 2020, SVB saw a rapid and significant inflow of deposits, fueled by the tech sector's boom and the influx of venture capital, which drove an **85%** increase in 2021. In comparison, deposits across all U.S. banks grew by a more moderate **14%** over the same period **(Exhibit 28)**.

A t-test analysis comparing SVB's deposit growth to the overall deposit growth among U.S. banks further underscores this disparity. The results reveal a highly significant difference (p-value = 0,0052), with SVB's deposit growth standing out as an outlier.

The confidence interval of [6,20; 32,57] does not include zero, confirming with 95% confidence that the difference is statistically significant. The interval indicated that SVB's average deposit growth rate was likely between 6,20 and 32,57 percentage points higher than the overall U.S. banking sector's deposit growth rate. The test statistic (2,9952) further confirms this large difference, emphasizing the unique nature of SVB's growth during this period **(Exhibit 29)**.

Due to its high proportion of deposits, SVB maintained a comparatively low loan-to-deposit ratio of **42%**, well below the U.S. banking industry average of approximately **63,6%** (Dela Cruz & Ghaznavi, 2023). Furthermore, SVB's deposit costs surged from 0,04% to 0,46% in 2022 **(Exhibit 14)**, leading to a **980%** increase in interest expenses compared to only a **72%** rise in interest income **(Exhibit 30)**.

While many banks experienced a significant rise in interest expense growth, with an average increase of **296%**, SVB clearly stands out due to its disproportionately higher increase.

The modest growth in net interest income across banks suggests that rising interest expenses outpaced income gains, putting pressure on profitability and highlighting the challenges banks face in benefiting from higher interest rates. Additionally, SVB's NIM of **2,23%** remained below the industry average of **3,5%**, driven primarily by a rapid increase in deposit costs outpacing interest income, compounded by slower loan repricing and the structure of its asset portfolio **(Exhibit 13)**.

Moreover, deposit growth proved to be highly volatile. The rapid growth of the innovation economy, which had been a major source of deposits and low-interest funding, began to slow as venture capital activity declined in 2022 **(Exhibit 31)**. Higher interest rates and economic uncertainty have lowered investor risk appetite **(Exhibit 32)**, resulting in less venture capital deployment and fewer liquidity events. Companies, in response, started using their existing deposits for operations, leading to withdrawals from SVB and decreased liquidity inflows.

A regression analysis confirms that SVB deposits are highly influenced by venture capital activity, with a statistically significant coefficient of 0,614 (p-value = $1{,}86e^{-09}$). The findings show that for every 1-unit increase in VC activity, SVB deposits increase by 0,614 units, holding interest rates constant **(Exhibit 33)**. The findings align with SVB's client base and its strong focus on the startup ecosystem, which relies heavily on venture capital funding.

The analysis explains SVB's rapid deposit growth and the subsequent decline as venture capital activity slowed. Hence, by Q1 2022, SVB's deposits peaked before experiencing an **8,5%** decline by the end of the year. In contrast, the U.S. banking sector saw only a slight **4,7%** reduction in deposits over this time, indicating that SVB's deposit base was more aggressive in its expansion and more susceptible to rapid fluctuations **(Exhibit 28)**.

The disparity highlights the heightened concentration risk and cyclical nature of SVB's client base, while other banks reduced their exposure to sector-specific risk.

Corporate clients, particularly in the technology and venture capital sectors, are more likely to move large amounts of money in response to changes in interest rates or market uncertainty. As rising interest rates offered more attractive yields elsewhere, these corporate clients had a stronger incentive to withdraw their funds and move them to higher-yielding alternatives, such as money market funds or other short-term investments (Rose 2023).

Meanwhile, larger banks have a more balanced mix of retail and commercial deposits. These deposits tend to be smaller, more stable, and insured by the FDIC. Retail customers are generally less reactive to short-term market shifts, focusing more on their accounts' safety and convenience, making retail deposits a more reliable funding source (Rose 2023).

Additionally, most of SVB's deposits were uninsured due to its business model.

Banks, encouraged by a low interest rate environment, took on interest rate risk by investing in long-term assets while relying on these volatile uninsured deposits (Acharya et al. 2023).

Although the FDIC insures deposits up to **$250.000**, many venture capital-backed companies with accounts at SVB held balances in the tens or hundreds of millions to meet their operational requirements. As of late 2022, the bank had **37.466** depositors with balances surpassing the FDIC-insured limit. These accounts totaled **$157 billion**, with an average of **$4,2 million** per account (Rubinstein 2023).

A t-test underscores SVB's heavy reliance on uninsured deposits, revealing a highly significant difference compared to the uninsured deposit levels of the broader U.S. banking sector.

The results reveal a p-value of $2{,}67e^{-07}$, indicating a statistically significant disparity. The confidence interval of [30,94; 44,89] does not include zero, which confirms with 95% confidence that SVB's uninsured deposit ratio was consistently higher than the sector average.

Specifically, the interval suggests SVB's uninsured deposits were between 30,94 and 44,89 percentage points higher than among other U.S. banks. The test statistic of 12,113 further underscores the magnitude of this difference **(Exhibit 34)**.

By March 2023, SVB's extraordinarily high uninsured deposit ratio of **93,9%** and outstanding unrealized losses on its balance sheet led to a catastrophic loss of depositor confidence **(Exhibit 35)**. This sparked an unprecedented bank run, with **25%** of deposits withdrawn in a single day and an additional 62% scheduled for the following day before the bank was closed. The hidden risk lay in SVB's concentrated depositor base of over 35.000 corporate clients, many influenced by a small group of venture capital firms, who simultaneously acted in lockstep, withdrawing deposits. SVB's deposit insurance coverage ratio[15] was alarmingly low at just **6%**, making the bank more exposed to risk than other banks **(Exhibit 36)**.

Similarly, Signature Bank, with an uninsured deposit ratio of 89,7% and a slightly higher insurance coverage ratio of 10%, also faced rapid outflows and ultimately collapsed.

First Republic Bank, while somewhat less exposed, with an uninsured deposit ratio of 67,7% and an insurance coverage ratio of 32%, still proved vulnerable to significant depositor withdrawals **(Exhibit 36)**. In contrast, central banks such as Bank of America and JPMorgan Chase had much lower percentages of uninsured deposits, at **47,1%** and **52,5%**, indicating a more stable and diversified depositor base. Larger banks with lower uninsured deposit ratios were less exposed to sudden liquidity shocks, as their deposit bases were more heavily insured by the FDIC, offering greater stability in times of financial stress.

Unlike historical deposit runs that unfolded over days or weeks, the collapse of SVB and other banks in 2023 occurred at an unprecedented speed, driven by technological advances that enabled instant withdrawals and real-time fund transfers.

[15] The deposit insurance coverage ratio is the percentage of a bank's total deposits that are protected by deposit insurance, ensuring depositor funds are secure up to the insured limit. Source: Federal Reserve Deposit Corporation

Communication through social media further amplified depositor panic, allowing information and fear to spread rapidly, leading to coordinated and almost instantaneous mass withdrawals.

6. Limitations

The paper effectively identifies critical factors behind the collapse of the Silicon Valley Bank, yet it acknowledges limitations that are out of scope. Other significant contributors, such as internal management decisions, corporate governance failures, and operational inefficiencies, likely played a pivotal role in the crisis. However, human behavior and decision-making processes are inherently complex and challenging to identify, mainly as internal company information is not publicly accessible. Moreover, regulatory changes and potential gaps in oversights might have contributed to the systematic weaknesses. Banks are among the most regulated institutions, yet it is unclear whether SVB fully complied with these regulations, attempted to exploit loopholes, or fell short in compliance. However, investigating such compliance issues was not the primary focus of this study. Finally, the comparison between SVB and other banks may not fully account for differences in business models, risk appetites, and client bases, which could further contextualize SVB's unique vulnerabilities.

Despite these limitations, the regression and t-test results, the analysis of SVB's bond portfolio, and the comparison to the other U.S. banks provide a critical foundation for understanding the systematic vulnerabilities that contributed to SVB's collapse and the 2023 banking crisis.

Future studies could incorporate additional variables and a more comprehensive risk analysis of the bank's exposure to provide a broader understanding of factors driving financial instability. Additionally, investigating the effectiveness of regulatory frameworks and stress-testing models in identifying early warning signals for banks with similar risk profiles would offer valuable insights for preventing future crises.

7. Conclusion

The main result of this analysis shows that Silicon Valley Bank's collapse was primarily due to its heavy exposure to long-term, low-interest bonds, asset-liability mismatch, failed hedging strategies, and high reliance on uninsured deposits in an environment of rapidly rising interest rates. Regression results confirm that increases in interest rates and treasury yields significantly devalued SVB's valuation and significantly led to unrealized losses in fixed-income securities. Different t-tests further highlight SVB's outlier status, with its HTM securities and uninsured deposit ratios far exceeding those of its peers.

Therefore, the study underscores three critical dynamics contributing to SVB's collapse.

First, banks with a high proportion of long-term bonds are more exposed to interest rate risks, as evidenced by the significant unrealized losses caused by rising federal funds rates. Second, significant mismatches between the duration of assets and liabilities increase vulnerability to liquidity crises when short-term funding sources cannot sustain long-term investments during rate hikes. Finally, banks with higher concentrations of uninsured deposits are especially prone to liquidity crises in volatile economic conditions, as depositor confidence diminishes and funds are rapidly withdrawn. The comparison with other U.S. banks, underscores the importance of robust risk management practices, diversified asset allocation, and a stable depositor base in weathering economic pressures. Although other U.S. banks did not collapse, they still faced setbacks due to rising interest rates, evident in increased deposit withdrawals and substantial unrealized losses on their balance sheets. These challenges reveal the broader vulnerabilities within the banking system, exposing systematic weaknesses triggered by abrupt monetary policy changes. Therefore, the failures of several banks in 2023 serve as a warning for the banking sector, highlighting that even "safe" securities can lead to systemic instability if not managed carefully. It underscores the pressing need for more adaptive risk management and regulatory oversight that account for the evolving macroeconomic landscape.

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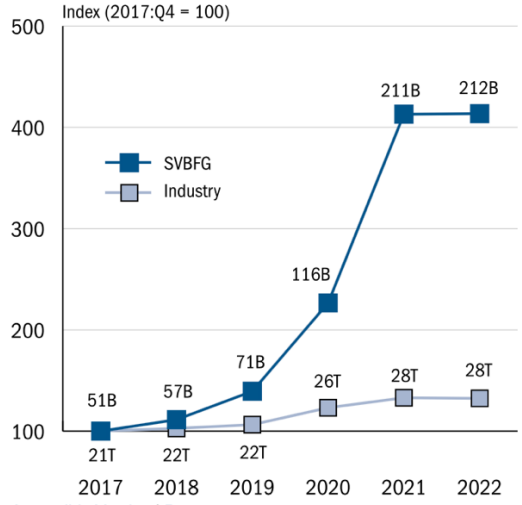
Appendix

Exhibit 1 – Balance Sheet of Silicon Valley Bank

Dollars in millions, except par value and share data	2022	2021	2020	2019	2018	2017
Assets						
Cash and cash equivalents	13803	14586	17675	6782	3572	2923
Available-for-sale securities, at fair value	26069	27221	30912	14015	7790	11121
Held-to-maturity securities, at amortized cost and net of allowance for credit losses	91321	98195	16592	13843	15487	12663
Non-marketable and other equity securities	2664	2543	1802	1214	941	651
Total investment securities	120054	127959	49307	29072	24219	24435
Loans, amortized cost	74250	66276	45181	33165	28338	23106
Allowance for credit losses: loans	-636	-422	-448	-305	-281	-255
Net loans	73614	65854	44734	32860	28057	22851
Premises and equipment, net of accumulated depreciation and amortization	394	270	176	162	129	129
Goodwill	375	375	143	138		
Other intangible assets, net	136	160	61	49		
Lease right-of-use assets	335	313	210	197		
Accrued interest receivable and other assets	3082	1791	3206	1745	951	876
Total assets	**211793**	**211308**	**115511**	**71005**	**56928**	**51214**
Liabilities and Total Equity						
Liabilities:						
Noninterest-bearing demand deposits	80753	125851	66519	40842	39103	36655
Interest-bearing deposits	92356	63352	35463	20916	10225	7599
Total deposits	173109	189203	101982	61758	49329	44254
Short-term borrowings	13565	71	21	17	631	1034
Lease liabilities	413	388	260	219		
Other liabilities	3041	2467	3972	2042	1006	912
Long-term debt	5370	2570	844	348	696	695
Total liabilities	**195498**	**194699**	**107078**	**64384**	**51663**	**46895**
SVBFG stockholders' equity:						
Preferred stock, $0.001 par value, 20,000,000 shares authorized	3646	3646	3401	3401		
Common stock, $0.001 par value, 150,000,000 shares authorized			52	52	53	53
Additional paid-in capital	5318	5157	1585	1470	1378	1314
Retained earnings	8951	7442	5672	4576	3792	2867
Accumulated other comprehensive income (loss)	-1911	-9	623	84	-54	-1
Total SVBFG stockholders' equity	16004	16236	8220	6470	5116	4180
Noncontrolling interests	291	373	214	151	149	140
Total equity	**16295**	**16609**	**8433**	**6621**	**5265**	**4319**
Total liabilities and total equity	**211793**	**211308**	**115511**	**71005**	**56928**	**51214**

Source: own representation based on 10-K report of SVB Financial Group. https://www.sec.gov/Archives/edgar/data/719739/000071973923000021/sivb-20221231.htm

Exhibit 2 – SVBFG´s Asset Growth in U.S. Dollars Compared to the Banking Industry



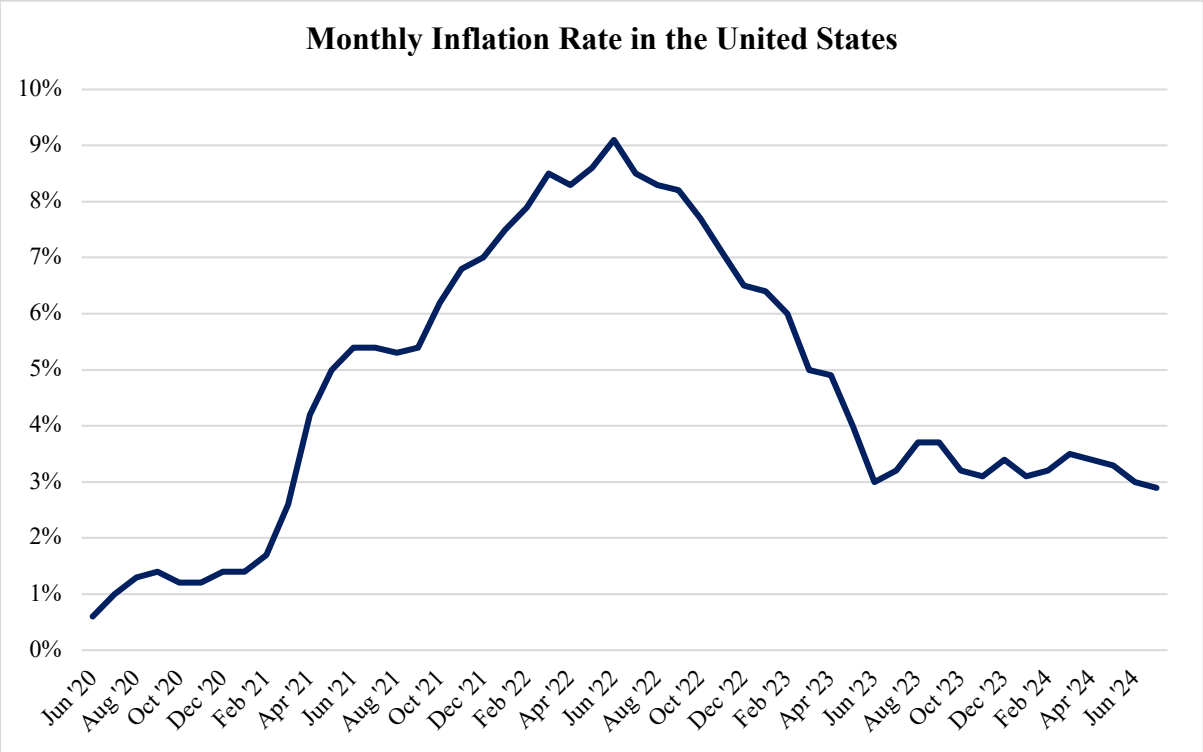
Source: Barr, Michael. 2023. "Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank." *Board of Governors of the Federal Reserve System*. April. https://www.federalreserve.gov/publications/files/svb-review-20230428.pdf

Exhibit 3 – Income Statement of Silicon Valley Bank

Dollars in millions, except per share amounts	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**
Interest Income						
Loans	3208	1966	1520	1599	1358	1026
Investment securities:						
Taxable	2113	1199	635	569	542	412
Non-taxable	140	106	61	45	35	6
Federal funds sold, securities purchased under agreements to resell and other short-term investment securities	212	18	26	96	35	22
Total interest income	**5673**	**3289**	**2242**	**2309**	**1970**	**1465**
Interest expense:						
Deposits	862	62	60	178	29	9
Borrowings	326	48	25	35	47	36
Total interest expense	**1188**	**110**	**85**	**213**	**76**	**45**
Net interest income	4485	3179	2157	2097	1894	1420
Provision for credit losses	420	123	220	106	88	92
Net interest income after provision for credit losses	4065	3056	1937	1990	1806	1328
Non-interest income						
Gains (losses) on investment securities, net	-285	761	421	135	88	65
Gains on equity warrant assets, net	148	560	237	138	89	55
Client investment fees	386	75	132	182	130	56
Wealth management and trust fees	83	44				
Foreign exchange fees	285	262	179	159	139	116
Credit card fees	150	131	98	119	94	77
Deposit service charges	126	112	90	89	76	59
Lending related fees	94	76	57	50	42	43
Letters of credit and standby letters of credit fees	57	51	47	43	35	29
Investment banking revenue	420	459	414	195		
Commissions	98	79	67	56		
Other	166	128	98	55	52	59
Total non-interest income	**1728**	**2738**	**1840**	**1221**	**745**	**557**
Noninterest expense:						
Compensation and benefits	2293	2015	1318	990	727	606
Professional services	480	392	247	205	159	122
Premises and equipment	269	178	127	97	78	72
Net occupancy	101	83	101	69	55	48
Business development and travel	85	24	24	69	48	42
FDIC and state assessments	75	48	28	19	34	35
Merger-related charges	50	129				
Other	268	201	190	153	87	85
Total noninterest expense	**3621**	**3070**	**2035**	**1601**	**1188**	**1011**
Income before income tax expense	2172	2724	1742	1610	1363	875
Income tax expense	563	651	448	426	352	355
Net income before noncontrolling interests and dividends	1609	2073	1294	1185	1011	519
Net loss (income) attributable to noncontrolling interests	63	-240	-86	-48	-38	-29
Preferred Stock Dividend	-163	-63	-17			
Net income available to common stockholders	**1509**	**1770**	**1191**	**1137**	**974**	**491**
Earnings per common share-basic	26	32	23	22	18	9
Earning per common share-diluted	25	31	23	22	18	9

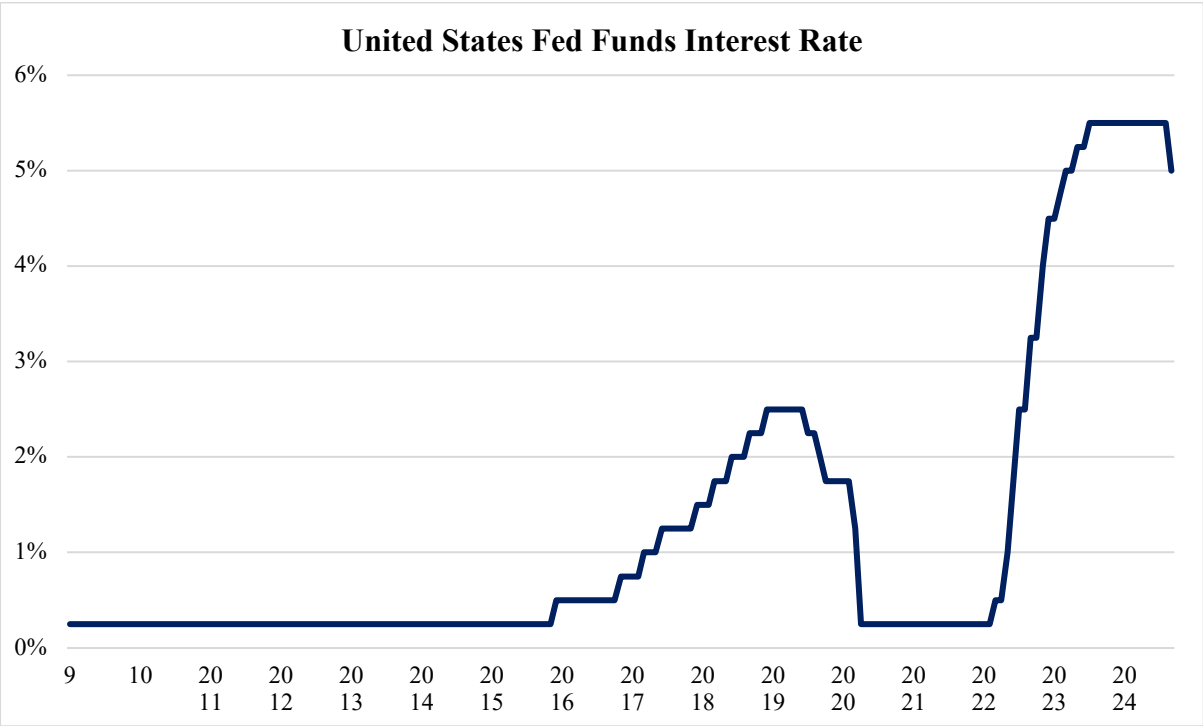
Source: own representation based on 10-K report of SVB Financial Group. https://www.sec.gov/Archives/edgar/data/719739/000071973923000021/sivb-20221231.htm

Exhibit 4 – Monthly Inflation Rate in the United States from 2020-2024



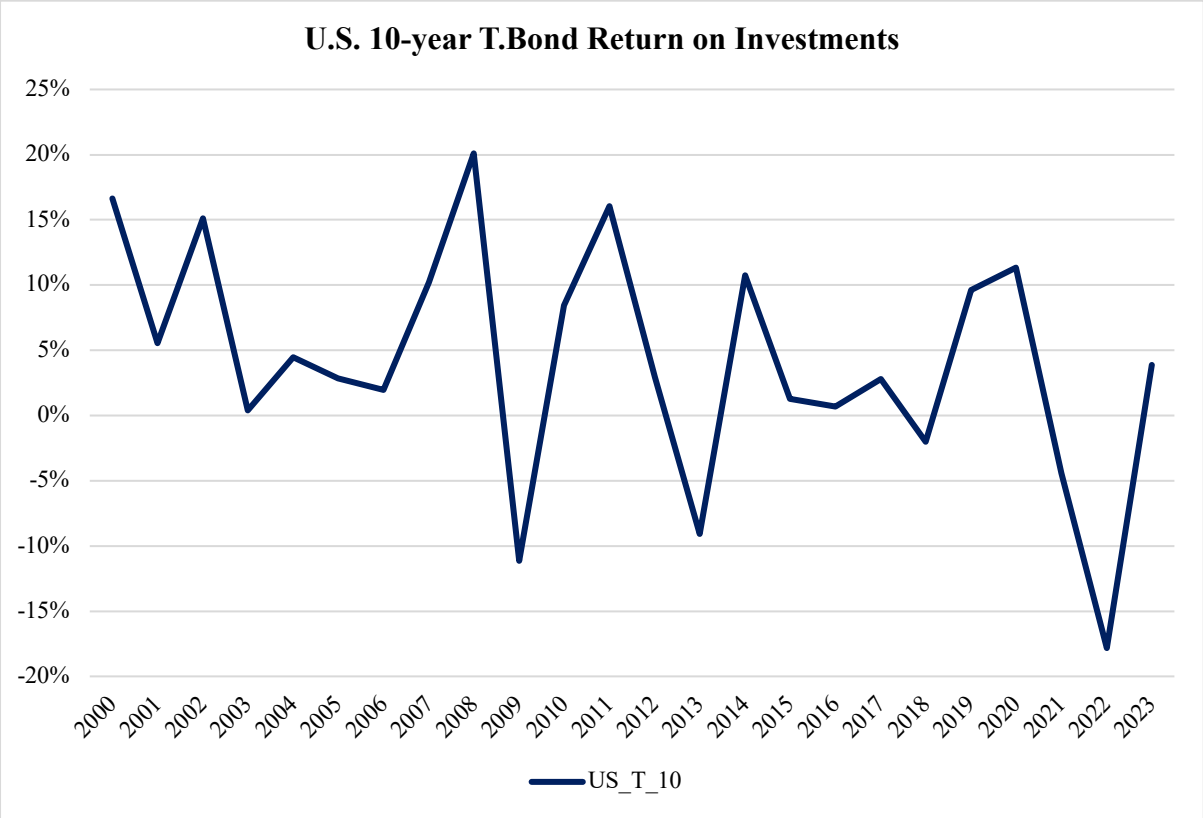
Source: own graph based on data obtained from Statista. 2024. "U.S. monthly inflation rate 2024." November 19, 2024.https://www.statista.com/statistics/273418/unadjusted-monthly-inflation-rate-in-the-us/.

Exhibit 5 – Interest Rates from 2009-2024 in the United States



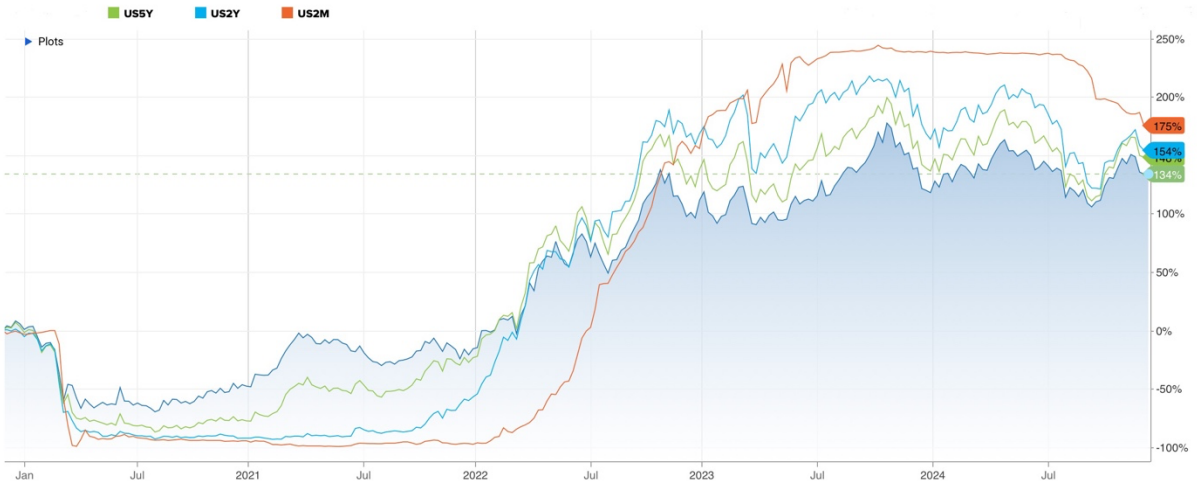
Source: own graph based on data collected from Trading Economics. (n.d.). *United States Fed funds interest rate*. https://tradingeconomics.com/united-states/interest-rate

Exhbit 6 – Annual Returns on Investments of U.S. 10-Year T.Bonds



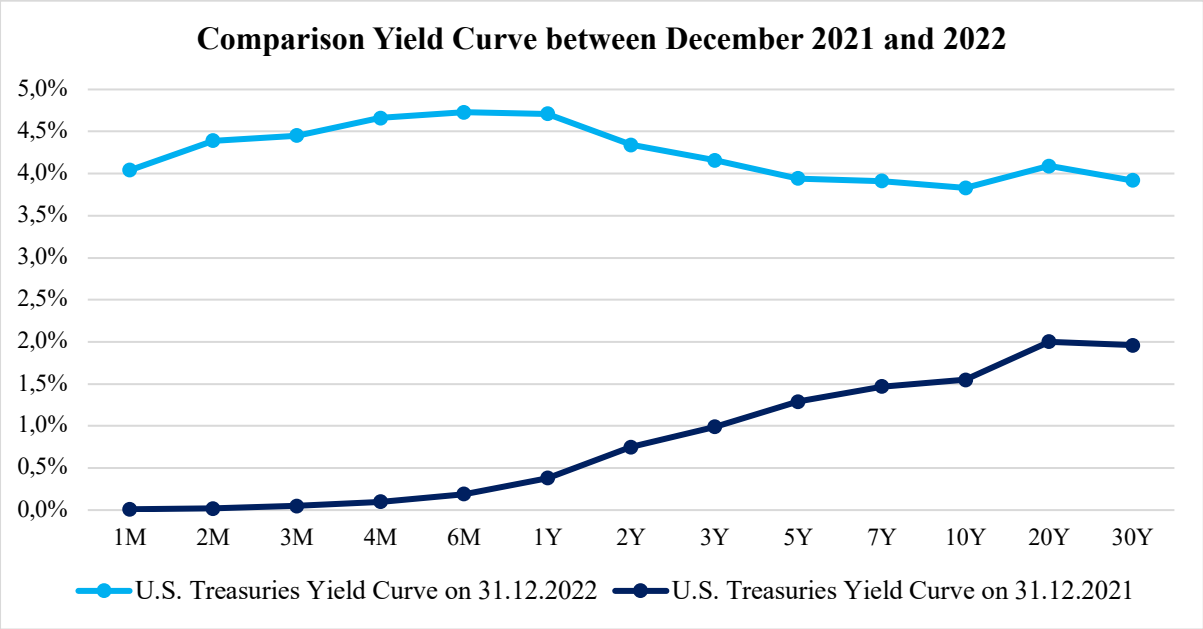
Source: own illustration based on data retrieved from Bloomberg

Exhibit 7 – U.S. 10-Year Treasury Yield vs. 5-Years, 2-Years and 2-Months



Source: CNBC. 2024. "U.S. 10 Year Treasury." https://www.cnbc.com/quotes/US10Y

Exhibit 8 – Comparison of U.S. Treasury Yield Curves: 2021 vs. 2022



Note. the dark blue yield curve is the normal one and the light blue yield curve is inverted
Source: own illustration based data retrieved from https://www.ustreasuryyieldcurve.com/

Exhibit 9 – Linear Regression Model Output

Linear regression model:
SVB_EQUS ~ 1 + Interest_Rates + 10YR_Bond_Yield

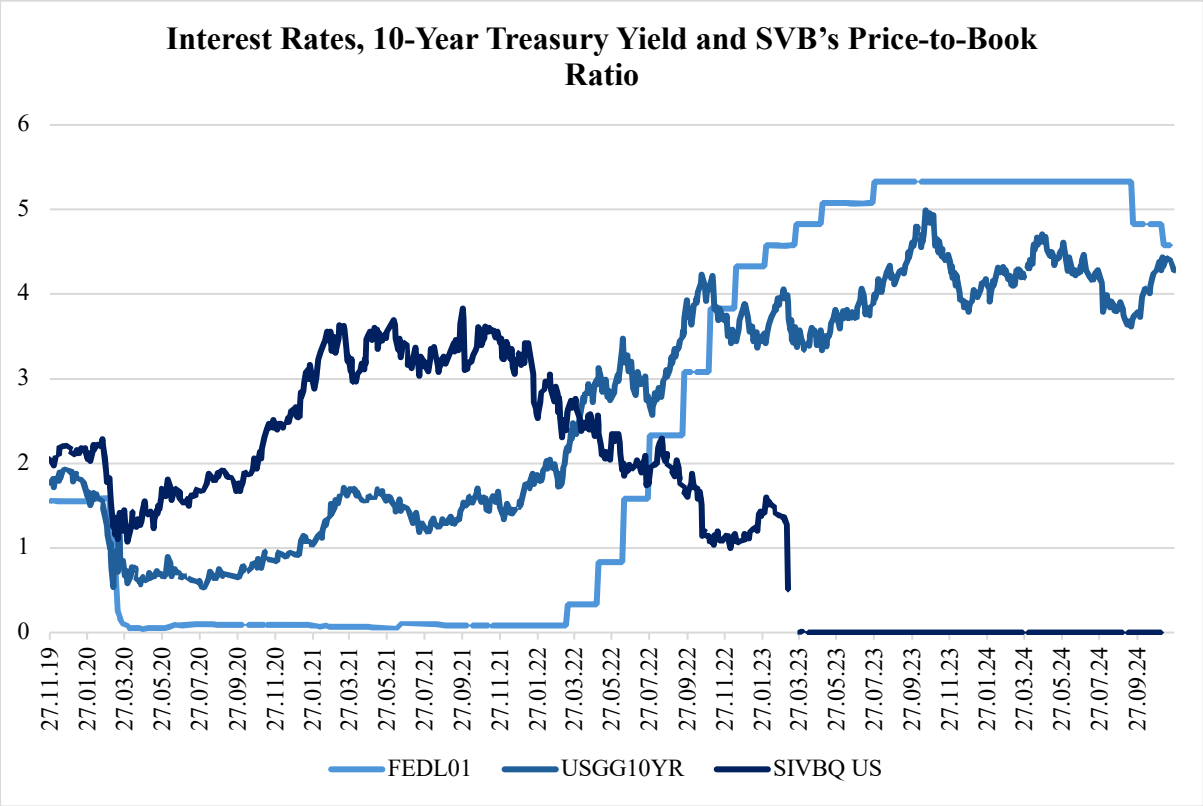
Estimated Coefficients:

	Estimate	SE	T-stat	P-value
(Intercept)	2,1238	0,041566	51,094	1,6818E-306
Interest_Rates	-0,76008	0,01659	-45,816	2,7232E-268
10YR_Bond_Yield	0,47009	0,027713	16,963	3,6897E-58

Number of observations: 1234; Error degrees of freedom: 1231
Root Mean Squared Error: 0,502
R-squared: 0,846; Adjusted R-Squared 0,846
F-statistic vs. constant model: 3,39E+03, p-value = 0

Source: own linear regression model based on data sourced from Bloomberg

Exhibit 10 – Rising Interest Rates and Treasury Yield on SVB's Price-to-Book Ratio



Source: own graph based on data obtained from Bloomberg

Exhibit 11 – SVB's AFS, HTM Portfolios, and Duration Trends under Changing Rates

Year ended December 31

Dollars in millions, duration in years	**2019**	**2020**	**2021**	**2022**
AFS	14015	30913	27221	26069
HTM	13843	16592	98202	91321
Duration HTM Portfolio	3,9	3,7	4	6,2
Interest Rate	1,75	0,25	0,25	4,5

Source: own illustration based on annual reports of SVB Financial Group. https://ir.svb.com/financials/annual-reports-and-proxies/default.aspx

Exhibit 12 – Comparison of HTM and AFS Securities across Major U.S. Banks 2020-2022

Source: Buhayar, Noah, Jennifer Surname, Andre Tartar, Raeedah Wahid, Dean Halford, and Hayley Warren. 2023. "US Banks Have $620bn of Unrealized Losses on Their Books." *Bloomberg*, March. https://www.bloomberg.com/graphics/2023-svb-ex- posed-risks-banks/?sref=k6GY0Sab&embedded-checkout=true.

Exhibit 13 – SVB's Performance and Condition Ratios Compared to Industry Benchmarks

	2022	2021	2020	2019	Benchmark
SVB's performance ratios in %					**All-2022**
Net Interest Margin	2,23	2,05	2,61	3,53	3,5
Return on Assets	0,96	0,8	0,95	1,65	1,12
Return on Equity	13,43	11,88	13,94	21,47	11,83
Yield on Earning Assets	2,77	2,09	2,68	3,83	3,5
SVB's condition ratios in %					
Loss Allowance to Loans & Leases	0,86	0,64	0,99	0,92	1,6
Nonperforming Assets to Total Assets	0,05	0,03	0,05	0,11	0,39
Leverage Ratio	7,96	7,24	6,43	7,3	8,98
Equity Capital to Total Assets	7,39	7,09	6,21	7,2	9,34
Net Loans and Leases to Deposits	41,97	34,4	43,35	52,18	62,62
Total Risk-Based Capital	16,05	15,4	11,49	11,96	14,94

Note. All-2022 represents the average performance of all banks across the U.S. during 2022
Source: own representation based on data collected from the Federal Deposit Insurance Corporation

Exhibit 14 – Selected Summary of SVB's Performance in 2022 vs. 2021

Dollars in millions, except per share data and ratios	**Year ended December 31**		
	2022	**2021**	**% Change**
Income Statement:			
Diluted EPS	25,35	31,25	-18,88%
Provision for credit losses	420	123	241,46%
Non-interest income	1728	2738	-36,89%
Earnings Ratios:			
Return on average assets	0,70%	0,84%	-16,67%
Return on average SVBFG common stockholders equity	12,14	17,1	-29,01%
Capital Ratios:			
SVBFG tier 1 risk-based capital ratio	15,40%	16,08%	-4,23%
Bank tangible common equity to tangible assets	7,28%	7,10%	2,54%
Bank tangible common equity to risk-weighted assets	13,65%	15,06%	-9,36%
Other Ratios:			
Total costs of deposits	0,46	0,04	1050,00%
Operating efficiency ratio	58,28%	51,88%	12,34%

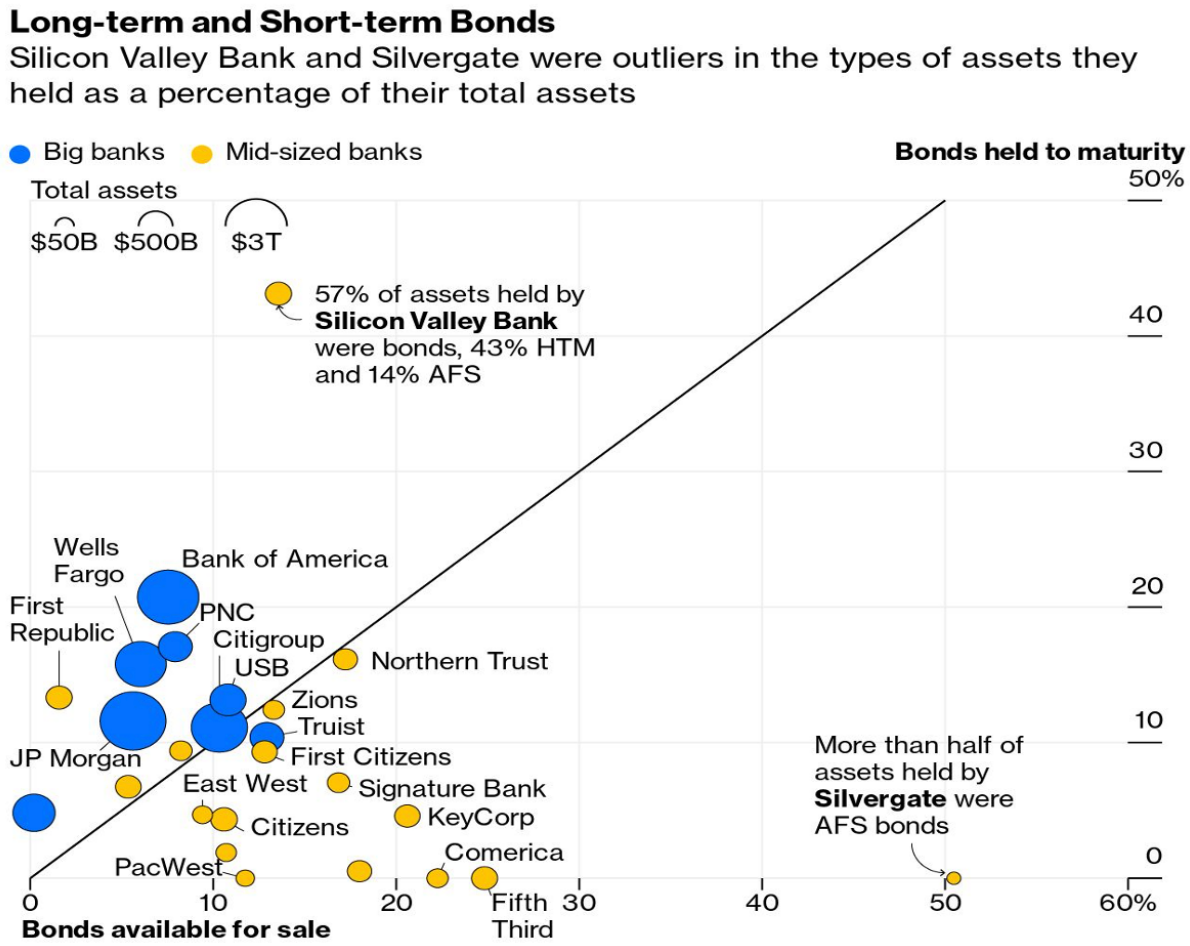
Source: own illustration based on the annual report from SVB Financial Group. https://ir.svb.com/financials/quarterly-results/default.aspx

Exhibit 15 – T-Test Results: SVB_HTM vs. US_ALL_HTM

T-Test Results: SVB_HTM vs Combines Other Banks HTM Ratios Reject the null hypothesis: Significant difference between the means of SVB_HTM and Combined Other Banks HTM Ratios P-value: 0,00098786 (highly significant) Confidence Interval: [10,1305; 30,7021] The condidence interval does not include 0, suggesting a significant difference Test Statistic: 4,3247 (large difference) Degrees of Freedom: 12

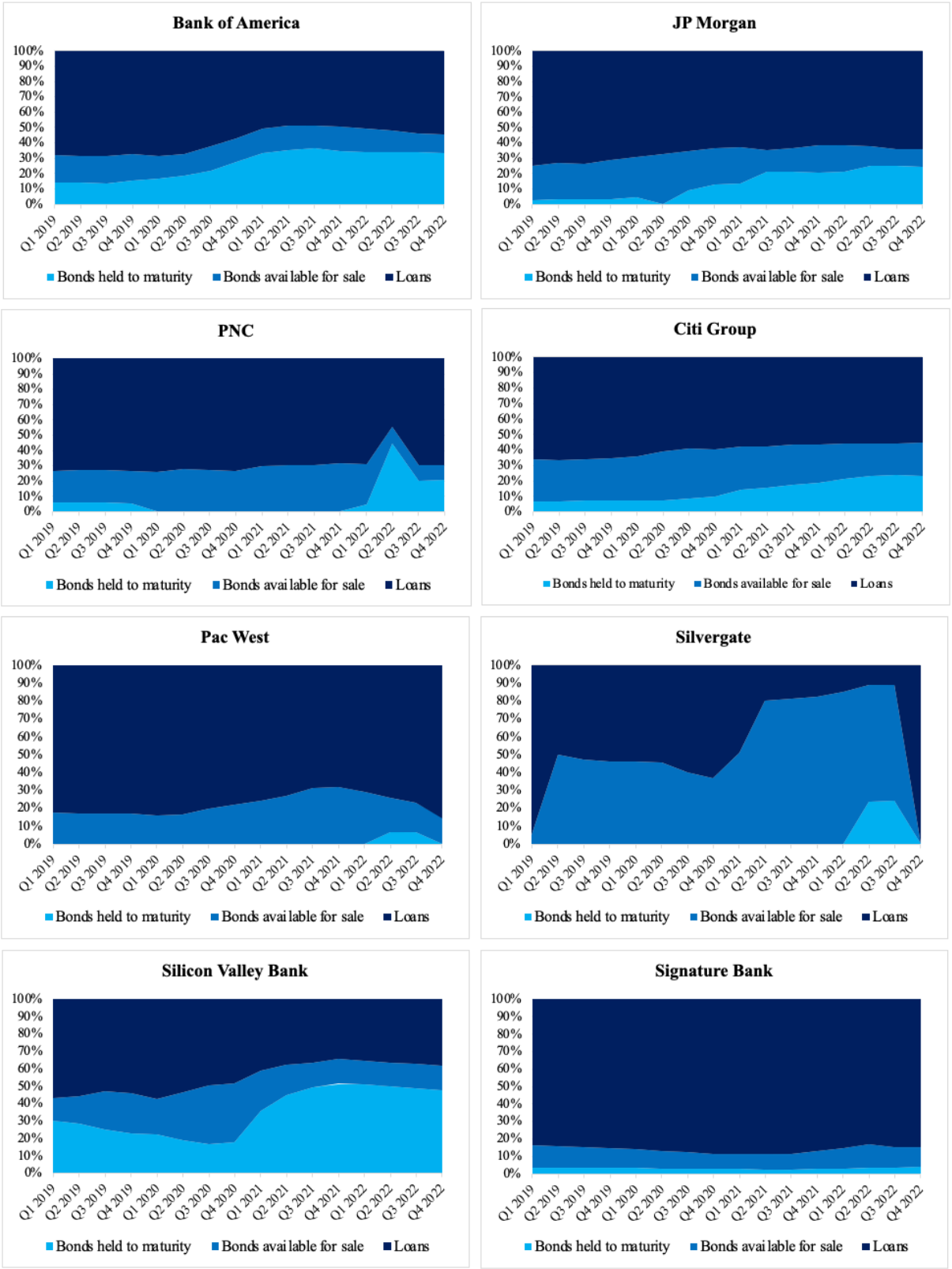
Source: own t-test based on data obtained from annual reports of the different banks

Exhibit 16 – Bond Holdings Comparison across U.S. Banks in Q4 2022



Source: Davies, Paul, and Elaine He. 2023. "Why Did Silicon Valley Bank Fail? What Happened to the Deposits?" *Bloomberg*. https://www.bloomberg.com/opinion/features/2023-04-02/why- did-silicon-valley-bank-fail-what-happened-to-the-deposits.

Exhibit 17 – Asset Composition of different U.S. Banks throughout 2019-2022



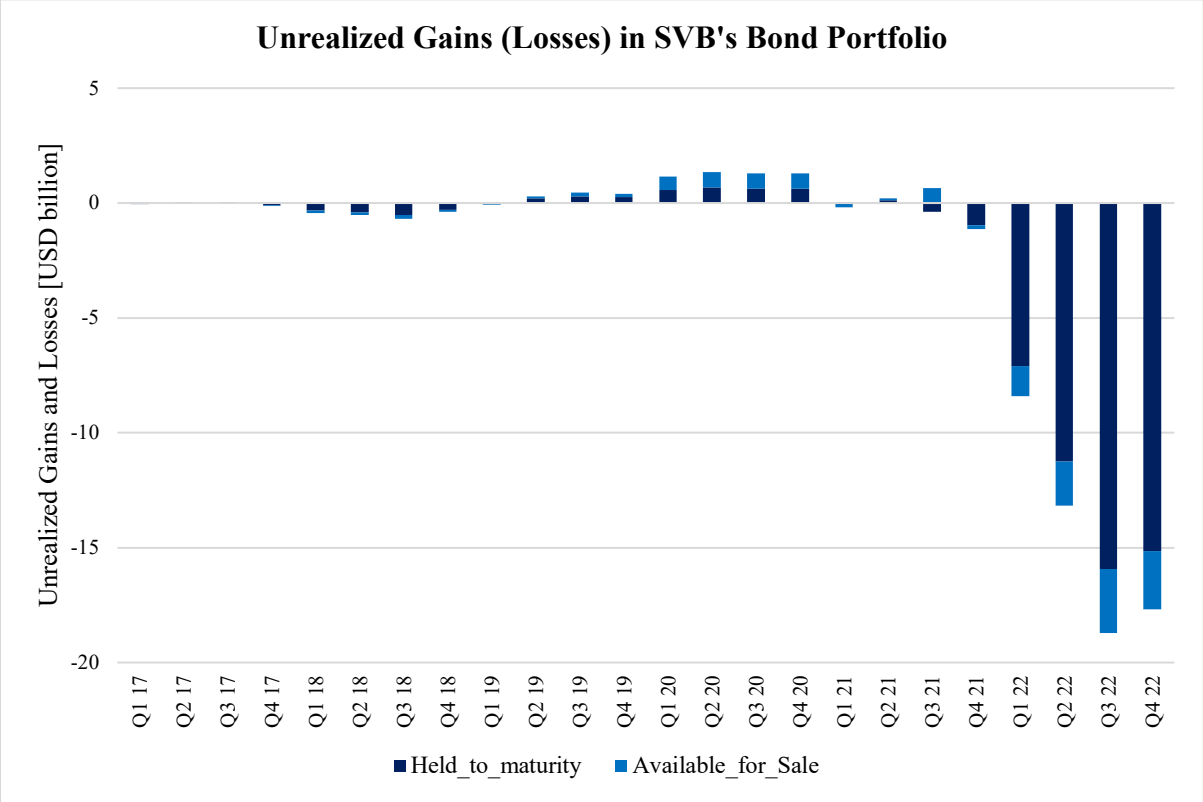
Source: own illustration based on data collected from quartely reports of the different banks

Exhibit 18 – AFS and HTM Devaluation Trends (USD million) with Interest Rate Changes

	Year Range	AFS Devaluation	HTM Devaluation	Interest Rate
1	2019-2020	-5.154	-14.425	2,5
2	2020-2021	298.012	1.028.988	1,75
3	2021-2022	2.090.000	90.289.000	0,25-4,25

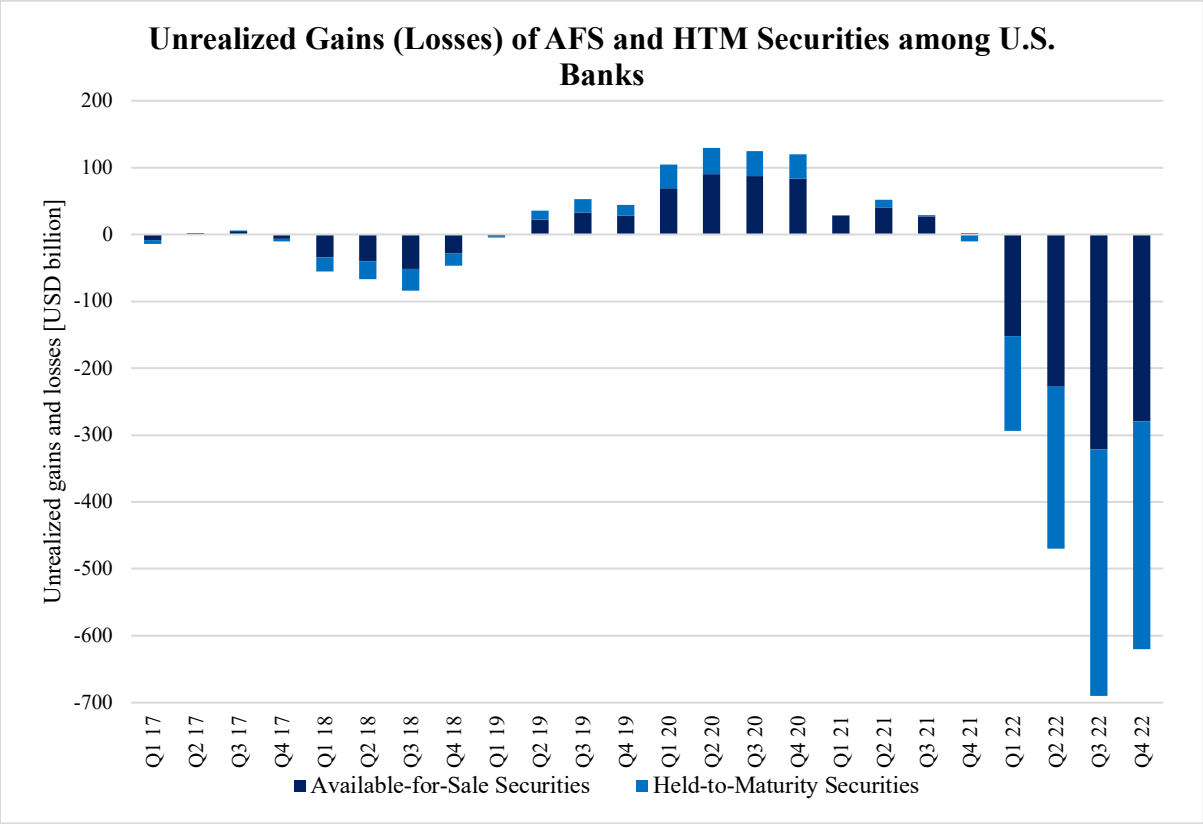
Source: own calculations based on annual reports 2019, 2020, 2021 and 2022 of SVB Financial Group. https://ir.svb.com/financials/annual-reports-and-proxies/default.aspx

Exhibit 19 – Unrealized Gains (Losses) in SVB's Bond Portfolio between 2017-2022



Source: own graph based on quarterly data from SVB Financial Group. https://ir.svb.com/financials/quarterly-results/default.aspx

Exhibit 20 – Unrealized Gains (Losses) of AFS and HTM Securities across U.S. Banks



Source: own graph based on data obtained from the Federal Deposit Insurance Corporation

Exhibit 21 – Linear Regression Model Output

Linear regression model:
HTM_UGL ~ 1 + Interest_Rates + 10YR_Bond_Yield

Estimated Coefficients:

	Estimate	SE	T-stat	P-value
(Intercept)	68,149	24,967	2,7296	0,0084204
Interest_Rates	-34,041	9,5321	-3,5711	0,00073046
10YR_Bond_Yield	-24,642	10,531	-2,34	0,022809

Number of observations: 60, Error degrees of freedom: 57
Root Mean Squared Error: 62
R-squared: 0,334; Adjusted R-Squared 0,311
F-statistic vs. constant model: 14,3; p-value = 9,31E-06

Source: own regression model based on data collected from the Federal Reserve Bank

Exhibit 22 – Linear Regression Model Output

Linear regression model:
AFS_UGL ~ 1 + Interest_Rates + 10YR_Bond_Yield

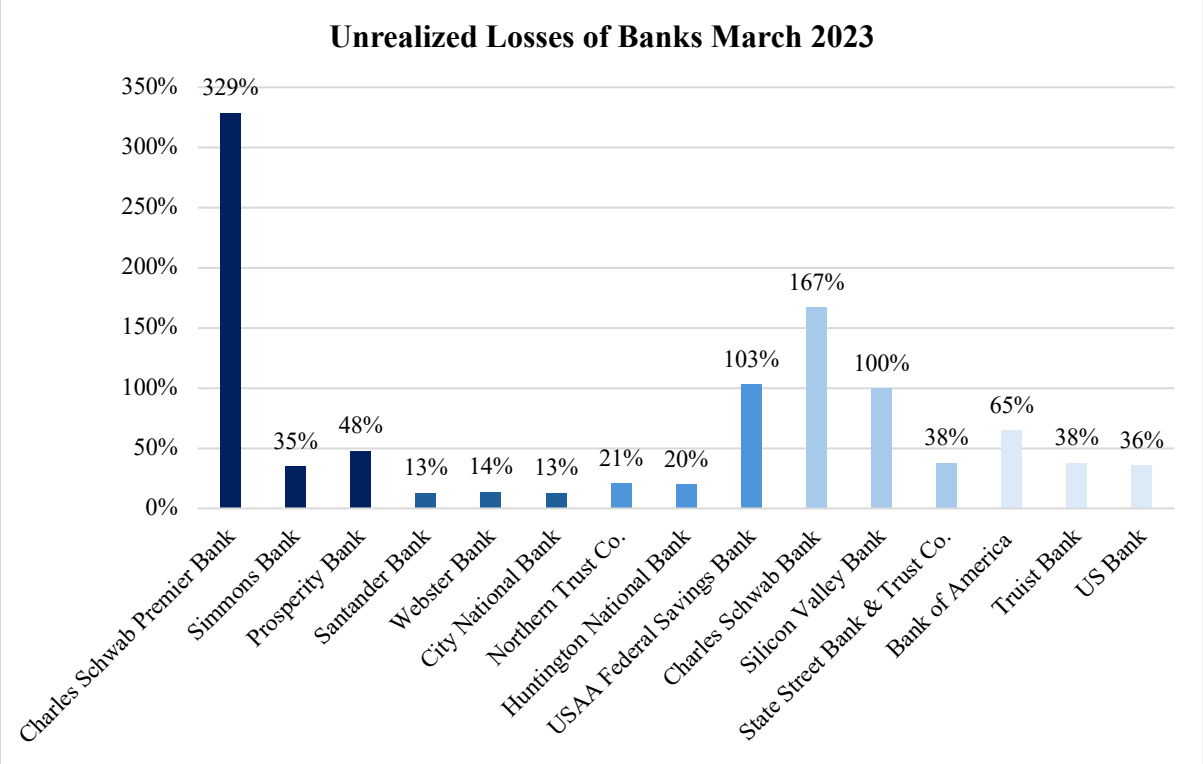
Estimated Coefficients:

	Estimate	SE	T-stat	P-value
(Intercept)	116,21	22,136	5,2498	2,3419E-06
Interest_Rates	-36,418	8,4513	-4,3092	6,5498E-05
10YR_Bond_Yield	-38,26	9,3366	-4,0979	0,00013348

Number of observations: 60, Error degrees of freedom: 57
Root Mean Squared Error: 55
R-squared: 0,499; Adjusted R-Squared 0,481
F-statistic vs. constant model: 28,4; p-value = 2,82E-09

Source: own regression model based on data obtained from the Federal Reserve Bank

Exhibit 23 – Unrealized Losses of U.S. Banks in March 2023



Source: own illustration based on data obtained from Bloomberg

Exhibit 24 – Held to Maturity Securities Portfolio by Asset Class and Maturity

December 31, 2022

	Total		One Year or Loss		After One Year to Five Years		After Five Years to Ten Years		After Ten Years	
(Dollar in millions)	Net Carry Value	Weighted Average Yield	Net carry Value	Weighted Average Yield	Net Carry Value	Weighted Average Yield	Net Carry Value	Weighted Average Yield	Net Carry Value	Weighted Average Yield
U.S. agency debentures	486	1,91%	$ 1,00	2,39%	118	2,50%	367	1,72%	—	—%
Residential MBS:										
Agency-issued MBS	57705	1,56%	—	1,65%	25	2,38%	1066	2,32%	56614	1,54%
Agency-issued CMO - fixed rate	10461	1,48%	—	—	90	1,47%	129	1,71%	10242	1,48%
Agency-issued CMO - variable rate	79	0,79%	—	—	—	—	—	—	79	0,74%
Agency-issued CMBS	14471	1,63%	39	0,45%	153	0,86%	966	1,93%	13313	1,62%
Municipal bonds and notes	7416	2,82%	29	2,26%	235	2,48%	1362	2,74%	5790	2,85%
Corporate Bonds	703	1,86%	—	—	115	1,72%	588	1,88%	—	—
Total	91321	1,66%	$ 69,00	1,25%	736	1,90%	4478	2,43%	80038	1,63%

Source: own illustration based on 10-K report of SVB Financial Group.
https://www.sec.gov/Archives/edgar/data/719739/000071973923000021/sivb-20221231.htm

Exhibit 25 – Available-for-Sale Securities Portfolio by Asset Class and Maturity

December 31, 2022

	Total		One Year or Loss		After One Year to Five Years		After Five Years to Ten Years		After Ten Years	
(Dollar in millions)	Carrying Value	Weighted Average Yield	Carrying Value	Weighted Average Yield	Carrying Value	Weighted Average Yield	Carrying Value	Weighted Average Yield	Carrying Value	Weighted Average Yield
U.S. Treasury Securities	16135	1,49%	$ 983,00	1,16%	14373	1,43%	779	2,96%	—	—%
U.S. agency debentures	101	4,15%	—	—	33	4,47%	68	4,02%	—	—
Foreign government debt securities	1088	2,12%	101	1,06%	52	2,29%	935	2,21%	—	—
Residential MBS:										
Agency-issued MBS	6603	1,54%	—	—	—	—	43	2,86%	6560	1,53%
Agency-issued CMO - fixed rate	678	1,33%	—	—	—	—	—	—	678	1,33%
Agency-issued CMBS	1464	1,89%	—	—	326	2,21%	1138	1,84%	—	—
Total	26069	1,56%	1084	1,15%	14,784	1,46%	2963	2,32%	7238	1,51%

Source: own illustration based on 10-K report of SVB Financial Group.
https://www.sec.gov/Archives/edgar/data/719739/000071973923000021/sivb-20221231.htm

Exhibit 26 – Silicon Valley Bank Hedging Strategy

	Cumulative Amount of Fair Value Hedging Adjustment Included in the Amortized Cost Basis of the Hedged Assets		
(Dollars in millions)	Amortized Cost Basis of the Hedged Assets	Active	Terminated
December 31, 2022			
AFS securities	563,00	-2	-290
December 31, 2021			
AFS securities	15,26	-131	6

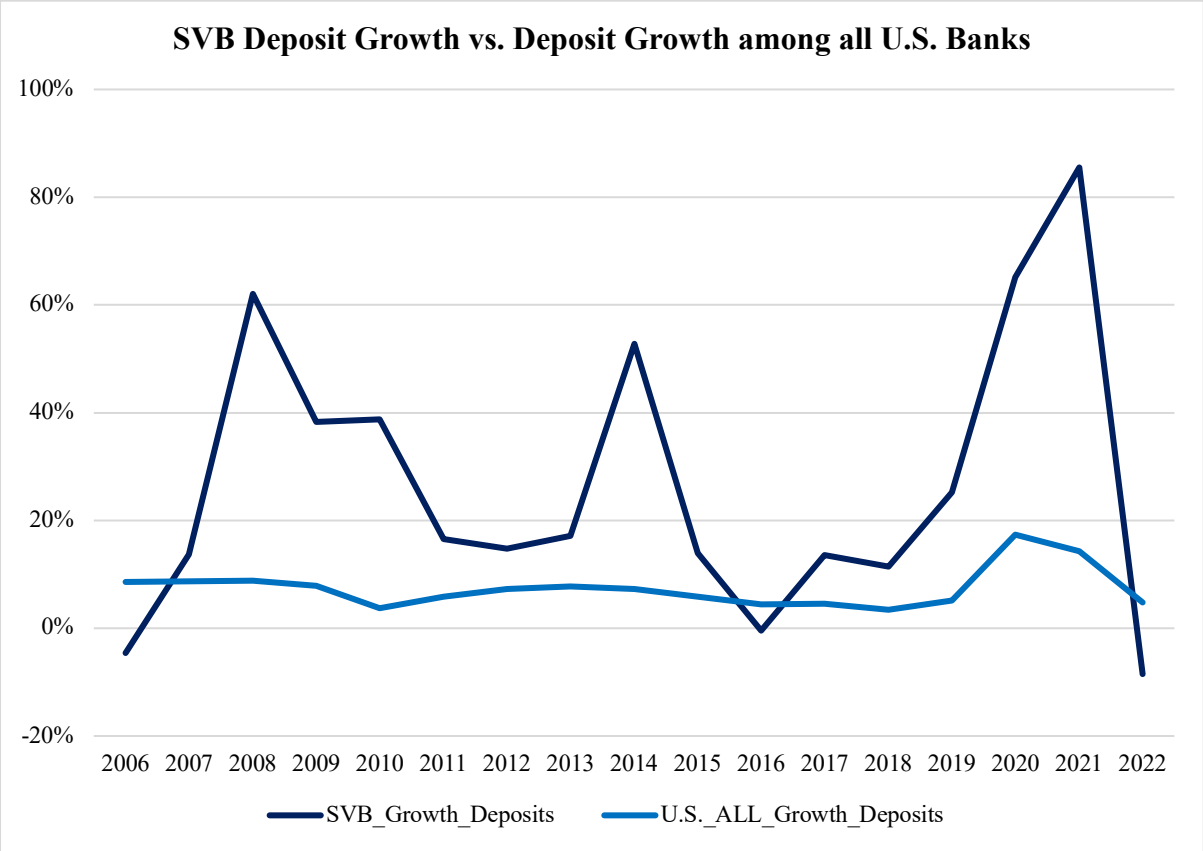
Source: own illustration based on 10-K report of SVB Financial Group.
https://www.svb.com/globalassets/library/uploadedfiles/content/corporate/2021-sivb-10-k.pdf

Exhibit 27 – Interest Rate Risk Hedging Strategy of different U.S. Banks

Bank	Interest Rate Risk Hedging Strategy
SVB	Managed interest rate risk through fixed-income securities, funding channels, capital market activities, and interest rate swaps as fair value hedges to manage exposure on available-for-sale securities and certain loans.
Signature Bank	Utilized cash flow and fair value hedges, including interest rate swaps for fixed-rate and variable-rate loans, to hedge cash flow variability and fair value risk attributable to interest rate fluctuations.
Goldman Sachs	Employed fair value and cash flow hedges for interest rate exposures, utilizing swaps to manage risks on fixed-rate borrowings and government securities, with periodic effectiveness assessments via statistical methods.
Citi Group	Used fair value hedges for fixed-rate long-term debt and available-for-sale securities, with hedge accounting when applicable; cash flow hedges managed forecasted cash flow variability from floating-rate assets.
Wells Fargo	Relied on interest rate derivatives and natural hedges from mortgage servicing rights; adjusted portfolios based on interest rate forecasts and economic conditions to manage exposure.
Fifth Third Bank	Conducted net interest income sensitivity analysis using simulation models, considering balance sheet and cash flow factors, and applied interest rate swaps where needed for hedging.
JP Morgan Chase	Managed structural interest rate risk with treasury oversight, using earnings-at-risk estimates and interest rate derivatives to hedge interest-sensitive assets and liabilities.
Bank of America	Used interest rate swaps to convert fixed-rate exposures to floating rates, diversified funding sources, and conducted simulation modeling to adjust asset allocation and portfolio duration based on interest rate changes.

Source: own table based on information obtained from annual reports of the different banks

Exhibit 28 – Deposit Growth SVB vs. the broader U.S. Banking Sector



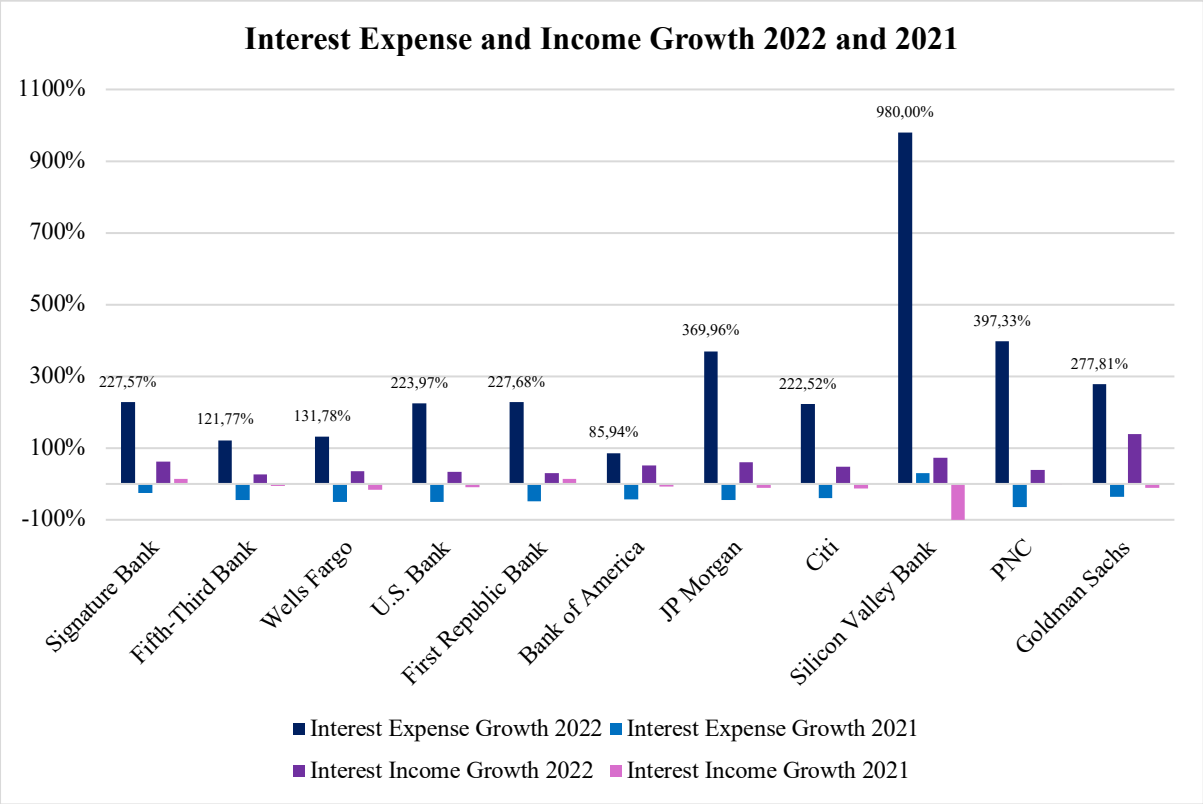
Source: own graph based on SVB's balance sheets and U.S. Bank data from the Federal Reserve Bank

Exhibit 29 – T-Test Results SVB Deposit Growth vs. U.S. Banks Deposit Growth

T-Test Results: SVB Deposit Growth % vs. U.S. ALL Deposit Growth % Reject the null hypothesis: Significant difference between the means of SVB Deposit Growth % and U.S. ALL Deposit Growth % P-value: 0,0052582 (highly significant) Confidence Interval: [6,2026; 32,5705] The condidence interval does not include 0, suggesting a significant difference Test Statistic: 2,9952 (large difference) Degrees of Freedom: 32

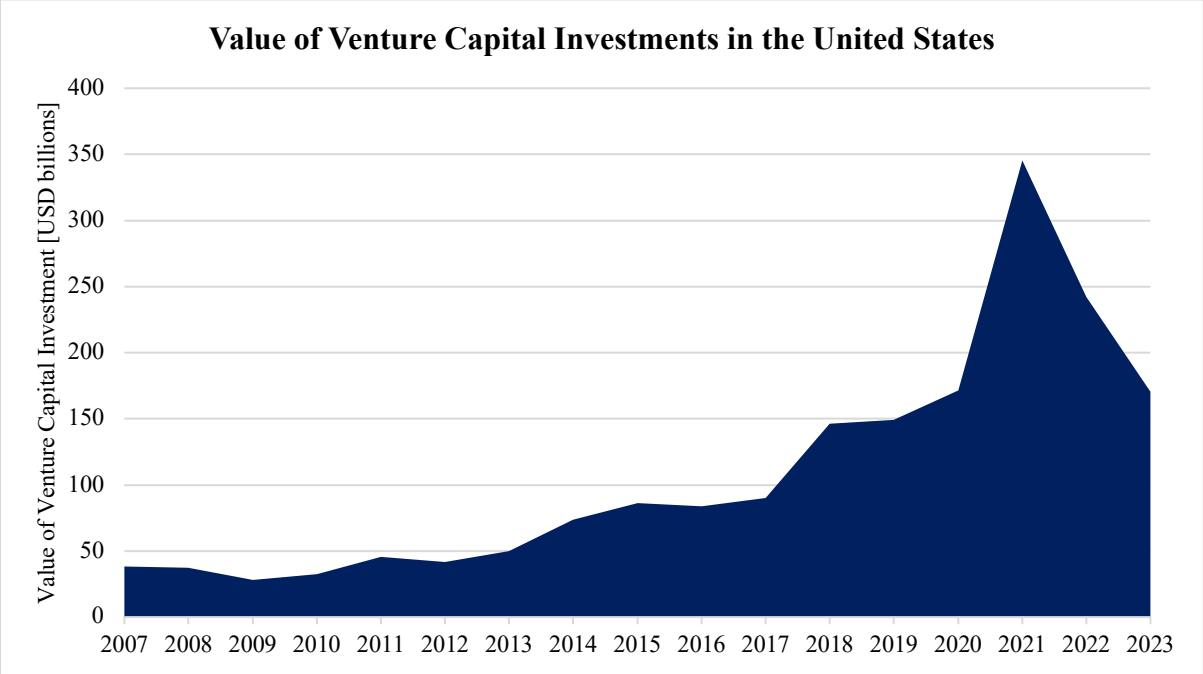
Source: own t-test based on annual reports of SVB and U.S. data obtained from the Federal Reserve Bank

Exhibit 30 – Net Interest Income and Expense Growth among U.S. Banks



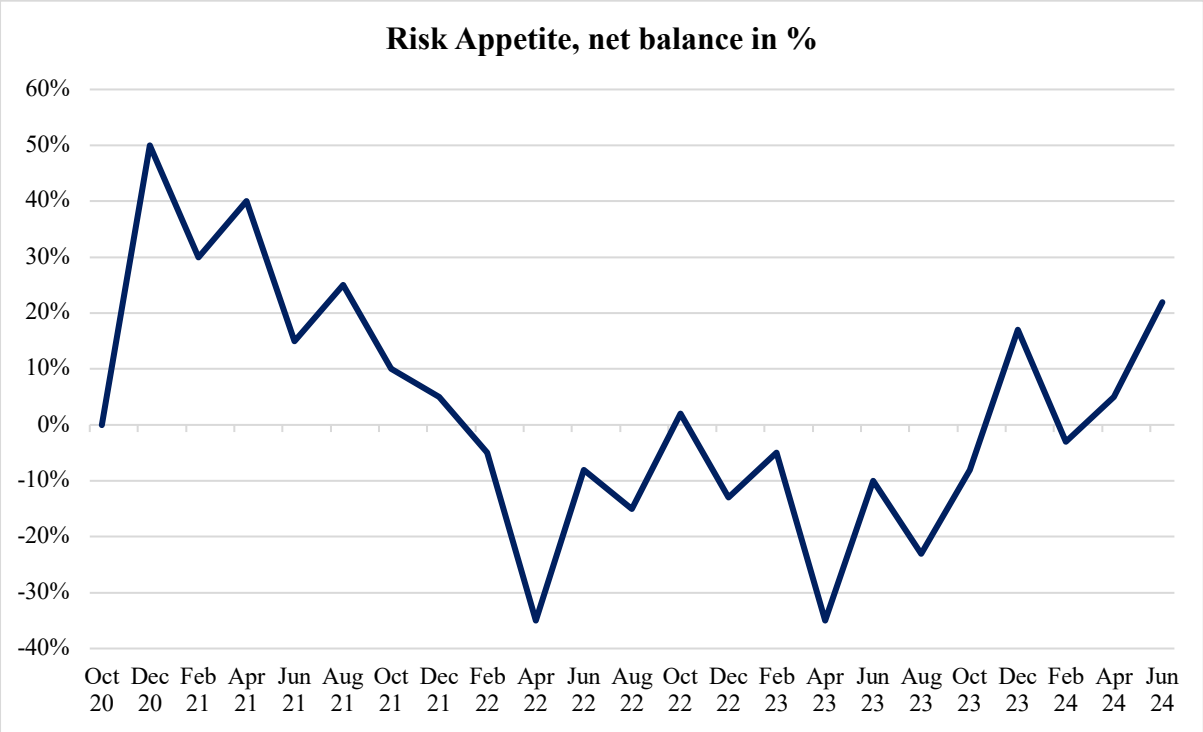
Source: own graph based on data collected from annual reports of the different banks

Exhibit 31 – Value of Venture Capital Investments in the United States from 2007-2023



Source: own graph based on data obtained from Statista https://www.statista.com/statistics/277501/venture-capital-amount-invested-in-the-united states-since-1995/

Exhibit 32 – Risk Appetite in % in the U.S. from 2020 to 2024



Note. the net balance reflects the percentage of people who are risk tolerant minus the percentage of those who are risk adverse.

Source: own graph based on data collected from the S&P Global Market Intelligence

Exhibit 33 – Linear Regression Model Output

Linear regression model:
SVB_Deposits ~1 + VC_Act + Interest_rates

Estimated Coefficients:

	Estimate	SE	T-stat	P-value
(Intercept)	-9,8024	6,3362	-1,547	0,14584
SVC_Act	0,61416	0,041953	-14,639	1,8635E-09
Interest_Rates	-2,3855	2,7986	-0,85241	0,40942

Number of observations: 16, Error degrees of freedom: 13
Root Mean Squared Error: 14,4
R-squared: 0,943; Adjusted R-Squared 0,935
F-statistic vs. constant model: 108; p-value = 7,86E-09

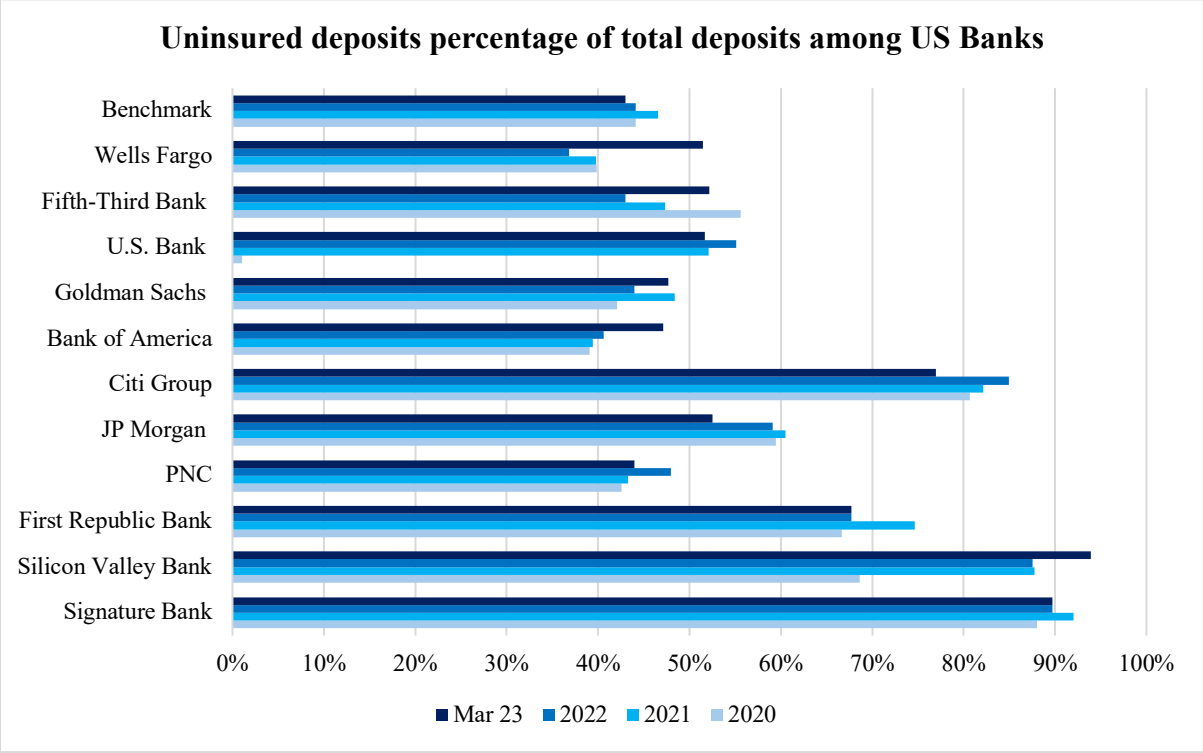
Source: own linear regression model based on annual reports of SVB, and data from the Federal Reserve Bank and Statista

Exhibit 34 – T-Test Results of Uninsured Deposits of SVB vs. U.S. Banks

T-Test Results: SVB Uninsured Deposits % vs. U.S. Uninsured Deposits % Reject the null hypothesis: Significant difference between the means of SVB Uninsured Deposits % and U.S. Uninsured Deposits % P-value: 2,6749E-07 (highly significant) Confidence Interval: [30,9415; 44,8906] The condidence interval does not include 0, suggesting a significant difference Test Statistic: 12,113 (large difference) Degrees of Freedom: 10

Source: own t-test based on annual reports of SVB and U.S. data collected from the Federal Reserve Bank

Exhibit 35 – Percentage of Uninsured Deposits among U.S. Banks from 2020-March 2023



Source: own graph based on data obtained from annual reports of the different banks and benchmark data from the FDIC

Exhibit 36 – Deposit Runs from 1984 to 2023

Bank	Date run started	Deposit insurance coverage (%)	Total outflow (%)	Duration of outflow
Continental Illinois	May 7, 1984	15	30	10 days
Washington Mutual	Sep 8, 2008	74	10,1	16 days
Wachovia	Sep 15, 2008	61	4,4	19 days
Silvergate	Q4 2022	11	52	Possibly 7 days or less
Silicon Valley Bank	March 9, 2023	6	25 + 62*	1 day + expected next day
Signature Bank	March 10, 2023	10	20 + 9*	1 day + expected next day
First Republic Bank	March 10, 2023	32	57	7-14 days

*Note. *outflows were scheduled to go out the next business day, but did not occur because the banks were closed*

Source: Rose, Jonathan. 2023. "Understanding the speed and size of bank runs in historical comparison." *Federal Reserve Bank of St. Louis*, May. https://www.stlouisfed.org/on-the-economy/2023/may/understanding-the-speed-and-size-of-bank-runs-in-historical-comparison.