

# Why do banks invest in MBS?

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## I Background

Silicon Valley Bank (SVB) was taken over by regulators on March 10, 2023. This is the second-largest bank failure in U.S. history, and the largest bank failure since the 2008 financial crisis. The proximate reason for the intervention was that SVB suffered a bank run after announcing a large loss on selling some of its mortgage-backed securities (MBS). The loss on MBS was caused by an increase in interest rates due to the Federal Reserve's monetary tightening. As of writing, there are increasing concerns about similar problems at other banks.

This raises an important question: Why did SVB invest in MBS? We answer this question by explaining the business model of banking. We discuss why banks invest in MBS, why it exposes them to interest rate risk, and how they hedge this interest rate risk. We then offer some observations of why SVB in particular suffered a bank run.

## II The business model of banking

1. Lending long, borrowing short: The business model of banking is to lend long and borrow short. Lending long means to make loans and invest in securities at interest rates that are fixed for some time. The average time for which interest rates are fixed (usually called duration) is around 3.9 years.

Borrowing short means that banks finance themselves by issuing short-term debt. Most of the short-term debt has a duration of 0, i.e., it can be taken out at any point in time

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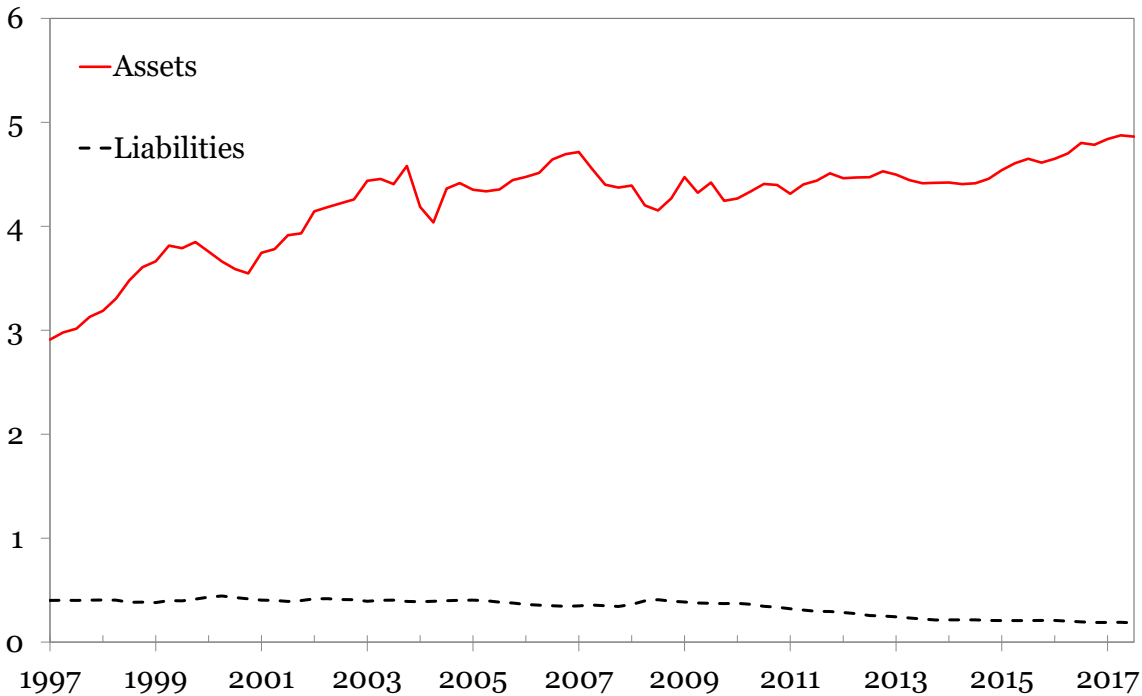
(e.g., saving deposits). Some bank short-term debt is fixed for a short period, usually up to one year (e.g., certificate of deposits). The average duration of all bank debt is around 3 months.<sup>1</sup>

This means that the average duration of banks assets is much longer than bank liabilities. This is called the duration (or maturity) mismatch of banking. Banks are therefore said to engage in maturity transformation, i.e., they transform long-term investments into short-term debt. This is an important feature of banks that distinguishes banking from non-financial firms. Non-financial firms usually avoid a duration mismatch, i.e., they finance long-term assets with long-term debt.

Figure 1 plots the average duration mismatch for the US banking system from 1990 to 2019. It shows a stable duration mismatch.

Figure 1: **Estimated duration of U.S. bank assets and liabilities**

The figure plots an estimate of duration (“repricing maturity”) of the assets and liabilities of the aggregate banking sector. The figure is reproduced from Drechsler, Savov, and Schnabl (2021).



<sup>1</sup>Duration estimates are taken from Drechsler, Savov, and Schnabl (2021).

2. The role of MBS in banking: Banks make loans to firms and households. A large share of bank lending is in the form of mortgages. Banks can issue their own mortgages or they can simply invest in a diversified bundle of mortgages made by other banks. The most common way to invest in a bundle of mortgages is to invest in an agency MBS, i.e., a pool of mortgages underwritten by the government. Specialized government agencies insure MBS against credit risk for a fee, i.e., banks have an insurance where they get their money back if someone defaults on their mortgage. The investor in the MBS takes on the risk that the value of the MBS changes if interest rate change.<sup>2</sup> The total MBS held by banks as of December 2022 was \$2.8 trillion.<sup>3</sup>
3. COVID caused large deposit inflows: Banks experienced large deposit inflows during the COVID pandemic. This was driven in part by investors who sold risky assets and invested the proceeds into safe deposits. This is common during times of crisis and usually referred to as “flight-to-safety.” COVID was such a crisis. The large deposit inflows were also in part driven by government stimulus programs, which provided payments to households and businesses. Most payments ended up as additional deposits with banks, at least initially. Finally, the Federal Reserve’s Quantitative Easing (QE) program also contributed to the growth in deposits. These factors led to the largest jump in deposits in forty years.

Figure 2 plots total deposits in the U.S. banking sector. Deposits increased by almost \$5 trillion, or 35%, from \$13.3 trillion in March 2020 to \$18.1 trillion in March 2022.

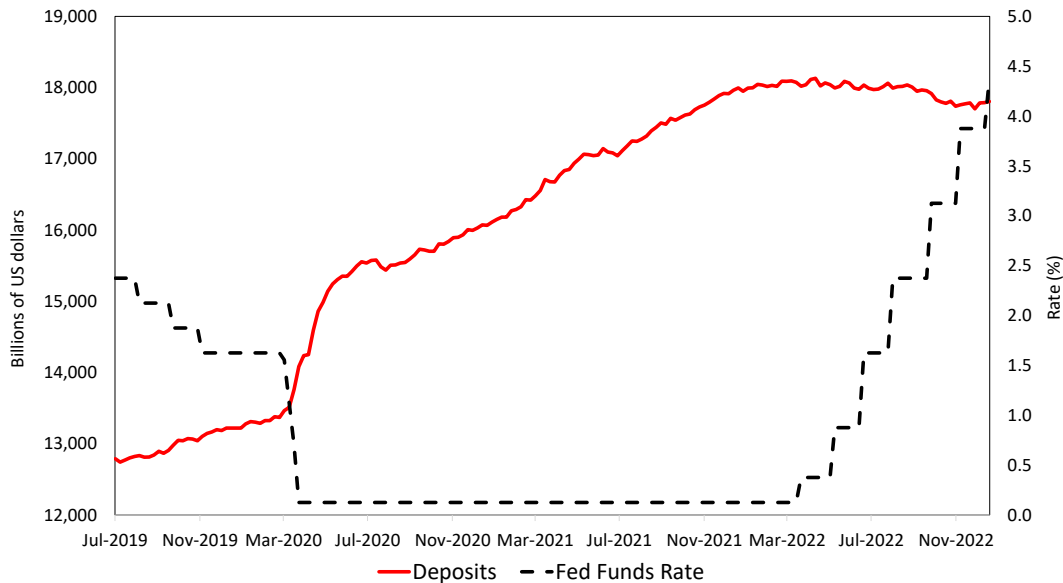
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<sup>2</sup>There is also prepayment risk if investors pay their mortgage early. This can be significant and is also related to the level of interest rates. For the purpose of this note, we think of prepayment risk as part of the overall interest rate risk.

<sup>3</sup><https://www.federalreserve.gov/releases/h8/20230106/>

Figure 2: **Total Deposits**

The figure shows total deposits of the U.S. banking sector from July 2019 until December 2022. The data is from FRED. The figure is reproduced from a presentation by Philipp Schnabl at the AFA Panel on Inflation on January 6, 2023, available at <https://www.youtube.com/watch?v=nb9maP5K3MY>.



4. Banks invested deposits in MBS: Banks had to put the deposits to work.<sup>4</sup> Deposit inflows greatly exceeded loan demand from firms. Loan demand was relatively low because of COVID and because firms received a lot of support from the government. Banks therefore invested the deposit inflows in MBS and other long-term, fixed-rate securities (primarily Treasuries). MBS was a natural choice because COVID also caused a housing boom due to the shift to remote work. Many households took out new mortgages or refinanced old mortgages, leading to record issuance of MBS.

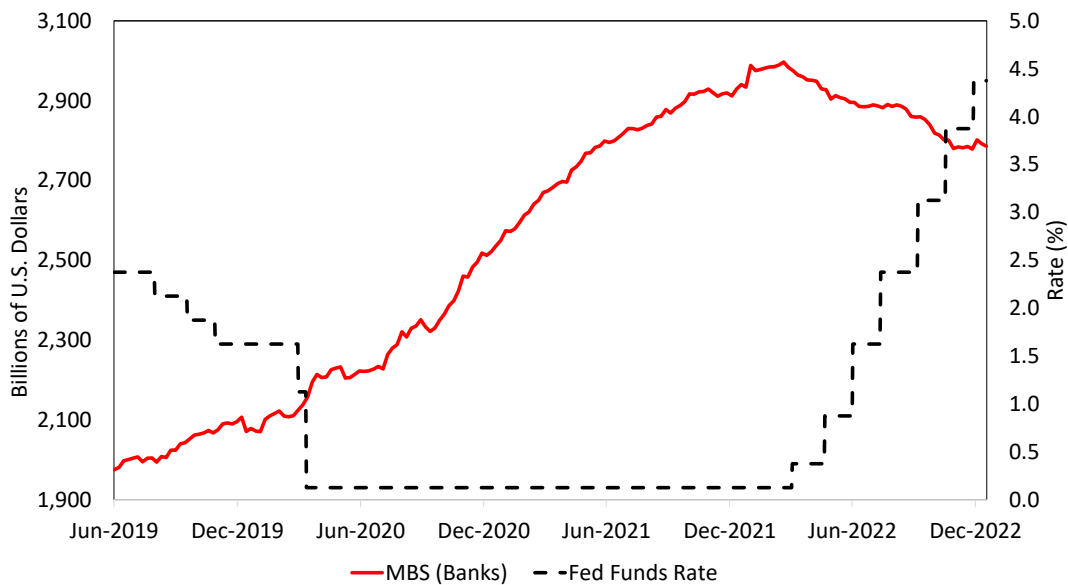
Figure 3 plots the increase in bank MBS holdings during COVID. The figure shows

<sup>4</sup>For example, on Nov 15, 2022, the Wall Street Journal reported, “*Bank of America CEO laid out the math in a July 2021 call with analysts. Deposits, he said, exceeded \$1.9 trillion, while loans were at about \$900 billion. “That difference has got to be put to work,” he said*”. The article is available at <https://www.wsj.com/articles/mortgage-rates-are-high-because-nobody-is-buying-mortgages-11668460705>

that MBS holdings increased at a similar rate as deposits.

Figure 3: **Total MBS Investments**

The figure shows total MBS investments from July 2019 until December 2022. The data is from FRED. The figure is reproduced from a presentation by Philipp Schnabl at the AFA Panel on Inflation on January 6, 2023, available at <https://www.youtube.com/watch?v=nb9maP5K3MY>.



5. MBS interest rate risk: The interest rate risk of MBS is very large. This is true not only for MBS but also for all long-term, fixed-rate investments. The average duration of bank securities is 5.7 years.<sup>5</sup> The loss from an increase in interest rates can be computed as the duration times the change in interest rates.

From January 2022 to now, interest rates increased by about 2.5%.<sup>6</sup> A back-of-the-

<sup>5</sup>This number is larger than the overall duration of loans and securities, 3.9 years, because securities have longer duration than loans. This is the estimated security duration for the average U.S. bank from Drechsler, Savov, and Schnabl (2021), Internet Appendix, Table IA.II.

<sup>6</sup>This was the increase in the 10-year Treasury rate from 1.5% at the start of 2022 to about 4% in March 2023. Long-term interest rates usually go up when the Fed tightens short-term rates but less than one-for-one.

envelope calculation suggests that the value of securities holdings will fall by around  $5.7 \times 2.5\% = 14.25\%$ . Banks' total securities holdings (mainly agency-backed MBS and Treasuries) stood at \$5.5 trillion in December 2022.<sup>7</sup> This implies that securities have lost approximately  $\$5.5 \times 14.25\% = \$780$  billion. This is slightly larger than the FDIC's estimate of banks' unrealized losses on securities at year-end 2022 of \$620 billion.<sup>8</sup> Regardless, these are large losses, equivalent to 28% to 36% of total bank equity.<sup>9</sup>

6. Interest rate risk beyond MBS: The estimated losses on securities are only part of the total unrealized losses banks suffered from the rise in interest rates. Loans, like securities, also lose value when interest rates go up. Total loans plus securities as of December 2022 was \$17.5 trillion. Applying the average duration of loans and securities (3.9 years), the total unrealized losses on total bank credit as of December 2022 is  $\$17.5 \times 3.9 \times 2.5\% = \$1.7$  trillion. This is only slightly less than total bank equity capital of \$2.1 trillion in 2022. Hence, the losses from the interest rate increase are comparable to the total equity in the entire banking system.
7. Banks hedge interest rate risk with deposits: Given the size of the interest rate risk, banks are careful to hedge against it. That means, they need something to offset losses on their loans and securities if interest rates go up. The main way banks do this is with deposits. This may seem surprising because deposits are a bank liability, not an asset. However, the business of taking deposits is an important source of income for banks. Moreover, it turns out that this income stream provides a hedge against the interest rate risk of their loans and securities.
8. Market power in deposit provision: Why deposits hedge banks against interest rate risk? The answer is that banks have market power in the provision of deposits. This market power comes from the fact that depositors do not leave their bank even when they can get a better rate elsewhere. There are several reasons for this. Some depositors invest in their relationship with their bank and find it a hassle to switch banks. Some depositors do not pay attention to market interest rates. And of course, many

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<sup>7</sup><https://www.federalreserve.gov/releases/h8/current/default.htm>

<sup>8</sup><https://www.fdic.gov/news/speeches/2023/spmar0623.html>

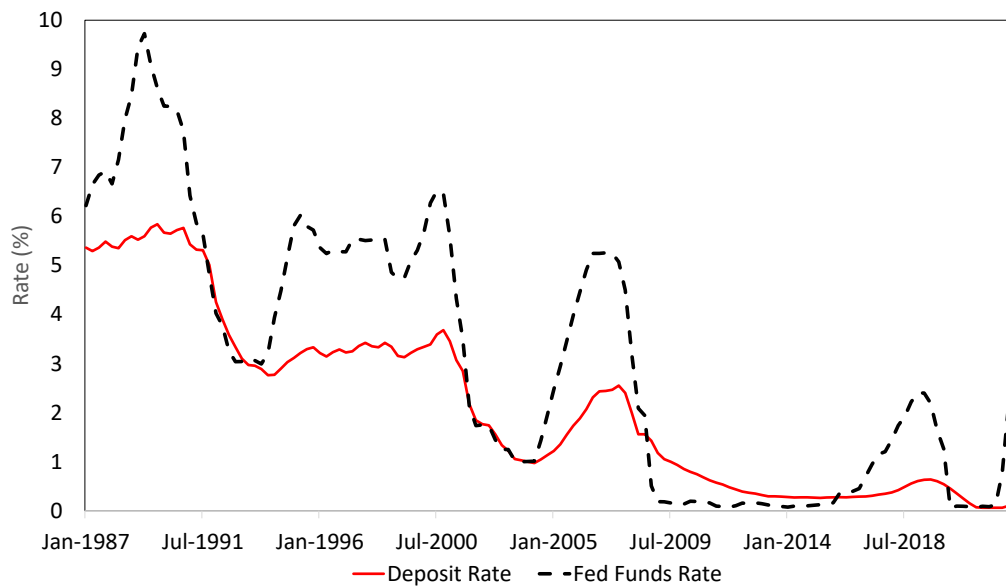
<sup>9</sup><https://www.federalreserve.gov/releases/h8/current/default.htm>

depositors find it a hassle to switch *and* do not pay attention.<sup>10</sup> Market power allows banks to keep deposit rates low even when the Fed raises interest rates. This is why the income they earn from deposits rises when interest rates rise.

Figure 4 plots the average deposit rate and the Fed funds rate from 1987 to 2020. The figure shows that deposit rates are usually far below the market interest rate when the market interest rate is positive.

Figure 4: **Average Bank Deposit Rate**

The figure plots the average deposit rate and the Fed funds rate. The figures is reproduced (and extended to 2020) from Drechsler, Savov, and Schnabl (2017).



9. Market power as a hedge: Banks use their market power to offset losses from their loans and securities holdings when interest rates rise. For example, in December 2021 the average deposit rate on savings deposits was close to 0%. It was still close to zero at 0.35% in February 2023.<sup>11</sup> Yet, during this time the Federal Reserve raised

<sup>10</sup>Some depositors do leave and put their money elsewhere (e.g., money market funds, T-Bills, etc.), but many depositors stay and banks are content to earn some money from their depositors.

<sup>11</sup><https://www.fdic.gov/resources/bankers/national-rates/2023-02-21.html>

short-term interest rates from 0% to 4.75%. This means banks save around 4.5% in financing costs. Total savings deposits in December 2022 were \$12.5 trillion.<sup>12</sup> This means that banks save  $\$12.5 \times 4.5\% = \$562$  billion in interest cost per year relative to financing themselves at market rates. To be clear, this is not their profit because banks also have significant costs in providing deposits (running branches, keeping payments secure, offering a user-friendly and secure app, etc.). But these costs generally do not change with the interest rate, while the income from deposits due to market power does change.

This means that banks can hedge against the interest rate risk of their loans and securities with deposits. If interest rates go up, banks suffer losses on their asset holdings but benefit from below-market financing with deposits. If interest rates go down, it goes the other way. In sum, banks hedge their long-term loans and securities with the value of their deposit franchise, i.e., the total value of current and future deposit income (net of costs).

10. How banks hedge in practice: Banks have Asset-Liability Committees (ALCO) that are tasked with maintaining this hedge. Loosely speaking, this works as follows. The ALCO estimates how much the bank has to pay its depositors if interest rates go up. This is called the deposit beta, i.e., the increase in the bank's deposit cost per 1% increase in the Fed funds rate. Next, they make sure that their securities and loans run off and reset at the same rate. For example, if the deposit beta is 0.25, the bank makes sure that around one-fourth of assets will reset to the going rate every year, thereby matching the deposit side. In practice, it is more complicated because banks have to account for deposit outflows, the difference between short- and long-term interest rates, among other factors, but this is the general idea. If the bank gets this right, the bank is well hedged against interest rate risk.
11. Hedging leads to stable net interest margins: It is straightforward to check whether banks are well hedged. If they are, their net interest margin (NIM) should not move with changes in interest rates. This is because the change in interest income (from loans and securities) will be the same as the change in interest expense paid on deposits.

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<sup>12</sup><https://www.federalreserve.gov/releases/h6/current/default.htm>. Savings deposits are given by "Other liquid deposits" in the M1 money supply.

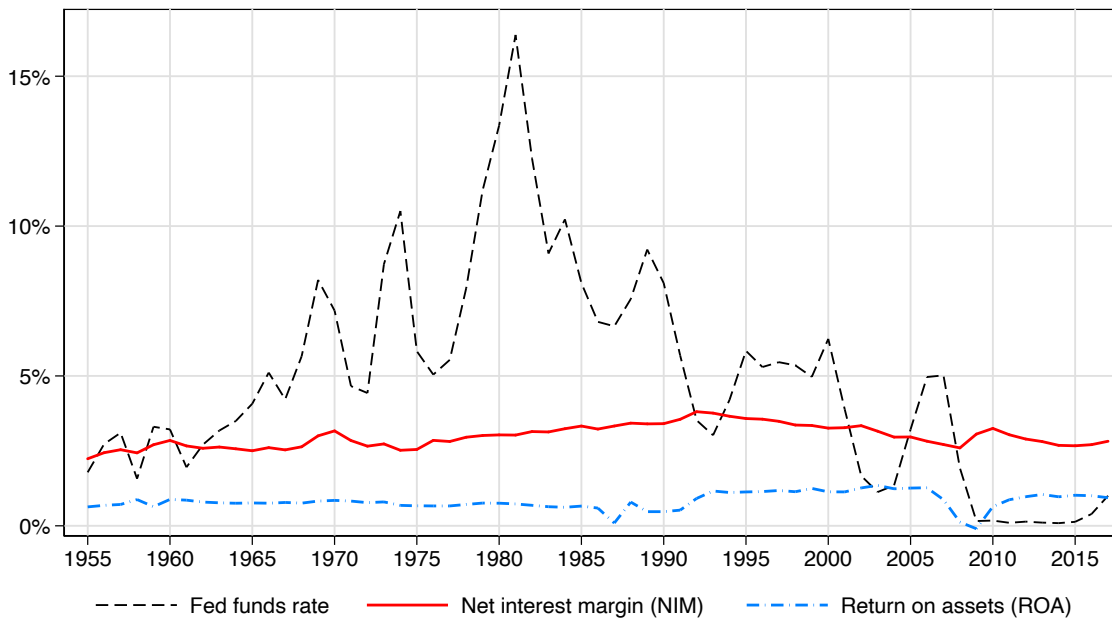


This is indeed what we see when we look at bank net interest rate margins.

Figure 5 plots the net interest margin of the U.S. banking system from 1955 to 2020. While interest rates varied widely from 0% all the way up to 16.4%, the net interest margin stayed quite stable and did not react to changes in the interest rate.

Figure 5: **Net Interest Margin**

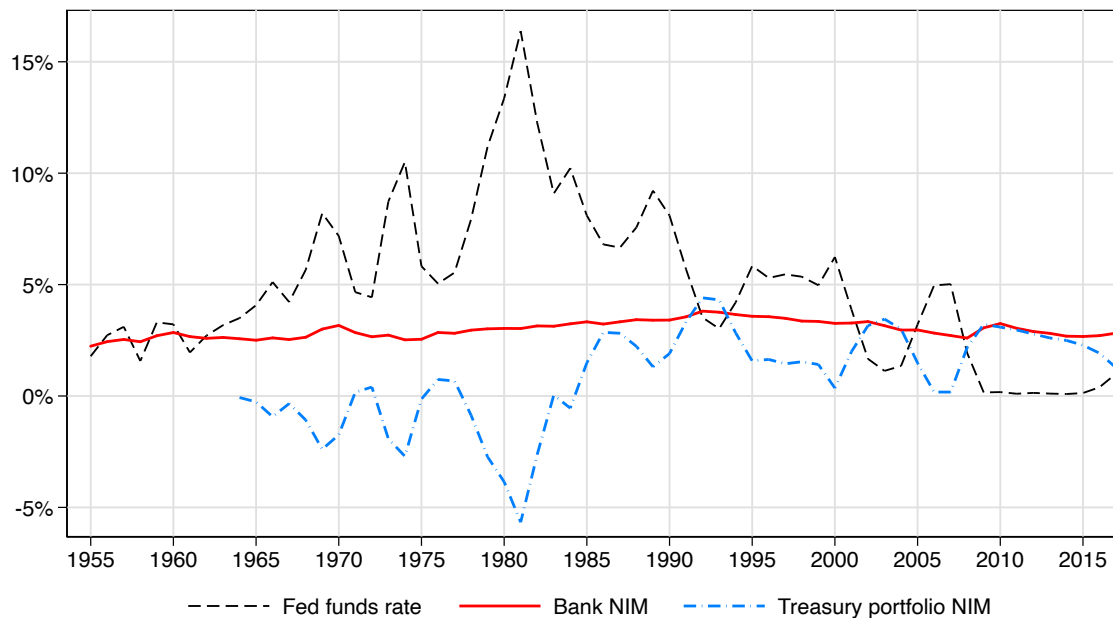
The figure plots the aggregate time series of the net interest margin for the U.S. banking system. The figure is reproduced from Drechsler, Savov, and Schnabl (2021).



As a counterfactual, suppose that banks financed themselves with short-term funding that paid the market interest rate (e.g., Fed funds rate). Their net interest margin would fall and become negative when interest rates go up. If banks funded themselves in this way, they would go bankrupt frequently. Figure 6 shows what this would look like.

Figure 6: **Counterfactual Net Interest Margin**

The figure plots the counterfactual NIM (Treasury portfolio NIM) if banks paid the market interest rates on their short-term funding. The figure is reproduced from Drechsler, Savov, and Schnabl (2021).



12. Threat of bank runs: Hedging via deposits only works if depositors stick around and do not run on the bank. U.S. banking has a history of bank runs and so that is a serious concern. The 2022 Nobel Prize was given (in part) for the ground-breaking work by Professors Douglas Diamond and Philip Dybvig on the canonical model of bank runs (Diamond and Dybvig (1983)). Bank runs are important and they are a threat to any banking system.
13. Insured depositors do not run: The U.S. (like most other countries) therefore has introduced deposit insurance. If depositors are insured, they usually don't run. In the U.S., the Federal Deposit Insurance Corporation (FDIC) is good at making sure insured deposits are almost immediately available for withdrawal if a bank fails. Hence, insured depositors generally have little to no incentive to run.

In 2022, FDIC reports total deposits of \$17.7 trillion and \$10.1 trillion of insured

deposits.<sup>13</sup> The insured share of deposits has declined in recent years. It stood at 78% in 2012 versus 57% at the end of 2022. One reason for the decline was the removal of deposit insurance for corporate checking accounts in 2012. The decline of the insured share of deposits may have increased the vulnerability of the banking system to runs.

14. Summary: Banks hedge against the interest rate risk of their loans and securities with their deposit franchise. This works as long as banks carefully hedge and depositors do not run.

### III Silicon Valley Bank (SVB)

15. We have no inside knowledge on SVB: We do not have any private information on what happened at SVB. Much of the publicly available information is unconfirmed and might be wrong. Rather than providing a detailed analysis of SVB, we apply the business model of banking to SVB and try to understand what may have gone wrong.
16. Deposit inflows: SVB saw large inflows of deposits from Silicon Valley investors. It seems they invested a large share of these deposits into agency MBS.
17. Loans: Banks runs usually happen because banks make loans that go bad or invest in securities that default. It is at this point unknown whether SVB had bad loans on the books. Regulators are likely looking through the loan book to ascertain this.
18. Interest rate hedge: SVB may have mismanaged their interest rate hedging. We do not know how carefully SVB managed their interest rate risk. It is possible that they were overly aggressive and purchased too many securities with long duration. They may also have misjudged the market power they had over their depositors. Presumably, regulators are looking into whether this was the case. If they were too aggressive or if they misjudged their depositors, this could surely lead to bank failure.
19. Deposit outflows: It appears SVB was already seeing significant runoff of deposits prior to March 10. One explanation is that SVB's clients, primarily tech startups, were experiencing high cash burn rates. These outflows necessitated the sale of part

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<sup>13</sup><https://www.fdic.gov/analysis/quarterly-banking-profile/statistics-at-a-glance/2022dec/fdic.pdf>

of SVB’s MBS portfolio at a loss. At the same time, the outflows reduced the value of SVB’s deposit franchise. The net effect is a partial loss of the interest rate hedge.

20. Bank run: According to the Financial Times, 96% of SVB’s deposits were uninsured. For contrast, Bank of America had only 38% uninsured deposits.<sup>14</sup>

The large share of uninsured deposits made SVB extremely vulnerable to a run. In a run, the bank loses its deposit franchise and becomes unhedged. This makes the run itself more likely.<sup>15</sup>

## References

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<sup>14</sup><https://www.ft.com/content/3c6551ff-9778-4713-afc5-f87ba0bb80dd>

<sup>15</sup>This is an application of the classic bank run model of Diamond and Dybvig (1983). In that model, runs occur when the balance sheet of the bank is relatively illiquid (assets cannot be sold quickly without a fire sale). In SVB’s case, the balance sheet was relatively liquid with a large amount of easy-to-sell agency MBS. However, the deposit franchise is a highly illiquid asset – its value collapses when depositors run on the bank.