Limited Hedging and Gambling for Resurrection by U.S. Banks During the 2022 Monetary Tightening?

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Erica Jiang, Gregor Matvos, Tomasz Piskorski, and Amit Seru[1]

Abstract

We analyze the extent to which U.S. banks hedged their asset exposure as the monetary policy tightened in 2022. We use call reports data for interest rate swaps covering close to 95% of all bank assets and supplement it with hand-collected data on broader hedging activity from 10K and 10Q filings for all publicly traded banks (68% of all bank assets). Interest rate swap use is concentrated among larger banks who hedge a small amount of their assets. Over three quarters of all reporting banks report no material use of interest rate swaps. Swap users represent about three quarters of all bank assets, but on average hedge only 4% of their assets and about one quarter of their securities. Only 6% of aggregate assets in the U.S. banking system are hedged by interest rate swaps. We also find limited hedging of interest rate exposure by publicly traded banks and by banks which report the duration of their assets. The use of hedging and other interest rate derivatives was not large enough to offset a significant share of the $2.2 trillion loss in the value of U.S. banks' assets (Jiang et al. 2023). The duration of bank assets increased during 2022, exposing banks to additional interest rate risk. We find slightly less hedging for banks whose assets were most exposed to interest rate risk. Banks with the most fragile funding – i.e., those with highest uninsured leverage -- sold or reduced their hedges during the monetary tightening. This allowed them to record accounting profits but exposed them to further rate increases. These actions are reminiscent of classic gambling for resurrection: if interest rates had decreased, equity would have reaped the profits, but if rates increased, then debtors and the FDIC would absorb the losses.

[1] Jiang is at University of Southern California (erica.jiang@marshall.usc.edu), Matvos is at Northwestern University and NBER (gregor.matvos@kellogg.northwestern.edu), Piskorski is at Columbia and NBER (tp2252@gsb.columbia.edu), and Seru is at Stanford GSB, the Hoover Institution, SIEPR and NBER (aseru@stanford.edu). We thank Brandon Gipper and John Kepler for helpful comments. We thank Winston Xu, Francesco Spizzuoco, Gin Zheng and Roshan Mahanth for excellent research assistantship.

Introduction

The Federal Reserve Bank responded to high inflation by increasing interest rates, which resulted in a $2.2 trillion loss in the value of U.S. banks' assets (Jiang et al. 2023). This exposed banks, which were funded with uninsured deposits, to solvency runs (Egan et al. 2017). Absent regulatory action, almost 200 banks were at severe exposure to such runs, as illustrated by the Silicon Valley Bank' (SVB) failure—the largest bank failure since the Great Recession (Jiang et al. 2023). In this note, we analyze the degree to which banks insured themselves against interest rate risk. In other words, to which degree was the $2.2 trillion loss in the value of U.S. banks' assets documented in Jiang et al. (2023) offset by gains from interest rate derivatives positions of banks. We examine differences in hedging across banks to understand whether banks, which were more exposed to runs or asset losses, hedged more. We then document how banks' approaches to interest rate management changed as interest rates increased during 2022.

We use two complementary data sources to shed light on the scale and importance of banks' hedging activity. The first source is bank call report data (Form 031 and 041). Banks with asset value above the reporting threshold of $5 billion are required to report the notional value of non-trading purpose interest rate swaps in Schedule RC-L. In total, there are 1,288 banks with assets above the reporting threshold in 2021:Q4, comprising about 94% of all bank assets (Table 1). The second source is 10K and 10Q filings for all publicly traded banks (240 banks, including SVB) that account for 68% of all bank assets. Since banks can in principle use derivatives other than interest rate swaps to hedge interest rate risk, their voluntary disclosure in these filings allows us to construct their hedging activity more broadly. Because hedging information is not reported in consistent formats across banks, such as being occasionally reported in footnotes, we hand collect and systematize the data. In total, 98 bank reported hedging related information in their 10K and 10Q filings. 62 publicly traded banks also report their total asset duration in their 10K disclosures for 2021, which we use in our analysis as well.

We find limited use of hedging, suggesting that even accounting for derivatives use, banks' assets are significantly exposed to interest rate risk. Over three quarters of all banks with asset values above the reporting threshold reported no material use of interest rate swaps at the end of 2021, before interest rate increases. Interest rate swap use is concentrated among larger banks who hedge a small amount of their assets. Swap users represent about three quarters of all bank assets, but on average hedge only 4% of their total assets, or, equivalently about one quarter of their securities. Overall, only 6% of aggregate assets in the U.S. banking system were hedged by interest rate swaps. As a calibration, Jiang et al. (2023) argue that more than 70% of bank assets were exposed to interest rate risk over this time period. We find similar results using broader measures of hedging from the 240 publicly traded (larger) banks. Over 60% of these banks choose not to report hedges. The very largest banks which report hedges, hedge about 9% of their assets and less than one third of their securities. Overall, largest banks rely on hedging most, but these hedges leave the vast majority of interest rate risk unhedged.[2]

The idea that banks assets are exposed to substantial interest rate risk even after hedging is corroborated on the sample of 62 banks, which report the duration of their total assets, including derivatives. With an average duration of 4.6 (and ignoring convexity) the implied losses from the monetary tightening associated with a two percentage points increase in interest rates[3] would add up to more than 9% of asset value. In other words, the use of hedging and other interest rate derivatives was not large enough to offset a vast majority of the $2.2 trillion loss in the value of U.S. banks' assets (Jiang et al. 2023).[4]

[2] Begenau et al. (2015) show that the largest banks use interest rate derivatives mainly for trading. In fact, most interest rate derivatives held by the banking sector are used for trading, thereby increasing banks' interest rate risk exposure.
[3] During the recent monetary tightening the 10-year Treasury yield increased by about two percentage points.
[4] Jiang et al. (2023) compute these losses for $17 trillion of aggregate bank assets amounting to a 12.5% loss, and about 10% loss relative to total assets.

One might expect that hedges are employed by banks, which are most at risk. We find little evidence that banks most at risk of asset losses or solvency runs hedged more. If anything, banks, which suffered larger marked to market losses on their assets due to interest rate increases, hedged a bit less. Although we find that banks who fund with more run-prone uninsured deposits are more likely to use interest rate swaps, the actual amounts hedged barely increase with funding fragility.

Last, we show that banks with more fragile funding *decreased* the amount of hedging activity during the period of monetary tightening. One might conjecture that banks more exposed to solvency runs would have larger incentives to avoid further asset value declines and thus avoid failure, so they might want to increase their hedging activities. Instead, we find that banks with higher uninsured leverage (higher share of uninsured deposit funding) sold or reduced their hedges during 2022. Because of reduced hedges, these banks went on to suffer larger losses when interest rates increased further. A case study of the recently failed Silicon Valley Bank (SVB) is illustrative. SVB hedged about 12% of all securities at the end of 2021. By the end of 2022, they hedged only 0.4% of all securities. During this period, the duration of their assets increased by almost two years. So, every additional percentage point increase in the policy rate led to a two-percentage point larger decrease in asset values than it would have in 2021. Reduction in hedges by the banks with more fragile funding is suggestive of gambling for resurrection. Selling profitable hedges allows weak banks to increase current accounting earnings. At the same time these banks have taken a large risk, which is profitable for bank shareholders on the upside, but the losses are borne by the FDIC on the downside.

Background: Accounting for Hedges

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

When banks report assets in their financial disclosures, two categories are relevant to hedging transactions: debt securities and derivatives. Debt securities can be classified at management's discretion based on their intent with the securities as either available for sale ("AFS") or held to maturity ("HTM").[5] AFS securities can be sold at banks' discretion, and their value is marked to market (fair value) with unrealized gains and losses reported in "other comprehensive income." HTM assets are intended and designated to be held to maturity, with the bank planning to collect the cash flows of the duration of the asset. HTM assets are recorded and held at cost, with differences between cost and fair value disclosed (occasionally) in footnotes. Hedging HTM securities would require banks to record changes in the value of these assets (which are otherwise held at cost) and reflect them directly on their income statement, resulting in the loss of the securities' HTM accounting status. This accounting treatment reduces banks' incentives to hedge HTM securities if they perceive such fluctuations in reported earnings as costly and prefer to retain the HTM designation.[6] Because AFS securities are marked to market, such accounting disincentives to hedging do not exist. As shown in Table A2, $2.9 trillion of securities are classified as AFS, while $2.8 trillion are classified as HTM. On average, AFS (HTM) securities make up 20.5% (3.8%) of bank assets. There is significant heterogeneity across banks: relative to smaller banks, the largest banks (assets above $250 billion) tend to classify fewer securities as AFS and more of them as HTM. As a result, the average HTM

[5] Debt securities can also be classified as "trading", a third classification that's typically relevant only for specific banking models with relatively large trading operations, such as Morgan Stanley.

[6] Many have argued since the financial crisis of 2007 that allowing HTM accounting, irrespective of the bank's ability to hold to maturity, is problematic (see Bischof, Laux, and Leuz 2021). Also see Begenau et al. (2022) on banks' balance sheet and leverage dynamics with not marking-to-market bank losses.

security to asset ratio for the largest banks is more than fourfold higher than that for banks with assets below $10 billion.

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

The actual disclosures of hedges somewhat complicate the computation of banks' hedging. Hedges need only be disclosed in footnotes for derivative instruments (and other transactions) that management assesses as "material". Disclosures must provide financial statement users an idea about the volume of derivative activity (e.g., notional dollar amounts), but there is variation across banks in the amount of detail that is disclosed. Moreover, not all derivatives (including swaps) are designated as hedges. Generally, there are categories of derivatives; for example, a bank may use categories such as "derivatives used for hedging" and "derivatives not used for hedging." Some of these latter derivatives will effectively serve as hedges for each other or other assets / liabilities of the bank. But they will not be designated as hedges for accounting purposes. This complicates accounting of bank hedging because banks may claim to be managing risks, such as interest rate risk, via a derivative portfolio, but information about risk management would be challenging to extract from bank financial disclosures.

Data, Sample, and Measurement

We use two complementary data sources to study the scale and importance of banks' hedging activity. The first source is bank call report data (Form 031 and 041). Banks with asset value above the reporting threshold of $5 billion are required to report the notional value of non-trading purpose interest rate swaps in Schedule RC-L. In total, there are 1,288 banks with assets above the reporting threshold in 2021:Q4, comprising about 94% of all bank assets (Table 1). The second source is 10K and 10Q filings from SEC Edgar for all publicly traded bank holding companies comprising 240 banks in 2022 (including SVB). Since banks can in principle use derivatives other than interest rate swaps to hedge interest rate risk, their voluntary disclosure in these filings allows us to construct their hedging activity more broadly. Because hedging information is not reported in consistent formats across banks, such as being occasionally reported in footnotes, we hand collect and systematize the data. Appendix B provides details on how the information was collected. We then link the 10K and 10Q filings to bank call reports using the link table provided by the Federal Reserve Bank of New York.

Both samples cover the largest banks across the size distribution (Figure A1). All large banks with assets above $5 billion are subject to the disclosure mandate that forms the basis of call report data. For the 10K and 10Q sample, publicly traded banks are larger than private banks, on average, thought there are 147 of them with assets less than $10 billion in 2021.

We construct two sets of hedging related measures. The first one focuses on the extensive margin. Using the call report sample, we construct an indicator for whether a reporting bank discloses any material use of interest rate swaps. The second set focuses on the intensive margin. We construct hedging ratios to evaluate the extent to which various asset categories are hedged. We use the notional value of interest rate swaps reported in bank call reports and divide it by total assets to get the main hedging ratio used in our analyses. This ratio measures the percentage of total assets covered by interest rate swaps.

As discussed above, banks have more incentives to hedge AFS securities. We construct two additional hedging ratios by dividing the notional value of interest rate swaps by the total value of securities and by the value of AFS securities. We provide supplementary analyses using these two hedging ratios in Appendix. We also construct three similar hedging ratios using banks' voluntary disclosures of hedges in

their 10K and 10Q reports (i.e., total derivatives designated as hedging instruments). Appendix B details the data collection process. Our three hedging ratios using this information are constructed by dividing the notional value of hedging derivatives by total assets, by total value of securities, and by the value of AFS securities.

Finally, if banks report such information in their 10K and 10Q filings, we collect data on the average duration[7] of investment securities portfolios by the end of 2021 and 2022.[8]

Banks' Use of Interest Rate Hedging Prior to Monetary Tightening (in 2021:Q4)

We begin by showing that few banks hedged their interest rate exposure prior to the monetary tightening in 2022 in Table 1 and Figure 1. About 94% of aggregate assets in the U.S. banking system are not hedged by interest rate swaps (Figure 1B). In contrast, as a calibration, Jiang et al. (2023) argue that more than 70% of bank assets were exposed to interest rate risk over this time period. Interest rate swaps and other hedges were mainly used by larger banks. The extent of hedging seems to be insufficient to significantly protect the assets of these banks against interest rate increases.

Only 296 of 1288 banks report usage of interest rate swaps. Therefore, over three quarters of all reporting banks report no material use of interest rate swaps. The predominant users of swaps are large banks, which also represent the vast majority of banks' assets. Banks representing $17 trillion, or 77% of assets do report some use of swaps. Almost all banks with assets above $250 billion report some use of interest rate swaps. For banks that do use interest rate swaps, the notional amount of swaps represents approximately about 4% of assets. Loans represent between one and two thirds of banks' assets, and securities around one fifth of their assets. These assets are exposed to interest rate risk. Even ignoring loans, banks that do use interest rate swaps, on average hedge about one fifth to one fourth of their securities interest rate risk based on notional amounts of swaps. Interest rate swap data alone suggests that even banks, which employ such hedges, are still significantly exposed to interest rate risk on their asset side.

Banks can in principle use derivatives other than interest rate swaps to hedge interest rate risk. Next, we look at voluntary disclosures of hedges and asset duration for public companies (Table 1 and Figure 1A). Within these banks, over 60% do not report on hedging and only 62 banks report their duration. Even among banks, which choose to report hedging, banks below $250 billion in assets hedge about 5% of their assets. Largest banks again hedge more, with the average bank hedging almost 9% of their total assets, or about 30% of their security holdings. In other words, even banks which choose to report their hedging activity, do not hedge the interest rate exposure of most of their securities, let alone loans and other assets.

The idea that banks assets are exposed to substantial interest rate risk after hedging is corroborated on the sample of 62 banks, which report the duration of their total assets, including derivatives. With an average duration of 4.6 (and ignoring convexity) the implied losses for about two percentage point increase in the 10-year Treasury yield[9] that occurred during the recent monetary tightening would add up to more than 9%

[7] For most banks that report the average duration on their securities portfolio, the data can be found under the Note – securities" section. We also manually check throughout the 10-K reports by searching for the keyword "duration" in case such information is reported under other items or sections.

[8] Some banks only report the average duration of portfolios by the end of the year 2022 without mentioning the information on the duration of their portfolios by the end of the year 2021 in their 2022's 10-K reports. For those banks, we also check their 2021's 10-K report to collect their duration data for the year 2021. There are a total of 12 banks reporting their average duration of portfolios by the end of the year 2022 without mentioning the duration by the end of the year 2021. For those 12 banks, we search through their 2021's 10-K reports, and we find that 8 of them report their average duration of portfolios in their 2021's 10-K reports. The remaining four banks do not report such information in their 2021's 10-K reports.

[9] The interest rate index used for bank asset duration may depend on the specific types of assets held by the bank. We use a variation in 10-year Treasury yield as a simple approximation.

of asset value. Jiang et al. (2023) find that marked to-market bank assets have declined by an average of 10% across all the banks during that period not accounting for risk hedges. This further corroborates the view that the use of hedging and other interest rate derivatives was not large enough to offset most of the $2.2 trillion loss in the value of U.S. banks' assets (Jiang et al. 2023).

As we discuss above, banks' incentives to hedge HTM securities are low, because such hedges can lead to additional earnings volatility.

Most Exposed Banks do not Hedge More (and may hedge less)

We find little evidence of additional hedging done by banks' whose assets were most exposed to interest rate risk or with more fragile liabilities. If anything, the most exposed banks hedged less. The absence of a strong pattern is best encapsulated in Figure 2C and Figure 3C, which show the outstanding amount of interest rate swaps in 2021—i.e., pre-monetary tightening—as a function of their exposure to runnable uninsured deposits or the mark to market asset losses these banks suffered in 2022. The lines are effectively flat, showing that the minimal use of interest rate swaps we record in the aggregate translates to similar patterns in the cross section. In other words, banks whose assets were more vulnerable to interest rate increases, or liabilities were more exposed to runs did not hedge much more.

Figure 3A shows that, if anything, banks that suffered the largest marked-to-market losses were less likely to use interest rate swaps than other banks. Conditional on having an interest rate swap, there is no clear pattern for banks that suffered more marked-to-market losses (Figure 3B). Figure 3C looks at the overall effect and shows that banks whose assets were more vulnerable to interest rate increases did not hedge much more. We find stronger results when we focus on the total hedging data voluntarily disclosed by a subset of public banks. In this sample, banks which suffered the largest marked to market losses, in fact, used substantially less hedging. The most exposed banks hedged over 5pp less as a share of assets than the less exposed banks (Figure 4B). As a point of reference, SVB's use of hedges prior to monetary tightening was similar to that of other banks with comparable interest rate exposure on the asset side.

We find less conclusive data for uninsured deposits. On the one hand, banks with the highest amount of uninsured leverage were significantly more likely to use interest rate swaps (Figure 2A). Around 30% of those banks had some swap usage, while banks with no uninsured leverage used almost no swaps. However, because the extent of hedging for those who did hedge was so small (Figure 2B), the total effect of interest rate hedges was small (Figure 2C). When we focus on the total number of hedges for public banks, if anything, we find that banks with more runnable deposits hedged less (Figure 4A). Again, the magnitudes are small. The totality of evidence is therefore quite noisy, and it is difficult to draw strong conclusions about the amount of hedging as a function funding fragility. We reached similar conclusions when using alternative hedging ratios (with denominators as total value of securities and AFS securities) in Appendix (Figure A3 and A4).

Banks with Fragile Funding Decreased Hedging during the Monetary Tightening in 2022

We document that several banks significantly adjusted their hedging activities during the period of monetary tightening. A case study of the recently failed Silicon Valley Bank (SVB) is illustrative. SVB hedged about 12% of all its securities at the end of 2021. By the end of 2022, it had reduced these hedges to 0.4%. In other words, as interest rates rose, SVB reduced its hedging of interest rate risk. Because these hedges had gone up in value as interest rates increased, selling them allowed SVB to record (an accounting) profit. On the other hand, selling hedges also increased the duration of its assets from 3.7 to 5.6, exposing the bank to significant additional losses if interest rates had increased further, which they did. In other words, SVB traded off increasing accounting profits with more exposure to interest rate risk. Given that the bank would have collected the profits had the rates declined, but FDIC would absorb losses if (when) SVB failed, this action by SVB is reminiscent of a classic "gambling for resurrection."

SVB was not an exception. As Figure 5 shows, more than a quarter of the publicly traded banks that reported hedging derivatives experienced declines in various hedging ratios. We divide all publicly traded banks that reported hedging derivatives into four groups based on their hedging ratio adjustments from 2021:Q4 to 2022:Q4. The bottom (top) quartile includes banks that experienced the largest decline (increase) in their hedging ratios. We then plot the evolution of average hedging ratios in each group over the course of 2022. For banks in the bottom quartile, the share of total assets that are covered by hedging derivatives declined by about 3% from 2021:Q4 to 2022:Q4 (Figure 5A). This is a large change. The best way to observe this is to look at the decline in hedging derivatives scaled by total securities or AFS securities. Banks in the bottom quartile see a decline in hedging ratios by -30% and -40%, respectively (Figure 5B and 5C).

We next dig deeper into the heterogeneity across banks. Selling (or closing) hedges during 2022 was more likely for banks with fragile funding structures. On the asset side, SVB was an exception. Banks whose *assets* were more exposed to interest rate risk slightly increased their interest rate swap use (Figure 5C), but they started from a lower level.[10] On the liabilities side, similar to SVB, banks with a higher uninsured leverage, i.e., more fragile funding, were more likely to sell (or close) hedges (Figure 6A).[11] The magnitude is substantial, with swap coverage decreasing by several percentage points of assets. We reached similar conclusions when using alternative hedging ratios in Appendix (Figure A5).

We find a similar pattern of reduced hedges when examining the overall duration of bank assets for the limited set of banks that reported this information (including SVB). During 2022, these banks increased the duration of their assets from 4.6 to 5.1 (Figure 7A). The duration increases were largest for banks with the highest uninsured leverage such as SVB, although the SVB case was extreme even among banks with very fragile funding (Figure 7B). In other words, one might imagine that banks, which were more exposed to solvency runs would have mitigated those runs by increasing their hedging. Instead, they sold or reduced their hedges, recorded an accounting profit, but exposed themselves to more interest rate risk. Changes in hedging among these banks suggests that SVB was likely not the only bank potentially engaged in gambling for resurrection.

Conclusion

We analyze the extent to which U.S. banks hedged their asset exposure as the monetary policy tightened in 2022. There are two important take-aways from this note. The use of hedging and other interest rate derivatives was not large enough to significantly offset the interest rate exposure of U.S. banks, or the $2.2 trillion loss in the value of U.S. banks' assets (Jiang et al. 2023). Second, banks with the most fragile funding, highest uninsured leverage, sold or reduced their hedges during the monetary tightening in actions that are reminiscent of classic gambling for resurrection.

The ongoing episode in the banking sector also raises questions about the risk management and disclosure practices at US banks. Similar discussions occurred during the aftermath of the 2007 financial crisis. The current structure of banks' risk management disclosures makes it very difficult to obtain a complete picture of banks' risk exposures.

[10] We do see slightly more selling (or closing) of hedges by banks which were more weakly capitalized.
[11] Figure 5B and 5D are based on bank equity and generate similar inferences.

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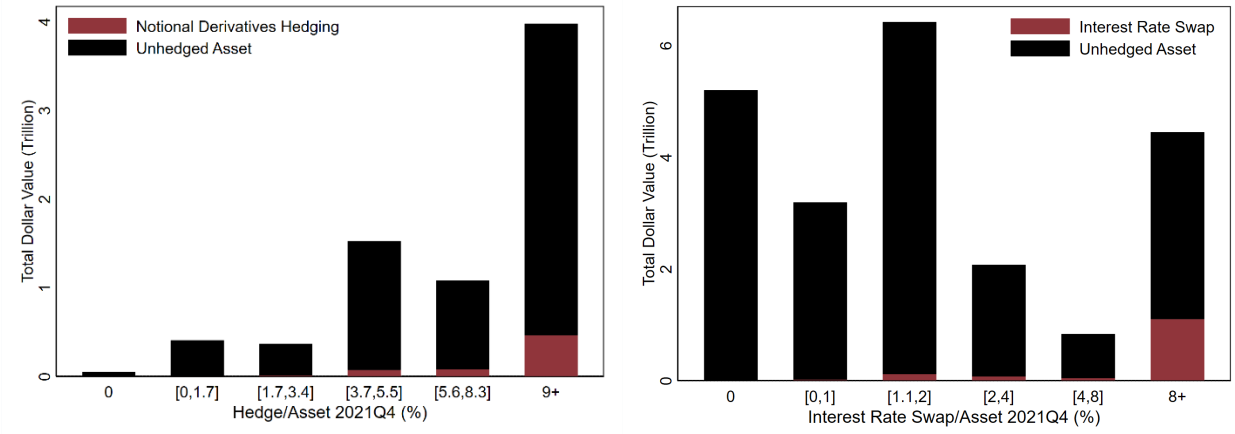
Table 1: Summary Statistics (as of 2021:Q4)

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

	(1) All Banks	(2) Asset <10B	(3) Asset [10B,250B]	(4) Asset >250B
Assets of FDIC-insured banks	23.7T	3.4T	7.1T	13.2T
Assets of banks required to report rate swap	22.2T	1.9T	7.1T	13.2T
# Banks required to report rate swap	1288	1129	146	13
Assets of banks with non-zero rate swap	17T	0.7T	3.9T	12.4T
# Banks with non-zero rate swap	296	206	79	11
Assets of publicly traded banks with 10Ks	15.8T	0.66T	3.9T	11.3T
# Publicly traded banks with 10Ks	240	147	85	8
Assets of publicly traded banks with hedging info.	7.4T	0.3T	2.8T	4.4T
# Publicly traded banks with hedging info.	98	48	44	6
Assets of publicly traded banks with reported duration	5.0T	0.1T	1.5T	3.4T
# Publicly traded banks with reported duration	62	27	31	4
Rate Swap/Asset (%)	0.9	0.7	2.2	3.1
	(2.1)	(1.9)	(2.9)	(3.0)
Rate Swap/Security (%)	5.8	4.6	13.7	16.8
	(14.5)	(13.1)	(20.3)	(20.1)
Rate Swap/AFS Security (%)	7.9	6.2	18.9	25.0
	(20.4)	(18.3)	(28.4)	(28.4)
Rate Swap/Asset | Non-Zero Rate Swap (%)	3.9	3.9	4.0	3.7
	(2.8)	(2.8)	(2.9)	(2.9)
Rate Swap/Security | Non-Zero Rate Swap (%)	24.6	24.6	25.1	19.9
	(20.8)	(20.5)	(21.6)	(20.4)
Rate Swap/AFS Security | Non-Zero Rate Swap (%)	32.6	31.9	34.6	29.6
	(30.0)	(29.9)	(30.6)	(28.7)
Hedge/Asset (%)	5.4	5.3	5.0	8.7
	(4.8)	(4.8)	(4.7)	(3.7)
Hedge/Security (%)	36.1	43.9	28.4	30.6
	(40.5)	(47.6)	(32.7)	(15.8)
Hedge/AFS Security (%)	44.9	52.2	36.6	46.9
	(46.4)	(52.6)	(39.8)	(31.3)
Duration	4.6	4.6	4.5	5.9
	(1.4)	(1.2)	(1.0)	(3.6)

Figure 1: Aggregate Hedged and Unhedged Asset Value as of 2021:Q4

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



(a) Hedge/Asset (10K)

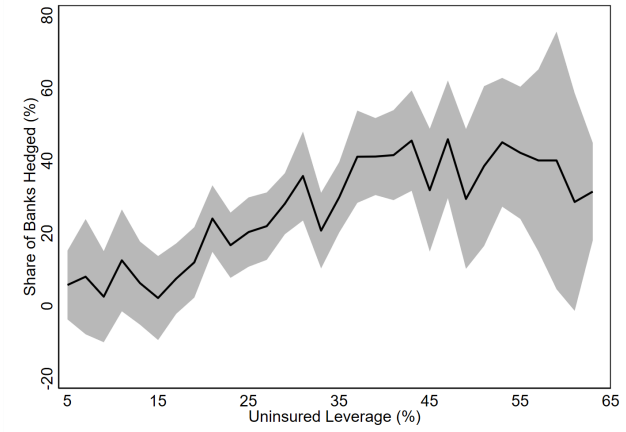
(b) Interest Rate Swap/Asset (call reports)

Figure 2: Interest Rate Swaps and Uninsured Leverage in 2021:Q4

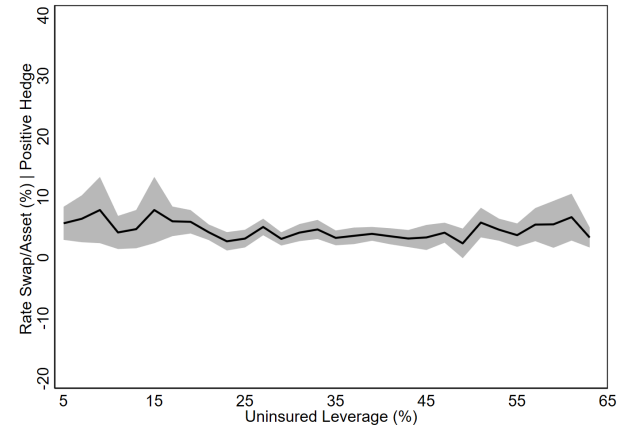
This figure plots hedging by banks using interest rate swaps against uninsured leverage ratio in 2021:Q4. Specifically, we estimate the following specification:

$$y_i = \sum_b \gamma_b \, I(uninsured_i \in Bin_b) + \epsilon_i,$$

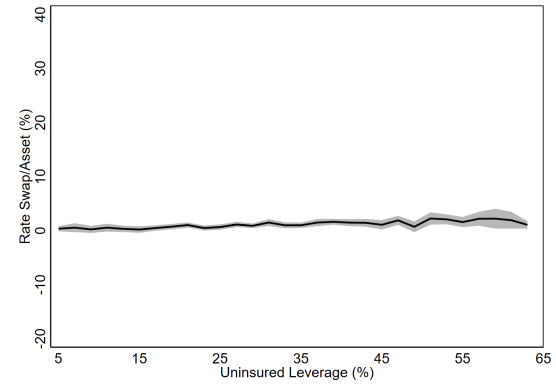
where y_i is an indicator for whether bank i reports positive interest rate swaps in 2021:Q4 in Panel (a) and interest rate swaps to asset ratio in Panel (b) and (c). $I(uninsured_i \in Bin_b)$ is an indicator of whether bank i's uninsured to deposit ratio in 2021:Q4 falls within the bucket Bin_b (plotted on the x-axis of each panel). Each bin covers an incremental value of 2 percentage-points in the uninsured leverage distribution. In other words, the difference between the largest uninsured leverage ratio and the smallest uninsured leverage ratio of banks in each bin is 2%. The plotted coefficients of interest, γ_b, show how banks' hedging activities vary non-parametrically with their uninsured deposit ratios. The shaded area shows the 95% confidence interval. Panel (a) shows the extensive margin, where the y-axis is the share of banks with positive interest rate swaps in 2021:Q4, and the underlying sample includes all banks that are required to report their use of interest rate swaps. Panel (b) shows the intensive margin, where the y-axis is interest rate swap to asset ratio, and the underlying sample includes all banks with positive interest rate swaps. Panel (c) shows the total effect, where the y-axis is interest rate swap to asset ratio, and the underlying sample includes all banks that are required to report their use of interest rate swaps. We winsorize the interest rate swap to asset ratios at the 5th and the 95th percentiles. *Data Sources*: Bank call reports in 2021:Q4.



(a) Extensive Margin



(b) Intensive Margin



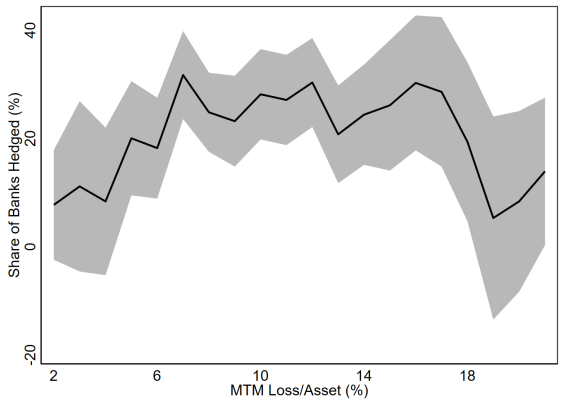
(c) Total Effect

Figure 3: 2021 Interest Rate Swaps in 2021:Q4 and Mark-to-Market Loss

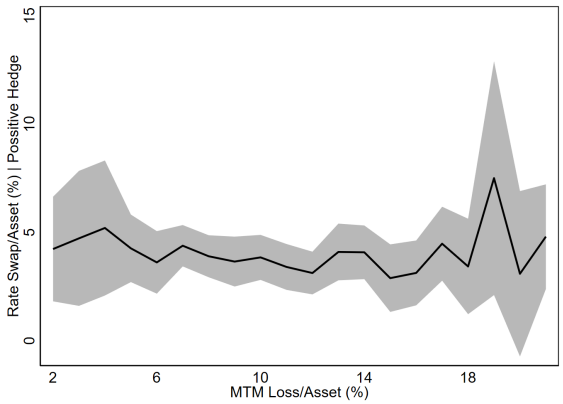
This figure plots hedging by banks in 2021:Q4 against mark-to-market losses in the future. Mark-to-market loss is calculated based on 2022:Q1 balance sheet information using change in asset price from 2022:Q1 to 2023:Q1. It is scaled by 2021:Q4 asset value. Specifically, we estimate the following specification:

$$y_i = \sum_b \gamma_b \, I(MTM\ Loss_i \in Bin_b) + \epsilon_i,$$

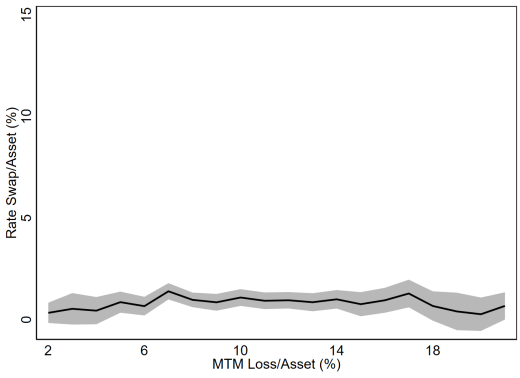
where y_i is an indicator for whether bank i reports positive interest rate swaps in 2021:Q4 in Panel (a) and interest rate swap to asset ratio in Panel (b) and (c). $I(MTM\ Loss_i \in Bin_b)$ is an indicator of whether bank i's mark-to-market loss scaled by assets falls within the bucket Bin_b. The plotted coefficients of interest, γ_b, show how banks' hedging activities vary non-parametrically with their mark-to-market losses. Each bin covers an incremental value of 1 percentage-points in the mark-to-market loss distribution. In other words, the difference between the largest mark-to-market loss and the smallest mark-to-market loss of banks in each bin is 1% of their assets. The shaded area shows the 95% confidence interval. Panel (a) shows the extensive margin, where the y-axis is the share of banks with positive interest rate swaps in 2021:Q4, and the underlying sample includes all banks that are required to report their use of interest rate swaps. Panel (b) shows the intensive margin, where the y-axis is interest rate swap to asset ratio, and the underlying sample includes all banks with positive interest rate swaps. Panel (c) shows the total effect, where the y-axis is interest rate swap to asset ratio, and the underlying sample includes all banks that are required to report their use of interest rate swaps. We winsorize the interest rate swap to asset ratios at the 5th and the 95th percentiles. *Data Sources:* Bank call reports in 2021:Q4.



(a) Extensive Margin



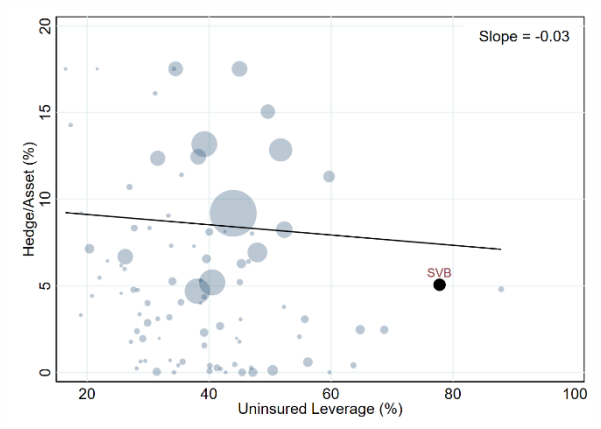
(b) Intensive Margin



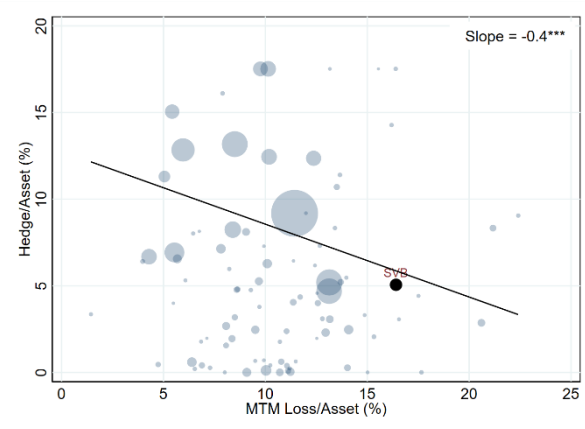
(c) Total Effect

Figure 4: Hedging Ratios and Bank Exposure to Interest Rate Risk using 10K and 10Q

This figure plots hedging ratio for publicly traded banks calculated using information in 10K and 10Q against two measures of bank exposure to interest rate risk. Panel (a) plots hedge to asset ratio against uninsured leverage ratio as of 2021:Q4. Panel (b) plots hedge to asset ratio as of 2021:Q4 against mark-to-market loss to total asset ratio in the future. Mark-to-market loss is calculated based on 2022:Q1 balance sheet information using change in asset price from 2022:Q1 to 2023:Q1. It is scaled by 2021:Q4 asset value. In both panels, the bubble size indicates the asset size of the bank as of 2021:Q4. The lines in each panel are the best fit lines based on weighted least squares. The slope and statistical significance is reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources:*10Ks and 10Qs and bank call reports.



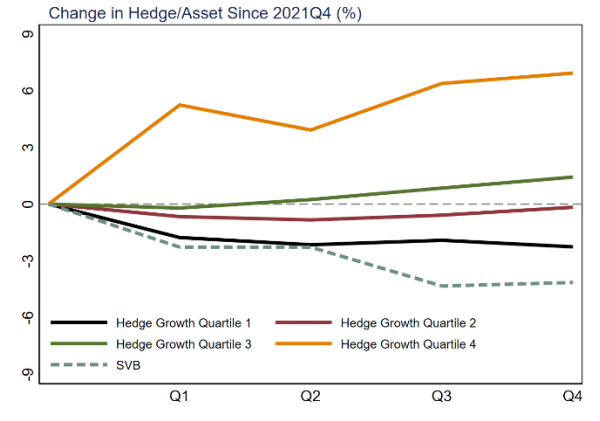
(a) Hedge/Asset: Uninsured Deposit



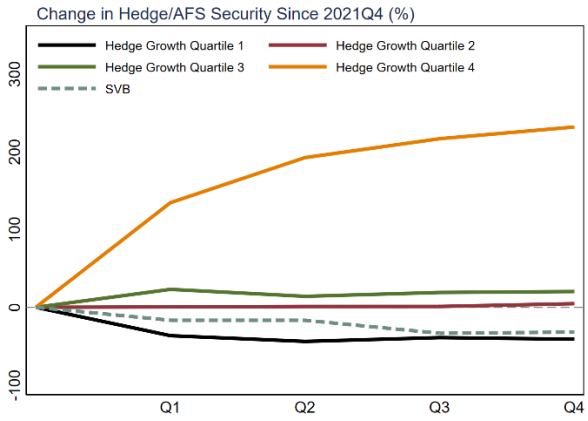
(b) Hedge/Asset: MTM Loss

Figure 5: Time Series Change in Hedging Ratios using 10K and 10Q

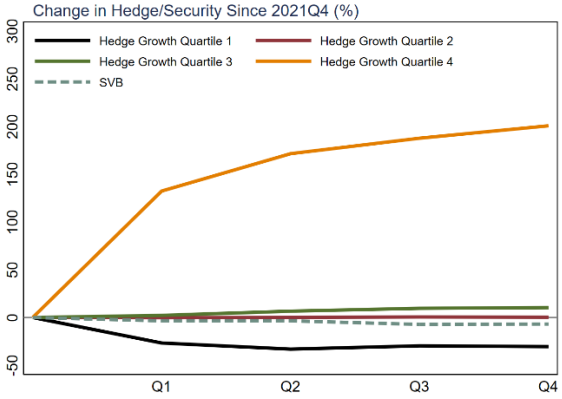
This figure plots quarterly hedging growth relative to 2021:Q4 using hedging information from 10K and 10Q. It plots the growth from 2022:Q1 till 2022:Q4. Hedging growth is calculated as change in notional value of hedging ratios obtained from publicly traded banks' 10Ks and 10Qs. In Panel (a), we divide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



(a) Hedge/Asset



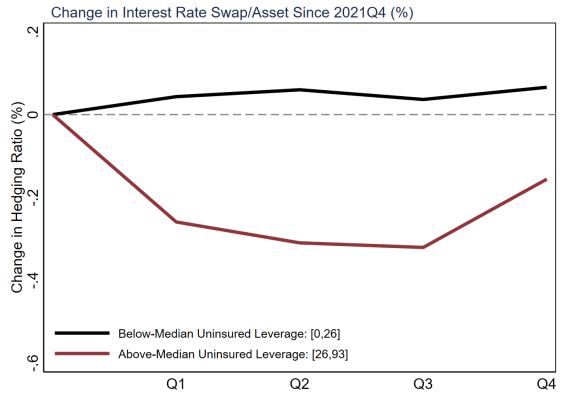
(b) Hedge/AFS Security



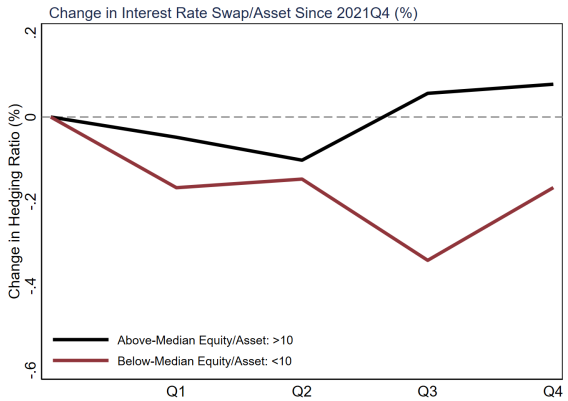
(c) Hedge/Security

Figure 6: Change in Hedging by Bank Balance Sheet Characteristics

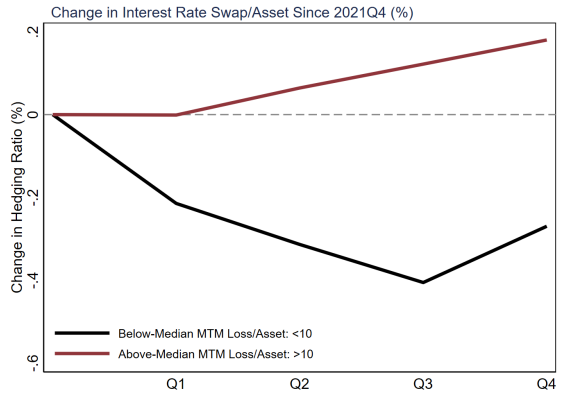
This figure plots quarterly hedging growth relative to 2021:Q4 using interest rate swap to asset ratio. It plots the growth from 2022:Q1 till 2022:Q4. In Panel (a), we divide banks into two equal-sized bins based on their uninsured leverage ratios in 2021:Q4. In Panel (b), we divide banks into two equal-sized bins based on their equity to asset ratio in 2021:Q4. In Panel (c), we divide banks into two equal-sized bins based on their future mark-to-market asset losses in the future based on asset price change from 2022:Q1 to 2023:Q1. In Panel (d), we divide banks into two equal-sized bins based on their future mark-to-market equity to asset ratio, which is calculated as (equity-mark-to-market loss)/(asset- market-to-market loss). In all panels, we plot the mean value of banks in each bin. *Data Sources:* Bank call reports.



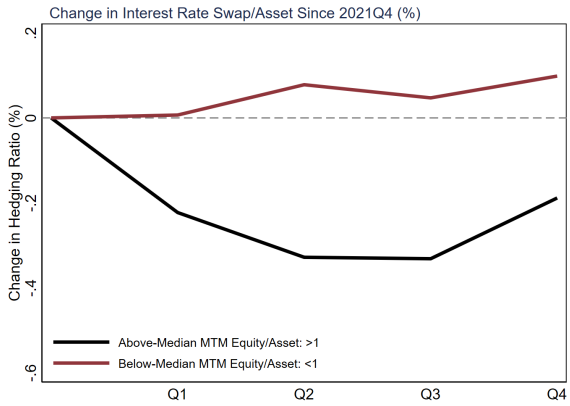
(a) Uninsured Leverage



(b) Equity/Asset 2021Q4



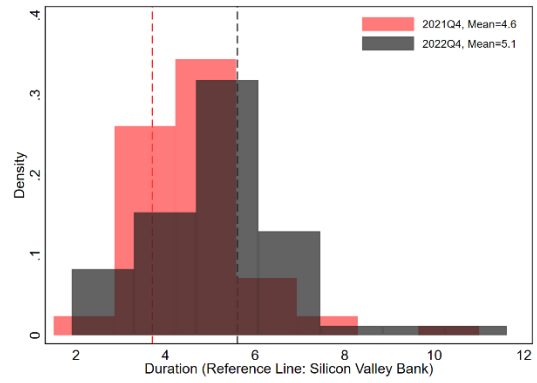
(c) MTM Loss/Asset



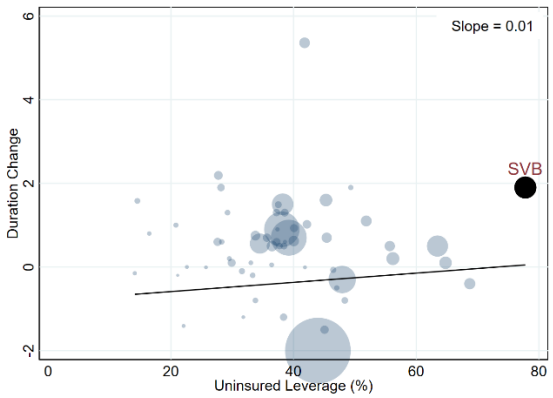
(d) MTM Equity/Asset

Figure 7: Duration using 10K and 10Q

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



(a) Duration Distribution



(b) Change in Duration

Appendix A: Tables and Figures

Table A1: Summary Statistics (as of 2022:Q4)

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

	(1) All Banks	(2) Asset <10B	(3) Asset [10B,250B]	(4) Asset >250B
Assets of FDIC-insured banks	23.6T	3.4T	7.1T	13.1T
Assets of banks required to report rate swap	22.0T	1.9T	7.1T	13.1T
# Banks required to report rate swap	1,219	1,061	145	13
Assets of banks w/ non-zero rate swap	16.3T	0.7T	4.0T	11.7T
# Banks w/ non-zero rate swap	270	180	80	10
Assets of publicly traded banks with 10Ks	16.0T	0.65T	4.2T	11.1T
# Publicly traded banks with 10Ks	240	142	90	8
Assets of publicly traded banks with hedging info.	7.6T	0.2T	3.0T	4.4T
# Publicly traded banks with hedging info.	98	44	48	6
Assets of publicly traded banks with reported duration	5.1T	0.1T	1.7T	3.3T
# Publicly traded banks with reported duration	65	27	34	4
Rate Swap/Asset	0.9	0.6	2.4	3.9
	(2.2)	(1.9)	(3.3)	(3.5)
Rate Swap/Security	5.3	3.9	14.4	19.9
	(13.9)	(11.9)	(20.5)	(20.1)
Rate Swap/AFS Security	7.6	5.4	19.7	41.6
	(19.3)	(16.3)	(27.7)	(34.2)
Rate Swap/Asset | Non-Zero Rate Swap	4.0	3.7	4.4	5.1
	(3.2)	(3.1)	(3.4)	(3.1)
Rate Swap/Security | Non-Zero Rate Swap	23.6	22.4	25.9	25.8
	(20.4)	(20.1)	(21.4)	(19.2)
Rate Swap/AFS Security | Non-Zero Rate Swap	32.4	29.7	35.6	54.1
	(28.2)	(27.5)	(28.7)	(28.4)
Hedge/Asset (10K)	6.5	6.1	6.4	11.0
	(6.3)	(6.3)	(6.4)	(4.2)
Hedge/Security (10K)	39.9	44.0	36.0	41.0
	(39.1)	(43.4)	(37.3)	(16.5)
Hedge/AFS Security (10K)	59.9	61.4	53.4	101.0
	(56.4)	(60.6)	(50.9)	(58.5)
Duration	5.1	4.9	5.2	5.7
	(1.6)	(1.4)	(1.6)	(2.8)

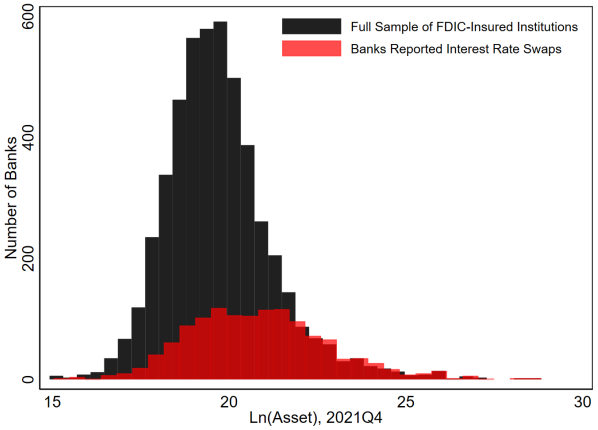
Table A2: Descriptive Statistics on AFS and HTM Assets

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

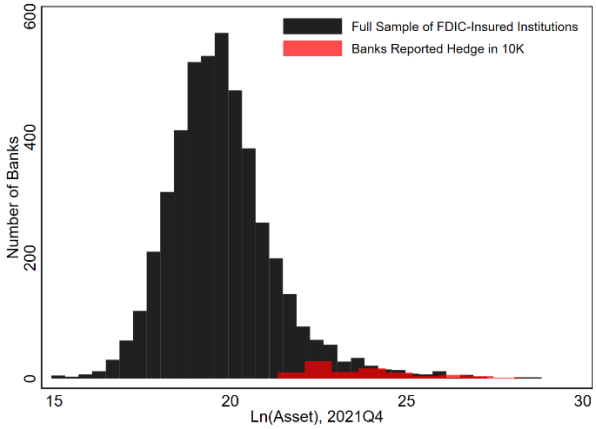
	(1) All Banks	(2) Asset <10B	(3) Asset [10B,250B]	(4) Asset >250B
Assets of FDIC-insured banks	23.6T	3.4T	7.1T	13.1T
Aggregate AFS Security	2.9T	612B	1.0T	1.2T
Aggregate HTM Security	2.8T	128B	538B	2.1T
Aggregate AFS Loan	0.1T	21B	31B	62B
Aggregate HTM Loan	11.9T	2.2T	4.4T	5.3T
AFS Security/Asset	20.5	20.7	15.3	14.6
	(15.9)	(16.0)	(12.9)	(12.9)
HTM Security/Asset	3.8	3.7	6.8	15.1
	(9.4)	(9.4)	(9.5)	(11.6)
AFS Loan/Asset	0.3	0.3	0.5	0.4
	(2.5)	(2.5)	(2.3)	(0.6)
HTM Loan/Asset	59.9	59.8	63.3	39.1
	(18.7)	(18.8)	(16.9)	(19.4)
Number of Banks	4738	4580	145	13

Figure A1: Data and Sample

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



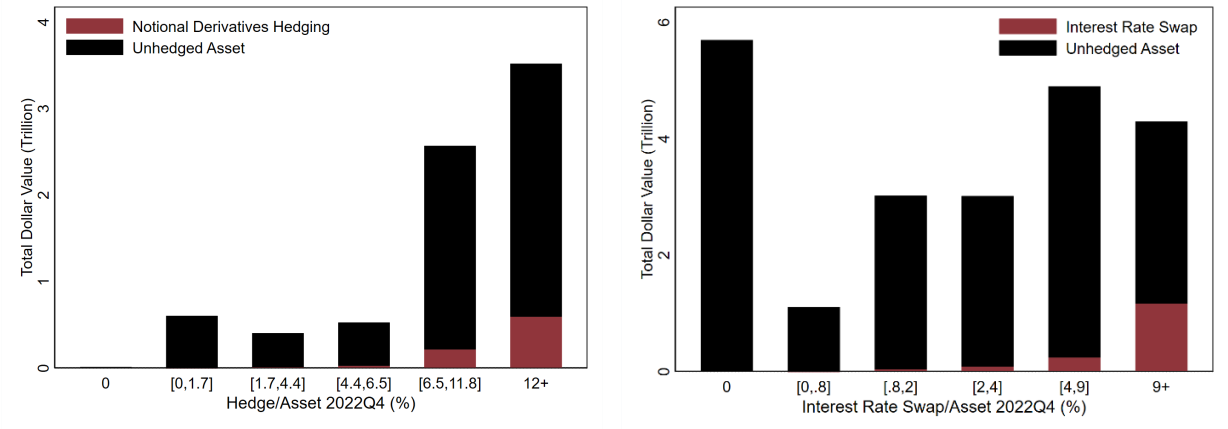
(a) Call Report Sample Analyzed



(b) 10K Sample Analyzed vs. Universe

Figure A2: Aggregate Hedged and Unhedged Asset Value as of 2022:Q4

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



(a) Hedge/Assets (10K)

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

Figure A3: Hedge and Bank Exposure to Interest Rate Risk
Alternative Hedging Ratio (Call Report)

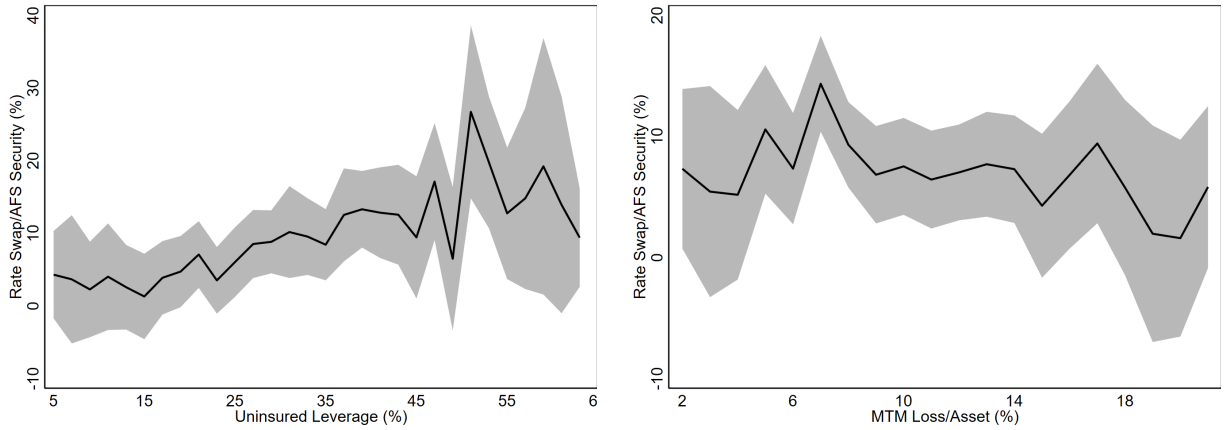
This figure plots hedging by banks using interest rate swaps in 2021:Q4 against uninsured leverage ratio (Panel a) and future mark-to-market loss (Panel b). Specifically, in Panel (a), we estimate the following specification:

$$y_i = \sum_b \gamma_b \, I(uninsured_i \in Bin_b) + \epsilon_i,$$

where y_i is interest rate swap to AFS security ratio. $I(uninsured_i \in Bin_b)$ is an indicator of whether bank i's uninsured to deposit ratio in 2021:Q4 falls within the bucket Bin_b (plotted on the x-axis of each panel). Each bin covers an incremental value of 2 percentage-points in the uninsured leverage distribution. In other words, the difference between the largest uninsured leverage ratio and the smallest uninsured leverage ratio of banks in each bin is 2%. The plotted coefficients of interest, γ_b, show how banks' hedging activities vary non-parametrically with their uninsured deposit ratios. The shaded area shows the 95% confidence interval. In Panel (b), we estimate the following specification:

$$y_i = \sum_b \gamma_b \, I(MTM\ Loss_i \in Bin_b) + \epsilon_i,$$

where y_i is interest rate swap to AFS security ratio. $I(MTM\ Loss_i \in Bin_b)$ is an indicator of whether bank i's mark-to-market loss, scaled by asset in 2021:Q4, falls within the bucket Bin_b (plotted on the x-axis of each panel). Mark-to-market loss is calculated based on 2022:Q1 balance sheet information using change in asset price from 2022:Q1 to 2023:Q1. Each bin covers an incremental value of 1 percentage-points in the mark-to-market loss distribution. In other words, the difference between the largest mark-to-market loss and the smallest mark-to-market loss of banks in each bin is 1% of their assets. The plotted coefficients of interest, γ_b, show how banks' hedging activities vary non-parametrically with their mark-to-market losses. The shaded area shows the 95% confidence interval. The underlying sample includes all banks that are required to report their use of interest rate swaps. We winsorize the interest rate swap to asset ratios at the 5th and the 95th percentiles. Results are qualitatively similar when we calculate hedging ratios as interest rate swaps divided by total values of securities. *Data Sources:* Bank call reports in 2021:Q4.

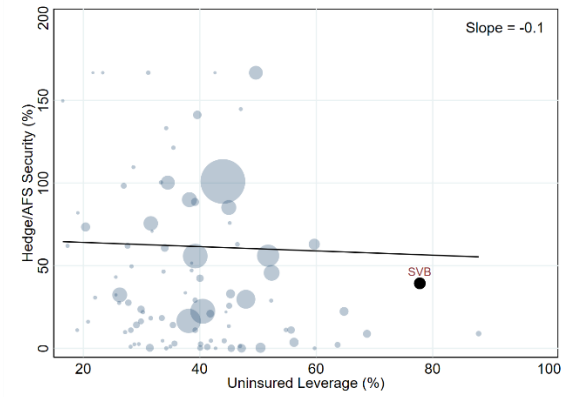


(a) Hedging and Uninsured Leverage

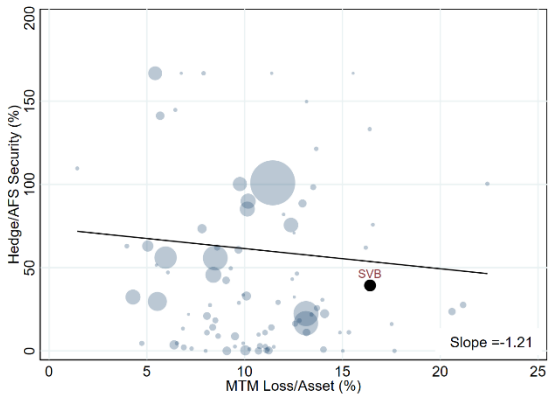
(b) Hedging and MTM loss/asset

Figure A4: Hedge and Bank Exposure to Interest Rate Risk
Alternative Hedging Ratio (10K)

This figure plots hedging ratio for publicly traded banks calculated using information in 10K and 10Q against two measures of bank exposure to interest rate risk. Panel (a) plots hedge to available-for-sale (AFS) security ratio against uninsured leverage ratio as of 2021:Q4. Panel (b) plots available-for-sale (AFS) security ratio as of 2021:Q4 against mark-to-market loss to total asset ratio in the future. Mark-to-market loss is calculated based on 2022:Q1 balance sheet information using change in asset price from 2022:Q1 to 2023:Q1. It is scaled by 2021:Q4 asset value. In both panels, the bubble size indicates the asset size of the bank as of 2021:Q4. The lines in each panel are the best fit lines based on weighted least squares. The slope and statistical significance is reported in each panel (with ***, ** and * implying significance at 1%, 5% and 10% levels respectively). *Data Sources:* 10Ks and 10Qs and bank call reports.



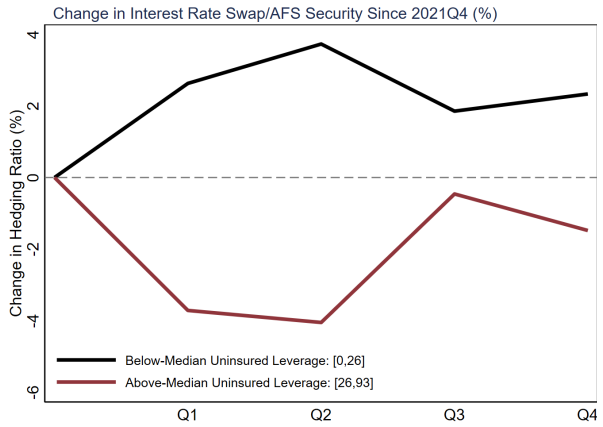
(a) Hedge/AFS Security: Uninsured Leverage



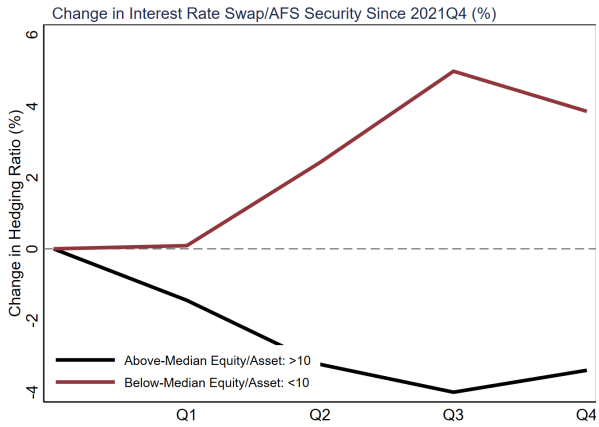
(b) Hedge/AFS Security: MTM Loss

Figure A5: Change in Hedging by Bank Balance Sheet Characteristics
Alternative Hedging Ratio (Call Report)

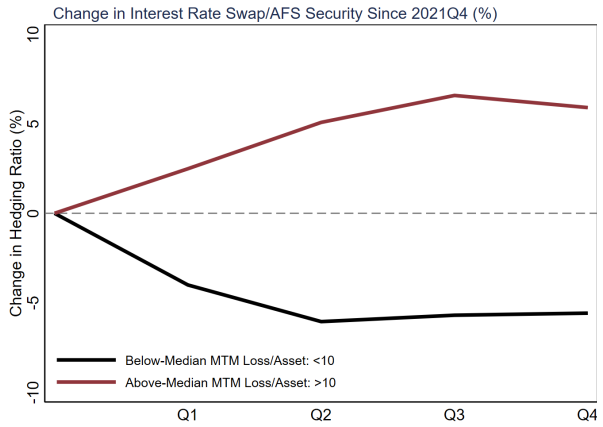
This figure plots quarterly hedging growth relative to 2021:Q4 using interest rate swap to AFS security ratio. It plots the growth from 2022:Q1 till 2022:Q4. In Panel (a), we divide banks into two equal-sized bins based on their uninsured leverage ratios in 2021:Q4. In Panel (b), we divide banks into two equal-sized bins based on their equity to asset ratio in 2021:Q4. In Panel (c), we divide banks into two equal-sized bins based on their future mark-to-market asset losses in the future based on asset price change from 2022:Q1 to 2023:Q1. In Panel (d), we divide banks into two equal-sized bins based on their future mark-to-market equity to asset ratio, which is calculated as (equity-mark-to-market loss)/(asset- market-to-market loss). In all panels, we plot the mean value of banks in each bin. *Data Sources:* Bank call reports.



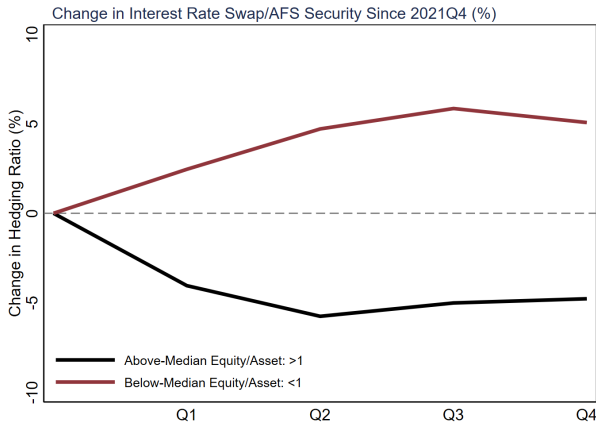
(a) Uninsured Leverage



(b) Equity/Asset



(c) MTM Loss/Asset



(d) MTM Equity/Asset

Appendix B: Description of data collection process from 10-K and 10-Q

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

Most information we collect from a bank's 2022 10-K report is recorded under "Item 8: Financial Statements and Supplementary Data."

1. **Available-for-sale (AFS) securities at fair value and held-to-maturity (HTM) securities at amortized cost as well as at fair value:**

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

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

SVB FINANCIAL GROUP AND SUBSIDIARIES
CONSOLIDATED BALANCE SHEETS

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

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

Wells Fargo & Company and Subsidiaries

Consolidated Balance Sheet

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

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

2. Notional value of hedging derivatives

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

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

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

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

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

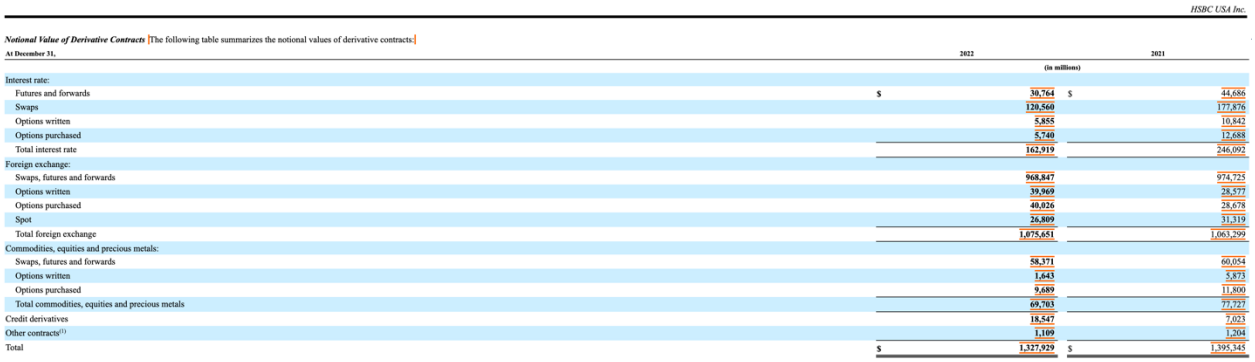
The total notional or contractual amounts and fair value of our derivative financial instruments at December 31, 2022, and December 31, 2021, were as follows:

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

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

Some banks only report the total derivatives at the notional or contractual amount, without reporting the total derivatives designated as hedging instruments and non-hedging instruments separately.

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



HSBC USA Inc.

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

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

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

3. Duration

We collect data on the effective average duration[12] of investment security portfolios by the end of 2021 and 2022 whenever such information is available. Slightly different from the securities data and derivatives data, for most banks that report the average duration on their securities portfolio, the information is reported under "Item 7: Management's Discussion and Analysis of Financial Condition and Results of Operations." We also manually check the entire 10-K reports for the keyword "duration" or "life" in case such information is reported under other items or sections. Figure 5 provides an example showing how SVB Financial Group reports the average duration of its investment securities portfolio in its 10-K report for 2022. More specifically, the paragraph of the discussion can be found under "Item 7, Consolidated Financial Condition, Investment Securities" on page 66 of SVB's 2022 10-K report. We record the average duration of SVB's investment security portfolios as 5.6 years for 2022 and 3.7 years for 2021, respectively (i.e., "the weighted-average duration of our total fixed income securities portfolio including the impact of fair value swaps" as described in Figure 5).

Portfolio duration is a standard measure used to approximate changes in the market value of fixed income instruments due to a change in market interest rates. The measure is an estimate based on the level of current market interest rates, expectations for changes in the path of forward rates and the effect of forward rates on mortgage prepayment speed assumptions. As such, portfolio duration will fluctuate with changes in market interest rates. Changes in portfolio duration are also impacted by changes in the mix of longer versus shorter term-to-maturity securities. The estimated weighted-average duration of our fixed income investment securities portfolio was 5.7 and 4.0 years at December 31, 2022, and December 31, 2021, respectively. The weighted-average duration of our total fixed income securities portfolio including the impact of our fair value swaps was 5.6 years at December 31, 2022, and 3.7 years December 31, 2021. The weighted-average duration of our AFS securities portfolio was 3.6 years at December 31, 2022, and 3.5 years at December 31, 2021. The weighted-average duration of our AFS securities portfolio including the impact of our fair value swaps was 3.6 years and 2.4 year at December 31, 2022, and December 31, 2021, respectively. The weighted-average duration of our HTM securities portfolio was 6.2 years at December 31, 2022, and 4.1 years at December 31, 2021.

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

We notice that some banks only report the average duration of portfolios by the end of the year 2022 without mentioning the information on the duration of their portfolios by the end of the year 2021 in their 2022's 10-K reports. For those banks, we also search their 2021 10-K reports to collect

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

their duration information for the year 2021.[13] To give an example, Figure 6 presents how BankUnited Inc. reports the average duration of its investment securities portfolio in its 10-K report for 2022, which only states that the effective duration of the portfolio was 2.0 years for 2022 without providing any information on the data for 2021. Therefore, we also look through BankUnited Inc.'s 10-K report for 2021. As shown in Figure 7, we find that the effective duration of its portfolio was 1.5 years by the end of 2021 from its 2021 10-K report.

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

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

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

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

4. Total carrying value of agency MBS

As part of AFS securities, we collect the values of Agency MBS as well as agency MBS with maturity above 10 years from "Note – securities" section. To give an example, Figure 8 presents the three tables under "Note 9 – Investment Securities" section from the SVB Financial Group's 2022 10-K report. The first two tables summarize the major components of SVB's AFS investment security portfolio as of December 31, 2022, and 2021. We collect the carrying value of agency MBS in each table (i.e., 6,603 million and 8,589 million for the years 2022 and 2021, respectively). The third table summarizes the AFS securities carried at fair value as of Dec 31, 2022, by the remaining contractual principal maturities. We collect the fair value of agency MBS with the remaining maturities above ten years (i.e., 6,560 million, as shown in the third table.).

We also collect the amortized cost of agency MBS classified as HTM by the end of 2022 and 2021 from "Note 9 – Investment Securities" section.. As another example, in the case of Wells Fargo & Company, we find the following two tables (as shown in Figure 9 and Figure 10, respectively) under "Note 3 – Available-for-Sale and Held-to-Maturity Debt Securities" section from Wells Fargo & Company's 2022 separate report accessed through the reference link in its 10K. We collect the same set of information as described above from these two tables.

	December 31, 2022			
(Dollars in millions)	Amortized Cost	Unrealized Gains	Unrealized Losses	Carrying Value
AFS securities, at fair value:				
U.S. Treasury securities	$ 17,206	$ —	$ (1,071)	$ 16,135
U.S. agency debentures	120	—	(19)	101
Foreign government debt securities	1,209	—	(121)	1,088
Residential MBS:				
Agency-issued MBS	7,701	—	(1,098)	6,603
Agency-issued CMO—fixed rate	762	—	(84)	678
Agency-issued CMBS	1,604	—	(140)	1,464
Total AFS securities (1)	$ 28,602	$ —	$ (2,533)	$ 26,069

	December 31, 2021			
(Dollars in millions)	Amortized Cost	Unrealized Gains	Unrealized Losses	Carrying Value
AFS securities, at fair value:				
U.S. Treasury securities	$ 15,799	$ 121	$ (70)	$ 15,850
U.S. agency debentures	200	—	(4)	196
Foreign government debt securities	61	—	—	61
Residential MBS:				
Agency-issued MBS	8,786	13	(210)	8,589
Agency-issued CMO—fixed rate	988	3	(9)	982
Agency-issued CMBS	1,536	27	(20)	1,543
Total AFS securities (1)	$ 27,370	$ 164	$ (313)	$ 27,221

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

(Dollars in millions)	December 31, 2022 Total	One Year or Less	After One Year to Five Years	After Five Years to Ten Years	After Ten Years
U.S. Treasury securities	$ 16,135	$ 983	$ 14,373	$ 779	$ —
U.S. agency debentures	101	—	33	68	—
Foreign government debt securities	1,088	101	52	935	—
Residential MBS:					
Agency-issued MBS	6,603	—	—	43	6,560
Agency-issued CMO—fixed rate	678	—	—	—	678
Agency-issued CMBS	1,464	—	326	1,138	—
Total	$ 26,069	$ 1,084	$ 14,784	$ 2,963	$ 7,238

Figure 8: Notes on AFS securities to the Consolidated balance sheet, SVB Financial Group, 10-K report for 2022.

Table 3.1: Available-for-Sale and Held-to-Maturity Debt Securities Outstanding

(in millions)	Amortized cost, net (1)	Gross unrealized gains	Gross unrealized losses	Fair value
December 31, 2022				
Available-for-sale debt securities:				
Securities of U.S. Treasury and federal agencies	**$ 47,536**	**9**	**(2,260)**	**45,285**
Non-U.S. government securities	**162**	**—**	**—**	**162**
Securities of U.S. states and political subdivisions (2)	**10,958**	**20**	**(533)**	**10,445**
Federal agency mortgage-backed securities	**53,302**	**2**	**(5,167)**	**48,137**
Non-agency mortgage-backed securities (3)	**3,423**	**1**	**(140)**	**3,284**
Collateralized loan obligations	**4,071**	**—**	**(90)**	**3,981**
Other debt securities	**2,273**	**75**	**(48)**	**2,300**
Total available-for-sale debt securities	**121,725**	**107**	**(8,238)**	**113,594**
Held-to-maturity debt securities:				
Securities of U.S. Treasury and federal agencies	**16,202**	**—**	**(1,917)**	**14,285**
Securities of U.S. states and political subdivisions	**30,985**	**8**	**(4,385)**	**26,608**
Federal agency mortgage-backed securities	**216,966**	**30**	**(34,252)**	**182,744**
Non-agency mortgage-backed securities (3)	**1,253**	**—**	**(147)**	**1,106**
Collateralized loan obligations	**29,926**	**1**	**(727)**	**29,200**
Other debt securities	**1,727**	**—**	**(149)**	**1,578**
Total held-to-maturity debt securities	**297,059**	**39**	**(41,577)**	**255,521**
Total	**$ 418,784**	**146**	**(49,815)**	**369,115**
December 31, 2021				
Available-for-sale debt securities:				
Securities of U.S. Treasury and federal agencies	$ 39,668	185	(192)	39,661
Non-U.S. government securities	71	—	—	71
Securities of U.S. states and political subdivisions (2)	16,618	350	(51)	16,917
Federal agency mortgage-backed securities	104,661	1,807	(582)	105,886
Non-agency mortgage-backed securities (3)	4,515	32	(15)	4,532
Collateralized loan obligations	5,713	2	(7)	5,708
Other debt securities	4,217	259	(7)	4,469
Total available-for-sale debt securities	175,463	2,635	(854)	177,244
Held-to-maturity debt securities:				
Securities of U.S. Treasury and federal agencies	16,544	599	(318)	16,825
Securities of U.S. states and political subdivisions	32,689	847	(61)	33,475
Federal agency mortgage-backed securities	188,909	1,882	(2,807)	187,984
Non-agency mortgage-backed securities (3)	1,082	31	(18)	1,095
Collateralized loan obligations	31,067	194	(2)	31,259
Other debt securities	1,731	17	—	1,748
Total held-to-maturity debt securities	272,022	3,570	(3,206)	272,386
Total	$ 447,485	6,205	(4,060)	449,630

Figure 9: Notes on AFS and HTM securities to the Consolidated balance sheet, Wells Fargo & Company, 2022 Annual Report attached in the 10-K report for 2022.

Table 3.6: Contractual Maturities – Available-for-Sale Debt Securities

By remaining contractual maturity ($ in millions)		Total	Within one year	After one year through five years	After five years through ten years	After ten years
December 31, 2022						
Available-for-sale debt securities (1):						
Securities of U.S. Treasury and federal agencies						
Amortized cost, net	$	47,536	4,046	21,094	20,884	1,512
Fair value		45,285	3,945	20,576	19,326	1,438
Weighted average yield		1.09%	1.19	0.55	1.59	1.44
Non-U.S. government securities						
Amortized cost, net	$	162	1	137	24	—
Fair value		162	1	137	24	—
Weighted average yield		3.49%	5.10	3.62	2.71	—
Securities of U.S. states and political subdivisions						
Amortized cost, net	$	10,958	1,139	2,471	4,866	2,482
Fair value		10,445	1,138	2,455	4,513	2,339
Weighted average yield		3.46%	4.06	3.43	3.16	3.80
Federal agency mortgage-backed securities						
Amortized cost, net	$	53,302	1	277	856	52,168
Fair value		48,137	1	264	799	47,073
Weighted average yield		3.26%	3.33	1.90	2.48	3.28
Non-agency mortgage-backed securities						
Amortized cost, net	$	3,423	—	—	71	3,352
Fair value		3,284	—	—	65	3,219
Weighted average yield		4.58%	—	—	3.31	4.61
Collateralized loan obligations						
Amortized cost, net	$	4,071	—	—	3,668	403
Fair value		3,981	—	—	3,592	389
Weighted average yield		5.53%	—	—	5.53	5.54
Other debt securities						
Amortized cost, net	$	2,273	81	203	866	1,123
Fair value		2,300	79	199	866	1,156
Weighted average yield		5.13%	5.16	5.73	4.47	5.52
Total available-for-sale debt securities						
Amortized cost, net	$	121,725	5,268	24,182	31,235	61,040
Fair value		113,594	5,164	23,631	29,185	55,614
Weighted average yield		2.57%	1.87	0.90	2.41	3.38

Figure 10: Notes on AFS and HTM securities' maturities to the Consolidated balance sheet, Wells Fargo & Company, 2022 Annual Report attached in the 10-K report for 2022.

5. Fair value hedges

We collect banks' quarterly fair value hedge information from 10-Q reports.. For each bank, we search for hedging information in the "Note — Derivative Financial Instruments" section and record the carrying amount of hedged assets that are designated and qualify as fair value hedges for AFS securities. We collect this information from 10-Q reports for 2022 Q1 to 2022 Q3 and combine them with the same information obtained from banks' 10-K reports in 2022. In 10-K reports, we collect the corresponding information at the end of 2021 and 2022, respectively. For banks with fiscal year end in June (or September), we collect the data from 10-Q reports for 2022 Q1, Q3, and Q4 (or Q1, Q2, and Q4) and then use the information obtained from the bank's 10-K reports as the data for Q2(or Q3).

Figure 11 shows the section with information about fair value hedges in SVB Financial Group's 10-Q reports as an example. We present figures corresponding to each quarter of 2022 (i.e., the first three tables in the figure) and 2022's 10-K report (i.e., the last table in the figure). These tables are located in "Note 16 – Derivative Financial Instruments" section in SVB's 10-K report and "Note 7 — Derivative Financial Instruments" section in SVB's 10-Q reports. We collect the amortized

cost basis of the hedged assets in each table, which is 15,260 million by the end of the year 2021, 9,604 million, 9,321 million, and 8,773 million at the end of 2022 Q1, Q2, and Q3, respectively, and 563 million at the end of the year 2022.

	March 31, 2022	
(Dollars in millions)	Amortized Cost Basis of the Hedged Assets	Cumulative Amount of Fair Value Hedging Adjustment Included in the Carrying Amount of the Hedged Assets (2)
AFS securities (1)	$ 9,604	$ (252)

(1) These amounts include the amortized cost basis of closed portfolios used to designate hedging relationships in which the hedged item is the last layer expected to be remaining at the end of the hedging relationship. At March 31, 2022, the amortized cost basis of the closed portfolios used in these hedging relationships was $9.6 billion, the amounts of the designated hedged items was $5.9 billion and the cumulative basis adjustments associated with these hedging relationships was $258 million.
(2) The balance includes $6 million of hedging adjustments on discontinued hedging relationships at March 31, 2022.

	June 30, 2022	
(Dollars in millions)	Amortized Cost Basis of the Hedged Assets	Cumulative Amount of Fair Value Hedging Adjustment Included in the Carrying Amount of the Hedged Assets (2)
AFS securities (1)	$ 9,321	$ (308)

(1) These amounts include the amortized cost basis of closed portfolios used to designate hedging relationships in which the hedged item is the last layer expected to be remaining at the end of the hedging relationship. At June 30, 2022, the amortized cost basis of the closed portfolios used in these hedging relationships was $9.3 billion, the amounts of the designated hedged items was $5.9 billion and the cumulative basis adjustments associated with these hedging relationships was $313 million.
(2) The balance includes $5 million of hedging adjustments on discontinued hedging relationships at June 30, 2022.

		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
September 30, 2022			
AFS securities	$ 8,773	$ —	$ (301)
December 31, 2021			
AFS securities (1)	$ 15,260	$ (131)	$ 6

(1) These amounts include the amortized cost basis of closed portfolios used to designate hedging relationships in which the hedged item is the last layer expected to be remaining at the end of the hedging relationship. At December 31, 2021, the amortized cost basis of the closed portfolios used in these hedging relationships was $11.2 billion, the amounts of the designated hedged items was $6.7 billion and the cumulative basis adjustments associated with these hedging relationships was $83 million.

		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	$ (2)	$ (290)
December 31, 2021			
AFS securities (1)	$ 15,260	$ (131)	$ 6

(1) These amounts include the amortized cost basis of closed portfolios used to designate hedging relationships in which the hedged item is the last layer expected to be remaining at the end of the hedging relationship. At December 31, 2021, the amortized cost basis of the closed portfolios used in these hedging relationships was $11.2 billion, the amounts of the designated hedged items was $6.7 billion and the cumulative basis adjustments associated with these hedging relationships was $83 million.

Figure 11: Fair value hedges of securities available for sale. SVB Financial Group, 10-K report for 2022 and, 10-Q reports for Q1-Q3 2022.