Partial Effects of Fed Tightening on U.S. Banks' Capital

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ABSTRACT

Silicon Valley Bank (SVB) failed on March 10, 2023, from a depositor run set off by massive unbooked securities losses that became salient only when the firm filed for a stock issue intended to replace some realized, but previously un-noticed, capital losses. The unprecedented increase in market interest rates associated with the Fed's 2022 inflation-fighting raises the question of whether SVB's situation reflects a broader problem in the banking system. As of 2022 Q4, we find $623 billion of before-tax security losses unbooked in Common Equity Tier 1 capital (CET1) and $466 billion of unbooked interest-rate-related loan losses. After tax, these unbooked losses ($482 billion and $362 billion, respectively) represent 40% of CET1 and are distributed relatively evenly across bank size classes. We did not measure some possibly offsetting effects on bank capital ratios, but we strongly suspect they are too small to offset these large asset losses. If all unbooked losses were fully reflected in bank balance sheets, roughly half of banks, holding roughly half of all bank assets, would not meet their minimum regulatory capital requirements. This appears to be a major cause for regulatory and depositor concern.

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I. INTRODUCTION

Publicly-reported financial statements for U.S. banks indicate that they had, collectively, ratios of book equity equal to about 9.4% of total assets at the end of 2022. The system's regulatory capital ratio shows that Common Equity Tier 1 (CET1) equaled about 13.6% of risk-weighted assets.[1] These and other capital ratios substantially exceed their values prior to the Great Financial Crisis and led numerous regulatory officials to declare that the banking system was "well capitalized."[2] Unfortunately, these reported capital measures omit substantial amounts of unbooked capital losses on banks' securities and loan portfolios. In other words, banks' regulatory reports overstate the fair value of their assets and equity, biasing equity capital ratios upward.[3] Since a bank's condition is evaluated largely on the basis of its capital ratios, unbooked capital losses can substantially affect outsiders' evaluations of a bank's condition. After we incorporate unbooked security and loan losses into equity capital measures, the corresponding equity and CET1 ratios fall to 6.8% and 8.1%, respectively. The banking sector has been dramatically affected by the unprecedented 425 basis point increase in the Fed policy rate during 2022.

Figure 1 shows the Fed Policy Rate and the ten-year Treasury Bond yield during the five years from April 1, 2018, to April 1, 2023. The Fed's monetary policy tightening during the year preceding March 2023 produced an interest rate path that challenged the creditworthiness of financial institutions with sufficiently maturity-mismatched balance sheets. As the Fed's policy rate rose by 425 bps, longer-term rates (including mortgage rates) naturally rose as well.[4] Although the ten-year rate increased by only 2.36% during 2022 (from 1.52% to 3.88%), a ten-year treasury bond issued at par at the end of 2021 would

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[1] Common Equity Tier 1 Capital Ratio is the ratio of Common Equity Tier 1 Capital (CET1) to Risk Weighted Assets (RWA), and is a key regulatory metric imposed by the Basel III Framework. CET1 is a core measure of a bank's financial strength. It is considered the most loss-absorbing form of capital because it provides a buffer to absorb losses without triggering resolution or insolvency. RWA is a measure of a bank's total assets, adjusted for the level of risk associated with each asset. Basel III categorizes assets into different risk categories. Each category is assigned a risk weight. The sum of the weighted assets in each category is then added together to arrive at the bank's total RWA. We return to the Basel III Framework in Section IV(A).

[2] For example, on March 12, 2023 the Board of Governors of the Federal Reserve System declared that "The capital and liquidity positions of the U.S. banking system are strong and the U.S. financial system is resilient" (Federal Reserve Board, 2023). On the same day, a press release from the U.S. Treasury concludes "The U.S. banking system remains resilient and on a solid foundation, in large part due to reforms that were made after the financial crisis that ensured better safeguards for the banking industry (U.S. Department of the Treasury, 2023). Even in the days following SVB's failure, informed observers failed to recognize the implication of its compromised capital ratio for the bank's demise.

[3] ASC 820-10-20 defines fair value as "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date."

[4] It is widely agreed that rate increases were required to combat inflation. We take no position on the appropriateness of past, or possible future, rate increases. Rather, we limit ourselves to evaluating how such increases have affected the U.S. banking system.

have lost approximately 18% of its value by the end of 2022. It thus appears plausible that securities and loans on banks' balance sheets could carry large embedded (unbooked) losses.

Recent concerns about the impact of unbooked capital losses on bank solvency emerged suddenly after the failure of the 18th-largest U.S. commercial bank on March 10, 2023. Other regional banks were subsequently plagued by panic-like concerns about their solvency and their abilities to earn profits in the current interest rate environment. Silicon Valley Bank (SVB) suffered from interest rate risk—a maturity mismatch between its assets and liabilities—combined with an unusually large proportion of uninsured liabilities. At the end of 2022, SVB reported an equity-to-assets ratio of 7.39% and a CET1 capital ratio of 15.26%. When we adjust these figures for unbooked fair value losses on bonds and loans, we find ratios of 1.64% and 2.75%, respectively. SVB's heavy reliance on uninsured deposits meant that any doubts about its solvency were likely to generate an immediate liquidity crisis (i.e., a depositor run). It thus makes sense to investigate whether SVB's position was unique or whether its asset value losses reflect similar risk exposures at other U.S. banks.

To answer this question, we collect Call Report data on all U.S. banks' assets and liabilities.[5] We estimate fair values for the two asset categories most affected by the Fed's recent increase in interest rates: securities and loans. Securities' fair values can largely be identified by careful examination of the banks' Call Reports. At yearend 2022, we find fair value losses in the securities portfolio equal to about $665 billion, or 2.8% of total assets.[6] Such ready identification does not exist for loans and leases, which accounted for 51.8% of reported bank assets at the end of 2022.[7] Many of these loans have fixed interest rates and long maturities and are reported at face value except for a (generally) minor adjustment for the allowance for loan and lease losses. Fortunately, bank Call Reports provide a relatively coarse breakdown

[5] Bank Call Reports are financial reports that banks in the United States are required to file with their primary regulator on a quarterly basis. These reports provide detailed information on the bank's financial condition and performance, including information on assets, liabilities, capital, income, and expenses. The reports are filed quarterly by all federally-insured banks and thrifts, and are used by regulators to monitor and supervise the banking industry, identify emerging risks, and ensure that banks are operating in a safe and sound manner. Call Reports are filed on one of three forms: FFIEC 031, 041, or 051. FFIEC 031 is used by banks with total assets of more than $100 billion, banks with international operations, and banks that are subject to more stringent regulatory requirements under the Basel III framework. FFIEC 041 is used by banks with domestic offices only and total assets of less than $100 billion, excepts for banks required to file FFIEC 031 and banks eligible to file FFEIC 051. Form FFIEC 051 is used by banks with domestic offices only that have total assets of less than $5 billion and do not have complex banking operations. The main difference between these forms is the level of detail required in each. Overall, the specific form used by a bank depends on its total assets and the nature of its operations. Banks with more complex operations and larger assets use FFIEC 031, while smaller banks with simpler operations use the FFIEC 051.

[6] This number is slightly higher than the $620 billion number reported by FDIC Chairman Gruenberg in March 2023 (Gruenberg, 2023). The difference of $45 billion results from a peculiar feature of how security losses are recorded in the Call Reports. We return to this discrepancy in Section III.

[7] Henceforth, for simplicity, we use the single word "loans" to refer to the sum of loans and leases.

of maturities (for fixed-rate loans) and times to repricing (for floating-rate loans).[8] Using this information, we estimate that the 2022 interest rate increases reduced the fair value of bank loans by $466 billion (2.0% of total assets). These losses are not recognized anywhere in the balance sheets available to the public.

Summing losses from securities and loans, we find that the fair value of banks' assets fell by $1.13 trillion before tax, or $877 billion after tax, as a result of interest rate increases. GAAP requires that only 28% of these losses be recognized in bank equity accounts. Unbooked asset losses cause the fair value of GAAP equity to be overstated by approximately 40%. More importantly, a core regulatory concept of equity capital—common equity tier 1 (CET1)—also fails to reflect unrealized asset value losses.[9] As with GAAP equity, unrealized losses on loans and Held-to-Maturity securities are omitted from CET1. Unlike GAAP equity, however, CET1 also omits AFS losses for most banks. Prior to a 2019 regulatory change, unrealized losses on "Available for Sale" securities had also been included in equity. After 2019, only the very largest banks are required to book AFS losses, and most banks do not. Out of a total of $877 billion in after-tax losses from loans and securities, only $33 billion (less than 4%) are recognized in reported CET1 measures. As a result, reported CET1 overstates its fair value by approximately 68%.[10]

These aggregate valuation effects, while large, do not provide a complete picture of the stability of the U.S. banking industry. Going beyond simple averages, we also examine the distribution of losses by their effect on reported equity capital and, separately, on CET1.

We find that if asset losses were incorporated into CET1 at the end of 2022, more than half of U.S. banks (2,548 of 4,756 banks) would fail to meet their expected capital adequacy hurdles. Together, these banks control $12.2 trillion in assets, which represent 52% of all U.S. banks' assets. These conclusions apply to the aggregate banking system and to all bank size classes. In nearly all cases, the situation would worsen if rates rise further.[11]

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[8] These maturity brackets are (a) less than 3 months, (b) 3 months to 1 year, (c) 1 to 3 years, (d) 3 to 5 years, (e) 5 to 15 years, and (f) over 15 years. For floating rate loans, "maturity" is defined as the time of the next repricing rather than the stated maturity (or amortization period) of the loan.

[9] We explain in Section II the key differences between GAAP equity and CET1.

[10] Throughout the paper we use the term "GAAP Equity" to refer to the GAAP-based equity reported on line 28 of schedule RC, and "CET1" to refer to the Common Equity Tier 1 regulatory capital reported on line 19 of schedule RC-R-I.

[11] A recent paper by Jiang et al. (2023) pursues a similar research idea. Using a methodology different from ours, they arrive at different conclusions. First, their aggregate estimate of (before-tax) bank losses is twice as big as ours: $2.2 trillion compared to our $1.1 trillion. The main reason for this difference, we believe, is that they use primarily external proxies derived from the ETF market to estimate losses while we measure, to the extent possible, these losses directly from the banks' Call Reports. Second, despite their loss estimates being significantly bigger than ours, their estimated number of impaired banks (and corresponding asset size) is considerably smaller. Under their most conservative scenario, 186 banks controlling $300 billion in assets are impaired. In contrast, based on our own conservative assumptions, we estimate that 2,548 banks, holding $12.2

It is difficult to assemble the data required to estimate the effect of a bank's fair value losses on banks' GAAP equity and CET1 ratios. This informational friction may explain some observers' misunderstanding about the role of interest rate changes in the failure of Silicon Valley Bank. For example, one op-ed article by two well-known public policy participants asserts that "Calls for increased capital and liquidity, appealing in their simplicity, inevitably follow bank failures, but Silicon Valley Bank had plenty of both (emphasis added)." [12] Ignoring possible offsetting effects, which we discuss in Section V, below, but do not estimate here, the adequacy of SVB's equity capital was questionable at best.

Our computed valuation effects could overestimate the impact on bank equity and CET1 because we have estimated fair value losses only for banks' assets. A complete evaluation of bank fair value changes must incorporate (at least) two further items: the impact of interest rate hikes on the value of bank liabilities and the presence of derivative hedging instruments. These items are more difficult to evaluate than securities and loans, so we have left them to future research. We briefly discuss these limitations in Section V, but at this time, we think it unlikely that hedging or liability effects could offset a large fraction of these losses. We plan to evaluate those items in a successor to this paper.

The rest of the paper proceeds as follows. Section II begins with a discussion of how unbooked value changes affect bank and financial stability. We then summarize the accounting treatment of losses associated with interest risk exposure. In Section III, we report results: the fair value losses that U.S. commercial banks have already incurred on their loans and securities. These losses have large effects on the capital ratios that constitute crucial elements of the regulatory system for evaluating bank soundness. In Section IV, we discuss our paper's implications for policy and research. Section V discusses several mitigating factors and sets the stage for investigating how they may affect our conclusions. Section VI summarizes and concludes.

II. ACCOUNTING FOR UNREALIZED LOSSES FROM SECURITIES AND LOANS

A hypothetical market-value accounting system might include unrealized gains and losses in contemporaneous net income, thereby affecting a bank's equity and CET1 as (negative) retained earnings. Real-world bank accounting conventions (GAAP and regulatory views on which elements of equity will

trillion in assets, suffer capital impairments. The difference lies in how we classify troubled banks. Jiang et al. (2023) focus on the ability of banks to pay uninsured depositors from their fair-valued assets. Instead, we follow the current regulatory environment and focus on banks' capital adequacy ratios (CET1 capital ratio and CBLR, as appropriate for each bank). We return to this comparison in Section IV(D).

[12] SVB had "plenty" of book capital, but its fair value capital was nearly zero.

actually absorb losses) do a poor job of reflecting such value changes. Because many losses and gains are not reported in GAAP statements, value changes caused by market rate fluctuations are not readily apparent from the Call Reports.[13] Even stress tests generate little information about interest rate risk exposure.[14] Accordingly, publicly reported regulatory information can mislead observers about bank capital ratios. Piecing together the extent to which reported equity ratios reflect fair asset values is a nontrivial task.

A. Do Unbooked Losses Matter?

Some observers of the banking sector have argued that unbooked losses are irrelevant unless the bank must sell its under-valued assets. We are uncomfortable with this idea and propose several reasons why a bank's unbooked losses should be subtracted from its equity account in order to measure its true ability to absorb risk.[15] First, uninsured depositors will recognize that the bank has little wealth available to absorb transaction costs (and market moves against it) if it needs to sell assets to cover withdrawals. Therefore, depositor runs seem more likely, and an initial run is more likely to spur other runs at similarly capitalized institutions.[16] Second, a dollar of equity capital reported on the banks' books cannot absorb a dollar in operating losses. Given regulators' concerns that equity capital must be available to absorb losses, it seems that large unbooked losses should limit their confidence in the capital adequacy of the affected banks. Third, unbooked losses may indicate poor earnings prospects. In the current situation, market rates have risen quickly and the cost of retaining deposits will be higher than in the past, depressing future earnings (other things the same). Fourth, the FDIC's cost of closing failed banks will include at least a portion of its unbooked losses, which are therefore relevant to setting appropriate deposit insurance rates.

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[13] If rates change rapidly, as they did during calendar 2022, the corresponding change in value can be large. For example, five-year treasuries were yielding 1.26% at yearend 2021 and four-year treasuries were yielding 4.11% a year later. The corresponding change in market value was –10.3% of principal. Corresponding value changes for 10- and 20-year treasuries were –17.8% and –28.3% respectively. These numbers indicate that the Fed's rate increases may have had substantial effects on banks' equity ratios.

[14] For example, in the Fed's February 2022 stress test, the "Severely Adverse Scenario" assumed that for the subsequent three years (2022-2025) short-term interest rates would be 0.1% and inflation would remain 2% (Federal Reserve Board, 2022).

[15] In the Basel III regulatory framework, CET1 is intended to be the highest quality of capital, designed to absorb losses immediately as they occur. If CET1 is meant to absorb losses immediately and with very high probability, an equity account impaired by unbooked losses is *de facto* less reliable than one with fewer unbooked losses.

[16] Jiang et al. (2023) also discuss this possibility, pointing out that Silicon Valley Bank's poor (post-unbooked losses) capital position became an urgent problem only when depositors started to withdraw.

A final reason for removing today's unbooked losses from measures of bank equity may be particularly relevant given the current outlook for monetary policy. Most of our measured security losses derive from banks' so-called "held to maturity" (HTM) assets. Banks need not account for fluctuations in the value of HTM securities in order to insulate income and equity accounts from short-term, reversible fluctuations. This logic assumes that security prices will revert to "normal," higher levels. But today, a "normal" rate would be too high to restore many low-coupon securities and loans to their face values. At least some of today's unbooked losses are likely to be permanent because of the path interest rates have followed.

B. Booking Unrealized Losses from Interest Risk Exposure

Because equity accounts are so important to assessing a bank's condition, we begin by explaining that U.S. commercial banks report two different measures of equity on their quarterly Call Reports: a GAAP-based measure for "Total Equity" and a separate measure for regulatory purposes called Common Equity Tier 1 (CET1), which forms the basis for the Basel III risk-based capital requirements.[17] The GAAP and CET1 equity measures differ in two important ways: (1) CET1 does not recognize goodwill as an asset, and (2) for the vast majority of banks, CET1 does not recognize any unrealized security losses. The latter difference is critical to our paper.

i. Security Losses

Upon purchasing a security (such as a treasury bond or a mortgage-backed security), a bank classifies it as either "Held to Maturity" (HTM) or "Available for Sale" (AFS). This designation determines how (or whether) subsequent, unrealized changes in the security's market value are incorporated into the bank's balance sheet under GAAP. HTM securities are recorded on an amortized cost basis; their reported values never deviate from the scheduled amortization amounts until the security is sold.[18] Accordingly,

[17] See line 28 of the Call Report's Schedule RC and on line 19 of Schedule RC-R Part I. GAAP equity is defined as the sum of perpetual preferred stock and related surplus (RCON3838), common stock (RCON3230), surplus (exclude all surplus related to preferred stock) (RCON3839), retained earnings (RCON3632) and other equity capital components (RCONA130). CET1 equity is an adjusted version of GAAP equity used for regulatory purposes. It is computed as shown in Schedule RC-R Part I, lines 1 through 18.

[18] The amortized value of a security represents the security's cost adjusted for the amortization of any premiums or discounts. When a company buys a security at a price that is different from its face value, the difference between the purchase price and the face value creates either a premium or a discount. Over time, the premium or discount is gradually amortized over the life of the security. This means that a portion of the premium or discount is recorded as an adjustment to the security's value each year until it reaches its face value at maturity. Although the amortized value of a security reflects the impact of any premiums or discounts that were paid at the time of purchase, it does not reflect the impact of market changes in the underlying interest rate that may have occurred since the security was purchased. In this sense, the amortized value closely resembles the concept

unrealized HTM gains and losses do not affect a bank's GAAP equity capital in any way.[19] With most HTM bonds overvalued in current balance sheets, bank equity accounts are similarly overvalued. The aggregate effect of HTM over-valuations on the banking system's balance sheet can be observed simply by summing each bank's unbooked HTM security losses. The Call Reports explicitly provide information about an HTM security's book value and its estimated "fair value," which is what the bank believes the bond could be sold for under current conditions. These fair value estimates indicate that HTM securities are worth only 87.8% of their reported value. We accept the banks' own fair value estimates as legitimate.

The accounting treatment of gains and losses on AFS securities is more complicated. AFS securities are carried on the balance sheet at fair value. Changes in market interest rates generally move securities' fair values in the opposite direction, and the Fed's 2022 rate increases tended to reduce AFS bonds' fair values. Unrealized gains and losses on AFS securities do not affect Net Income but rather fall into Other Comprehensive Income (OCI), which accumulates over time into an Accumulated Other Comprehensive Income (AOCI) account that measures cumulative unbooked AFS losses.[20] AOCI affects the value of GAAP equity directly without flowing through the income statement. This means that a loss from an AFS security would not affect operating income but would nonetheless reduce the book value of equity by an amount equal to the after-tax value of the loss. This standard GAAP treatment applies to all types of firms, not just commercial banks.

While all banks account for AOCI in their GAAP measure of equity, after November 2019 only a small number of banks include it in CET1 capital.[21] (In contrast, *all* banks in the European Union

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of a depreciated book value as opposed to market value. For example, a security purchased at par for $1,000 will maintain its amortized value at $1,000 until maturity, regardless of any subsequent changes in the underlying interest rate.

[19] The insulation of income and equity measures from HTM value changes is a GAAP convention, designed to minimize "temporary" fluctuations in reported net income. Realized gains or losses on HTM securities are recorded in the sale period's net income.

[20] AOCI includes more than just losses from AFS securities. It also includes, among others, (1) net gains (or losses) on derivative instruments that are designated to be cash flow hedges, (2) net gains (or losses) on derivative instruments that are designated to hedge changes in market value of AFS securities, (3) gains (or losses) on defined benefit pension and other postretirement plans, (4) the change in the fair value of a liability resulting from a change in its credit risk , (5) in the case of large, complex financial institutions, gains (or losses) from certain foreign currency transactions, and (6) a deferred tax liability (asset) that captures the cumulative tax effects of these gains (losses). AOCI does not include gains (losses) on publicly traded equity securities.

[21] Prior to 2014 AOCI was excluded from CET1 for all U.S. banks. A regulatory change reversed that instruction, mandating that AOCI be included in both equity and CET1. Shortly after these new rules went into effect, however, regulators offered most banks a one-time opportunity to "opt out" of the requirement that AOCI be included in their regulatory capital.[21] Banks following the "Advanced Approaches capital framework"—generally those with at least $250 billion in assets—were not permitted to opt out. Nearly all the others did so. Subsequently, on November 1, 2019, the Office of the Comptroller of the Currency (OCC) issued a final rule permitting most banks with assets between $250 billion and $700 billion also to opt out.

incorporate unrealized AFS losses into their capital ratios.[22]) At yearend 2022, only 49 out of 4,756 banks included accumulated AFS value changes in measures of regulatory equity. These reporters include the four largest banks (all above $1.7 trillion in total assets), five banks owned by two of the four largest bank holding companies, four GSIB banks with asset sizes averaging $380 billion, seven banks owned by these four GSIB bank holding companies, and 29 other banks that voluntarily chose *not* to "opt out." These 29 banks report average assets of $12.6 billion, with a range from $7 billion to $155 billion. For the 4,707 "opt-out" banks, unrealized gains and losses on AFS securities are booked into the GAAP measure of equity (Schedule RC) but are no longer incorporated into CET1 (schedule RC-R). Because AOCI is generally negative on December 31, 2022, the opt-out banks' regulatory capital ratios overstate their fair-valued levels on account of the treatment of unrealized AFS losses.[23]

In sum, losses from HTM securities are never booked in GAAP equity or CET1 capital. Losses from AFS securities are booked in GAAP total equity for all banks, but are *not* booked in CET1 capital for most U.S. banks (4,707 out of 4,765).

ii. <u>Loan Losses</u>

U.S. banks hold loans equal to 51.8% ($12.2 trillion) of their total book assets. With minor exceptions, banks are not required to report the fair value of their loans. (Only $52 billion or 0.4% of loans are reported at fair value). Although the Call Reports' Allowance for Loan and Lease Losses (ALLL) is recognized in both GAAP equity and CET1, losses resulting from adverse rate changes are not recognized in the loan valuations or the capital accounts. While many of these loans carry variable interest rates subject to monthly adjustments, many others, such as fixed-rate mortgages, do not reprice for extended periods of time.[24] We estimate fair values for outstanding loans using the Call Reports' information identifying when fixed-rate loans mature and when floating-rate loans' contract rates are due to be repriced.

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[22] See EU Regulation no. 573/2013 Article 26, paragraph 1(d) (Eur-Lex, 2013). In the EU, as here, unrealized HTM losses are not booked into AOCI.

[23] The Fed's recent monetary policy actions make it likely that AOCI is now negative for most banks. As of yearend 2022, 91.4% of all banks (4,348 out of 4,756) reported negative values of AOCI. Previously, AOCI could have been positive or negative and it may have varied across reporting banks. For example, only 47.6% of banks reported negative AOCI at yearend 2021.

[24] For example, of the $12.2 trillion in loans reported on Schedule RC, more than half ($6.9 trillion) are loans that reprice in three months or longer. This maturity/repricing information is qualitatively different from the rest of the Call Report's primary focus on credit quality measures.

iii. Summary of How Interest Risk Losses are Booked

We summarize in Table 1 the accounting treatment of unrealized losses from securities and loans, when such losses result from exposure to interest rate increases. Panel A of Table 1 shows how these losses flow through the income statement, and Panel B shows their impact on the two measures of bank capital: GAAP equity and CET1. Column [2] of Panel B is particularly important to our paper: for most banks (4,707 out of 4,765), none of the losses are booked into CET1! Column [3] of Panel B shows that the only losses booked into CET1 are losses associated with AFS securities incurred by large banks, GSIBs, and a few other banks that decided not to opt out of the AOCI exclusion. This explains why, in the aggregate, less than 4% of unrealized losses are booked into CET1 across the banking sector.

C. Tax Treatment of Unrealized Losses

Throughout the paper, we report both before- and after-tax losses from securities and loans. In part, this reflects the information available in Call Reports. While there are no immediate tax implications for unrealized HTM security or loan losses, losses on AFS assets are recognized in OCI on an *after-tax* basis. (The reported gains or losses include a deferred tax asset corresponding to the expected tax effects attached to the assets' future sale.) As a result, the amount of OCI in income statements and the corresponding AOCI on balance sheets combine two separate economic concepts: the (pre-tax) decline in the market value of the AFS securities and an offsetting deferred tax asset.[25] [26]

How should potential tax deductions affect the way we value unrealized losses on bank balance sheets? The aggregate effect is quite large: unrealized losses across the banking sector amount to $1.13 trillion pre-tax vs. $877 billion after-tax.[27] We are inclined to emphasize the smaller, after-tax losses: so

[25] In addition to AFS losses being reported on an after-tax basis in AOCI, they are also reported on a pre-tax basis elsewhere in the Call Reports: their pre-tax value is provided in Schedule RC-B, which reports both the amortized cost and fair value of certain securities. Thus, AFS losses can be observed both before-tax and after-tax, directly from the Call Reports. ASC 220-10-55-8B provides examples of the alternative formats for disclosing the tax effects related to the components of OCI.

[26] To illustrate this concept, consider the following example: at yearend 2022 a bank holds AFS securities with an amortized value of $1,000. Suppose that the fair market value of these securities is $800 and suppose that the bank's relevant tax rate is 21%. On line 8 of Schedule RC-B, the bank would report $1,000 in AFS holdings in column C (amortized value) and $800 of AFS holding in column D (fair value). The difference between these two numbers implies a before-tax loss of $200. Suppose further that the entire loss occurred in 2022 and that the value of AOCI was zero on December 31, 2022. In this case, at yearend 2022 the bank would recognize a deferred tax asset of $42 (equal to the 21% tax rate times the $200 before-tax loss) and report in AOCI a single amount, corresponding to the sum of the actual loss (–$200) and of the deferred tax asset (+$42), for a total of –$158.

[27] To review: the Call Reports provide measures of both before- and after-tax losses for AFS securities. HTM losses are only available before tax. Loan losses are not reported at all and must be estimated. We convert the pre-tax losses on loans and HTM securities into after-tax values using an estimate of the firm's applicable *tax rate*. We estimate the firm's *tax rate* as the higher of (a) the statutory 21% tax rate and (b) the actual effective tax rate paid by the firm in 2022.

long as the bank does not fail, the after-tax loss is what affects bank shareholders.[28] We recognize that our approach implies that a bank forced to sell securities at a loss would nonetheless continue as a going concern. If the bank were to be liquidated, they might not be able to recover the value of the deferred tax asset, and thus, its actual losses could be bigger than the ones we report here. In this sense, the after-tax losses we report are likely to provide a lower-bound estimate of the true economic losses.

III. RESULTS: FAIR VALUE LOSSES FOR SECURITIES AND LOANS

Based upon our review of the accounting and tax treatments of security and loan losses, we now explain how we measure unbooked losses using information in the Call Reports and propose a methodology to compute the fair value of losses incurred by U.S. commercial banks as of yearend 2022. Because different-sized banks operate using different business models and have access to different institutional liquidity arrangements, we separate banks into nine "size" categories identified by Labonte and Perkins (2021). We conduct our analyses within each size category and for the banking sector as a whole. Table 2 describes how we classify banks into three broad categories and nine asset size groups as of yearend 2022. Loosely speaking, Category A includes money center banks, Category B includes regional banks, and Category C includes community banks.[29] Within each group, the labels 1, 2, and 3 signify large, medium, and small asset sizes. For example, Category C1 includes large community banks, B3 represents small regional banks, and A1 represents the large, money center banks.

We now compute the fair value of U.S. banks' assets and equity as of yearend 2022. We begin by measuring the impact of unbooked securities losses, continue with measuring the impact of loan losses, and conclude with a cross-sectional analysis of how many banks (and affected bank assets) would have their regulatory capital ratios seriously impacted by the recognition of unbooked losses. Our general approach is to be conservative in our estimation process, making assumptions that err on the side of minimizing losses to the banks' capital. In this sense, the estimates we produce should be viewed as lower bounds of the true economic losses, subject to the limitations described in Section V.

[28] These losses are essentially shared between the banks' shareholders and the U.S. Treasury, so it seems reasonable to exclude the Treasury's portion before we estimate a fair value of equity for U.S. banks.

[29] We deviate from Labonte and Perkins (2021) in how we delineate the boundaries among banks in Category C: we define C2 and C3 according to the Community Reinvestment Act's 2023 definition of "intermediate small" and "small" community banks.

A. Measuring Securities' Unrealized Losses

U.S. banks held 26% ($6.2 trillion) of their assets in securities (primarily treasuries and mortgage-backed bonds), which have no credit or default risk but do have the potential for imposing interest-rate-related losses on the bank's shareholders. Table 3 reports the total unrealized and unbooked security losses for the entire banking system and nine size groups, as of 12/31/2022. We measure unrealized losses on three different groups of securities: AFS, HTM, and a third group consisting of securities previously classified as AFS that were reclassified as HTM during 2022.[30] For simplicity, we discuss only the after-tax numbers here in the text, although the table shows pre-tax losses as well. The first row of Table 3 (columns [4] and [5]) indicates that the banking system has $266 billion in unbooked losses on its HTM securities, which represent 4.3% of the book value of all securities. The largest banks (group A1) are more affected than their smaller counterparts because they hold more HTM securities as a proportion of their assets.[31] Columns [6] through [13] report AFS securities losses, which are "booked" in the sense that they enter Other Comprehensive Income, and thus GAAP equity. Columns [8] and [9] report booked, but unrealized, AFS losses, which total 3.5% of the securities portfolio's value. Unlike the HTM losses, AFS losses are spread relatively uniformly across bank size classes. The sum of columns [2] and [6] correspond to the total unbooked losses reported by Gruenberg (2023). Although these constitute the bulk of the securities problem, columns [12] and [13] report other unrealized losses that were booked (mostly during 2022) as a result of converting some HTM securities to AFS status. This is by far the smallest component of unrealized bank security losses.[32]

Table 4 applies the after-tax unbooked security losses (all of which are HTM securities) from Table 3 to the banks' GAAP equity, which is overstated in standard reports by 13.61% for the whole banking

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[30] This third category deserves its own treatment due to a peculiarity of the accounting system used by the Call Reports. When a security previously classified as AFS is reclassified as HTM, unrealized losses are immediately recognized in GAAP equity and the fair value of the corresponding securities is transferred from the "fair value" AFS column to the "amortized value" HTM column in Schedule RC-B. In the process of effecting this transfer, losses incurred by securities in this category are erased from the memory of Schedule RC-B and must be retrieved using a different method. The magnitude of this effect is relatively small: $34 billion in after-tax losses ($45 billion before tax) are not directly observable from Schedule RC-B.

[31] The largest banks in size group A1 hold 18% of their assets in HTM securities, compared to only 4% for the smallest banks in size group C. Across the banking sector the average proportion of assets held in HTM securities is 12% and this proportion generally increases with banks' size.

[32] Table 3 shows both "before tax" and "after tax" measures of these losses. As we explain in Section II(C), this distinction arises because OCI reports AFS value changes along with a deferred tax asset or liability meant to capture the eventual tax that would be paid if security values do not change. The losses in columns [8], and [12] include these deferred tax assets. HTM losses can be obtained from the Call Reports only on a before-tax basis, shown in column [2]. We adjust these before-tax numbers to after-tax by applying our estimate of the corporate tax rate, which (as previously mentioned) is the higher of 21% or the actual after-tax rate obtained from the bank's income statements, and show the after-tax amount in column [4].

system. The mean scale of these effects varies substantially across the nine bank size groups, with money-center banks' equity over-valued the most, by more than 24%. Smaller bank size groups have smaller over-valuations from security losses, down to only 2.2% for the smallest set of community banks.

In Table 5, we examine the effect of unbooked security losses on CET1. Recall that AFS losses are *not* booked in CET1 for most banks. Therefore, in Table 5, we apply the unbooked losses from *both* HTM and (most) AFS securities to CET1. The mean overall overstatement of CET1 is nearly 30%—more than double the corresponding proportions for GAAP equity in Table 4. These overstatement measures are quite similar across the size classes.

B. Estimating Loans' Unrealized Losses

We turn now to our estimate of loan losses. The Call Reports provide very limited fair-value information about the loan portfolio.[33] In fact, we find that only 4.3% of reported 2022 book-valued loans had accompanying fair value information. This proportion varies very little across bank size classes. We accumulate the fair-value losses where available. For the other loans, we estimate fair values for a representative loan from each of the six loan repricing categories reported in the Call Reports' Schedule RC-C: (i) three months or less, (ii) three to 12 months, (iii) one to three years, (iv) three to five years, (v) five to 15 years, and (vi) over 15 years.[34] Loans are classified based on their stated maturity or next repricing date, whichever comes first. For example, a 15-year real-estate loan issued last year that reprices every five years would be classified in the "three-to-five years" bracket, as if it had a four-year remaining maturity. A floating rate loan that reprices every month would be classified in the "three months or less" bracket, regardless of its stated maturity. And, a newly issued 30-year fixed-rate residential mortgage would be classified in the "over-15-years" maturity bracket.

We assume that loans classified in the "three months or less" maturity bracket suffered no discernable losses on account of interest risk exposure. For loans classified in the remaining five brackets, we employ the following methodology:

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[33] Bank Call Reports record most loans at face value, with two minor exceptions: estimated credit losses are reported through the allowance of loans and lease losses (ALLL) for all loans, and a very small number of loans are reported at fair value, primarily because they are held for sale or because they were recently purchased.

[34] Although the Call Reports provide little explicit information about the fair value of loans and leases, they provide adequate information about the distribution of maturities and repricing intervals. We use this information to estimate unbooked losses in the loan portfolio due to the past year's market rate increases (see Memoranda lines 2a and 2b of Schedule RC-C-Part I of the Call Reports).

i. We estimate, for each maturity bracket, the amount of loans that is not already reported at fair value, reducing the face values by the allowance for loans and lease losses.[35]

ii. We assume that all loans within each maturity bracket can be reduced to a single "representative loan" for each bracket, with a maturity or repricing interval generally equal to the bracket's midpoint,[36] and compute the percentage change in the fair value of that loan between 12/31/2021 and 12/31/2022 resulting from interest rate increases. We refer to this percentage change as a "haircut" factor.

iii. We multiply, within each maturity bracket, the haircut factor in item (ii) by the volume of loans in item (i) and sum this product across maturity brackets to provide a before-tax estimate of interest-rate losses incurred by a bank's loan portfolio in 2022.

Table 6 describes the assumptions we make to obtain the "haircut" factor. Panel A of Table 6 describes the representative loan in each maturity bracket. For example, in the "5yr-15yr" bracket, the representative loan is an installment loan originated on 12/31/2021 with a ten-year maturity. We assume that the loan was originated at an interest rate equal to the then ten-year treasury rate plus a risk premium equal to the difference between the prime rate and the federal funds rate.

One limitation of our methodology is that we do not account for expected loan pre-payments.[37] The effective maturity of loans could be shorter than the maturity stated, and hence their haircut smaller than the one we compute. We note, however, that pre-payment risk is higher in an environment where interest rates are *decreasing*. In today's environment, the valuation effects of pre-payment risks are likely to be small. We also assume that changing risk properties are properly captured by changes in each firm's loan loss allowance account. Future work is planned to understand the impact of these assumptions on our conclusions. Panel B of Table 6 shows the computations and actual "haircut" factors for each maturity bracket. Rows [1] – [6] describe the loan's parameters at yearend 2021. For example, in the "5yr-15yr" bracket, we assume that the initial loan of $1,000 carried a coupon rate of 4.69%, resulting in a monthly

[35] Subtracting this allowance from reported loan values yields a default-risk-free measure of outstanding loans and calculate the impact of interest rate changes on the present value of the loans' remaining cashflows.

[36] There are two exceptions to this midpoint bracket assumption. First, for the "15+ year" maturity bracket (where the midpoint is unknown) we conservatively assume that the maturity is 16 years on 12/31/2021 and 15 years on 12/31/2022. This is consistent with our desire to produce lower-bound estimates of loan losses. Second, for the shortest "3-12 months" bracket, we assume that the loan matures (or is repriced) at the lower end of that bracket (i.e., in three months) rather than in the middle of the bracket. This assumption does not significantly alter the main conclusions of our paper because the losses estimated for this maturity bracket are a very small portion of total loan losses (0.9%).

[37] Jiang et al. (2023) value loans with ETFs whose prices presumably reflect rational prepayment expectations. We have no feeling for how important these prepayment effects are in the data.

installment payment of $10.46. In lines [7] through [13], we calculate the fair value of this loan on 12/31/2022, when its remaining maturity is nine years and its unpaid principal is $919.72. The prevailing nine-year treasury rate is 3.91%. After adjusting for applicable risk premium, a willing buyer would offer $833.44 for this loan. We compare this "fair value" to the amount of unpaid principal and estimate a "haircut" factor equal to 9.4% for this maturity bracket (line [14] of Panel B). The rest of the columns in line [14] provide "haircut" coefficients for the remaining maturity brackets. Next, we multiply each maturity-specific "haircut" estimate by the amount of loans that is *not* reported at fair value in its respective maturity bracket. This amount is shown on line [15] of Panel B. The product of lines [14] and [15] is summed across all maturity brackets to obtain, for each bank, a *before-tax* estimate of loan losses. To estimate after-tax losses, we multiply before-tax losses by each bank's (1 – tax rate).

Table 7 shows our estimates of unrealized loan losses for the banking sector as a whole and for each of the nine size groups. Recall that none of these losses are booked into GAAP equity or CET1. Column [1] of Table 7 shows the book value of loans, as reported on Schedule RC. Most loans are reported at book value, adjusted for a (normally small) allowance for loan and lease losses. Column [2] shows that the fraction of loans in Column [1] not fair-valued on the Call Reports is quite large: over 96%, on average. Multiplying columns [1] and [2], we compute in column [3] the volume of loans not reported at fair value on the Call Reports. We further disaggregate this number into the five maturity brackets and apply, for each bracket, the haircut factor shown in Panel B of Table 6. Summing across all five brackets, we obtain a before-tax and an after-tax estimate of loan losses (columns [4] and [6]). Overall, column [7] reports $361 billion in unbooked, after-tax loan losses, representing 5.3% of the book value of loans. This percentage does not vary greatly across size classes.[38] The losses reported in Table 7 are comparable to the security losses reported in Table 3. Like HTM security losses, these loan losses are not booked into GAAP or CET1 capital. However, unlike HTM security losses, these losses are not even recorded, which makes them less salient to investors, depositors, and policymakers. This lack of transparency makes it more difficult to estimate the true economic condition of banks.

[38] We validated the accuracy of our "haircut" methodology for estimating loan losses by applying the same methodology to the six maturity brackets reported for securities holdings in Schedule RC-B of the Call Reports. When we apply newly-computed haircut factors to the amount of securities in each maturity bracket, we obtain an overall before-tax estimate of $634 billion in security losses, compared to a reported $665 in the banks' self-reported fair value losses (sum of columns [2], [6] and [10] in Table 3). The difference is less than 5%. The "haircut" method slightly underestimates actual losses reported banks due to one conservative assumption we make: we assume that the representative security in the 15+ year maturity has a maturity equal to 15 years—the lower end of the range. The results of this validation test are strongly supportive of our loan valuation methodology.

We now examine the effect of loan losses on two different measures of equity in Tables 8 and 9. Similar effects of the unbooked security losses are reported in Tables 11 and 12. Table 8 illustrates how GAAP equity would change if these loans were reported at fair value. Column [1] shows the book value of GAAP equity (obtained from line 28 in Schedule RC). Column [2] shows the after-tax loan losses reported in column [6] of Table 7. Column [3] shows the value of GAAP equity under a hypothetical accounting system that would require banks to report all loans at fair value.[39] Column [4] shows that GAAP equity is overstated by approximately 20% by failing to report loans at fair value. The bias roughly falls with bank size. Table 9 repeats the analysis of Table 8, focusing on CET1 instead of GAAP equity. Overall, CET1 is also overstated by approximately 21% by failing to report loans at fair value. This effect is largest for large community banks (C1 and C2) and small regional banks (B3), for which loans represent the largest portfolio share.

C. Combining Losses from Securities and Loans

We sum the losses from securities and loans to obtain a single "total loss" measure per bank. Using our analysis of the accounting and regulatory treatment of such losses, we can determine the portion of each loss that has not been booked in GAAP equity or, alternatively, in CET1. We then compute each bank's restated, fair-value measures of GAAP equity and CET1.[40] Comparing reported GAAP equity and CET1 to their fair-valued counterparts, we estimate in Table 10 the extent to which publicly reported measures are overstated.[41] Column [1] shows the after-tax sum of losses from four different types of bank assets: (1) AFS securities never reclassified, (2) AFS securities reclassified as HTM, (3) HTM securities never reclassified, and (4) loans. These are all unrealized, "paper" losses totaling approximately $877

[39] We exclude, for the moment, the valuation effects of securities because our focus in Tables 8 and 9 is on loans. Later in the paper we evaluate the effects of aggregate losses from loans and securities.

[40] Jiang et al. (2023) provide an alternative approach to estimating loan and security losses resulting from interest risk exposure. They measure the percentage change between yearend 2021 and yearend 2022 in the value of mortgage and treasury Electronic Traded Funds (ETF) and apply that percentage change, adjusted for maturity bracket and pre-payment risk, to each banks' loan and security portfolio to estimate the appropriate haircut amount for each bank. This approach also has limitations in that does not make use of the fact that securities are already fair-valued on the call reports, and it assumes that fluctuations in the market price of the iShares CMBS ETF are due exclusively to interest risk exposure. These fluctuations may also reflect changes in credit risk as well as other factors that affect the broader stock market. We have evaluated this approach and concluded that it would produce larger loss estimates when compared to our approach. For instance, the value of the iShares CMBS ETF declined by 11.42% during 2022, while the losses we report on our loan portfolio amount to 4.2% before tax and 3.0% after tax. This could be one of the reasons why Jiang et al. (2023) report approximately $2.2 trillion in (before-tax) losses from loans and securities throughout the banking sector. Our aggregate loss estimate is half that amount: $1.1 trillion before tax, or $877 billion after-tax.

[41] In using the term "overstated," we do not mean to imply that reported security values are inconsistent with GAAP or with the Basel III requirements. Rather, the GAAP and CET1 numbers overstate fair value by amounts that are not clearly shown on public balance sheet reports.

million after tax. Columns [2] through [4] show how losses in column [1] are treated for GAAP purposes. Only $249 billion are booked in GAAP equity (column [2]). This number corresponds to losses from never-reclassified AFS securities and from AFS securities that had been reclassified as HTM. The majority of these losses, $628 million in column [3], reflect losses from loans and from never-reclassified HTM securities. Overall, 71.6% of bank losses are *not* booked into GAAP equity (column [4]). This proportion is largest (92.7%) for l money center banks (in category A1, which hold a disproportionate amount of HTM securities.

Columns [5] to [7] of Table 10 show how the losses in column [1] are treated for the purpose of reporting CET1. The only losses booked into CET1 are those from AFS securities, and only for the small set of (primarily large) banks that include AOCI in CET1. These losses, shown in column [5], represent a very small fraction of the overall losses of column [1] and come from two sources: (1) never-reclassified AFS securities for banks that do not opt out, and (2) AFS securities reclassified as HTM for banks that do not opt out. Remarkably, these booked losses are small even for the largest, money center banks (group A1). Although these banks are required to include AFS losses in CET1, they held almost no AFS securities at yearend 2022. The overwhelming majority of their securities were classified as HTM. Column [6] reports total bank losses that are *not booked* in CET1. These losses come from four different sources: (1) loan losses for all banks, (2) HTM losses for all banks, (3) never-reclassified AFS losses for banks that opt out, and (4) losses from AFS securities reclassified as HTM for banks that opt out. Column [7] shows that the percentage of bank losses that are *not booked* in CET1 exceeds 96%, a proportion that is quite uniform over the size groups.

Tables 11 and 12 show what would happen to bank equity if banks were forced to book *all* losses, not just what is required under current accounting and regulatory standards. Column [1] of Table 11 shows the value of GAAP equity as reported in line 28 of Schedule RC of the Call Reports. In columns [2] to [5], we decrease this value by losses not booked in GAAP equity – those on HTM securities (column [2]) and loans (column [4]). Column [5] shows what fair-valued GAAP equity would be if banks had to book losses from these two sources. Comparing columns [1] and [5], we see that GAAP equity overstates its fair value by approximately 40% for the banking sector as a whole. This percentage is largest in two separate groups of banks: large, money center banks in group A1, which hold a disproportionate amount of HTM securities, and medium/large community banks in groups C1 and C2, which hold a disproportionate amount of long-duration loans. These results have important implications for regulators, investors, and rating agencies that follow publicly traded bank securities. An important

question we plan to investigate in future work is whether security prices and bond ratings on 12/31/2022 accurately reflected the actual economic conditions of banks.

Table 12 repeats the format of Table 11, focusing on CET1, the bank's regulatory capital. We ask how CET1 would change if banks were forced to recognize all losses for regulatory purposes. We expect the CET1 results to exceed the GAAP equity results shown in Table 11. Column [1] of Table 12 shows the value of CET1 (line 19 of Schedule RC-R-Part I). Columns [2] to [5] show three sources of losses: from AFS securities (columns [2] and [3]), from HTM securities (column [4]), and from loans (column [5]). Column [6] shows what CET1 would be if banks were forced to recognize all those losses. The difference between columns [1] and [5] is striking: as of yearend 2022, the banking system's reported CET1 overstates its fair value by 68%.[42] A reported CET1 ratio of 10% (leverage = 10), for example, would correspond to a "true" CET1 ratio of 5.99% (leverage > 16). Economically, these are very large distortions, which show no simple relationship to bank size.

IV. IMPLICATIONS FOR INDIVIDUAL BANKS, FDIC, AND TAXPAYERS

Prior tables report large volumes of unbooked losses in the banking system at the end of 2022. Because unbooked losses will rise if the Fed continues raising its policy rate, these numbers represent, if anything, underestimates of the scale and distribution of potential bank problems. We now evaluate the cross-sectional variation in unbooked losses' effects on two bank capital ratios commonly used to indicate bank soundness: CET1 Capital Ratio and the Community Bank Leverage Ratio (CBLR). Because both ratios use CET1 in the numerator, both of these ratios will be overstated, perhaps suggesting that a bank with capital impairments is sufficiently well capitalized.[43]

A. Bank Regulatory Frameworks

In response to the 2008 Global Financial Crisis, the Basel Committee on Banking Supervision developed a new set of regulatory standards for global banks, commonly known as the "Basel III Accords,"

[42] These distortions are large even for money center banks in size group A1 (56%). Columns [2] and [3] show zero amounts for banks in the A1 group, because regulators forced them to recognize their AFS losses (and only those losses) into CET1. Nonetheless, these banks show major losses on HTM securities and, to a lesser extent, on loans, which is why their reported CET1 is still significantly overstated.

[43] Although both ratios are based on CET1, the numerator is different across these two ratios. The Capital Ratio, used by banks subject to the Basel III framework, is CET1 divided by risk-weighted assets. The Community Banking Leverage Ratio, used by all other banks, is "Tier 1 Capital" divided by average assets, where "Tier 1 Capital" equals CET1 plus some adjustments for minority interest and other type of capital (see lines 19-26 of Schedule RC-R-I of the Call Reports). Therefore, since CET1 appears in the numerator of both ratios, if CET1 is overstated, both ratios will be overstated.

or simply "Basel III." These rules build on the previous Basel II Accords and introduce higher capital requirements (among other changes). Banks must comply with the Basel III Accords to operate internationally, and the Fed has imposed similar requirements on all U.S. banks with more than $10 billion in assets. The Basel III standard requires banks to hold CET1 equal to at least 4.5% of their risk-weighted assets. They must also hold a "capital conservation buffer" of 2.5%, raising the minimum capital ratio to 7%. Banks with less than 7% CET1 may not sell new debt or distribute equity funds to shareholders via dividends or share repurchases.[44]

Smaller banks have the option for their capital adequacy to be evaluated on the basis of a Community Bank Leverage Ratio (CBLR), whose denominator is not the computationally-intensive risk-weighted assets but rather a recent average of total assets.[45] The 1,675 community banks that have opted for this simplified regulatory approach are evaluated using a simplified leverage ratio that compares "Tier 1 capital" (a modified version of CET1) to total assets (averaged across four quarters). Banks that opt into the CBLR Framework are required to maintain capital equal to at least 9% of average total assets.

B. How Widespread are the Capital Impairments?

We begin by identifying the effects of unbooked losses on individual banks. We will use the term "capital impairment" to designate the financial condition of a bank that does not meet its relevant capital ratio: the 7.0% Ratio under Basel III, or the 9.0% Community Banking Leverage Ratio.

We present these results in Table 13, whose Panel A describes banks that are subject to Basel III Capital Ratios. Column [1] of Panel A shows the number of banks in this regulatory group. They include all large banks, almost all regional banks, and a majority of community banks. Most banks in this group

[44] Basel III imposed this capital conservation buffer on all banks. According to Basel III: "Whenever the buffer falls below 2.5%, automatic constraints on capital distribution (for example, dividends, share buybacks and discretionary bonus payments) will be imposed so that the buffer can be replenished. … Apart from these constraints, a bank will be able to continue to conduct business as normal when it draws down its capital conservation buffer." (Bank for International Settlements, 2019). In addition, banks that fail to meet the capital conservation buffer might receive lower scores on the Capital Adequacy component of their CAMELS ratings. CAMELS, an acronym for Capital Adequacy, Assets, Management Capability, Earnings, Liquidity, and Sensitivity to Market Risk, is a government rating tool through which FDIC monitors the health of U.S. Banks. CAMELS ratings range from 1 (strong) to 5 (critically deficient). Banks with ratings of 3, 4 or 5, are typically required to enter into an agreement with supervisors to correct the issues. All else equal, lower CAMELS ratings result in higher assessments for deposit insurance premia (Scott and Labonte, 2023).

[45] The Community Bank Leverage Ratio (CBLR) Framework was introduced in 2019 by the Federal Deposit Insurance Corporation (FDIC), the Federal Reserve, and the Office of the Comptroller of the Currency (OCC) in the United States. This framework is intended to simplify the capital requirements for qualifying community banks with less than $10 billion in total assets and without any international activities. See Gardineer (2021) for additional details.

are expected to maintain a CET1 capital ratio of at least 7%.[46] Column [2] of Panel A shows the reported values of CET1 obtained from the Call Reports, line 19 of Schedule RC-R-Part I. Column [3] shows the fair-valued CET1 banks would report if they were required to book all losses. The difference between columns [2] and [3] is large and economically meaningful. Column [4] shows the bank's risk-weighted assets, reported on line 48 of Schedule RC-R-Part I. Column [5] shows the bank's CET1 Capital Ratio, as currently reported, which is obtained as the ratio of columns [2] and [4]. This number is identical to what banks report as their "Common Equity Tier 1 Capital Ratio" on line 49 of Schedule RC-R Part I. Column [5] tells a rather comfortable story about the capital adequacy of the banking sector: for most banks, this ratio is expected to be above 7% (slightly higher for GSIBs), and reported ratios exceed 13% on average. Column [6] recomputes the CET1 Capital Ratio using the fair-valued CET1 estimates from column [3]. The average CET1 Capital Ratio is now only 8.1% for the overall banking system. It averages close to 7% for most size groups, bringing the average close to the Basel III limit. The numbers presented in column [6] suggest that a large number of banks may be suffering capital impairments when CET1 is stated on a fair value basis.

Panel B of Table 13 examines banks that have chosen the CBLR framework. Recall that smaller banks without international activities are eligible to choose this simplified regulatory metric and that these banks are required to maintain a CBLR of at least 9%. Column [1] indicates that 1,675 banks made that choice, the vast majority being small and medium-sized community banks (size classes C2 and C3). Column [2] shows a modified version of CET1, called "Tier 1 Capital," as reported on line 26 of Schedule RC-R-Part I.[47] Column [3] shows the fair value of "Tier 1 Capital" that would obtain if banks were forced to book all losses. Once again, the difference in magnitude between columns [2] and [3] is economically significant for these institutions. Column [4] shows the bank's *average assets* used in the calculation of CBLR.[48] Column [5] shows the reported CBLR for banks in this group, defined as the ratio of column [2] to column [4]. This number is identical to what banks report on line 31 of Schedule RC-R-Part I. On average, reported CBLR is 12.1%, comfortably higher than the required 9% minimum, suggesting that CBLR banks are adequately capitalized. However, on a fair-value basis, obtained by dividing the amount in column [3] by that in column [4], CBLR values are much reduced and now average less than 9%. At least some of

[46] We are aware that stress-tested banks have their capital conservation buffer determined by the test results. We have seen data on these buffer amounts, which we intend to incorporate into future work.

[47] "Tier 1 Capital" is a modified version of CET1 that includes adjustments for minority interest and other capital instruments. See lines 20 to 25 in Schedule RC-R-Part I for additional details. The Community Banking Leverage Ratio is defined based on the "Tier 1 Capital," rather than CET1.

[48] CBLR uses *average assets* rather than quarter-end assets in its calculations. Computed as four-quarter rolling average of assets, a*verage assets* are reported each quarter on line 30 of Schedule RC-R-Part I.

these banks are not likely to meet minimum capital standards if they must report CBLR on a fair value basis.

Although Table 13 indicates large aggregate effects, the cross-sectional incidence of these effects is at least equally important. Table 14 describes the distribution of capital ratios across banks in Panel A and across bank sizes in Panel B. Panel A of Table 14 shows the cross-sectional distribution of capital impairments obtained by *counting* banks within each relevant regulatory compliance category. Columns [2] to [5] show the results for the banks subject to the Basel III regulatory framework. As we understand current requirements, these banks must maintain a *de-minimis* CET1 capital ratio of 4.5%, plus an additional 2.5% *capital conservation buffer*.[49] [50] The 1,726 banks in column [3] clearly pass the *de minimis* Basel III requirements, and the 584 banks in column [5] seem to fail. In between, we see 771 banks with CET1 ratios in the buffer range. While these banks are not required to raise additional capital, they are prohibited from raising debt or distributing capital until their CET1 ratios exceed 7%. In addition, they might receive a lower evaluation score on the "C" component of their CAMELS ratings, resulting in higher deposit insurance premia. When we calculate the percentage of banks with capital impairments, we count both columns [4] and [5]. Columns [6] to [8] of Panel A show the results for banks subject to the Community Bank Leverage Ratio Framework. Among these 1,675 banks, 1,193 would fail their capital standard. The remaining 482, comprising 29% of all CBLR banks, pass. The proportion of banks with inadequate capital cushions exceeds one-half. Column [9] computes the fraction of banks with capital impairments. This fraction is obtained by summing the number of banks with CET1 capital ratios below 7% (columns [4] and [5]) and banks with CBLR below 9% (column [8]), and dividing that sum by the total number of banks shown in column [1].

To summarize: we find that ***more than half of all U.S. banks would fail to meet their expected capital requirement*** if unbooked losses were fully recognized in regulatory capital measures. This fraction is relatively constant across asset sizes, though the problem seems slightly more pronounced for the regional and community banks.

How important are these (apparently) under-capitalized banks? Panel B of Table 14 reports the total asset value of banks that fail or pass their capital requirements. Column [7] of Panel is quite alarming:

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[49] Banks with CET1 capital ratios between 4.5% and 7% do not meet the capital conservation buffer. These banks are prohibited from issuing debt or making equity distributions (dividends or share repurchases) until their CET1 capital ratio exceeds 7%. In addition, these banks might also receive lower CAMELS ratings, which result in higher deposit insurance assessments.

[50] We take the minimum required CET1 ratio as 7%, although it is higher for 23 of the largest institutions. The number of banks with capital impairments in Table 14 may therefore understate the number of true problematic situations.

banks holding 51.7% of all bank assets (approximately $12 trillion) manifest inadequate capital by the standards we apply here. This percentage is large across all size groups, and although regional and community banks appear more affected, this is clearly not a "small bank" problem. Even the largest banks are not immune: half of the money-center banks (size group A1), with more than $4 billion in total assets, appear to hold inadequate capital.

C. Implications for Policy

Our results carry important implications for FDIC, taxpayers, and regulators, but they are less specific than the predicted run-related failures discussed by Jiang et al. (2023). Their model of depositor flight generates a specific number of failures at identified banks. In contrast, we make a more general assessment that low capital ratios are certain to cause problems in the financial system. We believe that banks with very low fair-valued capital ratios will be subject to deposit runs unless regulators take steps to head them off. More generally, though, low capital ratios may reduce the ability of banks to survive credit losses. We tend to think that low fair-valued capital ratios will generate confidence problems.

i. Implications for FDIC

Our results carry important implications for the FDIC. At yearend 2022, the balance in the FDIC Deposit Insurance Fund was $128.2 billion. Subsequently, FDIC used $20 billion (16% of its balance) to pay for SVB's failure (FDIC, 2023). Thus, the current value of the FDIC insurance fund is closer to $100 billion. The aggregate losses we report in this paper amount to approximately $1.1 trillion before tax, or $877 billion required after tax.[51] In theory, FDIC's exposure to these losses is limited to only the amount that the banks' equity accounts cannot absorb. Since the aggregate book value of U.S. bank equities exceeds $2.2 trillion at yearend 2022, it would appear at first glance that banks should have sufficient capital to absorb these losses without depleting the Deposit Insurance Fund.

This argument, however, ignores the deadweight costs of bankruptcy, which can be non-trivial, as in the case of Silicon Valley Bank. SVB reported a $15 billion book value of equity at yearend 2022. According to our calculations, their losses amount to $12 billion, and hence the bank still had $3 billion in equity on a fair-value basis at the end of 2022. In the absence of bankruptcy costs, the losses to FDIC should have been minimal because the shareholders should have absorbed most, if not all, losses from the banks' ill-fated investments. Instead, FDIC lost $20 billion. This means that bankruptcy costs were

[51] While after-tax losses are more relevant for valuation purposes, before-tax losses might be more informative in evaluating the total social cost of current losses (including the portion born by taxpayers for any required bailouts).

approximately $23 billion, or 11% of SVB's assets (this number includes the $3 billion fair-valued equity and the $20 billion loss to the FDIC).

In Panel A of Table 16, we show that 584 banks do not meet the *de-minimis* 4.5% Basel III capital ratio, and in Panel B, we show that their total assets are $3.5 trillion. If bankruptcy costs are at least 10% of assets (as was the case for SVB), and if this entire group of banks were to fail, FDIC's Deposit Insurance Fund could be insufficient to cover resulting losses.

ii. Implications for Taxpayers

Our results also carry important implications for the U.S. Treasury and taxpayers. There are (at least) two distinct paths through which these bank losses could affect taxpayers. First, if the U.S. banking sector experiences large-scale failures that impose losses on FDIC in excess of $100 billion, the difference might have to be funded by the Treasury, most likely through deficit spending.[52]

Second, even banks that do not fail might be forced to realize some of these losses in order to meet their liquidity needs. Upon realizing such losses, these banks would "cash in" their deferred tax asset and reduce their tax liabilities accordingly. We estimate that the aggregate value of these deferred tax assets is approximately $254 billion, which is 5% of projected government revenue and 18% of projected deficit for the current fiscal year.[53] If banks are able to convert this deferred tax asset into an actual tax deduction, the revenue of the U.S. Treasury would be reduced by a corresponding amount.

iii. Implications for Regulators

Finally, our results carry important implications for prudential regulators. It is reasonable to ask why observers took so long to recognize the implications of unbooked security losses for SVB. We believe that inappropriate reporting is largely to blame. Following the credit-quality-related bank failures of the Global Financial Crisis, most regulatory oversight and reporting seems oriented toward identifying the *credit risk* presented by various types of assets, and government bonds are considered riskless in the sense of credit losses.[54] But of course, government bonds are not immune to interest rate risk. If market interest

[52] Normally, FDCI would cover such losses by increasing deposit insurance premia on surviving banks. However, in the event of widespread bank failures, at least some of the bank losses might have to be passed on to taxpayers. Stackhouse (2018) explains that "For catastrophic events, the [FDIC Deposit Insurance Fund] is further supported by a $100 billion line of credit at the Treasury Department, meaning that taxpayers serve as the ultimate backstop in the event of a crisis."

[53] The Congressional Budget Office estimates U.S. Government revenue at $4.8 trillion and U.S. Government deficit at $1.4 trillion for the current fiscal year.

[54] This is evidenced by the fact that Basel III's risk-weighted asset computations almost exclusively reflect assessed credit quality. For example, government bonds carry zero weight in the computation of risk-weighted assets, regardless of their duration.

rates rise quickly, "short-funded" institutions will see their liability funding costs rise faster than their asset returns. Profits fall and can even become negative.

The primary data source available to U.S. bank regulators—the quarterly Call Reports—contain only limited information about interest risk exposure. While HTM and AFS fair values are readily available in the quarterly Call Reports, losses or gains are tricky to accumulate, after which they must be evaluated in the context of equity accounts. Moreover, fair value estimates for the loan portfolio are virtually nonexistent in the Call Reports, an opacity that may impede regulators' and the public's ability to assess the true condition of U.S. banks. It also hinders the monetary policy process if the Fed cannot easily understand the financial-sector consequences of monetary tightness.

We believe bank Call Reports should be revised to collect detailed information on interest risk exposure. Such information would provide better tools to bank examiners to assess the safety and soundness of banks and to monetary policymakers to better evaluate all impacts of their monetary policy decisions. The latter is particularly relevant in view of the fact that the Fed's policy rate has increased by an additional 65 bps since yearend 2022. Finally, we recommend that the next revision to the Basel Accords emphasize the importance of better managing banks' exposures to interest rate risk.

D. Discussion of Empirical Findings and Implications for Research

We find a very large and economically significant amount of unbooked capital losses in the U.S. banking system. After applying these losses to reported capital ratios, we find that more than half of U.S. banks, representing more than half of U.S. bank assets, are inadequately capitalized. We have attempted to be conservative in our methodological assumptions. For example, we base our conclusion on after-tax losses rather than the larger pre-tax losses. As a result (subject to the limitations we discuss in the next section), the losses we report are likely to provide lower bound estimates of the true asset value losses. We expect our conclusion to be challenged, given its far-reaching economic implications. Two of our methodological choices are likely to come under particular scrutiny. First, we assert that all unbooked losses should be removed from the capital measures reported by the balance sheets of U.S. banks. We recognize that this assertion is controversial and encourage debate on the question. Second, we classify 771 banks (16.2% of the total sample) as impaired even though their CET1 capital ratios lie in the "capital conservation buffer" region. Banks in this buffer region may operate normally, but are unable to increase their debt or distribute equity through dividends or share repurchases. These banks may also receive lower CAMELS ratings, resulting in higher FDIC deposit insurance premia. Removing these 771 banks from our impairment total would reduce the assets of impaired banks by slightly more than $8 trillion, lowering

the proportion of assets with impaired capital to 17.3% (vs. 53.6% in panel A of Table 14). Yet the threat is far from eliminated: even without counting banks in the "capital conservation buffer," we still label 37% of banks, holding 17.3% of bank assets, as inadequately capitalized.

Despite the capital conservation buffer being discretionary, we find evidence that bankers view the 7% ratio as the true cutoff and are willing to pay for the resulting financing freedom it provides. Among U.S. banks subject to the Basel III framework, none reports a CET1 capital ratio of less than 7% at yearend 2022. The fact that *all* "book value" ratios exceed 7% suggests that no bank wants to operate in the buffer zone and that banks view the 7% threshold as the *de-facto* minimum. It appears, therefore, that concerns about higher deposit insurance assessments, along with capital structure constraints imposed on banks in the buffer zone, are sufficiently important to deter banks from falling below this 7% minimum. Nonetheless, the proper treatment of banks in the "capital conservation buffer" seems important, and we plan to investigate further this subset of banks.

Our paper highlights the importance of interpreting fair-valued losses through the lenses of applicable regulatory and reporting standards, paying particular attention to their accounting and tax treatment in the Call Reports. Using a different methodology than Jiang et al. (2023), we find a much lower amount of bank losses but a much higher number of banks and bank assets with capital impairments. Our paper differs from Jiang et al. (2023) in how we measure losses and how we define impaired banks.

We measure losses by making optimal use of information available in the Call Reports. For instance, when losses are directly reported by banks (as with security losses), we accept the banks' loss estimate as legitimate (though we validate them with an external test). In contrast, Jiang et al. (2023) estimate security losses from U.S. treasuries ETFs, a process that introduces estimation error. In the case of loans, we use the more conservative "representative loan" approach rather than inferring fair value changes from the external ETF market. Price fluctuations in mortgage ETFs could also reflect changes in default risk in addition to interest rate risk. We also highlight that losses affect valuations on an after-tax basis and that a portion of these losses—those resulting from AFS securities—has already been booked into GAAP equity and assets.[55]

[55] These observations are helpful for interpreting Jiang et al.'s $2.2 trillion estimate of aggregate bank losses. At first, the amount seems enormous in that it is equal to the book value of banks' equities for the entire banking sector. However, the $2.2 trillion amount apparently excludes the effect of taxes and ignores the fact that losses from AFS securities have already been booked into reported equity and asset values. Moreover, by using ETF proxies rather than banks' self-reported loss estimates, their estimate is likely to be noisier than the direct measurement we make in our paper.

Apart from the magnitude of losses, our paper also differs from Jiang et al. (2023) in how we define impaired banks. Their primary focus seems to be on the risk that uninsured depositors trigger a bank run and on losses incurred by insured deposits in the event of such a run. Jiang et al. propose the "Insured Deposit Coverage Ratio" (IDCR) as their primary metric for bank impairment. The numerator in the IDCR is the fair-valued assets, less insured deposits, less the fraction of uninsured deposits that might be withdrawn in a bank panic. They assume that these uninsured deposits are withdrawn at face value. The denominator is the insured deposits. A negative IDCR means that a bank that liquidates all assets and pays all its uninsured depositors' withdrawals in full will not have sufficient funds to pay its insured depositors. Banks with negative IDCRs are considered impaired.[56]

In contrast to Jiang et al. (2023), we define bank impairment using capital adequacy ratios, the most important regulatory metrics applicable to U.S. Banks. Maintaining sufficient regulatory capital is critical for a bank's continuing operations. This means it is unnecessary for IDCR or (even bank capital) to become negative for a bank to fail. Simply falling below a basic regulatory threshold is a sufficient reason for concern. When we define impairments through capital adequacy ratios, we identify a much broader problem than Jiang et al., despite our loss estimates being smaller than theirs. We show that 2,548 banks (more than ½ of all U.S. banks), controlling $12.2 trillion in assets (more than ½ of U.S. banks' assets), have capital impairments. Jiang et al. only estimate 186 impaired banks, controlling $300 billion in assets. The scale of the difference between the two estimates highlights the importance of evaluating bank losses through the lenses of applicable regulatory standards.

V. POTENTIALLY MITIGATING FACTORS

Although we believe we have captured the largest sources through which interest rate risk affects bank value, our analysis is incomplete: we did not consider the change in deposit values or hedging. Either of these factors could reduce, or perhaps eliminate for some banks, the value implications we present here. We also evaluate each bank on a stand-alone basis, without aggregating banks belonging to the same holding company. This biases our estimated effects upward to the extent that some bank losses are

[56] A critical assumption in this logic is that uninsured depositors always get paid in full because they are first in line in case of bankruptcy. In reality, they will most likely get paid in full, at least for large banks, but for a different reason—because of implicit government guarantees aimed at minimizing the risk of contagion. In other words, Jiang et al. (2023) assume that uninsured deposits are truly uninsured and that only those uninsured depositors who "are first in line" get paid in full. This assumption appears contrary to recent evidence on how FDIC resolved the SVB failure in that, to prevent contagion, all depositors were paid in full, not just those who had withdrawn before the bank was closed.

offset by gains at other subsidiaries of the same holding company. We provide below a brief discussion of these factors and plan to explore them in greater detail in future work.

A. Deposits

A bank's value changes with interest rates to the extent that such changes have a differential effect on its assets compared to its liabilities. Although Call Reports provide four buckets for deposit balance maturities (three months or less, three to 12 months, one to three years, and over three years), these don't align very well with the asset-side buckets. This limits the public's ability to compare asset and liability distributions into maturity brackets. When we use this information to compute a three-year asset-liability mismatch, we find that deposits make hardly any difference: long-term (greater than three years) assets equal 39.7% of total bank assets, while long-term liabilities equal only 3.1% of bank assets. Thus, the implied change in deposit values is very small compared to the implied change in asset values. According to this measure, a rise in interest rates substantially lowers the typical bank's equity value.

However, computing the impact of market rate changes on retail deposits is difficult. The logic of the previous paragraph assumes that deposits and assets respond similarly to market rate changes. We know, however, that equilibrium deposit rates lie below short-term market rates, and substantial evidence indicates that at least some deposit balances will remain at a bank even if they pay significantly below market rates (Flannery and James, 1983, Drechsler et al., 2021, Abdymomunov et al., 2023).[57] A complete evaluation of how deposit balances affect banks' value when market rates change requires estimating this cross-elasticity, which is largely responsible for the "franchise value" of many banks. However, even if sticky depositors have stabilized banks in the past, recent institutional and communications innovations may reduce the franchise value of retail deposits going forward. This elasticity also has implications for banks' value if the Fed continues to raise rates. We will pursue these issues in future research.

B. Hedging with Interest Rate Derivatives

Some of the losses we report here could have been offset by properly hedging against interest rate increases. Although a thorough analysis of banks' derivative hedging is beyond the scope of this

[57] For example, the average deposit rate paid on all bank interest-bearing deposits at the end of 2022 was 1.30%, compared to a 3.70%, return on the 30-day T-Bill. Abdymomunov et al. (2023) present evidence of sticky deposit interest rates: an increase of 100 bps in the Fed policy rate reduces the banks' net interest margin by only 13 bps. This effect is estimated over the period from 1997 to 2021. It is possible that deposit rates became less sticky in the past year due to increased access to information and relative ease of moving money across financial institutions. We intend to further investigate the franchise value of bank deposits in future work.

paper, we briefly examine this question and conclude, subject to the limitations of the Call Reports, that banks did not significantly hedge their interest risk exposure through the use of derivatives. Jiang et al. (2023) offer a similar conclusion.

For HTM securities and loans, profit and losses (P&L) from interest rate hedges are treated as income. Such hedges are somewhat illogical because they exactly reverse the motivation for permitting banks to insulate their income from HTM value fluctuations. The Call Reports contain only limited information about income from interest rate derivates. The smaller banks (those filing forms FFIEC 041 and FFIEC 051) are not required to identify their derivatives trading results separately from other income items. However, we do have 40 large banks that filed form FFEIC 031 at yearend 2022, which requires explicit reporting of net profits from interest rate derivatives trading. Together, these firms own $15.8 trillion in assets and report net profits of $4.6 billion on interest rate derivatives in 2022. Yet this profit amounts to less than 1% of the banks' before-tax losses on HTM securities ($287 billion) and loans ($247 billion). It seems unlikely that these 40 large banks meant to hedge their HTM trading losses. And hence we preliminarily conclude that smaller banks were likewise inactive in this area.[58]

For AFS securities, P&Ls are included in Other Comprehensive Income (OCI) and over time accumulate in AOCI. Therefore, reported AOCI numbers include both the unrealized value changes for AFS securities and the P&L on derivatives intended to hedge interest rate risks. Thus, a perfectly hedged AFS securities position would generate exactly zero AOCI regardless of how interest rates moved during the accounting period.[59] We find that AOCI is negative for 2022 at 91.4% of banks that own 98.9% of assets and conclude that banks likely did not hedge the interest risk exposure of their AFS securities.[60]

From our preliminary examination of bank Call Reports we conclude that the banking sector did not hedge against the 425 basis points increase in the Fed policy rate during 2022. Even the Fed's own Stress Test did not consider such a large increase. The Fed's "Severely Adverse Scenario" assumed low

[58] This conclusion is likely to generalize to all banks, even those that file forms FFIEC 041 and 051. Banks that file form FFIEC 041 do not disaggregate their trading P&L into its various components but rather report a single lump sum that aggregates P&L from all trading activities. As a group, these banks report a modest $440 million in net trading revenue during 2022, representing 0.2% of their $215 billion security losses. Banks that file form FFIEC 051 must, as a condition of using that form, convince their regulators that they do not engage in "significant" trading activities. In is unlikely that these two groups of banks hedged their interest risk exposure.

[59] This statement assumes that AOCI was zero at yearend 2021 and that the rest of the bank's OCI components in 2022 are zero.

[60] This conclusion abstracts from the possible use of cashflow hedges, which we intend to evaluate in future work. We do, however, note that, in the aggregate, at yearend 2022 the banking sector reports a $33 billion *net loss* from cashflow hedges in Schedule RC-R-Part I, lines 9c and 9f.

inflation (below 2%) and short-term rates near zero for the test's nine simulated quarters.[61] This scenario apparently failed to push the tested banks to consider larger rate changes.[62] We intend to investigate the return to hedging in future work, perhaps using more detailed information from the holding companies' Form FR Y-9C.

C. Noninterest Income

Abdymomunov et al. (2023) note that larger banks have more varied business models, making it possible that their noninterest income varies positively with market rates and thus offsetting part of the effect we identify in this paper. We plan to explore this possibility in future work.

D. Aggregation to the Bank Holding Company Level

We have collected data only for banks and banking subsidiaries of banking holding companies. Our conclusions therefore omit any interest rate effects arising from non-bank holding company subsidiaries, which may be important for some of the largest banks. In addition, we did not aggregate banks within the same holding company. To the extent that subsidiaries of a holding company have offsetting unrealized loss positions, our results overstate the implications for financial stability. We will investigate the relevance of holding company agglomerations in future work, using the FRY-9C data.

VI. CONCLUSIONS

The Fed's recent efforts to fight inflation have left many banks facing capital problems. Some are potentially very serious, but few are reflected in typical GAAP accounting reports, and almost none are reflected in regulatory reports.

We identify after-tax security losses of $515 billion (2.2% of total bank assets) by our carefully reading the Call Reports. We calculate further after-tax losses of $362 billion on outstanding loans during 2022 (1.5% of total bank assets). In other words, we estimate that the banking sector has lost $877 billion (after tax), of which only $249 billion is booked into the GAAP balance sheet. As a result, at yearend 2022, GAAP balance sheets for banks overstate total assets by about 2.7% and total equity by about 40%. Total GAAP equity is not relevant to most regulatory assessments of bank conditions, which rely more on

[61] Additional details are available in the Fed's "2022 Stress Test Scenarios," pages 5-12 as well as Tables 3A and 3B (Federal Reserve Board, 2022).

[62] The Severely Adverse Scenario's emphasis on real-sector shocks is another manifestation of our repeated observation that the Call Reports should provide much more complete information about credit risk than interest rate risk.

Common Equity Tier 1 (CET1). An even smaller fraction of total losses ($33 billion of $877 billion) has been booked into CET1. The vast majority of total unrealized loan losses ($844 billion or 96%) are *not* booked into CET1. As a result, CET1 is overstated by approximately 68%.

Incorporating the cumulative effect of unrealized asset losses into CET1 indicates that 2,548 banks, controlling over $12 trillion in assets, fail to meet regulatory standards for adequate capital. These include 17 of the 34 large "money center" banks (size group A), 131 out of 239 "regional banks" (size group B), and 2,400 out of 4,483 "community banks" (size group C). Collectively, these banks control 52% of all banking assets. Within the various size groups, we find large concentrations of banks with impaired capital. For example, the 17 banks with capital impairments in size group A control 49% of assets in that group ($8.1 trillion out of $16.6 trillion). In size group B, the 131 banks with capital impairments control 59% of that group's total assets ($2.6 trillion out of $4.4 trillion). And the 2,400 banks with capital impairments in size group C control 59% of that group's assets ($1.5 trillion out of $2.6 trillion).

While we do not mean to imply that we expect half of the nation's banks to fail, the widespread existence of banks with low fair-valued capital ratios raises the possibility of widespread bank runs and failures, which may require (as in the case of SVB) non-standard government responses. We acknowledge that factors omitted from our analysis might diminish the magnitude of these effects, and we plan to address these possibilities more completely in subsequent research. However, our preliminary investigations indicate that these mitigating factors are unlikely to reverse our main conclusions about U.S. banking losses.

Regardless of our final conclusions about bank solvency, we are also anxious to argue that greater transparency in recording value changes at banks can only help financial stability. As we have shown, simple GAAP accounting concepts like equity and assets can obscure a bank's actual condition or economic value. Publishing misleading measures of bank conditions generates investor and depositor uncertainty, which in turn, can lead to runs and herding. Neither of these behaviors adds value to the banking or financial system.

Figure 1: Interest Rate Changes from April 1, 2018, to March 31, 2023

This figure illustrates the Fed's policy rate (dotted line) and the ten-year treasury rate (solid line) for the five-year period from April 1, 2018, to April 1, 2023. The policy rate is the interest rate the Federal Reserve pays its commercial banks on their reserves. The data are obtained from the Board of Governors of the Federal Reserve System.

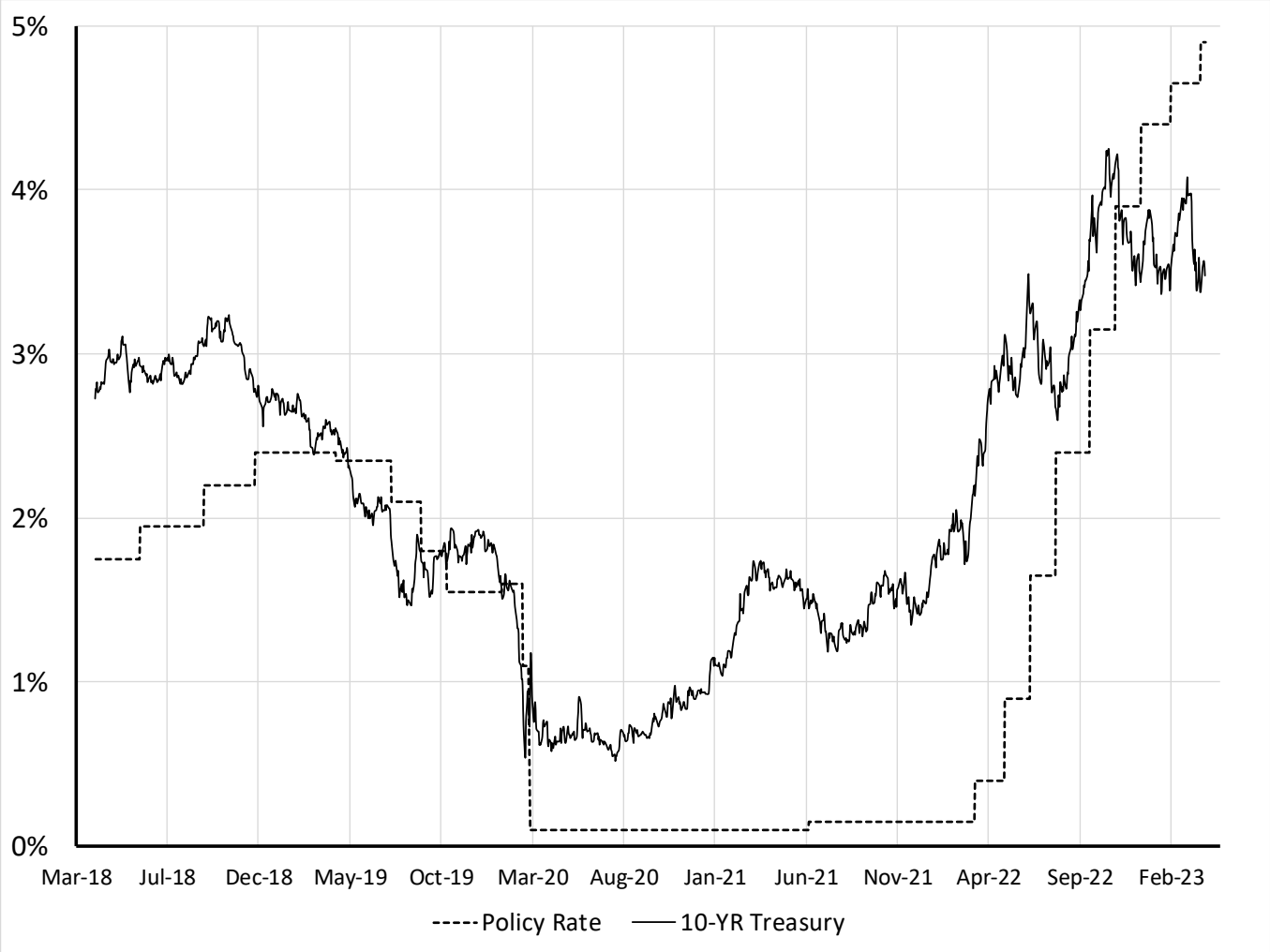

Table 1: Accounting Treatment of Security and Loan Losses Caused by Changes in Interest Rates

This table provides a visual indication of how unrealized security and loan losses affect various dimensions of bank equity. Although we provide further details below, for now, the uninitiated should think of CET1 as the most solid form of equity capital, fully able to absorb operating and investment losses. By contrast, other equity measures tend to include "softer" assets like goodwill and unbooked security value changes. Panel A explains how losses from securities and loans flow through a bank's income statement (Schedule RI of the bank's Call Reports). Panel B shows how these losses affect the bank's balance sheet. Column [1] of Panel B shows the impact on GAAP balance sheet (Schedule RC), and columns [2] and [3] show the impact on regulatory capital (Schedule RC-R).

Type of asset	**Mechanics of how losses flow through the Call Reports**
Securities Available for Sale (AFS)	Do not affect net income but are recognized as Other Comprehensive Income and affect GAAP equity through Accumulated Other Comprehensive Income. Most banks (see column [2] in Panel B) need not include such gains or losses in their regulatory measure of capital called common equity tier 1 (CET1).
Securities Held to Maturity (HTM)	These losses are reported but are not recognized in GAAP equity or CET1.
AFS Securities Reclassified as HTM	Do not affect net income but are recognized as Other Comprehensive Income and affect GAAP equity through Accumulated Other Comprehensive Income. Most banks, those listed in column [2] of Panel A, need not include such gains or losses in their regulatory measure of capital called common equity Tier 1 (CET1).
Loans Not Reported at Fair Value	These losses are not reported and not recognized in GAAP equity or CET1

Panel B: How Losses are Booked in Balance Sheets

Type of asset	**Accounting treatment of interest risk losses**		
	In GAAP equity	**In CET1**	
		Most banks (4,701 out of 4,765)	**Large banks, GSIBs, and other banks that do not opt out (64 out of 4,765)**
	[1]	**[2]**	**[3]**
Securities Available for Sale (AFS)	Booked	Unbooked	Booked
Securities Held to Maturity (HTM)	Unbooked	Unbooked	Unbooked
AFS Securities Reclassified as HTM	Booked	Unbooked	Booked
Loans Not Reported at Fair Value	Unbooked	Unbooked	Unbooked

Table 2: Definition of Bank "Size" Based on Yearend 2022 Book Value of Assets

This table shows our classification of banks into nine size groups, based on the reported size of their assets at yearend 2022. The breakpoints are chosen based on Labonte and Perkins (2021), except that banks in size categories C2 and C3 correspond to the definition of "intermediate small banks" and "small banks," respectively, under the Community Reinvestment Act of 1977 (CRA). Banks in group size A are those with enhanced prudential regulations, including Federal-Reserve-run stress tests. These banks usually file their Call Reports on form FFIEC 031. The size cutoffs between groups A1, A2, and A3 are those between Categories II, III, and IV in Labonte and Perkins (2021). Banks in group size B are generally required to file form FFIEC 041. The cutoffs between groups B1, B2, and B3 pertain to different levels of prudential regulation imposed by the Dodd-Frank Act of 2010. Banks in group size C are the smallest banks that are generally allowed to file form FFIEC 051. The cutoffs between groups C1, C2, and C3 pertain to three different levels of compliance under the CRA. Banks in group C3 (and larger) are required to comply with all provisions of the CRA and are evaluated under a lending test, an investment test, and a service test. Smaller banks in group C2 are assessed under a more simplified test that evaluates the lending, service, and investment they provide to their respective communities. The smallest banks in group C3 are assessed under the simplest method that focuses on their general lending performance. Dollar amounts in millions.

Bank size group	Asset size within group	Total assets	Proportion of total industry assets	Number of banks
[1]	[2]	[3]	[4]	[5]
ALL		$23,615,059	100.0%	4756
A1	In excess of $700B	$9,104,733	38.6%	4
A2	Between $250B and $700B	$3,982,147	16.9%	9
A3	Between $100B and $250B	$3,506,219	14.8%	21
B1	Between $50B and $100B	$1,207,232	5.1%	16
B2	Between $20B and $50B	$1,507,540	6.4%	48
B3	Between $5B and $20B	$1,692,960	7.2%	175
C1	Between $1.5B and $5B	$1,134,577	4.8%	443
C2	Between $376M and $1.5B	$1,041,242	4.4%	1426
C3	Below $376M	$438,409	1.9%	2614

Table 3: Unrealized Losses from Securities

This table reports our estimates of unrealized securities losses related to the Fed's 2022 interest risk increases. Data are obtained from the Call Reports for 2022 Q4. Column [1] shows the face value of securities obtained from line 8, columns A and C, of Schedule RC-B. Column [2] shows the dollar amount before-tax loss on securities Held To Maturity (HTM) obtained as the difference in line 8 between columns A and B on Schedule RC-B. Column [4] estimates after-tax losses on HTM securities and is obtained by multiplying the number in column [2] by (1-*tax rate*). The *tax rate* is the highest of 21% (the statutory tax rate), and the actual tax rate paid by the bank obtained from schedule RI. Losses reported in columns [2] and [4] are not booked into GAAP equity. Column [6] shows before-tax losses on Securities Available for Sale (AFS), obtained as the difference in line 8 between columns C and D on Schedule RC-B. Column [8] shows the after-tax value of column [6]. In most instances, this amount is obtained from line 9a of Schedule RC-R-Part I. For banks without AOCI opt-out election, we estimate the amount in [8] by multiplying the amount in column [6] by (1-*tax rate*). Column [10] shows before-tax value of losses resulting from AFS securities reclassified as HTM, and column [12] shows the after-tax value of these same losses. The amount in column [12] is obtained from line 9e of Schedule RC-R-I, where available (otherwise, it is assumed to be zero), and the amount in column [10] is the amount in column [12] divided by (1-*tax rate*). Columns [3], [5], [7], [9], [11], and [13] correspond to columns [2], [4], [6], [8], [10], and [12], respectively, divided by column [1]. Dollar amounts in millions.

Bank size group	Face value of securities	Unbooked (and unrealized) losses					Booked (but unrealized) losses							
		HTM securities					AFS securities				Securities reclassified from AFS to HTM during 2022			
		Before tax			After tax		Before tax		After tax		Before tax		After tax	
	Amount	Amount	%		Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
	[1]	[2]	[3]		[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
ALL	$6,154,769	$340,874	5.5%		$265,748	4.3%	$279,544	4.5%	$214,506	3.5%	$44,496	0.7%	$34,476	0.6%
A1	$2,369,897	$211,864	8.9%		$166,032	7.0%	$26,833	1.1%	$20,904	0.9%	$0	0.0%	$0	0.0%
A2	$1,293,196	$51,669	4.0%		$40,594	3.1%	$65,156	5.0%	$49,348	3.8%	$27,578	2.1%	$21,550	1.7%
A3	$843,990	$42,571	5.0%		$32,270	3.8%	$52,190	6.2%	$38,018	4.5%	$6,283	0.7%	$4,657	0.6%
B1	$246,894	$4,526	1.8%		$3,484	1.4%	$22,193	9.0%	$17,291	7.0%	$2,588	1.0%	$2,038	0.8%
B2	$377,460	$11,283	3.0%		$8,800	2.3%	$25,154	6.7%	$18,866	5.0%	$4,234	1.1%	$3,267	0.9%
B3	$395,017	$9,503	2.4%		$7,284	1.8%	$31,560	8.0%	$24,051	6.1%	$2,158	0.5%	$1,670	0.4%
C1	$248,248	$5,093	2.1%		$3,894	1.6%	$22,372	9.0%	$16,985	6.8%	$835	0.3%	$654	0.3%
C2	$257,150	$3,124	1.2%		$2,431	0.9%	$23,224	9.0%	$19,549	7.6%	$636	0.2%	$498	0.2%
C3	$122,917	$1,240	1.0%		$959	0.8%	$10,864	8.8%	$9,495	7.7%	$182	0.1%	$143	0.1%

Note: The sum of columns [2] and [6] amounts to $620,419, which is the loss reported by FDIC Chairman (Gruenberg, 2023).

Table 4: GAAP Equity Restated for HTM Security Losses

This table adjusts GAAP total equity measures by the unbooked HTM securities losses reported in column [4] of Table 3. Data are from Call Reports for 2022 Q4. Column [1] is the book value of equity measured in accordance with GAAP, reported on line 28 of Schedule RC. Column [2] is the same as column [4] of Table 3. Column [3] is the difference between columns [1] and [2]. Column [4] is the percentage by which column [1] is higher than column [3]. Dollar amounts in millions.

Bank size group	GAAP equity values as reported on Schedule RC	Adjusted for losses from securities held to maturity		Percentage by which GAAP equity overstates restated equity
		Unbooked HTM security losses	Restated equity value	
	[1]	[2]	[3]	[4]
		Table 3 [4]	[1] – [2]	{[1] / [3]} - 1
ALL	$2,217,756	$265,747	$1,952,008	13.61%
A1	$855,536	$166,031	$689,504	24.08%
A2	$350,015	$40,593	$309,422	13.12%
A3	$312,199	$32,269	$279,930	11.53%
B1	$111,442	$3,483	$107,959	3.23%
B2	$159,874	$8,800	$151,073	5.83%
B3	$172,253	$7,284	$164,969	4.42%
C1	$111,511	$3,894	$107,617	3.62%
C2	$100,979	$2,431	$98,548	2.47%
C3	$43,943	$959	$42,984	2.23%

Table 5: Common Equity Tier 1 (CET1) Capital Restated for HTM and AFS Security Losses

This table adjusts the regulatory measure known as Common Equity Tier 1 (CET1) by the unbooked security losses (both HTM and AFS) reported in columns [4], [8], and [12] of Table 3. Data are from Call Reports for 2022 Q4. Column [1] is the reported value of CET1 obtained from line 19 of Schedule RC-R-Part I. Columns [2] and [3] show AFS losses that have been booked into GAAP equity but not into CET1 capital. Column [2] are AFS losses that are not booked into CET1 due to the optout, obtained from line 9a of Schedule RC-R-I. Column [3] are losses from securities previously classified as AFS, reclassified as HTM during 2022. This amount is from line 9e of Schedule RC-R-I and is the same as in column [12] of Table 3. Column [4] shows losses from HTM securities that are not booked into GAAP equity. It is the same as the amount in column [4] of Table 3. Column [5] is an adjusted value of CET1 that subtracts all losses from columns [2], [3], and [4]. Column [6] is the percentage by which column [1] is higher than column [5]. Dollar amounts in millions.

Bank size group	Common Equity Tier 1 (CET1) as reported	Losses booked In GAAP equity but not in CET1 (due to the opt-out)		Losses not booked in GAAP equity	CET1 restated for all security losses	Percentage by which CET1 overstates its restated value
		Securities available for sale (AFS)	Securities reclassified from AFS to HTM			
	[1]	[2]	[3]	[4]	[5]	[6]
			Table 3 [12]	Table 3 [4]	[1] – [2] – [3] – [4]	{[1] / [5]} – 1
ALL	$2,091,891	$181,848	$34,476	$265,747	$1,609,818	29.90%
A1	$740,994	$0	$0	$166,031	$574,962	28.90%
A2	$332,559	$42,093	$21,549	$40,593	$228,322	45.70%
A3	$308,421	$33,796	$4,657	$32,269	$237,697	29.80%
B1	$111,261	$17,290	$2,038	$3,483	$88,449	25.80%
B2	$144,615	$18,807	$3,266	$8,800	$113,740	27.10%
B3	$169,695	$23,853	$1,669	$7,284	$136,887	24.00%
C1	$117,544	$16,985	$654	$3,894	$96,010	22.40%
C2	$114,598	$19,537	$497	$2,431	$92,131	24.40%
C3	$52,201	$9,483	$142	$959	$41,616	25.40%

Table 6: Methodology for Estimating "Haircut" Factor for Loans Losses

This table reports the assumptions we make to estimate maturity-specific "haircut" factors for bank loans. We assume all loans within each maturity bracket can be reduced to a single representative loan. Panel A shows the design parameters of each representative loan. We assume that representative loans are installment loans, originated on 12/31/2021 (line [1]), maturing inside the maturity bracket (line [2]), at an interest rate equal to the risk-free rate for the corresponding maturity at the time of origination, plus a risk premium equal to the difference between the prime rate and the federal funds rate. [63] We assume that these representative loans are repriced on 12/31/2022 based on prevailing market conditions in effect at that date. Panel B shows the change in the fair value of each representative loan between 12/31/2021 and 12/31/2022. The haircut factor, shown in line [14] of Panel B, is the decline in value between the loan's unpaid principal (line [12]) and the loan's fair value (line [13]) at yearend 2022. Line [15] of Panel B shows the amount of non-fair-valued loans in each maturity bracket at yearend 2022. Interest rates shown in lines [2], [3], [8], and [9] of Panel B are from the Board of Governors of the Federal Reserve.

Panel A: General Assumptions for each Representative Loan as of December 31, 2022

		Representative loan structure assumptions for each maturity bracket reported in Schedule RC-C				
		3mo-1yr	**1yr-3yr**	**3yr-5yr**	**5yr-15yr**	**Over 15yr**
[1]	Loan origination date	12/31/2021	12/31/2021	12/31/2021	12/31/2021	12/31/2021
[2]	Loan maturity date	3/31/2023	12/31/2023	12/31/2025	12/31/2031	12/31/2037
[3]	Number of months to maturity	15	24	48	120	192
[4]	Type of loan	Instalment	Instalment	Instalment	Instalment	Instalment
[5]	Risk Premium at origination (RP_i)	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate
[6]	Risk-Free Rate at origination (Rf_i)	15-month Treas. Bond	2-year Treas. Bond	4-year Treas. Bond	10-year Treas. Bond	16-year Treas. Bond
[7]	Interest rate at origination	RP_i+Rf_i	RP_i+Rf_i	RP_i+Rf_i	RP_i+Rf_i	RP_i+Rf_i
[8]	Fair value measured on	12/31/2022	12/31/2022	12/31/2022	12/31/2022	12/31/2022
[9]	Remaining number of months to maturity	3	12	36	108	180
[10]	Risk Premium for fair value measurement (RP_{fv})	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate	Prime Rate – Fed Fund Rate
[11]	Risk-Free Rate for fair value measurement (Rf_{fv})	3-month T-Bill	1-year Treas. Bond	3-year Treas. Bond	9-year Treas. Bond	15-year Treas. Bond
[12]	Interest rate for fair value measurement	$RP_{fv}+Rf_{fv}$	$RP_{fv}+Rf_{fv}$	$RP_{fv}+Rf_{fv}$	$RP_{fv}+Rf_{fv}$	$RP_{fv}+Rf_{fv}$

[63] This risk premium assumption most likely overestimates the interest rates charged on loans as many borrowers today pay less than the prime rate. Due to convexity, by overestimating the risk premium, we are underestimating the "haircut" factor, which is consistent with our goal of providing conservative loss estimates throughout the paper.

Panel B: Haircut Factors for each Maturity Bracket as of December 31, 2022

	Date	Pricing assumptions for each maturity bracket reported in Schedule RC-C					
			3mo-1yr	**1yr-3yr**	**3yr-5yr**	**5yr-15yr**	**Over 15yr**
[1]	12/31/2021	Maturity of loan (months)	15	24	48	120	192
[2]		***Treasury rate***	***0.48%***	***0.73%***	***1.12%***	***1.52%***	***1.77%***
[3]		***Prime rate less Fed Funds***	***3.17%***	***3.17%***	***3.17%***	***3.17%***	***3.17%***
[4]		Assumed annual interest	3.65%	3.90%	4.29%	4.69%	4.94%
[5]		Amount borrowed	$1,000	$1,000	$1,000	$1,000	$1,000
[6]		Monthly payment	$68.30	$43.38	$22.71	$10.46	$7.55
[7]	12/31/2022	Remaining maturity (months)	3	12	36	108	180
[8]		***Treasury rate***	***4.42%***	***4.73%***	***4.22%***	***3.91%***	***4.01%***
[9]		***Prime rate less Fed Funds***	***3.17%***	***3.17%***	***3.17%***	***3.17%***	***3.17%***
[10]		Assumed annual interest	7.59%	7.90%	7.39%	7.08%	7.18%
[12]		Unpaid principal	$203.66	$509.73	$765.80	$919.72	$957.92
[13]		Fair value of loan	$202.33	$498.96	$731.16	$833.44	$830.24
[14]		Haircut factor	0.651%	2.114%	4.523%	9.381%	13.329%
[15]		Non-fair-valued loans in each bracket ($ millions)	$646,699	$1,198,770	$1,479,803	$1,873,887	$1,454,175

Table 7: Unrealized Losses from Loans Across All Maturity Brackets

This table reports the sum of the fair value estimates for the different maturity buckets reported in Schedule RC-C-I, except for the shortest (less than three months) bucket. Data are from Call Reports for 2022 Q4. The applicable marginal "tax rate" is the larger of the bank's own tax paid on net income or 21% (the statutory maximum). We assume that loans repricing or maturing in less than three months have suffered no changes in fair value. For the other maturity brackets, we assume that all loans in a given bracket can be reduced to a single "representative" loan whose parameters are shown in Panel A of Table 6. Column [1] shows the book value of loans from Schedule RC, lines 4a and 4b. Column [2] shows the percentage of column [1] amount that is not reported at book value. Column [3] is the product of [1] and [2] and shows the amount of loans that is not reported at fair value. Column [4] shows estimates of fair-value before-tax losses incurred by loans in column [3]. To obtain these loss estimates, we multiply the loan amount in each bracket by the haircut factor shown in line [14] of Table 6, Panel B, and sum this product across maturity brackets. Column [6] shows the after-tax value of column [4]. The applicable marginal "tax rate" is the larger of the bank's own tax paid on net income or 21% (the statutory maximum). Columns [5] and [7] are the ratios of columns [4] and [6], respectively, to column [1]. Dollar amounts in millions.

Bank size group	Value of all loans			Estimated losses			
				Before tax		After tax	
	Book value	Fraction NOT reported at fair Value	Volume NOT reported at fair value	Volume	Proportion of book value	Volume	Proportion of book value
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
ALL	$6,855,579	96.70%	$6,653,334	$466,098	6.8%	$361,800	5.3%
A1	$1,897,456	95.60%	$1,822,296	$125,600	6.6%	$98,426	5.2%
A2	$774,657	96.10%	$749,929	$57,100	7.4%	$44,940	5.8%
A3	$1,023,219	97.60%	$1,002,593	$74,822	7.3%	$57,885	5.7%
B1	$438,511	97.10%	$425,442	$29,598	6.7%	$22,672	5.2%
B2	$540,307	97.40%	$525,908	$39,027	7.2%	$30,232	5.6%
B3	$799,229	96.60%	$772,199	$52,606	6.6%	$40,256	5.0%
C1	$601,718	97.70%	$587,776	$38,799	6.4%	$29,795	5.0%
C2	$558,776	98.20%	$548,693	$35,527	6.4%	$27,483	4.9%
C3	$221,705	98.40%	$218,497	$13,019	5.9%	$10,112	4.6%

Table 8: GAAP Equity Restated for Loan Losses

This table adjusts GAAP total equity measures by the unbooked loan losses reported in column [6] of Table 7. Data are from Call Reports for 2022 Q4. Column [1] is the book value of equity measured in accordance with GAAP, reported on line 28 of Schedule RC. This is the same as column [1] in Table 4. Column [2] is our after-tax estimate of loan losses and is the same as column [6] of Table 7. Column [3] is the difference between columns [1] and [2]. Column [4] is the percentage by which column [1] is higher than column [3]. Dollar amounts in millions.

Bank size group	GAAP equity as reported on Schedule RC	Adjusted for unbooked after-tax loan losses		Percentage by which GAAP equity overstates restated equity
		Value of losses	Restated	
	[1]	[2]	[3]	[4]
		Table 7[6]	[1] – [2]	{[1] / [3]} – [1]
ALL	$2,217,756	$361,800	$1,855,956	19.50%
A1	$855,536	$98,425	$757,110	13.00%
A2	$350,015	$44,940	$305,075	14.70%
A3	$312,199	$57,885	$254,314	22.80%
B1	$111,442	$22,672	$88,770	25.50%
B2	$159,874	$30,232	$129,641	23.30%
B3	$172,253	$40,255	$131,998	30.50%
C1	$111,511	$29,794	$81,716	36.50%
C2	$100,979	$27,483	$73,496	37.40%
C3	$43,943	$10,111	$33,832	29.90%

Table 9: Common Equity Tier 1 (CET1) Capital Restated for Loan Losses

This table adjusts regulatory measures of common equity tier 1 (CET1) by the unbooked loan losses reported in column [6] of Table 7. Data are from Call Reports for 2022 Q4. Column [1] is the reported value of CET1 obtained from line 19 of Schedule RC-R-Part I. Columns [2] is our after-tax estimate of loan losses and is the same as column [6] of Table 7. These losses are not booked into CET1. Column [3] is an adjusted value of CET1 that subtracts loan losses from column [2]. Column [4] is the percentage by which column [1] is higher than column [3]. Dollar amounts in millions.

Bank size group	Common Equity Tier 1 (CET1) as reported on Schedule RC-R	Adjusted for unbooked after-tax loan losses		Percentage by which reported CET1 overstates restated CET1
		Value of losses	Restated CET1	
	[1]	[2]	[3]	[4]
		Table 7[6]	[1] – [2]	{[1] / [3]} – [1]
ALL	$2,091,891	$361,800	$1,730,091	20.90%
A1	$740,994	$98,425	$642,568	15.30%
A2	$332,559	$44,940	$287,619	15.60%
A3	$308,421	$57,885	$250,536	23.10%
B1	$111,261	$22,672	$88,589	25.60%
B2	$144,615	$30,232	$114,382	26.40%
B3	$169,695	$40,255	$129,439	31.10%
C1	$117,544	$29,794	$87,749	34.00%
C2	$114,598	$27,483	$87,114	31.50%
C3	$52,201	$10,111	$42,090	24.00%

Table 10: Total Unrealized Losses (Booked and Unbooked) by U.S. Commercial Banks

This table summarizes all after-tax unrealized interest risk losses from all sources, incurred by U.S. commercial banks at yearend 2022. The table also shows how these losses are treated in the Call Reports for the purpose of GAAP equity (columns [2] to [4]) and, alternatively, for the purpose of CET1 (columns [5] to [7]). Data are from Call Reports for 2022 Q4. Column [1] shows the total unrealized after-tax losses from securities and loans. It corresponds to the total of columns [4], [8], [12] from Table 3 plus column [6] from Table 7. Column [2] shows the portion of column [1] booked into GAAP equity. It is the sum of columns [8] and [12] of Table 3. Column [3] shows the portion of column [1] that is not booked in GAAP equity. It corresponds to the sum of column [4] in Table 3 and column [6] in Table 7. Column [4] shows the proportion of losses unbooked in GAAP equity. It is the ratio of column [3] to column [1]. Column [6] shows losses unbooked into CET1. These losses are the total of columns [2], [3], and [4] of Table 5. Column [5] shows losses booked into CET1. This column is the difference between columns [1] and [6]. Column [7] shows the proportion of losses unbooked into CET1. Dollar amounts in millions.

Bank size group	Total after-tax unrealized losses	Treatment of these losses for GAAP equity			Treatment of these losses for regulatory capital purposes (CET1)		
		Booked	Unbooked	Proportion unbooked	Booked	Unbooked	Proportion unbooked
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Table 3 [4]+[8]+[12] plus Table 7 [6]	Table 3 [8]+[12]	Table 3 [4] + Table 7 [6]	[3] / [1]	[1] – [6]	Table 5 [2]+[3]+[4] plus Table 7 [6]	[6] / [1]
ALL	$876,530	$248,982	$627,548	71.6%	$32,657	$843,872	96.3%
A1	$285,361	$20,904	$264,457	92.7%	$20,904	$264,457	92.7%
A2	$156,431	$70,897	$85,533	54.7%	$7,253	$149,177	95.4%
A3	$132,829	$42,675	$90,154	67.9%	$4,220	$128,609	96.8%
B1	$45,484	$19,328	$26,155	57.5%	$0	$45,484	100.0%
B2	$61,165	$22,132	$39,032	63.8%	$57	$61,107	99.9%
B3	$73,260	$25,720	$47,540	64.9%	$197	$73,063	99.7%
C1	$51,328	$17,639	$33,688	65.6%	$0	$51,328	100.0%
C2	$49,961	$20,046	$29,914	59.9%	$11	$49,949	100.0%
C3	$20,708	$9,637	$11,071	53.5%	$11	$20,696	99.9%

Table 11: GAAP Equity Restated for All Unbooked Losses

This table adjusts GAAP total equity measures by all unbooked losses from securities and loans. Data are from Call Reports for 2022 Q4. Column [1] is the book value of equity measured in accordance with GAAP, reported on line 28 of Schedule RC. This is the same as column [1] in Tables 4 and 8. Column [2] shows after-tax security losses obtained from column [4] in Table 3. Column [3] is the difference between columns [1] and [2] and shows what the value of GAAP equity would be if security losses were booked. Column [4] shows the after-tax value of loan losses obtained from column [6] in Table 7. Column [5] is the difference between columns [3] and [4] and shows the fair-valued GAAP equity that accounts for both loan and security losses. Column [6] is the percentage by which column [1] is higher than column [5]. Dollar amounts in millions.

Bank size group	GAAP equity as reported on Schedule RC	Adjusted for losses from securities held to maturity		Adjusted for additional loan losses		Percentage by which GAAP equity overstates restated equity
		Value of losses	Restated	Value of losses	Restated	
	[1]	[2]	[3]	[4]	[5]	[6]
		Table 3 [4]	[1] – [2]	Table 7 [6]	[3] – [4]	{[1] / [5]} – 1
ALL	$2,217,756	$265,747	$1,952,008	$361,800	$1,590,208	39.5%
A1	$855,536	$166,031	$689,504	$98,425	$591,078	44.7%
A2	$350,015	$40,593	$309,422	$44,940	$264,481	32.3%
A3	$312,199	$32,269	$279,930	$57,885	$222,045	40.6%
B1	$111,442	$3,483	$107,959	$22,672	$85,287	30.7%
B2	$159,874	$8,800	$151,073	$30,232	$120,841	32.3%
B3	$172,253	$7,284	$164,969	$40,255	$124,713	38.1%
C1	$111,511	$3,894	$107,617	$29,794	$77,822	43.3%
C2	$100,979	$2,431	$98,548	$27,483	$71,065	42.1%
C3	$43,943	$959	$42,984	$10,111	$32,872	33.7%

Table 12: Common Equity Tier 1 (CET1) Capital Restated for All Unbooked Losses

This table adjusts the regulatory measure known as Common Equity Tier 1 (CET1) by all unbooked losses from securities and loans. Data are from Call Reports for 2022 Q4. Column [1] is the reported value of CET1 obtained from line 19 of Schedule RC-R-Part I. This is the same as columns [1] in Tables 5 and 9. Columns [2] and [3] show AFS losses that have not been booked into CET1 capital. Column [2] are AFS losses that are not booked into CET1 due to the opt-out, obtained from line 9a of Schedule RC-R-I. Column [3] are losses from securities previously classified as AFS, reclassified as HTM during 2022. This amount is from line 9e of Schedule RC-R-I and is the same as the amount in column [12] of Table 3. These two columns are the same as columns [2] and [3] of Table 5. Column [4] shows losses from HTM securities, which are not booked into CET1. It is the same as the amount in column [4] in Tables 3 and 5. Column [5] shows loan losses obtained from column [6] of Table 7. These losses are not booked into CET1. Column [6] shows the fair-valued CET1. It corresponds to what CET1 would be if all losses from securities and loans were booked and is equal to column [1] minus the sum of columns [2] to [5]. Column [7] is the percentage by which column [1] is higher than column [6]. Dollar amounts in millions.

Bank size group	Common Equity Tier 1 (CET1) as reported on Schedule RC-R	AFS security losses from securities available for sale (AFS)	Losses from securities reclassified from AFS to HTM	HTM security Losses	Loan Losses	CET1 measured at fair value	Percentage by which reported CET1 overstates fair value CET1
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
				Table 3[4]	Table 7[6]	[1] – [2] – [3] – [4] – [5]	{[1] / [6]} – 1
ALL	$2,091,891	$181,848	$34,476	$265,747	$361,800	$1,248,018	67.6%
A1	$740,994	$0	$0	$166,031	$98,425	$476,536	55.5%
A2	$332,559	$42,093	$21,549	$40,593	$44,940	$183,382	81.3%
A3	$308,421	$33,796	$4,657	$32,269	$57,885	$179,812	71.5%
B1	$111,261	$17,290	$2,038	$3,483	$22,672	$65,777	69.1%
B2	$144,615	$18,807	$3,266	$8,800	$30,232	$83,507	73.2%
B3	$169,695	$23,853	$1,669	$7,284	$40,255	$96,632	75.6%
C1	$117,544	$16,985	$654	$3,894	$29,794	$66,215	77.5%
C2	$114,598	$19,537	$497	$2,431	$27,483	$64,648	77.3%
C3	$52,201	$9,483	$142	$959	$10,111	$31,505	65.7%

Table 13: Effect of Unbooked Losses on Banks' Compliance with Minimum Regulatory Capital Ratios

This table reports two basic capital adequacy ratios used to regulate U.S. banks, with and without the effect of unbooked fair value losses. Data are from Call Reports for 2022 Q4. Panel A contains the subset of banks that are subject to the Basel III regulatory framework. For these banks, the relevant capital adequacy ratio is the "Common Equity Tier 1 Capital Ratio," defined as the ratio of CET1 to risk-weighted assets. Panel B contains the subset of banks that use the Community Bank Leverage Ratio Framework. For these banks, the relevant capital adequacy ratio is a "Leverage Ratio," defined as the ratio of "Tier 1 Capital" to the four-quarter moving average of (unweighted) assets. Column [1] in Panel A shows the number of banks subject to the Basel III Framework. Column [2] shows the CET1 reported by these banks, obtained from line 19 of Schedule RC-R-I. Column [3] shows the fair-valued CET1 for this set of banks. It is obtained by subtracting from column [2] all unbooked losses from loans and securities. Column [4] shows the risk-weighted assets used in the Basel III Framework, obtained from line 48 of Schedule RC-R-I. Column [5] is the "Common Equity Tier 1 Capital Ratio" reported by banks, obtained from line 49 of Schedule RC-R-I. It is also the ratio of column [2] divided by column [4]. Column [6] of Panel A shows the fair-valued "Common Equity Tier 1 Capital Ratio" obtained as the ratio of column [3] divided by column [4]. Column [1] in Panel B shows the number of banks subject to the Community Bank Leverage Ratio regulatory framework. Column [2] shows the "Tier 1 Capital" reported by these banks, obtained from line 26 from Schedule RC-R-I. Column [3] shows the fair-valued "Tier 1 Capital" for this set of banks. It is obtained by subtracting from column [2] all unbooked losses from loans and securities. Column [4] shows the four-quarter moving average of (unweighted) assets obtained from line 30 of Schedule RC-R-I. Column [5] shows the "Leverage Ratio" reported by banks in this group, obtained from line 31 of schedule RC-R-I. It is also the ratio of columns [2] and [4]. Column [6] of Panel B shows the fair-valued "Leverage Ratio" obtained as the ratio of column [3] divided by column [4]. Dollar amounts in millions.

Panel A: Banks that are subject to the Basel III Regulatory Framework

Bank Size Group	Number of banks	CET1 as reported on Schedule RC-R	CET1 restated at fair value	Risk-weighted assets reported on Schedule RC-R	Capital ratio based on reported CET1	Capital ratio based on fair-valued CET1
	[1]	[2]	[3]	[4]	[5]	[6]
					[2] / [4]	[3] / [4]
ALL	3,081	$2,006,232	$1,196,011	$14,730,704	13.6%	8.1%
A1	4	$740,994	$476,536	$5,142,980	14.4%	9.3%
A2	9	$332,559	$183,382	$2,547,843	13.1%	7.2%
A3	21	$308,421	$179,812	$2,394,332	12.9%	7.5%
B1	16	$111,261	$65,777	$934,412	11.9%	7.0%
B2	48	$144,615	$83,507	$1,082,701	13.4%	7.7%
B3	167	$163,422	$92,844	$1,214,088	13.5%	7.6%
C1	373	$97,907	$54,546	$727,771	13.5%	7.5%
C2	991	$78,783	$43,057	$526,694	15.0%	8.2%
C3	1,452	$28,266	$16,545	$159,879	17.7%	10.3%

Panel B: Banks that Elected to Use the Community Bank Leverage Ratio Framework

Bank size group	Number of banks	Tier 1 capital as reported on schedule RC-R	Tier 1 capital restated at fair value	Average assets for the purpose of the leverage ratio reported on schedule RC-R	CBLR based on reported Tier 1 capital	CBLR based on fair value Tier 1 capital
	[1]	[2]	[3]	[4]	[5]	[6]
					[2] / [4]	[3] / [4]
ALL	1,675	$85,848	$52,196	$710,110	12.1%	7.4%
A1	0	-	-	-	-	-
A2	0	-	-	-	-	-
A3	0	-	-	-	-	-
B1	0	-	-	-	-	-
B2	0	-	-	-	-	-
B3	8	$6,273	$3,787	$55,476	11.3%	6.8%
C1	70	$19,636	$11,669	$168,521	11.7%	6.9%
C2	435	$35,930	$21,707	$298,664	12.0%	7.3%
C3	1,162	$24,007	$15,031	$187,448	12.8%	8.0%

Table 14: Fraction of Banks that Do Not Meet Key Regulatory Ratios on a Fair Value Basis

This table reports the distribution of banks and bank assets based on their fair-valued capital adequacy ratios. Data are from Call Reports for 2022 Q4. Panel A shows the number of banks in different capital adequacy categories, and Panel B shows the total asset of banks in different capital adequacy categories. Column [1] of Panel A shows the total number of U.S. banks. It is the same as column [1] of Table 2. Columns [2] to [6] of Panel A examine banks that are subject to the Basel III regulatory framework. Column [2] shows the number of banks subject to Basel III; it is the same as column [1] of Table 13, Panel A. Columns [3] to [5] show the distribution of banks in column [2] according to their fair-valued CET1 capital ratios. Fair-valued capital ratios are those reported in column [6] of Table 13, Panel A. Banks are divided into three compliance groups. Column [3] shows the number of banks whose fair-valued capital ratio meet the highest 7% Basel III hurdle, defined as the *de-minimis* 4.5% capital ratio plus a capital conservation buffer of 2.5%. Column [4] shows the number of banks whose fair-valued capital ratio falls within the capital conservation buffer (between 4.5% and 7%). Column [5] shows the number of banks whose fair-valued capital ratio falls below 4.5%. Columns [6] to [8] of Panel A examine banks that are subject to the Community Bank Leverage Ratio (CBLR) regulatory framework. Column [6] shows the number of banks using CBLR; it is the same as column [1] of Table 13, Panel B. Columns [7] and [8] show the distribution of banks in column [6] according to their fair-valued leverage ratios. Fair-valued leverage ratios are those reported in column [6] of Table 13, Panel B. Column [7] shows the number of banks in column [6] whose fair-valued leverage ratios meet the 9% CBLR requirements. Column [8] shows the number of banks in column [6] whose fair-valued leverage ratios do not meet the 9% CBLR requirements. Column [9] shows the proportion of banks with capital impairments. It is the sum of columns [4], [5], and [8], divided by column [1]. Panel B shows the total assets of banks categorized in Panel A into their respective capital adequacy columns. Dollar amounts in millions.

Panel A: Number of Banks that do not meet Key Regulatory Ratios on a Fair Value Basis

Bank size group	Total number of banks	Banks using risk-weighted CET1 capital ratios (CR)				Banks using the *Community Banks Leverage Ratio* (CBLR)			Proportion of banks with capital impairments
		Number of banks	N. banks with CR≥7%	N. banks with 4.5%≤CR<7%	N. banks with CR<4.5%	Number of banks	N. banks with CBLR≥9%	N. Banks with CBLR<9%	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
									{[4]+[5]+[8]} / [1]
ALL	4756	3081	1726	771	584	1675	482	1193	53.6%
A1	4	4	2	2	0	0	0	0	50.0%
A2	9	9	5	1	3	0	0	0	44.4%
A3	21	21	10	6	5	0	0	0	52.4%
B1	16	16	5	7	4	0	0	0	68.8%
B2	48	48	20	20	8	0	0	0	58.3%
B3	175	167	81	60	26	8	2	6	52.6%
C1	443	373	169	135	69	70	11	59	59.4%
C2	1426	991	493	277	221	435	88	347	59.3%
C3	2614	1452	941	263	248	1162	381	781	49.4%

Panel B: Total Assets of Banks that do not meet Key Regulatory Ratios on a Fair Value Basis

Bank size group	Total assets of banks in each size group	Total assets of banks with *Capital Ratio* (CR) requirements (these banks do not use the Community Bank Leverage Ratio Framework)			Banks with *Community Banks Leverage Ratio* (CBLR) requirements		Proportion of assets held by banks with capital impairments
		Total assets of banks with CR≥7%	Total assets of banks with 4.5%≤CR<7%	Total assets of banks with CR>4.5%	Total assets of banks with CBLR≥9%	Total assets of banks with CBLR<9%	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
							{[3]+[4]+[6]} / [1]
ALL	$23,615,059	$11,255,054	$8,109,890	$3,537,455	$155,768	$556,889	51.7%
A1	$9,104,733	$4,968,694	$4,136,039	$0	$0	$0	45.4%
A2	$3,982,147	$1,949,745	$552,307	$1,480,094	$0	$0	51.0%
A3	$3,506,219	$1,615,426	$994,028	$896,764	$0	$0	53.9%
B1	$1,207,232	$381,593	$491,958	$333,679	$0	$0	68.4%
B2	$1,507,539	$595,267	$701,644	$210,627	$0	$0	60.5%
B3	$1,692,959	$801,201	$613,228	$222,728	$15,688	$40,111	51.7%
C1	$1,134,576	$435,903	$350,555	$178,969	$28,821	$140,325	59.0%
C2	$1,041,242	$359,012	$216,964	$165,789	$61,659	$237,816	59.6%
C3	$438,409	$148,209	$53,164	$48,802	$49,599	$138,635	54.9%

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