Unrealized Losses on Amortized-Cost Securities and Bank Lending during Monetary Tightening

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Abstract

This paper examines how the recognition consequences of unrealized losses on banks' amortized-cost (AC) securities shape monetary policy transmission to euro-area lending. Exploiting the 2022–2023 tightening and combining security-holdings data with loan-level credit-register data, we find that a one-percentage-point increase in AC losses relative to lagged total assets is associated with an additional one-percentage-point decline in loan growth. Within banks' AC portfolios, positions carrying larger losses are less likely to be reduced, while banks with larger AC losses pass through a larger share of policy-rate increases to depositors without a differential contraction in deposit quantities. These findings are consistent with a recognition-based funding-cost mechanism in which banks pay more to preserve deposits and retain securities whose disposal would recognize embedded losses. The lending response is stronger among banks relying more heavily on uninsured deposits or holding smaller liquidity buffers, and weaker among banks with greater interest-rate hedging. The contraction is concentrated in fixed-rate and longer-maturity loans. It extends to bank–borrower relationship formation and termination, affects smaller firms more strongly, and lowers aggregate bank borrowing growth among firms more exposed to banks with larger AC losses, highlighting its uneven incidence across banks, loan types, and borrowers during monetary tightening.

Keywords: Unrealized losses, security holdings, credit register, monetary policy transmission, bank lending, amortized cost accounting
JEL Classifications: E43, E52, G21, G32, M41

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1 Introduction

Monetary policy can affect bank lending not only by changing banks' funding conditions, but also by repricing fixed-income securities already held on their balance sheets. Whether and how these valuation changes influence lending can depend on the accounting classification of the securities and their prudential treatment. Accounting classification determines whether changes in market value enter profit or loss, other comprehensive income, and total equity while securities are retained, whereas prudential rules can further determine whether recognized changes affect regulatory capital. Recent evidence shows that these distinctions can shape monetary-policy transmission when changes in securities values pass through regulatory capital (Orame et al., 2025; Greenwald et al., 2024). Considerably less is known about whether valuation losses matter when they are disclosed but remain outside earnings, total equity, and regulatory capital while securities are retained. The sharp 2022–2023 monetary tightening in the euro area provides a setting in which to examine this unresolved issue. More specifically, do unrealized losses on amortized-cost (AC) securities affect credit supply when interest rates rise rapidly, through which margins do banks adjust, and how is the resulting adjustment distributed across banks, loan types, and borrowers? This paper aims to answer these questions.

From a theoretical standpoint, it is not clear *ex ante* whether unrealized losses on securities measured at AC should affect bank lending. When interest rates rise, the market value of securities carrying fixed contractual returns declines regardless of their accounting classification. AC accounting does not eliminate this economic loss; rather, it defers recognition of the loss in reported earnings and total equity while the security is retained (Laux and Leuz, 2009, 2010). Even when an AC portfolio is managed to collect contractual cash flows, deferred recognition may have limited immediate consequences for lending if the bank has the ability to retain the securities and finance them at a manageable cost. The situation changes when rapid monetary tightening over a compressed adjustment horizon simultaneously increases the losses embedded in legacy fixed-return positions and raises the cost of financing them. Retaining an AC

security leaves the embedded loss unrecognized but requires the bank to continue funding the position, whereas selling it generates liquidity and can reduce funding needs, but causes the previously unrecognized loss to enter reported earnings and total equity. Because this recognition consequence increases with the size of the embedded loss, banks may selectively retain AC securities carrying larger losses and shift adjustment toward other margins. In particular, they may offer greater deposit remuneration to preserve funding and restrain prospective lending to contain additional funding commitments. This mechanism can operate preemptively, without a preceding deposit outflow or an actual security sale. Whether this interaction between rising funding costs and the accounting consequences of disposal of loss-bearing AC securities—which we refer to as the recognition-based funding-cost mechanism—affects the transmission of monetary policy to bank lending is therefore an empirical question.

To address this question, we compile a uniquely granular dataset of more than five million banking-group–firm–quarter observations by merging multiple confidential supervisory and statistical sources available at the European Central Bank (ECB). Specifically, we combine end-of-quarter security holdings and their accounting classifications at the International Securities Identification Number (ISIN) level from the *Securities Holdings Statistics Group* (SHSG) database; firm-level information on term loans, including outstanding amounts and borrower size, location, and industry, from *AnaCredit*—a large and harmonized credit register developed by the Eurosystem—and regulatory information on banking groups' balance sheets from ECB supervisory statistics. This combination allows us to construct consistent security-holding-level measures of market-value losses across accounting classifications and link these exposures to subsequent lending decisions. Our final sample comprises 82 euro-area banking groups lending to 411,965 firms across 18 euro-area countries from the third quarter of 2021 through the second quarter of 2023.

Methodologically, we estimate panel regressions at the banking-group–firm–quarter level, saturated with highly granular fixed effects, to isolate credit-supply effects across multiple banking relationships, following Khwaja and Mian (2008). Our identification strategy leverages

the largely unanticipated pace and magnitude of the 2022–2023 monetary tightening in the euro area. We interact lagged market-value losses on banks' securities portfolios with an indicator capturing the start of the ECB's rate-hiking cycle in July 2022. We construct the loss measures as the difference between nominal and market values for each security holding and aggregate them separately across amortized-cost, fair value through other comprehensive income (FVOCI), and fair value through profit or loss (FVPL) portfolios at the banking-group level, scaled by lagged total assets. Our baseline specifications include borrower–quarter fixed effects, which compare lending by different banking groups to the same firm in the same quarter, and banking-group–borrower fixed effects, which absorb persistent characteristics of each lending relationship. We also control for a wide set of bank characteristics and allow their relationships with lending to change during monetary tightening (Kishan and Opiela, 2000; Gambacorta, 2005; Jiménez et al., 2020). In additional tests, we examine single-bank relationships using industry–location–size–quarter fixed effects to control for credit demand among observably similar firms, following Acharya et al. (2019); Degryse et al. (2019); Berg et al. (2021). Finally, we validate the SHSG-based AC-loss measure against disclosed AC losses computed using carrying amounts and fair values hand-collected from banks' annual reports.

Our results show that losses embedded in banks' securities portfolios condition monetary-policy transmission to lending, but that the relationship varies across accounting classifications. The relationship between AC losses and loan growth becomes significantly more negative during monetary tightening relative to the pre-tightening period. Economically, a one-percentage-point increase in AC losses relative to lagged total assets is associated with an additional tightening-related decline in loan growth of approximately one percentage point. The relationship between FVOCI losses and loan growth likewise becomes more negative during tightening, whereas the corresponding estimates for FVPL losses are statistically insignificant. Importantly, the AC-loss interaction remains negative and statistically significant when all three loss measures are included jointly, indicating that the AC result persists after accounting for losses embedded in securities portfolios already measured at fair value. We

also find a tightening-related downward shift in the relationship between AC losses and the probability of expanding credit within existing banking relationships, whereas the corresponding estimates for FVOCI and FVPL losses are not consistently statistically significant across specifications. Dynamic estimates provide no detectable evidence of differential lending trends before tightening, and the quarter-specific coefficients turn negative with the beginning of the ECB's rate-hiking cycle. The findings are also robust to controls for securities-portfolio characteristics, covariate-balancing reweighting, alternative fixed-effect structures and estimation methods, and replacing the monetary-policy indicator with quarterly changes in the deposit facility rate. Taken together, the evidence indicates that unrealized losses on AC securities are associated with a material additional contraction in bank lending during monetary tightening, even though these losses remain unrecognized in earnings and total equity while the securities are retained and therefore do not mechanically reduce regulatory capital through contemporaneous accounting recognition.

To investigate why AC losses that remain unrecognized nevertheless matter for lending, we next examine two adjustment margins predicted by the recognition-based funding-cost mechanism: security retention and deposit pricing. When monetary policy tightens, market repricing lowers the value of AC securities, increasing the losses that an early disposal would recognize, and deposit funding reprices, increasing the cost of financing existing asset positions whose contractual returns remain unchanged (Drechsler et al., 2021). Retaining these securities avoids recognizing the embedded losses in earnings and total equity but requires banks to continue financing them on increasingly costly terms. Our evidence reflects both sides of this trade-off.

First, on the asset side, we find that within banks' AC portfolios, the relationship between unrealized losses and subsequent material position reductions becomes significantly more negative after market repricing. Economically, a one-standard-deviation increase in the security-level AC loss ratio is associated with a 2.5-percentage-point downward shift in the probability of a material position reduction relative to the pre-repricing period, equivalent to approximately

29% of its unconditional mean. This finding is consistent with prior studies showing that, during the financial crisis, insurers permitted to continue carrying downgraded asset-backed securities at historical cost were less likely to sell them (Ellul et al., 2014, 2015). However, in that setting, the retention incentives came from the interaction between accounting treatment and risk-based capital requirements. In our setting, the tightening-induced unrealized losses do not reduce regulatory capital while the securities are retained; nevertheless, the security-level evidence is consistent with a similar retention response, as banks selectively retain the positions for which disposal would have the largest recognition consequences.

Second, on the funding side, we show that banks with larger AC losses exhibit a greater tightening-related increase in deposit-rate pass-through. This pricing response is stronger among banks entering the tightening cycle with a greater reliance on uninsured wholesale deposits, whose holders are generally more responsive to differences in remuneration and have greater scope to reallocate funds across banks and toward alternative investments (Cappelletti et al., 2024). At the same time, we find no statistically detectable differential contraction in deposit quantities, consistent with banks preserving deposit funding by offering higher remuneration. A corroborating analysis combining banks' annual reports with data from the European Banking Authority (EBA) Transparency Exercise yields the same pricing-versus-quantity pattern using disclosed AC losses and realized deposit interest expense. This combined evidence is consistent with Bischof et al. (2021), who argue that a bank's ability to retain fixed-income assets to collect their contractual cash flows depends on its capacity to sustain the funding needed to carry them. Together with our lending results, these findings suggest that, when monetary policy tightens, banks with larger embedded AC losses selectively retain securities whose disposal would produce larger recognition consequences, pay more to preserve deposit funding, and restrain prospective lending to contain additional funding commitments.

An important question that follows is when the lending response associated with AC losses is stronger and how banks allocate the adjustment across loan types. Our cross-sectional analyses suggest that the tightening-related lending response is not uniform but varies with

banks' funding structure, liquidity buffers, and interest-rate hedging. Complementing the preceding deposit-pricing evidence, the additional contraction is more pronounced among banks entering the cycle with greater reliance on uninsured deposit funding. Conversely, the lending response is attenuated among banks holding larger liquidity buffers. It is also weaker, for both loan growth and the probability of expanding credit within existing relationships, among banks with greater interest-rate hedging of their AC portfolios. This mitigating association is noteworthy given U.S. evidence that interest-rate swaps provided little aggregate protection against banks' asset-side interest-rate exposure (McPhail et al., 2023) and that more vulnerable banks reduced their hedging during monetary tightening, a finding that Granja et al. (2024) interpret as consistent with a gambling-for-resurrection strategy (Acharya and Ryan, 2016). At the loan level, the negative lending estimates are concentrated in fixed-rate loans and longer-maturity loans, while the corresponding estimates for floating-rate and shorter-maturity loans are statistically indistinguishable from zero. These findings are consistent with banks carrying larger AC losses limiting prospective lending that would lock in fixed contractual returns as funding costs rise or commit resources over longer horizons and thereby reduce funding flexibility (Paligorova and Santos, 2017a; Varraso, 2024).

Finally, we examine how the lending adjustment extends across bank–borrower relationships and varies across different types of borrowers. We find that the relationship between AC losses and the probability of establishing a new lending relationship shifts downward during monetary tightening, while existing relationships involving banks with larger AC losses have a higher probability of exiting one year later. The lending contraction is also more pronounced for smaller firms, which generally face greater informational frictions and have more limited access to alternative financing sources (Boot, 2000; Becker and Ivashina, 2014, 2018; Chodorow-Reich et al., 2022). Finally, firms more exposed to banks with larger AC losses experience lower growth in aggregate bank borrowing during tightening, suggesting that the bank-level contraction is not fully offset by borrowing from other lenders and is therefore consistent with incomplete cross-bank substitution. Taken together, these results show that

the lending adjustment extends to the extensive margin of bank–borrower relationships and disproportionately affects borrowers with more limited capacity to substitute across funding sources.

This paper makes two contributions to the literature. First, we contribute to the literature examining how accounting classification and prudential treatment shape the transmission of monetary policy through banks' securities portfolios. The transmission of securities valuation changes to lending is not automatic. Using U.S. residential mortgage applications over 1997–2012, Xie (2016) finds no evidence that unrealized gains and losses on available-for-sale (AFS) securities affect banks' mortgage-lending decisions relative to unrealized gains and losses on held-to-maturity (HTM) securities. More recent studies show that valuation changes can influence lending when their accounting or prudential treatment affects regulatory capital. Using supervisory and credit-register data from Italy, Orame et al. (2025) show that historical-cost-based prudential treatment mutes the expansionary transmission of quantitative easing because increases in securities values do not pass through to regulatory capital and thereby recapitalize banks. Concurrent work by Greenwald et al. (2024) documents that U.S. banks experiencing larger losses on AFS securities extend less credit during monetary tightening; this response is stronger when unrealized AFS gains and losses enter regulatory capital, whereas the corresponding estimates for HTM securities are substantially smaller and statistically insignificant.[1] We begin from this broader classification-based perspective and find that losses on FVOCI securities—the closest IFRS 9 counterpart to U.S. AFS securities—are indeed associated with a more negative lending response during tightening, consistent with transmission when valuation changes enter total equity and ordinarily affect regulatory capital. We then show that the relationship between AC losses and lending also becomes more negative and remains so when losses across all three accounting classifications are included jointly. Our central contribution is to show that—and provide empirical evidence on why—AC losses matter for

[1]Related research on the 2022–2023 tightening examines bank lending in the euro area (Cappelletti et al., 2024; Coulier et al., 2024; Behn et al., 2025; Burlon et al., 2025) and the implications of securities losses, deposit funding, and interest-rate-risk management for U.S. banks (Jiang et al., 2024; Drechsler et al., 2023; McPhail et al., 2023; Granja et al., 2024).

lending decisions even though they remain unrecognized in earnings and total equity while the securities are retained and do not mechanically reduce regulatory capital. Using a large and highly granular dataset that combines security-, bank-, and loan-level information, we connect AC losses to selective security retention, deposit repricing, and prospective lending across 18 euro-area countries during the sharpest monetary tightening cycle in euro-area history. These findings provide evidence of a recognition-based funding-cost mechanism through which AC losses can affect banks' lending decisions even without contemporaneous regulatory-capital pass-through.

Second, our paper contributes to the broader literature on accounting recognition and financial stability (Laux and Leuz, 2009, 2010; Acharya and Ryan, 2016; Bischof et al., 2021).[2] Prior research shows that the timing of loss recognition and its interaction with regulatory capital can affect institutions' portfolio-adjustment incentives and corrective actions (Ellul et al., 2014, 2015). Relatedly, Bischof et al. (2023) show that reclassifying financial assets from fair-value categories into amortized-cost categories can delay loss recognition and provide temporary regulatory-capital relief, but does not substitute for real corrective actions. More directly related to our setting, Bischof et al. (2021) emphasize that a bank's ability—not merely its intention—to retain assets can depend on the funding structure supporting them. We provide evidence on this interaction in a monetary-tightening setting. We show that the recognition consequences of disposal can shape adjustment even when unrealized losses do not themselves reduce regulatory capital while the securities are retained. During monetary tightening, disposing of a loss-bearing AC security causes the embedded loss to enter reported earnings and total equity, whereas retaining the security requires the bank to continue financing it as deposit funding reprices. Our security-retention and deposit-pricing results provide evidence consistent with banks retaining AC securities carrying larger losses, paying more to preserve deposit funding, and restraining prospective lending to contain additional funding commitments. The mechanism can therefore operate preemptively: the prospect of recogni-

[2]For broader reviews of banks' financial reporting and fair value accounting, we refer the reader to Ryan (2011), Beatty and Liao (2014), and McDonough et al. (2020).

tion can affect banks' behavior before an actual loss-recognizing sale or differential deposit outflow occurs. These findings show that deferring recognition does not make interest-rate-driven valuation losses irrelevant to banks' lending decisions. Instead, deferred recognition changes the relative cost of disposal and creates a trade-off between recognizing the loss and continuing to fund the security. The ability to retain the securities, in turn, depends on the cost and stability of the bank's funding base.

From a policy perspective, however, the additional lending contraction is not necessarily undesirable, because restraining credit and aggregate demand is an intended component of monetary tightening. Its policy relevance lies instead in its uneven incidence: the same policy-rate increase can produce different lending responses across banks, loan types, and borrowers. Our findings therefore do not imply that monetary tightening should be avoided or that amortized-cost accounting should be changed. Rather, they highlight the importance of assessing unrealized losses alongside securities-portfolio maturity, interest-rate hedging, liquidity buffers, and funding structure when evaluating the consequences of rapid interest-rate changes, because these characteristics condition banks' ability to retain AC securities and the extent to which the adjustment is transmitted to credit supply.

2 Accounting Classification and the Recognition-Based Funding-Cost Mechanism

The way interest-rate-driven changes in the value of banks' securities are reflected in the financial statements depends crucially on their accounting classification and measurement. Under IFRS 9, the debt securities studied in this paper fall into three main categories: AC, FVOCI, and FVPL. Their accounting classification depends on both the bank's business model for managing the assets and the contractual characteristics of their cash flows. A debt security is measured at AC when it is held within a business model whose objective is to collect contractual cash flows, and those cash flows consist solely of payments of principal and interest.

It is measured at FVOCI when the business-model objective is achieved through both collecting contractual cash flows and selling assets, provided that the same contractual-cash-flow condition is satisfied. Debt securities that do not meet the criteria for measurement at either AC or FVOCI are generally measured at FVPL.[3]

For our analysis, the central implication of this classification is that it determines whether and when interest-rate-driven changes in market value affect reported earnings and equity. For securities measured at FVPL, such changes are recognized in profit or loss as they arise and therefore flow through total equity. For FVOCI debt securities, interest-rate-driven changes in fair value are recognized in other comprehensive income and therefore affect total equity as they arise; when the security is derecognized, the cumulative amount recognized in other comprehensive income is reclassified to profit or loss. Put differently, because the fair-value change has already affected total equity through other comprehensive income, this reclassification does not produce an additional reduction in total equity. Moreover, under the ordinary CRR treatment, accumulated other comprehensive income forms part of CET1, such that FVOCI valuation changes generally also affect regulatory capital as they arise.[4]

By contrast, securities measured at AC remain recorded at their amortized carrying amounts, subject to impairment.[5] A decline in the fair value of an AC security driven by rising interest rates therefore does not reduce profit or loss, other comprehensive income, or total equity while the security is retained, even though its fair value is reported in the financial-statement

[3]IFRS 9 replaced the classification framework of IAS 39, which distinguished among financial assets measured at fair value through profit or loss, held-to-maturity investments, loans and receivables, and available-for-sale financial assets. IFRS 9 instead bases the classification of financial assets principally on the entity's business model and the contractual characteristics of the asset's cash flows. IFRS 9 became effective for annual periods beginning on or after January 1, 2018. For further details on the classification of financial assets under IFRS 9, we refer the reader to: https://www.ifrs.org/issued-standards/list-of-standards/ifrs-9-financial-instruments/.

[4]CRR Articles 26(1)(d) and 35 provide the ordinary treatment. A temporary and narrow exception under Article 468 permitted electing banks to remove from CET1 70% in 2021 and 40% in 2022 of cumulative post-2019 FVOCI changes on selected, specified non-credit-impaired public-sector exposures; no corresponding relief applied in 2023. We reviewed the annual reports and Pillar 3 disclosures available for 74 banking groups in each of 2021 and 2022 and identified application by one banking group in 2021 and nine in 2022. Because the relief was partial, targeted, and exposure-specific, FVOCI losses continued to affect regulatory capital to a substantial extent over our sample period.

[5]Our analysis concerns interest-rate-driven changes in fair value rather than credit deterioration. IFRS 9 separately requires the recognition of expected credit losses through its impairment model.

notes.[6] However, if the security is sold and derecognized for less than its carrying amount, the difference between the carrying amount and the sale proceeds is recognized in profit or loss. The sale therefore recognizes in earnings and total equity a pre-existing market-value loss that had remained unrecognized while the security was retained.

Importantly, AC classification does not require a bank to hold every security until maturity and does not prohibit sales. IFRS 9 evaluates the business model at the level at which groups of financial assets are managed. A hold-to-collect business model can therefore remain consistent with sales, with the assessment depending on the frequency, value, and timing of those sales. IFRS 9 explicitly states that sales do not by themselves determine the business model and that an entity need not hold every asset to maturity for a portfolio to qualify as hold-to-collect.

Central to our analysis is the distinction between the underlying economic loss and its accounting recognition. When interest rates rise, the present value of a security's fixed contractual cash flows declines even if those cash flows are ultimately collected in full. The resulting decline in market value therefore arises regardless of whether the security is measured at FVPL, FVOCI, or AC. Accounting classification determines whether and when such a valuation change is reflected in reported earnings and equity, rather than whether the underlying change in economic value exists. As Laux and Leuz (2009, 2010) argue, current market values can remain economically relevant even for assets intended to be retained until maturity, and historical-cost accounting does not eliminate the economic exposure associated with changes in securities values.

This distinction between economic value and accounting recognition can, in turn, affect banks' incentives to dispose of loss-bearing securities. Selling an AC security for less than its carrying amount does not create the underlying economic loss; rather, it causes a previously unrecognized loss to enter reported earnings and equity. For a given carrying amount of securities sold, a larger embedded loss therefore implies a larger reduction in reported earnings

[6] IFRS 7 separately requires disclosure of fair value by class of financial instruments, subject to specified exceptions, allowing financial statement users to compare fair value with carrying amount even when an asset is not measured at fair value on the balance sheet.

and equity upon disposal.[7] Accounting classification can thus affect the relative attractiveness of selling a security even though it does not determine the security's underlying economic value.

Consistent with this reasoning, Ellul et al. (2015) show that insurers permitted to continue carrying downgraded asset-backed securities at historical cost were less likely to sell those securities and were more likely to sell other securities carrying unrealized gains. Their mechanism operates through the interaction between accounting treatment and regulatory capital requirements, whereas unrealized losses on AC securities in our setting do not mechanically reduce regulatory capital as long as the securities are retained. Nevertheless, their findings illustrate the broader principle that the timing of accounting recognition can affect portfolio-adjustment incentives. In our setting, this principle implies that AC measurement can make the disposal of securities carrying larger embedded losses relatively less attractive.

The distinction between economic losses and their accounting recognition becomes particularly consequential when banks enter a tightening cycle with substantial legacy positions paying fixed contractual returns over relatively long horizons. Euro-area banks entered 2022 with sizeable AC portfolios that had expanded during the preceding low-rate period and contained securities with relatively long contractual maturities. Figure 1 shows that the share of securities measured at AC increased leading into the tightening cycle and that the median original contractual maturity of AC holdings had lengthened. This balance-sheet configuration is consistent with a broader literature showing that prolonged low interest rates can strengthen banks' incentives to *search for yield* and influence their asset allocation (Borio and Zhu, 2012; Dell'Ariccia and Marquez, 2013). More specifically, Hanson and Stein (2015) show that banks increase the maturity of their securities holdings when the yield curve steepens, consistent with their incentives to preserve current portfolio income. Consequently, when interest rates began to rise, banks held substantial legacy AC positions, including fixed-rate securities whose contractual returns would not adjust with their marginal funding costs.

[7] By lowering current earnings and, ultimately, retained earnings, recognition can also narrow capital headroom and trigger distribution restrictions (Couaillier et al., 2024).

The speed and magnitude of the subsequent monetary tightening sharply increased the losses embedded in these positions. As Panel A of Figure 2 shows, beginning in July 2022, the ECB began the fastest rate-hiking cycle in euro-area history.[8] Although some increase in interest rates was anticipated following the inflationary pressures that emerged in the summer of 2021 (Gagliardone and Gertler, 2023), Panel B shows that, even in June 2022, the policy-rate path implied by the ECB Survey of Monetary Analysts remained substantially below the path that subsequently materialized.[9] The increase of approximately four percentage points over the subsequent 12 months therefore left banks with limited time to adjust the maturity composition of their assets, their funding structure, or their hedging positions in advance of the realized tightening.[10]

Even though the full policy-rate path was not anticipated, fixed-income markets had already begun to reprice in early 2022 as expectations of monetary-policy normalization strengthened. Figure 3 shows that the aggregate market-to-nominal-value gap in banks' AC portfolios moved sharply from embedded gains at the end of 2021 to embedded losses in the first quarter of 2022; these losses widened further in the second quarter, before the first policy-rate increase, and continued to increase throughout 2022.[11]

On the liability side, funding conditions also changed materially. Panel A of Figure 4 shows that the prolonged increase in the share of stickier, lower-remuneration overnight deposits began to reverse following the first policy-rate increase, as the share of more rate-sensitive term and redeemable deposits rose, suggesting a compositional shift in deposit funding. Panel B shows that both deposit and bond funding costs increased during the tightening cycle. Bond

[8]The ECB describes the episode as the fastest hiking cycle on record. For further details, we refer the reader to: https://www.ecb.europa.eu/press/annual-reports-financial-statements/annual/html/ecb.ar2023~d033c21ac2.en.html.

[9]The ECB Survey of Monetary Analysts collects information on market participants' expectations about the future evolution of key monetary-policy parameters, financial-market variables, and the wider economy around the time of the Governing Council meetings. For further information, we refer the reader to: https://www.ecb.europa.eu/stats/ecb_surveys/sma/html/index.en.html.

[10]Although our analysis focuses on euro-area banks, evidence from the United States similarly documents limited balance-sheet adjustment during the initial stages of monetary tightening (Fuster et al., 2024).

[11]The ECB similarly notes that the €STR forward curve began shifting upward in December 2021 as markets started pricing in policy normalization. For further information, we refer the reader to: https://www.ecb.europa.eu/press/key/date/2023/html/ecb.sp230216_1~f8cf2cd689.el.html.

funding costs began to rise earlier and increased more sharply, whereas deposit costs adjusted more gradually and remained substantially lower. Although deposit funding remained less expensive than bond funding, its cost rose progressively, increasing the cost of financing existing AC securities whose contractual returns remained unchanged. This environment makes the observation of Bischof et al. (2021) particularly relevant: when funding must be continually rolled over, a bank's ability to retain assets for the collection of contractual cash flows cannot be considered independently of its funding structure. In our setting, retaining existing AC positions increasingly depended on banks' capacity to sustain funding on more costly terms.

These features distinguish the 2022–2023 episode from settings in which unrecognized valuation losses may prompt few corrective actions or other observable managerial adjustments. When embedded losses are small or funding costs reprice gradually, banks have more time to allow securities to mature or adjust their balance sheets while preserving their intended holding strategy. During the 2022–2023 tightening, by contrast, large unrecognized losses coincided with rapidly increasing funding costs over a compressed adjustment horizon. This combination simultaneously increased the cost of retaining existing AC positions and the amount of the previously unrecognized loss that an early disposal would bring into reported earnings and equity.

Against this background, banks continuously adjust along several margins: which securities to retain or sell, how much to pay for funding, and how much credit to extend. Retaining an AC security allows the bank to continue collecting its contractual cash flows and leaves the embedded loss unrecognized, but requires the bank to continue financing a legacy position whose fixed return does not adjust as funding costs rise. Selling the security generates liquidity and, if the proceeds are used to repay liabilities, reduces the amount of funding required to support the balance sheet. However, a sale below the carrying amount also causes the previously unrecognized loss to enter reported earnings and equity.

Because disposing of AC securities carrying larger embedded losses produces a larger recognition effect, managers seeking to avoid these reporting consequences may selectively retain

those securities within portfolios already managed to collect contractual cash flows and shift adjustment toward other margins. This incentive neither makes the underlying economic loss disappear nor precludes a sale; rather, it changes the relative cost of using disposal as an adjustment margin.

One complementary adjustment margin is deposit pricing. As policy rates rise and depositors' opportunity cost of holding lower-remuneration deposits increases, banks may offer greater remuneration to preserve deposit funding. Prior research shows that monetary tightening changes the pricing and composition of deposit funding and that these changes affect bank lending (Drechsler et al., 2017; Girotti, 2021). Relatedly, Drechsler et al. (2021) emphasize that banks' holdings of long-term fixed-rate assets are closely connected to the low and relatively rate-insensitive funding provided by their deposit franchises. When deposit costs begin to reprice, financing existing fixed-return positions becomes more costly. Banks carrying larger embedded AC losses may nevertheless have stronger incentives to preserve deposit funding because reducing their funding needs through an early security disposal would recognize a larger loss. Importantly, this pricing response can occur preemptively, without a preceding net deposit outflow.

Restraining prospective lending provides another adjustment margin. Extending new credit creates additional funding commitments and reduces the flexibility available to sustain existing positions if funding conditions deteriorate. Importantly, limiting prospective lending does not generate liquidity with which to meet a withdrawal that has already occurred. Its role is prospective: by containing additional funding requirements, banks can preserve greater capacity to finance their existing AC positions and reduce the likelihood that subsequent funding pressure forces an early disposal that recognizes embedded losses. Lending restraint can therefore arise before any net deposit outflow or actual security sale.

In sum, AC accounting does not itself cause funding costs to rise. Rather, it changes the relative attractiveness of the margins through which banks respond when AC securities carry larger embedded losses. The interaction between rising funding costs and the accounting con-

sequences of disposal can therefore shift banks' adjustment toward selective security retention, greater deposit remuneration, and restraint in prospective lending. We refer to this interaction as the recognition-based funding-cost mechanism and state our central hypothesis as follows:

Hypothesis: *During monetary tightening, the relationship between unrealized losses on amortized-cost securities and bank lending becomes more negative.*

3 Methodology

To analyze whether and to what extent unrealized losses on amortized-cost securities affect bank lending during the 2022-2023 monetary policy tightening, we employ the following bank–borrower-level panel regression model:

$$\begin{aligned} \textit{Loan growth}_{i,c,j,t} = \alpha &+ \beta_1 AC_losses_{i,c,t-1} \\ &+ \beta_2[AC_losses_{i,c,t-1} \times MP_Tightening_t] \\ &+ \beta_3 X_{i,c,t-1} + \beta_4[X_{i,c,t-1} \times MP_Tightening_t] \\ &+ \delta_{j,t} + \lambda_{c,t} + \mu_{i,c,j} + \epsilon_{i,c,j,t}. \end{aligned} \tag{1}$$

The dependent variable, *loan growth*, is defined as one hundred times the change in the natural logarithm of outstanding credit supplied by the banking group i in the country c to the borrowing firm j from $t-1$ to t: $\textit{Loan Growth}_{i,c,j,t} = 100 \times [\ln(Loan_{i,c,j,t}) - \ln(Loan_{i,c,j,t-1})]$. As an alternative lending outcome, we define *Loan expansion* as an indicator equal to one if outstanding credit supplied within an existing banking-group–borrower relationship increases between consecutive quarters, and zero otherwise. We estimate Equation (1) using each dependent variable in turn. *Loan growth* captures the magnitude of the net credit adjustment, whereas *Loan expansion* indicates whether credit supplied within the relationship increases. The monetary policy tightening indicator ($MP_Tightening_t$) is equal to one from the third

quarter of 2022 onward, reflecting the start of the ECB tightening cycle in July 2022, and zero for the preceding quarters.[12]

This empirical setting is particularly well-suited for examining our research question because of the sharp and largely unexpected nature of the ECB's interest rate increases. As discussed in Section 2, Panels A and B of Figure 2 document the speed of the tightening and the limited anticipation of the realized policy-rate path. The nearly four-percentage-point increase over the subsequent 12 months left banks with limited time to adjust their balance sheets and lending activities in advance. This feature mitigates the concern that the securities positions underlying AC losses were selected in anticipation of the rate increases that subsequently materialized and provides a useful setting in which to examine whether those losses condition banks' lending responses to monetary tightening (see, for example, Behn et al. (2025) for a similar approach).

Our main explanatory variable is the interaction between lagged unrealized losses on amortized-cost securities and the monetary policy tightening indicator ($AC_losses_{i,c,t-1} \times MP_Tightening_t$).[13] We estimate unrealized losses as the difference between the nominal and market values for each bank-security holding in a bank's portfolio, using security data at the International Securities Identification Number (ISIN) level. Large positive differences indicate larger estimated unrealized losses. This high degree of granularity, combined with detailed accounting classification data, is a key and distinctive feature of our analysis, as it enables us to construct a consistent measure of unrealized losses at the security-holding level across euro-area banks and separately by accounting classification.[14] We subsequently aggregate the security-level differences separately within the AC, FVOCI, and FVPL portfolios at

[12] In our baseline regressions, the monetary policy tightening indicator distinguishes the tightening period from preceding quarters. In Section 5.7, as a robustness test, we replace this indicator with the quarter-on-quarter change in the deposit facility rate and obtain qualitatively similar results.

[13] We acknowledge that the composition of banks' securities portfolios is an internal and potentially endogenous choice. However, the rapid and largely unanticipated path of the ECB's tightening cycle mitigates the concern that the pre-tightening securities positions underlying these losses were selected in anticipation of the realized rate increases.

[14] Because nominal values can differ from carrying amounts, we validate the SHSG-based measure against disclosed AC losses computed using carrying amounts and fair values hand-collected from banks' annual reports. Section 5.7 discusses this validation exercise in greater detail.

the banking-group level, scale them by total assets in the preceding quarter, and multiply the resulting ratios by 100. The resulting variables are stock measures of the market-value losses embedded in each portfolio in a given quarter, rather than measures of the valuation change arising during that quarter. A one-unit increase in a loss measure therefore represents a market-value loss equal to one percent of the banking group's lagged total assets. To provide a benchmark for banks' exposure to declining fixed-income values, Table 3 examines the AC, FVOCI, and FVPL loss measures separately and jointly.[15] Importantly, we lag each loss measure by one quarter to mitigate concerns of reverse causality, ensuring that our measure of loss exposure is observed in time $t-1$ with respect to lending decisions in time t. Furthermore, it is worth pointing out that our group-level aggregation is consistent with prior empirical studies such as Benetton and Fantino (2021), Bottero et al. (2022), and Orame et al. (2025).

The coefficient of interest is β_2, which captures whether the relationship between lagged AC losses and loan growth changes during monetary tightening relative to the pre-tightening period. A negative coefficient indicates that banks with larger AC losses reduce loan growth more strongly during tightening relative to the pre-tightening period. Under the recognition-based funding-cost mechanism developed in Section 2, we expect β_2 to be negative. Larger AC losses increase the amount of loss that an early disposal would recognize, while monetary tightening simultaneously raises the cost of financing those fixed-return positions. This combination may shift banks' adjustment toward deposit pricing and prospective lending restraint.

We also include a vector of control variables in all models ($X_{i,c,t-1}$), lagged by one period to address potential endogeneity and reverse causality concerns. We begin by controlling for the distance to the Maximum Distributable Amount (MDA). This variable measures the percentage-point difference between a bank's CET1 ratio and the capital threshold at which MDA restrictions become binding, thereby capturing the bank's capital headroom above that threshold (Couaillier et al., 2024). We also control for several lagged bank-level factors known

[15]Table OA1 in the Online Appendix reports AC-loss-only specifications for loan growth across alternative fixed-effect structures, retaining all bank controls and their interactions with monetary tightening. The estimated interaction coefficient is negative and statistically significant at conventional levels across all four specifications.

from prior research to affect bank-firm lending (Kishan and Opiela, 2000; Gambacorta, 2005; Gambacorta and Marques-Ibanez, 2011; Jiménez et al., 2020). Specifically, we control for return on assets (ROA) and the cost-to-income ratio (CIR) to measure differences in profitability and operating efficiency, respectively; $Bank\ size$, measured as the natural logarithm of total assets, to account for differences in the scale of banks' balance sheets; the non-performing loan ratio (NPL) to control for the asset quality of the loan portfolio; cash and central-bank balances scaled by total assets ($Cash$) to proxy for bank liquidity; and risk-weighted assets scaled by total assets (RWA) to account for differences in banks' asset-risk intensity. Importantly, we follow the approach of Gomez et al. (2021) and allow each control to have a heterogeneous impact on lending following the initiation of the monetary policy tightening by interacting it with the monetary policy tightening indicator ($X_{i,c,t-1} \times MP_Tightening_t$). This approach reduces the concern that the estimated AC-loss interaction captures differences in how other observable bank characteristics affect lending during monetary tightening. We winsorize all continuous variables at the 2.5th and 97.5th percentiles to address outliers and report detailed variable definitions in Appendix A.[16]

To control for various unobserved factors, we also saturate our lending specifications with highly granular fixed effects: $\delta_{j,t}$ represents borrower-quarter fixed effects, while $\mu_{i,c,j}$ represents banking group–borrower fixed effects. Borrower–quarter fixed effects are particularly important in this setting, as they allow us to exploit variation in lending by different banking groups to the same borrowing firm in the same quarter, thereby controlling for firm-specific credit-demand shocks and other time-varying heterogeneity at the borrower level (Khwaja and Mian, 2008). Moreover, the inclusion of banking group–borrower fixed effects allows us to absorb time-invariant characteristics of each lending relationship, including persistent determinants of the matching between banking groups and firms (Paligorova and Santos, 2017b). Furthermore, these fixed effects also absorb all time-invariant banking-group characteristics,

[16] In Table OA2 of the Online Appendix, we alternatively winsorize at the 1st and 99th percentiles and find qualitatively similar results.

including relevant dimensions of the business model underlying securities classification.[17] Furthermore, in some specifications, we include country–quarter fixed effects ($\lambda_{c,t}$), where c denotes the banking group's country, thereby controlling for time-varying macroeconomic and policy conditions at the country level. Given that we include borrower–quarter fixed effects across all lending specifications, the indicator for monetary tightening ($MP_Tightening_t$) is entirely subsumed by these fixed effects and therefore does not appear separately in the analyses. Finally, standard errors are two-way clustered at the banking group and borrower levels to account for potential correlation within these clusters (Petersen, 2008).[18]

4 Data and descriptive statistics

4.1 Data

To analyze the effect of unrealized losses on amortized-cost securities on loan supply during the 2022–2023 monetary tightening cycle, we construct a large and highly granular dataset at the banking group–borrowing firm level, relying on multiple confidential data sources. We proceed as follows. First, we collect lending data and borrower characteristics from the *AnaCredit* database, the pan-European credit register of the European System of Central Banks, which contains instrument-level credit information subject to a reporting threshold of EUR 25,000 in a borrower's aggregate commitments vis-à-vis an observed banking entity.[19] Developed

[17] We acknowledge that a bank's business model, including its internal risk preferences or strategic motivations for holding certain securities, may evolve over time and affect a bank's investment strategies (Hodder et al., 2002; Ellul et al., 2014; Paananen et al., 2012; Bischof et al., 2023). However, IFRS 9 requires securities classification to reflect the bank's business model at the time of initial recognition, and reclassification is limited to rare cases, as regulators heavily scrutinize these reclassifications (Orame et al., 2025). Moreover, our analysis focuses on a relatively short time window (2021–2023), during which such structural shifts are less likely to occur broadly or rapidly. Nonetheless, we reviewed our sample banks and securities data and found no systematic evidence of material reclassification. Moreover, as discussed later in Section 5.2, we also exclude observations affected by reclassification from our analyses. This contrasts with the United States, where banks appear to have used such reclassifications more frequently during the monetary tightening cycle (Granja, 2023; Granja et al., 2024).

[18] In Table OA3 of the Online Appendix, we alternatively cluster standard errors at the banking-group level only and find qualitatively similar results.

[19] For further information on *AnaCredit*, we refer the reader to `https://www.ecb.europa.eu/stats/money_credit_banking/anacredit/html/index.en.html`.

jointly by the European Central Bank and national central banks, *AnaCredit* provides a harmonized reference for bank credit across the euro area, making it particularly well suited for cross-country analysis. Specifically, the database offers detailed information on various loan characteristics, such as outstanding amounts, as well as on borrowing firms (e.g., size, location, and industry) and lending banks (including location and group structure). Since the data are reported at the individual banking-entity level, we consolidate the lending activity at the banking group–borrower level (see, for example, Cappelletti et al. (2024) and Behn et al. (2024), for a similar approach). Importantly, we restrict the sample to term loans, as they represent the largest component of loan-level data in *AnaCredit*. Moreover, prior literature suggests that drawdowns on credit lines can reflect borrowers' credit demand under pre-existing commitments (Greenwald et al., 2020).[20]

Second, we gather data on banking groups' securities holdings, including positions classified as AC, FVOCI, and FVPL, from the Securities Holdings Statistics Group (*SHSG*) database, which provides end-of-quarter ISIN-level information on securities holdings and their accounting classification. As outlined in Section 3, we compute the loss measures from the difference between the nominal and market values for each security holding at the ISIN level.[21] Third, we collect information on bank characteristics from two administrative databases: the ECB's financial reporting (*FINREP*) and common reporting (*COREP*) supervisory statistics. Both are confidential supervisory databases based on harmonized reporting standards, and euro area banks are required to provide accurate information.[22]

[20]This focus on term loans should also help address concerns about heterogeneity in loan types raised by Acharya and Ryan (2016), who emphasize that different types of loans may be subject to different accounting treatments and loss recognition standards, potentially confounding supply-side effects. By restricting our analysis to a single loan type, we aim to mitigate this source of variation.

[21]For papers relying on similar data sources see, for example, Barbiero et al. (2024). For additional information on the SHSG database, we refer the reader to: https://data.ecb.europa.eu/methodology/securities-holdings-statistics.

[22]COREP is the standardized reporting framework issued by the European Banking Authority (EBA) to comply with the Capital Requirements Directive (CRD). It covers credit risk, market risk, operational risk, own funds, and capital adequacy ratios. The FINREP database includes bank balance sheets, income statements, disclosures of financial assets and liabilities, off-balance sheet activities, and non-financial instrument disclosures. For further details, please see: https://www.ecb.europa.eu/stats/supervisory_prudential_statistics/html/index.en.html.

After matching these data sources, the main lending sample comprises quarterly data on lending activity, unrealized losses on amortized-cost securities, and bank and borrower characteristics for 82 banking groups from the third quarter of 2021 to the second quarter of 2023. Similar to Greenwald et al. (2024), we focus on a relatively short period to examine how unrealized losses on amortized-cost securities impact bank lending in a monetary policy tightening environment while limiting the scope for other developments, including changes in fiscal policy, to confound the analysis.[23]

Panel A of Figure 5 illustrates the distribution of the 82 banking groups by country, with Germany (15 banking groups), Italy (12 banking groups), and Spain (10 banking groups) being the most represented, while smaller countries like Estonia, Lithuania, and Slovenia contribute only one banking group each to the sample. This distribution is broadly in line with the relative economic sizes of the euro area economies, as larger economies such as Germany, Italy, and Spain are expected to have a greater number of banking groups in the sample, reflecting their overall economic scale and financial sector size. Relatedly, the distribution of banking-group–firm observations, while uneven, in part reflects the economic relevance and depth of credit markets across euro area countries. As shown in Table 1, France, Italy, and Spain account for the vast majority of observations, followed by Germany and Portugal. Together, these five countries represent more than 95% of total banking-group–firm–quarter observations in the sample. However, it is important to clarify that a firm borrowing from multiple banking groups in our sample contributes multiple observations in the same quarter. Similar cross-country differences in firms' reliance on multiple banking relationships are also documented by Kosekova et al. (2025). Country-level observation counts, therefore, depend on the number of borrowing firms, their relationships with the banking groups included in the sample, and the number of quarters for which these relationships are observed. This composition is broadly consistent with that of Coulier et al. (2024), supporting the comparability of our sample with prior research. Finally, it is worth pointing out that all sample banking groups were significant

[23]Please see the IMF's overview of fiscal policies during COVID-19: https://www.imf.org/en/topics/imf-and-covid19/fiscal-policies-database-in-response-to-covid-19.

institutions subject to ECB supervision and collectively provided more than EUR 1.65 trillion in lending at the end of 2022 to firms across 18 euro area countries.

4.2 Descriptive Statistics

Table 2 presents descriptive statistics for the variables used in our analysis, reported separately for the respective estimation samples. The average quarterly loan growth across bank–borrower observations is approximately -5% over the sample period. The median is -4.64%, and the 75th percentile is -0.79%, indicating that at least three-quarters of observations involve a decline in outstanding credit. Consistent with this pattern, *Loan expansion* equals one in 12.1% of observations. Regarding unrealized losses on securities at amortized cost for the banks in our sample, the average ratio of unrealized losses to lagged total assets is approximately 0.26%, with a standard deviation of 0.47%. Specifically, the 25th percentile of this ratio corresponds to unrealized gains (i.e., negative unrealized losses) of about 0.01% of total assets. In contrast, the 75th percentile corresponds to unrealized losses of about 0.47% of total assets.

Panel B of Figure 5 illustrates the distribution of unrealized losses as a percentage of total assets across banks following the onset of monetary tightening. The histogram shows the proportion of banks (y-axis) relative to the share of unrealized losses on amortized-cost securities as a percentage of total assets (x-axis). Roughly one-quarter of banks exhibit unrealized losses close to zero, while about 40% report positive unrealized losses within the range of 0% to 0.5%. However, the distribution is notably right-skewed, with a non-negligible share of banks exhibiting unrealized losses around or above 0.5%, and a few extreme cases reaching losses above 2%. This variation highlights the heterogeneity in banks' exposure to market-value declines in their amortized-cost portfolios.

Furthermore, Figure 3, discussed in Section 2, aggregates the security-level market-to-nominal-value differences underlying our bank-level AC-loss measure. Specifically, Panel A reports the aggregate gap from Q3 2018 to Q2 2023, with negative values indicating unreal-

ized losses. The aggregate loss reached approximately EUR 80 billion in Q4 2022. Panel B decomposes the gap by the issuer sector over the same period and shows that sovereign securities account for the largest share of the losses, with corporate and other fixed-income securities making smaller but still significant contributions (Popov and Van Horen, 2015; Balduzzi et al., 2018; Bofondi et al., 2018; De Marco, 2019).

The main statistics of the remaining variables are consistent with those reported in prior studies using euro-area credit registry data. For example, the average cost-to-income ratio is 62%, which compares with 69% in Couaillier et al. (2024). Similarly, the average ratio of risk-weighted assets relative to total assets is approximately 36%, which is close to the 39% found in Dautovic et al. (2023).

5 Empirical Results

5.1 Baseline Results

We begin by examining whether market-value losses embedded in banks' securities portfolios are associated with differences in their lending responses to monetary tightening, distinguishing between AC, FVOCI, and FVPL security holdings. Table 3 presents the estimated results of Equation (1) using *Loan growth* as the dependent variable, with the specification extended to examine losses across accounting classifications separately and jointly. All specifications include borrower–quarter and banking group–borrower fixed effects, together with bank controls and their interactions with the monetary policy tightening indicator.

In Column (1), we find that the coefficient on our main variable of interest, *i.e.*, the interaction term between unrealized losses on amortized-cost securities relative to lagged total assets and the monetary policy tightening indicator, is negative and statistically significant at the 1% level, indicating that banks with a larger share of unrealized losses reduce loan growth more than their peers during tightening, relative to the pre-tightening period. The magnitude of the coefficient, approximately -1.28, implies that a one percentage point increase

in amortized-cost unrealized losses relative to lagged total assets is associated with an additional tightening-related decline in loan growth of approximately 1.28 percentage points. The estimate remains negative and statistically significant when country–quarter fixed effects are included in Column (2), with a coefficient of approximately −1.17.

In Columns (3)–(6), we broaden the analysis to losses on securities measured at fair value. We find that the interaction between FVOCI losses and monetary tightening is negative and statistically significant at the 1% level in Columns (3)–(4), consistent with recent evidence from the U.S. setting that banks experiencing larger losses on available-for-sale securities portfolios extend less credit (Greenwald et al., 2024).[24] By contrast, the interaction coefficients for FVPL losses in Columns (5)–(6), although negative, are statistically insignificant. In Columns (7)–(8), we include all three loss measures and their interactions with monetary tightening jointly. Importantly, we continue to find that the AC-loss interaction remains negative and statistically significant at the 1% level, with coefficients close in magnitude to those in Columns (1)–(2) (about −1.19 and −1.10, respectively). The FVOCI-loss interaction also remains negative and statistically significant, while the FVPL-loss interaction continues to be statistically insignificant. These findings suggest that losses embedded in banks' securities portfolios condition monetary policy transmission to lending. At the same time, the persistence of the AC-loss effect is particularly informative because, unlike fair-value losses recognized through profit or loss or other comprehensive income, market-value losses on amortized-cost securities remain unrecognized in profit or loss and total equity while the securities continue to be measured at amortized cost and, therefore, do not mechanically reduce regulatory capital through contemporaneous accounting recognition. The AC result consequently points to a lending channel that may operate even in the absence of such recognition. In the following analyses, we investigate why these unrecognized losses nevertheless matter for banks' lending decisions.

This pattern continues to hold when we examine whether banks expand credit within ex-

[24] As discussed in Section 2, these valuation changes are recognized in total equity and ordinarily affect CET1; a temporary and partial exception applied to specified public-sector exposures in 2021 and 2022.

isting lending relationships. In Table 4, following De Jonghe et al. (2020), we replace the dependent variable in Equation (1) with an indicator, *Loan expansion*, which equals one when outstanding credit supplied by banking group i to borrowing firm j increases from $t-1$ to t, and zero otherwise, and estimate a linear probability model. Importantly, these regressions include the same set of control variables and their interactions with monetary tightening, as well as the high-dimensional fixed effects used in our baseline analyses. All specifications also jointly include the AC, FVOCI, and FVPL loss measures and their interactions with monetary tightening. We find that the interaction between AC losses and monetary tightening is negative across all four specifications and statistically significant at the 5% level in Columns (1)–(3) and at the 10% level in Column (4). This indicates that, for banks with larger AC losses, the probability of expanding outstanding credit within existing relationships declines more during monetary tightening relative to the pre-tightening period. In economic terms, a one-percentage-point increase in AC losses relative to lagged total assets is associated with an additional tightening-related decline of approximately 1.02–1.47 percentage points in the probability of loan expansion. By contrast, the corresponding interactions for FVOCI and FVPL losses are not consistently statistically significant across specifications. Thus, among the three accounting classifications, AC losses are the only loss measure consistently associated with an additional tightening-related reduction in the probability of expanding credit within existing relationships. These findings suggest that AC losses are particularly relevant to banks' credit-expansion decisions and complement the evidence on loan growth by showing that the AC-loss effect extends from the magnitude of credit adjustments to the likelihood that outstanding credit within an existing relationship increases.

To further quantify the economic relevance of our findings, we assess the effect size using the approach of Faccio and Xu (2015). Specifically, we multiply the estimated coefficient on the AC-loss interaction in the joint specification reported in Column (8) of Table 3 by the standard deviation of AC losses as follows: $[(\frac{dy}{dx}) \times \text{STD}(x)]$. This yields an implied additional tightening-related decline in loan growth of about 0.52 percentage points for a one-standard-deviation

increase in unrealized losses. To put this effect into perspective, the average bank–firm loan growth rate over the full sample period is approximately −5%. A bank with unrealized losses one standard deviation higher is therefore associated with an additional tightening-related decline of 0.52 percentage points, *all else equal*, implying a contraction approximately 10% larger in magnitude than the sample average.[25] As an alternative scaling, we apply the interquartile-range transformation $[(\frac{dy}{dx}) \times \text{IQR}(x)]$, which similarly implies that moving from the first to the third quartile of unrealized losses is associated with a 0.53 percentage-point larger tightening-related decline in loan growth. Taken together, these estimates indicate that unrealized losses on amortized-cost securities are associated with a materially larger contraction in bank lending during monetary tightening.

Next, to assess whether banks with greater AC losses were already experiencing systematically different lending trends before the ECB began raising policy rates, we report, in Figure 6, quarter-specific coefficients from a dynamic specification that interacts lagged AC losses with quarter indicators while retaining the controls and fixed effects used in our baseline analysis. We use Q2 2022, the quarter immediately preceding the start of the ECB monetary policy tightening cycle in July 2022, as the omitted period. This specification preserves the continuous variation in AC-loss exposure used in our baseline analyses, with each coefficient indicating whether the relationship between AC losses and loan growth in a given quarter differs from that in Q2 2022.

The estimated coefficients in the pre-tightening period are statistically indistinguishable from zero, with the confidence intervals for both Q4 2021 and Q1 2022 including zero. We therefore find no detectable evidence that banks with greater unrealized AC losses were already experiencing systematically weaker loan growth before the start of the tightening cycle. Beginning in Q3 2022, however, the estimated coefficients become negative and remain negative through the end of the sample period. The timing and persistence of these estimates

[25] A one-standard-deviation increase in AC losses (0.469 percentage points) is associated with an additional tightening-related decline in loan growth of approximately 0.52 percentage points. This corresponds to about 10.34% of the average contraction in loan growth, since $-1.1024 \times 0.469 = -0.5170$ and $\frac{-0.5170}{-5.001} \approx 0.1034$.

are consistent with a differential decline in lending emerging around the onset of monetary tightening, rather than reflecting the continuation of a preexisting divergence in lending trends between banks with greater and smaller AC losses.

Finally, to assess the robustness of our baseline findings, we examine whether the AC-loss result reflects characteristics of the underlying securities portfolios rather than the loss exposure itself. Table OA4 in the Online Appendix reports the results. In Columns (1)–(2), we augment the joint specifications with controls for aggregate securities characteristics, including the logarithms of residual maturity and securities volume, the government-security share, and accumulated impairment scaled by total assets. In Columns (3)–(4), we additionally control for the corresponding characteristics within the AC portfolio. All securities controls and their interactions with the monetary policy tightening indicator are included in these regressions. We find that the AC-loss interaction remains negative and economically meaningful across the specifications. These findings alleviate the concern that the estimated AC-loss effect merely reflects observable differences in the maturity, scale, issuer composition, or impairment of the securities underlying our loss measure.

In a separate set of tests, we also examine whether AC losses merely proxy for banks' broader exposure to losses on securities measured at fair value. In Columns (5)–(8), we progressively exclude banks with the largest accumulated FVOCI and FVPL losses over the sample period. Columns (5)–(6) exclude banks in the top quartile of the fair-value-loss distribution, while Columns (7)–(8) exclude those in the top half. We find that the AC-loss interaction remains negative and statistically significant across all four restricted-sample specifications. Taken together, these restricted-sample results suggest that the relationship between AC losses and lending persists even among banks with relatively limited fair-value losses, thereby alleviating the concern that the AC-loss result merely captures banks' broader exposure to accumulated losses in their FVOCI and FVPL portfolios.

5.2 Recognition-Based Funding-Cost Mechanism: Security Retention and Deposit Repricing

Having established that AC losses remain associated with lower lending even when accounting for losses on securities measured at fair value and observable securities characteristics, we now investigate why losses that remain unrecognized while securities are held nevertheless matter for banks' lending decisions. As discussed in greater detail in Section 2, the recognition-based funding-cost mechanism we examine concerns banks' incentives to preserve their ability to retain AC securities and avoid realizing losses through an early disposal as funding costs rise. AC securities are held within portfolios managed primarily to collect contractual cash flows, but continued retention depends on banks' capacity to sustain funding over the intended holding horizon. This dependence helps explain why current market values remain relevant even for assets held to collect contractual cash flows, particularly when banks must maintain or roll over funding (Laux and Leuz, 2009, 2010).

During the rapid 2022–2023 tightening, the cost of financing existing AC positions increased while declines in their market values enlarged the unrealized losses that an early disposal would crystallize. Selling these securities below their carrying amounts would generate liquidity but would also require banks to recognize previously deferred losses in reported earnings, thereby reducing total equity. Hence, to the extent that managers seek to avoid this recognition effect, larger unrealized losses may strengthen the incentive to retain positions they already intend to hold. Banks may therefore pay more to retain deposits and restrain prospective lending to contain additional funding commitments and preserve their ability to carry existing AC positions if funding conditions deteriorate. This recognition friction can amplify the transmission of monetary policy through banks' funding conditions to loan supply, a channel emphasized in the bank lending literature (Kashyap and Stein, 2000; Drechsler et al., 2017). The prospect of loss recognition can therefore prompt preemptive funding and lending adjustments even without net deposit outflows or actual security sales.

In the following analyses, we examine two implications of this mechanism. First, within

banks' AC portfolios, we assess whether larger unrealized losses are associated with a greater decline in the probability of a material position reduction following the market repricing associated with monetary tightening. Second, we analyze whether banks with larger AC losses exhibit a greater tightening-related increase in deposit-rate pass-through, without necessarily experiencing a differential contraction in deposit quantities.

We begin by examining whether unrealized losses are associated with banks' decisions to reduce individual AC security positions. Table 5 reports bank–security–quarter–level linear probability models in which the dependent variable, *Material position reduction*, is an indicator equal to one if a bank's position in an AC security disappears entirely or its nominal value declines by at least 5% in the following quarter. We use the 5% threshold to focus on substantive reductions in positions that banks generally intend to retain, while limiting the influence of small, routine portfolio adjustments.[26] To reduce the possibility that the measure captures contractual runoff or accounting reclassification, we require each security to have at least two quarters remaining to contractual maturity and exclude reductions arising from reclassifications across accounting categories. The regressions include banking group–quarter fixed effects, allowing us to compare securities carrying different unrealized losses within the same banking group and quarter. These fixed effects absorb the common influence of contemporaneous deposit flows, funding costs, liquidity needs, and capital headroom on the banking group's security-reduction decisions. We also control for the natural logarithms of residual maturity and nominal position size and include issuer-sector fixed effects. Standard errors are clustered at the banking-group level.

In Column (1), we interact the security-level AC loss ratio with an indicator equal to one from the second quarter of 2022 onward, capturing the market repricing that preceded the

[26] IFRS 9 permits sales consistent with a hold-to-collect business model and, unlike IAS 39's held-to-maturity category, does not impose an automatic tainting rule. Our 5% cutoff is an empirical definition of a material position reduction. For comparison, a 3.5% movement corresponds to the 75th percentile of the distribution of AC security position movements observed at year-end 2021, before monetary tightening. The baseline cutoff therefore imposes a more stringent requirement than this pre-tightening benchmark. Table OA5 of the Online Appendix shows that the dynamic results are qualitatively similar under the 3.5% reduction threshold and when we retain the 5% threshold but progressively require securities to have at least four, six, or eight quarters remaining to contractual maturity.

ECB's first policy-rate increase. We use this timing because the loss a bank would recognize upon sale depends on the gap between its carrying amount and the prevailing market price, which can widen in anticipation of policy-rate increases. As discussed earlier, by June 2022, market participants expected rate increases, although the anticipated tightening was more limited than the tightening that subsequently materialized. Consistent with this anticipatory repricing, we observe a sharp widening of the negative aggregate market-to-nominal-value gap in AC portfolios in the second quarter of 2022. Because position reductions are measured in the following quarter, the Q2 2022 observations connect losses already embedded in security values before the first policy-rate increase to subsequent position reductions in Q3 2022, the first quarter of monetary tightening. This timing also aligns the security-level analysis with our lending specifications, which likewise relate outcomes during tightening to loss exposure measured in the preceding quarter. We find that the interaction coefficient is negative and statistically significant at the 1% level. Economically, a one-standard-deviation increase in the AC loss ratio (0.064) corresponds to a 2.5-percentage-point downward shift in the probability of a material position reduction after repricing relative to the pre-repricing period, equivalent to approximately 29% of the unconditional mean of 8.9%. Thus, following the market repricing, the relationship between unrealized losses and subsequent position reductions becomes significantly more negative.

This finding is consistent with larger unrealized losses reinforcing retention within portfolios already managed to collect contractual cash flows and aligns with prior evidence that deferred loss recognition shapes insurers' portfolio adjustments when credit downgrades increase regulatory capital requirements (Ellul et al., 2014, 2015). In our setting, the relevant adjustment pressure instead arises from rapidly rising funding costs, which make retaining existing positions more costly. The unrealized AC losses do not themselves mechanically reduce regulatory capital, but the prospect of recognizing them upon an early disposal can still influence current funding and lending decisions.

In Column (2), we examine whether the security-level result varies with secondary-market

liquidity. If AC securities carrying larger losses were intrinsically more difficult or costly to sell, their lower probability of a material position reduction could reflect execution costs as well as recognition incentives. To assess this possibility, we use an indicator for government bonds as a proxy for relatively liquid securities within the AC portfolio and interact this indicator with the AC loss ratio and the market-repricing indicator, including the corresponding pairwise interactions. We find that the interaction between the AC loss ratio and market repricing remains negative and statistically significant for non-government securities, while the point estimate of the triple interaction with the *Highly liquid* indicator is small relative to the double interaction and statistically insignificant. Thus, we find no statistically detectable difference in the repricing-related change in the loss-reduction relationship between government bonds and the remaining AC securities, a pattern consistent with selective retention extending to more liquid government bonds.

In Column (3), as a robustness test, we redefine the post period to begin in Q3 2022, the quarter of the first ECB policy-rate increase. The interaction remains negative and is statistically significant at the 10% level, indicating a similar shift under this later timing definition. Finally, Column (4) reports a dynamic specification that interacts the AC loss ratio with quarter indicators, using Q3 2021, the first quarter of our sample, as the omitted period. We find that the coefficients for the two quarters preceding the market repricing, Q4 2021 and Q1 2022, are statistically indistinguishable from zero. The interaction coefficients for Q2 2022 through Q2 2023 are negative and statistically significant relative to the omitted period. The first significant negative shift links losses measured in Q2 2022 to subsequent position reductions in Q3 2022, and the pattern persists through position reductions in Q3 2023. Taken together, these findings are consistent with prospective loss recognition influencing which AC security positions banks retained.

To provide corroborating accounting evidence on this recognition mechanism, we then examine banks' reported net income from derecognition of securities measured at amortized cost. Disposing of an AC security whose fair value lies below its carrying amount can convert

an embedded valuation loss into a recognized loss, whereas retaining the position leaves that market-value loss unrecognized. We hand-collect these disclosures together with the carrying amounts and fair values of AC securities and construct an indicator equal to one when a banking group explicitly reports zero net derecognition income. We measure disclosed AC losses as the difference between the carrying amount and fair value of AC securities, scaled by total assets. The analysis uses a balanced annual panel of 35 out of our 82 banking groups observed from 2021 through 2023.[27] The tightening episode sharply changed the underlying valuation environment, moving banks' AC portfolios from predominantly embedded gains in 2021 to predominantly embedded losses in 2022–2023.[28] We therefore include banking-group fixed effects to absorb persistent differences across banks in reporting and derecognition practices and year fixed effects to account for changes common to banks in each year. We estimate specifications with and without controls for bank size, profitability excluding AC derecognition income, and the size of the AC portfolio. We also re-estimate the specifications excluding 2022, the transition year in which monetary tightening began, thereby comparing 2021 directly with 2023. Table OA6 of the Online Appendix reports the results.

The results are broadly consistent with the security-level retention evidence. The interaction between disclosed AC losses and the tightening-period indicator is positive and statistically significant across specifications, indicating that the relation between AC losses and zero net derecognition income becomes more positive during tightening relative to 2021. More importantly, the implied tightening-period slope is positive and statistically significant. In Column (2), a one-standard-deviation increase in disclosed AC losses is associated with an approx-

[27] The smaller sample size reflects unavailable annual reports and insufficiently granular disclosures for some banks. Importantly, we exclude missing derecognition-income observations instead of coding them as zero.

[28] In our signed disclosed AC loss measure, negative values denote unrealized gains, while positive values denote unrealized losses. In the balanced sample, the mean (standard deviation; median) of disclosed AC losses is -0.131% $(0.306\%; -0.047\%)$ of total assets in 2021, 0.638% $(0.565\%; 0.455\%)$ in 2022, and 0.302% $(0.437\%; 0.299\%)$ in 2023. The corresponding 25th and 75th percentiles are $[-0.170\%, -0.0004\%]$, $[0.127\%, 1.137\%]$, and $[0.058\%, 0.659\%]$, respectively. Across the 105 bank–year observations, disclosed AC losses average 0.270% of total assets, with a standard deviation of 0.545%, and 12.4% of observations explicitly report zero net derecognition income. The mean (standard deviation) of bank size, measured as the natural logarithm of total assets, profitability excluding AC derecognition income, and the AC portfolio relative to total assets is 12.012 (1.469), 0.758% (0.629%), and 10.061% (7.867%), respectively.

imately 10-percentage-point increase in the probability of reporting zero net derecognition income, and this tightening-period slope remains statistically significant under Webb wild-cluster bootstrap inference ($p = 0.007$). The estimated relation is stronger when we exclude the transition year 2022 and compare 2021 directly with 2023. This bank-level accounting analysis therefore helps triangulate the security-level retention evidence using data from banks' annual reports. However, because derecognition income is reported on a net annual basis, we acknowledge that a zero reported amount does not establish the absence of security sales or other derecognition transactions throughout the year, as individual derecognitions may occur without producing a gain or loss and gains and losses may offset one another. Nonetheless, when combined with the security-level evidence, the results provide some suggestive evidence that banks tilt their AC portfolio adjustments away from transactions that would recognize unrealized losses.

We next examine the funding-side response by analyzing deposit quantities and pricing during monetary tightening. Banks with larger AC losses may offer greater remuneration to retain deposits and sustain funding, without first experiencing net deposit outflows. These analyses build on prior evidence that deposit funding and its sensitivity to policy rates play a central role in the transmission of monetary policy to bank lending (Drechsler et al., 2017, 2021). Table 6 presents regression results based on banking group–quarter-level data. The dependent variables are deposit growth, the natural logarithm of total deposits, and the deposit beta, respectively. Our variable of interest is the interaction between lagged AC losses and the monetary policy tightening indicator. We include the same lagged bank controls and their interactions with the monetary policy tightening indicator as in the lending regressions, together with banking group and quarter fixed effects.[29] Standard errors are clustered at the banking-group level.

In Columns (1) and (2), the interaction between AC losses and monetary tightening is statistically insignificant for both deposit growth and the logarithm of total deposits. Thus,

[29]The quarter fixed effects fully subsume the $MP_Tightening_t$ indicator, which is therefore omitted from the regressions.

we find no statistically significant evidence of a tightening-related differential contraction in deposit quantities associated with larger AC losses.

In Column (3), we turn to deposit pricing and examine *Deposit beta*, which measures the pass-through of changes in the policy rate to the interest rate paid on deposits and therefore captures how strongly banks' deposit funding costs reprice during monetary tightening.[30] We find that the interaction between AC losses and monetary tightening is positive and statistically significant at the 5% level, indicating that the relationship between AC losses and deposit-rate pass-through becomes more positive during tightening relative to the pre-tightening period. This pattern is consistent with banks offering greater remuneration to retain deposits as depositors' opportunity cost of holding comparatively low-remuneration deposits rises. Such pricing responses may be especially relevant for uninsured wholesale depositors, who may be more responsive to differences in remuneration and have greater scope to reallocate funds across banks or toward alternative investments (Diamond and Dybvig, 1983; Goldstein and Pauzner, 2005; Cappelletti et al., 2024; Cipriani et al., 2024).

In Column (4), we augment the specification with a triple interaction between AC losses, monetary tightening, and *High uninsured*, an indicator equal to one for banks with an above-median ratio of uninsured wholesale deposits to total assets at year-end 2021, together with the corresponding pairwise interactions. We measure this ratio before the tightening cycle to reduce the concern that the classification reflects banks' endogenous funding adjustments after policy rates began to increase. We find that the triple-interaction coefficient is positive and statistically significant at the 10% level. Thus, the tightening-related change in the relationship between AC losses and deposit-rate pass-through is stronger among banks entering the cycle with greater reliance on uninsured deposits. This finding is consistent with these banks facing stronger incentives to support deposit funding through greater remuneration as the returns available on alternative investments rise.

[30] The number of observations is lower in the deposit-beta regressions because of limited data availability. Specifically, these regressions include 330 banking group–quarter observations covering 49 of the 82 sample banks, compared with 503 observations in the deposit-quantity regressions.

To triangulate our deposit-pricing evidence using direct accounting measures of both AC losses and deposit expenses, we combine information hand-collected from banks' annual reports with data from the EBA Transparency Exercise.[31] Because the required information is not available for all banks in both sources, merging the two datasets yields a balanced annual panel of 29 of the 82 banking groups in our main sample, observed from 2021 through 2023. As in the derecognition analysis, we measure *Disclosed AC losses* as the difference between the carrying amount and fair value of AC securities, scaled by total assets.[32] The dependent variables capture deposit interest expense relative to total deposits or total assets, together with the ratio of total deposits to total assets and the natural logarithm of total deposits. The specifications include banking-group and year fixed effects and controls for bank size, profitability excluding deposit interest expense, and the size of the AC portfolio relative to total assets. Table OA7 of the Online Appendix reports the results.

The interaction between disclosed AC losses and the tightening-period indicator is positive and statistically significant for both measures of deposit funding costs. In Column (1), the relationship between disclosed AC losses and deposit interest expense relative to total deposits becomes 0.348 percentage points more positive during 2022–2023 than in 2021 for each one-percentage-point increase in disclosed AC losses. In Column (2), the corresponding difference in the relationship with deposit interest expense relative to total assets is 0.305 percentage points. By contrast, the interactions are statistically insignificant for both deposit quantities in Columns (3)–(4). Thus, the findings exhibit the same pricing-versus-quantity pattern as the quarterly analysis: the relationship between AC losses and realized deposit funding costs becomes more positive during tightening relative to 2021, without a statistically detectable

[31] For further information on the EU-wide transparency exercise conducted by the European Banking Authority, we refer the reader to: https://www.eba.europa.eu/risk-and-data-analysis/risk-analysis/eu-wide-transparency-exercise.

[32] The balanced sample comprises 87 bank–year observations from 29 banking groups over 2021–2023. On average, deposit interest expense amounts to 0.752% of total deposits and 0.475% of total assets, with substantial cross-sectional and time-series variation (standard deviations of 0.802% and 0.484%, respectively). Deposits represent, on average, 69.6% of total assets, with a median of 74.4%. Disclosed AC losses average 0.311% of total assets, with a standard deviation of 0.582% and a median of 0.192%. The AC portfolio represents, on average, 10.9% of total assets, with a median of 9.7%.

differential change in deposit quantities. Taken together, these results triangulate our deposit-beta evidence using a direct accounting measure of AC losses, realized deposit interest expense, and annual information from two complementary data sources.

Overall, the deposit results are consistent with banks seeking to preserve funding through greater remuneration, without a statistically detectable differential contraction in deposit quantities. Viewed alongside the security-level evidence and our lending results, this pattern is consistent with the recognition-based funding-cost mechanism developed in Section 2. Retaining loss-bearing AC securities avoids immediate loss recognition but leaves banks financing assets whose fixed returns do not adjust to rising funding costs. When interest rates rise rapidly, the prospective recognition consequences of an early disposal can therefore create an additional incentive to sustain deposit funding and restrain lending commitments. These adjustments can help banks preserve their ability to carry AC securities as funding conditions tighten. This recognition friction can therefore amplify the standard funding-cost channel even while the underlying losses remain unrecognized in earnings and total equity and do not themselves mechanically reduce regulatory capital.

5.3 Channels of Amplification: Funding Structure and Liquidity Buffers

The preceding empirical results document a tightening-related decline in loan growth associated with AC losses and provide evidence consistent with the recognition-based funding-cost mechanism examined in Section 5.2. Building on these findings, we next examine how banks' funding structure and liquidity buffers condition the strength of the lending response. Specifically, we test whether the tightening-related lending response associated with AC losses is more pronounced for banks that rely more heavily on uninsured deposits or have smaller liquidity buffers.

The deposit-pricing results in Table 6 show that banks with larger AC losses exhibit a greater tightening-related increase in deposit-rate pass-through, particularly when they rely more heavily on uninsured deposits. This finding is consistent with these banks paying more

to preserve deposit funding. As deposit remuneration rises, financing existing fixed-rate AC positions becomes more costly, while their contractual returns remain unchanged (Drechsler et al., 2021). Disposing of loss-bearing AC securities would generate liquidity but would also require banks to recognize previously deferred losses. Larger AC losses may therefore strengthen managers' incentives to preserve the deposit funding needed to retain positions they already intend to hold, even as that funding becomes more expensive. This reasoning is consistent with Bischof et al. (2021), who emphasize that, when banks rely on short-term funding such as wholesale deposits, their ability to hold assets for the collection of contractual cash flows can depend on interim market prices because that funding must be continually rolled over.

Restraining prospective lending therefore provides a complementary adjustment margin, consistent with prior evidence that changes in deposit funding conditions affect bank lending (Drechsler et al., 2017). By limiting additional funding commitments, banks can preserve greater capacity to carry their existing AC positions as funding conditions tighten. Because the deposit-pricing response associated with AC losses is stronger among banks relying more heavily on uninsured deposits, we expect the tightening-related lending response associated with AC losses to be more pronounced among these banks.

Liquidity buffers, in turn, affect banks' capacity to accommodate funding pressure without materially adjusting their lending. Banks with larger liquidity buffers have greater flexibility to sustain their existing AC positions and loan supply as funding conditions tighten. Conversely, banks with smaller buffers may have stronger incentives to limit lending commitments to preserve their capacity to carry existing positions. We therefore expect larger liquidity buffers to attenuate the tightening-related lending response associated with AC losses. [33]

[33] Anecdotal evidence is consistent with the importance of funding structure and liquidity buffers. For example, Bankinter's 2022 annual report describes its funding approach as combining *limited reliance on wholesale markets* "with balanced growth in retail funding, diversification of wholesale funding sources across instruments and markets, a balanced maturity schedule, and the maintenance of a sufficient buffer of liquid assets. The bank reported a year-end LCR of 193.54% and noted that wholesale-funding maturities were distributed over time to *minimize refinancing difficulties*." For further information, see https://www.bankinter.com/file_source2/webcorporativa/estaticos/pdf/accionistas-e-Inversores/informacion-financiera/informes-anuales/2022/Informe_Anual_Consolidado_2022_EN.pdf.

To examine these predictions, we augment Equation (1) with a triple interaction between lagged AC losses, the monetary policy tightening indicator, and each conditioning characteristic, together with the corresponding lower-order terms. The triple-interaction coefficient captures how the tightening-related change in the relationship between AC losses and loan growth varies with each characteristic. Table 7 presents the results. Columns (1)–(3) examine funding structure using uninsured wholesale deposits relative to total assets, while Columns (4)–(6) examine liquidity buffers using the lagged liquidity coverage ratio (LCR). The LCR measures the stock of high-quality liquid assets relative to total net cash outflows over a 30-day stress period. We retain the controls, control interactions, and alternative fixed-effect structures used in the baseline lending regressions. All specifications include borrower–quarter fixed effects, and standard errors are clustered at the banking-group and borrower levels.[34]

We begin by examining the funding dimension in Columns (1)–(3).[35] We find that the triple interaction between AC losses, monetary tightening, and uninsured deposits is negative across all three specifications and statistically significant at the 5% level in Column (1) and at the 10% level in Columns (2)–(3). Thus, the relationship between AC losses and loan growth becomes more negative during tightening among banks relying more heavily on uninsured deposits. This finding complements the deposit-pricing evidence reported in Table 6 and is consistent with greater reliance on uninsured deposit funding amplifying the tightening-related lending response associated with AC losses.

Figure 7 visually represents this relationship by showing the estimated tightening-related change in loan growth associated with a one-percentage-point increase in AC losses at vary-

[34]It is worth noting that the two characteristics are related but capture different aspects of banks' funding and liquidity positions. Their correlation is -0.754 in the common estimation sample, indicating that banks relying more heavily on uninsured deposits tend to have lower LCRs. The uninsured-deposit ratio captures the composition and potential sensitivity of deposit funding, whereas the LCR measures banks' capacity to meet stressed net cash outflows using high-quality liquid assets. The two analyses therefore examine complementary aspects of banks' capacity to sustain their intended AC holdings as funding conditions tighten.

[35]The number of observations is lower because data on uninsured deposits are not available for some banks in the ECB supervisory statistics. Moreover, data on uninsured deposits are not available at a quarterly frequency. We therefore rely on year-end 2021 values, prior to the onset of monetary tightening, as a proxy for banks' funding structure. This implies that the standalone uninsured-deposit term is fully subsumed by the fixed effects.

ing ratios of uninsured wholesale deposits to total assets. For banks with uninsured-deposit ratios below 40%, the estimated effects are not statistically distinguishable from zero, as the confidence intervals overlap with zero. However, the estimated reduction in lending becomes statistically significant at uninsured-deposit ratios of 40% and above. At a ratio of 50%, for example, a one-percentage-point increase in AC losses is associated with an additional tightening-related decline in loan growth of approximately 1.9 percentage points.

We next examine the role of liquidity buffers in Columns (4)–(6). We find that the triple interaction between AC losses, monetary tightening, and the LCR is positive and statistically significant at the 1% level across all three specifications. These coefficients indicate that the tightening-related change in the relationship between AC losses and loan growth is less negative at higher levels of the LCR. Conversely, the associated lending contraction is more pronounced among banks with smaller liquidity buffers. This finding is consistent with larger liquidity buffers providing greater flexibility to accommodate funding pressure while sustaining existing AC positions and loan supply.

To gain further insight into this relationship, Figure 8 visually represents the estimated tightening-related change in loan growth associated with a one-percentage-point increase in AC losses at varying levels of the LCR. Banks with an LCR between 100% and 180% experience a statistically significant decline in lending, as shown by confidence intervals that do not overlap with zero. The estimated contraction becomes progressively less negative as the LCR increases and is no longer statistically distinguishable from zero at LCR values of 200% and above. At an LCR of 100%, for example, a one-percentage-point increase in AC losses is associated with an additional tightening-related decline in loan growth of approximately 3.3 percentage points.

Overall, the tightening-related lending response associated with AC losses is stronger among banks relying more heavily on uninsured deposits and weaker among banks with larger liquidity buffers. Viewed alongside the security-retention and deposit-pricing evidence, these findings are consistent with banks restraining prospective lending to preserve their ability to retain AC securities, with stronger adjustment when reliance on uninsured deposit funding is

greater or liquidity buffers are smaller.

5.4 Interest-Rate Hedging as a Mitigating Factor

Motivated by Purnanandam (2007) and McPhail et al. (2023), we next examine whether interest-rate hedging attenuates the lending response associated with unrealized losses on amortized-cost securities. Recent evidence from Italian banks shows that interest-rate swaps provide material, although partial, protection against valuation losses on banks' bond portfolios, including securities measured at amortized cost (Bianchi et al., 2026). Interest-rate derivatives form part of banks' broader risk management framework and may help them sustain their intended AC holdings as funding conditions tighten. To the extent that these derivatives offset the interest-rate exposure associated with AC portfolios, we expect the tightening-related lending response associated with AC losses to be weaker among banks with greater AC hedging.

Table 8 presents the results. The variable *AC Hedging* is defined as the amount of interest-rate derivatives used to hedge securities measured at amortized cost relative to total assets. We use the one-quarter lag of this measure to relate lending outcomes to previously observed hedging positions. We augment Equation (1) with the triple interaction $AC\ losses_{i,c,t-1} \times MP_Tightening_t \times AC\ Hedging_{i,c,t-1}$ and include the corresponding lower-order interaction terms. Columns (1)–(2) examine *Loan growth*, while Columns (3)–(4) examine *Loan expansion* within existing banking group–borrower relationships. The regressions retain the controls, control interactions, and high-dimensional fixed effects used in our lending analyses. Standard errors are clustered at the banking-group and borrower levels.

In Columns (1)–(2), the interaction between AC losses and monetary tightening is negative and statistically significant at the 5% level, with coefficients of approximately -1.16 and -1.02, respectively. These coefficients capture the tightening-related change in the AC-loss slope at zero AC hedging. The triple-interaction coefficients are positive and statistically significant at the 5% level in both columns, indicating that the negative tightening-related lending response

associated with AC losses becomes weaker as the extent of AC hedging increases. The linear combinations reported at the bottom of the table evaluate the tightening-related change in the AC-loss slope at the sample-average level of hedging. The resulting estimates are −0.457 and −0.362 and are statistically indistinguishable from zero. Thus, the estimated change is substantially less negative at average hedging than at zero AC hedging.

We find a similar pattern when examining whether banks expand outstanding credit within existing lending relationships. In Columns (3)–(4), the interaction between AC losses and monetary tightening is negative and statistically significant at the 1% level, while the triple interaction with AC hedging is positive and statistically significant at the 5% level. At zero AC hedging, a one-percentage-point increase in AC losses is associated with an additional tightening-related decline of approximately 2.18–2.51 percentage points in the probability of loan expansion. At average hedging, these estimates are smaller in magnitude, at approximately −0.33 and −0.64 percentage points, respectively, and are statistically indistinguishable from zero.

Taken together, these findings show that greater AC hedging is associated with a weaker tightening-related lending response to AC losses across both loan growth and the probability of loan expansion, consistent with interest-rate hedging helping banks sustain their AC holdings and lending as funding conditions tighten.[36]

5.5 Allocation of Credit Across Loan Types and Borrowers

Having examined the mechanism linking AC losses to lending during monetary tightening, we next investigate how the lending response is distributed across loan types and borrowers. We first consider loan interest-rate type and maturity. Building further on Bischof et al. (2021), who argue that reliance on short-term funding can affect banks' ability to hold assets until maturity, and on our preceding evidence on deposit repricing and uninsured deposit

[36] U.S. evidence documents a limited role for derivatives in offsetting banks' asset-side interest-rate exposure (McPhail et al., 2023; Granja et al., 2024). Granja et al. (2024) further find that more vulnerable banks reduced their hedging activity during monetary tightening. Our analysis complements this evidence by examining how AC hedging conditions the lending response associated with unrealized losses.

funding, we ask whether banks with larger AC losses reallocate prospective lending along these dimensions. Such banks may be particularly reluctant to extend fixed-rate loans, whose returns do not adjust as funding costs rise, or longer-maturity loans, which commit funding over longer horizons.

Interest-rate type and maturity capture related but distinct dimensions of this adjustment. Fixed-rate lending adds assets whose contractual returns do not adjust to subsequent changes in funding costs, whereas floating-rate loans reprice at their next reset date. Limiting additional fixed-rate lending may therefore help banks contain their interest-rate exposure. Contractual maturity, in turn, captures the horizon over which funds remain committed: even a floating-rate loan can tie up funding for an extended period. Limiting longer-maturity lending may thereby give banks greater flexibility to meet future funding needs without disposing of retained AC securities. This maturity prediction is consistent with Varraso (2024), who documents that unexpected monetary tightening leads banks to reduce their maturity gaps and shift their balance sheets toward shorter-maturity assets.

To test these predictions, we estimate our baseline lending specification separately by loan interest-rate type and maturity, with *Loan growth* as the dependent variable. Table 9 presents the results. Panel A compares fixed-rate and floating-rate lending, while Panel B compares long-term loans, with a maturity greater than three years, with short-term loans, with maturities of three years or less.[37]

Panel A reports the results by interest-rate type. In Columns (1), (3), and (5), the interaction between AC losses and monetary tightening is negative and statistically significant at the 1%, 5%, and 1% levels, respectively. The coefficients range from approximately -0.72 to -1.00, indicating that the relationship between AC losses and fixed-rate loan growth becomes more negative during tightening. The corresponding estimates for floating-rate lending

[37]Table OA8 in the Online Appendix shows that our findings are robust to alternative definitions of loan maturity. Panel A applies a one-year cutoff, while Panel B applies a two-year cutoff. Under both definitions, the interaction between AC losses and monetary tightening is negative and statistically significant at the 1% level for long-term lending across all specifications, whereas the corresponding estimates for short-term lending are statistically insignificant. Thus, the concentration of the lending response in longer-maturity credit is not specific to the three-year cutoff used in our main analysis.

in Columns (2), (4), and (6) are also negative but are statistically indistinguishable from zero. The pattern is consistent with banks carrying larger AC losses limiting additional fixed-rate exposure as they seek to sustain their existing securities positions.

Panel B reports the results by loan maturity. In Columns (1), (3), and (5), the interaction between AC losses and monetary tightening is negative and statistically significant at the 1% level across all specifications, with coefficients ranging from approximately -1.17 to -1.29. Thus, larger AC losses are associated with a more negative tightening-related change in long-term loan growth. The corresponding estimates for short-term lending in Columns (2), (4), and (6) are smaller in magnitude and statistically insignificant. This finding is consistent with banks limiting longer-term funding commitments to preserve flexibility as funding conditions tighten and aligns with Paligorova and Santos (2017a), who find that banks relying more heavily on short-term uninsured funding shorten the maturity of both newly originated loans and their loan portfolios.

Taken together, the interaction between AC losses and monetary tightening is negative and statistically significant in the fixed-rate and longer-maturity subsamples, while the corresponding estimates in the floating-rate and shorter-maturity subsamples are statistically indistinguishable from zero. In line with our preceding evidence, this pattern is consistent with banks adjusting prospective lending in ways that limit additional interest-rate exposure and longer-term funding commitments. Such adjustments may help banks preserve their capacity to retain loss-bearing AC securities without recognizing the losses embedded in those positions.

We next examine whether the lending response associated with AC losses varies across borrowers of different sizes. Motivated by the notion that smaller firms are typically more vulnerable to credit supply shocks because of greater informational frictions and limited access to alternative market-based financing, we assess whether the contractionary effect associated with AC losses is more pronounced for lending to smaller firms (Boot, 2000; Becker and Ivashina, 2014, 2018).

We proxy for firm size with the natural logarithm of the number of employees from the *AnaCredit* database. We augment Equation (1) with a triple interaction between AC losses, monetary tightening, and borrower size, together with the corresponding lower-order interaction terms. The coefficient on the triple interaction indicates whether the tightening-related change in the relationship between AC losses and loan growth becomes less negative as borrower size increases. Table 10 presents the results.[38] All specifications include borrower–quarter fixed effects, allowing us to compare lending by banks with different AC losses to the same borrower in the same quarter. Columns (3)–(4) additionally include banking group–borrower fixed effects.

We find that the interaction between AC losses and monetary tightening is negative and statistically significant at the 1% level across all four specifications. The triple interaction with borrower size is positive across specifications and statistically significant at the 10% level in Columns (1), (2), and (4) and at the 5% level in Column (3), with coefficients ranging from approximately 0.19 to 0.30. Thus, the tightening-related relationship between AC losses and loan growth becomes less negative as borrower size increases, indicating that the associated lending contraction is more pronounced for smaller borrowers. These results are consistent with prior literature documenting that smaller firms are more exposed to contractions in bank credit because of greater information asymmetries and more limited access to alternative financing sources (Berger and Udell, 1995; Gertler and Gilchrist, 1994; Petersen and Rajan, 1994; Iyer et al., 2014; Chodorow-Reich et al., 2022).

We also examine whether the lending response associated with AC losses varies with borrowers' preexisting credit risk. This analysis helps distinguish our setting from the borrower-specific rollover mechanism documented by Blattner et al. (2023). In their setting, deferred losses reside in the loan relationship, so withdrawing credit from a distressed borrower may trigger default and require the bank to recognize previously underreported loan losses. In our setting, the deferred losses reside in the securities portfolio, and reducing lending to a

[38] The number of observations is lower because data on the number of employees are unavailable for a subset of firms in *AnaCredit*. Borrower size is absorbed by the borrower–quarter fixed effects because it varies at the borrower–quarter level and therefore does not appear separately in the table.

riskier borrower does not itself trigger recognition of losses on AC securities. Table OA9 of the Online Appendix examines this issue using three pre-tightening measures of borrower risk: past-due days, amount-in-arrears, and non-performing-loan status. The interaction between AC losses and monetary tightening remains negative and statistically significant across all three specifications, while the triple interactions with the borrower-risk indicators are statistically insignificant and do not exhibit a consistent sign. Thus, we find no evidence that the lending contraction associated with AC losses is systematically concentrated among either observably safer or riskier borrowers. Although these null estimates do not imply that banks treat all borrowers identically, they distinguish our setting from a mechanism in which deferred losses generate systematic lending support for distressed borrowers.

Taken together, the evidence indicates that the lending contraction associated with AC losses during tightening is concentrated in fixed-rate and longer-maturity credit and is more pronounced for smaller borrowers, but does not vary systematically with our measures of borrower risk. This allocation pattern is consistent with banks adjusting prospective lending in ways that limit additional interest-rate exposure and longer-term funding commitments, with smaller firms—typically more reliant on bank financing—bearing a larger share of the adjustment.

5.6 Firm-Level Borrowing and Bank-Borrower Relationships

We now examine whether the contraction documented at the bank–firm level reaches firms' aggregate bank financing or is offset when borrowers obtain additional credit from other banks. A decline in lending supplied by an individual bank need not reduce a firm's total borrowing if the firm can replace that credit through its other existing lenders or by establishing relationships with new lenders. We therefore aggregate each firm's borrowing across all observed banks and use *Borrowing growth* as the dependent variable. This outcome allows us to assess whether cross-bank substitution offsets the lending contraction associated with AC losses.[39]

[39] We also explored whether the lending contraction translated into changes in investment or production by matching *AnaCredit* borrowers to *Orbis* financial statements. However, the predominantly annual frequency

Building on the loan-share-weighted firm-exposure construction of Iyer et al. (2014) and the shift-share approaches of Coulier et al. (2024) and Avril et al. (2025), we construct a time-varying measure of firms' exposure to banks with large AC losses. We fix each bank's share of a firm's total borrowing in Q4 2021, before monetary tightening began, and classify banks in each subsequent quarter according to whether their lagged AC losses fall within the top quartile of the quarter-specific distribution. The indicator *High AC loss exposure* equals one when banks classified in the top quartile in quarter $t-1$ accounted for more than 50% of the firm's total borrowing in Q4 2021, and zero otherwise. Because lender shares are fixed before tightening while banks' loss classifications vary across quarters, the measure can vary within firms over time without mechanically reflecting firms' subsequent reallocation of borrowing across lenders.

Table 11 presents the results. The regressions include lender-share-weighted bank controls and their interactions with monetary tightening, together with industry–location–size–quarter fixed effects (Acharya et al., 2019; Degryse et al., 2019; Berg et al., 2021). Standard errors are clustered at the level of the firm's largest lender. We find that the interaction between *high AC loss exposure* and monetary tightening is negative and statistically significant at the 1% level in both columns. Firms with high exposure experience an additional tightening-related decline in total borrowing growth of approximately 1.70–1.84 percentage points relative to firms not classified as highly exposed. In Column (2), the interaction estimate remains similar when borrower fixed effects are included to absorb persistent differences across firms. Because the dependent variable aggregates borrowing across all observed banks, these findings are consistent with incomplete cross-bank substitution: the reduction in lending associated with high-AC-loss banks is not fully offset by additional borrowing from other lenders.

We next examine the extensive margin of loan supply through the formation of new bank–borrower relationships and the exit of existing relationships. Following the approach of Coulier

of *Orbis* prevents us from aligning these outcomes with the quarterly timing of our main analyses. Moreover, the matched sample covers only a subset of *AnaCredit* borrowers and is disproportionately composed of larger firms, and so it differs materially from the broader *AnaCredit* population.

et al. (2024), we define *New bank–borrower relationship* as an indicator equal to one when either a firm enters *AnaCredit* without having had a banking relationship in the preceding quarter or an existing borrower begins borrowing from an additional bank. Table 12 presents the results. The specifications progressively absorb credit-demand conditions through industry–location–quarter, industry–location–size–quarter, and borrower–quarter fixed effects, respectively.

We find that the interaction between AC losses and monetary tightening is negative and statistically significant at the 1% level across all three specifications. Thus, the relationship between AC losses and the probability of establishing a new lending relationship shifts significantly downward during monetary tightening. The negative interaction coefficients largely offset the positive pre-tightening coefficients on AC losses. Economically, the interaction offsets between 86% and 95% of the positive pre-tightening coefficient across specifications. This pattern remains in Column (3), which compares banks serving the same borrower in the same quarter through the inclusion of borrower–quarter fixed effects. In this specification, the interaction attenuates the positive pre-tightening slope by approximately 92%, reducing it from 0.1985 to 0.0157. The results are consistent with banks carrying larger AC losses becoming less inclined, relative to their pre-tightening period, to undertake the additional funding commitments associated with establishing new lending relationships.

Finally, Table 13 examines whether existing relationships involving banks with larger AC losses immediately before monetary tightening are more likely to exit afterward. Following the approach of Jasova et al. (2021), we collapse the panel to a cross section containing one observation for each bank–borrower relationship observed in Q2 2022. The dependent variable, *Bank–borrower relationship exit*, equals one when the relationship is no longer observed in Q2 2023, and zero when it remains. *Initial AC losses* and the bank-level controls are measured in Q2 2022, before the relationship-exit outcome is observed. This cross-sectional design therefore uses predetermined AC-loss exposure and avoids relying on repeated quarterly observations of the same relationship. All specifications include borrower fixed effects, such that the identification comes from comparisons across different banking relationships of the same

borrower. Columns (1)–(2) additionally include country fixed effects, while Columns (2) and (4) include bank-level controls measured in Q2 2022.

We find that initial AC losses are positively associated with the probability of relationship exit across all four specifications. The estimates are statistically significant at the 5% level or better in Columns (1)–(2) and at the 10% level in Columns (3)–(4). Economically, in Column (2), a one-standard-deviation increase in initial AC losses (0.190 percentage points) is associated with a 1.7-percentage-point increase in the probability of relationship exit, equivalent to approximately 12% of the unconditional mean exit probability of 14.2%. Thus, among relationships existing in Q2 2022, those involving banks with larger AC losses at the onset of monetary tightening are more likely to be absent in Q2 2023. This finding is consistent with the tightening-related lending adjustment extending beyond changes in lending volumes within continuing relationships to the extensive margin of banks' existing borrower networks.

Taken together, the firm-level and relationship-level results show that the lending contraction associated with AC losses reaches firms' aggregate bank financing and is accompanied by adjustments along both relationship margins. During monetary tightening, the previously positive association between AC losses and new relationship formation is largely eliminated, while relationships observed in Q2 2022 involving banks with larger initial AC losses are more likely to exit by Q2 2023. These patterns complement the evidence on loan expansion within continuing relationships and are consistent with banks carrying larger AC losses limiting prospective funding commitments and with incomplete substitution by borrowers across lenders.

5.7 Robustness and supplemental tests

In our final set of analyses, we assess the robustness of our results by (i) examining whether AC losses are associated with observable pre-tightening bank characteristics; (ii) applying a covariate-balancing reweighting method; (iii) using alternative controls for credit demand and including single-bank borrowers; (iv) controlling for loan maturity; (v) weighting observations by the size of the loan exposure; and (vi) replacing the tightening indicator with quarterly

changes in the ECB deposit facility rate. All of these analyses are reported in the Online Appendix.

First, we assess whether within-bank variation in AC losses before monetary tightening covaries systematically with observable bank characteristics. Table OA10 of the Online Appendix presents bank-quarter regressions in which AC losses are regressed on a broad set of bank-specific characteristics. These coefficients therefore capture within-bank associations over the pre-tightening period, after absorbing persistent differences across banks and common quarterly changes. We find that most coefficients are statistically insignificant. Only return on assets and the NPL ratio exhibit weak associations; for example, periods in which a bank is more profitable tend to be associated with slightly larger unrealized losses. Importantly, other key covariates, including bank size, distance to MDA, and RWA, do not appear to be systematically correlated with AC losses. These findings provide little evidence that within-bank variation in AC losses before tightening systematically covaried with variation in the observable bank characteristics included in the analysis.

Nonetheless, to further address concerns that observable bank characteristics correlated with AC losses might confound the results, we implement the *covariate-balancing generalized propensity score* (CBGPS) method proposed by Fong et al. (2018). This method constructs weights that balance pre-tightening bank characteristics across the continuous distribution of AC losses and thereby reduces observable covariate imbalance across banks with different AC-loss exposure. The reweighted regressions in Table OA11 yield estimates that are qualitatively similar to the baseline results. The interaction between AC losses and monetary tightening remains negative across all four specifications, with coefficients ranging from approximately -1.01 to -1.21, and is statistically significant at conventional levels in all four specifications.

We next examine the sensitivity of the results to alternative controls for borrowers' credit demand. Following Acharya et al. (2019), Degryse et al. (2019), and Berg et al. (2021), Table OA12 replaces borrower-quarter fixed effects with quarter-varying fixed effects based on combinations of borrower characteristics such as industry, location, and size (ILS). The

industry classification is based on granular NACE4 codes, the location is categorized at the postal-code level, and the size classification includes micro, small, medium, and large firms as reported in the *AnaCredit* database. Following Khwaja and Mian (2008), our baseline borrower–quarter fixed-effects design identifies credit-supply effects using firms that borrow from multiple banks. Replacing those fixed effects with granular ILS-by-quarter controls allows us to retain single-bank borrowers while controlling for time-varying credit demand among observably similar firms. This extension is important because single-bank firms represent a large share of credit relationships in several euro area countries (Kosekova et al., 2025).

We find that the interaction term remains negative and statistically significant across all four specifications, with coefficients ranging from approximately -0.83 to -0.96. The estimates are therefore similar when credit demand is absorbed within granular groups of observably comparable borrowers and in specifications restricted to single-bank borrowers, which cannot contribute to the baseline within-borrower, across-lender comparison. Although these fixed effects cannot absorb unobserved borrower-specific changes in credit demand within each industry–location–size cluster, the results provide corroborating evidence that the baseline finding is not driven by its fixed-effect structure or by the restriction to firms borrowing from multiple banks.

In Table OA13 of the Online Appendix, we further control for the average maturity of loans within each bank-firm exposure and its interaction with the monetary policy tightening indicator. Differences in contractual maturity could affect observed loan growth through scheduled repayments or differences in the horizon over which loans remain outstanding. After controlling for loan maturity and its interaction with monetary tightening, we continue to find that the interaction between AC losses and monetary tightening is negative and statistically significant across both specifications, with coefficients of approximately -1.03 and -1.33. These estimates indicate that the baseline result is not explained by differences in the maturity composition of bank-firm loan exposures.

Table OA14 reports weighted least squares (WLS) estimates in which each observation is

weighted by the lagged outstanding amount of the corresponding bank–firm loan exposure. This procedure gives greater weight to larger lending relationships and allows us to assess whether the baseline result is driven disproportionately by smaller loan exposures. The interaction between AC losses and monetary tightening remains negative in both specifications, with coefficients of approximately -1.05 and -1.26, and remains statistically significant at conventional levels in both specifications. Thus, the estimated lending response also persists when economically larger loan relationships receive greater weight.

Next, in Table OA15 of the Online Appendix, we replace the $MP_Tightening$ indicator with the continuous variable $\Delta Policy\ Rate$, defined as the change in the ECB deposit facility rate from quarter $t-1$ to quarter t.[40] In Column (1), we find that the interaction between AC losses and the change in the deposit facility rate is negative and statistically significant. Using the sample standard deviation of the quarterly policy-rate change of 0.548 percentage points, the estimate implies that a one-standard-deviation increase in $\Delta Policy\ Rate$ is associated with an additional 0.42-percentage-point decline in loan growth for each one-percentage-point increase in AC losses.

Columns (2)–(3) re-examine the conditioning roles of uninsured deposit funding and liquidity buffers. In Column (2), the triple interaction with uninsured deposits is negative and statistically significant, indicating that the relationship between AC losses and loan growth becomes more negative as the policy rate increases among banks relying more heavily on uninsured deposits. In Column (3), the triple interaction with the LCR is positive and statistically significant, indicating that larger liquidity buffers attenuate this relationship. Taken together, these supplemental tests show that the baseline results are robust to observable bank differences, covariate-balancing reweighting, alternative controls for credit demand, loan maturity, exposure-based weighting, and a continuous measure of monetary policy tightening.

Finally, we validate our SHSG-based loss measure against the corresponding information disclosed in banks' annual reports. For 57 of the 82 banking groups in our sample, the dis-

[40] The ECB deposit facility rate is available at: https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html.

closures are sufficiently granular and comparable across 2021–2023 to identify separately the carrying amounts and fair values of debt securities measured at AC. For the remaining banks, the relevant amounts are reported either at a broader level of aggregation or not consistently across all three years. We construct *Disclosed AC losses* as the difference between carrying amount and fair value, scaled by total assets, and compare it with the corresponding year-end SHSG-based measure constructed using nominal and market values. Figure OA1 of the Online Appendix shows that most bank–year observations cluster around the 45-degree line. The two measures also capture the shift from predominantly embedded gains in 2021 to embedded losses in 2022 and 2023.[41] They are not identical, as expected, because nominal and carrying amounts may differ due to purchase-price premiums or discounts, interest accruals, impairment, and other carrying-value adjustments. Nevertheless, their close correspondence for most observations gives us confidence that the SHSG-based measure provides a reasonable approximation of the unrealized losses obtained directly from banks' financial statement disclosures. The annual report data therefore provide a direct accounting benchmark, whereas SHSG provides broader bank coverage and the quarterly security-level information required for our main analyses.[42]

[41] The mean (standard deviation; median) was -0.055% $(0.248\%; -0.043\%)$ of total assets in 2021, 0.647% $(0.586\%; 0.455\%)$ in 2022, and 0.303% $(0.385\%; 0.192\%)$ in 2023. Across 2021–2023, the corresponding figures were 0.295% $(0.513\%; 0.078\%)$, with an interquartile range of $[-0.016\%, 0.482\%]$.

[42] The annual report measure used in this validation is also employed in the derecognition analysis reported in Table OA6. That analysis contains 35 banking groups because it additionally requires sufficiently granular disclosure of net income from the derecognition of securities measured at amortized cost. Using this sample, we also examine whether disclosed AC losses are associated with the textual characteristics of banks' annual reports. All textual measures are calculated using the full text of each annual report. Following Loughran and McDonald (2011, 2016), we measure the use of uncertain language and supplement this measure with the Gunning Fog index and the Flesch–Kincaid grade level, with higher values indicating greater textual complexity and lower readability. Among these measures, uncertainty most directly captures whether banks with larger losses use more uncertain language in their annual reports during monetary tightening. We find no systematic tightening-related change in uncertainty or readability associated with AC losses, including in specifications with banking-group and year fixed effects and controls for annual-report length and tone. Table OA16 of the Online Appendix reports the results.

6 Conclusion

This paper investigates how the recognition consequences attached to unrealized losses on banks' amortized-cost securities shape monetary policy transmission to lending in the euro area. Exploiting the sharp 2022–2023 monetary tightening and combining granular supervisory data on security holdings with loan-level credit-register data, we find that banks with larger unrealized losses on amortized-cost securities reduce lending more strongly. A one-percentage-point increase in unrealized losses relative to lagged total assets is associated with an additional decline in loan growth of approximately one percentage point, highlighting the economic relevance of these losses. This relationship remains negative after accounting for market-value losses on FVOCI and FVPL securities and observable characteristics of banks' securities portfolios.

We also find no evidence that banks with larger unrealized losses experience a differential contraction in deposit quantities, but they pass through a larger share of policy-rate increases to depositors, a pattern consistent with banks preserving deposit funding by paying more for it. Within banks' amortized-cost portfolios, positions carrying larger losses are less likely to be materially reduced in subsequent periods, indicating selective retention of more loss-exposed positions. Together, these findings are consistent with a recognition-based funding-cost mechanism: as deposit funding reprices upward, the cost of carrying existing positions rises, while selling loss-bearing amortized-cost securities would trigger recognition of those losses, creating incentives to adjust by limiting prospective lending.

Consistent with this mechanism, banks with larger losses also exhibit a greater tightening-related decline in the probability of expanding credit within existing relationships, while the positive pre-tightening association between AC losses and new relationship formation is largely eliminated during tightening. Existing relationships involving banks with larger initial AC losses are also more likely to exit one year later. The negative lending estimates appear concentrated in fixed-rate and longer-maturity credit, with the corresponding estimates for floating-rate and shorter-maturity credit statistically indistinguishable from zero, a pattern

consistent with banks limiting additional fixed-rate exposure and longer-term credit commitments. Further supporting this interpretation, both deposit-rate pass-through and the lending response are stronger among banks relying more heavily on uninsured deposits, whereas the lending response is attenuated among banks with larger liquidity buffers and more extensive interest-rate hedging.

The lending adjustment is also not evenly distributed across borrowers. It is more pronounced for smaller firms, which generally depend more heavily on bank financing and have more limited access to market-based finance. We also find lower growth in total bank borrowing among firms more exposed to banks with larger unrealized losses, consistent with incomplete substitution across lenders.

Overall, these findings provide novel evidence on the role of accounting recognition in shaping monetary policy transmission, with implications for financial stability. Although amortized-cost accounting defers recognition of interest-rate-driven market-value losses, it does not fully shield banks from the economic consequences of such losses when funding conditions change. Our evidence is consistent with the prospect of recognizing these losses influencing deposit pricing and lending decisions even while the losses remain unrecognized in earnings and total equity and do not mechanically reduce regulatory capital. The additional lending contraction we document is not necessarily undesirable, because restraining credit and aggregate demand is an intended component of monetary tightening. However, its policy relevance lies in its uneven incidence: the same policy-rate increase can generate different lending responses across banks and borrowers, even when the aggregate contraction is consistent with price stability objectives. Our findings therefore do not imply that monetary tightening should be avoided or that amortized-cost accounting should be changed. Rather, they highlight the importance of monitoring unrealized losses on amortized-cost securities, along with securities-portfolio maturity, interest-rate hedging, liquidity buffers, and funding structure, particularly when rapid interest-rate changes leave banks with limited time to adjust their balance sheets.

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A Variable Definitions

Variable	Definition
	Lending and relationship outcomes
Loan growth	One hundred times the change in the natural logarithm of the outstanding credit supplied by banking group i to borrowing firm j from $t-1$ to t. (*Source*: AnaCredit)
Loan expansion	Indicator equal to one if the outstanding credit supplied by banking group i to borrowing firm j increases from quarter $t-1$ to quarter t within an existing bank–borrower relationship, and zero otherwise. (*Source*: AnaCredit)
New bank–borrower relationship	Indicator equal to one if a firm that was not observed borrowing in the preceding quarter enters the credit register or if a firm already borrowing in the preceding quarter begins borrowing from an additional banking group, and zero otherwise. (*Source*: AnaCredit)
Bank–borrower relationship exit	Indicator equal to one if a bank–borrower relationship observed in Q2 2022 is no longer observed in Q2 2023, and zero otherwise. (*Source*: AnaCredit)
Borrowing growth	One hundred times the change in the natural logarithm of borrowing firm j's total outstanding credit across all banking groups observed in AnaCredit from quarter $t-1$ to quarter t. (*Source*: AnaCredit)
	Deposit outcomes
Deposit growth	One hundred times the change in the natural logarithm of the banking group's total deposits from quarter $t-1$ to quarter t. (*Source*: ECB Supervisory Statistics)
Total deposits	Natural logarithm of the banking group's total deposits. (*Source*: ECB Supervisory Statistics)
Deposit Beta	Constructed measure of the pass-through from changes in the ECB policy rate to the volume-weighted interest rate paid by banking group i on demand deposits, deposits redeemable at notice, and term deposits. Deposit volumes are used as weights. (*Source*: ECB Supervisory Statistics)
	Security-level variables
Material position reduction	Indicator equal to one if, in the following quarter, the nominal value of a bank–security position disappears entirely or declines by at least 5%, provided that the amortized-cost security has at least two quarters remaining to contractual maturity. Reductions attributable to reclassification across accounting categories are excluded. (*Source*: SHSG database)
AC loss ratio	Security-level unrealized loss on an AC security, calculated as the nominal value of the bank–security position minus its market value, divided by its nominal value. Positive values indicate losses and negative values indicate gains. (*Source*: SHSG database)

Highly liquid	Indicator equal to one for government bonds and zero for the remaining securities in the AC portfolio. (*Source*: SHSG database)
Residual maturity	Natural logarithm of the number of days from the end of quarter t to the security's contractual maturity date. (*Source*: SHSG database)
Nominal security position	Natural logarithm of the nominal value of the securities held by a banking group in a given security at the end of the quarter. (*Source*: SHSG database)
	Securities-loss and monetary-policy variables
AC losses	Stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. These security-level gaps are computed at the individual-security level and then aggregated across the banking group's AC portfolio, divided by the group's total assets in the preceding quarter, and multiplied by 100. Positive values indicate losses, while negative values indicate gains. (*Source*: SHSG database and ECB Supervisory Statistics)
FVOCI losses	Stock measure of the nominal-minus-market-value gap on securities measured at fair value through other comprehensive income. The measure is constructed in the same manner as *AC losses*: security-level nominal-minus-market-value gaps are aggregated across the banking group's FVOCI portfolio, scaled by total assets in the preceding quarter, and multiplied by 100. Positive values indicate losses, while negative values indicate gains. (*Source*: SHSG database and ECB Supervisory Statistics)
FVPL losses	Stock measure of the nominal-minus-market-value gap on securities measured at fair value through profit or loss. The measure is constructed in the same manner as *AC losses*: security-level nominal-minus-market-value gaps are aggregated across the banking group's FVPL portfolio, scaled by total assets in the preceding quarter, and multiplied by 100. Positive values indicate losses, while negative values indicate gains. (*Source*: SHSG database and ECB Supervisory Statistics)
Initial AC losses	*AC losses* measured in 2022Q2, immediately before the first ECB policy-rate increase in July 2022. (*Source*: SHSG database and ECB Supervisory Statistics)
MP tightening	Indicator equal to one from 2022Q3 onward, following the beginning of the ECB monetary-policy tightening cycle in July 2022, and zero otherwise. (*Source*: ECB Key Interest Rates)
Market repricing	Indicator equal to one from 2022Q2 onward, capturing the market repricing that preceded the first ECB policy-rate increase in July 2022, and zero otherwise. (*Source*: Authors' definition)
	Bank characteristics
Distance to MDA	Difference, in percentage points, between the banking group's CET1 capital ratio and the applicable capital-ratio threshold that triggers restrictions under the Maximum Distributable Amount. (*Source*: ECB Supervisory Statistics)
ROA	Ratio of net income to total assets, expressed as a percentage. (*Source*: ECB Supervisory Statistics)

Bank size	Natural logarithm of the banking group i's total assets. (*Source*: ECB Supervisory Statistics)
CIR	Ratio of operating expenses to operating income, expressed as a percentage. (*Source*: ECB Supervisory Statistics)
NPL	Ratio of non-performing loans to gross loans, expressed as a percentage. (*Source*: ECB Supervisory Statistics)
Cash	Ratio of cash and balances held at the central bank to total assets, expressed as a percentage. (*Source*: ECB Supervisory Statistics)
RWA	Ratio of risk-weighted assets to total assets, expressed as a percentage. (*Source*: ECB Supervisory Statistics)
LCR	Ratio of the stock of high-quality liquid assets to total net cash outflows over the following 30 calendar days, expressed as a percentage (*Source*: ECB Supervisory Statistics)
Uninsured Deposits	Ratio of wholesale uninsured deposits to total assets, expressed as a percentage (*Source*: ECB Supervisory Statistics)
High uninsured	Indicator equal to one if the banking group's uninsured-deposit measure at year-end 2021 exceeds the median across sample banking groups, and zero otherwise. (*Source*: ECB Supervisory Statistics)
AC hedging	Amount of interest-rate derivatives used to hedge securities measured at amortized cost, scaled by the banking group's total assets and expressed as a percentage. (*Source*: SHSG database and ECB Supervisory Statistics)
Borrower characteristics and firm-level exposure	
Borrower Size	Natural logarithm of the number of employees of a borrowing firm j. (*Source*: AnaCredit)
High AC–loss exposure	Time-varying shift-share-style indicator constructed using each firm's lender shares fixed in 2021Q4 and banks' quarter-specific positions in the AC-loss distribution. The indicator equals one when banks in the top quartile of the AC-losses-to-total-assets distribution in quarter $t-1$ accounted for more than 50% of the firm's total borrowing in 2021Q4, and zero otherwise. (*Sources*: AnaCredit, SHSG database, and ECB Supervisory Statistics)

Table 1: Distribution of observations, banks, firms, and bank–firm relationships by bank country.

This table reports the distribution of observations, banks, firms, and bank–firm relationships by the reporting bank's country, identified by two-letter ISO country codes. Throughout the table, bank refers to the consolidated banking group used in the empirical analyses. *No. Obs* denotes the number of bank–firm–quarter observations; *No. Banks* denotes the number of unique reporting banking groups; *No. Firms* denotes the number of distinct borrowing firms; *No. Relationships* denotes the number of unique banking-group–firm pairs; and % denotes each country's share of total bank–firm–quarter observations. The total row reports sample-wide counts. Because a firm may borrow from banking groups located in more than one country, the country-level numbers of firms need not sum to the sample-wide number of distinct firms. Percentages are rounded to two decimal places.

Country	No. Obs	No. Banks	No. Firms	No. Relationships	%
AT	11,325	7	2,370	3,274	0.21
BE	672	5	478	483	0.01
CY	516	2	163	163	0.01
DE	87,423	15	15,946	18,656	1.64
EE	45	1	10	10	0.00
ES	1,767,499	10	135,839	326,845	33.22
FI	75,496	3	7,369	14,827	1.42
FR	1,490,602	8	167,040	290,259	28.02
GR	246	4	55	69	0.00
IE	5,066	3	630	1,163	0.10
IT	1,779,530	12	153,049	345,147	33.45
LT	60	1	18	18	0.00
LU	2,176	2	754	754	0.04
LV	114	1	28	28	0.00
MT	51	1	13	13	0.00
NL	20,621	4	5,896	6,383	0.39
PT	78,109	2	12,966	15,630	1.47
SI	285	1	118	118	0.01
Total	**5,319,836**	**82**	**411,965**	**1,023,840**	**100.00**

Table 2: Descriptive statistics.

This table reports summary statistics for the variables used in the main empirical analyses. Panels A–E report statistics for, respectively, the bank–firm–quarter lending sample, the bank–quarter deposit sample, the bank–security–quarter position-reduction sample, the firm–quarter borrowing sample, and the bank–firm relationship-transition sample. Statistics are calculated using the relevant baseline estimation sample for each analysis. We report the number of observations (N), mean, standard deviation (SD), and the 25th, 50th, and 75th percentiles ($p25$, $p50$, and $p75$, respectively). All continuous variables are winsorized at the 2.5% and 97.5% levels. Residual maturity is reported in days for readability but enters the regressions as its natural logarithm. Appendix A provides detailed definitions, units, and transformations.

Variable	N	Mean	SD	p25	p50	p75
Panel A: Bank–firm–quarter sample						
Loan growth (%)	5,319,836	-5.001	14.666	-8.860	-4.636	-0.792
Loan expansion (0/1)	5,319,836	0.121	0.326	0.000	0.000	0.000
New bank − borrower relationship (0/1)	18,327,857	0.032	0.178	0.000	0.000	0.000
MP_Tightening (0/1)	5,319,836	0.563	0.495	0.000	1.000	1.000
AC losses (%)	5,319,836	0.255	0.469	-0.011	0.045	0.468
FVOCI losses (%)	5,243,951	0.067	0.187	-0.020	0.020	0.103
FVPL losses (%)	5,243,951	0.024	0.093	-0.013	0.003	0.034
Distance to MDA (%)	5,319,836	6.751	2.724	4.372	6.310	9.089
ROA (%)	5,319,836	0.324	0.255	0.115	0.249	0.470
Bank size (log)	5,319,836	25.751	1.120	24.777	25.288	26.486
CIR (%)	5,319,836	62.168	12.432	51.511	61.186	71.004
NPL (%)	5,319,836	2.958	1.507	1.540	2.486	3.770
Cash (%)	5,319,836	15.189	5.425	11.602	15.799	20.761
RWA (%)	5,319,836	36.422	7.678	29.592	34.815	43.689
Uninsured deposits (%)	4,794,702	42.640	16.637	30.416	42.125	51.665
LCR (%)	5,319,836	201.454	52.906	160.598	189.093	232.530
AC hedging (%)	5,248,575	0.481	1.178	0.000	0.011	0.296
Borrower size (log)	4,524,581	2.377	1.627	1.386	2.302	3.367
Panel B: Bank–quarter sample						
Deposit growth (%)	503	-0.288	5.889	-3.090	0.167	2.466
Total deposits (log)	503	25.048	1.439	24.313	24.967	26.075
Deposit beta (%)	330	19.755	55.229	1.000	3.268	20.767
Panel C: Bank–security–quarter sample						
Material position reduction (0/1)	215,750	0.089	0.284	0.000	0.000	0.000
AC loss ratio	215,750	0.024	0.064	-0.001	0.000	0.038
Highly liquid (0/1)	215,750	0.345	0.475	0.000	0.000	1.000
Residual maturity (days)	215,750	3,374	6,428	287	1,247	2,469
Market_Repricing (0/1)	215,750	0.637	0.480	0.000	1.000	1.000
Panel D: Firm–quarter sample						
Borrowing growth (%)	7,580,437	-4.650	10.558	-7.507	-3.848	-1.228
High AC − loss exposure (0/1)	7,580,437	0.031	0.174	0.000	0.000	0.000
Panel E: Bank–firm relationship-exit sample						
Bank − firm relationship exit (0/1)	792,807	0.142	0.348	0.000	0.000	0.000
Initial AC losses (%)	792,807	0.084	0.190	-0.001	0.027	0.239

Table 3: Valuation losses across accounting classifications and bank lending during the 2022–2023 monetary policy tightening cycle.

This table analyzes the relationship between banks' valuation losses and bank lending across accounting classifications during the 2022–2023 monetary tightening cycle. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost, *FVOCI losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at fair value through other comprehensive income, and *FVPL losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at fair value through profit or loss. Columns (1)–(2) report specifications including *AC losses*, columns (3)–(4) report specifications including *FVOCI losses*, columns (5)–(6) report specifications including *FVPL losses*, and columns (7)–(8) include all three loss measures jointly. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are omitted from the table for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth							
	AC losses		**FVOCI losses**		**FVPL losses**		**Joint specifications**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.2763***	-1.1673**					-1.1935***	-1.1024***
	(0.373)	(0.472)					(0.344)	(0.406)
$FVOCI\ losses_{t-1} \times MP_Tightening_t$			-3.2346***	-3.4151***			-2.7531***	-2.9835***
			(0.658)	(0.663)			(0.745)	(0.722)
$FVPL\ losses_{t-1} \times MP_Tightening_t$					-1.3449	-2.5266	-0.3415	-0.6329
					(1.233)	(1.671)	(1.292)	(1.811)
$AC\ losses_{t-1}$	1.0059**	0.8995*					0.9721***	0.9225***
	(0.429)	(0.488)					(0.346)	(0.343)
$FVOCI\ losses_{t-1}$			3.6517***	3.8125***			3.4484***	3.7017***
			(0.773)	(0.681)			(0.928)	(0.842)
$FVPL\ losses_{t-1}$					0.6266	0.9523	-0.2541	-0.5658
					(1.204)	(1.451)	(1.327)	(1.659)
N	5,143,159	5,143,155	5,143,159	5,143,155	5,143,159	5,143,155	5,143,159	5,143,155
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls × $MP_Tightening_t$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower–quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country–quarter FE	No	Yes	No	Yes	No	Yes	No	Yes
Banking group–borrower FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59

Table 4: Valuation losses across accounting classifications and loan expansion within existing bank–borrower relationships during the 2022–2023 monetary policy tightening cycle.

This table examines the relationship between banks' valuation losses and loan expansion within existing bank–borrower relationships during the 2022–2023 monetary policy tightening cycle. The dependent variable is *Loan expansion*, an indicator equal to one when the outstanding credit amount within an existing bank–borrower relationship increases from $t-1$ to t, and zero otherwise. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost, *FVOCI losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at fair value through other comprehensive income, and *FVPL losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at fair value through profit or loss. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in the regressions but are not displayed in the table for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan expansion			
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-0.0147**	-0.0130**	-0.0129**	-0.0102*
	(0.006)	(0.006)	(0.006)	(0.006)
$FVOCI\ losses_{t-1} \times MP_Tightening_t$	-0.0053	-0.0084	-0.0186*	-0.0123
	(0.011)	(0.011)	(0.011)	(0.011)
$FVPL\ losses_{t-1} \times MP_Tightening_t$	0.0070	0.0101	0.0311*	0.0210
	(0.018)	(0.029)	(0.018)	(0.029)
$AC\ losses_{t-1}$	0.0059	0.0087	0.0097	0.0091
	(0.008)	(0.007)	(0.008)	(0.006)
$FVOCI\ losses_{t-1}$	-0.0041	0.0023	-0.0006	-0.0007
	(0.011)	(0.010)	(0.010)	(0.010)
$FVPL\ losses_{t-1}$	-0.0211	-0.0377	-0.0283	-0.0393
	(0.024)	(0.029)	(0.025)	(0.031)
N	5,243,951	5,243,949	5,143,159	5,143,155
Controls	Yes	Yes	Yes	Yes
Controls $\times\ MP_Tightening_t$	Yes	Yes	Yes	Yes
Borrower–quarter FE	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	No	No
Country–quarter FE	No	Yes	No	Yes
Banking group–borrower FE	No	No	Yes	Yes
R^2	0.49	0.49	0.65	0.65

Table 5: Unrealized losses, security liquidity, and material reductions in amortized-cost security positions during the 2022–2023 monetary policy tightening cycle.

This table examines the relationship between unrealized losses and the probability that a bank's position in an amortized-cost security is materially reduced in the following quarter. The unit of observation is the bank–security–quarter, and the sample is restricted to securities measured at amortized cost. The dependent variable is *Material position reduction*, an indicator equal to one if, in the following quarter, the nominal value of a bank–security position either disappears entirely or declines by at least 5%, provided that the security has at least two quarters remaining to contractual maturity and that the decline is not driven by a reclassification across accounting categories. $Market_Repricing$ is a dummy variable that equals one from 2022Q2 onward, capturing the market repricing that preceded the first ECB policy-rate increase in July 2022. $MP_Tightening$ is a dummy variable that equals one from 2022Q3 onward, and zero otherwise. *AC loss ratio* denotes the security-level unrealized loss on an amortized-cost security, scaled by the nominal value of the bank–security position. *Highly liquid* is an indicator for government bonds, which serve as a proxy for more liquid securities. Column (1) reports the baseline market-repricing specification. Column (2) augments this specification with interactions among *AC loss ratio*, $Market_Repricing$, and *Highly liquid*. Column (3) instead defines the post period based on the implementation of ECB policy tightening beginning in 2022Q3. Column (4) reports a dynamic specification in which *AC loss ratio* is interacted with quarter indicators; 2021Q3 is the omitted quarter. The regressions include the natural logarithms of residual maturity and nominal security position as controls, together with issuer-sector and banking group-quarter fixed effects. The specifications are estimated as linear probability models. The table reports heteroskedasticity-robust standard errors, clustered at the banking group level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Material position reduction$_{t+1}$			
	(1)	(2)	(3)	(4)
$AC\ loss\ ratio_t \times Market_Repricing_t$	-0.398***	-0.418**		
	(0.116)	(0.174)		
$AC\ loss\ ratio_t \times Market_Repricing_t \times Highly\ liquid_t$		0.0497		
		(0.195)		
$AC\ loss\ ratio_t \times MP_Tightening_t$			-0.225*	
			(0.123)	
$AC\ loss\ ratio_t \times 2021Q4$				-0.168
				(0.136)
$AC\ loss\ ratio_t \times 2022Q1$				0.162
				(0.346)
$AC\ loss\ ratio_t \times 2022Q2$				-0.447***
				(0.163)
$AC\ loss\ ratio_t \times 2022Q3$				-0.402***
				(0.137)
$AC\ loss\ ratio_t \times 2022Q4$				-0.391**
				(0.158)
$AC\ loss\ ratio_t \times 2023Q1$				-0.459**
				(0.187)
$AC\ loss\ ratio_t \times 2023Q2$				-0.271*
				(0.137)
$AC\ loss\ ratio_t$	0.291**	0.341*	0.130	0.286**
	(0.141)	(0.204)	(0.134)	(0.137)
N	215,750	215,750	215,750	215,750
Pairwise interaction terms	No	Yes	No	No
Residual maturity	Yes	Yes	Yes	Yes
Nominal security position	Yes	Yes	Yes	Yes
Issuer-sector FE	Yes	Yes	Yes	Yes
Banking group-quarter FE	Yes	Yes	Yes	Yes
R^2	0.15	0.15	0.15	0.15

Table 6: Unrealized losses on amortized-cost securities and deposit funding and deposit pricing during the 2022–2023 monetary policy tightening cycle.

This table examines the relationship between banks' unrealized losses on amortized-cost securities and deposit funding and deposit pricing during the 2022–2023 monetary policy tightening cycle. The dependent variables are *Deposit growth*, *Total deposits*, and *Deposit beta*. $MP_Tightening$ is a dummy variable that equals one after the start of the ECB monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. *High uninsured* is an indicator equal to one for banks with above-median uninsured wholesale deposits, measured using year-end 2021 values prior to the onset of monetary tightening. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in the regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Deposit growth	**Total deposits**	**Deposit beta**	
			Baseline	**High uninsured**
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-0.4518	0.0190	0.4647**	0.1459
	(0.890)	(0.0225)	(0.220)	(0.124)
$AC\ losses_{t-1} \times MP_Tightening_t \times High\ uninsured$				0.6182*
				(0.356)
$AC\ losses_{t-1}$	-0.3330	-0.0307	-0.3865**	-0.2121*
	(1.128)	(0.027)	(0.166)	(0.113)
N	503	503	330	330
Pairwise interaction terms	No	No	No	Yes
Controls	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
R^2	0.48	0.99	0.66	0.68

Table 7: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: The role of uninsured deposit base and liquidity buffers.

This table examines how the relationship between unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle varies with banks' deposit base and liquidity buffers. Uninsured deposit base is measured using uninsured wholesale deposits as a percentage of total assets at year-end 2021, before the onset of monetary tightening (*Uninsured deposits*). Liquidity buffers are measured by the liquidity coverage ratio (*LCR*), defined as the stock of high-quality liquid assets relative to total net cash outflows over the following 30 calendar days. The dependent variable is *Loan growth*. *MP_Tightening* is a dummy variable equal to one after the start of the monetary policy tightening cycle in July 2022, and zero otherwise. Columns (1)–(3) examine uninsured deposit base, while columns (4)–(6) examine liquidity buffers. Following Gomez et al. (2021), all control variables and their interactions with *MP_Tightening* are included in the regressions but omitted from the table for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth					
	Uninsured deposit base			**Liquidity buffers**		
	(1)	(2)	(3)	(4)	(5)	(6)
$AC\ losses_{t-1} \times MP_Tightening_t$	2.0537	1.2649	1.6658	-6.5091***	-5.3225***	-5.5526***
	(1.722)	(1.379)	(1.765)	(1.579)	(1.879)	(1.529)
$AC\ losses_{t-1} \times MP_Tightening_t \times Uninsured\ deposits_{pre}$	-0.0786**	-0.0564*	-0.0706*			
	(0.038)	(0.030)	(0.039)			
$AC\ losses_{t-1} \times MP_Tightening_t \times LCR_{t-1}$				0.0248***	0.0201***	0.0188***
				(0.007)	(0.007)	(0.006)
$AC\ losses_{t-1}$	-2.9547*	-1.9758	-2.7129*	6.0077***	5.2736***	6.6830***
	(1.689)	(1.416)	(1.604)	(1.441)	(1.618)	(1.259)
LCR_{t-1}				0.0054	0.0051	0.0081
				(0.007)	(0.008)	(0.007)
N	4,794,702	4,794,702	4,783,311	5,319,836	5,319,834	5,216,716
Pairwise interaction terms	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	No	Yes	Yes	No
Country-quarter FE	No	Yes	No	No	Yes	No
Banking group-borrower FE	No	No	Yes	No	No	Yes
R^2	0.42	0.42	0.56	0.42	0.42	0.58

Table 8: Interest-rate hedging, unrealized losses on amortized-cost securities, and bank lending during the 2022–2023 monetary policy tightening cycle.

This table examines whether interest-rate hedging attenuates the relationship between unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle. The dependent variable is *Loan growth* in columns (1)–(2) and *Loan expansion* in columns (3)–(4). $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC hedging* captures the extent to which interest-rate derivatives are used to hedge amortized-cost securities relative to total assets and is expressed in percentage points. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in the regressions but omitted from the table for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. Appendix A provides detailed variable definitions.

	Loan growth		**Loan expansion**	
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.1581**	-1.0158**	-0.0218***	-0.0251***
	(0.511)	(0.509)	(0.007)	(0.007)
$AC\ losses_{t-1} \times MP_Tightening_t \times AC\ Hedging_{t-1}$	1.4549**	1.3730**	0.0381**	0.0391**
	(0.725)	(0.608)	(0.018)	(0.019)
$AC\ losses_{t-1}$	0.5080	0.4910	0.0037	0.0085
	(0.582)	(0.586)	(0.010)	(0.009)
$AC\ Hedging_{t-1}$	0.1016	0.1675	0.0026	0.0017
	(0.126)	(0.117)	(0.002)	(0.003)
Change in the *AC losses* slope	-0.457	-0.362	-0.0033	-0.0064
during tightening at average hedging	(0.636)	(0.620)	(0.010)	(0.010)
N	5,216,716	5,216,712	5,248,575	5,135,678
Pairwise interaction terms	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Controls $\times\ MP_Tightening_t$	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes
Banking group FE	Yes	No	Yes	No
Banking group-borrower FE	No	Yes	No	Yes
R^2	0.42	0.59	0.49	0.64

Table 9: Unrealized losses on amortized-cost securities and the allocation of credit across loan interest-rate type and maturity during the 2022–2023 monetary policy tightening cycle.

This table examines whether the relationship between unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle varies by loan interest-rate type and maturity. Panel A reports results separately for fixed-rate and floating-rate lending. Panel B reports results separately for long-term and short-term lending, where long-term lending has a maturity greater than three years, and short-term lending has a maturity of three years or less. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are omitted from the table for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth					
	Fixed rate (1)	**Floating rate** (2)	**Fixed rate** (3)	**Floating rate** (4)	**Fixed rate** (5)	**Floating rate** (6)
Panel A: Fixed-rate versus floating-rate lending						
$AC\ losses_{t-1} \times MP_Tightening_t$	-0.9656***	-0.7722	-0.7245**	-0.5702	-0.9970***	-0.7552
	(0.311)	(0.575)	(0.307)	(0.662)	(0.306)	(0.662)
$AC\ losses_{t-1}$	0.9787***	-0.5333	0.9462***	-0.5956	1.2147***	0.4230
	(0.309)	(0.656)	(0.303)	(0.669)	(0.298)	(0.610)
N	2,269,454	1,701,590	2,269,450	1,701,588	2,198,069	1,657,199
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls × $MP_Tightening_t$	Yes	Yes	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	Yes	Yes	No	No
Country-quarter FE	No	No	Yes	Yes	Yes	Yes
Banking group-borrower FE	No	No	No	No	Yes	Yes
R^2	0.49	0.43	0.49	0.43	0.66	0.59
Panel B: Long-term maturity versus short-term maturity lending						
	Long-term (1)	**Short-term** (2)	**Long-term** (3)	**Short-term** (4)	**Long-term** (5)	**Short-term** (6)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.2937***	-0.4544	-1.1678***	-0.2320	-1.1703***	-0.3061
	(0.269)	(0.575)	(0.348)	(0.647)	(0.358)	(0.631)
$AC\ losses_{t-1}$	0.7167***	0.0230	0.7380**	-0.0195	0.8101**	-0.0197
	(0.250)	(0.608)	(0.313)	(0.644)	(0.306)	(0.740)
N	2,223,321	1,559,369	2,223,306	1,559,361	2,131,824	1,456,012
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls × $MP_Tightening_t$	Yes	Yes	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	Yes	Yes	No	No
Country-quarter FE	No	No	Yes	Yes	Yes	Yes
Banking group-borrower FE	No	No	No	No	Yes	Yes
R^2	0.48	0.45	0.48	0.45	0.62	0.60

Table 10: Unrealized losses on amortized-cost securities and bank lending to borrowers of different sizes during the 2022–2023 monetary policy tightening cycle.

This table examines whether the relationship between banks' unrealized losses on amortized-cost securities and bank lending varies with borrower size during the 2022–2023 monetary policy tightening cycle. The dependent variable is *Loan growth*. *Borrower size* is measured as the natural logarithm of the number of employees, sourced from the *AnaCredit* database. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are omitted from the table for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth			
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.8836***	-1.6174***	-1.8493***	-1.6271***
	(0.489)	(0.493)	(0.389)	(0.456)
$AC\ losses_{t-1} \times MP_Tightening_t \times Borrower\ size_{t-1}$	0.2963*	0.2789*	0.2265**	0.1926*
	(0.159)	(0.157)	(0.109)	(0.105)
$AC\ losses_{t-1}$	1.0657***	0.9577**	1.7838***	1.5337***
	(0.399)	(0.395)	(0.413)	(0.480)
N	4,524,581	4,524,579	4,434,259	4,434,255
Pairwise interaction terms	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	No	No
Country-quarter FE	No	Yes	No	Yes
Banking group-borrower FE	No	No	Yes	Yes
R^2	0.42	0.42	0.58	0.58

Table 11: Unrealized losses on amortized-cost securities and firm-level borrowing during the 2022–2023 monetary policy tightening cycle.

This table examines whether firms with greater exposure to high-AC-loss banks experienced lower borrowing growth during the 2022–2023 monetary policy tightening cycle. The dependent variable is *Borrowing growth*. $High\ AC\ loss\ exposure_{t-1}$ is a time-varying shift-share-style indicator constructed using firms' lender shares fixed in 2021Q4 and banks' quarter-specific classification in the top quartile of the AC-losses-to-total-assets distribution in quarter $t-1$. It equals one when banks classified in the top quartile in quarter $t-1$ accounted for more than 50% of the firm's total borrowing in 2021Q4, and zero otherwise. Because firms' lender shares are fixed but banks' loss classifications vary by quarter, *High AC loss exposure* can vary within firms over time. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. Bank-level control variables are weighted averages using each bank's share in the firm's total borrowing. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in the regressions but are not tabulated for brevity. The regressions include industry-location-size-quarter fixed effects. Column (2) additionally includes borrower fixed effects. The table reports heteroskedasticity-robust standard errors, clustered at the largest lender level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Borrowing growth	
	(1)	(2)
$High\ AC\ loss\ exposure_{t-1} \times MP_Tightening_t$	-1.6972***	-1.8446***
	(0.413)	(0.353)
$High\ AC\ loss\ exposure_{t-1}$	2.7474***	24.2413***
	(0.618)	(1.072)
N	7,580,437	7,516,439
Controls	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes
Industry-location-size-quarter FE	Yes	Yes
Borrower FE	No	Yes
R^2	0.28	0.51

Table 12: Unrealized losses on amortized-cost securities and new bank-borrower relationships during the 2022–2023 monetary policy tightening cycle.

This table examines how the relationship between banks' unrealized losses on amortized-cost securities and the probability of establishing new bank-borrower relationships changes during the 2022–2023 monetary policy tightening cycle. The dependent variable is $New\ bank-borrower\ relationship$, an indicator equal to one if: i) a new firm that did not have any bank relationships in the previous quarter enters the AnaCredit credit register; or ii) a firm that had one or more bank relationships in the previous quarter starts borrowing from a new bank. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. $AC\ losses$ denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	New bank-borrower relationship		
	(1)	(2)	(3)
$AC\ losses_{t-1} \times MP_Tightening_t$	-0.2301***	-0.2177***	-0.1828***
	(0.047)	(0.045)	(0.031)
$AC\ losses_{t-1}$	0.2664***	0.2294***	0.1985***
	(0.053)	(0.042)	(0.029)
N	18,327,857	12,611,535	5,856,400
Controls	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes
Borrower-quarter FE	No	No	Yes
Industry-location-quarter FE	Yes	No	No
Industry-location-size-quarter FE	No	Yes	No
R^2	0.24	0.33	0.49

Table 13: Unrealized losses on amortized-cost securities and bank-borrower relationship exits during the 2022–2023 monetary policy tightening cycle.

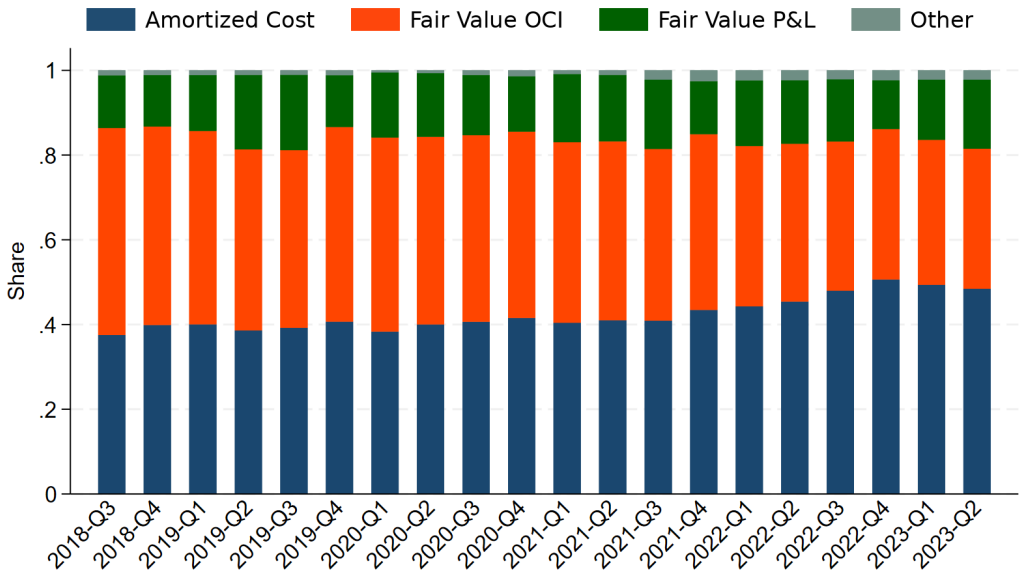
This table examines whether bank–borrower relationships involving banks with larger unrealized losses on amortized-cost securities immediately before monetary tightening are more likely to be absent one year later. The sample contains one observation for each bank–borrower relationship observed in Q2 2022. The dependent variable is $Bank-borrower\ relationship\ exit$, an indicator equal to one if a bank-borrower relationship exists before the tightening episode but is no longer observed in Q2 2023. *Initial AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost at the onset of the monetary tightening cycle (Q2 2022). The regressions follow a collapsed before/after relationship-transition design, in line with Jasova et al. (2021). Columns (1) and (2) include country fixed effects, while columns (3) and (4) exclude them. Columns (2) and (4) include bank-level controls measured at the onset of the tightening cycle. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Bank-borrower relationship exit			
	(1)	(2)	(3)	(4)
Initial AC losses	0.084**	0.088***	0.052*	0.049*
	(0.033)	(0.028)	(0.031)	(0.026)
N	792,807	792,626	792,809	792,628
Bank-level controls	No	Yes	No	Yes
Borrower FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	No	No
R^2	0.48	0.47	0.49	0.48

Figure 1: Accounting classification and maturity composition of euro-area banks' securities portfolios over time

This figure describes the evolution of euro-area banks' securities portfolios. Panel A reports the quarterly distribution of the aggregate nominal value of securities held by banks in the sample across four accounting classifications from 2018Q3 through 2023Q2: amortized cost (AC), fair value through other comprehensive income (FVOCI), fair value through profit or loss (FVPL), and other accounting classifications. The four shares sum to one in each quarter. Panel B reports the annual median of the natural logarithm of the original contractual maturity of securities classified at amortized cost from 2015 through 2023. Original contractual maturity is measured from issuance to contractual maturity.

(a) Accounting classification of securities portfolios



(b) Median original contractual maturity of amortized-cost securities

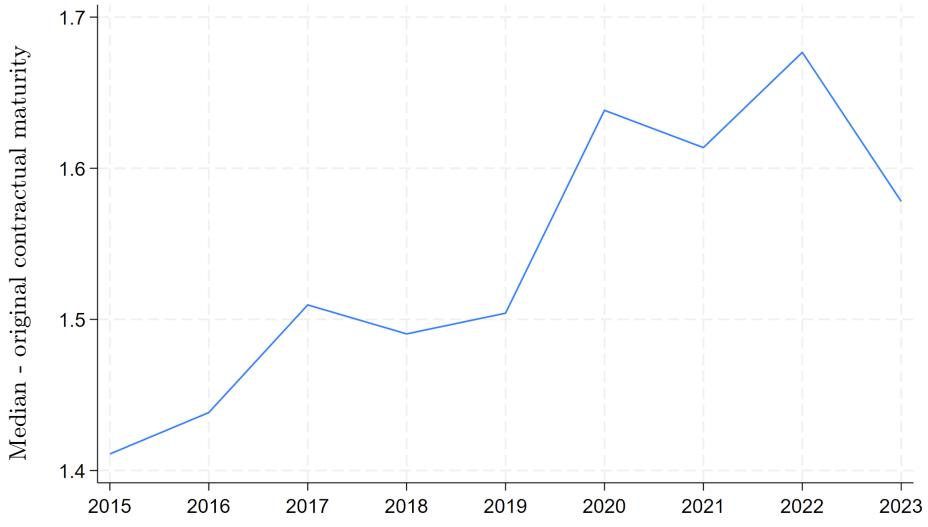
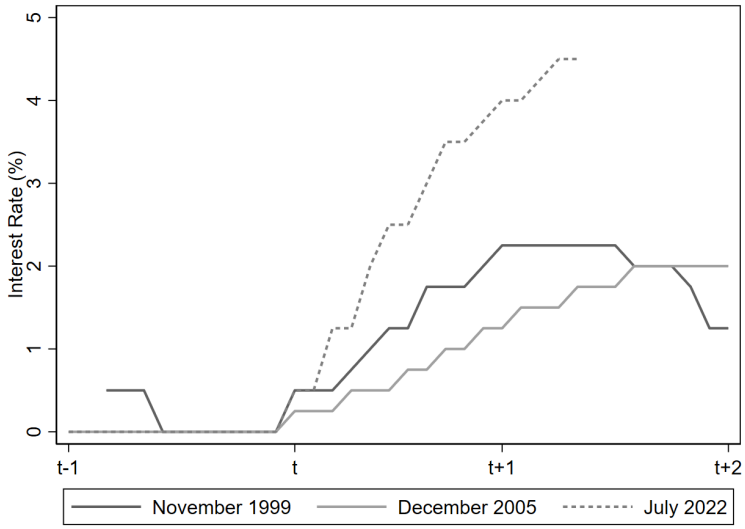


Figure 2: ECB policy-rate expectations and the pace of monetary tightening

Panel A compares changes in the ECB main refinancing operations rate across three monetary policy tightening cycles beginning in November 1999, December 2005, and July 2022. Event time is measured in years, with $t = 0$ denoting the first policy-rate increase in each cycle. Rate changes are measured in percentage points relative to the policy rate immediately before the first increase. Panel B compares the realized ECB deposit facility rate with the policy-rate paths expected by market participants in January and June 2022. Expected rates are obtained from the ECB Survey of Monetary Analysts, while the realized path reports the deposit facility rates subsequently announced by the ECB.

(a) Cumulative policy-rate increases across ECB tightening cycles



(b) Expected and realized policy-rate path during the 2022 tightening cycle

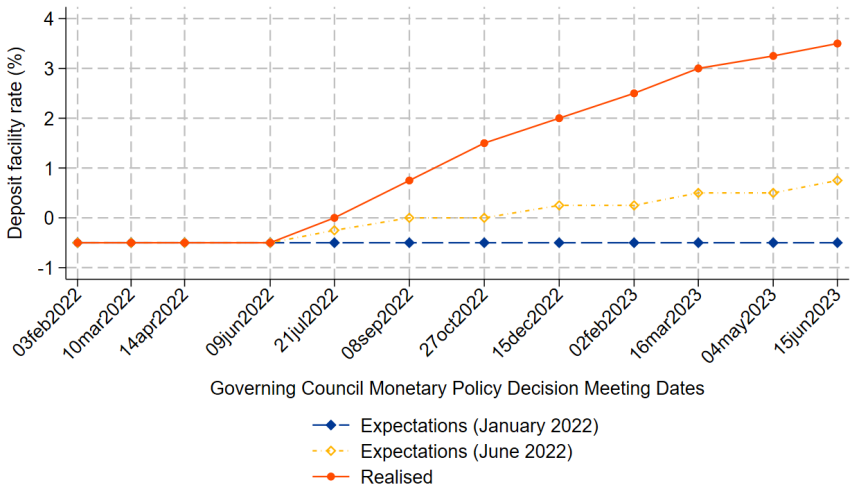
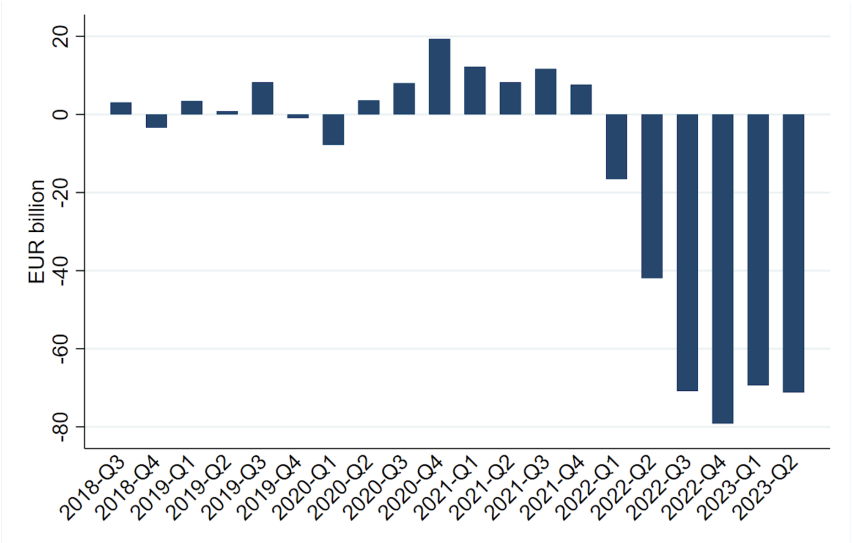


Figure 3: Aggregate market-to-nominal-value gaps in banks' amortized-cost portfolios

This figure provides an overview of the aggregate market-to-nominal-value gap in banks' amortized-cost portfolios across 18 euro-area countries. Panel A displays the evolution of the aggregate gap from 2018Q3 to 2023Q2. Panel B decomposes the aggregate gap by issuer sector. The gap is calculated as the market value minus the nominal value of securities held at amortized cost. Negative values, therefore, represent unrealized losses, while positive values represent unrealized gains. All amounts are in EUR billions.

(a) Aggregate market-to-nominal-value gap



(b) Decomposition of the aggregate gap by issuer sector

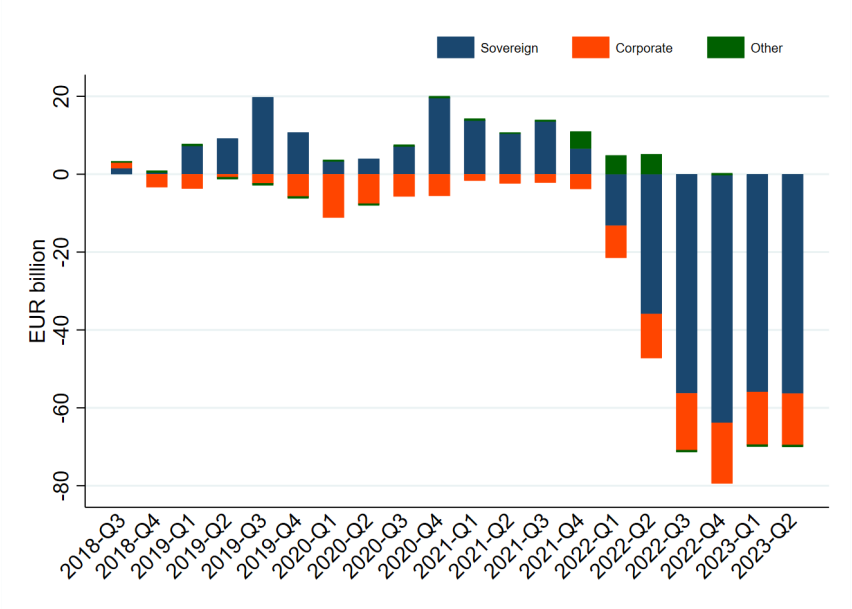
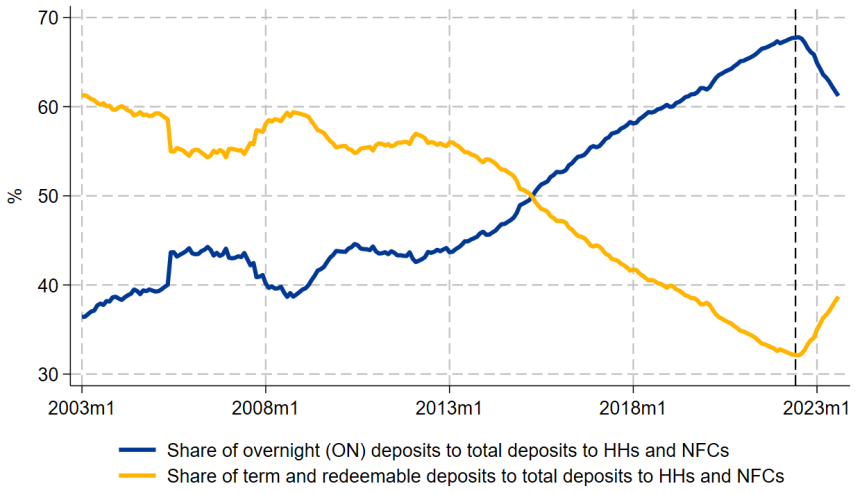


Figure 4: Deposit composition and bank funding costs

This figure describes developments in euro-area deposit composition and bank funding costs. Panel A reports overnight deposits and term and redeemable deposits from euro-area households (HHs) and non-financial corporations (NFCs), expressed as shares of total deposits from euro-area HHs and NFCs held by monetary financial institutions (MFIs), excluding the European System of Central Banks (ESCB). All currencies are included. The vertical dashed line marks the first ECB policy-rate increase in July 2022. Panel B reports the weighted-average costs of deposit and bond funding, expressed as annual percentages. *Sources:* Panel A: ECB Balance Sheet Items statistics; Panel B: authors' calculations.

(a) Overnight versus term and redeemable deposit shares



(b) Weighted-average deposit and bond funding costs

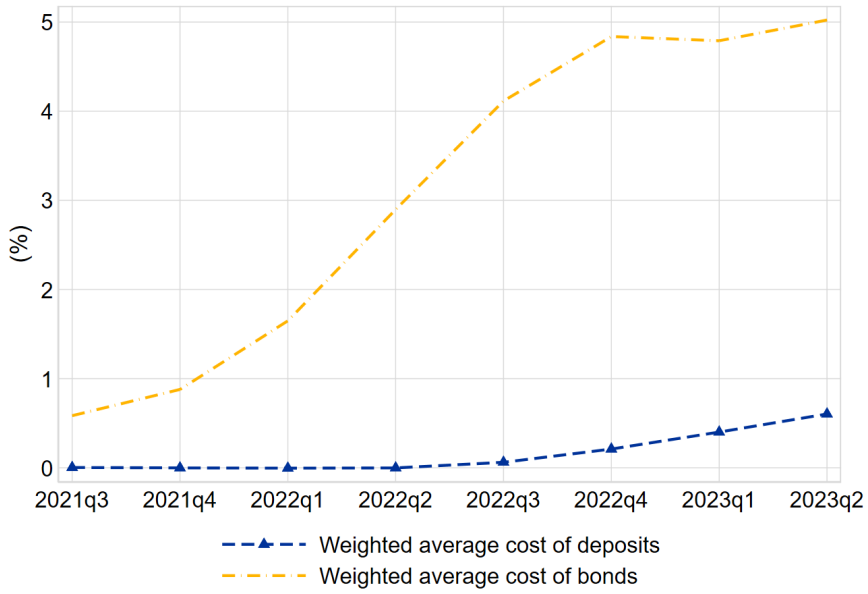
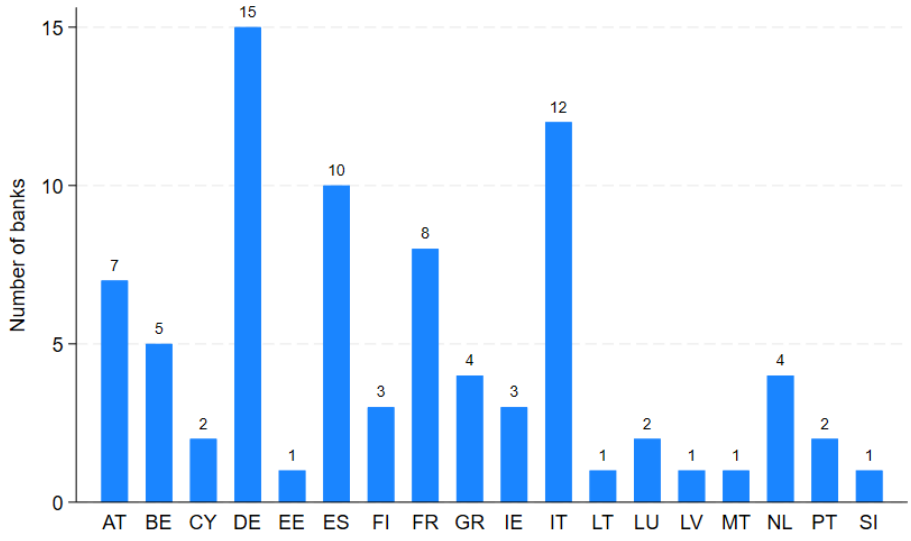


Figure 5: Sample coverage and distribution of unrealized-loss exposure on amortized-cost securities

Panel A displays the number of banks in the sample by country, identified by two-letter ISO country codes. Panel B displays the distribution of unrealized losses on securities held at amortized cost following the onset of monetary policy tightening. The x-axis reports unrealized losses as a percentage of total assets, while the y-axis reports the percentage of banks. Positive values indicate unrealized losses, whereas negative values indicate unrealized gains.

(a) Number of banks by country



(b) Distribution of unrealized-loss exposure following the onset of monetary policy tightening

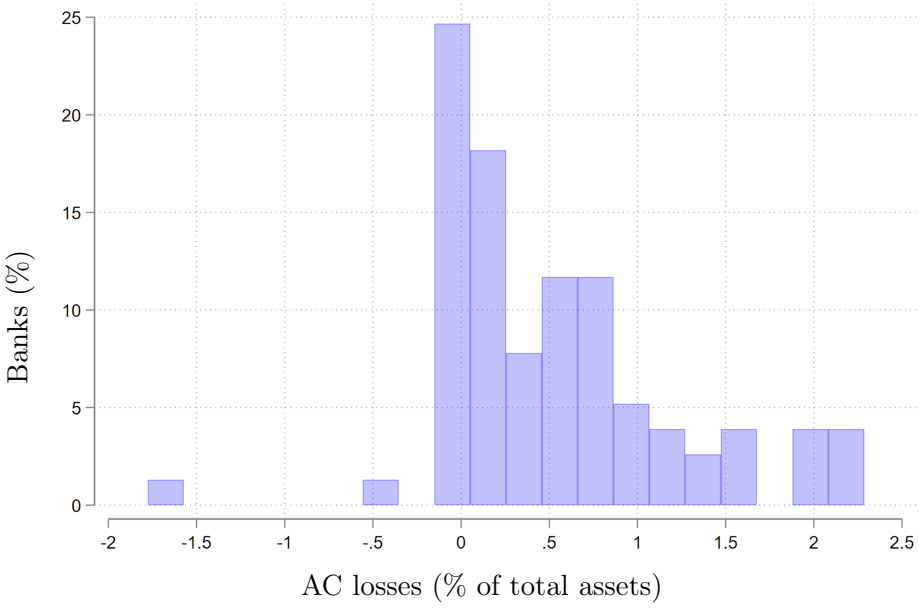


Figure 6: Dynamic effect of unrealized losses on amortized-cost securities on bank lending around the 2022–2023 monetary policy tightening cycle.

This figure plots quarter-specific coefficients from a dynamic specification that interacts banks' unrealized losses on amortized-cost securities with quarter indicators. The dependent variable is *Loan growth*. The coefficients report the change in loan growth associated with a one-percentage-point increase in *AC losses*. The omitted quarter is 2022Q2, the quarter immediately preceding the start of the ECB monetary tightening cycle in July 2022. The vertical whiskers represent the 95% confidence interval.

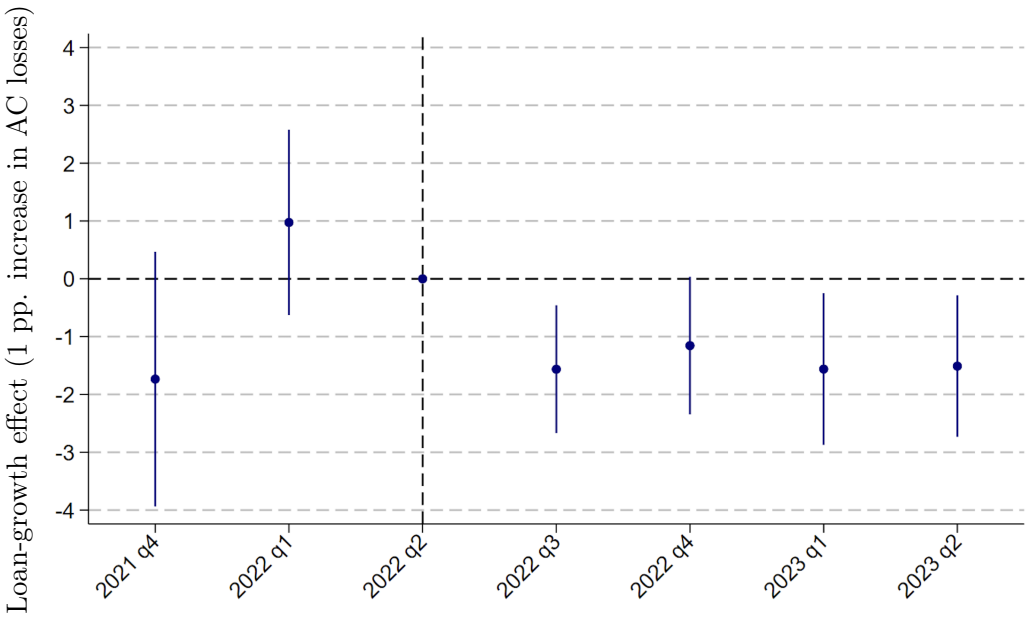


Figure 7: Unrealized losses on amortized-cost securities, bank lending, and uninsured deposit base.

This figure plots the estimated change from the pre-tightening period to the monetary policy tightening period in the relationship between banks' unrealized losses on amortized-cost securities and loan growth, evaluated at different shares of uninsured deposits in total assets. The y-axis reports the change in loan growth associated with a one-percentage-point increase in *AC losses*, relative to the corresponding pre-tightening relationship. The x-axis reports uninsured wholesale deposits as a percentage of total assets. The vertical whiskers report 95% confidence intervals, and the horizontal dashed line denotes zero.

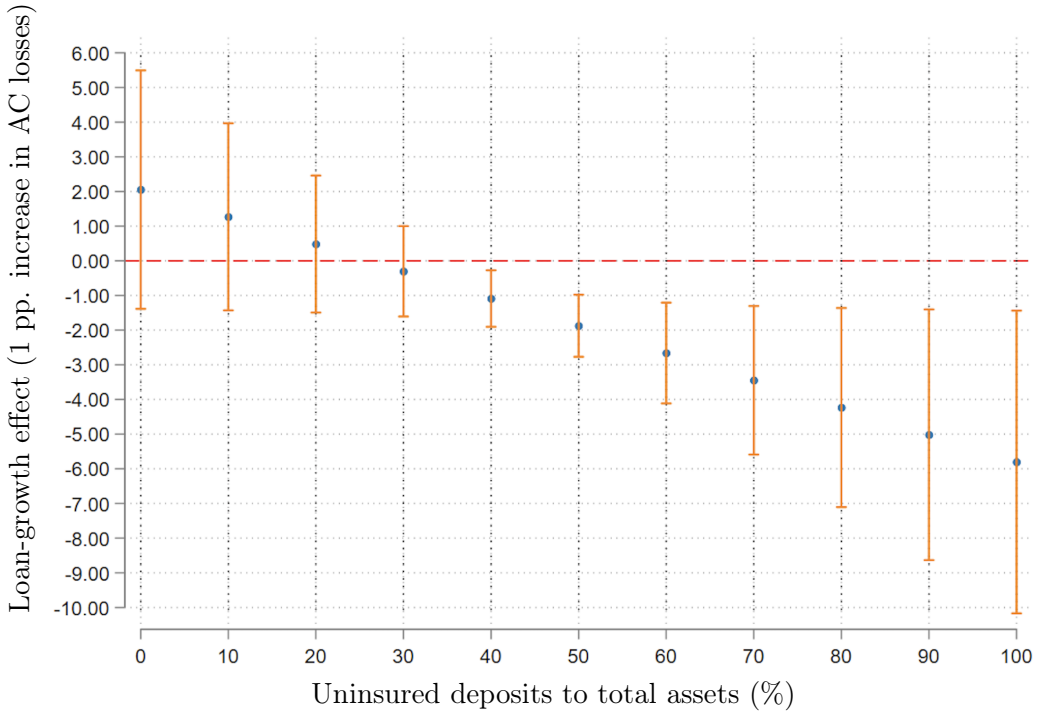
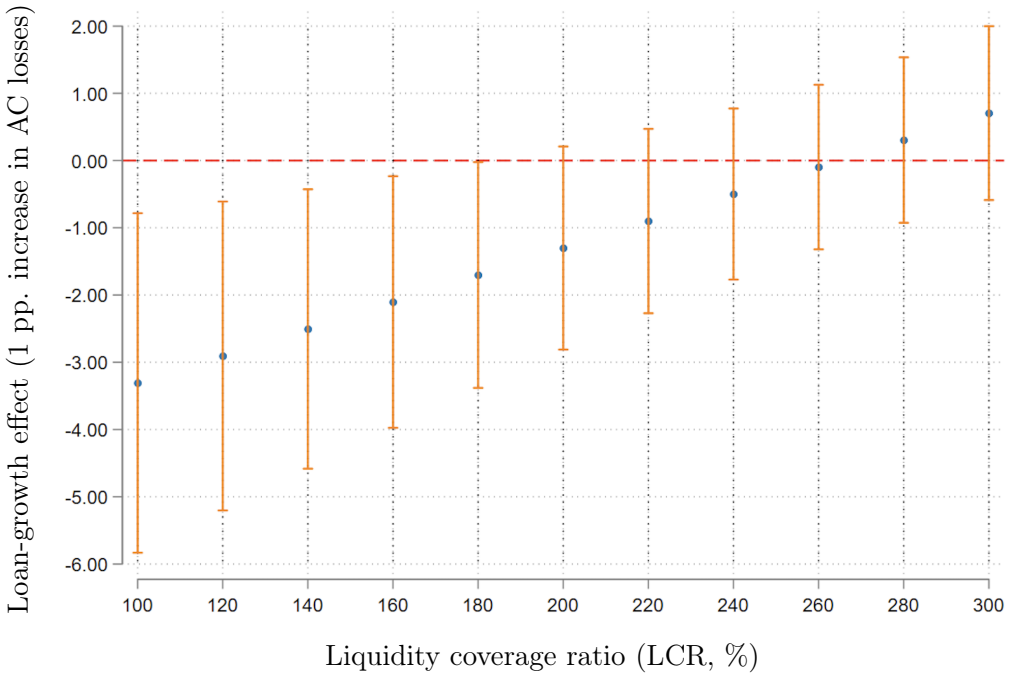


Figure 8: Unrealized losses on amortized-cost securities, bank lending, and liquidity buffers.

This figure plots the estimated change from the pre-tightening period to the monetary policy tightening period in the relationship between banks' unrealized losses on amortized-cost securities and loan growth, evaluated at different levels of the liquidity coverage ratio (LCR). The y-axis reports the change in loan growth associated with a one-percentage-point increase in *AC losses*, relative to the corresponding pre-tightening relationship. The x-axis reports the LCR, defined as the stock of high-quality liquid assets relative to total net cash outflows over the following 30 calendar days and expressed as a percentage. The vertical whiskers report 95% confidence intervals, and the horizontal dashed line denotes zero.



Online Appendix of the Paper

Unrealized Losses on Amortized-Cost Securities and Bank Lending during Monetary Tightening

Overview of Additional Tables and Figures

This Online Appendix presents robustness tests and supplemental analyses referenced throughout the paper. Specifically, it includes the following:

- Table OA1: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: AC-loss-only specifications.
- Table OA2: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Alternative winsorization at the 1% and 99% percentiles.
- Table OA3: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Alternative clustering at the banking-group level.
- Table OA4: Valuation losses and bank lending during the 2022–2023 monetary policy tightening cycle: Robustness to securities characteristics and excluding high FV-loss banks.
- Table OA5: Unrealized losses and material position reductions of amortized-cost securities: Robustness to alternative definitions of material position reduction.
- Table OA6: Unrealized losses on amortized-cost securities and reported derecognition outcomes during the 2022–2023 monetary policy tightening cycle.
- Table OA7: Unrealized losses on amortized-cost securities and realized deposit funding costs during the 2022–2023 monetary policy tightening cycle.
- Table OA8: Unrealized losses on amortized-cost securities and the maturity allocation of credit during the 2022–2023 monetary policy tightening cycle: Alternative maturity thresholds.

- Table OA9: Unrealized losses on amortized-cost securities and bank lending across borrowers with different credit risk during the 2022–2023 monetary policy tightening cycle.

- Table OA10: Bank characteristics and unrealized losses on amortized-cost securities.

- Table OA11: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Covariate-balancing generalized propensity score weighting.

- Table OA12: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Alternative credit-demand controls and single-bank borrowers.

- Table OA13: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Controlling for loan maturity.

- Table OA14: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Loan-exposure-weighted estimates.

- Table OA15: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Changes in the ECB deposit facility rate.

- Table OA16: Unrealized losses on amortized-cost securities and annual-report disclosure characteristics during the 2022–2023 monetary policy tightening cycle.

- Figure OA1: Validation of the SHSG-based measure of losses on amortized-cost securities.

Table OA1: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: AC-loss-only specifications.

This table reports specifications examining the relationship between banks' unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary tightening cycle. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth			
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.0121***	-0.8145*	-1.1950***	-1.0754**
	(0.380)	(0.434)	(0.366)	(0.453)
$AC\ losses_{t-1}$	0.5780	0.5528	0.9595**	0.8415*
	(0.412)	(0.438)	(0.414)	(0.458)
N	5,319,836	5,319,834	5,216,716	5,216,712
Controls	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	No	No
Country-quarter FE	No	Yes	No	Yes
Banking group-borrower FE	No	No	Yes	Yes
R^2	0.42	0.42	0.58	0.59

Table OA2: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Alternative winsorization at the 1% and 99% percentiles.

This table re-estimates the AC-loss-only specifications reported in Table OA1 after winsorizing all continuous variables at the 1st and 99th percentiles, rather than at the 2.5th and 97.5th percentiles used in the baseline analyses. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth			
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-0.7592**	-0.6011	-0.9838***	-0.8637**
	(0.359)	(0.403)	(0.350)	(0.432)
$AC\ losses_{t-1}$	0.3534	0.2837	0.6806*	0.5536
	(0.387)	(0.418)	(0.398)	(0.440)
N	5,319,836	5,319,834	5,216,716	5,216,712
Controls	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	No	No
Country-quarter FE	No	Yes	No	Yes
Banking group-borrower FE	No	No	Yes	Yes
R^2	0.42	0.42	0.58	0.59

Table OA3: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Alternative clustering at the banking-group level.

This table re-estimates the AC-loss-only specifications reported in Table OA1 using standard errors clustered only at the banking-group level. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth			
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.0121**	-0.8145	-1.1950**	-1.0754*
	(0.491)	(0.562)	(0.472)	(0.586)
$AC\ losses_{t-1}$	0.5780	0.5528	0.9595*	0.8415
	(0.533)	(0.567)	(0.535)	(0.594)
N	5,319,836	5,319,834	5,216,716	5,216,712
Controls	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	No	No
Country-quarter FE	No	Yes	No	Yes
Banking group-borrower FE	No	No	Yes	Yes
R^2	0.42	0.42	0.58	0.59

Table OA4: Valuation losses and bank lending during the 2022–2023 monetary policy tightening cycle: Robustness to securities characteristics and excluding high FV-loss banks.

This table analyzes the robustness of the relationship between banks' securities losses and bank lending during the 2022–2023 monetary tightening cycle. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC Losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost, *FVOCI Losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at fair value through other comprehensive income, and *FVPL Losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at fair value through profit or loss. Columns (1)–(2) augment the baseline specification with aggregate securities characteristics (*i.e.*, controls for residual maturity and aggregate volume of the securities held by the banking group, government-security share, and accumulated impairment allowances relative to total assets). Columns (3)–(4) additionally include securities characteristics for the AC portfolio. Columns (5)–(6) exclude banks in the top quartile of fair-value losses. Columns (7)–(8) exclude banks in the top half of fair-value losses. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$AC\ Losses_{t-1} \times MP_Tightening_t$	-1.4519***	-1.4324**	-1.0452**	-0.8131	-1.5278***	-1.6434***	-1.2194***	-1.0503**
	(0.437)	(0.641)	(0.431)	(0.579)	(0.347)	(0.382)	(0.371)	(0.466)
$FVOCI\ Losses_{t-1} \times MP_Tightening_t$	-2.0311**	-2.5525***	-0.9303	-1.4973	-2.8961	-3.3342	-4.7767**	-6.2105**
	(0.948)	(0.852)	(1.001)	(0.948)	(1.794)	(2.030)	(2.038)	(2.596)
$FVPL\ Losses_{t-1} \times MP_Tightening_t$	0.1147	0.3745	-0.6290	-0.0597	-0.9631	-0.7972	4.8736	6.8757
	(1.446)	(2.158)	(2.117)	(2.853)	(1.555)	(2.230)	(4.765)	(4.737)
$AC\ Losses_{t-1}$	0.9884***	1.0154**	1.1420***	1.2348***	1.2057***	1.1539***	1.1533**	0.6929
	(0.364)	(0.465)	(0.363)	(0.458)	(0.249)	(0.245)	(0.449)	(0.624)
$FVOCI\ Losses_{t-1}$	2.2352**	2.6502***	1.1427	1.0370	2.4920*	2.8585*	3.8777**	4.6491**
	(1.115)	(0.928)	(1.144)	(0.866)	(1.428)	(1.567)	(1.570)	(1.837)
$FVPL\ Losses_{t-1}$	-1.7137	-2.0553	-0.6701	-0.2308	-0.4596	-1.3594	-5.8617	-8.0143
	(1.668)	(2.078)	(2.231)	(2.891)	(1.852)	(2.421)	(4.826)	(4.923)
$Distance\ to\ MDA_{t-1}$	0.1054	0.0893	0.1039	0.1103	0.1187	0.0752	-0.0767	-0.1037
	(0.139)	(0.155)	(0.169)	(0.180)	(0.121)	(0.130)	(0.216)	(0.245)
ROA_{t-1}	1.0001	1.4153*	0.8548	1.0596	1.5664*	1.3468	2.6288***	2.0946**
	(0.604)	(0.749)	(0.584)	(0.671)	(0.802)	(0.845)	(0.858)	(0.853)
$Bank\ size_{t-1}$	-5.9399**	-9.2277***	-6.7391**	-11.8086***	-6.7210**	-8.1431***	5.0012	4.0409
	(2.731)	(3.043)	(2.944)	(3.196)	(2.634)	(2.627)	(8.064)	(9.881)
CIR_{t-1}	0.0744***	0.0838***	0.0717***	0.0838***	0.0795***	0.0871***	0.0778***	0.0854***
	(0.013)	(0.014)	(0.011)	(0.013)	(0.016)	(0.016)	(0.017)	(0.020)
NPL_{t-1}	-0.5487*	-0.5097*	-0.7920**	-0.8416**	-0.3600	-0.2904	-0.5872*	-0.3289
	(0.309)	(0.286)	(0.349)	(0.348)	(0.247)	(0.242)	(0.338)	(0.311)
$Cash_{t-1}$	0.1208	0.1701	0.0982	0.2015	0.1826***	0.2258***	0.1055*	0.1810**
	(0.105)	(0.119)	(0.107)	(0.125)	(0.056)	(0.059)	(0.062)	(0.068)
RWA_{t-1}	-0.0515	-0.0282	-0.0692	-0.0073	0.0130	0.0673	0.2001	0.3295
	(0.100)	(0.103)	(0.106)	(0.109)	(0.106)	(0.117)	(0.222)	(0.261)
N	4,952,864	4,952,860	4,898,703	4,898,699	4,258,651	4,258,651	2,922,517	2,922,517
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls × $MP_Tightening_t$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aggregate securities controls	Yes	Yes	Yes	Yes	No	No	No	No
Aggregate securities controls × $MP_Tightening_t$	Yes	Yes	Yes	Yes	No	No	No	No
AC portfolio securities controls	No	No	Yes	Yes	No	No	No	No
AC portfolio securities controls × $MP_Tightening_t$	No	No	Yes	Yes	No	No	No	No
Excl. top quartile FV-loss banks	No	No	No	No	Yes	Yes	No	No
Excl. top half FV-loss banks	No	No	No	No	No	No	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-quarter FE	No	Yes	No	Yes	No	Yes	No	Yes
Banking group-borrower FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.60	0.60	0.60	0.60	0.59	0.59	0.61	0.61

Table OA5: Unrealized losses and material position reductions of amortized-cost securities: Robustness to alternative definitions of material position reduction.

This table examines the robustness of the dynamic relationship between security-level unrealized losses and material position reductions of securities measured at amortized cost to alternative definitions of material position reduction. The unit of observation is the bank–security–quarter. The dependent variable is *Material position reduction*, an indicator equal to one if, in the following quarter, the nominal value of the bank–security position either disappears entirely or declines by at least the threshold indicated in the column heading, provided that the security has at least the indicated number of quarters remaining to contractual maturity. Reductions attributable to reclassifications across accounting categories are excluded. Column (1) uses a 3.5% reduction threshold and requires at least two quarters remaining to maturity. Columns (2)–(4) use a 5% reduction threshold and require at least four, six, and eight quarters remaining to maturity, respectively. *AC loss ratio* denotes the security-level unrealized loss, scaled by the nominal value of the bank–security position. The omitted quarter is 2021Q3. The regressions include the natural logarithms of residual maturity and the nominal value of the security position as controls, together with issuer-sector and banking-group-quarter fixed effects. The table reports heteroskedasticity-robust standard errors, clustered at the banking group level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Material position reduction$_{t+1}$			
	$\geq$ 3.5% reduction 2 quarters (1)	**$\geq$ 5% reduction 4 quarters** (2)	**$\geq$ 5% reduction 6 quarters** (3)	**$\geq$ 5% reduction 8 quarters** (4)
AC loss ratio$_t$ × 2021*Q*4	-0.366	-0.156	-0.140	-0.123
	(0.228)	(0.133)	(0.131)	(0.138)
AC loss ratio$_t$ × 2022*Q*1	-0.109	0.192	0.194	0.190
	(0.380)	(0.334)	(0.317)	(0.312)
AC loss ratio$_t$ × 2022*Q*2	-0.641***	-0.401**	-0.388**	-0.384**
	(0.202)	(0.160)	(0.158)	(0.161)
AC loss ratio$_t$ × 2022*Q*3	-0.604***	-0.339**	-0.291**	-0.259*
	(0.196)	(0.135)	(0.134)	(0.140)
AC loss ratio$_t$ × 2022*Q*4	-0.536**	-0.338**	-0.311**	-0.301*
	(0.211)	(0.151)	(0.150)	(0.159)
AC loss ratio$_t$ × 2023*Q*1	-0.577**	-0.409**	-0.390**	-0.359**
	(0.251)	(0.185)	(0.181)	(0.176)
AC loss ratio$_t$ × 2023*Q*2	-0.369*	-0.241*	-0.237*	-0.233*
	(0.187)	(0.133)	(0.130)	(0.137)
AC loss ratio$_t$	0.418**	0.265*	0.259*	0.259*
	(0.203)	(0.135)	(0.134)	(0.143)
N	215,750	215,750	215,750	215,750
Residual maturity	Yes	Yes	Yes	Yes
Nominal security position	Yes	Yes	Yes	Yes
Issuer-sector FE	Yes	Yes	Yes	Yes
Banking group-quarter FE	Yes	Yes	Yes	Yes
R^2	0.15	0.15	0.15	0.15

Table OA6: Unrealized losses on amortized-cost securities and reported derecognition outcomes during the 2022–2023 monetary policy tightening cycle.

This table examines the relationship between disclosed unrealized losses on securities measured at amortized cost and the likelihood of reporting zero net income from derecognition during the 2022–2023 monetary policy tightening cycle. The dependent variable, *Zero net derecognition income*, is an indicator equal to one when a banking group reports zero net income from the derecognition of securities measured at amortized cost, and zero when it reports a nonzero amount (missing or insufficiently granular disclosures are excluded and not coded as zero). *Disclosed AC losses* denotes the difference between the carrying amount and fair value of securities measured at amortized cost, scaled by total assets and multiplied by 100. All data to construct the variables are collected from banks' annual reports. $MP_Tightening$ is an indicator equal to one in 2022 and 2023, and zero in 2021. Columns (1)–(2) use the balanced 2021–2023 sample. Columns (3)–(4) exclude 2022, the transition year in which monetary tightening began, and therefore compare 2021 with 2023. Bank controls include bank size (natural logarithm of total assets), profitability excluding net income from derecognition of securities measured at amortized cost relative to total assets and multiplied by 100, and the carrying amount of the amortized-cost portfolio scaled by total assets and multiplied by 100. Continuous variables are winsorized at the 2.5th and 97.5th percentiles. The row *Disclosed AC losses during tightening* reports the linear combination of the coefficient on *Disclosed AC losses* and its interaction with $MP_Tightening$. The table reports heteroskedasticity-robust standard errors, clustered at the banking group level, in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. For the linear-combination estimates, bracketed p-values additionally report Webb wild-cluster bootstrap inference using 100,000 replications. Appendix A provides detailed variable definitions.

	Zero net derecognition income			
	2021–2023		**2021 vs. 2023**	
	(1)	(2)	(3)	(4)
$Disclosed\ AC\ losses_t \times MP_Tightening_t$	0.5128**	0.5560***	0.6526***	0.7026***
	(0.201)	(0.197)	(0.148)	(0.165)
$Disclosed\ AC\ losses_t$	-0.3472**	-0.3743**	-0.3414***	-0.3698***
	(0.167)	(0.164)	(0.123)	(0.134)
Disclosed AC losses during tightening	0.1656**	0.1817***	0.3113***	0.3327***
	(0.060)	(0.056)	(0.083)	(0.083)
Wild-cluster bootstrap p-value	[0.033]	[0.007]	[0.011]	[0.005]
N	105	105	70	70
Controls	No	Yes	No	Yes
Banking group FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.65	0.66	0.80	0.80

Table OA7: Unrealized losses on amortized-cost securities and realized deposit funding costs during the 2022–2023 monetary policy tightening cycle.

This table examines the relationship between unrealized losses on securities measured at amortized cost and realized deposit funding costs during the 2022–2023 monetary policy tightening cycle. The analysis uses a balanced panel of 29 banking groups observed from 2021 through 2023 for which both annual report and EBA Transparency Exercise data are available. The dependent variables are *Deposit interest expense to deposits*, defined as the annual interest expense on deposits scaled by total deposits and multiplied by 100; *Deposit interest expense to total assets*, defined as the annual interest expense on deposits scaled by total assets and multiplied by 100; *Total deposits to total assets*, defined as total deposits scaled by total assets and multiplied by 100; *Total deposits*, defined as the natural logarithm of total deposits. *Disclosed AC losses* denotes the difference between the carrying amount and fair value of securities measured at amortized cost, scaled by total assets and multiplied by 100. *MP_ Tightening* is an indicator equal to one in 2022 and 2023, and zero in 2021. Bank controls include bank size (natural logarithm of total assets), profitability excluding interest expense on deposits relative to total assets and multiplied by 100, and the carrying amount of the amortized-cost portfolio scaled by total assets and multiplied by 100. Continuous variables are winsorized at the 2.5th and 97.5th percentiles. The table reports heteroskedasticity-robust standard errors, clustered at the banking-group level, in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides variable definitions.

	Deposit funding costs		**Deposit quantities**	
	Deposit interest expense to deposits	**Deposit interest expense to total assets**	**Total deposits to total assets**	**Total deposits**
	(1)	(2)	(3)	(4)
$Disclosed\ AC\ losses_t \times MP_Tightening_t$	0.3480*	0.3050**	-0.4100	0.0030
	(0.192)	(0.134)	(1.962)	(0.026)
$Disclosed\ AC\ losses_t$	-0.3480**	-0.2480**	0.4740	0.0020
	(0.158)	(0.113)	(1.824)	(0.024)
N	87	87	87	87
Bank controls	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.93	0.94	0.98	0.99

Table OA8: Unrealized losses on amortized-cost securities and the maturity allocation of credit during the 2022–2023 monetary policy tightening cycle: Alternative maturity thresholds.

This table examines whether the change in the relationship between unrealized losses on amortized-cost securities and bank lending varies by loan maturity during the 2022–2023 monetary policy tightening cycle. Panel A uses a one-year maturity threshold: long-term lending has a maturity of more than one year, while short-term lending has a maturity of one year or less. Panel B uses a two-year threshold: long-term lending has a maturity of more than two years, while short-term lending has a maturity of two years or less. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are omitted from the table for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth					
	Long-term	**Short-term**	**Long-term**	**Short-term**	**Long-term**	**Short-term**
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: One-year maturity cutoff						
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.3804***	1.1218	-1.2004***	1.0568	-1.2577***	0.7487
	(0.343)	(0.764)	(0.395)	(0.777)	(0.405)	(0.753)
$AC\ losses_{t-1}$	0.8219**	-0.8875	0.8374**	-0.8595	0.9408**	-0.9004
	(0.371)	(0.765)	(0.390)	(0.822)	(0.381)	(0.797)
N	4,232,268	344,359	4,232,268	344,337	4,135,334	307,541
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	Yes	Yes	No	No
Country-quarter FE	No	No	Yes	Yes	Yes	Yes
Banking group-borrower FE	No	No	No	No	Yes	Yes
R^2	0.45	0.50	0.45	0.50	0.58	0.63
Panel B: Two-year maturity cutoff						
	Long-term	**Short-term**	**Long-term**	**Short-term**	**Long-term**	**Short-term**
	(1)	(2)	(3)	(4)	(5)	(6)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.1854***	-0.2132	-1.0315***	-0.1611	-1.1464***	0.0656
	(0.311)	(0.650)	(0.382)	(0.673)	(0.393)	(0.727)
$AC\ losses_{t-1}$	0.6827**	-0.0651	0.6868*	-0.0792	0.8312**	-0.6576
	(0.322)	(0.652)	(0.365)	(0.681)	(0.346)	(0.792)
N	3,323,339	780,470	3,323,335	780,455	3,229,414	701,805
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	Yes	Yes	No	No
Country-quarter FE	No	No	Yes	Yes	Yes	Yes
Banking group-borrower FE	No	No	No	No	Yes	Yes
R^2	0.46	0.48	0.46	0.48	0.59	0.62

Table OA9: Unrealized losses on amortized-cost securities and bank lending across borrowers with different credit risk during the 2022–2023 monetary policy tightening cycle.

This table examines whether the impact of unrealized losses on amortized-cost securities on bank lending varies with borrower credit risk during the 2022–2023 monetary policy tightening cycle. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Borrower credit risk is measured before the onset of monetary tightening. *Past due* is an indicator equal to one for borrowers with positive past-due days, and zero otherwise. *High arrears* is an indicator equal to one for borrowers in the top decile of the distribution of amounts in arrears, and zero otherwise. *Non performing borrower* is an indicator equal to one when a borrower is classified as nonperforming, and zero otherwise. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. Pairwise interaction terms are included in all regressions. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth		
	Past due	**High arrears**	**Nonperforming borrower**
	(1)	(2)	(3)
$AC\ losses_{t-1} \times MP_Tightening_t$	-0.8979**	-1.0604***	-1.0560***
	(0.401)	(0.384)	(0.382)
$AC\ losses_{t-1} \times MP_Tightening_t \times Borrower\ Risk_{pre}$	-0.3402	0.5374	0.9504
	(0.646)	(0.722)	(0.946)
$AC\ losses_{t-1}$	0.5948	0.6480	0.6285
	(0.419)	(0.417)	(0.416)
N	5,319,836	5,319,836	5,319,836
Pairwise interaction terms	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes
Banking group FE	Yes	Yes	Yes
Country-quarter FE	No	No	No
Banking group-borrower FE	No	No	No
R^2	0.43	0.43	0.43

Table OA10: Bank characteristics and unrealized losses on amortized-cost securities.

This table reports the results from bank-quarter regressions examining whether bank characteristics are associated with unrealized losses on amortized-cost securities during the pre-tightening period. The dependent variable is the sum of the unrealized losses at the banking group level, scaled by the previous quarter's total assets (*AC losses*). The table reports heteroskedasticity-robust standard errors clustered at the banking group level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. Appendix A provides the variable definitions.

	AC losses							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Distance to MDA	-0.6186							-2.3519
	(1.032)							(3.619)
ROA		0.1079**						0.0873*
		(0.053)						(0.050)
Bank size			-0.0799					-1.0514
			(0.617)					(1.704)
CIR				0.0006				-0.0005
				(0.001)				(0.001)
NPL					-0.0425**			-0.0245
					(0.020)			(0.019)
Cash						0.8597		0.7588
						(1.785)		(2.338)
RWA							-0.0176	-0.0172
							(0.019)	(0.025)
N	292	292	292	292	292	292	292	292
Banking group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.41	0.41	0.41	0.41	0.41	0.41	0.38	0.42

Table OA11: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Covariate-balancing generalized propensity score weighting.

This table analyzes the impact of banks' unrealized losses on amortized-cost securities on monetary policy transmission to lending supply during the 2022–2023 monetary tightening cycle using the *covariate-balancing generalized propensity score weighting method* (CBGPS) proposed by Fong et al. (2018). The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth			
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.2115***	-1.0058**	-1.1635**	-1.0642*
	(0.438)	(0.500)	(0.456)	(0.544)
$AC\ losses_{t-1}$	0.6772	0.6855	0.9069*	0.8373
	(0.493)	(0.535)	(0.517)	(0.566)
N	5,319,836	5,319,834	5,216,716	5,216,712
Controls	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes
CBGPS weights	Yes	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes	Yes
Banking group FE	Yes	Yes	No	No
Country-quarter FE	No	Yes	No	Yes
Banking group-borrower FE	No	No	Yes	Yes
R^2	0.46	0.46	0.61	0.61

Table OA12: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Alternative credit-demand controls and single-bank borrowers.

This table examines the robustness of the relationship between banks' unrealized losses on amortized-cost securities and bank lending to alternative credit-demand controls (Acharya et al. (2019); Degryse et al. (2019); Berg et al. (2021)) and the inclusion of single-bank borrowers. Columns (1) and (2) include borrowers with single and multiple bank relationships, whereas columns (3) and (4) restrict the sample to single-bank borrowers. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth			
	All borrowers		**Single-bank borrowers**	
	(1)	(2)	(3)	(4)
$AC\ losses_{t-1} \times MP_Tightening_t$	-0.8966**	-0.9590**	-0.8311**	-0.8431*
	(0.420)	(0.445)	(0.377)	(0.444)
$AC\ losses_{t-1}$	0.5669	0.6015	0.6579**	0.6271*
	(0.355)	(0.410)	(0.287)	(0.372)
N	17,279,928	11,899,516	11,679,631	6,572,998
Controls	Yes	Yes	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes	Yes	Yes
Industry-location-quarter FE	Yes	No	Yes	No
Industry-location-size-quarter FE	No	Yes	No	Yes
Banking group FE	Yes	Yes	Yes	Yes
R^2	0.23	0.28	0.23	0.27

Table OA13: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Controlling for loan maturity.

This table examines the robustness of the relationship between banks' unrealized losses on amortized-cost securities and bank lending when controlling for the maturity of the bank–firm credit exposures. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. *Loan maturity* measures the average maturity of the bank-firm credit exposure. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth	
	(1)	(2)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.0284***	-1.3317***
	(0.382)	(0.365)
$AC\ losses_{t-1}$	0.5994	1.2425***
	(0.406)	(0.402)
$Loan\ maturity_{t-1}$	-0.5859**	-5.9082***
	(0.257)	(0.773)
N	5,268,393	5,166,181
Controls	Yes	Yes
Controls $\times\ MP_Tightening_t$	Yes	Yes
Loan maturity $\times MP_Tightening_t$	Yes	Yes
Borrower-quarter FE	Yes	Yes
Banking group FE	Yes	Yes
Banking group-borrower FE	No	Yes
R^2	0.42	0.59

Table OA14: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Loan-exposure-weighted estimates.

This table examines the robustness of the relationship between banks' unrealized losses on amortized-cost securities and bank lending using weighted least squares estimation. Observations are weighted by the lagged outstanding amount of the bank–firm credit exposure, so that larger lending relationships receive greater weight. The dependent variable is *Loan growth*. $MP_Tightening$ is a dummy variable that equals one after the start of the monetary tightening cycle in July 2022, and zero otherwise. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost. Following the approach of Gomez et al. (2021), all control variables and their interactions with $MP_Tightening$ are included in all regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth	
	(1)	(2)
$AC\ losses_{t-1} \times MP_Tightening_t$	-1.0452*	-1.2591**
	(0.554)	(0.618)
$AC\ losses_{t-1}$	0.5549	0.8497
	(0.719)	(0.739)
N	5,319,836	5,216,716
Controls	Yes	Yes
Controls $\times$ $MP_Tightening_t$	Yes	Yes
Borrower-quarter FE	Yes	Yes
Banking group FE	Yes	No
Banking group-borrower FE	No	Yes
R^2	0.48	0.57

Table OA15: Unrealized losses on amortized-cost securities and bank lending during the 2022–2023 monetary policy tightening cycle: Changes in the ECB deposit facility rate.

This table examines the robustness of the relationship between banks' unrealized losses on amortized-cost securities and bank lending using changes in the ECB deposit facility rate as a continuous measure of monetary policy tightening. The dependent variable is *Loan growth*. $\Delta Policy\ Rate$ is the change in the ECB deposit facility rate, measured in percentage points, from quarter $t-1$ to quarter t over the period 2021Q3–2023Q2. *AC losses* denotes the stock measure of the nominal-minus-market-value gap on securities measured at amortized cost, expressed in percentage points of total assets. Column (1) reports the baseline specification. Column (2) examines whether the relationship varies with uninsured deposit base, measured by uninsured wholesale deposits as a percentage of total assets (*Uninsured deposits*). Column (3) examines whether it varies with banks' liquidity buffers, measured by the liquidity coverage ratio (LCR). Following the approach of Gomez et al. (2021), all control variables and their interactions with $\Delta Policy\ Rate$ are included in the regressions but are not tabulated for brevity. The table reports heteroskedasticity-robust standard errors, clustered at the banking group and borrower levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides detailed variable definitions.

	Loan growth		
	Baseline	**Uninsured deposit base**	**Liquidity buffers**
	(1)	(2)	(3)
$AC\ losses_{t-1} \times \Delta Policy\ Rate_t$	-0.7631**	2.2549*	-4.9880***
	(0.313)	(1.319)	(1.021)
$AC\ losses_{t-1} \times \Delta Policy\ Rate_t \times Uninsured\ deposits_{t-1}$		-0.0819***	
		(0.031)	
$AC\ losses_{t-1} \times \Delta Policy\ Rate_t \times LCR_{t-1}$			0.0190***
			(0.005)
$AC\ losses_{t-1}$	0.5626	-3.2120**	5.9262***
	(0.379)	(1.217)	(1.022)
LCR_{t-1}			0.0105
			(0.006)
N	5,216,716	4,783,311	5,216,716
Pairwise interaction terms	No	Yes	Yes
Controls	Yes	Yes	Yes
Controls $\times\ \Delta Policy\ Rate_t$	Yes	Yes	Yes
Borrower-quarter FE	Yes	Yes	Yes
Banking group-borrower FE	Yes	Yes	Yes
R^2	0.58	0.56	0.58

Table OA16: Unrealized losses on amortized-cost securities and annual-report disclosure characteristics during the 2022–2023 monetary policy tightening cycle.

This table examines whether banks' unrealized losses on securities measured at amortized cost are associated with broad textual characteristics of their annual reports during the 2022–2023 monetary policy tightening cycle. All textual measures are calculated using the full text of each annual report. In Columns (1)–(6), the dependent variable is *Uncertainty*, measured as the percentage of words classified as uncertainty-related using the Loughran–McDonald financial dictionary (Loughran and McDonald, 2011, 2016). In Columns (7)–(8), the dependent variables are the Gunning Fog index and the Flesch–Kincaid grade level, respectively; higher values indicate greater textual complexity and lower readability (Bochkay et al., 2023). *Disclosed AC losses* denotes the difference between the carrying amount and fair value of securities measured at amortized cost, scaled by total assets and multiplied by 100. $MP_Tightening$ is an indicator equal to one in 2022 and 2023, and zero in 2021. Bank controls include bank size, profitability excluding net income from derecognition of securities measured at amortized cost relative to total assets and multiplied by 100, and the carrying amount of the amortized-cost portfolio scaled by total assets and multiplied by 100. Text controls include the logarithm of report length, tone, and the shares of litigious, constraining, and strong-modal words. Continuous variables are winsorized at the 2.5th and 97.5th percentiles. All specifications include year fixed effects; selected specifications additionally include banking-group fixed effects. The table reports heteroskedasticity-robust standard errors, clustered at the banking-group level, in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Appendix A provides variable definitions.

	Uncertainty						**Gunning Fog**	**Flesch–Kincaid**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Disclosed\ AC\ losses_t \times MP_Tightening_t$	-0.0254	-0.0326	0.0182	-0.0362	-0.1168	0.0157	0.3857	0.3791
	(0.186)	(0.046)	(0.185)	(0.046)	(0.159)	(0.035)	(0.548)	(0.539)
$Disclosed\ AC\ losses_t$	-0.2392	0.0515	-0.2778	0.0529	-0.1481	-0.0021	-0.7195*	-0.7225*
	(0.196)	(0.035)	(0.194)	(0.037)	(0.164)	(0.027)	(0.422)	(0.409)
N	104	104	104	104	104	104	104	104
Bank controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Text controls	No	No	No	No	Yes	Yes	Yes	Yes
Banking group FE	No	Yes	No	Yes	No	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.14	0.98	0.22	0.98	0.37	0.99	0.96	0.96

Figure OA1: Validation of the SHSG-based measure of losses on amortized-cost securities.

This figure compares the SHSG-based measure of losses on amortized-cost securities with the corresponding measure constructed from banks' annual-report disclosures. Each observation represents a banking group–year. The horizontal axis reports the aggregate nominal-minus-market-value gap for AC securities obtained from SHSG, scaled by total assets and multiplied by 100. The vertical axis reports the difference between the carrying amount and fair value of AC debt securities disclosed in banks' annual reports, scaled by total assets and multiplied by 100. The sample covers 57 banking groups with available disclosures during 2021–2023. Positive values indicate losses and negative values indicate gains. The dashed 45-degree line represents perfect equality between the two measures.

