HKU BUSINESS SCHOOL 港大經管學院

HKU Jockey Club Enterprise Sustainability Global Research Institute

**Hong Kong University Business School:**
HKU Jockey Club Enterprise Sustainability
Global Research Institute Paper Series

# Security Losses, Interbank Markets, and Monetary Policy Transmission: Evidence from the Eurozone

Paper No. 2025/049

**Mariassunta Giannetti**
Stockholm School of Economics
CEPR
ECGI
Swedish House of Finance

**Martina Jasova**
Columbia University

**Caterina Mendicino**
European Central Bank

**Dominik Supera**
Columbia University

# Security Losses, Interbank Markets, and Monetary Policy Transmission: Evidence from the Eurozone*

Mariassunta Giannetti‡ Martina Jasova§

Caterina Mendicino¶ Dominik Supera‖

March 30, 2025

**Abstract**

Banks that experienced larger losses in their pledgeable securities portfolios following the July 2022 monetary policy tightening became less able to borrow through the interbank market and subsequently reduced their corporate lending, regardless of whether the securities were booked at market or historical value. These effects were less pronounced for banks with abundant collateral and for domestic subsidiaries of banking groups, which received liquidity through their group's internal capital market. Our results highlight a collateral channel in the bank-based transmission of monetary policy and show how differences in banking structure can contribute to an uneven transmission of monetary policy.

Keywords: Monetary policy tightening; interbank market; security losses; banking groups; foreign banks

*We thank seminar participants at the Columbia Macro Lunch Seminar, the National Bank of Belgium Empirical Financial Intermediation Workshop, the Research Institute for Industrial Economics (IFN) in Stockholm, the University of Naples Federico II, and the University of Porto. Giannetti acknowledges financial support from the Karl-Adam Bonnier Foundation. Special thanks to Nolwenn Allaire for superb research assistance. The opinions expressed herein are those of the authors and do not necessarily reflect those of the ECB or the Eurosystem. All errors are our own.

‡Stockholm School of Economics; Centre for Economic Policy Research (CEPR); European Corporate Governance Institute (ECGI); and Swedish House of Finance. Email: Mariassunta.Giannetti@hhs.se

§Barnard College, Columbia University. Email: mjasova@barnard.edu

¶European Central Bank. Email: caterina.mendicino1@ecb.int

‖Columbia Business School. Email: ds3791@columbia.edu

Banks face inherent liquidity risk due to the maturity mismatch between their assets and liabilities (Diamond and Rajan, 2001, 2005). The value of their collateral holdings determines their borrowing capacity in both interbank markets and from central banks, thereby influencing their ability to insure liquidity risk and extend illiquid loans to the corporate sector. Through their effect on collateral valuations, changes in the monetary policy stance can alter the severity of collateral constraints and potentially decrease the credit supply.

Despite the theoretical importance, empirical evidence on the bank-based collateral channel of monetary policy transmission remains limited. This paper fills this gap by exploiting granular credit and securities register data from the euro area — covering interbank lending, bank lending to firms, and banks' securities holdings — to document the operation of this channel and identify the conditions that amplify its effects.

We rely on the latest episode of monetary policy tightening. In July 2022, the European Central Bank (ECB) raised the policy interest rate in response to increasing inflation. Banks with greater holdings of long-term securities in their portfolios were more exposed to the monetary policy tightening through their losses in the value of the securities they held. Using granular data on interbank lending, we show that banks that experience more significant security losses when monetary policy tightens obtain less credit through the interbank market, indicating that the decrease in the market value of collateral decreased banks' ability to access the interbank market. The effect is both statistically and economically significant. A one-standard-deviation increase in borrowing banks' losses is associated with a 3.76% decline in credit received in the interbank market.

We further document the relevance of the collateral channel by exploiting cross-sectional differences between banks. First, we show that only losses in pledgeable securities affect banks' access to the interbank market. Losses in non-pledgeable securities do not have a significant impact, indicating that the effects are not driven by a decrease in banks' net wealth. This interpretation is further supported by the finding that pledgeable security losses negatively affect only borrowing through the repo market, with no effect on access to the unsecured market.

Second, we observe that the ability to borrow through the interbank market decreases

to a larger extent for banks that had already pledged a larger proportion of their securities holdings. This again suggests that the effects are driven by a binding collateral constraint limiting banks' ability to insure against liquidity shocks. Consistent with this result, we find no evidence that the net worth channel plays a role: the impact of security losses is not stronger for less capitalized banks, supporting the conclusion that collateral constraints, rather than reduced creditworthiness, are the primary mechanism restricting access to liquidity.

Third, we examine whether security losses have a greater impact on interbank market access when they affect regulatory capital. To this end, we compare the effects for the securities classified as available-for-sale (AFS) that are marked-to-market, compared to securities held to maturity (HTM) that rely on historical (book) valuation. We find that both AFS and HTM securities appear to negatively affect a bank's access to credit in the interbank market. This suggests that the effects are not solely driven by regulatory capital considerations.

Fourth, we take into account that some banks in our sample are part of banking groups (i.e., have the same holding company), while others operate as stand-alone banks. We conjecture that the former should be able to access liquidity through the internal capital market and consequently be less negatively affected by the loss in value of their collateral. We show that, indeed, within-group interbank loans partially isolate subsidiaries located in the same country as the headquarters (i.e., domestic subsidiaries) from the effects of security losses. The headquarters and other subsidiaries of the same group extend larger loans to those domestic subsidiaries that have experienced more significant security losses due to the interest rate hike.

Integration within the banking group, however, appears to be incomplete. The foreign subsidiaries located within the eurozone that experience security losses do not obtain loans from other group members and receive less credit when their within-group lenders experience losses.

We further investigate whether banks more exposed to monetary tightening via security losses on their pledgeable security holdings reduce lending to firms, and whether intra-group liquidity support mitigates this effect for subsidiaries of banking groups. Using granular credit registry data and controlling for firm-level credit demand following the methodology

of Khwaja and Mian (2008), we find that banks experiencing larger security losses reduce their corporate lending by more compared to less affected banks. This contraction in credit is economically meaningful – A one-standard-deviation increase in security losses is associated with a 5.5% decline in lending – and applies to security losses on both mark-to-market and held-to-maturity valued securities. Consistent with the collateral channel, the reduction in lending is sharper for banks with high collateral utilization and those with weaker ex-ante liquidity positions, highlighting how constrained access to liquidity amplifies the impact on corporate credit supply. Furthermore, we find that banks with larger security losses also charge higher interest rates and grant new loans with shorter maturities.

Access to liquidity through the interbank markets and intra-group borrowing affects the credit supply to the corporate sector, with heterogeneous impacts across different types of banks. Domestic subsidiaries of banking groups are partially shielded from the negative effects of security losses through intra-group loans and, as a result, contract their lending less than stand-alone banks that experienced a similarly strong adverse shock to the value of their security portfolios.

However, due to the interbank market segmentations affecting within-group loans, foreign subsidiaries of banking groups do not benefit from such support and contract lending to the same extent as stand-alone banks.

These findings underscore that liquidity redistribution within banking groups is segmented along national lines, contributing to uneven monetary policy transmission within the euro area.

We make several contributions to the literature. First, we contribute to the literature that leverages credit registry data to study the transmission mechanism of monetary policy (e.g. Jiménez et al., 2012). A few papers in this literature have exploited heterogeneity in banks' securities holdings to capture cross-sectional differences in exposure to monetary policy shocks (e.g. Rodnyansky and Darmouni, 2017; Acharya et al., 2018; Gomez et al., 2021; Greenwald et al., 2024). While others have highlighted the effects of security losses on bank net wealth and regulatory capital, we are the first to show that the lower value of pledgeable securities reduces banks' access to the interbank market and the cross-sectional differences between banks. In this respect, we contribute to the literature on the collateral

channel. The influential theories of Bernanke and Gertler (1989); Kiyotaki and Moore (1997) highlight how changes in the value of collateral amplify the credit cycle. Empirical studies have shown how firms' ability to post collateral affects their access to debt and investment (Chaney et al., 2012; Cvijanović, 2014; Adelino et al., 2015; Bahaj et al., 2020, 2022). To the best of our knowledge, we are the first to highlight the relevance of a bank-based collateral channel.

In addition, thanks to the granularity of our data, we can contribute to the debate on the circumstances under which decreases in the valuation of securities holdings affect bank lending. We show that even banks that marked their security portfolios as held to maturity and could use historical cost accounting were negatively affected by the interest rate hike because their collateral constraint became more binding limiting access to the interbank market. Accordingly, we provide evidence that the impact of monetary policy through security losses does not merely depend on banks' net wealth and regulatory capital requirements.

Second, we contribute to the literature on the international transmission of bank liquidity shocks. Prior research demonstrates that international banks transmit shocks to their foreign subsidiaries (e.g. Peek and Rosengren, 2000; Schnabl, 2012) and that US banks can access liquidity from foreign subsidiaries during periods of funding stress (Cetorelli and Goldberg, 2012a). Moreover, internal capital markets within global banking groups have been shown to play a crucial role in how liquidity and monetary policy shocks in advanced economies affect lending to emerging markets (Cetorelli and Goldberg, 2012a; Morais et al., 2019). Domestically, multi-market banks have also been found to transmit positive liquidity shocks within their U.S. branch networks (Gilje et al., 2016) and to transmit negative shocks outside their core markets, defined as areas in which banks do not have branches (Cortés and Strahan, 2017). A strand of this literature studies the lending channel of monetary policy in stand-alone banks and financial conglomerates (e.g. Campello, 2002; Cetorelli and Goldberg, 2012a). We make two important innovations. First, while existing contributions rely on banks' balance sheets to measure outstanding credit, the granularity of our credit registry data allows us to control for corporate credit demand using the Khwaja and Mian (2008) methodology. Second, we highlight how access to internal capital markets influences the

strength of monetary policy transmission among banks. We distinguish between domestic and foreign subsidiaries of a banking group. We find that being part of a banking group attenuates the effect of monetary policy shocks on domestic subsidiaries' credit supply. However, the headquarters' propensity to provide liquidity to foreign subsidiaries facing security losses is limited. Consequently, foreign subsidiaries remain more exposed to monetary policy shocks and contract lending as much as stand-alone banks. Our results reveal an organizational pecking order within euro area credit groups that, differently from U.S. global banks (Cetorelli and Goldberg, 2012b), do not appear to allocate liquidity according to subsidiaries' investment opportunities.

Finally, we contribute to a growing literature exploring the transmission mechanism of monetary policy within the euro area. Our results highlight a novel mechanism through which differences in banking structure produce asymmetries in monetary policy transmission emerge (Kashyap and Stein, 2000; Beraja et al., 2019). Bank consolidation and the tendency of banking groups to acquire distant banks have often been considered an important channel for achieving a more homogeneous financial structure and an even transmission mechanism of monetary policy across geographical areas of the monetary union. The finding that liquidity is not transferred across borders within banking groups highlights that national deposit insurance and local liquidity pools limit the extent to which bank consolidation can integrate capital markets and lead to an even transmission of monetary policy.

# 1 Data

We exploit different data sources to evaluate whether differences in banking structure affect monetary transmission.

First, we rely on the Securities Holdings Statistics (SHS-G), which provides detailed information on debt security holdings at the ISIN-bank-quarter level. SHS-G offers granular data on security holdings, including the amount held, book value, market value, and the accounting classification of instruments. The accounting classification allows us to differentiate whether the bank applied an accounting standard that classifies the security at amortized cost (book value) or at fair value (marked to market). We focus on fixed-income securities

held by banks, issued in the Eurozone, and denominated in euros and define as pledgeable the securities that are accepted as collateral by the ECB.

Second, we use loan-level data from the European System of Central Banks' AnaCredit (AC) credit register, established in 2018. AC covers information on borrower characteristics (e.g., location, industry), loan types, loan terms (e.g., loan size, maturity, interest rate, issuance date), and the outstanding credit of a bank to a given borrower. Specifically, we use AC to analyze (i) bank lending to non-financial firms (NFCs) and (ii) interbank lending between Eurozone banks.

Finally, we complement our analysis with data from the Individual Balance Sheet Items (IBSI) database, maintained by the ECB. This database contains monthly-level information on banks' granular asset and liability items. We use time-varying variables, such as total assets, deposit-to-total-assets ratio, equity ratio, and liquidity ratio, at the bank subsidiary level.

# 2 Monetary Tightening and Security Losses

On July 21, 2022, the ECB increased the three key policy rates by 50 basis points. As a consequence of this decision, the interest rate on the main refinancing operations and the interest rates on the marginal lending facility and the deposit facility were increased to 0.50%, 0.75%, and 0.00%, respectively. The initial rate increase was followed by nine interest rate hikes during our sample period that ends in December 2023.

Naturally, this tightening cycle led to a repricing of the securities in the banks' portfolios, and banks that held relatively more long-term securities experienced more significant losses. Overall, euro area banks proved to be resilient to the monetary policy shocks and were able to report Common Equity Tier 1 (CET1) capital ratios well above the requirements (Enria, 2023). Yet, the security losses negatively affected the liquidity of their assets as the proportion of illiquid loans increased. As conjectured by Altavilla et al. (2025), this can, in turn, translate into a decrease in the supply of credit.

Data from the ECB's SHS-G allows us to compute the losses on banks' security portfolios and evaluate whether higher exposure to liquidity risk deriving from security losses affect

negatively bank lending. We observe 2,862 bank subsidiaries belonging to 498 banking groups operating across 19 euro area (EA) countries during the sample period from January 2022 to December 2023 (Figure 1 Panel A). Euro area banks hold a substantial amount of fixed-income securities on their balance sheets, amounting, on average, to EUR 3.2 billion or 18% of their total assets.

A key advantage of our detailed security level data is that it enables us to measure the total value change in a bank's securities portfolio by capturing fluctuations in individual security prices. Furthermore, the granularity of the SHS-G data allows us to distinguish whether, in each bank's portfolio, a security is classified as available for sale (AFS), and consequently marked to market, or held to maturity (HTM), and consequently booked at historical value. On average, as of the end of the first quarter of 2022, we observe that most securities are reported as HTM (65%), while a smaller share (35%) is classified as AFS. This repartition differs from the evidence on bank holding companies (BHCs) in the US, where the 29 largest BHCs classify 60% of their security portfolios as AFS (Greenwald et al., 2024). The difference in the proportion of AFS and HTM securities in banks' portfolios could be due to institutional differences between the US and EA banking sectors, as well as the fact that our sample covers a total of 498 banking groups, revealing important aggregate trends as well as cross-sectional variation that goes beyond the largest EA banks.

We use the SHS-G data to compute a bank's overall security losses triggered by monetary tightening as well as its security losses in the AFS and HTM components of its portfolio. We further distinguish between security losses affecting pledgeable securities, defined as those accepted as collateral by the ECB, and other securities. Securities eligible within the ECB collateral framework are typically also accepted as collateral in the repo market, where lenders impose higher haircuts (Jasova et al., 2024).

To focus on losses triggered by monetary tightening, abstracting from any attempts to rebalance the portfolio, we consider securities in a bank's portfolio as of the end of the first quarter of 2022, which is well before the monetary policy tightening.[1]

[1]By treating a bank's ex-ante security holdings as fixed, we do not incur the problem that banks more negatively affected by the monetary policy tightening may opportunistically choose to mark a larger fraction of their security holdings as HTM to avoid mark-to-market accounting for AFS securities (Granja, 2023). As shown in Figure 8 in the Appendix, there is no evidence that this is the case.

Holding constant the bank's security holdings, we cumulate the price changes over the period 2022 Q1 – 2023 Q3 and compute the cumulative security losses as follows:

$$\text{Security Losses}_{i,t} = \frac{\sum_s \left( \frac{P^s_t - P^s_{2022Q1}}{P^s_{2022Q1}} \times \text{Value Held}^s_{i,2022Q1} \right)}{\text{Total Assets}_{i,2022Q1}} \tag{1}$$

Our measures consider all the losses accruing to a bank on the securities it held just before the monetary tightening up to month $t$ to take into account the effects of all monetary policy decisions. Since monetary policy decisions are often anticipated, we also consider price changes in the two months before the first increase in policy rates. As is evident from Figure 2, which plots the dynamics of the losses, most of the losses were realized in the second and third quarters of 2022, in the aftermath of the first interest rate hike. While other events may have driven these patterns, the securities we consider are predominantly sovereign bonds. Any effect of political and country risk on the price of the treasuries issued by some countries and held by domestic banks will be controlled non-parametrically because we always absorb country shocks in interactions of country and time fixed effects.

As of the third quarter of 2023, banks suffered, on average, security losses of 1% of their total assets or 12% of their total equity. Figure 3, Panel A, further summarizes the distribution of overall losses on security portfolios as a share of total assets, highlighting the significant cross-sectional variation in these losses. In Panel B, we decompose the losses in the HTM and AFS portfolios, holding the classification constant as of the first quarter of 2022, and find that the largest security losses are associated with HTM holdings. HTM losses, on average, amount to 0.84% of total assets (9.8% of total equity), while the mean AFS losses are four times smaller and amount to 0.21% of total assets (2.5% of total equity). In addition to the average losses, we also observe a smaller dispersion of AFS losses, which relates to the fact that EA banks are generally more likely to hold securities as HTM.

Security losses also vary significantly by bank type. Figure 4 shows the distribution of losses separately for subsidiaries of banking groups (Panel A), stand-alone banks (Panel B), and for domestic and foreign subsidiaries of banking groups (Panels C and D, respectively). On average, banks within banking groups experienced losses of 1.1% of total assets, nearly double the 0.57% incurred by stand-alone banks. Within banking groups, domestic sub-

sidiaries suffered losses more than twice as high as those of foreign subsidiaries (1.2% vs. 0.56% of total assets).

The large security losses experienced by banks are linked to the fact that they hold a significant portion of their assets in securities—particularly long-duration securities, which are especially sensitive to interest rate changes. Figure 5 shows the distribution of security holdings across banks, expressed as a share of total assets, as of the first quarter of 2021—prior to the start of the ECB's monetary tightening. Panel A displays all security holdings, while Panel B focuses on a subset of long-term securities with a maturity greater than three years. There is substantial cross-sectional variation in banks' security holdings. On average, securities represent 18.4% of bank assets, with long-term securities accounting for 6.6%.

There is also substantial heterogeneity in security holdings and associated losses across Euro area countries (see Figures 6 and 7). Banks in peripheral countries, such as Italy, Spain, Portugal, and Greece, hold significantly more securities on average than those in core countries like Germany and France. These holdings are concentrated in long-term securities with maturities over three years. Consequently, banks in peripheral countries were more exposed to the ECB's monetary tightening and incurred the largest losses.

In what follows, we exploit cross-sectional variation in securities losses across banks within a country to identify the effects of the monetary policy tightening. Specifically, we analyze how changes in the value of those securities subsequently influence the bank's behavior in the interbank market and lending to firms.

# 3 Stand-Alone Banks and Banking Groups within the Euro Area

To evaluate the relevance of the collateral channel of the bank-based transmission of monetary policy, we not only exploit cross-sectional differences in security losses that impair a bank's ability to post collateral but also a bank's ability to substitute the interbank market with liquidity transfers from other subsidiaries of the same banking group. Therefore, we

conjecture that banks that are part of banking groups, differently from stand-alone banks, can take advantage of the internal capital market to tap liquidity.

We also consider that while banking groups in the EA encompass subsidiaries in many EA countries, deposit insurance still segments capital requirements and liquidity pools along national borders. The extent to which these foreign subsidiaries can benefit from an internal capital market is thus an empirical question.

For these reasons, we categorize banks into three distinct groups: i) stand-alone banks, which are not part of any banking group, ii) domestic subsidiaries, which are banks that are part of a banking group and are located in the same country as the headquarters, and iii) foreign subsidiaries, which are banks owned by a foreign banking group. In total, the sample includes 1,832 stand-alone banks, 644 domestic subsidiaries, and 386 foreign subsidiaries.

Table 1, Panel A summarizes the descriptive statistics of the EA banking sector. Domestic and foreign subsidiaries collectively belong to 108 banking groups operating in the EA. On average, there are about 151 banks per country, with a median of 26 banks per country. In a median country, there are ten stand-alone banks, six domestic subsidiaries, and nine foreign subsidiaries. In a median country, banking group subsidiaries belong to 13 banking groups, four of which are headquartered domestically. On average, a banking group owns six subsidiaries and operates in three countries. While banking groups in the EA tend to exhibit a home bias, a significant portion of their assets and corporate loans is held by foreign subsidiaries, accounting for 25% of total assets and 26% of corporate loans, respectively.

Reflecting differences in country size, the distribution of banks is significantly skewed towards the EA Big-4 countries (Germany, Italy, Spain, and France), which together account for around 72% of all banks (see Figure 1 Panel A). In contrast to the median EA country, the vast majority of banks in Big-4 countries are part of a banking group, with 150 subsidiaries compared to 70 stand-alone banks. In addition, Big-4 countries have more than twice as many domestic subsidiaries as foreign ones, with 100 domestic subsidiaries versus 50 foreign ones. These subsidiaries are part of 52 banking groups, 18 of which are headquartered domestically.

While stand-alone banks are significant in numbers, they are typically small and account for a smaller proportion of total assets, corporate lending, and security holdings than sub-

sidiaries of banking groups. Specifically, subsidiaries of banking groups hold, on average, 70% of a country's banking sector assets, with the remaining 30% held by stand-alone banks.

Among subsidiaries, foreign subsidiaries play a crucial role, holding more than a quarter of total assets, while domestic subsidiaries account for 44%. These proportions are similar for corporate lending and securities holdings, with subsidiaries of banking groups representing 67% and 69%, respectively. Foreign subsidiaries are almost as important as stand-alone banks, accounting for 26% of corporate loans and 24% of securities held.

As Figure 1, Panel B highlights, the distribution of domestic and foreign subsidiaries is not homogeneous across the EA. Foreign subsidiaries play a disproportionally more important role in countries with smaller domestic banking systems, such as Portugal, Belgium, Luxembourg, Slovakia, Lithuania, and Estonia, where the share of corporate loans extended by foreign subsidiaries is close to 50%.

These patterns make it important to explore to what extent the collateral channel affects banks with and without access to liquidity internal to the banking group and eventual differences in the treatment of domestic and foreign subsidiaries.

# 4 Security Losses and the Interbank Market

## 4.1 Effects of borrowing banks' losses

Euro area banks rely heavily on the interbank market to finance their balance sheets, with an average of 13.8% of bank assets funded through interbank borrowing (see Table 1, Panel B). Even more importantly, the interbank market plays an important role in redistributing liquidity when banks face negative shocks. Security losses, reducing the value of a bank's collateral, can impair its ability to access the interbank market and negatively affect the bank's ability to ensure liquidity shocks. If this is the case, banks may reduce the credit supply to the corporate sector to limit their exposure to liquidity risk.

To evaluate whether this is the case, we start by exploring how security losses affect a bank's borrowing ability in the interbank market. Specifically, we estimate the following model by ordinary least squares (OLS), where the dependent variable, Loan Amount$_{b,c,l,h,t}$

is the logarithm of the outstanding interbank credit amount issued by bank $l$ located in country $h$ to bank $b$ based in country $c$ during month $t$:

$$\text{Loan Amount}_{b,c,l,h,t} = \alpha + \beta \text{ Security Losses}_{b,t-1} + \delta_{b,l} + \mu_{c,t} + \theta_{h,t} + \epsilon_{b,c,l,h,t}. \quad (2)$$

The variable of interest is Security Losses$_{b,t}$, which denotes the ratio of security losses to total assets of the borrowing bank as described by equation (1). This variable allows us to capture how, starting from August 2022, security losses affected a bank's participation in the interbank market. The vector $\delta_{b,l}$ denotes interactions of borrowing bank and lending bank fixed effects and controls for the strength of the interbank relation. In addition, $\mu_{c,t}$ and $\theta_{h,t}$ are interactions of the borrowing bank's country and time and the lending bank's country and time fixed effects, respectively, and capture any shocks affecting the borrowing bank's and the lender bank's countries.

Table 2 tests these hypotheses. A negative estimate of the coefficient of interest $\beta$ would suggest that banks with larger securities losses decrease their exposure to their counterparties in the interbank market. Column 1 of Table 2 shows that banks that experience more significant security losses following the monetary tightening receive less credit in the interbank market. The effect is both statistically and economically significant. A one-standard-deviation increase in borrowing banks' losses is associated with a 3.76% decline in credit received in the interbank market.

Even if, in principle, the effect could depend on the fact that banks with larger securities losses have lower demand for credit, because the shock coincides with a drop in their lending opportunities, we consider it more plausible that the effect is supply-determined. Not only do we control for shocks affecting the bank's country, which should capture asymmetric changes in the banks' investment opportunities, but we will demonstrate by exploring bank lending to the corporate sector that these banks' propensity to lend decreases, holding constant their borrowers' investment opportunities. Therefore, we use from the onset the narrative that security losses negatively affect a bank's ability to borrow in the interbank market.

Security losses may matter because the value of the collateral that a bank can post has decreased but also affect negatively a bank's net wealth. A decrease in creditworthiness

can, in turn, decrease a bank's ability to access the interbank market. To evaluate to what extent the collateral channel is at work, we distinguish between securities that are accepted by the ECB as collateral and other securities. Only the former are accepted as collateral in the interbank market. In column 2, we observe that a decrease in the value of pledgeable securities is associated with a decrease in the amount of funds that a bank is able to borrow in the interbank market. In column 3, we do not observe an analogous effect for nonpledgeable securities.

To further scrutinize the collateral channel, in column 4 we define a bank's collateral utilization rate, as the ratio of its outstanding debt to other banks to the value of its securities in March 2022. Consistent with the collateral channel, we observe that the ability to borrow through the interbank market decreases to a larger extent for banks that are likely to have posted most of their securities as collateral.

Not only do these findings support the collateral channel, but in columns 7 and 8, we observe that security losses have an effect only on the amount that a bank is able to borrow through the repo market. Security losses appear to have no effect on banks' access to the unsecured market.

The negative effects of security losses on interbank borrowing could also operate through the net worth channel. Specifically, security losses may affect a bank's profitability and capital position, reducing its creditworthiness and, in turn, limiting its ability to borrow in the interbank market. If the net worth channel is at play, the impact of security losses should be stronger for banks with lower ex-ante capital ratios. To test this mechanism, we extend specification 2 by introducing a double interaction between security losses and the borrowing bank's capital ratio. However, as shown in column (5), this interaction is not statistically significant, suggesting that the net worth channel plays a less critical role in banks' ability to obtain liquidity in the secured interbank market. This finding is consistent with the fact that security losses did not affect the financial stability of euro area banks (Enria, 2023) and points to the collateral channel as the primary mechanism driving our results.

We also consider whether security losses matter most when they affect the bank capital requirements. This is the case if the securities, being categorized as AFS, are marked-to-market. In column 6, we distinguish between security losses in HTM and AFS portfolios.

Both AFS and HTM securities appear to negatively affect a bank's access to credit in the interbank market.

Table 3 focuses on losses affecting a bank's pledgeable securities and distinguishes between loans that a bank receives from subsidiaries outside and within the banking group (columns 1 and 2). While a bank's ability to borrow from banks outside the banking group substantially decreases when the value of a bank's pledgeable securities decreases, the bank appears to receive large loans from other subsidiaries within the banking group.

The effect is not only statistically but also economically significant. A one standard deviation increase in borrowing banks' losses is associated with a 13.6% increase in credit received from other banks in the same banking group. Thus, the decrease in interbank market borrowing for banks experiencing security losses is entirely driven by lending from banks that do not belong to the same banking group. Intra-group lending has a counteracting effect.

These results provide micro-foundations for the findings of existing literature showing that the outstanding credit on the balance sheets of banks that are part of business groups is less sensitive to monetary policy (Campello, 2002).

## 4.2 Effects of Lending Banks' Losses

To the extent that a bank that has experienced security losses is less able to attract liquidity through the interbank market, it can also become less inclined to extend credit. Given our interest in identifying the collateral channel, we continue to focus on losses affecting pledgeable securities and investigate whether collateral security losses also affect banks' lending behavior. To this end, we estimate equation (1) but focus on the role of the lending bank's ratio of security losses to total assets. Equation (2) describes our empirical model:

$$\text{Loan Amount}_{b,c,l,h,t} = \beta \text{ Security Losses}_{l,t-1} + \delta_{b,l} + \mu_{c,t} + \theta_{h,t} + \epsilon_{b,c,l,h,t}, \tag{3}$$

where the key variable of interest is the lending bank's ratio of security losses to total assets ($\text{Security Losses}_{l,t}$).

Column 3 of Table 3 presents the results. We find that security losses not only affect banks' ability to receive credit but also their lending behavior. Banks that experience more

significant security losses extend less credit in the interbank market. The effect is once again statistically and economically significant, with a one-standard-deviation increase in lending banks' losses associated with an 8.9% decrease in their credit supply in the interbank market. Columns 4 and 5 reveal that the effect is entirely driven by loans to subsidiaries outside the banking group. The internal capital market is unaffected by the lending bank's security losses.

All results on the redistribution of liquidity between and within banking groups are confirmed in columns 6 – 8 when we consider together borrowing and lending banks' security losses. Overall, it appears that collateral valuations facilitate the functioning of the interbank market and the redistribution of liquidity, which is crucial for banks' ability to insure liquidity shocks.

# 5 Credit Flows Between Domestic and Foreign Subsidiaries of a Banking Group

## 5.1 Within-Group Lending to Domestic and Foreign Subsidiaries

Banking groups transfer liquidity to subsidiaries experiencing collateral security losses, effectively substituting for the interbank market. This finding provides relevant cross-sectional variation for studying the importance of the collateral channel for the supply of credit to the corporate sector. To obtain an even more granular prediction for our empirical investigation, we ask to what extent the insurance provided by the banking groups differs between domestic and foreign subsidiaries. Such an investigation can also help in understanding whether cross-border consolidation through business groups favors an even transmission of monetary policy across different countries in the EA, even if deposit insurance remains national and banking groups are required to maintain local liquidity pools.

We distinguish between domestic and foreign subsidiaries of the banking group. For the within-group lending analysis, we use two different definitions of domestic vs. foreign subsidiaries. First, we define a subsidiary as domestic based on the geo-location of the lending and borrowing banks. The borrowing subsidiary is considered domestic if it is based

in the same country as the lending subsidiary, and foreign otherwise. Second, we define a subsidiary as domestic with respect to the headquarters. In this case, a subsidiary is considered domestic if it is based in the same country as its banking group headquarters, and foreign otherwise. As in the earlier tests, we perform subsample analysis to facilitate interpretation.

We first ask whether there is a difference in liquidity support provided to domestic and foreign subsidiaries within a banking group that has experienced security losses. Table 4 columns 1-3 present the results for borrowing subsidiary losses. Only domestic subsidiaries receive more loans from another part of the banking group when they experience considerable security losses, while we do not observe an analogous effect for foreign subsidiaries. This is the case whether we consider foreign subsidiaries located in a different country from the lending subsidiary (column 2) or subsidiaries located in a different country from the group headquarters (column 3).

Interestingly, columns 4 and 5 highlight the importance of border effects for the functioning of internal capital markets. In column 4, we consider the subsample of foreign subsidiaries. It appears that foreign subsidiaries support other subsidiaries that are not located in the same country as the headquarters and have experienced losses to their pledgeable securities, while in column 5, domestic subsidiaries lend to other subsidiaries located in the same country as the headquarters. So puzzlingly, the internal capital markets seem to remain segmented arguably because of local liquidity pools and firewalls arising from the lack of common deposit insurance.

Columns 6 to 8 consider how subsidiaries of the banking group extend liquidity when they experience security losses. On average, subsidiaries of a banking group do not extend less credit when they experience security losses (column 6). However, it appears that subsidiaries based in a different country than the headquarters extend less credit (column 8), suggesting that local liquidity pools and firewalls limit their ability to provide insurance within the banking group.

## 5.2 Between-Group Lending to Domestic and Foreign Subsidiaries

Importantly, the evidence of segmentation along national borders appears to be specific to banking groups. Table 5 considers intergroup lending and how this depends on the security losses experienced by borrowing and lending banks. In column 1, banks that experience larger security losses obtain less credit from other banks outside the business group, irrespective of whether they are domestic or foreign. If anything, the effect of security losses appears smaller for foreign banks, defined as banks that are located in a different country from the borrowing subsidiary.

We draw similar conclusions for lending subsidiaries. Column 2 shows that subsidiaries that experience security losses lend less. Even though the effect appears to be statistically different from zero only for the domestic subsidiaries of a banking group, the lack of statistical significance for loans to domestic banks (defined as loans extended by banks located in the same country as the borrowing subsidiary) is largely due to lack of power. Overall, there is no evidence that banks outside the group provide liquidity support to other banks experiencing security losses, whether these are domestic or foreign. Thus, border effects appear to only emerge within banking groups.

## 5.3 Robustness: Other Subsidiary Characteristics

One reason banking groups tend to shield domestic subsidiaries from losses to a greater extent could be that the domestic subsidiaries are larger and more central to the group's business. If this is the case, the border could play a minor role in explaining the segmentations in liquidity provision that we observe within the group.

Column 1 of Table 6 indeed shows that large subsidiaries tend to receive more credit from other subsidiaries of the group when they experience more extensive losses. However, column 2 shows that only large domestic subsidiaries of banking groups obtain liquidity support. The double interaction term $SecurityLosses_{b,t} \times LargeSubsidiary_b$ is negative and significant, indicating that not only large foreign subsidiaries do not benefit from the intra-group liquidity support but also obtain less liquidity than other foreign subsidiaries.

Thus, large domestic subsidiaries, and domestic subsidiaries in general, benefit from the

intra-group liquidity provision. This finding resonates with (Cetorelli and Goldberg, 2012a) that US banks obtain liquidity from their foreign subsidiary when funding conditions at home deteriorate. However, we also show that foreign subsidiaries subject to shocks do not experience similar benefits. We also observe that foreign subsidiaries experiencing losses tend to provide less credit to other domestic subsidiaries of the group.

# 6 Monetary Transmission to Corporate Lending

This section explores whether banks' collateral value, affecting their ability to insure liquidity risks, matters for the supply of credit. We test whether banks that are more exposed to the monetary tightening through their security holdings lend less to firms and whether subsidiaries of banking groups that benefit from liquidity provision from other subsidiaries of the group insulate their borrowers from the shock. These tests are important to evaluate the collateral-based bank lending channel of monetary policy and also the extent to which stand-alone banks and domestic and foreign subsidiaries of banking groups transmit the monetary tightening to the corporate sector. Since we are able to control for borrowers' credit demand, these tests also allow us to evaluate to what extent the decrease in liquidity distribution through the interbank market and within banking groups may depend on differences in banks' lending opportunities.

We estimate the following equation for the outstanding credit issued by bank (subsidiary) $b$ belonging to group $g$ to firm $f$ during month $t$:

$$\text{Loan Amount}_{b,g,f,t} = \alpha + \beta \text{ Security Losses}_{b,t} + \gamma X_{b,t} + \delta_{f,t} + \mu_{g,t} + \theta_{b,f} + \epsilon_{b,g,f,t}. \quad (4)$$

Following (Khwaja and Mian, 2008), we include throughout the analysis interactions of firm and time fixed effects ($\delta_{f,t}$) to control for demand shocks. We also control for the strength of the relationship between a bank and a firm, including interactions of bank and firm fixed effects ($\theta_{b,f}$). Finally, in some specifications, we include subsidiary level controls ($X_{b,t}$), namely share of deposits to total assets, equity to total assets, and the logarithm of total assets, to capture group and subsidiary level financial conditions, and interactions of

banking group and time fixed effects ($\mu_{g,t}$), which allow us to compare domestic and foreign subsidiaries of the same banking group. Specifically, the share of deposits to total assets allows us to control for the fact that banks may experience deposit outflows when policy interest rates increase, and for this reason, they contract the supply of credit (Drechsler et al., 2017).

Table 7 shows that banks that experience larger security losses because of monetary policy tightening lend less to a given firm relative to other banks. The effect is both statistically and economically significant. A one-standard-deviation increase in banks' losses is associated with a 5.48% decline in lending to firms (column 3). This seems to be the case whether the losses are in securities that are marked-to-market or at historical cost accounting in columns 4 to 6.

Supporting the collateral channel, column 7 shows that the effect of security losses is larger for banks with high collateral utilization rates. Thus, collateral scarcity leads to a sharper contraction in bank lending following a monetary tightening.

Security losses should affect more negatively the supply of credit of banks with less liquidity holdings, which are less able to face deposit redemptions and other negative liquidity shocks without accessing the repo market. In column 8, we test whether the effect of security losses varies across banks with different levels of ex-ante liquidity. We proxy for a bank's liquidity position using excess liquidity, defined as the amount deposited with the central bank above the minimum reserve requirements (Altavilla et al., 2025). While the coefficient on security losses is negative and significant, the double interaction between security losses and excess liquidity is positive and statistically significant, indicating that, for a given level of security losses, the impact is stronger for banks with weaker ex-ante liquidity positions. These findings underscore that security losses impair banks' ability to access liquidity, which in turn constrains illiquid corporate lending. Such an interpretation is confirmed in column 9, where we interact the pledgeable security losses with the bank's amount of borrowing from the ECB relative to the bank's total assets. The monetary tightening coincided with the phasing out of the Targeted Long-Term Refinancing Operations (TLTRO), which allowed banks to access liquidity at favorable rates from the ECB. Banks that had borrowed more through this facility are naturally more exposed to the drop in liquidity. Security losses

may have a particularly negative effect on their supply of credit. This is precisely what the negative and significant coefficient on the interaction term suggests in column 9.

Overall, these results are consistent with the findings of Altavilla et al. (2025) that the liquidity of bank assets matters for the credit supply. While they focus on reserve holdings, we highlight the complementary role of securities value. As a consequence, monetary tightening, by decreasing the value of a bank's pledgeable securities, can have particularly large negative effects on the credit supply when is accompanied by quantitative tightening.

Importantly, the estimated parameter on the variable of interest is similar in columns 2 and 3 when we include interactions of group and time fixed effects. This suggests that subsidiaries of a banking group experiencing losses contract lending, notwithstanding the liquidity they receive from other subsidiaries of the group. However, as we will show in Table 9, the average effect conceals important differences between domestic and foreign subsidiaries of the same banking group,

Table 8 further examines the effects of banks' security losses on lending to firms. Column 1 presents the results for newly issued loan amounts. Consistent with the previous findings, the negative and statistically significant coefficient suggests that banks experiencing larger security losses extend fewer new loans compared to banks with smaller losses. Columns 2 and 3 explore the terms of newly issued loans, specifically interest rates and loan maturities. In column 2, the positive and statistically significant coefficient indicates that banks with greater security losses charge higher interest rates on new loans, further corroborating the evidence of a reduced supply of credit. Column 3 shows that these banks also offer new loans with shorter maturities, which may reflect increased caution in their lending practices and the desire to limit liquidity risks arising from long maturity loans. Overall, the results in Table 8 suggest that security losses not only reduce the quantity of new lending but also affect the pricing and structure of credit, amplifying the transmission of banks' security losses to the real economy.

Table 9, column 1 distinguishes between stand-alone banks and subsidiaries of banking groups. It appears that one euro of security losses translates into a larger contraction in lending for stand-alone banks rather than for subsidiaries of banking groups. In column 2, we focus on stand-alone banks and domestic subsidiaries to compare banks within the same

country. The coefficient estimates in column 2 are consistent with column 1 and confirm that domestic subsidiaries are partially shielded from security losses by intra-group loans.

Column 3 restricts the sample to group banks and considers differences between domestic subsidiaries and foreign subsidiaries, defined as subsidiaries located in a different country from the headquarters. Consistent with the finding that foreign subsidiaries of banking groups do not benefit from liquidity redistribution, they appear to contract credit significantly more than domestic subsidiaries for a euro amount of losses.

# 7 Conclusions

We document that collateral constraints affect bank lending. Monetary policy tightenings affect the valuations of securities that banks can pledge in the interbank market. As a result, banks experience reduced access to liquidity through the interbank market and cut lending.

We show that the internal capital market within banking groups tends to mitigate the adverse effects of security losses at their domestic subsidiaries, which, consequently, can extend more credit than similarly affected stand-alone banks. However, foreign subsidiaries of banking groups do not appear to benefit as much from the internal capital market when they experience security losses and cut credit as much as stand-alone banks.

# References


Acharya, Viral V, Tim Eisert, Christian Eufinger, and Christian Hirsch, 2018, Real effects of the sovereign debt crisis in europe: Evidence from syndicated loans, *The Review of Financial Studies* 31, 2855–2896.

Adelino, Manuel, Antoinette Schoar, and Felipe Severino, 2015, House prices, collateral, and self-employment, *Journal of Financial Economics* 117, 288–306.

Altavilla, Carlo, Miguel Boucinha, Lorenzo Burlon, Mariassunta Giannetti, and Julian Schumacher, 2025, Central bank liquidity reallocation and bank lending: Evidence from the tiering system, *Journal of Financial Economics* .

Bahaj, Saleem, Angus Foulis, and Gabor Pinter, 2020, Home values and firm behavior, *American Economic Review* 110, 2225–2270.

Bahaj, Saleem, Angus Foulis, Gabor Pinter, and Paolo Surico, 2022, Employment and the residential collateral channel of monetary policy, *Journal of Monetary Economics* 131, 26–44.

Beraja, Martin, Andreas Fuster, Erik Hurst, and Joseph Vavra, 2019, Regional heterogeneity and the refinancing channel of monetary policy, *The Quarterly Journal of Economics* 134, 109–183.

Bernanke, Ben, and Mark Gertler, 1989, Agency costs, net worth, and business fluctuations, *American Economic Review* 79, 14–31.

Campello, Murillo, 2002, Internal capital markets in financial conglomerates: Evidence from small bank responses to monetary policy, *The Journal of Finance* 57, 2773–2805.

Cetorelli, Nicola, and Linda S Goldberg, 2012a, Banking globalization and monetary transmission, *The Journal of Finance* 67, 1811–1843.

Cetorelli, Nicola, and Linda S Goldberg, 2012b, Liquidity management of us global banks: Internal capital markets in the great recession, *Journal of International Economics* 88, 299–311.

Chaney, Thomas, David Sraer, and David Thesmar, 2012, The collateral channel: How real estate shocks affect corporate investment, *American Economic Review* 102, 2381–2409.

Cortés, Kristle Romero, and Philip E Strahan, 2017, Tracing out capital flows: How financially integrated banks respond to natural disasters, *Journal of Financial Economics* 125, 182–199.

Cvijanović, Dragana, 2014, Real estate prices and firm capital structure, *The Review of Financial Studies* 27, 2690–2735.

Diamond, Douglas, and Raghuram Rajan, 2001, Liquidity risk, liquidity creation, and financial fragility: A theory of banking, *Journal of Political Economy* 109, 287–327.

Diamond, Douglas W, and Raghuram G Rajan, 2005, Liquidity shortages and banking crises, *The Journal of finance* 60, 615–647.

Drechsler, Itamar, Alexi Savov, and Philipp Schnabl, 2017, The deposits channel of monetary policy, *The Quarterly Journal of Economics* 132, 1819–1876.

Enria, Andrea, 2023, Press conference on the 2023 srep results and the supervisory priorities for 2024-26, *Speech by the Chair of the Supervisory Board of the ECB* .

Gilje, Erik P, Elena Loutskina, and Philip E Strahan, 2016, Exporting liquidity: Branch banking and financial integration, *The Journal of Finance* 71, 1159–1184.

Gomez, Matthieu, Augustin Landier, David Sraer, and David Thesmar, 2021, Banks' exposure to interest rate risk and the transmission of monetary policy, *Journal of Monetary Economics* 117, 543–570.

Granja, Joao, 2023, Bank fragility and reclassification of securities into htm, *Available at SSRN 4409834* .

Greenwald, Daniel, John Krainer, and Pascal Paul, 2024, Monetary transmission through bank securities portfolios, Technical report, National Bureau of Economic Research.

Jasova, Martina, Luc Laeven, Caterina Mendicino, José-Luis Peydró, and Dominik Supera, 2024, Systemic risk and monetary policy: The haircut gap channel of the lender of last resort, *The Review of Financial Studies* 37, 2191–2243.

Jiménez, Gabriel, Steven Ongena, José-Luis Peydró, and Jesús Saurina, 2012, Credit supply and monetary policy: Identifying the bank balance-sheet channel with loan applications, *American Economic Review* 102, 2301–2326.

Kashyap, Anil K, and Jeremy C Stein, 2000, What do a million observations on banks say about the transmission of monetary policy?, *American Economic Review* 90, 407–428.

Khwaja, Asim Ijaz, and Atif Mian, 2008, Tracing the impact of bank liquidity shocks: Evidence from an emerging market, *American Economic Review* 98, 1413–42.

Kiyotaki, Nobuhiro, and John Moore, 1997, Credit cycles, *Journal of Political Economy* 105, 211–248.

Morais, Bernardo, José-Luis Peydró, Jessica Roldán-Peña, and Claudia Ruiz-Ortega, 2019, The international bank lending channel of monetary policy rates and qe: Credit supply, reach-for-yield, and real effects, *The Journal of Finance* 74, 55–90.

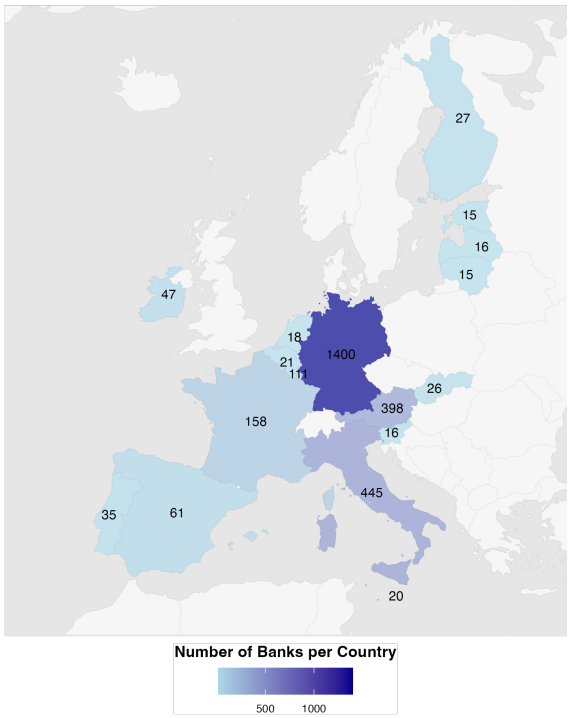
Peek, Joe, and Eric S Rosengren, 2000, Collateral damage: Effects of the japanese bank crisis on real activity in the united states, *American Economic Review* 91, 30–45.

Rodnyansky, Alexander, and Olivier M Darmouni, 2017, The effects of quantitative easing on bank lending behavior, *The Review of Financial Studies* 30, 3858–3887.

Schnabl, Philipp, 2012, The international transmission of bank liquidity shocks: Evidence from an emerging market, *The Journal of Finance* 67, 897–932.

Figure 1: Distribution of Banks within the Euro Area

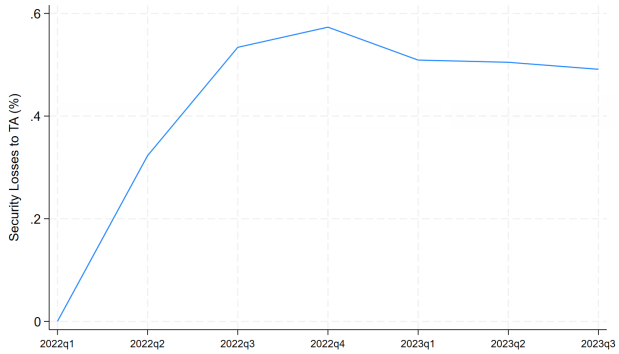
(a) Geographical Distribution of Banks




(b) Lending Share of stand-alone Banks and Banking Groups


The figure plots the country-level distribution of banks and their lending shares across the Euro Area. Panel A shows the number of banks per country. Panel B decomposes the lending shares of stand-alone banks, domestic and foreign subsidiaries of banking groups in each Euro Area country. A stand-alone bank refers to a bank that is not part of a larger banking group. A bank (subsidiary) is classified as domestic if it is located in the same country as its banking group's headquarters, and as foreign otherwise.

Figure 2: Security losses over time

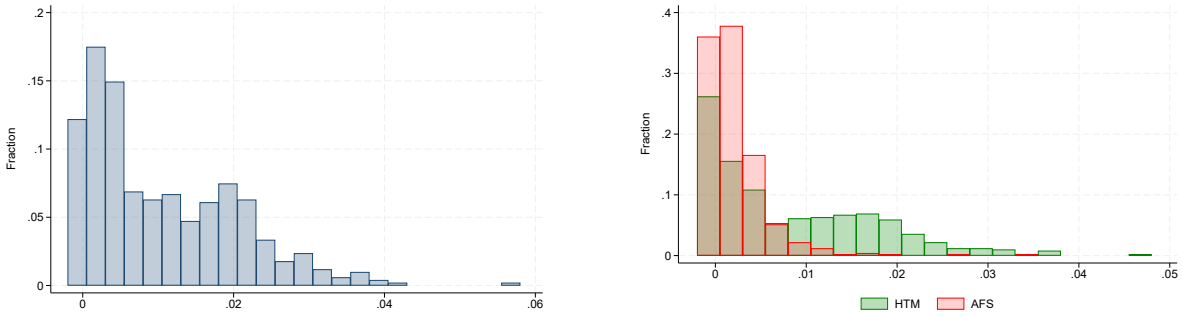



The figure presents the time-series evolution of aggregate security losses as a share of total assets, as defined in Equation (1). Aggregate security losses are calculated as the weighted average of individual bank losses.

Figure 3: Distribution of Security Losses Across Banks

(a) Total Security Losses

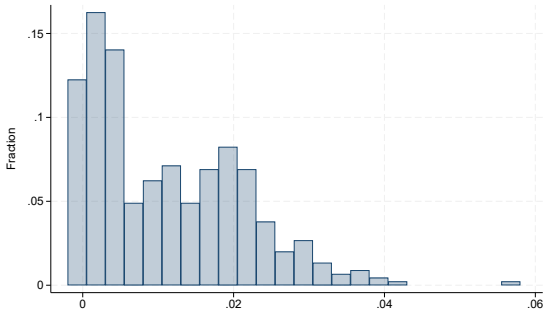
(b) HTM vs. AFS Security Losses



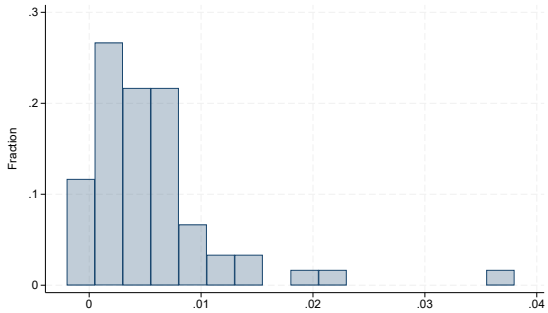

The figure shows the distribution of security losses as a share of total assets as of 2023q3, as described by Equation 1 Panel A presents the distribution of total security losses. Panel B plots the distribution of HTM vs. AFS portfolio losses, respectively.

Figure 4: Distribution of Security Losses: Subsidiaries vs. Stand-alone Banks

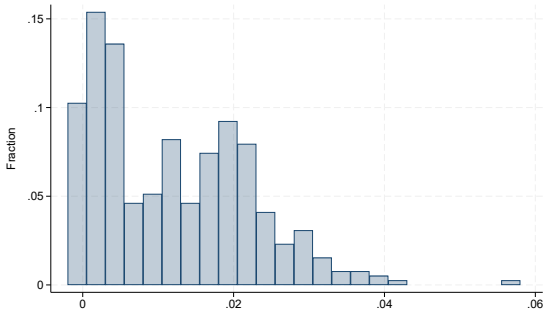
(a) Subsidiaries of Banking Groups



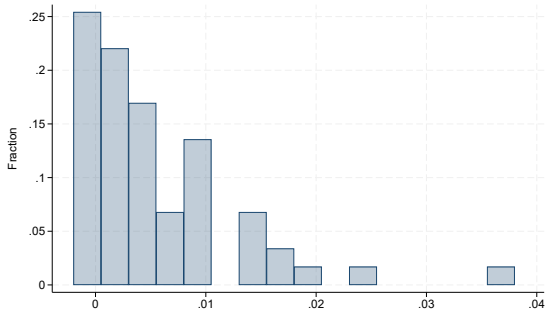

(b) Stand-alone Banks




(c) Domestic Subsidiaries of Banking Groups



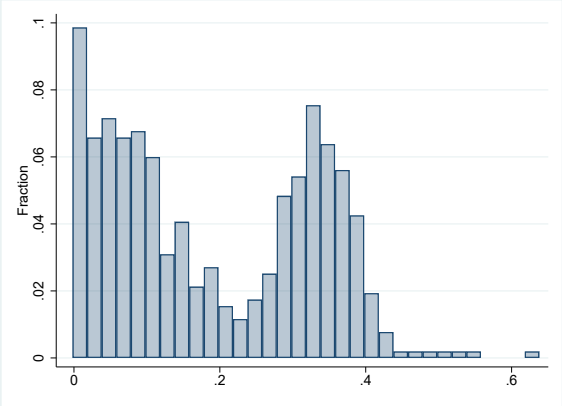

(d) Foreign Subsidiaries of Banking Groups



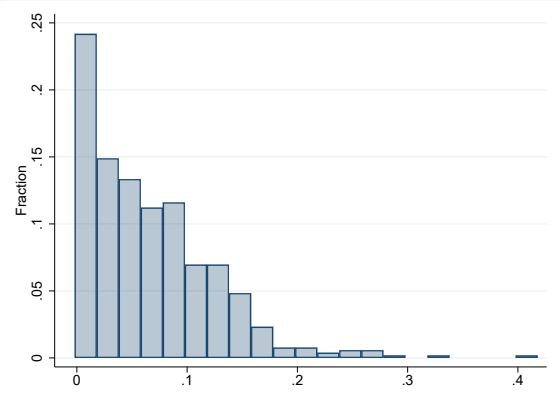

The figure shows the distribution of security losses as a share of total assets as of 2023q3, as described by Equation 1. Panel A presents the distribution of security losses for subsidiaries of banking groups. Panel B presents the distribution of security losses for stand-alone banks. Panel C and D present the distribution of security losses for domestic and foreign subsidiaries of banking groups, respectively.

Figure 5: Security Holdings by Banks

(a) All Securities



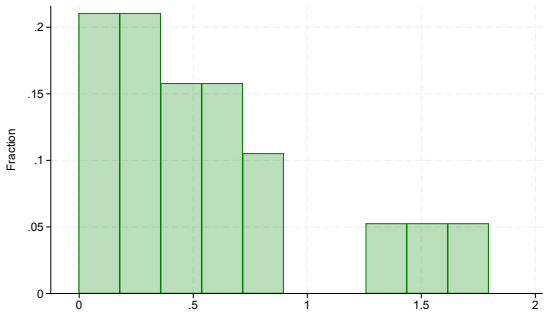

(b) Long-Term Securities



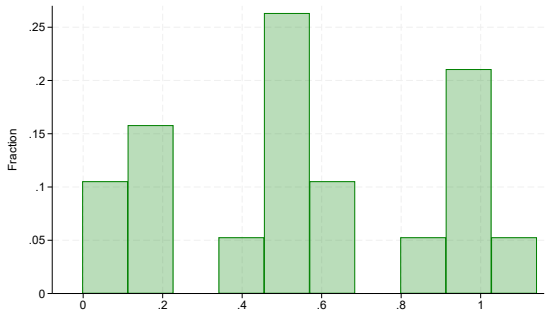

The figure plots the distribution of security holdings across banks in Euro Area countries as of 2022q1. Panels A presents the histogram of total security holdings, while Panel B focuses on long-term securities with a residual maturity greater than three years. All values are reported as a percentage of total assets.

Figure 6: Security Losses by Country

(a) Median Bank



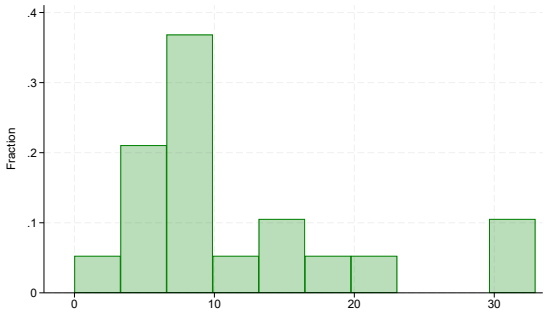

(b) Weighted Average



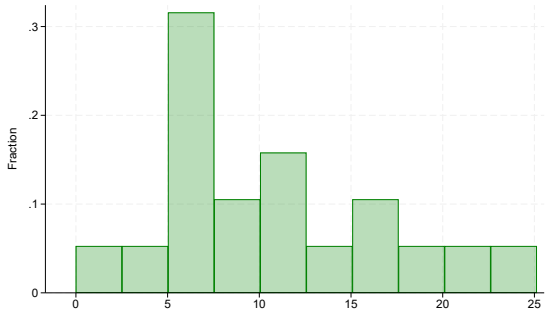

The figure plots security losses across Euro Area countries as of 2023q3. Panel A presents the country-level security losses of all reported securities for a median bank. Panel B plots the security losses as a weighted average of banks within the country. All values are reported as a percentage of total assets.

Figure 7: Security Holdings by Country

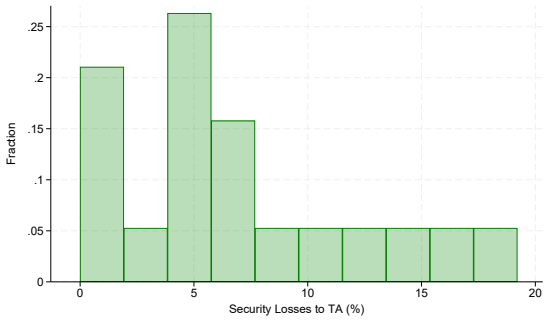
(a) All Securities (Median Bank)



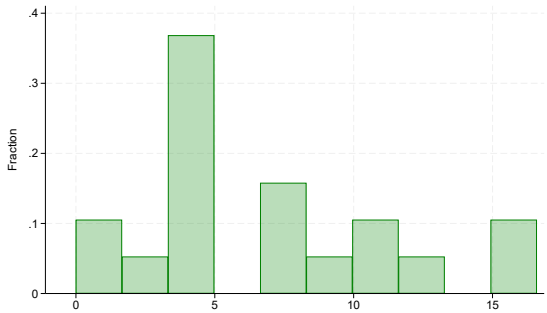

(b) All Securities (Weighted Average)




(c) Long-Term Securities (Median Bank)




(d) Long-Term Securities (Weighted Average)




The figure plots security holdings across Euro Area countries as of 2022q1. Panels A and B present the country-level security holdings of all reported securities for a median bank and as a weighted average, respectively. Panels C and D focus on long-term securities with a residual maturity of more than three years, showing the country-level distribution for a median bank and as a weighted average, respectively. All values are reported as a percentage of total assets.

Table 1: Summary Statistics

*Panel A: Country-level summary statistics of stand-alone banks and banking groups in the Euro Area*

| Variable | N | Mean | SD | P10 | P50 | P90 |
|---|---|---|---|---|---|---|
| *Number of Banks and Banking Groups per Country* | | | | | | |
| Total Number of Banks | 19 | 151 | 328 | 15 | 26 | 445 |
| Number of stand-alone Banks | 19 | 96 | 285 | 5 | 10 | 293 |
| Number of Domestic Subsidiaries | 19 | 34 | 64 | 1 | 6 | 124 |
| Number of Foreign Subsidiaries | 19 | 20 | 24 | 3 | 9 | 78 |
| Number of Banking Groups Present in the Country | 19 | 105 | 294 | 9 | 13 | 314 |
| *Composition of Banks per Country (in %)* | | | | | | |
| stand-alone Banks / All Banks | 19 | 43.29 | 22.97 | 12.77 | 44.26 | 80.00 |
| Domestic Subsidiaries Banks / All Banks | 19 | 25.75 | 22.02 | 5.00 | 21.05 | 66.67 |
| Foreign Subsidiaries Banks / All Banks | 19 | 30.96 | 19.54 | 5.03 | 27.78 | 63.83 |
| *Composition of Key Balance Sheet Variables per Country (in %)* | | | | | | |
| Share of NFC Lending by stand-alone Banks | 19 | 33.25 | 25.52 | 7.58 | 24.38 | 79.21 |
| Share of NFC Lending by Domestic Subsidiaries | 19 | 40.83 | 34.72 | 0.00 | 34.99 | 91.52 |
| Share of NFC Lending by Foreign Subsidiaries | 19 | 25.92 | 26.43 | 0.74 | 14.97 | 70.07 |
| Share of Total Assets of stand-alone Banks | 19 | 30.55 | 25.08 | 10.81 | 18.35 | 76.23 |
| Share of Total Assets of Domestic Subsidiaries | 19 | 44.24 | 34.56 | 0.27 | 46.06 | 87.04 |
| Share of Total Assets of Foreign Subsidiaries | 19 | 25.20 | 25.48 | 1.15 | 14.58 | 70.55 |
| Share of Security Holdings by stand-alone Banks | 19 | 30.93 | 30.14 | 4.14 | 18.76 | 95.88 |
| Share of Security Holdings by Domestic Subsidiaries | 19 | 45.55 | 35.69 | 0.00 | 44.70 | 93.21 |
| Share of Security Holdings by Foreign Subsidiaries | 19 | 23.52 | 28.26 | 0.00 | 8.30 | 79.87 |
| *Number of Subsidiaries and Key Characteristics per Banking Group* | | | | | | |
| Number of Subsidiaries | 108 | 6.08 | 10.96 | 2 | 2.5 | 10 |
| Number of Domestic Subsidiaries | 108 | 3.94 | 10.08 | 1 | 1 | 5 |
| Number of Foreign Subsidiaries | 108 | 2.14 | 3.42 | 0 | 1 | 6 |
| Number of Countries Banking Group Operates in | 108 | 2.68 | 1.98 | 1 | 2 | 6 |
| Share of Group NFC Lending Held Domestically | 108 | 83.29 | 24.94 | 49.98 | 95.35 | 100.00 |
| Share of Group Total Assets Held Domestically | 108 | 86.25 | 20.87 | 64.15 | 94.67 | 100.00 |

*Panel B: Bank-level security holdings, security losses and other balance sheet variables*

| Variable | N | Mean | SD | P10 | P50 | P90 |
|---|---|---|---|---|---|---|
| *Security Holdings (as of 2022q1)* | | | | | | |
| Total Security Holdings (mil EUR) | 498 | 3,164 | 8,657 | 38 | 386 | 9,592 |
| Security Holdings to Total Assets (in %) | 498 | 18.37 | 14.45 | 1.64 | 14.26 | 36.96 |
| Long-Term Security Holdings to Total Assets (in %) | 498 | 6.59 | 5.86 | 0.21 | 5.23 | 14.12 |
| HTM Securities / Total Security Holdings (in %) | 498 | 64.19 | 33.26 | 0.00 | 71.76 | 99.98 |
| AFS Securities / Total Security Holdings (in %) | 498 | 35.81 | 33.26 | 0.02 | 28.24 | 100.00 |
| (ECB + Interbank Borrowing) / Total Security Holdings (in %) | 498 | 90.92 | 90.08 | 27.77 | 55.55 | 202.89 |
| *Other Balance Sheet Variables (as of 2022q1)* | | | | | | |
| Total Assets (log) | 498 | 8.48 | 2.21 | 5.81 | 8.02 | 11.47 |
| Interbank Borrowing (% of Total Assets) | 498 | 13.82 | 16.05 | 0.32 | 13.55 | 23.73 |

| Variable | N | Mean | SD | P10 | P50 | P90 |
|---|---|---|---|---|---|---|
| *Security Losses* | | | | | | |
| Security Losses (% of Total Assets) | 3486 | 0.87 | 1.02 | 0.00 | 0.51 | 2.19 |
| Collateral Security Losses (% of Total Assets) | 3486 | 0.86 | 1.00 | 0.00 | 0.49 | 2.17 |
| Non-Collateral Security Losses (% of Total Assets) | 3486 | 0.01 | 0.20 | 0.00 | 0.00 | 0.05 |
| HTM Security Losses (% of Total Assets) | 3486 | 0.68 | 0.91 | 0.00 | 0.29 | 1.91 |
| AFS Security Losses (% of Total Assets) | 3486 | 0.18 | 0.29 | 0.00 | 0.08 | 0.48 |
| Security Losses (% of Total Equity) | 3486 | 10.26 | 14.42 | 0.00 | 6.37 | 24.79 |
| Collateral Security Losses (% of Total Equity) | 3486 | 10.09 | 13.97 | 0.00 | 6.09 | 24.47 |
| Non-Collateral Security Losses (% of Total Equity) | 3486 | 0.17 | 3.36 | 0.00 | 0.00 | 0.61 |
| HTM Security Losses (% of Total Equity) | 3486 | 8.02 | 13.46 | 0.00 | 3.31 | 21.18 |
| AFS Security Losses (% of Total Equity) | 3486 | 2.07 | 3.29 | 0.00 | 0.90 | 5.48 |

*Panel C: Loan-Level Summary Statistics*

| Variable | N | Mean | SD | P10 | P50 | P90 |
|---|---|---|---|---|---|---|
| *Interbank Lending* | | | | | | |
| Loan Amount (log) | 67,845 | 16.27 | 3.48 | 11.75 | 16.62 | 20.39 |
| Security Losses of Borrowing Banks (% of Total Assets) | 67,609 | 0.66 | 0.62 | 0.08 | 0.45 | 1.59 |
| Security Losses of Lending Banks (% of Total Assets) | 67,341 | 0.65 | 0.60 | 0.08 | 0.45 | 1.59 |
| Repo Amount (log) | 14,820 | 18.04 | 2.32 | 14.92 | 18.42 | 21.00 |
| Repo Rates (in %) | 14,820 | 1.03 | 1.53 | -0.35 | 0.01 | 3.60 |
| *Corporate Lending* | | | | | | |
| Loan Amount (log) | 19,005,930 | 12.23 | 1.76 | 10.31 | 12.07 | 14.48 |
| Number of Bank Relationships | 19,005,930 | 3.40 | 4.25 | 2 | 3 | 6 |
| Security Losses (% of Total Assets) | 19,005,930 | 0.79 | 0.57 | 0.08 | 0.81 | 1.34 |

Table 2: Types of Security Losses and Interbank Market

| | Loan Amount | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | All Instruments | | | | | | Repo | Non-Repo |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| All Security Losses$_{b,t-1}$ | -3.691*** | | | | | | | |
| | (1.403) | | | | | | | |
| Collateral Security Losses$_{b,t-1}$ | | -9.006*** | | -6.226* | -9.953*** | | -25.22*** | 2.480 |
| | | (3.211) | | (3.325) | (3.632) | | (5.602) | (4.592) |
| Non-Collateral Security Losses$_{b,t-1}$ | | | -1.236 | | | | | |
| | | | (1.014) | | | | | |
| Collateral Security Losses$_{b,t-1}$ | | | | -4.939*** | | | | |
| ×Collateral Util. Rate$_{b,2022q1}$ | | | | (1.251) | | | | |
| Collateral Security Losses$_{b,t-1}$ | | | | | 2.088 | | | |
| ×Total Capital Ratio$_{b,2022q1}$ | | | | | (3.458) | | | |
| AFS Security Losses$_{b,t-1}$ | | | | | | -13.24** | | |
| | | | | | | (5.441) | | |
| HTM Security Losses$_{b,t-1}$ | | | | | | -6.930** | | |
| | | | | | | (3.325) | | |
| Bank Lender – Bank Borrower FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Lender – Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Borrower – Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 120,799 | 120,005 | 120,005 | 99,344 | 120,005 | 120,005 | 13,258 | 85,280 |
| $R^2$ | 0.899 | 0.898 | 0.898 | 0.896 | 0.898 | 0.898 | 0.809 | 0.888 |

The table reports the results of the relationship between banks' behavior in the interbank market and security losses. We examine the effect of borrowing banks' losses, where the dependent variable is the natural logarithm of the outstanding interbank credit amount issued by bank $l$ to bank $b$ during month $t$. Security losses are calculated based on equation (1). Collateral utilization rate is defined as a ratio of the ECB and interbank borrowing to total security holdings. OLS regressions are used to estimate the models. Standard errors are two-way clustered at the borrowing bank-time and lending bank-time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

Table 3: Security Losses and Interbank Market

| | Loan Amount | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Borrowing Banks' Losses | | Lending Banks' Losses | | | Borrowing and Lending Banks' Losses | | |
| | Between Groups | Within Group | All | Between Groups | Within Group | All | Between Groups | Within Group |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Collateral Security Losses$_{b,t-1}$ | -16.73*** | 13.61*** | | | | -6.563*** | -15.56*** | 9.269** |
| | (3.778) | (3.971) | | | | (2.342) | (5.839) | (3.839) |
| Collateral Security Losses$_{l,t-1}$ | | | -8.896** | -10.26** | 0.273 | -9.598*** | -9.900** | -1.017 |
| | | | (3.467) | (4.840) | (4.280) | (3.592) | (4.936) | (4.203) |
| Bank Lender – Bank Borrower FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Lender – Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Borrower – Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 99,134 | 20,855 | 51,879 | 35,330 | 16,518 | 51,150 | 35,151 | 15,968 |
| $R^2$ | 0.881 | 0.907 | 0.882 | 0.841 | 0.916 | 0.880 | 0.841 | 0.910 |

The table reports the results of the relationship between banks' behavior in the interbank market and security losses for the subsamples of between groups and within group loans, as described by equations (2) and (3). The dependent variable is the natural logarithm of the outstanding interbank credit amount issued by a lending bank $l$ to a borrowing bank $b$ during month $t$. Security losses are calculated based on equation (1). Standard errors are two-way clustered at the borrowing bank-time and lending bank-time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

Table 4: Within-Group Lending to Domestic and Foreign Subsidiaries

| | Loan Amount | | | | | |
|---|---|---|---|---|---|---|
| | Borrowing Subsidiary's Losses | | | | Lending Subsidiary's Losses | |
| Definition of domestic/foreign: | Domestic$^{\dagger}$ | Domestic$^{\ddagger}$ | Domestic$^{\ddagger}$ | Domestic$^{\ddagger}$ | Domestic$^{\dagger}$ | Domestic$^{\ddagger}$ |
| Lending by: | All | All | Foreign subs. | Domestic subs. | All | All |
| | (2) | (3) | (4) | (5) | (7) | (8) |
| Collateral Security Losses$_{b,t-1}$ × Foreign$_b$ | -8.960 | 3.573 | 71.22* | -4.625 | | |
| | (13.30) | (12.72) | (39.40) | (13.57) | | |
| Collateral Security Losses$_{b,t-1}$ × Domestic$_b$ | 10.82*** | 9.948*** | 8.796 | 5.346* | | |
| | (3.690) | (3.834) | (7.820) | (2.956) | | |
| Collateral Security Losses$_{l,t-1}$ × Foreign$_b$ | | | | | -6.681 | -62.79*** |
| | | | | | (12.82) | (13.24) |
| Collateral Security Losses$_{l,t-1}$ × Domestic$_b$ | | | | | 1.003 | 5.021 |
| | | | | | (4.487) | (4.689) |
| Bank Lender – Bank Borrower FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Lender – Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Borrower – Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 16,132 | 16,132 | 1,420 | 15,214 | 16,423 | 16,423 |
| $R^2$ | 0.910 | 0.910 | 0.867 | 0.922 | 0.916 | 0.916 |

The table presents the results of the effects of banks' security losses on within-group lending to domestic and foreign subsidiaries, as described by equations (2) and (3). The dependent variable is the natural logarithm of the outstanding intra-bank credit amount issued by a lending bank $l$ to a borrowing bank $b$ during month $t$. Security losses are calculated based on equation (1). Two different definitions of domestic versus foreign borrowing (lending) subsidiaries are used. Domestic$^{\dagger}$ is based on the location of the lending and borrowing bank: the borrowing subsidiary is classified as domestic if it is located in the same country as the lending subsidiary, and as foreign otherwise. Domestic$^{\ddagger}$ is based on the subsidiary's location relative to its headquarters: the subsidiary is classified as domestic if it is located in the same country as its banking group's headquarters, and foreign otherwise. Standard errors are two-way clustered at the borrowing bank-time and lending bank-time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

Table 5: Between-Group Lending to Domestic and Foreign Subsidiaries

| | Loan Amount | |
|---|---|---|
| | Borrowing Subsidiary's Losses | Lending Subsidiary's Losses |
| | (1) | (2) |
| Collateral Security Losses$_{b,t-1}$ | -4.119* | |
| ×Foreign$_b$ | (-1.71) | |
| Collateral Security Losses$_{b,t-1}$ | -22.92*** | |
| ×Domestic$_b$ | (5.939) | |
| Collateral Security Losses$_{l,t-1}$ | | -6.699 |
| ×Foreign$_l$ | | (6.421) |
| Collateral Security Losses$_{l,t-1}$ | | -13.57** |
| ×Domestic$_l$ | | (5.590) |
| Bank Lender – Bank Borrower FE | Yes | Yes |
| Country Lender – Time FE | Yes | Yes |
| Country Borrower – Time FE | Yes | Yes |
| N | 35271 | 35243 |
| $R^2$ | 0.842 | 0.841 |

The table presents the results of the effects of banks' security losses on between-group lending to domestic and foreign subsidiaries, as described by equations (2) and (3). The dependent variable is the natural logarithm of the outstanding interbank credit amount issued by a lending bank $l$ to a borrowing bank $b$ during month $t$. Security losses are calculated based on equation (1). Domestic dummy is based on the location of the lending and borrowing bank: the borrowing subsidiary is classified as domestic if it is located in the same country as the lending subsidiary, and as foreign otherwise. Standard errors are two-way clustered at the borrowing bank-time and lending bank-time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

Table 6: Large Subsidiaries and Intra-Group Domestic and Foreign Lending

| | Loan Amount | |
|---|---|---|
| | (1) | (2) |
| Collateral Security Losses$_{b,t-1}$ | 8.025** | 26.48* |
| | (3.857) | (14.56) |
| Collateral Security Losses$_{b,t-1}$× Large Subsidiary$_b$ | 11.22** | -58.02*** |
| | (5.245) | (20.95) |
| Collateral Security Losses$_{b,t-1}$× Domestic$_b$ | | -22.56 |
| | | (14.89) |
| Collateral Security Losses$_{b,t-1}$× Large Subsidiary$_b$× Domestic$_b$ | | 67.87*** |
| | | (21.48) |
| Bank Lender – Bank Borrower FE | Yes | Yes |
| Country Borrower – Time FE | Yes | Yes |
| Country Lender – Time FE | Yes | Yes |
| N | 19,267 | 16,091 |
| $R^2$ | 0.906 | 0.909 |

The table presents the results of the effects of banks' security losses on intra-group lending to domestic and foreign subsidiaries, differentiated by subsidiary size. The dependent variable is the natural logarithm of the outstanding interbank credit amount issued by a lending bank $l$ to a borrowing bank $b$ during month $t$. Security losses are calculated based on Equation (1). Large Subsidiary is a dummy variable, which takes the value of one if the subsidiary's total assets rank above the median of total assets within its banking group, and zero otherwise. Domestic is an indicator variable that takes the value of one if the subsidiary is located in the same country as its banking group's headquarters, and zero otherwise. Standard errors are two-way clustered at the borrowing bank-time and lending bank-time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

Table 7: Security Losses and Bank Lending to Firms

| | Loan Amount | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Collateral Security Losses$_{b,t-1}$ | -2.910*** | -2.542*** | -5.476*** | | | | -5.204*** | -4.725*** | -4.498*** |
| | (0.572) | (0.541) | (0.576) | | | | (0.945) | (0.873) | (0.906) |
| Collateral HTM Security Losses$_{b,t-1}$ | | | | -7.120*** | | -6.489*** | | | |
| | | | | (0.838) | | (0.872) | | | |
| Collateral AFS Security Losses$_{b,t-1}$ | | | | | -5.727*** | -3.868*** | | | |
| | | | | | (1.069) | (1.048) | | | |
| Collateral Security Losses$_{b,t-1}$ | | | | | | | -2.588*** | | |
| ×Collateral Utilization Rate$_{b,2022q1}$ | | | | | | | (0.354) | | |
| Collateral Security Losses$_{b,t-1}$ | | | | | | | | 16.989** | |
| ×Excess Liquidity$_{b,2022q1}$ | | | | | | | | (7.499) | |
| Collateral Security Losses$_{b,t-1}$ | | | | | | | | | -30.073*** |
| ×ECB Borrowing$_{b,2022q1}$ | | | | | | | | | (5.155) |
| Bank Controls | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Bank – Firm FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm – Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Banking Group – Time FE | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 16,290,844 | 16,290,840 | 16,290,839 | 16,290,839 | 16,290,839 | 16,290,839 | 12,536,511 | 12,610,601 | 12,610,594 |
| $R^2$ | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.968 | 0.967 | 0.968 |

The table presents the results of the effects of banks' security losses on bank lending to firms, as described by Equation (4) The dependent variable is the natural logarithm of the outstanding credit issued by a bank (subsidiary) $b$ to a firm $f$ during month $t$. Security losses are calculated based on Equation 1. Collateral utilization rate is defined as the ratio of ECB + interbank borrowing to total security holdings as of 2022Q1. Excess liquidity is defined as liquidity deposited with the central bank in excess of the minimum reserve requirements as of 2022Q1. ECB Borrowing represents the ratio of bank funding from the central bank (ECB) to total assets as of 2022Q1. Standard errors are two-way clustered at the bank and time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

Table 8: Security Losses and New Bank Lending to Firms

| | Loan Amount | Rates | Maturity |
|---|---|---|---|
| | (1) | (2) | (3) |
| Collateral Security Losses$_{b,t-1}$ | -3.138** | 0.688*** | -13.93** |
| | (1.284) | (0.164) | (6.816) |
| Controls | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes |
| Industry-Country-Time FE | Yes | Yes | Yes |
| Banking Group-Time FE | Yes | Yes | Yes |
| N | 383,092 | 383,092 | 383,092 |
| $R^2$ | 0.787 | 0.869 | 0.824 |

The table presents the results of the effects of banks' security losses on the new bank of lending to firms, as described by Equation (4). In column 1, the dependent variable is the natural logarithm of the new credit issued by a bank (subsidiary) $b$ to a firm $f$ in month $t$. In column 2, the dependent variable is the annualized interest rate on the newly issued loan by a bank (subsidiary) $b$ to a firm $f$ in month $t$. In column 3, the dependent variable is the log of original maturity of the newly issued loan by a bank (subsidiary) $b$ to a firm $f$ in month $t$. Security losses are calculated based on Equation 1. Standard errors are two-way clustered at the bank and time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

Table 9: Security Losses, Banking Group Structure and Lending

| | Loan Amount | | |
|---|---|---|---|
| | All Banks | Domestic Banks | Banking Groups |
| | (1) | (2) | (3) |
| Collateral Security Losses$_{b,t-1}$× stand-alone Bank$_b$ | -6.761*** | -7.368*** | |
| | (2.052) | (2.064) | |
| Collateral Security Losses$_{b,t-1}$× Subsidiary$_b$ | -1.951*** | -1.985*** | |
| | (0.8181) | (0.855) | |
| Collateral Security Losses$_{b,t-1}$× Foreign Subsidiary$_b$ | | | -4.125*** |
| | | | (1.093) |
| Collateral Security Losses$_{b,t-1}$× Domestic Subsidiary$_b$ | | | -1.446*** |
| | | | (0.556) |
| Bank Controls | No | No | No |
| Bank – Firm FE | Yes | Yes | Yes |
| Firm – Time FE | Yes | Yes | Yes |
| Banking Group – Time FE | No | No | Yes |
| N | 16,290,844 | 13,748,918 | 10,611,217 |
| $R^2$ | 0.972 | 0.972 | 0.974 |

The table presents the results of the effects of banks' security losses on bank lending to firms, by differentiating different types of banks. The dependent variable is the natural logarithm of the outstanding credit issued by a bank (subsidiary) $b$ to a firm $f$ during month $t$. Security losses are calculated based on Equation (1). Column 1 contrasts the lending behavior of stand-alone banks with subsidiaries of the banking groups. Column 2 repeats the analysis from Column 1 but restricts the sample to stand-alone banks and domestic subsidiaries within the same country. Column 3 restricts the sample to banking group subsidiaries and examines differences between domestic and foreign subsidiaries. A subsidiary is classified as domestic if it is located in the same country as its banking group's headquarters, and as foreign otherwise. Standard errors are two-way clustered at the bank and time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

# Internet Appendix

Figure 8: Importance of AFS Portfolio over Time

(a) Share of Securities in AFS Portfolio


(b) Reclassification


The figure examines changes in the importance of the AFS (Available for Sale) portfolio. Panel A plots the distribution of the share of all securities held in the AFS portfolio as a percentage of total security holdings in 2022 Q1 versus 2023 Q3. Panel B uses observations at the bank-ISIN level and focuses on the subset of securities that a specific bank b has reported in both AFS and HTM portfolios in different periods. It plots the share of securities from this restricted sample that are reported as part of the AFS portfolio in 2022 Q1 versus 2023 Q3.