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Bank to non-bank lending and the reallocation of credit

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Challenges for Monetary Policy Transmission in a Changing World Network (ChaMP)

This paper contains research conducted within the network “Challenges for Monetary Policy Transmission in a Changing World Network” (ChaMP). It consists of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the European System of Central Banks (ESCB).

ChaMP is coordinated by a team chaired by Philipp Hartmann (ECB), and consisting of Diana Bonfim (Banco de Portugal), Margherita Bottero (Banca d’Italia), Emmanuel Dhyne (Nationale Bank van België/Banque Nationale de Belgique) and Maria T. Valderrama (Oesterreichische Nationalbank), who are supported by Melina Papoutsi and Gonzalo Paz-Pardo (both ECB), 7 central bank advisers and 8 academic consultants.

ChaMP seeks to revisit our knowledge of monetary transmission channels in the euro area in the context of unprecedented shocks, multiple ongoing structural changes and the extension of the monetary policy toolkit over the last decade and a half as well as the recent steep inflation wave and its reversal. More information is provided on its website.

Abstract

We analyze how bank lending to non-bank financial institutions (NBFIs) affects credit supply to the real economy. Using granular supervisory and loan-level data, we document rapid growth in bank lending to NBFIs relative to lending to non-financial firms. This growth is driven primarily by reverse repos to NBFIs that invest in securities, e.g., investment funds, rather than by loans to NBFIs that extend credit to firms, e.g., private credit funds. We show that the expansion in bank–NBFI lending reflects rising NBFI borrowing demand to fund government securities, which stems in part from the tapering of QE and the expansion of government bond supply in the Euro area, US, UK, and Japan. Importantly, loans to NBFIs disproportionately crowd out loans to non-financial firms rather than securities on bank balance sheets, which ultimately contracts credit supply to the real economy. A model rationalizes our empirical findings and quantifies the aggregate crowding-out effect. Taken together, our results imply that the rise of bank lending to NBFIs represents a narrowing of bank business models and a contraction in bank credit intermediation.

JEL: G21; G23; G24; G28; E44; E58.

Keywords: banks, non-bank financial institutions, financial intermediation, securities funding, bank regulation.

Non-Technical Summary

Over the past decade, banks in the euro area have increasingly shifted their lending toward non-bank financial institutions (NBFIs). This shift raises an important policy question: *does greater bank lending to NBFIs ultimately expand or reduce the amount of credit available to firms in the real economy?*

Using comprehensive euro-area supervisory and loan-level data, this paper provides three key empirical findings. First, we document that a large and growing share of bank-to-NBFI lending takes the form of *reverse repurchase agreements (reverse repos)*—short-term, collateralised loans typically used to finance government securities rather than to fund loans to firms. While some NBFIs, such as private credit funds, may channel bank credit into corporate lending, most of the NBFI borrowing from banks—especially hedge funds, mutual funds, and dealer-type institutions— mainly invest in marketable securities rather than in loans to firms. As a result, much of the growth in bank-to-NBFI lending does not support firm credit.

Second, bank lending to NBFIs systematically crowds out bank lending to non-financial firms. We show that banks expanding their exposures to NBFIs reduce their corporate lending significantly more than they reduce holdings of other assets, such as government bonds or reserves. This substitution is driven by two forces. On the demand side, NBFIs—particularly hedge funds—have sharply increased their borrowing to finance securities positions, especially in the context of rising government bond supply and quantitative tightening. On the supply side, bank capital and liquidity constraints amplify the shift: loans to NBFIs are safer, more liquid, and carry lower regulatory costs than loans to firms, making them attractive when banks face tighter balance-sheet pressures.

Third, the reallocation toward NBFI lending has meaningful real effects. Firms whose pre-existing banks increased their lending to NBFIs experienced materially larger declines in credit. These effects are concentrated among smaller and riskier firms, which have limited access to market-based funding and are less able to replace lost bank credit through other banks, NBFIs, or capital markets, leading to declines in both total borrowing and overall debt.

To interpret these findings, we develop a model in which banks and heterogeneous NBFIs interact in funding markets. The model shows that when credit demand originates from NBFIs that predominantly invest in securities—and when banks face balance-sheet constraints—an expansion in bank-to-NBFI lending reduces aggregate credit supplied to non-financial firms. The extent of this contraction depends on whether the shift is driven by NBFI demand or bank regulatory pressures, and on the composition of the NBFI sector.

Overall, the paper shows that the rapid growth in bank lending to NBFIs has not simply rerouted credit through alternative intermediaries. Instead, it has contributed to banks becoming "narrower," reallocating credit toward safer, more liquid exposures at the expense of lending to firms. This shift has implications for credit availability, the transmission of monetary policy, and the resilience of the financial system.

1 Introduction

An essential function of the financial system is to extend credit to firms in the real economy. Traditionally, deposit-taking banks directly lend to non-financial firms. More recently, banks are increasingly lending to non-bank financial institutions (NBFIs). For instance, banks lend to private debt funds (Chernenko et al., 2025) and extend credit lines to real estate investment funds (REITS) (Acharya et al., 2024a). In the U.S., term loans and credit line commitments to NBFIs have exceeded $0.3 trillion and $1.5 trillion in 2022 (Acharya et al., 2024b). A similar trend is evident in the Euro area, where bank lending to NBFIs has expanded to more than EUR 3.1 trillion—equivalent to 63% of total bank lending to firms. Between 2019 and 2024, bank lending to NBFIs grew by nearly 60%, while lending to non-financial firms rose by only about 20%. The divergence has become especially pronounced since 2022, as bank loans to firms have stagnated while lending to NBFIs has continued to expand steadily.

As bank-to-NBFI lending takes up an increasing share of bank balance sheets, an important question is how aggregate credit supply to firms is affected. On the one hand, banks' increased lending to NBFIs may, in turn, allow NBFIs to supply more loans. For example, bank lending to private debt funds enables them to lend more to non-financial firms. In this sense, NBFIs may simply pass through or even expand banks' lending capacity. On the other hand, NBFIs' increased borrowing from banks may not be for lending purposes but to fund other assets, such as government securities. If constrained banks cut direct lending to firms in order to lend to NBFIs, the aggregate credit supply to firms may contract.

To address this question, we first document that the rapid growth in bank lending to NBFIs is primarily comprised of reverse repos to NBFIs that invest in securities, e.g., investment funds, rather than by loans to NBFIs that extend credit to firms, e.g., private credit funds. We then examine the forces behind this trend and show that it is driven by rising NBFI borrowing demand to finance government securities, consistent with the tapering of quantitative easing and the expansion of government bond supply in the Euro area, the US, the UK, and Japan.

At the same time, we find that bank lending to NBFIs disproportionately crowds out bank lending to non-financial firms rather than other liquid assets on bank balance sheets. Banks' reallocation is amplified by their capital and liquidity constraints that penalize risky and illiquid asset holdings. Our empirical analysis and model show that the reduction in bank lending to non-financial firms is not offset by NBFI's increased lending to non-financial firms, which is why, ultimately, aggregate credit to the real economy contracts.

Taken together, our findings imply that bank lending to NBFIs is not merely the pass-through of lending through intermediaries with lower balance sheet costs. Rather, when borrowing demand originates from NBFIs that do not extend credit to firms, banks effectively become "narrower" and contract credit supply to the real economy. Our findings also imply that the presence of bank-to-NBFI lending exacerbates the crowding out of credit provision to the real economy as major central banks continue shrinking the size of their balance sheets, leaving an ever-increasing supply of government bonds in search of funding.

We begin by examining bank-to-NBFI lending using credit registry data from Anacredit that covers all loans extended by banks in the Euro area from 2019 to 2024. Our first key finding is that a significant share of bank lending to NBFIs is comprised of reverse repos. Reverse repos make up 45% of all loans at the end of our sample, while term loans and credit lines account for 35% and 23%, respectively.[1] The prevalence of reverse repos is significant because reverse repos fund their underlying collateral, i.e., government bonds, and are therefore not directly facilitating lending to the real economy.

We also find that the growth of bank-to-NBFI loans was primarily taken up by NBFIs that do not focus on lending to the real economy. To understand which NBFIs borrow from banks, we manually classify NBFI borrowers into granular institution types. Our classification reveals that NBFIs can be roughly grouped into those that focus on lending to firms and those that do not. The former includes, for example, private debt funds, lending companies, leasing companies, and factoring companies. The latter includes, for example, hedge funds, mutual funds, security dealers, and brokers. We find that the former primarily takes up credit lines and term loans, while the latter borrows a disproportionate amount of reverse repos. Hedge funds, in particular, are playing an increasingly important role in this market and account for the rapid growth in reverse repos since 2023. We confirm that our results are not driven by loans within banking groups and matched-book repos.

What explains the rapid growth in bank-to-NBFI lending? We show that a key driver is the rise in borrowing demand by NBFIs that invest in securities, especially government bonds. That is why loan growth is concentrated in reverse repos and disproportionately taken up by investment funds like hedge funds, even after conditioning on the same lending bank. At the same time, loan spreads increase, especially for loans to hedge funds and backed by government securities,

[1] The use of term loans and credit lines is consistent with bank lending to NBFIs in the U.S. setting, as documented by Acharya et al. (2024b). Given the focus on term loans and credit lines in the literature, the outsized share of reverse repos may seem surprising. One possible reason is that the FR Y-14Q data in the U.S. does not require the reporting of reverse repo positions.

consistent with a rise in demand rather than supply for these loans. We further provide evidence consistent with the rise in NBFI borrowing demand being driven by the unwinding of QE in the Euro area, the US, the UK, and Japan, leaving behind a larger volume of government bonds in search of financing.

The expansion of bank lending to NBFIs has significant consequences for aggregate credit supply. We find that the extension of bank-to-NBFI loans has come largely at the expense of loans to non-financial firms. Quantitatively, a one–percentage-point increase in NBFI lending is associated with a roughly 0.55 percentage point decline in lending to firms on bank balance sheets, while substitution across other balance sheet items, such as government bonds, reserves, and interbank claims, is substantially weaker or insignificant. This reallocation from firm to NBFI loans coupled with the rise of NBFI loan demand to fund securities over lending implies a net reduction in loan supply to non-financial firms. We find that this loss in loan supply cannot be offset by other forms of credit extended by NBFIs, and firms more reliant on banks with higher NBFI loan growth are especially exposed. In other words, the reallocation of bank balance sheets toward NBFI lending is not a neutral reshuffling of credit. Rather, it represents a narrowing of bank business models and ultimately results in a contraction of credit supply.

Finally, we show that banks' incentive to reallocate away from firm loans into NBFI loans is amplified by capital and liquidity constraints. Loans to NBFIs are safer, carry lower risk weights, and are more liquid than direct lending to firms in part due to NBFIs' equity cushion, making them more attractive when regulatory capital becomes binding or liquidity tightens. Consistent with this channel, banks with lower capital ratios, larger deposit outflows, or greater exposure to the ECB's liquidity tightening expand their lending to NBFIs more.

We develop a model to rationalize the empirical findings and to quantify the aggregate effect on firm loan supply given different drivers of bank-to-NBFI lending. In our model, a representative bank issues deposits to fund corporate loans, holds securities, and lends to a heterogeneous set of NBFIs, subject to regulatory capital costs. Corporate loans are riskier than securities, in part because they are less liquid and trade at a sizable discount if sold in the subsequent period. Consistent with regulatory risk weights, the capital cost of holding corporate loans exceeds that of securities. We denote loans secured with securities as collateralized. Loans to NBFIs are thus collateralized to varying degrees, capturing differences in the mix of reverse repos and other loans.[2] Consistent with the regulatory treatment, the capital cost of lending to NBFIs declines

[2]More broadly, we can interpret the share of secured loans as the share of loans that is fully collateralized against losses in the case of default. In practice, term loans and credit lines may also be secured to some extent, but these

with the degree of collateralization as collateral reduces the loss given default of loans.

NBFIs choose their portfolio allocations to maximize their equity, taking into account that the demand for their claims increases with expected return and decreases with risk. Importantly, different types of NBFIs differ in the sensitivity of their claims to risk and return. For example, investors in money market funds are more sensitive to risk than those in private debt funds and lending companies. This heterogeneity may arise from differences in investor bases or from the same investors mentally allocating wealth across vehicles for distinct purposes. Given investors' preferences, each NBFI chooses how much to borrow from the bank, its degree of collateralization, and the allocation between corporate loans and securities. Finally, given the exogenous supply of corporate loans and securities, both markets clear in equilibrium.

One contribution of our model is to capture the heterogeneity of NBFIs in a coherent framework. We show that differences in risk sensitivity yield cross-sectional patterns in NBFIs' asset and liability choices consistent with our empirical results. NBFIs with more risk-sensitive investor bases choose to hold more securities and take on less leverage. The higher portfolio share of securities in turn allows them to borrow from banks using more collateralized instruments, e.g., reverse repos. In contrast, NBFIs with less risk-sensitive investors choose to hold more corporate loans, take on more leverage, and borrow from banks using less collateralized instruments, e.g., term loans and credit lines. These predictions are borne out in the data. Empirically, we find that NBFIs that lend more have higher total leverage, and a smaller proportion of their loans are reverse repos. In contrast, NBFIs that lend less and invest in more securities have lower leverage and a larger proportion of their loans are reverse repos.

Another key contribution of our model is to evaluate how banks' balance sheet constraints versus NBFIs' borrowing demand influence the *total* supply of loans to non-financial firms, taking into account both direct bank lending and indirect lending through NBFIs. When the increase in bank-to-NBFI lending is driven by a rise in NBFI borrowing demand to fund government securities, both banks and NBFIs shift their holdings towards the higher-yielding securities and away from firm loans. In the presence of bank-to-NBFI lending, NBFIs further borrow from the bank to fund more securities, and the bank optimally reallocates away from direct lending to firms toward lending to NBFIs.

For the same increase in outstanding government bonds to be financed, bank-to-NBFI lending amplifies the crowding out of loans to the real economy. In our model, this effect arises

assets tend to be less safe and offer less protection against loan default for the same haircut.

because the bank has more duration-sensitive marginal investors and/or higher regulatory costs for bearing duration risk than NBFIs like hedge funds. As a result, banks prefer to lend short-term reverse repos rather than hold government securities on their balance sheets. This is why more government securities end up on the joint balance sheet of banks and NBFIs. When lending to NBFIs becomes easier, the bank also faces a stronger incentive to reallocate away from direct firm lending toward NBFI lending in response to the security supply increase. In other words, the presence of bank-to-NBFI lending amplifies the crowding-out effect of public debt on credit supply to the real economy.

2 Literature Review

We contribute to the growing literature on bank lending to NBFIs. Acharya et al. (2024b) provides the first comprehensive documentation of bank lending to NBFIs in the U.S. They show that banks and NBFIs have become highly interconnected and that banks remain exposed to credit and funding risk from their NBFI loans. Several papers have focused on bank lending to private credit. Chernenko, Ialenti and Scharfstein (2025) argue that banks lend to private credit funds because of their favourable capital treatment and analyze associated financial stability risk. Haque, Jang and Wang (2025) study the effect of bank lending to private credit on monetary policy transmission. Others zoom in on credit lines. Jiang (2023) analyzes how banks' credit lines to mortgage borrowers affect their competition in mortgage markets. Acharya, Gopal, Jager and Steffen (2024a) examine banks' credit lines to REITs and show that banks may decide against extending credit lines to firms that are dependent on nonbank financing. Xu (2025) also studies banks' credit lines to NBFIs and develops a macroeconomic model to measure the value of contingent liquidity. Closely related to us is Buchak, Matvos, Piskorski and Seru (2024), who document the decline of financial intermediation on bank balance sheets. This trend is rationalized by a model in which banks hold securities issued by originate-to-distribute intermediaries.

Our contribution to the above literature is twofold. First, while prior work has mostly focused on banks' regulatory constraints in explaining the rise of bank-to-NBFI lending, we show that NBFI's demand for bank funding, driven by the global growth in government bond supply, played an equally, if not more important, role. These findings are consistent with the rise in leveraged Treasury holdings through the Treasury-basis trade (Barth and Kahn, 2021, Kashyap et al., 2025). Second, we show that bank lending to NBFIs is not limited to credit lines and term loans—a significant share of loans is in the form of reverse repos borrowed by NBFIs like hedge funds and security dealers. Given this heterogeneity, the composition of the NBFIs is consequential for

whether and by how much aggregate loan supply to the real economy is reduced as banks lend more to NBFIs.

More broadly, we relate to the literature on non-bank financial intermediation. This literature has largely studied different NBFIs separately. One exception is Cetorelli, Cisternas and Sarkar (2025), who classify NBFI sectors by their economic functions. We develop a framework in which NBFIs are heterogeneous in the sensitivity of their claims to risk and returns, which in turn determines their asset and liability choices. For example, money market funds and mutual funds have more sensitive claims and choose to hold more securities using lower leverage, while private debt funds have less sensitive claims and can afford to hold more loans using higher leverage. Traditionally, bank deposits have been shown to be a safe and liquid asset for investors Gorton and Pennacchi (1990), Dang, Gorton, Holmström and Ordonez (2017), Diamond (2020). Our classification is consistent with the view that NBFIs also provide some degree of liquidity and safety. Sunderam (2015) shows that short-term shadow bank claims, e.g., money market fund shares, are also money-like claims. Ma, Xiao and Zeng (2025) find that bond mutual funds also provide a sizeable amount of liquidity to investors.

We also contribute to the literature on the consequences of tighter financial regulation for banks following the Global Financial Crisis. Existing research has shown, both empirically and using quantitative models, that higher capital requirements lead banks to reduce lending to firms (Elenev et al., 2021, Mendicino et al., 2019, Gropp et al., 2019, Fraisse et al., 2020) and to increase their holdings of safe and liquid securities (Stulz et al., 2022). A contraction in bank credit has been found to generate adverse real effects, especially for smaller firms (Chen et al., 2017), and to prompt a substitution toward borrowing from NBFIs (Gopal and Schnabl, 2022), contributing to the rise of non-bank financial intermediation (Begenau and Landvoigt, 2022). In a broader context, prior literature has documented a long-term decline in bank lending associated with falling interest rates (Wang, 2025, Supera, 2021), the rise in intangible assets (Dell'Ariccia et al., 2021), and regulatory and technological changes (Buchak et al., 2024). We extend this literature by showing that the trend of banks becoming "narrower" is also reflected in their shift from riskier, more illiquid corporate lending to shorter-term, safer loans to NBFIs. While some of these NBFIs intermediate funds further to firms, we show that bank credit increasingly flows to NBFIs that primarily invest in securities rather than extend credit, implying that the reallocation of bank credit toward NBFIs has a net negative effect on firm borrowing.

3 Data

We construct a novel granular dataset combining several regulatory sources from the ECB to analyze banks' lending to both NBFIs and non-financial firms.

Bank-level data. We use the Individual Balance Sheet Items (IBSI) database maintained by the ECB, which provides monthly information on granular asset and liability categories for approximately 2000 banks operating in the euro area. To obtain a more detailed view of balance sheet composition, we complement these data with supervisory information from Financial Reporting (FINREP), which contains harmonized accounting data on the structure of banks' assets, liabilities, and income statements. We also use regulatory data from Common Reporting (COREP) to capture banks' capital positions and risk exposures. Finally, we use Bankscope and the Register of Institutions and Affiliates Database (RIAD) to construct the ownership and group structure of banks.

Loan-level data. We use loan-level information from AnaCredit, a credit registry jointly maintained by the ECB and the national central banks of the Eurosystem. AnaCredit contains transaction-level data on all credit exposures of euro area banks, providing a detailed and consistent view of bank-borrower relationships, including bank lending to both NBFIs and non-financial corporations. The dataset covers a comprehensive range of credit instruments, including revolving credit, credit lines, reverse repurchase agreements, and term loans, with a reporting threshold of EUR 25,000, and reports both drawn and undrawn amounts for each instrument. For a subset of our repo market analysis, we further supplement AnaCredit with transaction-level bilateral data from the Money Market Statistical Reporting (MMSR) dataset, a confidential ECB dataset that records all euro-denominated borrowing and lending transactions conducted by a representative sample of major euro area banks across both the secured and unsecured segments of the money market.

4 Stylized Facts

4.1 Bank Lending to Non-Banks by Instrument and Sector

Fact 1. A significant share of bank lending to NBFIs is comprised of reverse repos to NBFIs that primarily invest in securities.

We begin by examining the breakdown of bank lending to NBFIs using different instruments. In Figure 1, we plot the outstanding volume of credit lines, term loans, revolving credit, reverse

repos, and other loans lent by banks to all NBFIs using AnaCredit data. We note that reverse repos are the largest category, accounting for 45% of all loans at the end of the sample period in 2024. Term loans and credit lines also make up a sizeable share of total loans at 35% and 23%, respectively. The prevalence of term loans and credit lines is consistent with bank lending to NBFIs in the U.S. setting, as documented by Acharya et al. (2024b). Given the focus on term loans and credit lines in the literature, the outsized share of reverse repos may seem surprising. One possible reason is that the FR Y-14Q data in the U.S. does not require the reporting of reverse repo positions. The prevalence of reverse repos is important because reverse repos fund their underlying collateral, i.e., government bonds, and are therefore not directly facilitating lending to the real economy.

Which NBFIs borrow from banks? In Figure 2, panel (a) shows the volume of loans lent to investment funds, insurances, and pensions. Observe that investment funds, including hedge funds, mutual funds, real estate funds, and private equity funds, are the largest borrowers and their loan volume is growing rapidly especially from 2023 onwards. Panel (b) shows the volume of loans lent to other financial institutions (OFIs), financial auxiliaries (FAs), and captive financial institutions (Captives), where the loan volume of OFIs is particularly pronounced. OFIs, FAs, and Captives correspond to codes S125, S126, and S127 in the ECB's official institutional sector classification, respectively. The official classification, though comprehensive, does not fully capture the economic function of the underlying institutions. That is why we further classify NBFIs into more granular institution types using a combination of manual methods and large language models.

Panels (c), (d), and (e) of Figure 2 show loan volumes to the granular NBFI sectors classified by our algorithm. Panel (c) shows that among investment funds, hedge funds are the largest borrowers and also display the rapid growth observed in Panel (a) starting in 2023. Mutual funds also have a growth spurt toward the end of the sample, but their overall borrowing is below that of hedge funds. In addition to hedge funds and mutual funds, which predominantly invest in securities, there are also other funds and real estate funds. The former includes private debt funds and funds invested in alternative assets, while the latter predominantly invests in real estate assets and are similar to REITs in the US. These are the second- and third-largest borrowers among investment funds, and their borrowing volume has been steadily increasing. The volume of loans to private equity funds is relatively limited.

In panel (d) of Figure 2, the largest borrowers are the dealer and the market infrastructure

provider sectors. The dealer sector includes dealers and brokers, i.e., firms that trade securities, derivatives and structured products for their own account or as market-makers; the market infrastructure sector is comprised of entities that facilitate the functioning of financial markets, including clearing houses, exchanges, payment and settlement providers. The amount borrowed by insurance companies and pensions is relatively smaller. Overall, the institutions in this panel serve important functions but are generally not focused on lending to the real economy.

Panel (e) of Figure 2 plots the loan volume to all other NBFI sectors in our classification. Broadly speaking, these are all NBFIs that are more directly engaged in lending to the real economy. Lending companies are specialized lenders focused on commercial loans, consumer credit, and auto finance; leasing companies are financial firms that provide asset leasing for vehicles, equipment, and real estate; factoring companies lend to businesses against receivables. Finally, SPVs are entities created to isolate loans or mortgages and to repackage them into securities, while holding companies are financial subsidiaries that provide captive financing to firms.

The composition of NBFI borrowers is closely linked to the composition of loan instruments. To explore which type of NBFIs take up which kind of loans, we estimate

$$LoanGrowth_{kt} = \sum_{s} \beta_{ks} \mathbb{1}_s LoanGrowth_{kst} + \epsilon_{kst}, \tag{4.1}$$

where $LoanGrowth_{kt}$ is the log difference in loan volumes for instrument k in month t, $\mathbb{1}_s$ is an indicator variable for sector s, and $LoanGrowth_{kst}$ is the log difference in loan volumes for instrument k and sector s in month t. The more positive the coefficient β_{ks}, the more loan growth for sector s comoves with the overall loan growth for instrument k, consistent with sector s taking up more of those loans and driving more of the aggregate growth of those loans. For the ease of presentation, we group NBFIs with similar economic functions together into the same sector.

Table 1 shows the results. From columns (1), (2), and (3), we see that the growth in credit lines, term loans, and revolving credit most corresponds to the growth in credit lines, term loans, and credit lines extended to other investment funds, companies engaged in lending, factoring, and leasing, as well as holding companies and SPVs. At the same time, credit lines, term loans, and revolving credit are taken up less by dealers, market infrastructure providers, hedge funds, and mutual funds.

For reverse repos, however, column (4) paints the opposite picture. The growth of reverse repos to dealers, market infrastructure providers, hedge funds, and mutual funds closely accounts

for the overall growth in reverse repos, whereas reverse repo uptake by companies engaged in lending, factoring, and leasing as well, as holding companies and SPVs, is much more limited. These results are corroborated by Appendix Figures A2 to A3, where we plot each sector's loan volume for each instrument over time. One interpretation consistent with these results is that NBFIs more directly focused on lending to the real economy tend to borrow from banks in the form of credit lines, term loans, and revolving credit, while NBFIs less focused on lending tend to borrow more in the form of reverse repos. The next subsection will delve further into the relationship between NBFIs' asset composition and liability composition.

So far, we have shown that banks lend to various NBFI sectors using a variety of loan instrument, where reverse repos make up a significant share. This result is significant because reverse repos tend to fund government bonds rather than lending to the real economy.

Our analysis focuses on bank lending to NBFIs and its implications for lending to the real economy. We acknowledge that there are other exposures between banks and NBFIs. For example, some NBFIs may hold deposits at banks or other securities issued by banks. While these liability-side linkages are interesting, we focus on the gross exposures on the asset side given our research question and following a large literature on bank lending to firms. One specific concern may arise with reverse repos, where some dealers may simply be matching borrowers and lenders. To this end, we confirm that the majority of banks in our sample are not simply engaged in match-making. In Appendix Figure A4, we use bank balance sheet data to show that the reverse repos on the asset side of our sample of banks do not mirror the liability side of our sample of banks. The reason is that our sample includes deposit-taking banks engaged in lending. Indeed, if we only zoom in on the dealer banks that report in the MMSR data, which is required for the largest dealers in the repo market, then the reverse repo and repo positions are much more aligned, consistent with large dealers acting as match-makers in the repo market.

Another concern is that our results may be driven by banks lending to non-bank subsidiaries belonging to the same holding company. To this end, we create a mapping key for all subsidiaries of bank holding companies and check which loans are extended within group. From Appendix Figure A5, we observe that the majority of loans are extended to NBFIs outside of the lending bank's holding company. Only term loans have a relatively larger share of within-group loans. From Appendix Figures A7 and A6, we see that only OFIs, which include SPVs, leasing companies, lending companies, and factoring companies, have a relatively larger proportion of in-group loans. These NBFIs tend to use more term loans, consistent with the larger share of in-group

term loans.

4.2 Credit Demand by Non-Bank Financial Intermediaries

Fact 2. The expansion of bank lending to NBFIs reflects increased credit demand from NBFIs, particularly investment funds that seek to fund government bonds using reverse repos. This increase in demand coincides with quantitative tightening by central banks and a surge in sovereign debt issuance.

What drives the rapid growth in bank-to-NBFI lending? The aggregate evidence presented in Figures 1 and 2 suggests that the expansion in lending to NBFIs has been concentrated among specific borrowers, such as hedge funds, and specific loan instruments, most notably reverse repo loans. This pattern has intensified since 2023 and has coincided with a sharp increase in the supply of sovereign debt, as governments expanded issuance while central banks reduced their holdings of government securities during the phase of quantitative tightening (see Figure 4). The combination of higher sovereign debt supply and declining central bank securities holdings has increased the scope for Treasury basis trades, which rely heavily on reverse repo borrowing by hedge funds for leverage and funding.

One caveat of the Anacredit data is that we do not observe the specific collateral backing each reverse repo loan. To this end, we use transaction-level reverse repo data from the MMSR to confirm that the majority of reverse repos extended by banks to NBFIs are indeed secured by government bonds. Table 4 shows that, on average, 83% of reverse repos in Euros are secured by government bonds, where the ratios for investment funds, insurances, and pensions are even higher. These findings provide further support that the growth in reverse repo loans stems from the rising supply of government bonds in search of funding.

To formally assess the role of credit demand, we control for bank-level supply forces using bank–time fixed effects, following Amiti and Weinstein (2018), and estimate the following regression:

$$log(\text{Lending}_{b,n,i,t}) = \alpha_{b,t} + \alpha_{b,n,i} + \beta Post_t \times C_{b,n,i} + \epsilon_{b,n,i,t}, \tag{4.2}$$

where the outcome variable is the log level of lending by bank b to borrower n through instrument type i at time t. Post_t is a dummy variable equal to one for periods after 2022m12, corresponding to the period after major central banks around the world began quantitative tight-

ening. $C_{b,n,i}$ denotes borrower- or loan-level characteristics. Depending on the specification, we include bank–time fixed effects to absorb time-varying bank credit supply conditions, as well as bank–borrower or bank–borrower–instrument fixed effects to control for persistent heterogeneity across lending relationships.

Table 2 reports the results. Columns (1) and (2) compare lending across borrower types, with non-financial firms serving as the omitted category. We distinguish between investment funds and other NBFIs. The positive and highly significant coefficients on $\text{Post}_t \times$ Inv. Fund_n and $\text{Post}_t \times$ Other NBFI_n show that, after 2022m12, banks experienced a disproportionate increase in lending to NBFIs relative to non-financial firms, with the effect especially pronounced for investment funds. In economic terms, the estimates in columns (1) and (2) imply that lending to investment funds rose by about 18–19% more than lending to non-financial firms in the post period, while lending to other NBFIs rose by about 3–4% more. Importantly, these results remain very similar when bank–time fixed effects are added in column (2), indicating that the increase reflects stronger borrower demand rather than changes in bank-level credit supply.

Columns (3) and (4) restrict the sample to NBFI borrowers and interact Post_t with a dummy identifying hedge funds. We find a disproportionate increase in lending to hedge funds in the post period. Once again, the coefficient is very similar with and without bank–time fixed effects, reinforcing the interpretation that this pattern is primarily driven by stronger credit demand from hedge funds rather than by shifts in bank supply conditions. The estimates imply that hedge funds increased borrowing by roughly 23% more than other NBFIs. Column (5) further explores the composition of this increase within the NBFI sample by distinguishing reverse repo lending from other loan types. The results show that the post-period increase in borrowing by hedge funds is concentrated in reverse repo loans.

To examine the mechanism more closely, Table 3 focuses exclusively on reverse repo loans to NBFIs and considers both loan quantities and spreads. In columns (1)–(3), the dependent variable is the log quantity of reverse repo borrowing, while in columns (4)–(6) it is the spread charged on those loans. We find that both quantities and spreads increase disproportionately for hedge funds in the post period, consistent with stronger borrowing demand. Moreover, this increase is particularly pronounced for reverse repo loans denominated in non-euro currencies and for transactions backed by low-haircut collateral. These patterns are consistent with hedge funds increasing borrowing from banks to finance Treasury basis trades.

Taken together, these results indicate that rising credit demand from NBFIs, particularly in-

vestment funds and hedge funds, has contributed to the recent expansion in bank lending to the non-bank sector. Within the NBFI sector, the increase is especially concentrated in hedge fund reverse repo borrowing, particularly in non-euro currencies and against low-haircut collateral, consistent with funding needs associated with Treasury basis trades.

4.3 The Effect of Bank Lending to Non-Bank Financial Intermediaries on Credit Supply

Fact 3. Bank lending to non-bank financial intermediaries primarily crowds out bank credit to non-financial firms on bank balance sheets and leads to a contraction in aggregate credit supply.

What are the implications of bank lending to NBFIs? We have shown that much of the growth in lending goes to NBFIs that do not focus on lending to firms. But the net effect on credit supply further depends on how banks adjust their balance sheets to lend to NBFIs. Do banks substitute away from the same securities that are now held by NBFIs they lend to or do they contract actual lending to non-financial firms? Or, does lending to NBFIs move independently of other bank balance sheet items? At the same time, the net effect on credit supply also varies with how much non-financial firms can replace any loss in bank loans with loans and other forms of credit extended by NBFIs.

To examine the reallocation on bank balance sheets, we plot the evolution of bank loans to firms and NBFIs in Figure 3, with both series normalized to one in January 2019. Over the period from 2019 to 2024, bank lending to NBFIs grew by nearly 60%, whereas lending to firms increased by only about 20%. The divergence became especially pronounced after 2022 (Figure A10), when corporate lending stagnated while NBFI credit continued to expand steadily. To assess whether this divergence reflects active substitution on banks' balance sheets rather than coincidental trends, we formally test whether increases in lending to NBFIs are associated with reductions in lending to firms. We proceed in three steps.

First, we use supervisory balance sheet data to examine the relationship between changes in corporate and NBFI lending, each expressed as a share of total loans and securities, at the bank level. Figure 5 presents a binscatter of the change between 2019m12 and 2023m12, showing a strong negative relationship: banks that expanded credit to NBFIs tended to simultaneously reduce lending to firms. Panel (a) of Figure 6 shows that the same pattern holds in the short run when using month-by-month changes. Panels (b)–(d) show that the substitution to other asset classes, such as government bonds and reserves, MFI and household loans, and MFI bonds, is

much weaker or insignificant.

Second, we test these substitution patterns formally by estimating the following regression:

$$\Delta \frac{y_{b,t}}{\text{All Loans \& Securities}_{b,t}} = \alpha_b + \alpha_t + \beta \, \Delta \frac{\text{Corporate Loans}_{b,t}}{\text{All Loans \& Securities}_{b,t}} + \varepsilon_{b,t}, \tag{4.3}$$

where $\Delta y_{b,t}/\text{All Loans \& Securities}_{b,t}$ is the change in the holdings of asset type y (e.g., loans to NBFIs, banks, households, government bonds and reserves, or MFI bonds) by bank b in month t, normalized by total loans and securities. The key regressor, $\Delta\text{Corporate Loans}_{b,t}/\text{All Loans \& Securities}_{b,t}$, captures the change in bank lending to firms relative to total loans and securities. We saturate the model with time fixed effects (α_t) to absorb any time-varying trends in bank lending and changes in economic conditions, for example due to monetary policy. We also include bank fixed effects (α_b) to control for any observable and unobservable heterogeneity at the bank level, such as bank size or specialization in Corporate/NBFI lending.

Table 5 presents the results. We find that a decline in firm lending is associated with the strongest reallocation toward NBFI loans among all asset categories. The effect is both statistically and economically significant: a 1% decrease in corporate lending is associated with a 0.4% increase in lending to NBFIs. By contrast, the effects for other liquid or low-risk assets, such as government bonds, reserves, or interbank exposures, are much weaker or insignificant. This pattern indicates that banks substitute corporate loan exposures specifically for NBFI loans and, to a lesser extent, for other safe assets. In other words, the expansion of lending to NBFIs crowds out direct financing to the real sector.

Third, Table 6 complements the previous analysis by reversing the specification and using NBFI lending as the dependent variable. The results confirm that the main source of growth in NBFI lending is the reallocation of credit away from firm lending. The coefficient on corporate loans in Column (1) is economically large and statistically significant: a 1% increase in NBFI lending is associated with a 0.55% decrease in firm loans. By contrast, substitution from other asset categories, such as loans to banks, household loans, or government bonds and reserves, is considerably weaker in magnitude. This finding reinforces the conclusion that the expansion of NBFI credit primarily reflects a shift in banks' lending composition away from the corporate sector rather than broad-based balance sheet expansion.

So far, we have shown that the expansion of bank lending to NBFIs primarily crowds out bank lending to non-financial firms. The extent to which this shift in the composition of bank lending has real effects on firms' credit access further varies with how NBFIs use their bank loans and how much firms can substitute toward loans and other forms of credit, e.g., bonds, extended by NBFIs. To shed light on these effects, we examine firms' borrowing outcomes using firm-level balance sheet data from Orbis and estimate the following regression:

$$\Delta log(\text{borrowing}_f) = \alpha_i + \beta \Delta \text{NBFI loans}_f + \epsilon_f, \tag{4.4}$$

where the outcome variable is the log change in firm-level debt between 2019 and 2022. We consider firm-level loans outstanding from all sources (banks and NBFIs), and total debt, encompassing all loans and bonds. ΔNBFI loans$_f$ denotes firm-level exposure to banks' lending to NBFIs. It is constructed as the weighted average change in the share of each bank's credit to the NBFI sector, with weights given by the firm's outstanding credit with those banks in 2019. α_i denotes industry fixed effects.

Table 7 reports the results. Firms that were initially dependent on banks, which subsequently expanded their NBFI exposures, experienced significantly larger declines in both total bank loans and overall debt between 2019 and 2022. The effect is again concentrated among small firms, for which the interaction term roughly doubles in magnitude. These results indicate that the crowding-out of corporate lending by NBFI exposures translates into tangible reductions in external financing for non-financial firms. Bank lending to NBFIs does not appear to channel back to firms, which also fail to replace the lost bank credit through alternative sources, including direct NBFI borrowing or corporate bond issuance.

Together, our findings in this subsection highlight the real effects of the rise in bank-to-NBFI lending. As banks allocate more balance sheet space toward NBFI loans that predominantly fund securities, they also substitute away from direct lending to non-financial firms. Firms are unable to substitute the loss in bank funding with alternative sources and credit supply contracts, especially for smaller and riskier firms. Therefore, the rise in bank-to-NBFI lending reflects a narrowing of bank balance sheets and a reduction in credit intermediation.

4.4 Capital and Liquidity Constraints in Bank Lending to Non-Banks

Fact 4. The reallocation of credit supply away from corporate loans toward safer and more liquid exposures to NBFIs is amplified by bank capital and liquidity constraints.

The reallocation of bank lending away from firms and towards NBFIs may be further amplified by banks' balance sheet constraints. First, banks may substitute away from corporate lending toward NBFI loans in response to tighter capital requirements. Bank capital requirements have steadily increased across developed economies since the Global Financial Crisis and the implementation of Basel III. In addition, several euro area countries further tightened capital regulation in 2022 by raising countercyclical capital buffers. As capital requirements rise, banks operating closer to regulatory constraints—i.e., those with lower capital ratios—may respond by shifting away from assets that require more equity capital, such as higher–risk-weight corporate loans, toward safer assets with lower risk weights, including loans to NBFIs.

To examine this mechanism, we estimate the following regression:

$$log(\text{Lending to NBFI}_{b,n,t}) = \alpha_{n,t} + \alpha_{n,b} + \beta Post_t \times C_b + \epsilon_{b,n,t}, \tag{4.5}$$

where the outcome variable is the log level of bank b's loans to NBFI n at time t. $\Delta \frac{\text{NFC Lending}_b}{\text{Loans and Securities}_b}$ denotes the change in bank b's share of lending to firms between 2021m12 and 2023m12. C_b represents bank-level characteristics that proxy for the mechanisms behind the substitution. We saturate the regression with nonbank-time fixed effects, which control for time-varying credit demand by NBFI (Khwaja and Mian, 2008), and bank-NBFI fixed effects, that account for non-random bank-nonbank matching.

Table 8 compares the risk profiles of NBFI and corporate loans. Across all instruments, loans to NBFIs are systematically safer: default probabilities are between one and six percentage points lower for NBFI exposures compared to corporate loans. This indicates that NBFI loans carry much lower risk weights relative to corporate loans. Consequently, banks optimizing to meet tighter capital requirements may shift away from high–risk-weight assets, such as corporate loans, toward low–risk-weight assets, such as NBFI loans. Table 9, Column (2), confirms this conjecture and shows that banks with lower ex-ante total capital ratios increased their lending to the NBFI sector by more.

Appendix Table A1 provides additional evidence consistent with the role of capital constraints at the loan level. Column (1) confirms the bank-level results: when banks expand lending to NBFIs, their loans to firms decline also at the loan level. Columns (2)–(3) show that this contraction is concentrated among smaller and riskier firms. This pattern is consistent with banks reducing exposures to borrowers with higher risk weights when reallocating credit toward NBFIs.[3]

[3] In addition, the positive interaction with firms' residual loan rates in Column (4) of Appendix Table A1 indicates that the decline is less pronounced for borrowers associated with higher mark-ups, consistent with banks retaining

Our evidence on the importance of bank capital constraints is consistent with prior findings in the literature (Acharya et al., 2024b, Buchak et al., 2024, Chernenko et al., 2025, Xu, 2025).

Second, banks may shift away from corporate loans into NBFI loans due to liquidity constraints. NBFI loans are not only associated with lower default probabilities but also with higher liquidity, as a large fraction of them are reverse repos with shorter maturities, whereas corporate loans are mainly term loans and credit lines with longer maturities, and may require more stable funding, such as central bank liquidity and core deposits. As a result, we would expect that when banks experience negative funding shocks, they might shift towards more liquid NBFI loans that require less stable funding. To test this prediction, we exploit two liquidity shocks.

First, we examine the decline in access to central bank liquidity. Since the Global Financial Crisis, the ECB has provided banks with subsidized central bank borrowing facilities to ensure access to lender-of-last-resort liquidity. This funding reached nearly EUR 2 trillion during the COVID-19 pandemic. However, in October 2022, the ECB recalibrated its largest liquidity operation—the Targeted Longer-Term Refinancing Operations (TLTRO III)—by increasing the interest rate applied to outstanding funds. This decision triggered the fastest and largest decline in ECB borrowing ever recorded. Table 9, Column (3), shows that banks with larger ECB borrowing relative to their assets increased their NBFI lending by more following the policy change.

Second, we analyze the liquidity shock from deposit outflows. Beginning in July 2022, the ECB's rate hikes triggered significant outflows of deposits from bank balance sheets, consistent with the standard deposit channel of monetary policy (Drechsler et al., 2017). Table 9, Column (4), shows that banks losing a greater share of core deposits expanded their NBFI lending by more after the tightening of monetary policy. [4]

5 Model

In this section, we develop a model to rationalize our empirical findings and to quantify how demand and supply forces influence the aggregate credit to non-financial firms.

their most profitable exposures.

[4] Appendix Table A2 provides further evidence consistent with both risk- and liquidity-based mechanisms using instrument-level regressions. Column (2) shows that the increase in NBFI lending is more than ten times stronger for reverse repo transactions, which are collateralized by securities and therefore more liquid and associated with lower default risk. Column (3) shows that the expansion in NBFI lending is substantially weaker or even reverses for NBFIs with a high share of assets invested in loans, which are typically riskier and less liquid. Together, these results indicate that banks' reallocation of lending toward NBFIs is concentrated in exposures that are simultaneously safer and more liquid.

In Section 5.1, we present the model setup. We then analyze bank and NBFIs' portfolio optimization problems to shed light on the cross-sectional variation in NBFI balance sheet composition, which we confirm empirically. Finally, in Section 5.3, we discuss how NBFI's borrowing demand, as highlighted in Section 4.2, versus banks' balance sheet constraints, as highlighted in Section 4.4, impact aggregate credit to firms.

Note that in the model section, we will refer to firms' borrowing of loans and the issuance of securities as the supply of loans and securities, respectively. NBFIs and banks will optimally choose the amount of firms loans and securities they hold, i.e., demand firm loans and securities. This terminology aligns with modeling convention and does not change the economic intuition of firms demanding loans that are provided by banks and NBFIs.

5.1 Model Setup

We consider a two-period model with a representative bank and a set of heterogenous NBFIs. Both the bank and the NBFIs make portfolio allocation decisions in the first period, and returns are realized in the second period.

Assets There are two types of assets with exogenously given supply curves in the economy: loans to firms and securities, with returns R_L and R_S. We assume their returns are normally distributed, with expected returns denoted by μ_i for $i \in \{S, L\}$, and $\mu = (\mu_S, \mu_L)^\top$ in the vector form. The variance-covariance matrix of returns is denoted by Σ, where

$$\Sigma = \begin{pmatrix} \sigma_S^2 & \rho\sigma_L\sigma_S \\ \rho\sigma_L\sigma_S & \sigma_L^2 \end{pmatrix}. \tag{5.6}$$

We interpret securities as government bonds or other highly liquid and safe assets, which can be used to collateralize bank debt with low haircuts. Loans to firms are riskier and less liquid than securities. Hence we assume that $\sigma_L^2 > \sigma_S^2$.

The supply functions of loans and securities are given by $S_L(\mu_L)$ and $S_S(\mu_S)$. The asset supply functions are increasing in asset prices and hence decreasing in expected returns, i.e. $S_i' < 0$ for $i \in \{L, S\}$. These capture issuances from firms, governments or other agencies, netting out the demand of other investors outside the banking sector and NBFIs, such as households or foreign investors. In addition to these exogenously supplied assets, the bank can also lend to NBFIs, which we describe in details below.

NBFIs NBFIs invest externally supplied equity and their borrowing from the bank across the two risky assets, i.e., securities and loans to firms, taking the assets' expected returns and variances as given. We interpret securities as the safer, more liquid asset that can be pledged as collateral when NBFIs borrow from the bank. NBFIs can borrow from the bank at a loan rate $r_b(\lambda, \ell)$, where λ is the degree of collateralization and ℓ is the quantity of NBFI borrowing in terms of the bank's portfolio share. As we will show later, this loan schedule depends on the bank's optimization problem, and it is decreasing in the degree of collateralization λ and increasing in the amount borrowed ℓ.

For a given NBFI $i \in \mathcal{I}$, let $w_i \equiv (w_{S,i}, w_{L,i}, w_{b,i})^\top$ denote its portfolio weights on securities, corporate loans, and bank debt, respectively. We consider the parameter regions where NBFIs borrow from the bank so that $w_{b,i} < 0$. The budget constraint implies that

$$w_{S,i} + w_{L,i} + w_{b,i} = 1. \tag{5.7}$$

Furthermore, we assume only securities can be pledged as collateral for borrowing from the bank. Hence the collateral constraint can be written as

$$0 \;\leq\; w_{S,i} + \lambda_i \, w_{b,i}, \qquad \lambda_i \geq 0, \tag{5.8}$$

so that when $w_{b,i} < 0$, the NBFI must hold enough securities to satisfy the haircut requirement for the chosen degree of collateralization λ_i. Here, λ_i can be interpreted as either the average haircut on NBFI i's bank borrowing or, equivalently, the share of its bank borrowing that is collateralized by safe securities like in reverse repos.

Given the assets return distribution and bank loan rate $r_b(\lambda_i, \ell_i)$, the NBFI's portfolio return is

$$R_p(w_i, \lambda_i) = w_{S,i} R_S + w_{L,i} R_L + w_{b,i} r_b(\lambda_i, \ell_i). \tag{5.9}$$

With limited liability, the equity payoff is

$$R_e(w_i, \lambda_i) = \max\{R_p(w_i, \lambda_i),\, 0\}. \tag{5.10}$$

We assume investors' demand for NBFIs' equity claims rises with expected payoffs and falls with risk. In practice, mutual fund flows—and thus assets under management—have been shown to increase with expected returns and decrease with return volatility; pension funds exhibit similar

patterns over a longer horizon, attracting more capital when expected returns are higher and risk is lower. In order to flexibly estimate the demand for equity claims, we adopt a reduced-form equity-demand function for each NBFI i:

$$E_i(w_S, w_L, w_b, \lambda) \;=\; \bar{E} \;+\; \phi_{\mu,i}\,\mathbb{E}[R_e(w,\lambda)] \;-\; \tfrac{\phi_{\sigma,i}}{2}\,Var(R_e(w,\lambda)), \qquad \phi_{\mu,i} > 0,\ \phi_{\sigma,i} > 0, \tag{5.11}$$

where $\phi_{\sigma,i}$ and $\phi_{\mu,i}$ capture the sensitivity of investor demand to risk and return, respectively. The parameter $\bar{E}$ captures a baseline level of external equity that is independent of portfolio returns, for example due to locked-in investors or other institutional features.

We capture the heterogeneity in the NBFI sector through differences in risk and return sensitivities $\phi_{\sigma,i}$ and $\phi_{\mu,i}$. While hedge funds and mutual funds may have investors that are more sensitive to risk, lending companies may have more risk tolerant investors. Hence the relative magnitude of ϕ_σ to ϕ_μ is larger for hedge funds and mutual funds. These differences could originate from different investor bases and segmented markets. For example, retail investors may be able to invest in mutual funds, but may not have direct access to private debt funds. Alternatively, differences in sensitivity could come from investors mentally allocating wealth across different financial vehicles for different purposes, For example, investors may be less risk tolerant when thinking about investments in retirement savings compared to other investments. Another way to interpret the risk sensitivity is the convenience and liquidity value provided by the equity claims of NBFIs: high volatility reduces the convenience value provided by equity claims. While there are many other differences across different types of NBFIs, we show that the variation in risk sensitivity generates heterogeneity in NBFIs' asset and liability choices that are consistent with a range of empirical patterns documented in the previous section. One of the key contributions of the paper is to capture the wide degree of heterogeneity in the NBFI sector in a parsimonious way.

Taking asset returns and bank loan rates as given, each NBFI chooses its portfolio weights and collateralization to maximize equity value:

$$\max_{w_S, w_L, w_b, \lambda \in [0,\bar{\lambda}]} \; E_i(w_S, w_L, w_b, \lambda) \tag{5.12}$$

$$s.t. \qquad w_S + w_L + w_b = 1, \tag{5.13}$$

$$0 \le w_S + \lambda w_b. \tag{5.14}$$

Economically, NBFIs trade off higher expected returns from holding riskier, less liquid loans

(w_L) against the equity-risk penalty captured by ϕ_σ. They can reduce borrowing costs by pledging more collateral, which lowers the loan rate $r_b(\lambda, \ell)$ but requires holding more safe securities with lower returns. Heterogeneity in $\phi_{\mu,i}$ and $\phi_{\sigma,i}$ maps into different tilts toward risk, leverage, and collateralization across NBFI types.

Bank We consider a representative bank that finances itself with deposits D and a given amount of equity E_B. It allocates funds across securities and corporate loans, and may also extend loans to NBFIs with varying degree of collateralization.

Let bank holdings of securities and loans to firms be x_S and x_L, and let L_i denote the loan to NBFI i. The bank chooses $(x_S, x_L, \{L_i\}_{i\in\mathcal{I}}, D)$ taking as given NBFIs' collateral choices $\{\lambda_i\}_{i\in\mathcal{I}}$ and asset returns. The balance sheet satisfies

$$x_S + x_L + \sum_{i\in\mathcal{I}} L_i \;=\; D + E_B. \tag{5.15}$$

To capture the risk as well as the regulatory costs of holding different assets on the bank's balance sheet, we assume quadratic holding costs that depend on the asset type and the collateralization level of NBFI loans. Specifically, denote $a_S := x_S/E_B$, $a_L := x_L/E_B$, and $\ell_i := L_i/E_B$ as the bank's asset positions normalized by equity. The bank incurs quadratic holding costs

$$\tfrac{c_S}{2}a_S^2 \;+\; \tfrac{c_L}{2}a_L^2 \;+\; \tfrac{1}{2}\sum_{i\in\mathcal{I}} c(\lambda_i)\,\ell_i^2, \qquad c_L > c_S \geq 0,\; c(\cdot) > 0,\; c'(\cdot) < 0, \tag{5.16}$$

where $c_L > c_S$ reflects that loans to firms are riskier/less liquid than securities, and hence carry higher regulatory costs compared to securities. Throughout the paper, we assume that the function $c(\lambda_i)$ decreases with the collateralization level λ_i of the NBFI loan, i.e., $c'(\lambda_i) < 0$. This reflects the fact that more collateralized loans are less risky from the bank's perspective and therefore incur lower capital and regulatory costs.[5]

Furthermore, the bank takes the deposit demand curve $r_D(D, \sigma_B)$ as given, where σ_B represents the volatility of the bank's portfolio returns. A higher deposit rate attracts more deposits, i.e.,

$$\frac{\partial r_D}{\partial D} \geq 0. \tag{5.17}$$

[5] A richer microfoundation could model regulatory costs as a function of default probabilities and incorporate risk aversion over the bank's endogenous portfolio. The key economic mechanisms remain the same, hence we abstract from these details here.

Throughout the analysis, we assume the demand curve is weakly convex in D, i.e., $\frac{\partial^2 r_D}{\partial D^2} \geq 0$. In addition, a more volatile bank portfolio increases the risk of bank failure and reduces the convenience value of deposits, which lowers the demand for deposits and thus requires a higher deposit rate to attract the same amount of deposits. That is,

$$\frac{\partial r_D}{\partial \sigma_B} \geq 0. \tag{5.18}$$

The bank chooses its portfolio weight in securities, a_S, direct holding of corporate loans, a_L, lending to NBFIs, $\{\ell_i\}$, and deposits, d, to maximize its expected equity return net of regulatory costs:

$$\max_{a_S, a_L, \{\ell_i\}, d} \mu_S a_S + \mu_L a_L + \sum_{i \in \mathcal{I}} r_b(\lambda_i, \ell_i)\, \ell_i \; - \; r_D(d)\, d \; - \; \tfrac{c_S}{2} a_S^2 \; - \; \tfrac{c_L}{2} a_L^2 \; - \; \tfrac{1}{2} \sum_{i \in \mathcal{I}} c(\lambda_i)\, \ell_i^2 \tag{5.19}$$

subject to the normalized balance-sheet identity

$$a_S + a_L + \sum_{i \in \mathcal{I}} \ell_i \; = \; d + 1. \tag{5.20}$$

In equilibrium, the bank holds some securities indirectly through lending to NBFIs. In practice, even though government securities carry similar balance sheet cost as reverse repos, banks may prefer to hold securities through NBFI loans rather than direct holdings of government bonds due to differences in the willigness and cost to bear risk. The bank's marginal depositor base may be particularly sensitive to the duration risk that comes with direct holdings of government bonds, compared to the investor of mutual funds or hedge funds.[6] Hedging duration risk using derivatives is also subject to regulatory cost for banks but not for NBFIs like hedge funds. These factors are internalized by the bank when optimizing its portfolio through the deposit rate it pays, captured by the condition in (5.18), and it rationalizes bank's preference for indirect holdings.

Market Clearing In a competitive equilibrium, the bank and NBFIs choose their optimal portfolios taking as given asset returns and the bank loan schedule. All asset markets and loan markets clear.

$$\text{Securities:} \qquad x_S + \sum_{i \in \mathcal{I}} E_i\, w_{S,i} \; = \; S_S(\mu_S), \tag{5.21}$$

[6]Even though the insured sleepy depositors are insensitive to duration risk and interest rate fluctuations, the bank's marginal source of funding, including wholesale funding, is sensitive to the bank's portfolio risk. It is the marginal funding source that determines what the bank holds when there is an expansion of balance sheet size.

Loans to firms: $$x_L + \sum_{i \in \mathcal{I}} E_i \, w_{L,i} \;=\; S_L(\mu_L), \tag{5.22}$$

Bank–NBFI credit: $$L_i + E_i \, w_{b,i} = 0 \qquad \forall i \in \mathcal{I}. \tag{5.23}$$

Equation (5.21) and Equation (5.22) state the market clearing conditions for securities and corporate loans in dollar terms: the total demand for each type of asset from the bank and all NBFIs must equal the exogenous supply. Equation (5.23) states the market clearing condition for bank loans to each NBFI: the supply of bank lending to each NBFI must be equal to that NBFI's demand for bank borrowing.

5.2 Cross-sectional Heterogeneity of NBFIs

To explain the cross-sectional differences in NBFIs' portfolio choices, it is useful to define $\kappa_i := \phi_{\sigma,i}/\phi_{\mu,i}$, which summarizes NBFI i's relative sensitivity to risk versus return.

First, denote the Lagrangian multiplier in front of the bank's budget constraint as η. It captures the shadow price of the bank's balance sheet space. The first order condition for ℓ_i yields the bank's loan-supply schedule to NBFI i:

$$r_b(\lambda_i, \ell_i) = \eta + c(\lambda_i)\, \ell_i. \tag{5.24}$$

Given the regulatory holding cost is positive, $c(\lambda_i) > 0$, the loan-supply schedule is upward sloping in quantity ℓ_i. Furthermore, the fact that more collateralized loans incur less regulatory cost implies directly that it is cheaper to borrow more collateralized loans. We summarize the result below.

Lemma 1. *Under the assumption that $c'(\lambda) < 0$ for all $\lambda \geq 0$, the bank's loan-supply schedule $r_b(\lambda_i, \ell_i)$ to NBFI i is decreasing in the collateralization level λ_i, i.e., $\frac{\partial r_b}{\partial \lambda_i} \leq 0$, and increasing in the quantity lent ℓ_i, i.e. $\frac{\partial r_b}{\partial \ell_i} \geq 0$.*

Second, starting from the NBFI's optimization problem, we derive comparative statics that describe how portfolio choices vary with the relative risk sensitivity parameter, κ_i. Let $\theta_i := w_{S,i}/(w_{S,i} + w_{L,i})$ denote the share of securities in total investments in securities and loans. Intuitively, NBFIs that are more risk-sensitive (with higher κ_i) tilt their portfolios toward safer securities rather than riskier corporate loans and rely less on bank borrowing. However, conditional on borrowing, they do so at higher collateralization levels, since they hold more securities and more collateralized loans are cheaper. More formally,

Proposition 1. *Under the assumption that securities are safer $\sigma_S < \sigma_L$, NBFIs with higher relative risk sensitivity $\kappa_i = \phi_{\sigma,i}/\phi_{\mu,i}$ hold a higher share of securities in their asset portfolio, borrow less from the bank, but choose higher collateralization levels when they do borrow. That is,*

$$\frac{\partial \theta_i}{\partial \kappa_i} \geq 0, \qquad \frac{\partial w_{b,i}}{\partial \kappa_i} \geq 0, \qquad \frac{\partial \lambda_i}{\partial \kappa_i} = \begin{cases} > 0, & \text{if } w_{b,i} < 0 \text{ and } w_{S,i} + \lambda_i w_{b,i} = 0, \\ 0, & \text{otherwise.} \end{cases}$$

We proceed to examine the cross-sectional relationships between the asset composition of NBFI's portfolios, their leverage and the type of borrowing from the bank in the data. Panels (a) and (b) of Figure 7 plot the ratio of loans and securities of different NBFI sectors. We observe that investment funds, insurances, and pensions have a smaller fraction of loans on their asset side than OFIs, FAs, and Captives, which include the institutions in Figure 2 that are more engaged in lending. In contrast, investment funds, insurances, and pensions hold a larger fraction of securities than OFIs, FAs, and Captives.

At the same time, investment funds, insurances, and pensions also have lower leverage than OFIs, FAs, and Captives, as evident from panel (c) of Figure 7. Panel (d) confirms that the same relationship holds for the fraction of bank loans over total assets. Out of these bank loans, panel (e) further shows that investment funds, insurances, and pensions borrow a higher proportion of reverse repos than OFIs, FAs, and Captives. This finding is consistent with the results in Table 1, where the growth of reverse repos is more tied to hedge funds and mutual funds.

So far, we have shown that NBFIs that lend more have higher leverage and a smaller fraction of repo borrowing. Unfortunately, the data on NBFIs asset and liability composition is not available at an institution level. The most granular data available covers NBFI sectors by country. We use this data to more formally show the relationship between NBFIs' asset composition, leverage, and repo funding in Figure 8. In panel (a), the binscatter plot shows a clearly negative relationship between the ratio of bank loans borrowed against the ratio of securities held controlling for time fixed effects. The negative relationship remains when we include country-time fixed effects (panel (b)) and when we consider the ratio of debt over total assets (panels (c) and (d)). In other words, NBFIs that hold more securities also borrow less. In contrast, panels (e) and (f) show a positive relationship between the ratio of reverse repos versus the ratio of securities. That is, NBFIs that hold more securities borrow less but their loans borrowed are concentrated in reverse repos.

Table 10 complements this analysis by presenting the composition of collateral pledged by

NBFIs against their borrowing from banks across all instrument types. The collateral structure is highly informative about the asset composition of NBFIs' balance sheets. Institutions that primarily invest in securities, such as mutual funds, hedge funds, insurance companies, pension funds and dealers, have a larger fraction of securities within assets used as collateral. By contrast, NBFIs more directly engaged in credit intermediation, such as leasing, factoring, or lending companies, private funds, have a broader mix of assets, including loans, accounts receivables and other non-marketable claims, that are pledged to secure their borrowing. The composition of collateral thus provides indirect evidence on the heterogeneity of NBFI asset holdings and their underlying business models.

Taken together, we find that NBFIs holding more securities have lower leverage but borrow a higher fraction of their loans in the form of reverse repos, which is highly collateralized by safe government securities. These empirical findings are consistent with our model predictions. Although there are other differences across NBFIs, our results suggest that the heterogeneity in risk sensitivity across NBFIs can generate rich cross-sectional patterns consistent with the data.

5.3 Aggregate Lending to Firms

We are interested in the equilibrium amount of lending to firms from both the bank and the NBFIs. Let this aggregate loan quantity be $L \equiv E_B a_L + \sum_{i \in \mathcal{I}} E_i w_{L,i}$.

We consider two counterfactuals. First, we analyze the effect of a larger NBFI borrowing demand stemming from an increased amount of securities outstanding, as motivated by our empirical evidence in Section 4.2. Second, we analyze the effect of increased regulatory constraints on bank lending, as motivated by the findings in Section 4.4. To illustrate the effects cleanly, we consider one NBFI with minimal default risk and no correlation between loans and securities.[7]

5.3.1 NBFI Borrowing Demand: Increase in Security Supply

In our model, an increased demand by NBFIs to borrow from banks in order to fund a growing stock of securities can be captured by a rightward shift in the security supply curve $S_S(\mu_S)$. We consider a parallel shift of the security supply curve from $S_S(\mu_S)$ to $S_S(\mu_S) + \tau$ with $\tau > 0$. We obtain the following results:

Proposition 2. *Consider an increase in security supply by τ,*

[7] Assuming minimal default risk for the NBFI allows us to approximate the NBFI's equity return as a normal distribution, instead of a truncted normal distribution. We further assume the bank's depositor's sensitivity to risk is small to show the results cleanly in this section.

1. *the loan rate to the NBFI increases i.e.,* $\frac{\partial r_b(\lambda,\ell)}{\partial \tau} \geq 0$.

2. *total loan supply contracts, i.e.* $\frac{\partial L}{\partial \tau} \leq 0$*, assuming that the NBFI's equity* E *is fixed and the degree of collateralization* $\lambda = \bar{\lambda}$ *is large. This contraction in total loans is attenuated when it is more difficult for the bank to lend to NBFIs (higher* ρ*), i.e.* $\frac{\partial^2 L}{\partial \tau \partial \rho} \geq 0$ *and when the NBFI is more risk-averse, i.e.* $\frac{\partial^2 L}{\partial \tau \partial \kappa} \geq 0$.

First, an increase in security supply leads to an increase in the NBFI borrowing rate, as shown in part 1 of Proposition 2. When the security supply increases, the expected return on securities increases. To hold more of the higher-yielding securities, NBFIs' demand for bank loans increases, which pushes up the NBFI borrowing rate. Further, the bank also reallocates more balance sheet space toward securities and away from NBFI loans, leading to an upward shift in the bank's loan supply schedule to NBFIs and making it more expensive for NBFIs to borrow.

An increase in security supply in equilibrium leads to an increase in the return of holding securities, which in turn leads to both the bank and the NBFI to substitute away from corporate loans. This substitution effect is the main mechanism contributing to a negative spillover effect on loan volume, as shown in part 2 of Proposition 2. There is, however, also a scale effect that works in the opposite direction. When the security return is high, the NBFI draws in more external equity, and potentially takes on more leverage from the bank. Both factors scale up the balance sheet, leading to potentially higher demand for investing in corporate loans. In our proposition, we rule out the scale effect by assuming the NBFI's equity E is fixed and the degree of collateralization λ is large.[8] In practice, as long as the scale effect is small relative to the substitution effect, our results go through.

Further, we show that the negative spillover effect on aggregate lending to firms is stronger when it is easier for the bank to lend to NBFIs. We parametrize the holding cost function $c(\lambda)$ as $\rho\tilde{c}(\lambda)$: when ρ is smaller, it becomes easier for the bank to reallocate its balance sheet toward NBFI loans.[9] When it is easier for the bank to lend to NBFIs (lower ρ), the bank shifts more balance sheet space toward NBFI loans. When the degree of collateralization is high, the reallocation away from loans in response to a security return increase in the NBFI's portfolio is stronger than that of the bank's portfolio. Hence more lending from the bank to the NBFI amplifies the negative spillover effect on aggregate lending to firms as the NBFI draws out more funding from the bank.

[8] For fixed E, this is equivalent to fixing κ but letting $\phi_\mu \to 0$. Fixing λ is equivalent to assume the equilibrium $\lambda = \bar{\lambda}$, as in the case of reversed repo. Hence local changes in parameters do not alter the equilibrium λ.

[9] As before, we focus on the substitution effect in the bank and the NBFI's portfolio choices.

Finally, when the NBFI is more risk-sensitive (higher $\kappa = \phi_\sigma/\phi_\mu$), its portfolio adjustment is less sensitive to return changes. A larger weight on risk in the objective makes the NBFI value diversification across assets over chasing the higher-yield security, so the elasticity of w_L to increases in μ_S falls. Put differently, the variance penalty offsets part of the marginal gain from the higher security return, so the NBFI cuts its loan holdings by less when μ_S rises. With a smaller substitution away from loans, the negative spillover on aggregate lending to firms is weaker when the NBFI sector is more risk-sensitive.

5.3.2 Bank Lending Constraint: Increase in the Regulatory Cost of Corporate Loans

Given that firms' loan supply curve does not change, to analyze the equilibrium loan quantity, we just need to understand how the bank and NBFIs' loan demand curves from shift, respectively. From the bank's first order condition of a_L, we have

$$a_L = \frac{\mu_L - \eta}{c_L}. \tag{5.25}$$

When the regulatory cost of corporate loans c_L increases, the direct effect on the bank's portfolio allocation leads to a downward shift in the bank's loan demand curve, i.e., $\frac{\partial a_L(\mu_L;c_L)}{\partial c_L} \leq 0$. This direct effect leads to a contraction in bank lending to firms.

However, at the same time, the bank reallocates more funding toward NBFI loans, shifting the NBFIs' loan demand outward. This indirect channel, operating through the bank substituting corporate loans with NBFI loans, partly offsets the direct loan contraction. More specifically, when c_L increases, the bank adjusts its portfolio tilts, leading to a downward shift in its loan schedule for NBFIs in Equation (5.24), making it cheaper for NBFIs to lever up, i.e., $\frac{\partial r_b(\lambda,\ell)}{\partial c_L} \leq 0$, in contrast to the previous counterfactual. This result is formally shown in the first part of Proposition 3.

Proposition 3. *Consider an increase in the regulatory cost of corporate loans c_L.*

1. *The bank loan rate to the NBFI decreases i.e., $\frac{\partial r_b(\lambda,\ell)}{\partial c_L} \leq 0$.*
2. *The spillover effect on aggregate lending to firms is exacerbated when it is more difficult for the bank to lend to NBFIs (higher ρ), i.e. $\frac{\partial^2 L}{\partial c_L \partial \rho} \leq 0$ and when it is the NBFI is more risk-sensitive (higher κ), i.e. $\frac{\partial^2 L}{\partial c_L \partial \kappa} \leq 0$, assuming that the NBFI's equity E is fixed and the degree of collateralization $\lambda = \bar{\lambda}$ is large.*

Cheaper bank loans then induces the NBFIs to increase their leverage, which leads to higher

returns on their equity claims. This in turn draws in additional external equity. Both higher leverage and more equity contribute to a scale effect that increases NBFIs' loan demand.[10]

Hence, the net effect on aggregate lending to firms hinges on the balance between these two countervailing forces. Moreover, it depends on how easy it is for the bank to switch to NBFI loans when corporate loans become more expensive. The indirect effect is weaker when it becomes more difficult for the bank to reallocate its balance sheet toward NBFI loans, i.e., ρ is larger, which implies the net negative effect on aggregate lending to firms is stronger.

Further, the magnitude of the indirect channel also depends on the type of the NBFI, as the indirect effect is stronger for NBFIs whose investor base is less sensitive to risk and more sensitive to returns. With a smaller variance penalty (lower κ), a given decline in the bank loan rate raises optimal leverage by more. These are also the type of NBFIs that hold more loans. Note that the adjustment of external equity, if allowed, would further strengthen this effect by scaling up the balance sheet further, amplifying the outward shift in NBFI's loan demand. By contrast, for NBFIs with highly risk-sensitive investors, the leverage response is muted and portfolios tilt toward safer securities, so the indirect channel is weaker. Given the heterogeneity across NBFIs documented above, the magnitude of the overall indirect effect depends on the composition of the NBFI sector in the economy.

In practice, the increase in risk-weight applies to all risky loans, not just corporate loans. In other words, the regulatory cost of holding *risky* NBFI loans may also increase, which weakens the indirect effect. However, the degree of regulatory cost increase tends to be much lower for NBFI loans because the loans are partially collateralized and NBFI equity absorbs loss first. This is consistent with the empirical observation that bank-to-NBFI lending increases for more capital-constrained banks.

6 Conclusion

This paper studies how bank lending to NBFIs shapes the supply of credit to the real economy. Using granular data, we document that a substantial share of bank credit to NBFIs takes the form of reverse repos to entities that primarily invest in securities. At the same time, the expansion of bank lending to NBFIs has come largely at the expense of credit to non-financial firms.

[10] This is true as long as the optimal degree of collateralization is not too large. A sufficient condition is that $\lambda < 1$. When the optimal λ is too large, an increase in leverage requires a disproportional increase in securities, which may lead to a decrease in the portfolio weight of loans.

We show that this reallocation is driven by both NBFIs' credit demand and banks' credit supply constraints. On the demand side, NBFIs' borrowing surged as sovereign bond issuance increased and central bank holdings of sovereign bonds declined. That is also why the most pronounced increase in borrowing were at investment funds and in reverse repo loans. On the supply side, banks' capital and liquidity constraints amplified the shift by incentivizing the reallocation from riskier firm loans to safer and more liquid NBFI loans. Banks' capital constraints are also why smaller and riskier firms were most exposed to the reduction in firm credit.

Our model shows that the spillover effects of bank lending to NBFIs on firm credit depend critically on whether the expansion is driven by NBFI borrowing demand or by banks' balance-sheet constraints. In the model, bank lending to NBFIs incurs lower regulatory cost than direct lending to non-financial firms because of NBFIs' equity cushion. When regulatory risk weights increase, banks substitute away from firm loans and towards lending to NBFIs, which decreases the NBFI borrowing rate. In contrast, when NBFIs' borrowing demand increases to finance a larger stock of outstanding securities, the cost of borrowing for NBFIs increases. The combined bank and NBFI loan supply to firms contracts in both cases, but the extent varies with the ease of bank-to-NBFI lending and the composition of the NBFI sector. Regarding the composition of the NBFI sector, our model shows that when NBFI investors are more sensitive to risk, NBFIs tend to invest in a larger share of securities over loans.

Our results highlight that the bank–NBFI nexus has important implications for credit supply to the real economy. We unpack the drivers behind the rise in bank-to-NBFI lending and the heterogeneity within the NBFI sector. We show that bank lending to NBFIs is not a simple pass-through of bank credit to firms. Therefore, to gauge the spillover effects on the real economy, it is essential to continuously monitor the composition of the NBFI sector and the demand versus supply factors behind bank-to-NBFI lending.

7 Figures and Tables

Figure 1: Loan Volumes to NBFIs by Instrument

This figure shows the volume of loans lent to NBFIs by instrument, which includes credit lines, term loans, revolving credit, reverse repos, and others.

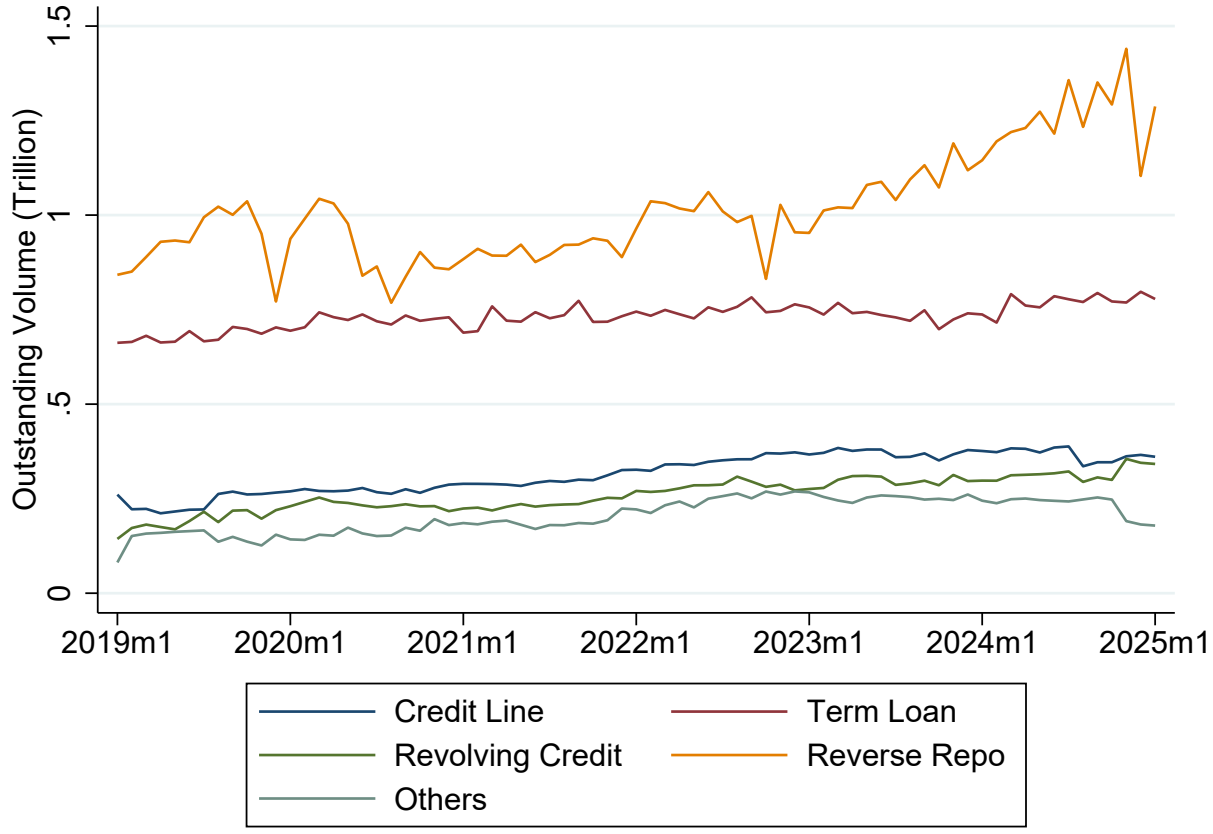
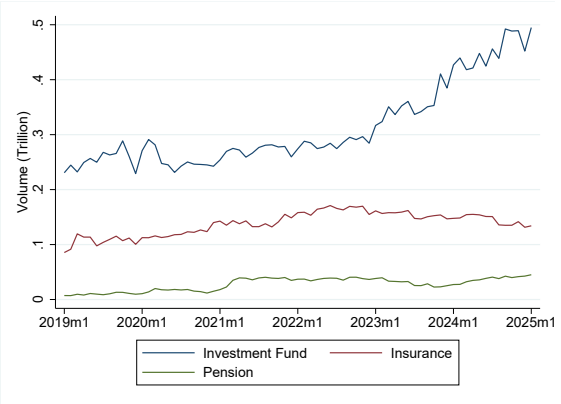


Figure 2: Loans to NBFIs by Sector

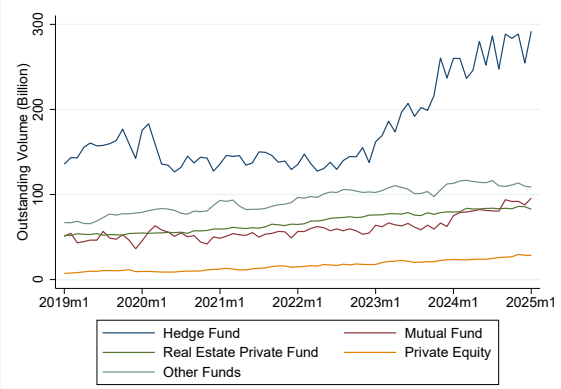
This figure shows the volume of loans lent to different non-bank financial institutions (NBFIs). Panels (a) and (b) show the overall breakdown between investment funds, insurances, pensions, financial auxiliaries, captive financing institutions, and other financial institutions. Panels (c) to (e) provide a more granular breakdown of volumes by sector, including loans to different investment funds and loans to different other financial institutions, financial auxiliaries, and captive financing institutions.

(a) Investment Funds, Pensions, and Insurances

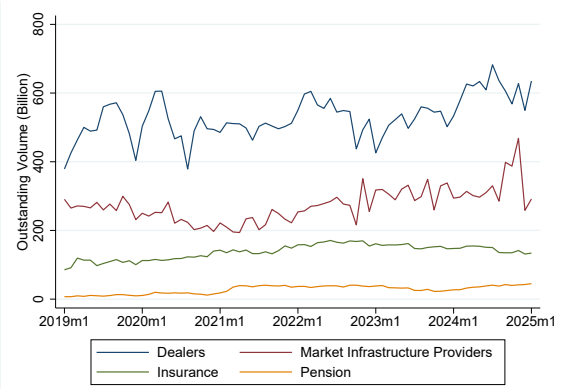


(b) Other Financial Institutions

(c) Investment Funds



(d) Dealers, Pensions, and Insurances



(e) Lending and Holding Companies

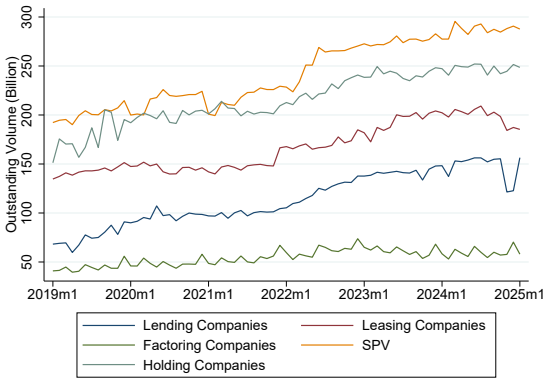


Figure 3: Loan Volumes to NBFI and firms

This figure shows the volume of loans lent to non-bank financial institutions (NBFIs) versus non-financial corporations. The volumes are normalized by their value in January, 2019.

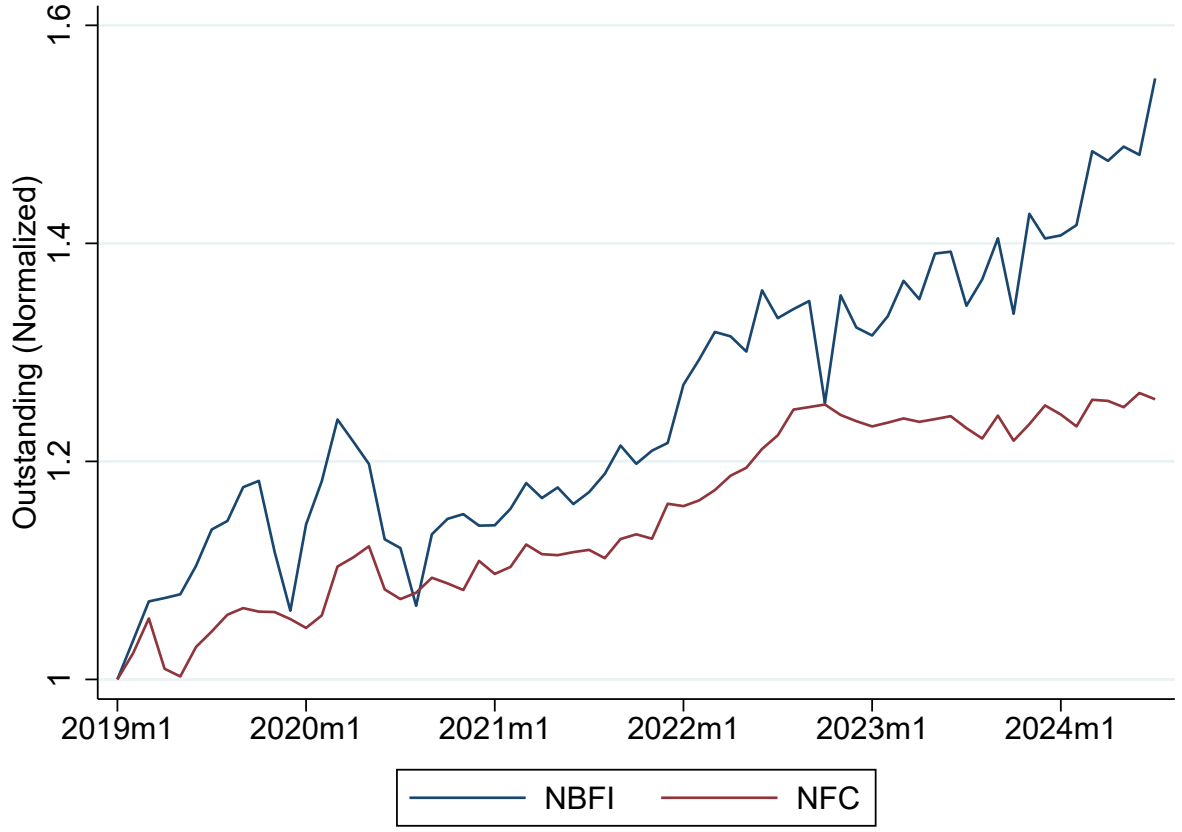
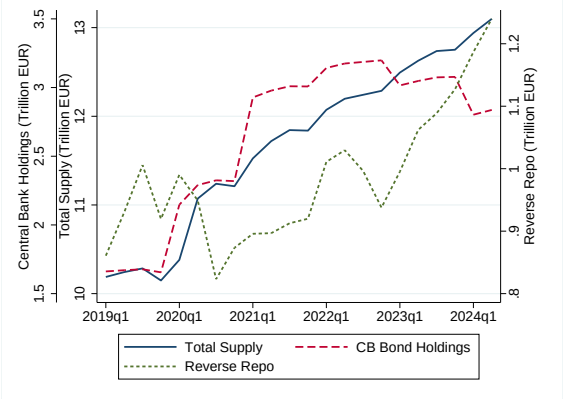


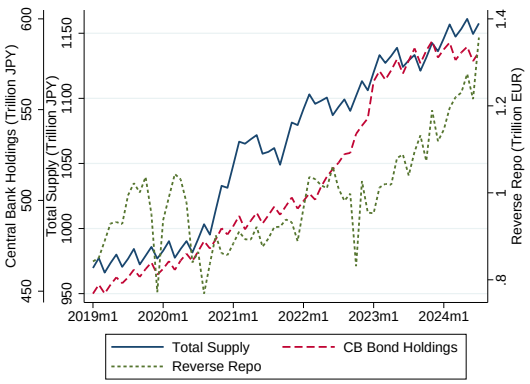
Figure 4: Sovereign Debt Supply and Central Bank Holdings Across Major Economies

This figure plots the evolution of the total outstanding supply of sovereign debt (blue line, left axis), central bank holdings of sovereign securities (red line, left axis) for four economies: (a) the euro area, (b) Japan, (c) the United Kingdom, and (d) the United States. The figure also plots reverse repo borrowing by NBFIs from banks (green dotted line, right axis). The sample period spans 2019 to 2024. Central bank holdings include government securities held outright by the respective monetary authorities.

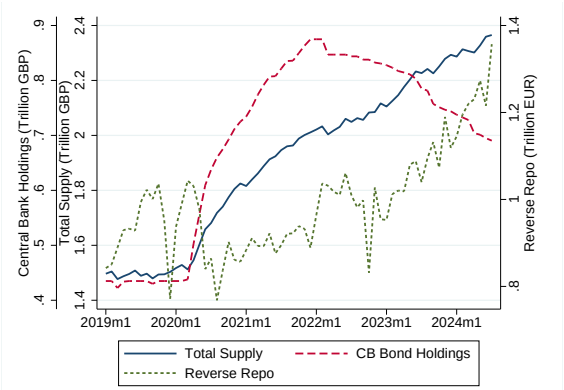
(a) Euro Area



(b) Japan



(c) United Kingdom



(d) US

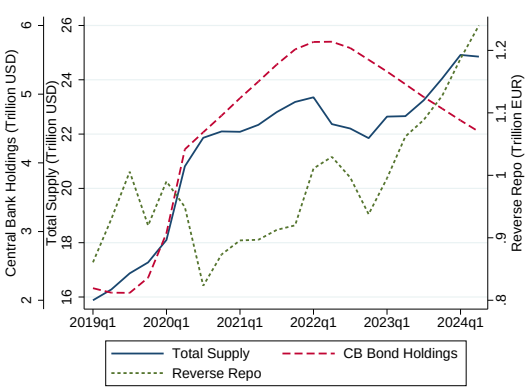


Figure 5: Substitution between corporate and NBFI lending: change between 2019m12 and 2023m12 at the bank-level

This figure presents a binscatter plot showing the relationship between changes in bank lending to non-financial corporations and to non-bank financial intermediaries (NBFIs) between December 2019 and December 2023. The variables on both axes are expressed as changes in the ratio of each loan type to total loans and securities. Each point represents the mean value within a bin of banks, and the fitted line shows the linear relationship between the two variables.

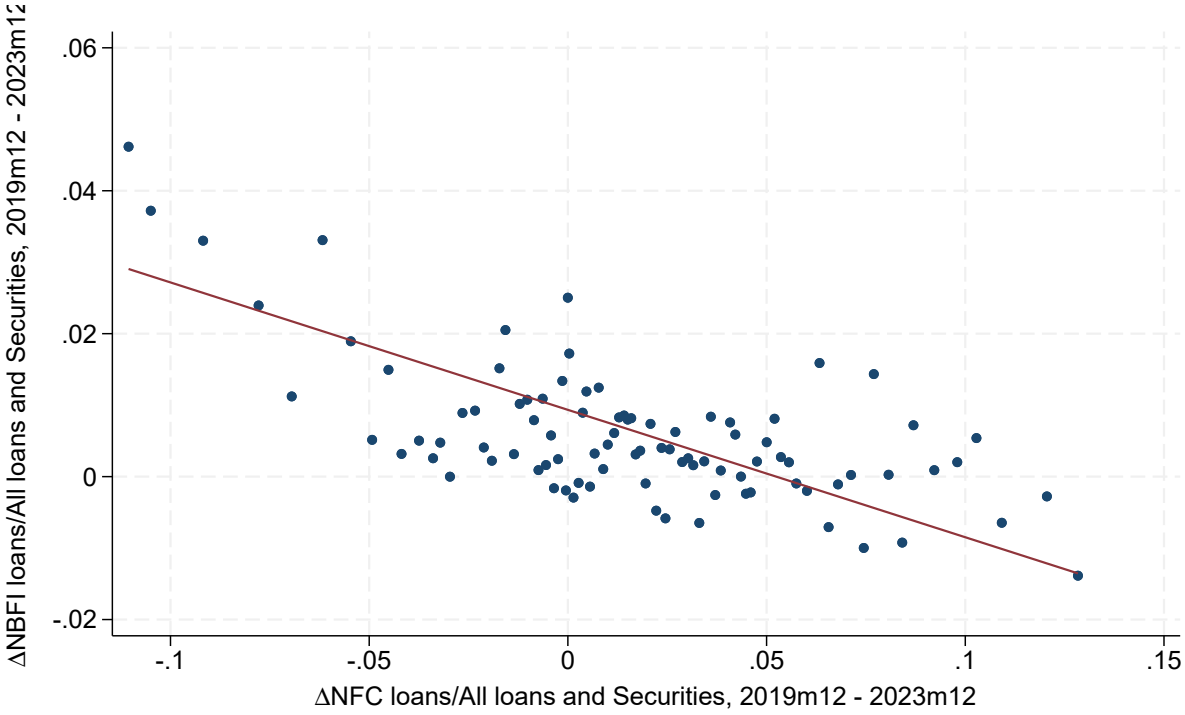
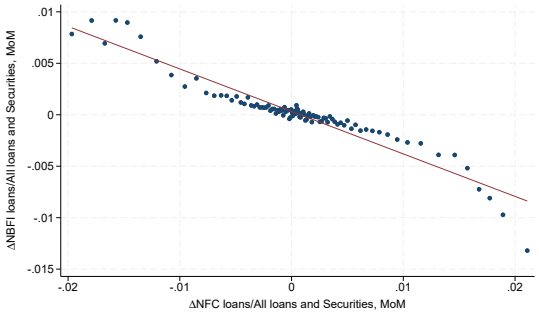


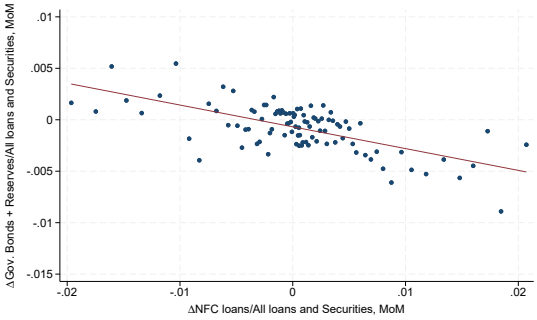
Figure 6: Substitution between corporate lending and other assets: month-over-month changes at the bank-level

This figure presents binscatter plots showing the relationship between month-over-month changes in bank lending to non-financial corporations and changes in other major asset categories at the bank level. Each point represents the mean value within a bin of banks after controlling for bank and time fixed effects. The variables on both axes are expressed as changes in the ratio of the respective asset type to total loans and securities. Panels (a)–(d) correspond to NBFI loans, government bonds and reserves, loans to MFIs and households, and bonds issued by MFIs, respectively.

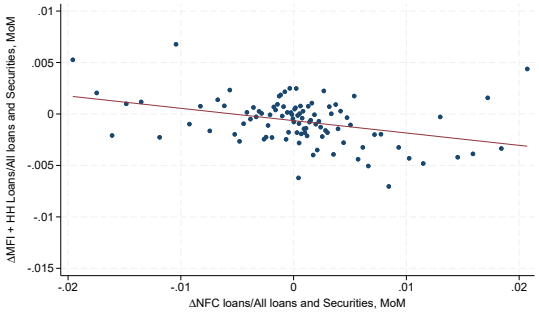
(a) NBFI loans



(b) Gov. Bonds + Reserves



(c) MFI + HH loans



(d) MFI Bonds

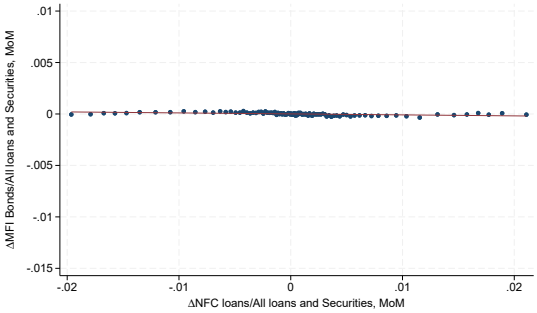
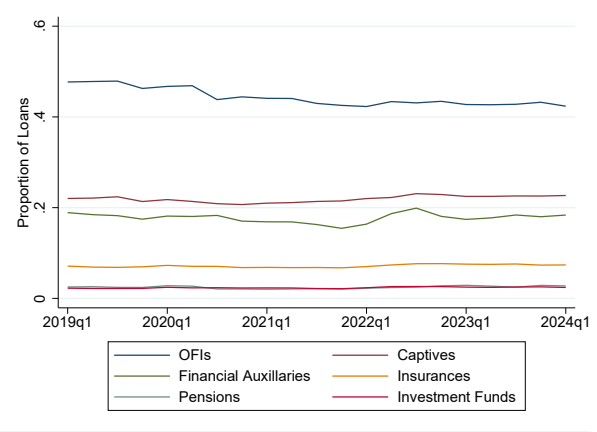


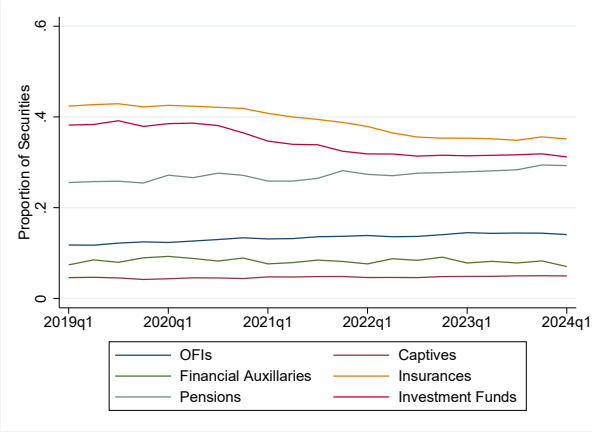
Figure 7: Asset and Liability Composition of NBFIs

Panels (a) and (b) show loans and securities on the asset side of the balance sheet as a proportion of total assets by NBFI sector. Panels (c) and (d) show debt and bank loans on the liability side of the balance sheet as a proportion of total assets by NBFI sector. Panel (e) shows reverse repos as a proportion of bank loans by NBFI sector.

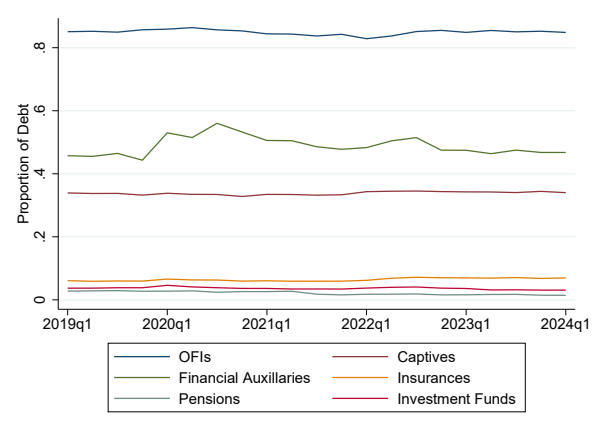
(a) Loans/Assets



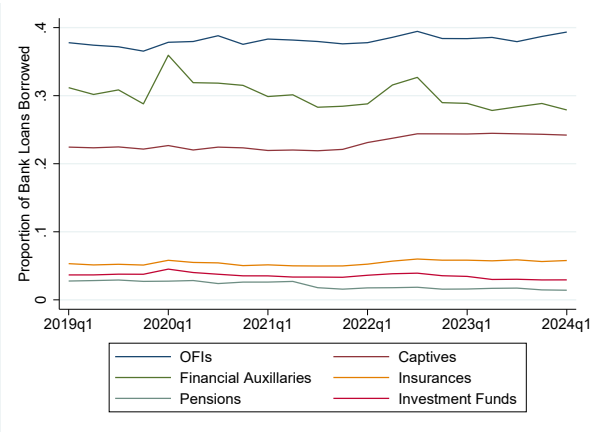
(b) Securities/Assets



(c) Debt/Assets



(d) Loans Borrowed from Banks/Assets



(e) Reverse Repos/Loans Borrowed from Banks

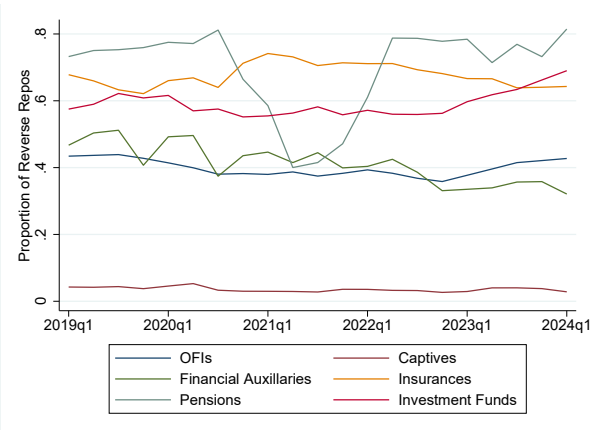
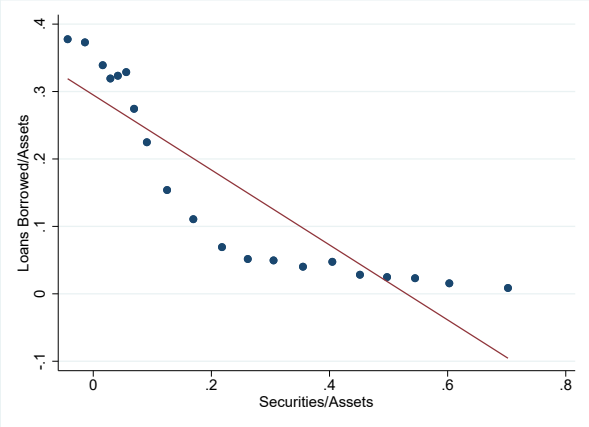


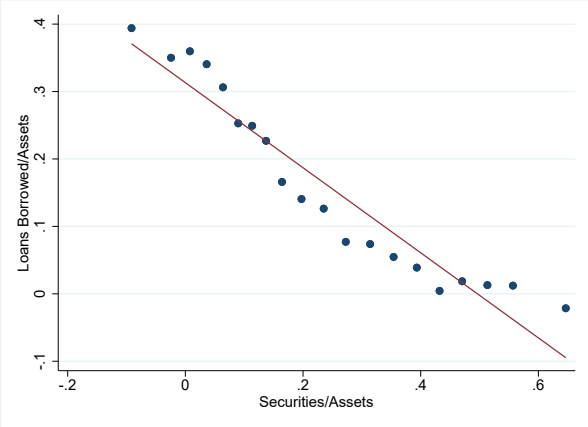
Figure 8: Liability Composition versus Asset Composition of NBFIs

This figure illustrated the relationship between NBFIs' liability and asset composition. Observations are at the country-NBFI-quarter level. Panel (a) shows the binscatter of the ratio of bank loans over total assets borrowed against the ratio of securities over total assets with a quarter fixed effect. Panel (c) shows the binscatter of the ratio of debt over total assets against the ratio of securities over total assets with a quarter fixed effect. Panel (e) shows the binscatter of the ratio of reverse repos over total loans against the ratio of securities over total assets with a quarter fixed effect. Panels (b), (d), and (f) show the corresponding plots with country-quarter fixed effects.

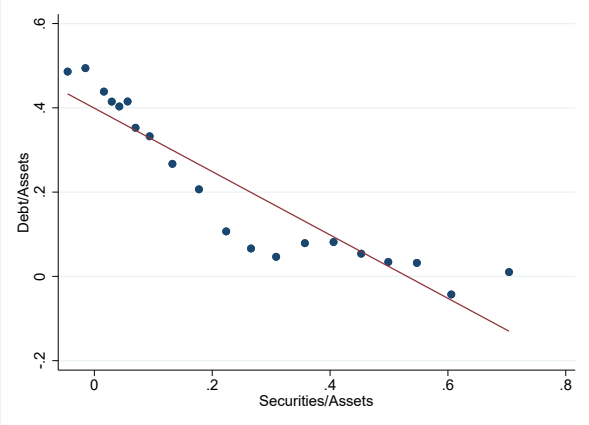
(a) Bank Loans vs Securities (Time FE)



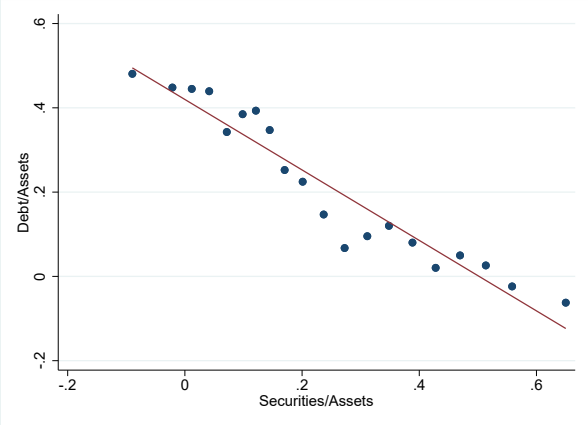
(b) Bank Loans vs Securities (Country-Time FE)



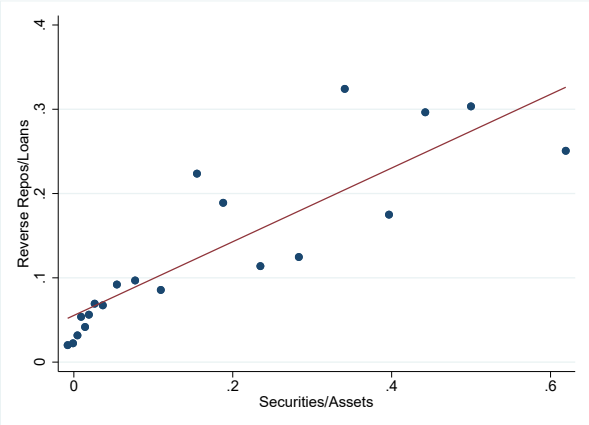
(c) Debt vs Securities (Time FE)



(d) Debt vs Securities (Country-Time FE)



(e) Rev Repos vs Securities (Time FE)



(f) Rev Repos vs Securities (Country-Time FE)

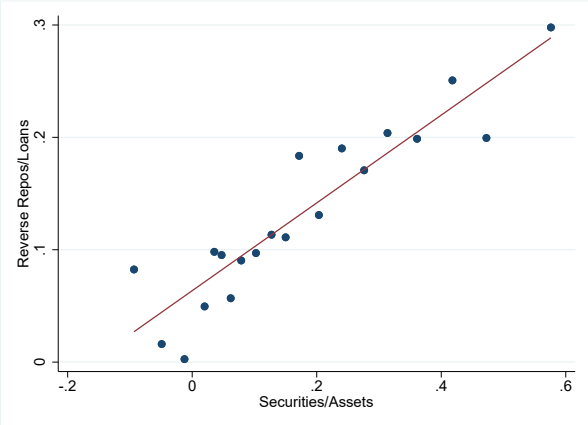


Table 1: Changes in Loan Volume by Instrument and NBFI Sector

This table shows the relationship between changes in loan volume to different NBFI sectors and changes in the aggregate loan volume for each instrument. Observations are at the instrument-sector-month level. The dependent variable, changes in the aggregate loan volume for each instrument, is calculated as the log difference in aggregate loan volume for each instrument. The independent variables are the log differences in loan volume for each sector and instrument. Standard errors are clustered by sector and month.

	Credit Line	Term Loan	Revolving	Repo	Other
	(1)	(2)	(3)	(4)	(5)
Dealers/Market Infrastructure × ΔLoans	0.20***	0.17***	0.15***	0.72***	0.54***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.10)
Hedge Funds/Mutual Funds × ΔLoans	0.35***	0.24***	0.05	0.50***	0.19*
	(0.06)	(0.04)	(0.04)	(0.07)	(0.09)
Other Funds × Δ Loans	0.66***	0.41***	0.37***	0.19***	0.17
	(0.15)	(0.06)	(0.04)	(0.03)	(0.09)
Lending/Factoring/Leasing × Δ Loans	0.72***	0.64***	0.20***	-0.06	0.49***
	(0.09)	(0.05)	(0.04)	(0.03)	(0.13)
Holding Companies and SPVs × Δ Loans	0.93***	0.94***	0.40***	0.10**	0.37*
	(0.14)	(0.11)	(0.02)	(0.03)	(0.16)
Insurances × Δ Loans	0.37***	0.10***	0.08*	0.30***	0.17
	(0.03)	(0.01)	(0.03)	(0.07)	(0.11)
Pensions × Δ Loans	-0.01	0.02***	0.05***	0.10**	0.03
	(0.01)	(0.00)	(0.01)	(0.03)	(0.04)
Observations	504	504	504	504	504
Adjusted R2	0.48	0.27	0.18	0.21	0.26

Table 2: Bank Lending to NBFIs: Loan-Level Evidence on Credit Demand Channels

This table investigates the demand-side channels driving banks' substitution from corporate to NBFI lending. Columns (1) and (2) compare lending to different borrower types across non-financial firms and NBFIs. The outcome variable in these columns is the log level of lending by bank b to borrower n at time t. Inv. Fund$_n$ is a dummy variable equal to 1 if borrower n is an investment fund, and 0 otherwise. Other NBFI$_n$ is a dummy variable equal to 1 if borrower n is a non-bank financial intermediary other than an investment fund, and 0 otherwise. The omitted category is non-financial firms. Columns (3)–(5) restrict the sample to NBFI borrowers. In these columns, the outcome variable is the log level of lending by bank b to NBFI borrower n through instrument i at time t. Hedge Fund$_n$ is a dummy variable equal to 1 if the borrower is a hedge fund, and 0 otherwise. Repo Loan$_{b,n,i}$ is a dummy variable equal to 1 if the loan is a reverse repo, and 0 otherwise. Post$_t$ is a dummy variable equal to 1 for periods after 2022m12. All specifications include controls and additional lower-order interactions. Standard errors are clustered at the bank $\times$ time and borrower $\times$ time levels. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	Between Firms and NBFIs log(Lending$_{b,n,t}$)		Within NBFI log(Lending to NBFI$_{b,n,i,t}$)		
	(1)	(2)	(3)	(4)	(5)
Post$_t$ $\times$ Inv. Fund$_n$	0.1775***	0.1855***			
	(0.0149)	(0.0155)			
Post$_t$ $\times$ Other NBFI$_n$	0.0365***	0.0289***			
	(0.0099)	(0.0065)			
Post$_t$ $\times$ Hedge Fund$_n$			0.142***	0.228***	-0.433***
			(0.0228)	(0.0254)	(0.0472)
Post$_t$ $\times$ Repo Loan$_{b,n,i}$					0.0422**
					(0.0181)
Post$_t$ $\times$ Repo Loan$_{b,n,i}$ $\times$ Hedge Fund$_n$					0.621***
					(0.0543)
Controls and Other Interactions	Yes	Yes	Yes	Yes	Yes
Bank $\times$ Time FE	No	Yes	No	Yes	Yes
Bank $\times$ Borrower	Yes	Yes	No	No	No
Bank $\times$ Borrower $\times$ Instrument FE	No	No	Yes	Yes	Yes
N	88357372	88357372	7517676	7503862	7517676
R^2	0.992	0.992	0.952	0.955	0.952

Table 3: Reverse Repo Lending to NBFIs: Quantity and Pricing Evidence on Credit Demand Channels

This table investigates the demand-side channels driving banks' reverse repo lending to NBFIs. The sample is restricted to reverse repo loans to NBFI borrowers. In columns (1)–(3), the outcome variable is the log quantity of reverse repo lending by bank b to borrower n at time t. In columns (4)–(6), the outcome variable is the spread charged by bank b to borrower n on reverse repo loans at time t. Hedge Fund$_n$ is a dummy variable equal to 1 if the borrower is a hedge fund, and 0 otherwise. Non-EUR Loan$_{b,n,i}$ is a dummy variable equal to 1 if the loan is denominated in a currency other than Euros, and 0 otherwise. Low Haircut$_{b,n,i}$ is a dummy variable equal to 1 if the loan has a haircut below 5%, and 0 otherwise. Post$_t$ is a dummy variable equal to 1 for periods after 2022m12. All specifications include controls and additional lower-order interactions. Standard errors are clustered at the bank $\times$ time and borrower $\times$ time levels. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	log(Quantity$_{b,n,t}$)			Spread$_{b,n,t}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Post$_t$ $\times$ Hedge Fund$_n$	0.265***	0.207***	-0.0972	0.0954***	0.0555***	0.306***
	(0.0290)	(0.0410)	(0.0824)	(0.0120)	(0.0150)	(0.0797)
Post$_t$ $\times$ Non-EUR Loan$_{b,n,i}$		-0.0849**			0.329***	
		(0.0411)			(0.0252)	
Post$_t$ $\times$ Hedge Fund$_n$ $\times$		0.203***			0.109***	
$\times$ Non-EUR Loan$_{b,n,i}$		(0.0642)			(0.0316)	
Post$_t$ $\times$ Low Haircut$_{b,n,i}$			0.314***			-0.876***
			(0.0524)			(0.0676)
Post$_t$ $\times$ Hedge Fund$_n$ $\times$			0.260***			0.389***
$\times$ Low Haircut$_{b,n,i}$			(0.0924)			(0.0972)
Controls and Other Interactions	Yes	Yes	Yes	Yes	Yes	Yes
Bank $\times$ Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank $\times$ Borrower	Yes	Yes	Yes	Yes	Yes	Yes
N	77265	77265	32912	61386	61386	21339
R^2	0.625	0.625	0.753	0.909	0.911	0.872

Table 4: Collateral Breakdown for Reverse Repo Loans

This table shows the breakdown of reverse repos in the MMSR data that are backed by government versus non-government collateral. For the overall sample and each NBFI sector, we show the mean, p25, p50, and p75 proportion of reverse repos backed by government collateral. The proportion of reverse repos backed by government collateral is calculated daily from 2019 to 2025.

	mean	p25	p50	p75
Overall	0.83	0.76	0.85	0.89
Investment Funds	0.86	0.82	0.87	0.90
OFIs	0.55	0.34	0.45	0.74
FAs	0.76	0.50	0.89	0.96
Captives	0.56	0.35	0.59	0.81
Insurances	0.95	0.93	0.98	0.99
Pensions	0.93	0.93	0.96	0.99

Table 5: Substitution from corporate lending across bank asset classes: bank-level evidence

This table examines how changes in bank lending to non-financial corporations are associated with adjustments in other asset holdings on banks' balance sheets, capturing patterns of asset substitution. The explanatory variable is the change in corporate lending by bank b at month t, normalized by total loans and securities in t. The dependent variables represent contemporaneous changes in different asset categories: loans to NBFIs (Column 1), loans to other banks (MFIs; Column 2), loans to households (Column 3), government bond holdings and reserves (Column 4), and bonds issued by other MFIs (Column 5). The sample covers 2021m12–2023m12. Standard errors are clustered at the bank × time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	Δ NBFI loans	Δ MFI loans	Δ HH loans	Δ Gov. Bonds + Reserves	Δ MFI Bonds
	(1)	(2)	(3)	(4)	(5)
$\Delta \frac{\text{Corporate loans}_{b,t}}{\text{All Loans and Securities}_{b,t}}$	-0.413***	0.00339	-0.0999***	-0.212***	-0.00961***
	(0.0198)	(0.0401)	(0.0129)	(0.0416)	(0.00225)
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
N	25969	22550	26001	20163	25953
R^2	0.261	0.0387	0.132	0.0446	0.0924

Table 6: Substitution from NBFI Lending across Bank Asset Classes: Bank-Level Evidence

This table examines how changes in bank lending to non-bank financial intermediaries (NBFIs) are associated with adjustments in other asset holdings on banks' balance sheets, capturing patterns of asset substitution. The explanatory variable is the change in NBFI lending by bank b at month t, normalized by total loans and securities in t. The dependent variables represent contemporaneous changes in different asset categories: loans to firms (Column 1), loans to other banks (MFIs; Column 2), loans to households (Column 3), government bond holdings and reserves (Column 4), and bonds issued by other MFIs (Column 5). The sample covers 2021m12–2023m12. Standard errors are clustered at the bank × time level. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	Δ Corporate loans	Δ MFI loans	Δ HH loans	Δ Gov. Bonds + Reserves	Δ MFI Bonds
	(1)	(2)	(3)	(4)	(5)
$\Delta \frac{\text{NBFI loans}_{b,t}}{\text{All Loans and Securities}_{b,t}}$	-0.547***	-0.115*	-0.120***	-0.310***	-0.0304***
	(0.0244)	(0.0647)	(0.0105)	(0.0683)	(0.00349)
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
N	25969	22542	25969	20159	25929
R^2	0.275	0.0395	0.134	0.0462	0.110

Table 7: Firm-level credit and exposure to bank lending to NBFIs

This table examines how firms' overall borrowing and debt respond to their exposure to banks that expand lending to NBFIs. The outcome variable is the log change in firm-level debt between 2019 and 2022. Columns (1)–(3) consider firm-level loans outstanding from all sources (banks and non-banks), while columns (4)–(6) include total debt, encompassing all loans and bonds. ΔNBFI loans$_f$ denotes firm-level exposure to banks' lending to NBFIs. It is constructed as the weighted average change in the share of each bank's credit to the NBFI sector, with weights given by the firm's outstanding credit with those banks in 2019. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	Δ log(loans$_f$)			Δ log(total debt$_f$)		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ NBFI loans$_f$	-0.389***	-0.369***	-0.147	-0.133**	-0.172***	0.00829
	(0.123)	(0.122)	(0.140)	(0.0647)	(0.0638)	(0.113)
Δ NBFI loans$_f$ $\times$ Small Firm$_f$			-0.804***			-0.276*
			(0.280)			(0.157)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
N	132680	132614	132614	171101	171064	183095
R^2	0.00130	0.0137	0.0139	0.00486	0.0307	0.0236

Table 8: Default Probability of NBFI and corporate loans

This table compares the risk profiles of loans to non-bank financial intermediaries (NBFIs) and non-financial corporations. Panel (a) reports average and median default probabilities by loan type, and Panel (b) by loan maturity.

(a) By Loan Type

	NBFI Median	Corporate Median	NBFI Mean	Corporate Mean	Diff in Means
	(1)	(2)	(3)	(4)	(5)
Credit Lines	0.64	0.79	5.30	6.55	1.25***
Term Loans	1.12	1.19	6.63	10.74	4.11***
Revolving Credit	1.00	1.83	10.01	16.06	6.06***
Repo	0.26	0.32	1.03	1.89	0.86***
Others	0.75	1.40	6.37	8.97	2.60***

(b) By Maturity

	NBFI Median	Corporate Median	NBFI Mean	Corporate Mean	Diff in Means
	(1)	(2)	(3)	(4)	(5)
Less than 1 month	1.04	1.37	8.22	11.13	2.91***
1 to 12 months	0.51	1.59	5.09	10.12	5.03***
1 to 5 years	0.97	1.29	6.64	9.88	3.24***
5 to 10 years	1.05	1.26	5.91	9.52	3.61***
More than 10 years	0.89	0.92	5.86	9.61	3.75***
Indefinite	1.00	1.67	10.45	17.97	7.53***

Table 9: Bank Lending to NBFIs: Loan-Level Evidence on Credit Supply Channels

This table examines the credit supply mechanisms underlying banks' reallocation of lending from non-financial corporations to non-bank financial intermediaries (NBFIs). The outcome variable is the log level of bank b's credit to NBFI n at time t. ΔCorporate Lending$b$ denotes the change in bank b's share of lending to non-financial corporations between 2021m12 and 2023m12. ΔECB Funding$b$ is the change in funding from the ECB, measured as a share of total loans and securities, over the same period. ΔHH+Corporate Deposits$_b$ is the change in household and corporate deposits, also expressed as a share of total loans and securities, between 2021m12 and 2023m12. The Total Capital Ratio is reported as of 2021m12. The sample period spans 2021m12 to 2023m12. Post$_t$ is a dummy variable equal to 1 for periods after 2022m12. Standard errors are clustered at the bank × time and borrower × time levels. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	log(Lending to NBFI$_{b,n,t}$)			
	(1)	(2)	(3)	(4)
Post$_t$ × ΔCorporate Lending$_b$	-0.0694***			
	(0.0210)			
Post$_t$ × Total Capital Ratio$_{b,2021}$		-0.538***		
		(0.128)		
Post$_t$ × ΔECB Funding$_b$			-0.0749*	
			(0.0428)	
Post$_t$ × ΔHH+Corporate Deposits$_b$				-0.0900***
				(0.0327)
Controls and Other Interactions	Yes	Yes	Yes	Yes
Borrower x Time FE	Yes	Yes	Yes	Yes
Bank x Borrower FE	Yes	Yes	Yes	Yes
N	970259	316544	549031	731335
R^2	0.966	0.964	0.964	0.965

Table 10: Collateral composition of NBFIs

This table reports the average composition of collateral pledged by different types of NBFIs in their borrowing from banks. The shares are calculated for each sector as the fraction of total collateral value accounted for by a given collateral category—real estate, cash, equity, securities, and other instruments (including loans). The "Sectoral Breakdown" panel aggregates NBFIs into broad groups such as Captives, Financial Auxiliaries, Insurance Corporations, Investment Funds, Other Financial Institutions (OFIs), and Pension Funds. The "Detailed Sectoral Breakdown" panel reports the corresponding averages for individual sub-sectors (e.g., Asset Management Companies, Hedge Funds, Leasing Companies). All values are expressed as fractions and rounded to three decimal places.

Sector	Real estate	Cash	Equity	Securities	Other (incl. loans)
Sectoral Breakdown					
Captives	0.446	0.202	0.044	0.056	0.252
Financial auxiliaries	0.225	0.081	0.057	0.437	0.201
Insurance Corporations	0.014	0.364	0.014	0.525	0.084
Investment Funds	0.221	0.071	0.031	0.512	0.165
OFIs	0.048	0.035	0.024	0.783	0.110
Pension Funds	0.015	0.037	0.019	0.859	0.071
Detailed Sectoral Breakdown					
Asset Management Companies	0.263	0.095	0.088	0.399	0.154
Factoring Companies	0.323	0.049	0.006	0.243	0.379
Financial Corporations Engaged in Lending	0.185	0.052	0.019	0.164	0.579
Financial Vehicle Corporations/Special Purpose Vehicles	0.240	0.235	0.021	0.049	0.456
Hedge Fund	0.008	0.047	0.039	0.875	0.030
Holding Companies of Non-Financial Institutions	0.316	0.290	0.036	0.068	0.290
Leasing Companies	0.327	0.080	0.022	0.106	0.464
Market Infrastructure Providers	0.008	0.018	0.003	0.954	0.017
Mutual Fund	0.015	0.105	0.063	0.766	0.051
Private Equity	0.314	0.081	0.152	0.081	0.371
Private Fund	0.368	0.126	0.058	0.206	0.241
Real Estate Private Fund	0.909	0.015	0.004	0.005	0.066
Security and Derivatives Dealers	0.009	0.008	0.033	0.912	0.038

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8 Appendix

Figure A1: Loans to NBFIs by Sector (Remaining Institutions)

This figure shows the volume of loans lent to non-bank financial institutions (NBFIs) that remain unclassified in the more granular classification of NBFI sectors in Figure 2.

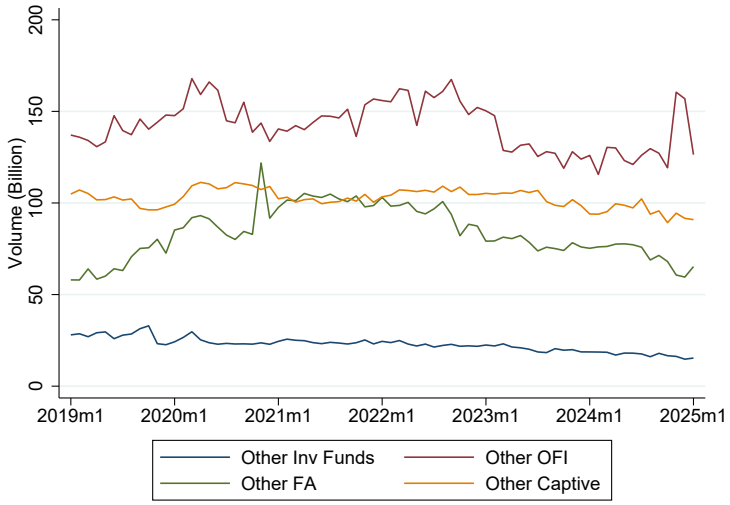
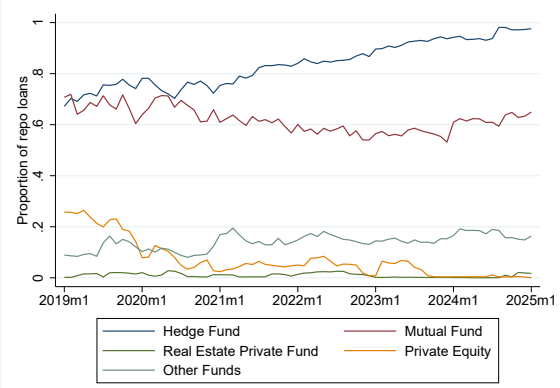


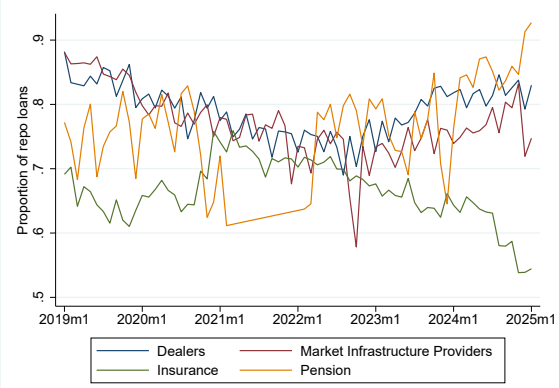
Figure A2: Reverse Repos to NBFIs by Sector (Detailed Breakdown)

This figure shows the volume of reverse repos to different non-bank financial institutions (NBFIs). Panels (a) to (c) provide a granular breakdown of volumes by institution types, including loans to different investment funds and loans to different other financial institutions, financial auxiliaries, and captive financing institutions. Panel (d) shows the volume of loans that remain unclassified in the classification.

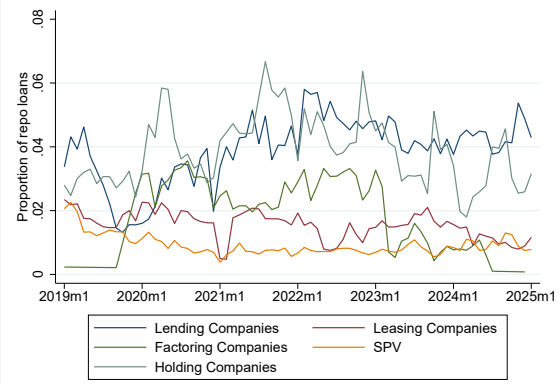
(a) Investment Funds



(b) Dealers, Pensions, and Insurances



(c) Other Financial Institutions



(d) Remaining Institutions (Optional)

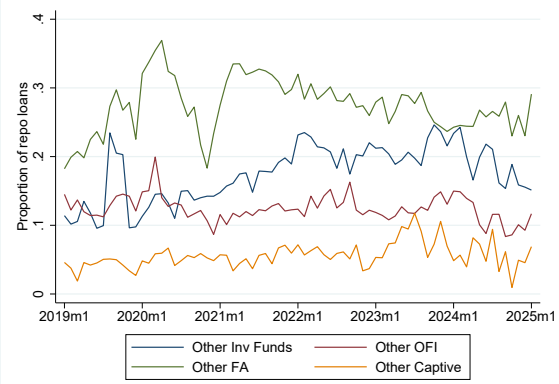
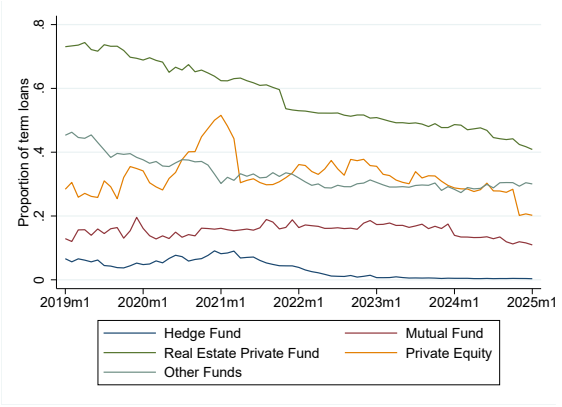


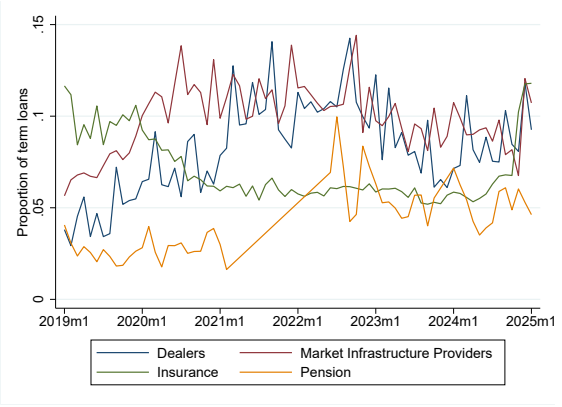
Figure A3: Term Loans to NBFIs by Sector (Detailed Breakdown)

This figure shows the volume of term loans to different non-bank financial institutions (NBFIs). Panels (a) to (c) provide a granular breakdown of volumes by institution types, including loans to different investment funds and loans to different other financial institutions, financial auxiliaries, and captive financing institutions. Panel (d) shows the volume of loans that remain unclassified in the classification.

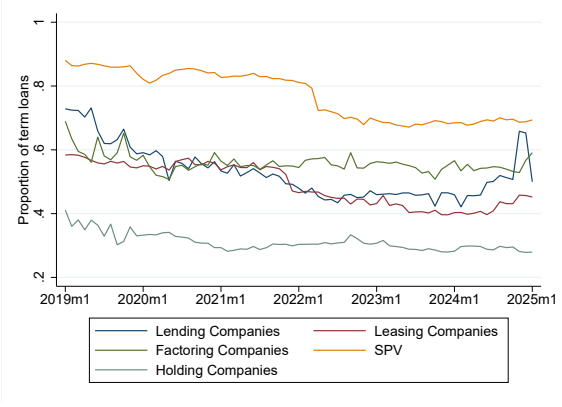
(a) Investment Funds



(b) Dealers, Pensions, and Insurances



(c) Other Financial Institutions



(d) Remaining Institutions (Optional)

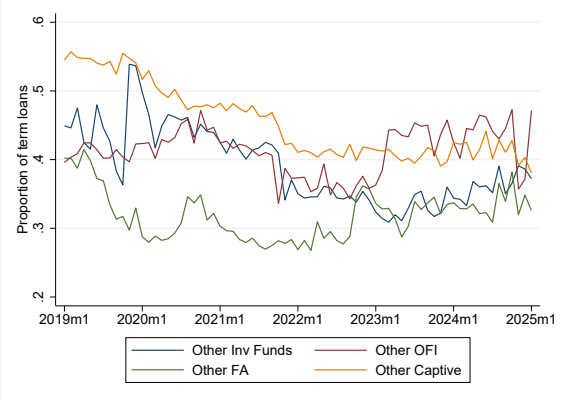
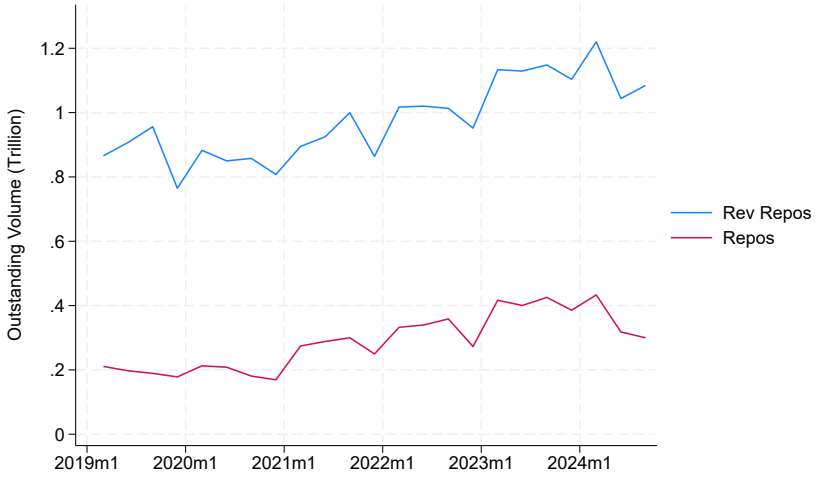


Figure A4: Reverse Repos and Repos on Bank Balance Sheets

Panel (a) shows the volume of reverse repos and repos for our sample of banks that are not reporting agents in the MMSR data based on bank balance sheet data in FINREP. Panel (b) shows the volume of reverse repos and repos for our sample of banks that are reporting agents in the MMSR data. In panel (b), we report reverse repo and repo volumes based on both FINREP and MMSR data.

(a) Banks not in MMSR



(b) Banks in MMSR

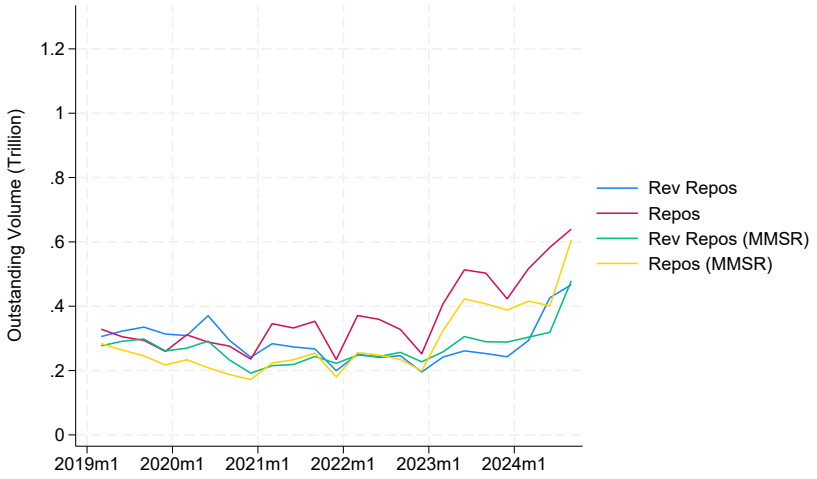
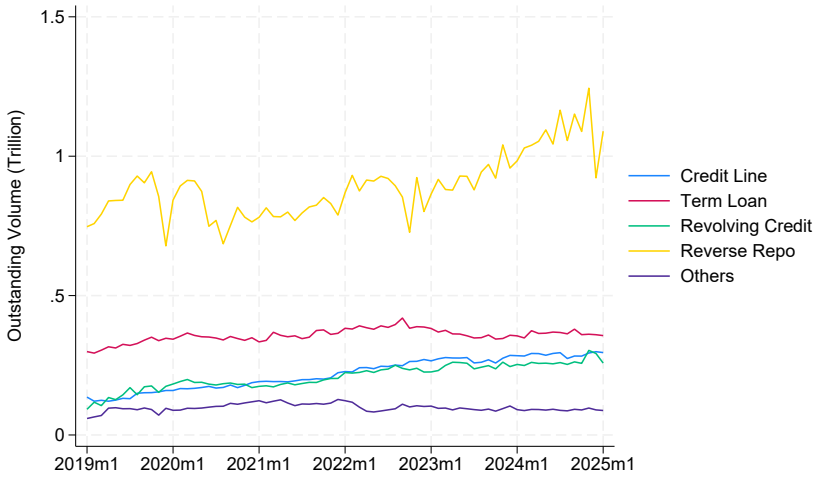


Figure A5: Loan Volumes to NBFIs by Instrument (External and Within Group Loans)

This figure shows the volume of loans lent to NBFIs by instrument, which includes credit lines, term loans, revolving credit, repos, and others. Panel (a) shows the volume of loans lent to NBFIs that are not part of the same holding company as the lending bank. Panel (b) shows the volume of loans lent to NBFIs that are part of the same holding company as the lending bank.

(a) External Loans



(b) Within-Group Loans

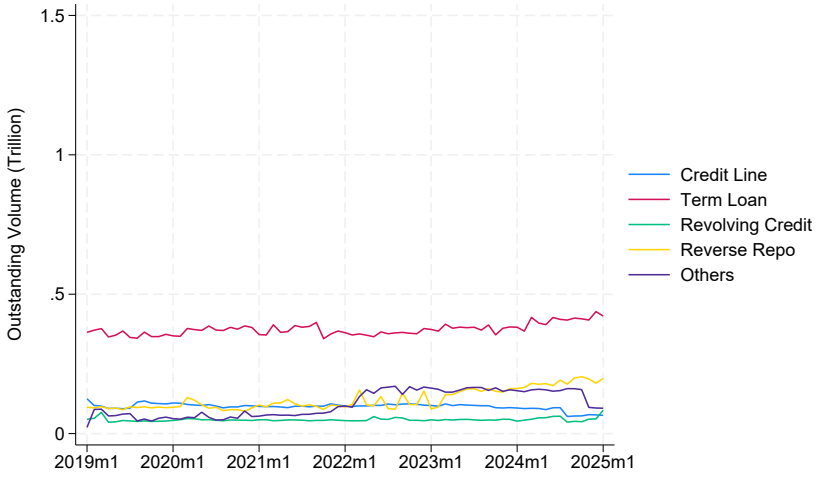
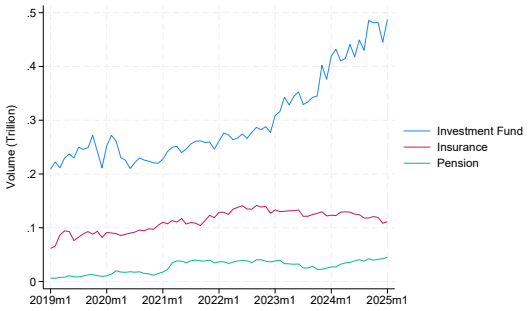


Figure A6: Loans to NBFIs by Sector (External Loans)

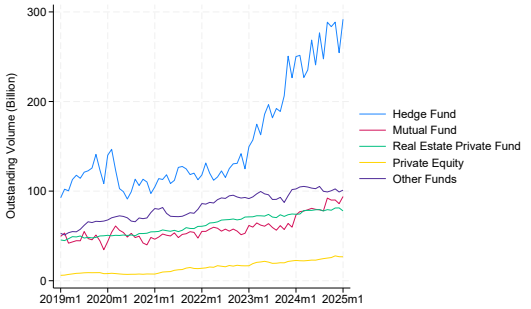
This figure shows the volume of loans lent to different non-bank financial institutions (NBFIs) that are not part of the same holding company as the lending bank. Panels (a) and (b) show the overall breakdown between investment funds, insurances, pensions, financial auxiliaries, captive financing institutions, and other financial institutions. Panel (c) to (e) provide a more granular breakdown of volumes by sector, including loans to different investment funds and loans to different other financial institutions, financial auxiliaries, and captive financing institutions.

(a) Investment Funds, Pensions, and Insurances

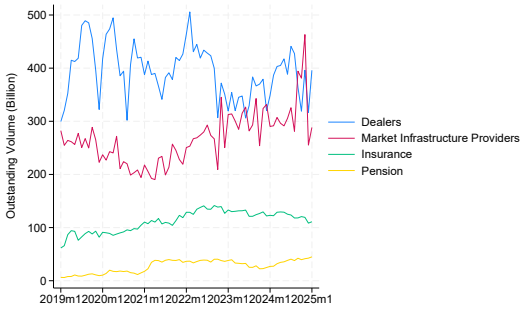


(b) Other Financial Institutions

(c) Investment Funds



(d) Dealers, Pensions, and Insurances



(e) Lending and Holding Companies

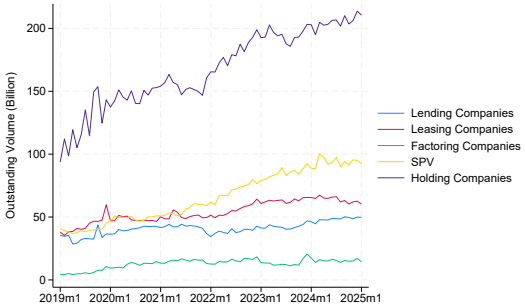
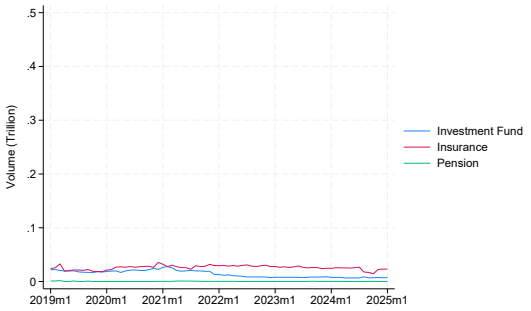


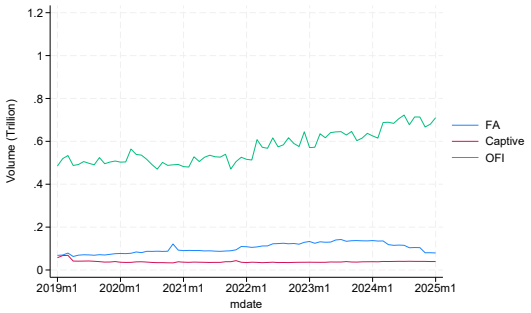
Figure A7: Loans to NBFIs by Sector (In-Group Loans)

This figure shows the volume of loans lent to different non-bank financial institutions (NBFIs) that are part of the same holding company as the lending bank. Panels (a) and (b) show the overall breakdown between investment funds, insurances, pensions, financial auxiliaries, captive financing institutions, and other financial institutions. Panel (c) to (e) provide a more granular breakdown of volumes by sector, including loans to different investment funds and loans to different other financial institutions, financial auxiliaries, and captive financing institutions.

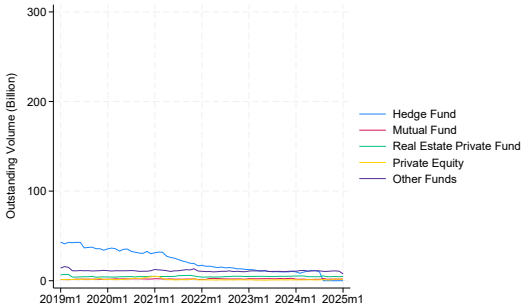
(a) Investment Funds, Pensions, and Insurances



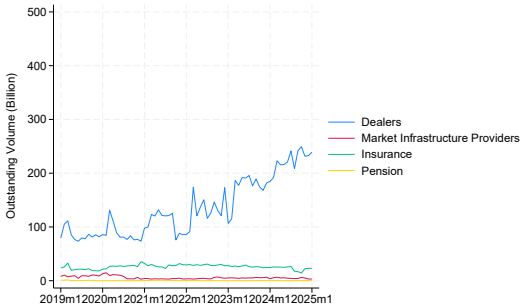
(b) Other Financial Institutions



(c) Investment Funds



(d) Dealers, Pensions, and Insurances



(e) Lending and Holding Companies

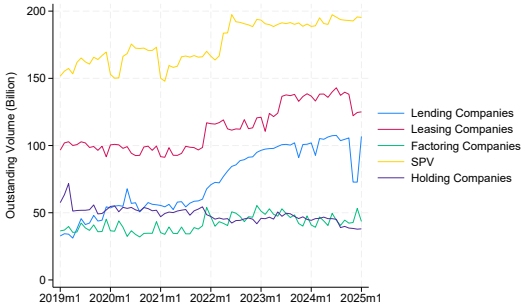
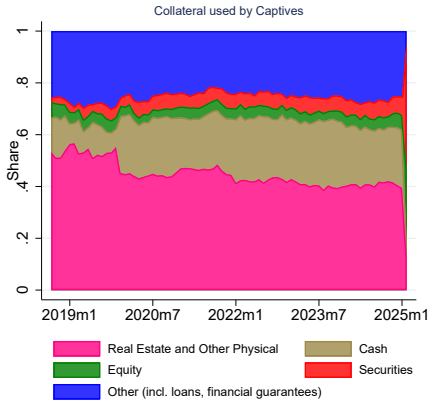
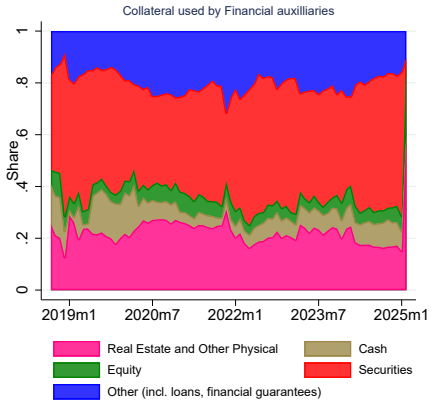


Figure A8: Collateral used for Bank Borrowing: Sectoral Breakdown

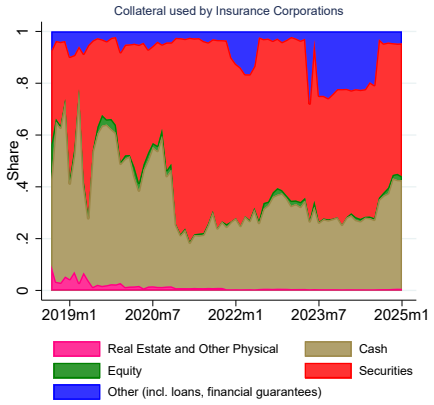
(a) Captives



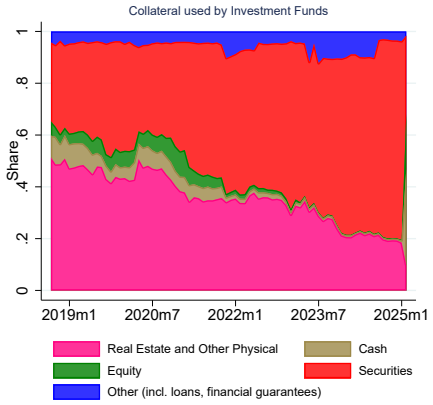
(b) Financial Auxiliaries



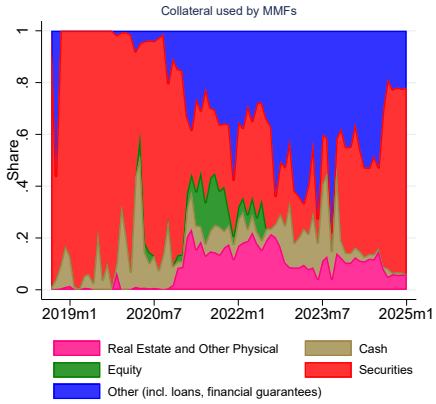
(c) Insurance Corporations



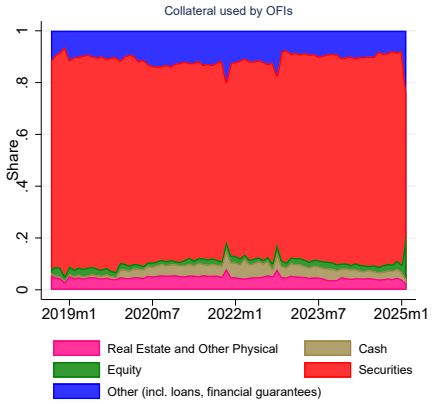
(d) Investment Funds



(e) MMFs



(f) OFIs



(g) Pension Funds

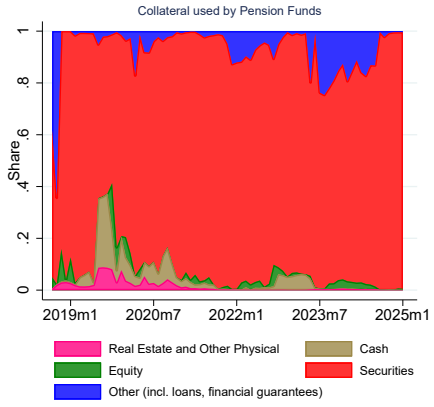
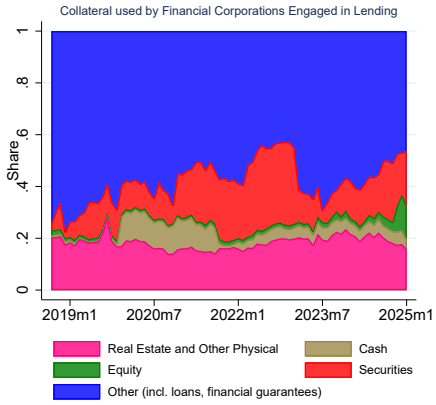
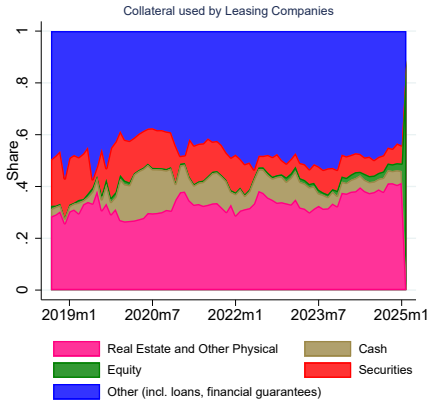


Figure A9: Collateral used for bank borrowing: detailed sectoral breakdown

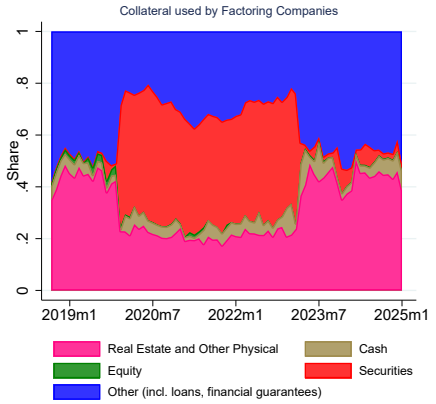
(a) FIs engaged in lending



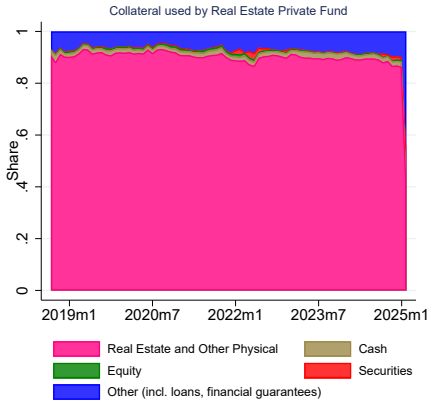
(b) Leasing Companies



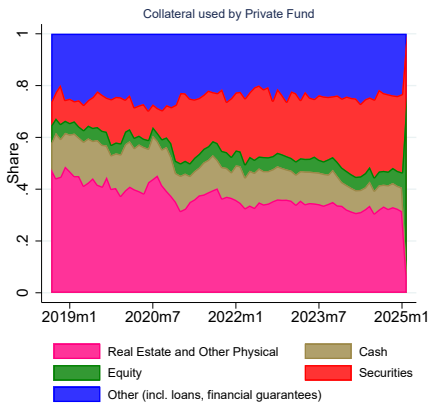
(c) Factoring Companies



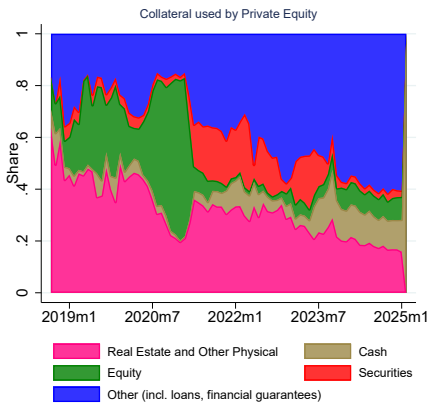
(d) Real Estate Fund



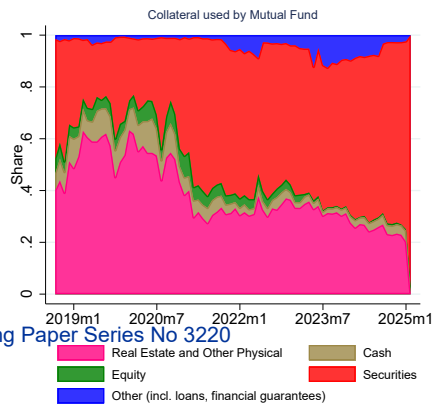
(e) Private Fund



(f) Private Equity



(g) Mutual Fund



(h) Hedge Fund

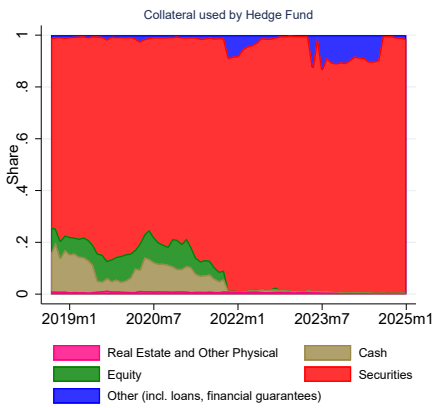


Figure A10: Loan Volumes to NBFI and firms

This figure shows the volume of loans lent to non-bank financial institutions (NBFIs) versus non-financial corporations. The volumes are normalized by their value in January, 2023.

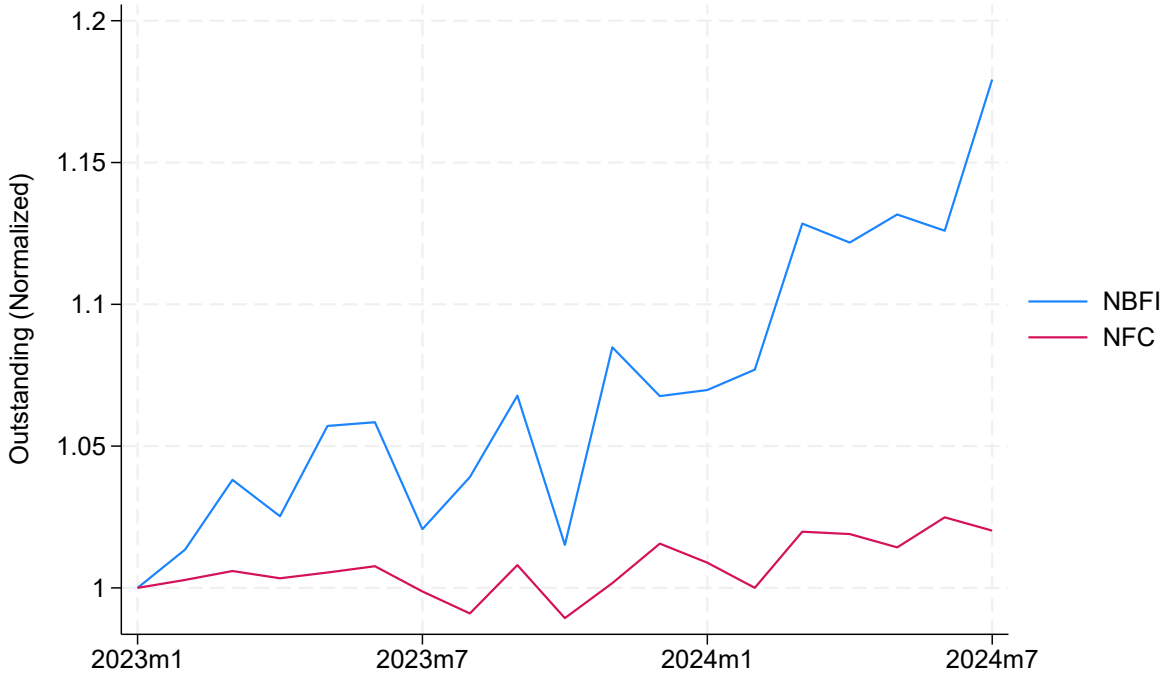


Table A1: Bank lending to firms: loan-level evidence on the affected firms

This table examines how banks' increased lending to NBFIs affects their credit supply to individual firms, and which types of firms experience the largest declines in borrowing. The outcome variable is the log level of bank b's credit to firm f at time t. ΔNBFI Lending$b$ denotes the change in bank b's share of lending to NBFIs between 2021m12 and 2023m12. $PD_{f,t-1}$ denotes firm probability of default in $t-1$. $log(assets_f)$ denotes average total assets of a firm over the period 2019-2022. Residual Rate$_f$ represents the residual from the regression of interest rate on observable borrower and loan characteristics. The sample period spans 2021m12 to 2023m12. Post$_t$ is a dummy variable equal to 1 for periods after 2022m12. Standard errors are clustered at the bank × time and borrower × time levels. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	log(Lending to Firms$_{b,f,t}$)				
	(1)	(2)	(3)	(4)	(5)
Post$_t$× ΔNBFI Lending$_b$	-0.181***	-0.145***	-1.147***	-0.958***	-0.159
	(0.0485)	(0.0498)	(0.355)	(0.369)	(0.108)
Post$_t$× ΔNBFI Lending$_b$ × $PD_{f,t-1}$		-0.710***		-0.845***	
		(0.118)		(0.180)	
Post$_t$× ΔNBFI Lending$_b$ × $log(assets_f)$			0.0461**	0.0372*	
			(0.0186)	(0.0192)	
Post$_t$× ΔNBFI Lending$_b$× Residual Rate$_f$					12.61***
					(4.755)
Controls and Other Interactions	Yes	Yes	Yes	Yes	Yes
Borrower x Time FE	Yes	Yes	Yes	Yes	Yes
Bank x Borrower FE	Yes	Yes	Yes	Yes	Yes
N	73552394	68399276	27410986	25598892	28423503
R^2	0.943	0.947	0.934	0.939	0.950

Table A2: Bank Lending to NBFIs: lending and borrower types

This table analyzes which types of NBFI lending expand most when banks reduce corporate lending, distinguishing between lending instruments and the characteristics of NBFI borrowers. The outcome variable is the log level of bank b's credit to NBFI n with instrument i at time t. ΔCorporate Lending$b$ denotes the change in bank b's share of lending to non-financial corporations between 2021m12 and 2023m12. Repo Loan$_{b,n,i}$ is a dummy that takes value of 1 if the loan is a repo, and 0 otherwise. HighLoanRatio $_n$ is a dummy that takes a value of 1 if the share of assets of NBFI n invested in loans is above median, and 0 otherwise The sample period spans 2021m12 to 2023m12. Post$_t$ is a dummy variable equal to 1 for periods after 2022m12. Standard errors are clustered at the bank × time and borrower × time levels. ***, **, and * denote significance at the 1%, 5%, and 10% (two-sided) levels, respectively.

	log(Lending to NBFI$_{b,n,i,t}$)		
	(1)	(2)	(3)
Post$_t$× ΔCorporate Lending$_b$	-0.0521**	-0.0438**	-0.0397**
	(0.0212)	(0.0209)	(0.0161)
Post$_t$× ΔCorporate Lending$_b$ × Repo Loan$_{b,n,i}$		-0.629**	
		(0.273)	
Post$_t$× ΔCorporate Lending$_b$ × HighLoanRatio $_n$			0.148**
			(0.0670)
Controls and Other Interactions	Yes	Yes	Yes
Borrower x Time FE	Yes	Yes	Yes
Bank x Borrower x Instrument FE	Yes	Yes	Yes
N	1635480	1635480	504236
R^2	0.967	0.967	0.964

Acknowledgements
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