WORKING paper

BANQUE DE FRANCE
EUROSYSTÈME

Deposit Funding and the Credit Channel of Monetary Policy

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December 2025, WP #1029

ABSTRACT

How does heterogeneity in deposit funding among banks influence the transmission of monetary policy to loan supply? To address this question, we exploit a bank-level panel dataset of more than 450 banks from 19 euro-area countries from 2007 to 2023. Our empirical findings reveal that banks with a higher reliance on deposit funding exhibit a more muted increase in lending rates following monetary policy tightening. These results are consistent with a mechanism in which deposit funding shapes bank loan supply.

Keywords: Banks, Deposit Pricing, Loan Supply

JEL classification: G14, G23, G29

* We thank Diana Bonfim, Miguel Garcia Posada, Mattia Girotti, Robin Greenwood, Oana Peia and Mauricio Salgado Moreno for helpful comments. We also thank participants at Banque de France – Bundesbank Joint Conference on Monetary Policy 2025, the workshop of the ESCB Challenges for Monetary Policy Transmission in a Changing World (Dublin, 2025) and the workshop on Financial Intermediaries and Monetary Policy (Paris, 2024). Sarah Moutard provided outstanding research assistance.

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NON-TECHNICAL SUMMARY

How do differences in banks' funding structures influence the transmission of monetary policy? This paper explores the role of deposit funding in shaping how policy rate changes affect lending conditions in the euro area.

The euro area recently experienced one of the fastest monetary tightening cycles in decades. Higher policy rates should quickly translate into higher deposit rates, as households seek better returns. Yet, the pass-through to deposit rates has been sluggish and incomplete. This rigidity matters because it affects banks' funding costs and, ultimately, their lending behavior—a mechanism known as the deposit channel of monetary policy.

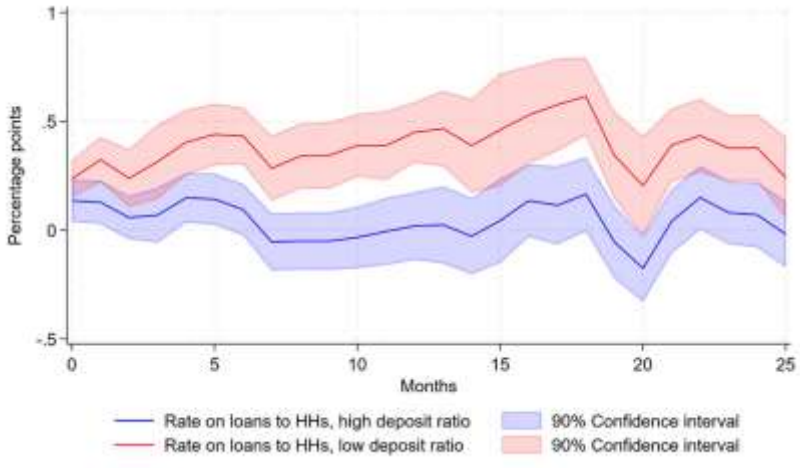
We use a unique monthly panel covering more than 120 banks across 19 euro-area countries from 2007 to 2023. The dataset combines granular interest rate information (on loans and deposits) with detailed balance sheet data from the ECB's IMIR and IBSI databases. Our empirical strategy relies on panel local projections to trace the dynamic response of lending rates and loan volumes to policy rate changes, controlling for macroeconomic conditions and bank-specific characteristics. Robustness checks employ monetary policy shocks as instruments.

Our main results are:

- Incomplete and delayed pass-through: On average, only about one-third of policy rate hikes are transmitted to deposit rates, and the adjustment peaks after six to twelve months.
- Loan pricing response: Lending rates rise following monetary tightening, but the magnitude and timing differ across segments. The response of household loan rates is on Figure 1. Corporate loan rates react faster and more strongly than household loan rates.
- Role of deposit funding: Banks with higher reliance on deposits increase lending rates less after a policy hike, reflecting their relatively stable funding costs. Evidence suggests these banks may also contract household lending less sharply, although differences in loan volumes remain modest.
- Alternative funding sources: Interbank and equity funding amplify the pass-through to lending rates, suggesting they are more costly funding than deposits.

Our results highlight that the structure of bank funding is a critical determinant of monetary policy transmission. Heterogeneity across banks means that policy tightening does not affect all institutions—or borrowers—equally. For central banks, understanding these dynamics is essential to ensure effective transmission.

Response of lending rate to households: high deposit funding vs low



Note: Response of lending rate to households after a 100 b.p. increase in policy rate, contrasting bank with high deposit funding (blue) to bank with low deposit funding (red).

Financement par dépôts et canal du crédit de la politique monétaire

RÉSUMÉ

Comment l'hétérogénéité dans le financement des banques par les dépôts influence-t-elle la transmission de la politique monétaire à l'offre de crédit ? Pour répondre à cette question, nous utilisons des données de panel comprenant plus de 450 banques dans 19 pays de la zone euro sur la période 2007–2023. Nos résultats empiriques montrent que les banques qui se financent davantage par dépôts augmentent plus modérément les taux des crédits à la suite d'un resserrement monétaire. Ces résultats sont cohérents avec un mécanisme selon lequel le financement par dépôts façonne l'offre de crédit bancaire.

Mots-clés : banques, tarification des dépôts, offre de crédit

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

1 Introduction

From 2022 to 2023, the euro area experienced a pronounced and rapid increase in monetary policy rates. Standard transmission mechanisms suggest that such hikes should induce a corresponding rise in eposit rates, as the opportunity cost for households of holding low-yield deposits rises. Nevertheless, the observed pass-through to deposit rates has been markedly sluggish relative to the swift rise in policy rates. This inertia may reflect factors such as limited market competition, as discussed in the literature on the deposit channel of monetary policy (Drechsler et al., 2017), or the abundance of reserves in the banking system, as highlighted by Fricke et al. (2024).

As shown by the literature on the deposit channel of monetary policy, banks' deposit pricing can significantly influence their loan supply. Banks market power allow them to not fully transmit policy rate increases to deposit rates. As the opportunity cost of holding demand deposits rises, some savers shift their funds to higher-yielding alternatives, such as term deposits or money market funds. But since allowing marginal savers to withdraw their funds leads to higher overall bank profits compared to fully transmitting policy rate increases, it is optimal for banks to maintain a low pass-through. As a consequence of the deposit outflow, banks curtail lending.

Building on the literature on the deposit channel, this paper investigates how the bank's reliance on deposit funding affects the transmission of monetary policy shocks to loan supply. To investigate this question, we use a bank-level monthly panel dataset covering more than 450 banks. The dataset integrates proprietary bank balance sheet data, detailed interest rate information on various types of loans and deposits. Our empirical approach employs Jordà (2005) panel local projections to examine the impact of changes in the policy rate on changes in interest rates on new loans and loan growth – separately for corporate and household loans – at various horizons controlling for lagged changes in the policy rate and an extensive set of control variables. The inclusion of lagged changes in the policy rate accounts for delays in the transmission of monetary policy to changes in loan supply. To address

potential endogeneity in policy rate changes, we use monetary policy shocks as instruments in a robustness exercise. The analysis spans 19 euro area countries from 2007 to 2023. This allows our identification strategy to exploit two sources of heterogeneity in the data: across banks and across different monetary policy changes. The cross-sectional dimension allows us to compare banks operating in various different markets, on which they can have very different market powers leading to different sources of funding. By focusing on bank-level data rather than country-level aggregates, we exploit substantial heterogeneity among banks, enhancing identification. Furthermore, since we have a panel with a large number of banks relative to the time dimension, the asymptotic distribution of the coefficient is dominated by the cross-sectional dimension, which largely removes concerns about potential roots near unity (Jorda and Taylor, 2025). In addition, having more than 15 years of monthly data enables us to analyze multiple monetary policy cycles.

Our baseline specification uses monthly data and panel local projections in long differences, with changes in the central bank's short-term policy rate-—the deposit facility rate (DFR)-—as the monetary policy instrument. These changes are purged of country-level macroeconomic influences through the inclusion of monthly country-level macro variables and country-year-quarter fixed effects.[1]

Our main regressions include bank and country-year-quarter fixed effects. Bank fixed effects control for unobserved bank-specific characteristics, such as bank business models, ensuring that the analysis isolates variations unrelated to intrinsic bank traits. Country-quarter fixed effects account for country-specific dynamics at the quarterly level, including changes in macro-financial variables not captured by the monthly controls. They also absorb loan demand shocks under the assumption that banks within a country face similar borrower pools. In addition, we include monthly bank-level controls to capture time-varying bank characteristics. By neutralizing the effects of changes in these characteristics, the coefficients

[1]This specification is equivalent to an augmented Taylor rule that incorporates not only output and inflation, which are standard endogenous variables in the central bank's reaction function, but also financial variables, along with bank- and country-level controls.

on the policy rate and its lags capture the effect of monetary policy on bank loan supply. The set of controls includes detailed measures of bank attributes, to measure their risk (securities held in portfolio, capital ratio, interbank funding, central bank funding, size) and to qualify their business models (share of loans to households or to NFCs, breakdown of deposits by type for NFCs and households). In addition, to take into account the endogenous variables in the Taylor rule and information on the macro-financial environment, our set of controls comprises monthly real GDP, HICP, EUR-USD exchange rate, commodity prices, the composite indicator of systemic stress (CISS), and the concentration in the banking sector. Each control variable enters the regressions with both its contemporaneous and lagged values, to account for potential delays in the effects of bank-specific and macro-financial conditions. This comprehensive approach ensures that our estimates effectively isolate the impact of monetary policy changes on loan supply.

Our results indicate that banks do not fully pass through monetary policy to deposit interest rates. On average, less than one-third of the change in monetary policy is transmitted to depositors. Moreover, the adjustment occurs with a delay, peaking between six months and one year after the initial shock. As the cost of bank funding rises, interest rates on new loans increase accordingly. Loan rates to firms exhibit a faster and more pronounced response to monetary policy shocks compared to those on household loans, whose dynamics closely mirror the adjustment in deposit rates. This results from loans to household having on average a longer maturity and being more often offered a fixed rate, insulating them to some extent from changes in short term-rates.

The loan supply response varies with the importance of deposit funding in a bank's overall funding structure. Our results indicate that greater reliance on deposits is associated with a more moderate increase in interest rates on new loans. Results also qualitatively suggest a weaker contraction in loan supply to household after one year, but the IRFs are not significatively different at the 10% level. These findings highlight how deposit funding shapes banks' lending decisions and underscore the role of heterogeneity among financial

intermediaries in the transmission of monetary policy to the real economy.

This paper is connected to the literature showing that deposit rates are much more rigid during policy rate increases than during decreases (Hannan and Berger, 1991; Neumark and Sharpe, 1992). This empirical asymmetry has been rationalized through the deposit channel of monetary policy (Drechsler et al., 2017, 2021). This channel shows that banks, leveraging their market power, only partially adjust deposit rates in response to increases in policy rates. This limited adjustment allows banks to maintain a relatively stable cost of deposit funding. However, as the opportunity cost for depositors of keeping funds in low rate deposit accounts increases, they reallocate funds towards higher-yield products. Given that deposits represent a primary funding source for banks, this reallocation results in a contraction in bank lending. Empirical evidence suggests that the importance of the deposit channel is magnified during periods of unexpected policy rate increases, which elevate the opportunity cost of deposits and render previously stable funding sources both volatile and costly (Kleimeier and Sander, 2006; Cappelletti et al., 2023). Our analysis complements this literature by dynamically illustrating the role of stable deposit funding in shaping the transmission of monetary policy to borrowers.

This paper also contributes to the literature that analyzes the pass-through from policy rates to deposit and loan rates (Avouyi-Dovi et al., 2017; Ulate, 2021). Auer et al. (2025) shows that greater reliance on deposit funding dampens the short-term pass-through to overnight deposit rates, but does not significantly affect the transmission to lending rates. Goncharenko and Lukmanova (2025) find that an increase in the DFR induces non-bank lenders-—whose funding is typically less stable than that of banks-—to raise interest rates on newly originated loans by more than banks, while adjustments in loan size remain economically small. We extend this body of work by highlighting the role of heterogeneity among banks in deposit funding, showing how differences in deposit funding influence the transmission of monetary policy to loan supply. Finally, our contribution is closely related to the literature on the heterogeneous effects of monetary policy, including Kashyap and Stein

(2000); Kishan and Opiela (2000); Jiménez et al. (2012); Heider et al. (2019).

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 presents the econometric approach. Section 4 discusses the results, and Section 5 concludes.

2 Empirical strategy

2.1 Econometric model

We aim to assess how monetary policy affects banks' funding costs and, ultimately, their loan supply. To this end, we estimate panel local projections (Jordà, 2005) and compute impulse response functions (IRFs) from the following baseline specification, estimated at the monthly frequency:

$$y_{b,t+h} - y_{b,t-1} = \alpha_{b,h} + \gamma_{c,quarter(t),h} + \delta_h \Delta \text{DFR}_t + \phi_h \Delta X_{b,t} + \Phi_h \Delta X_{c,t} + \epsilon_{b,t+h}, \quad (1)$$

where b indexes banks and t indexes months. $\gamma_{c,\text{quarter}(t),h}$ denotes quarterly time fixed effects in an otherwise monthly regression. The horizon is denoted by h. The vectors $X_{b,t}$ and $X_{c,t}$ contain exogenous controls and their lags—-including lags of $\Delta y_{b,t}$ and of ΔDFR_t—-with lags included up to six months. The dependent variable is in long-difference and measures the cumulated effect of the shock up to horizon h, a natural way to assess the transmission of monetary policy. Furthermore, long-difference effectively reduces the bias due to autocorrelation in $y_{b,t}$ at all horizons (Jorda and Taylor, 2025).

A critical aspect of the specification is addressing potential endogeneity issues in changes of the short-term interest rate. In our baseline approach, we mitigate this concern by controlling for country-level macroeconomic conditions through the inclusion of relevant macro variables and country-year-quarter fixed effects.[2]

To isolate the effect of monetary policy, we saturate the model with controls for bank

[2] As a robustness check, we instrument changes in the policy rate using the monetary policy surprises of Altavilla et al. (2019). These results are available in Appendix B.

characteristics and macro-financial conditions. If relevant bank fundamentals were omitted, it could lead to biased estimates due to their correlation with both lagged changes in policy rates and the outcome variable. For example, a higher GDP growth can raise both the policy rate and increase the bank's capacity to issue loans. By including comprehensive controls for both macro-financial conditions and bank characteristics, the model mitigates concerns about omitted-variable bias. Specifically, vector $X_{b,t}$ includes variables that measure bank b balance sheet structure. It includes bank capital ratio, the share of deposits from monetary financial institutions over total liabilities and the ratio of central-bank borrowing to total liabilities. It also includes the shares of loans to households, loans to NFCs, securities held in the portfolio, household overnight deposits, corporate overnight deposits, time deposits, and savings deposits–each computed relative to total assets. Finally, we control for bank size by including the log of total assets. All these variables are motivated by the changes in the banking system that took place in the last two decades, bank deleveraging and the change in their funding mix toward more stable sources. The second group of variables, vector $X_{c,t}$, comprises measurements for country-level macroeconomic and financial conditions. It includes real GDP and HICP to control for the position in the economic cycle, the EUR-USD exchange rate and a global commodity price index to take into account the external environment; the composite indicator of systemic stress (CISS), which proxies for financial stress; finally, the concentration in the banking sector, which proxies for bank market power. Controls in $X_{b,t}$ and $X_{c,t}$ also include lagged values, to take into account potential delays in the effect of bank conditions and of macro-financial conditions.

The model also incorporates bank-specific fixed effects α_b, which account for all time-invariant characteristics of individual banks, such as their business model, branch network, and services offered on a permanent basis. Additionally, country-year-quarter fixed effects $\gamma_{c,quarter(t),h}$ are included to absorb country-level macroeconomic and financial dynamics that are not already captured in $X_{c,t}$, such as the level of the interest rate and general business cycle conditions. These fixed effects also control for loan demand under the assumption that

all banks in a given country face similar potential borrowers.

The extensive set of controls and fixed effects enhances the identification of the estimated $\gamma_{h,j}$. These coefficients capture the impact of changes in policy rates, contemporaneous and up to two months ago, on the outcome $Y_{b,t}$ from t onward and up to 25 months after. This specification provides a robust framework to precisely quantify the effects of monetary policy on bank behavior across different dimensions, including deposit pricing and loan supply.

To assess how deposit funding affects the transmission of short-term interest rate shock to bank loan supply, we also exploit a specification in which ΔDFR_t is interacted with a dummy variable indicating whether the share of corporate and household deposits, over total assets, computed for bank b over the full time period is above or below the country-time sample median:

$$\begin{aligned} y_{b,t+h} - y_{b,t-1} &= \alpha_{b,h} + \gamma_{c,quarter(t),h} \\ &+ \left(\delta_h + \delta_h^{\text{High deposits}} \mathbb{1}\left[\text{Deposit ratio}_b > \text{Median}_{c,t}\right]\right) \Delta\text{DFR}_t + \phi_h \Delta X_{b,t} + \Phi_h \Delta X_{c,t} + \epsilon_{b,t+h}. \end{aligned} \tag{2}$$

The product of the dummy variable with the change in the policy rate has a bank $\times$ year $\times$ month dimension. It measures the exposure of each bank deposit funding to a change in rates by the central bank. Parameter δ_h measures the response in $y_{b,t+h} - y_{b,t-1}$ to an exogenous monetary policy tightening in month t at the average policy rate over the sample. Coefficient $\delta_h^{\text{High deposits}}$ shows how this impact varies with deposit holdings. According to the deposit channel of monetary policy, a higher deposit funding for a bank translates in an overall lower cost of funding after a policy tightening, hence a lower price on loan. We expect $\delta_h^{\text{High deposits}} < 0$ when the dependent variable is a loan rate. On the opposite, a lower return on deposits incentivize depositors to withdraw them and reduces bank ability to grant new loans. We expect $\delta_h^{\text{High deposits}} > 0$ when the dependent variable is loan volume.

3 Data and descriptive statistics

In this section, we present the data sources we use and provide summary statistics of the data.

3.1 Interest rates and banks' balance sheets

Our monthly dataset spans the period from August 2008 to October 2023 and includes 19 euro area countries. The dataset is constructed using a combination of confidential and publicly available data sources.

Our main data sources are the Individual Monetary and financial institutions Interest Rates (IMIR) dataset and the Individual Balance Sheet Item (IBSI) dataset. Both are maintained by the European Central Bank (ECB) and contain information at a monthly frequency for euro-area monetary and financial institutions (MFIs) at an unconsolidated level. The IMIR data provides monthly bank interest rate data on various bank products, whether deposits or loans. From the IMIR, we extract the average interest rates applied by individual banks to new overnight deposits for households and non-financial corporations, savings deposits, time deposits, and loans to households and non-financial corporations. The IBSI dataset provides monthly balance sheet information, including outstanding loan volumes, deposits quantities and debt securities. A notable advantage of these two datsets is that they are harmonized across euro-area. Hence, all MFIs report their balance sheets and interest rates using uniform standards, enabling comparisons across euro-area MFIs. Furthermore, the interest rates reported in the IMIR are directly related to quantities in the IBSI. We can therefore match the two datasets to compute interest expenses as the weighted sum of each deposit rate, where the weights are given by the share of each deposit product over total deposits.

In our sample, the merged IBSI-IMIR dataset covers 318 MFIs for approximately 67% of the total assets of euro-area MFIs. Focusing on banks, we retain only those institutions

that appear in the dataset for three consecutive years and allocate at least 5% of their assets to loans to households and non-financial firms. To account for bank mergers, we assign a new bank identifier to institutions experiencing asset growth or decline exceeding 50%. Additionally, we exclude banks exhibiting year-on-year loan growth or contraction greater than 50% for either household or corporate lending. These selection criteria result in a final sample of 118 institutions.[3] Lastly, we winsorize household and firm loan growth at the 1st and 99th percentiles.

3.2 Macro-financial data

Our specification comprises macro-financial variables as control. We obtain them via DBnomics. These include the US dollar/euro exchange rate, the Composite Indicator of Systemic Stress (CISS), a commodity price index, and country-level data on real GDP, HICP inflation, annual banking sector concentration, and the deposit facility rate (DFR). Real GDP is interpolated to a monthly frequency using industrial production with the Chow and Lin (1971) method. Banking sector concentration is measured using the Herfindahl index for credit institutions based on total assets, with monthly interpolation applied using the Denton-Cholette method. Data sources include the ECB for exchange rates, CISS, real GDP, HICP inflation, banking sector concentration, and the DFR, and the IMF for the commodity price index.

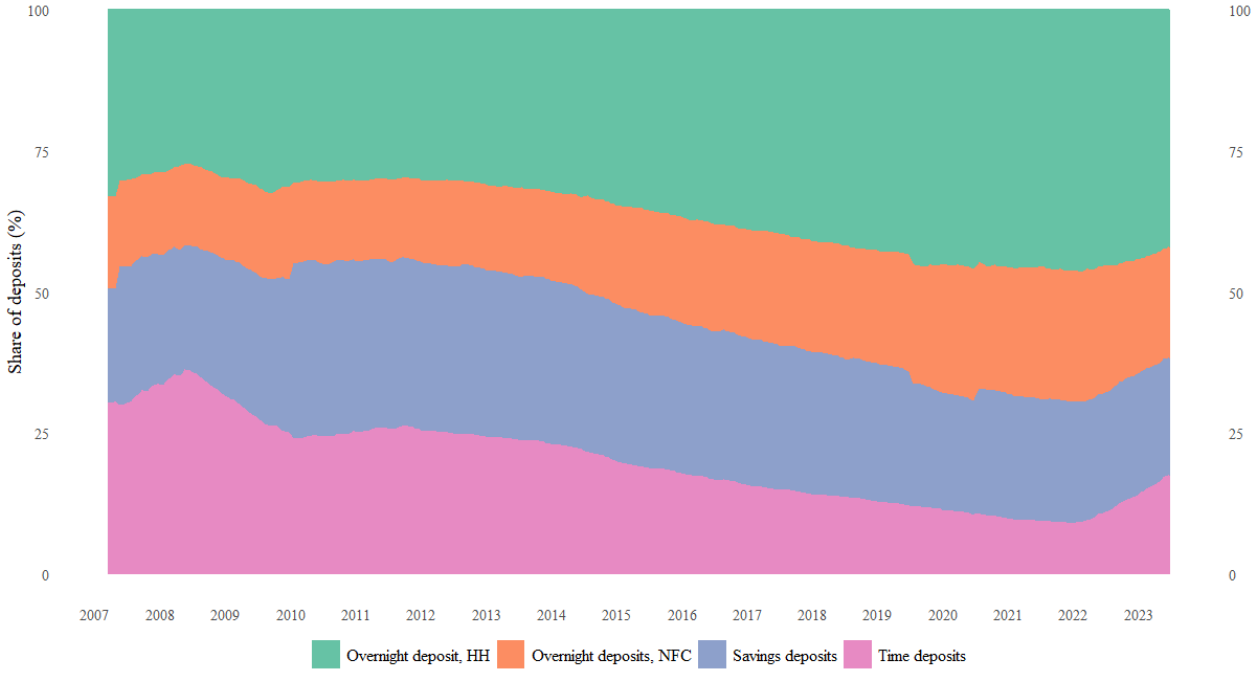
3.3 Descriptive statistics

Bank deposit structure varies over time, along with the monetary policy cycle. Figure 1 illustrates the evolution of the composition of deposits, among different deposit categories, over the sample period. In 2008, overnight deposits accounted for approximately half of all bank deposits. At that time, the DFR stood at the high level of 3.25%. In subsequent years,

[3] In particular, excluding banks that are not in the sample for at least 3 years removes 12 banks, excluding banks that do not allocate at least 5% of their assets to loans to households and non-financial firms removes 82 banks and excluding banks exhibiting year-on-year loan growth or contraction greater than 50% for either household or corporate lending, removes 106 banks from the sample.

declining interest rates reduced the opportunity cost of holding low-interest-bearing deposits, leading to an increase in the share of overnight deposits. Conversely, during the interest rate hiking cycle of 2022-2023, as rates rose, deposits flowed out of low-interest-bearing categories, resulting in a higher share of term and savings deposits.

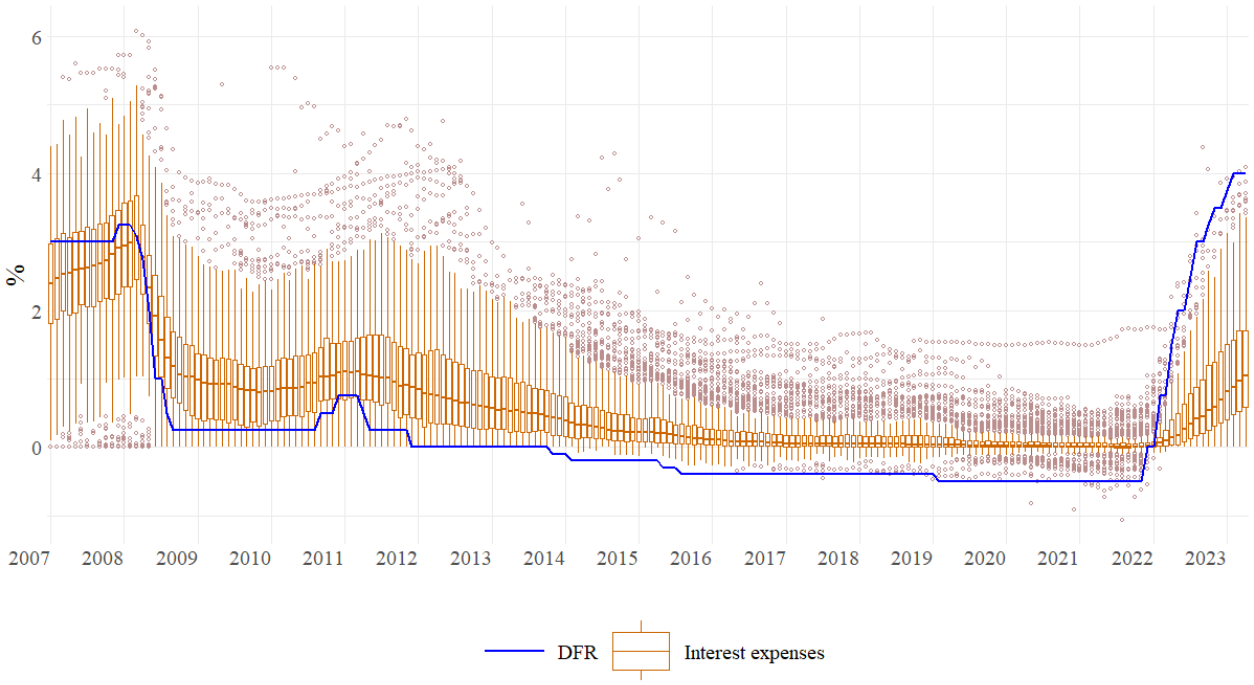
Figure 1: Deposit composition



Funds flow from deposit categories with low return toward higher remunerated deposit categories. Figure 2 illustrates the evolution of the DFR and banks' interest expense over time. The DFR is represented by the blue line, while the orange boxplots depict interest expenses. The horizontal orange line indicates the median interest expense across all banks in a given month. The boxes around the median represent the interquartile ranges, the vertical lines capture observations within 1.5 times the interquartile range, and the circles outside the vertical lines denote outliers. As shown in Figure 2, interest expenses track the DFR, increasing when the DFR rises and decreasing when it falls. Still, over the last hiking cycle, interest expenses raised at a much slower pace than the policy rate. Banks adjust their

deposit rates at varying speeds, leading to substantial differences in deposit pricing across institutions. This heterogeneity becomes more pronounced during periods of increasing DFR, as evidenced by the widening interquartile range in the boxplots.

Figure 2: Evolution interest rate expenses



To examine the effects of heterogeneity in deposit funding on lending to households and firms, we classify banks into high-deposit ratio and low-deposit ratio groups. To do so, we compute each bank average deposit ratio, over total assets, over the full time period and compare it to the country-specific sample median. Table 1 presents the summary statistics for the two groups of banks.[4]

The two groups of banks mainly differ in their lending behavior. Although their deposit interest rates are similar, banks with higher deposit ratios extend credit to households and non-financial corporations at lower lending rates and exhibit stronger loan growth. By contrast, low-deposit banks tend to be larger and less focused on household lending.

[4]Table A.1 in the appendix provides summary statistics for the variables in the panel dataset without separating banks into two groups.

Table 1: Descriptive statistics high low deposit ratio

	Low Deposit Ratio Banks		High Deposit Ratio Banks	
	Mean	St. dev	Mean	St. dev
Interest expenses (%)	0.43	0.66	0.44	0.64
Interest rates on deposits				
Interest overn. dep. HH (%)	0.22	0.44	0.24	0.41
Interest overn. dep. NFC (%)	0.30	0.62	0.24	0.52
Interest saving deposit (%)	0.58	0.75	0.64	0.79
Interest time deposit (%)	1.05	1.10	1.03	1.07
Amount of deposits				
Overnight deposits HH (log)	8.51	1.34	8.68	1.35
Overnight deposits NFC (log)	7.95	1.63	7.46	1.35
Time deposits (log)	6.73	1.88	6.32	1.70
Saving deposits (log)	6.50	2.41	7.14	2.15
Interest rates and amount of loans				
Interest loans NFC (%)	2.49	1.34	2.43	1.24
Interest loans HH (%)	3.13	1.97	2.96	1.30
Loan growth NFC (%)	3.33	8.74	5.01	8.25
Loan growth HH (%)	2.78	7.58	3.63	5.85
Bank balance sheet information				
Deposit ratio (%)	40.07	14.79	62.60	12.75
Loan-to-Deposits ratio (%)	145.42	86.83	99.93	31.52
Equity ratio (%)	8.86	4.08	8.63	3.23
MFI deposits share (%)	11.85	10.96	9.64	8.17
CB loans share (%)	4.16	3.71	1.58	1.93
Loans NFC/assets (%)	25.88	13.59	21.50	11.04
Loans HH/assets (%)	25.44	13.24	38.40	12.39
Debt securities/assets (%)	12.63	8.55	10.91	7.33
Assets (log)	10.42	1.50	9.87	1.29
Loans NFC (log)	8.92	1.49	8.20	1.29
Loans HH (log)	8.90	1.34	8.85	1.36

4 Results

In this section, we present the main results of the paper. First, in Section 4.1, we examine the overall impact of monetary policy on lending rates and volumes by estimating Equation 1 without interaction effects. Then, in Section 4.2, we implement Equation 2 to analyze how the responses of loan supply differ between low-deposit and high-deposit banks.

4.1 Main results: the impact of monetary policy on bank loan supply

Figures 3 and 4 display the impulse responses of household and NFC loan rates, along with banks' interest rate expenses, to contractionary monetary policy. The red lines represent the responses of household and NFC lending rates, while the blue lines depict the response of bank interest expenses. Shaded areas denote 90% confidence intervals.

A 1 percentage point increase in the DFR, net of country-level macroeconomic effects, triggers an immediate rise in both lending rates and bank interest expense. On impact, bank interest expenses increase by approximately 15 basis points and continue to rise gradually, peaking at about 33 basis points after eight months. The household loan rate responds on impact with an increase of roughly 20 basis points. Following the initial rise, the rate continues to climb but at a slower pace than interest expenses. They catch-up after one year and stabilize close to the interest expenses. For NFCs, the loan rate jumps immediately by around 40 basis points, peaking near 60 basis points after five months before beginning a gradual decline. The response of NFC loan rates is notably stronger and more front-loaded than that of household loan rates.

Figure 5 presents the impulse responses of loans to households (red line) and of loans to NFCs (blue line). Loan to households begin to contract roughly one year after the monetary policy contraction and reach their trough around 1 year and a half after the rise in the policy rate. In contrast to loan rates, the responses of household and NFC loan quantities are broadly similar.

4.2 How deposit funding affects the transmission of monetary policy?

Figure 6 depicts the response of household lending rates to contractionary monetary policy by comparing, within a given country and period, banks characterized by high versus low

Figure 3: Response of lending rate to households

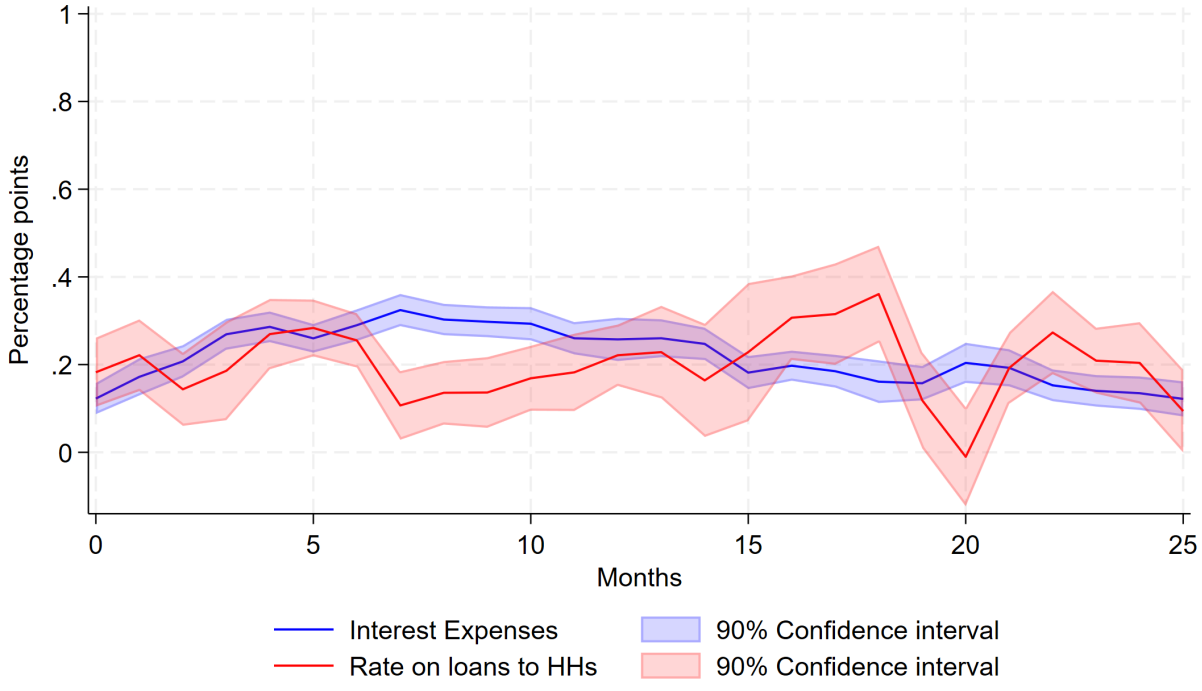


Figure 4: Response of lending rate to NFCs

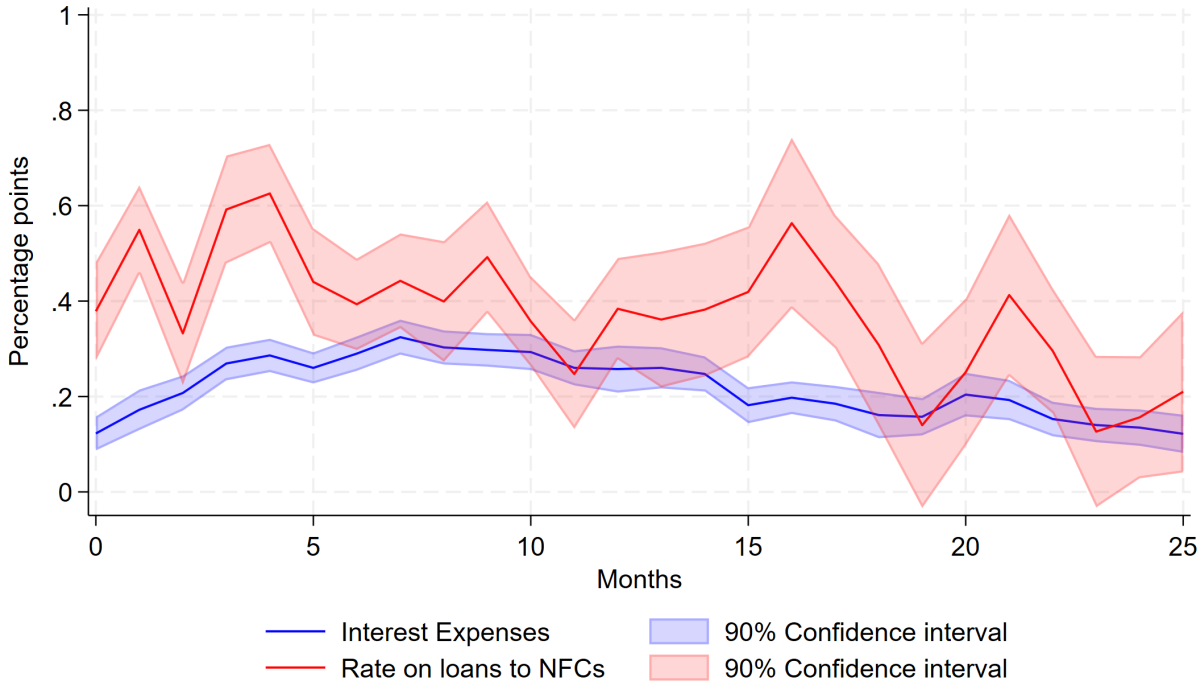
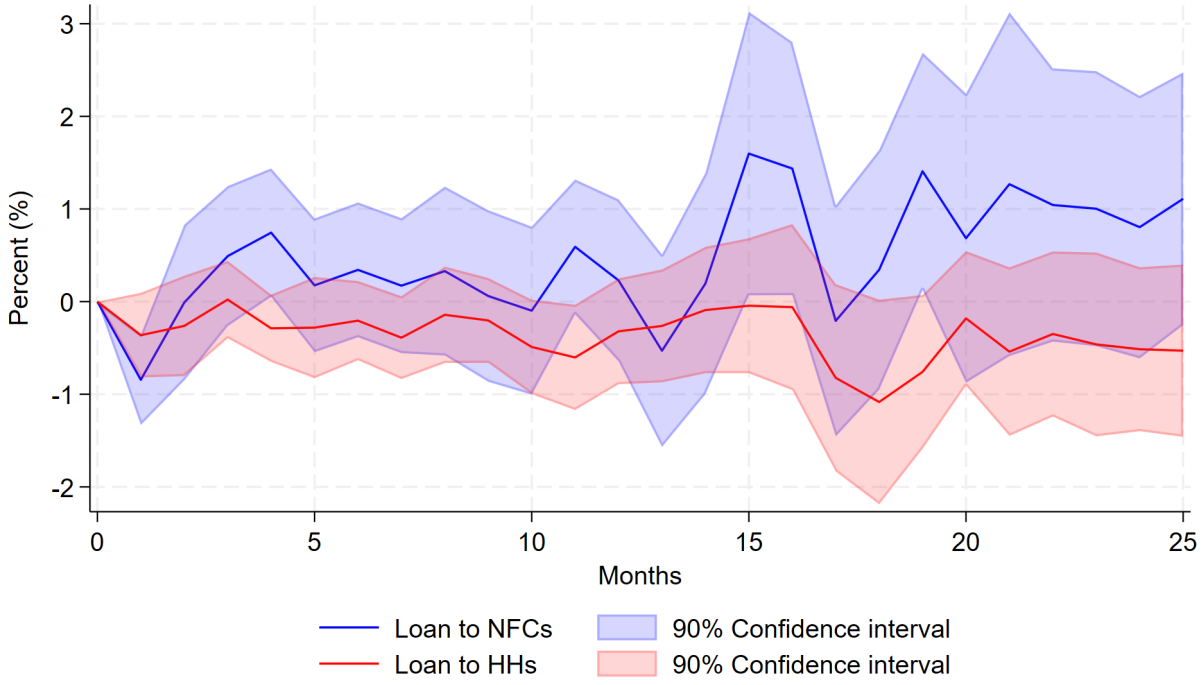


Figure 5: Response of volume of loans

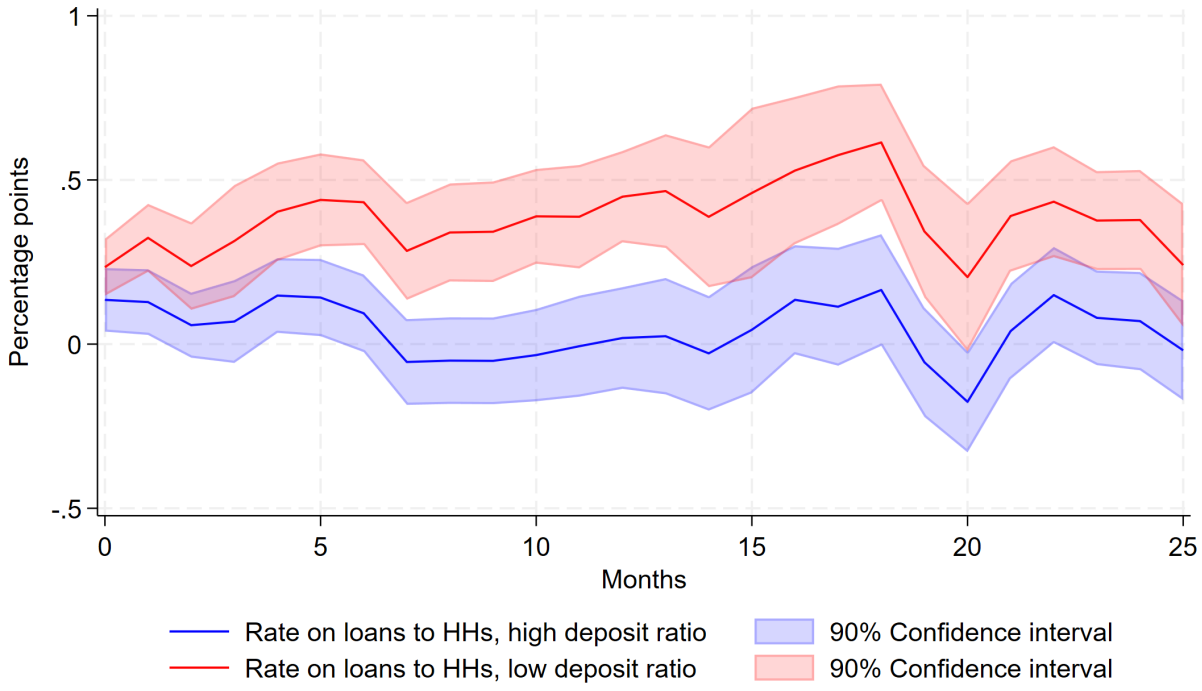


deposit ratios. The blue line represents the response of banks with high deposit ratios, while the red line shows the response of banks with low deposit ratios. The figure reveals that, following contractionary monetary policy, banks with lower deposit ratios and hence more expensive funding tend to increase household lending rates more aggressively than their high-deposit-ratio counterparts.

Similarly, Figure 7 displays the response of firm lending rates to contractionary monetary policy, again contrasting banks with high and low deposit ratios. The results indicate that, similar to household lending, banks with lower deposit ratios respond to contractionary monetary policy by increasing their firm lending rates more sharply than banks with higher deposit ratios.

Figures 8 and 9 illustrate how the responses of bank loan volumes vary with banks' reliance on deposit funding. Figure 8 shows that the response of loan supply is very similar for banks with or low deposit funding. Some differences appear after 1 year, suggesting that banks with greater reliance on deposit funding contract household lending more sharply following

Figure 6: Response of lending rate to households: high deposit funding vs low

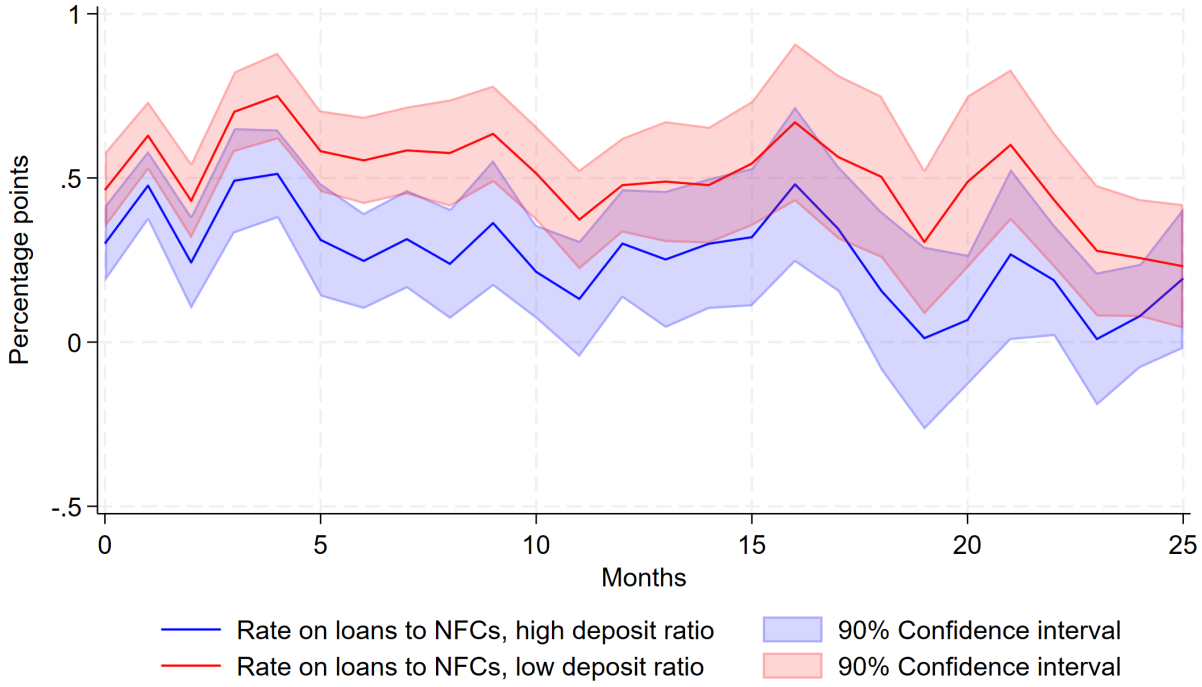


contractionary monetary policy as predicted by deposit funding channel, but the confidence intervals overlap. Figure 9 indicates even less differenes in the response of corporate lending between banks with high and low deposit ratios.

5 Alternative sources of funding

In this section, we examine whether alternative funding sources influence our baseline results. Even low-deposit banks can tap wholesale markets or central bank funding facilities to sustain lending. Does it matter how banks obtain financing beside deposits? To answer these questions, we estimate local projection models with a triple interaction:

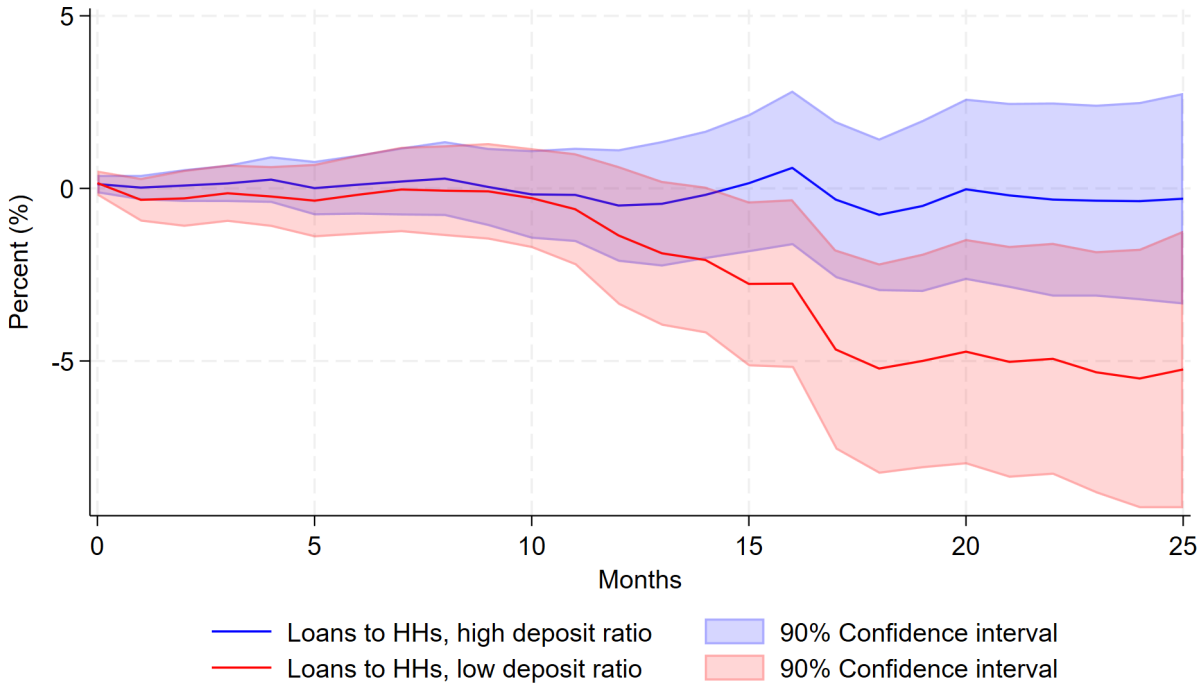
Figure 7: Response of lending rate to NFCs: high deposit funding vs low



$$
\begin{aligned}
y_{b,t+h} - y_{b,t-1} = \alpha_{b,h} + \gamma_{c,\text{quarter}(t),h} + \delta_h^1 \times \Delta\text{DFR}_t \\
+ \delta_h^2 \mathbb{1}[\text{Deposit ratio}_b > \text{Median}_{c,t}] \times \mathbb{1}[\text{Other funding}_b > \text{Median}_{c,t}] \Delta\text{DFR}_t \\
+ \delta_h^3 \mathbb{1}[\text{Deposit ratio}_b > \text{Median}_{c,t}] \times \Delta\text{DFR}_t \\
+ \delta_h^4 \mathbb{1}[\text{Other funding}_b > \text{Median}_{c,t}] \times \Delta\text{DFR}_t \\
+ \phi_h \Delta X_{b,t} + \Phi_h \Delta X_{c,t} + \epsilon_{b,t+h}, \quad (3)
\end{aligned}
$$

where $\mathbb{1}[\text{Other funding}_b > \text{Median}_{c,t}]$ is an indicator equal to 1 if the bank's average share of a given funding source over the sample exceeds the country-month median. We consider three alternative funding sources: interbank market funding, central bank funding, and equity funding. Interbank and central bank funding are defined as the share of total liabilities represented by deposits from MFIs and borrowing from the central bank, respectively. Equity

Figure 8: Response of loans to households: high deposit funding vs low

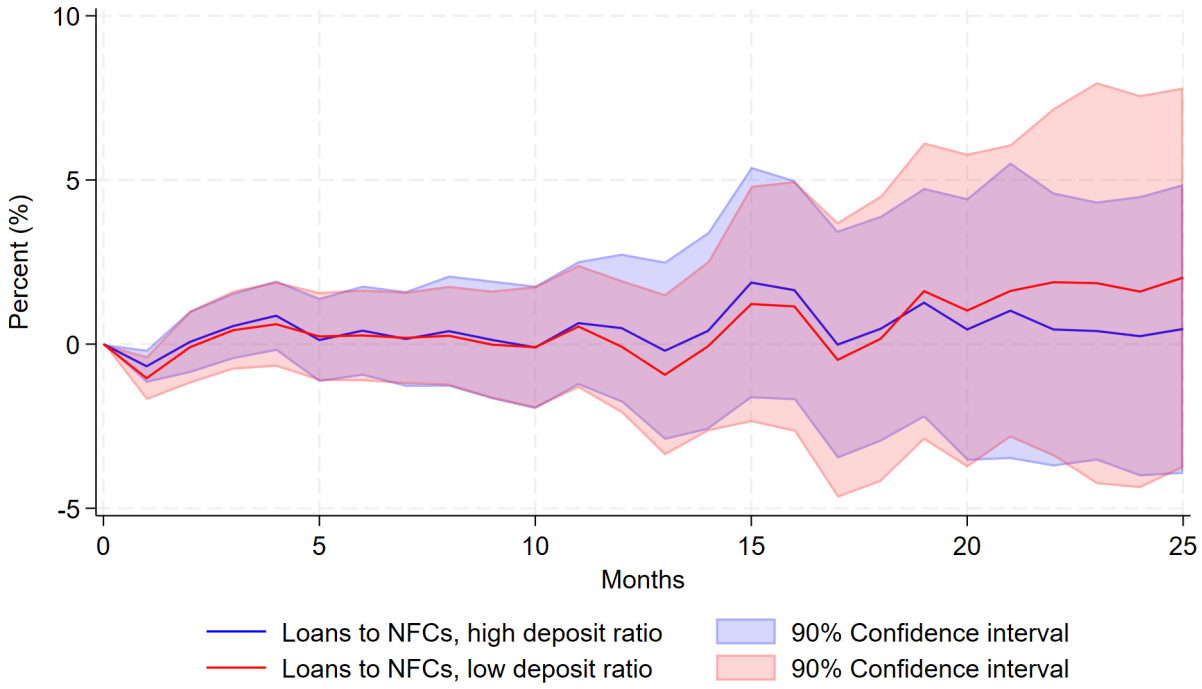


funding is measured as the ratio of equity to total assets. As in the baseline specification, we include country-time and bank fixed effects and control for bank- and country-level characteristics. Moreover, the matrix $\Delta X_{b,t}$ includes additional controls for the interactions between the indicator functions and the change in the DFR, as well as the interaction between the indicator functions themselves.

Figures 10–12 report impulse responses for the three specifications with the triple interaction. Figure 10 compares NFC lending rate responses for banks with high deposit shares, contrasting banks with high interbank funding shares (blue) versus those with low interbank funding (red). The figure shows that banks with higher interbank funding tend to increase NFC loan rates more strongly, suggesting again that market funding is more expensive for banks than deposit funding after a rate hike.

Figure 11 contrasts banks with high deposits and central bank funding (blue) against those with high deposits but low central bank funding (red). The figure shows that banks with higher central bank funding tend to increase NFC loan rates less strongly. At first

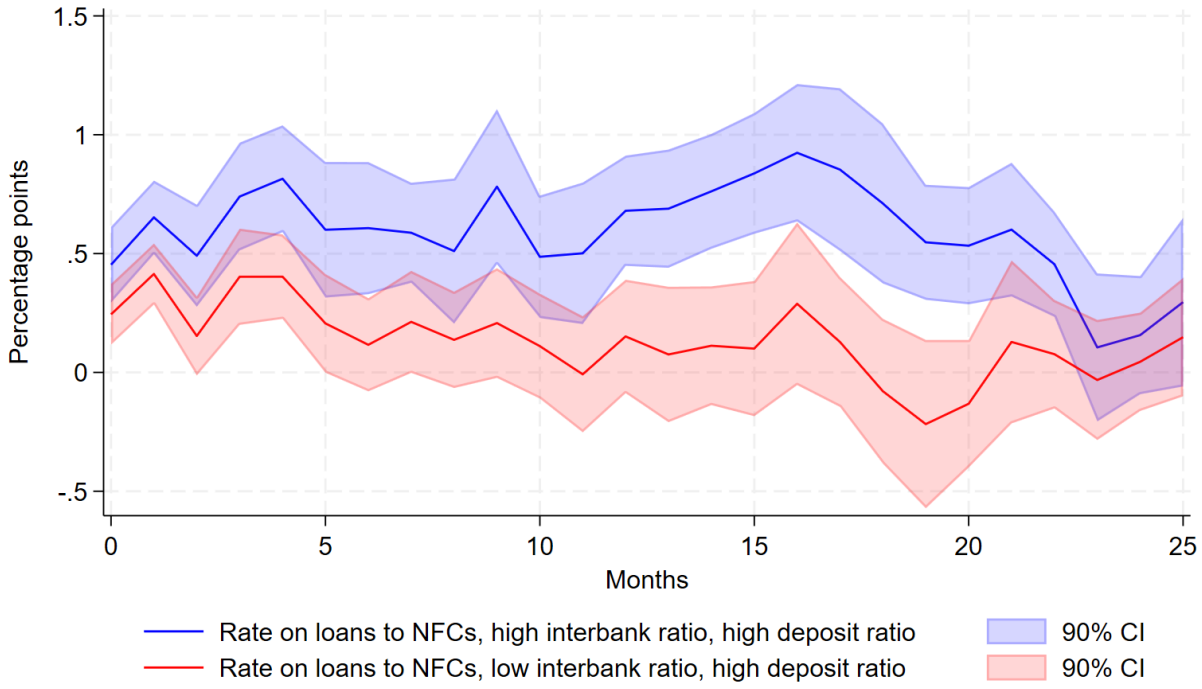
Figure 9: Response of loans to NFCs: high deposit funding vs low



glance, this may seem counterintuitive, since central bank refinancing operations are priced at the policy rate. However, this pattern suggests that banks borrowing from the central bank may substitute away from more expensive alternatives, such as interbank loans, whose rates can spike during periods of financial stress. Furthermore, some refinancing programs, such as the TLTROs, featured interest rates that decreased with ex-post loan growth, creating incentives for banks to expand lending and offer lower rates in order to qualify for cheaper central bank funding.

Figure 12 compares NFC lending rate responses for banks with high deposit and equity funding shares (blue) versus those with high deposits but low equity funding (red). The figure shows that banks with high equity funding raise NFC loan rates more than those with low equity funding. This pattern may reflect more cautious lending by less capitalized banks, which seek to strengthen their capital position by targeting safer borrowers with lower risk premia. In addition, borrowers may perceive poorly capitalized banks as riskier, forcing these banks to offer loans at lower rates to attract customers.

Figure 10: Response of lending rate to NFCs: high deposit funding and interbank funding

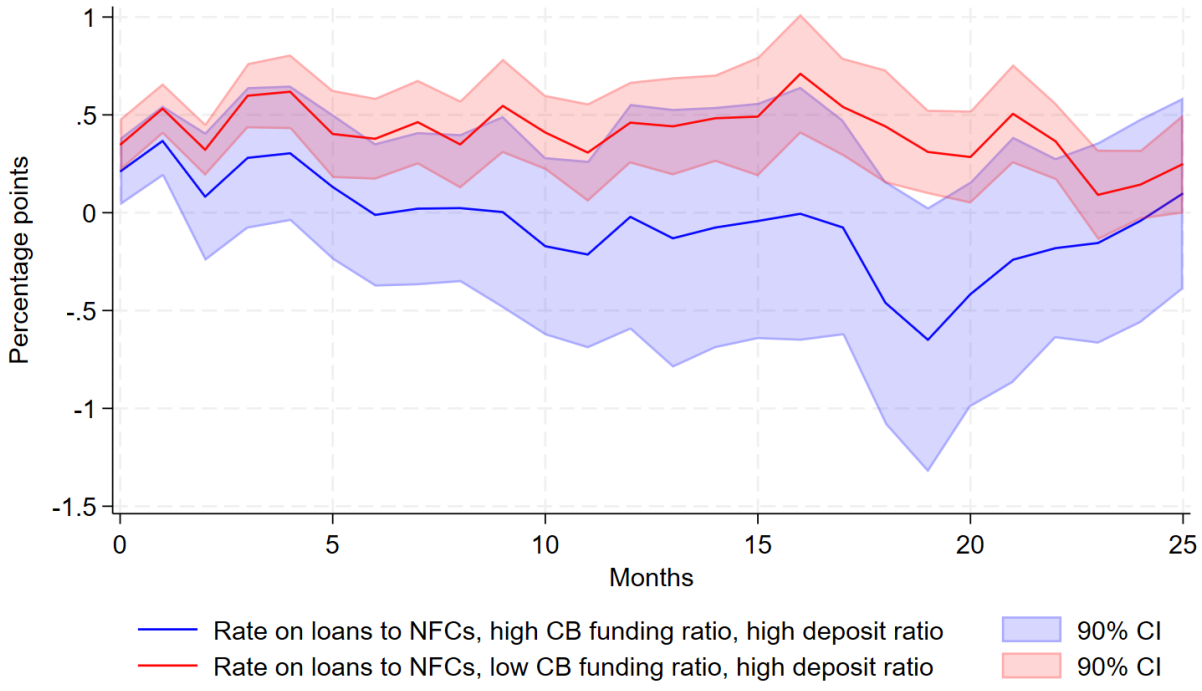


Overall, these results suggest that reliance on alternative funding sources influences the pass-through of monetary policy to NFC lending rates. Funding sources whose required return tends to rise with policy rates-—such as interbank and equity—-strengthen pass-through. In contrast, banks that depend more on central bank funding exhibit a weaker increase in NFC lending rates after monetary policy tightening, likely because this source of funding does not incorporate a risk premium like market-based funding.

6 Conclusion

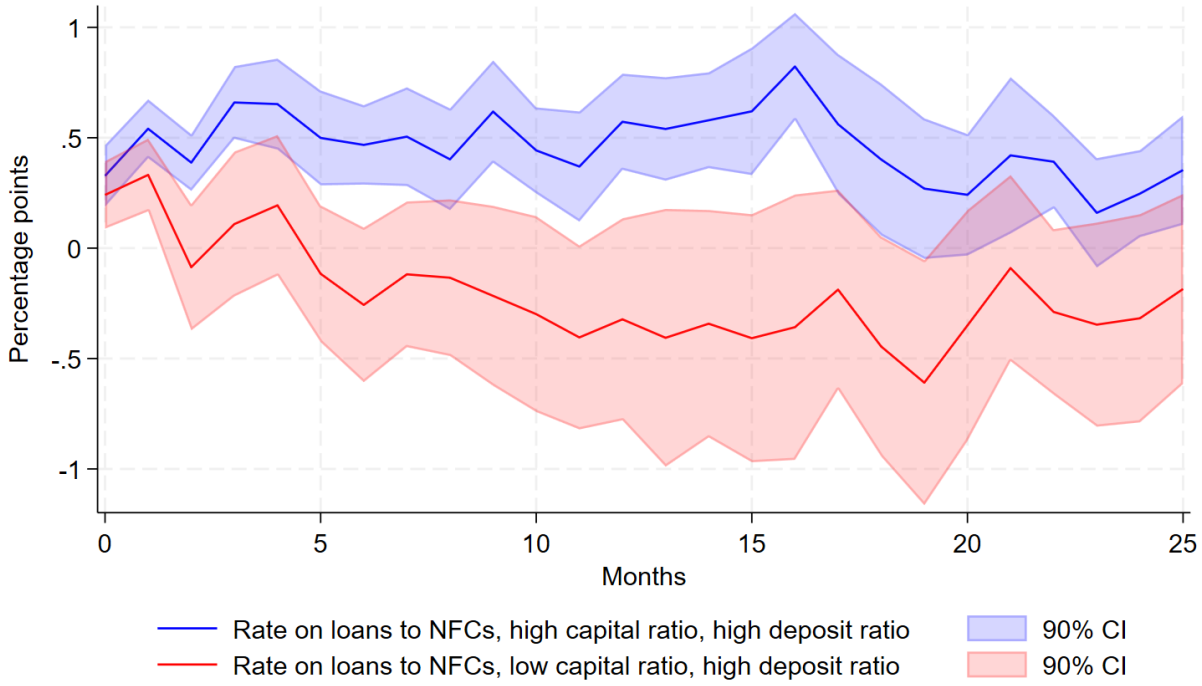
This study investigates how cross-bank heterogeneity in deposit funding affects the transmission of monetary policy to loan supply. Using bank-level interest rate and balance sheet data for more than 450 banks across 19 euro-area countries from 2007 to 2023-—combined with high-frequency monetary policy surprises and macro-financial controls—-the analysis shows that banks more reliant on deposit funding raise their lending rates by less and contract their

Figure 11: Response of lending rate to NFCs: high deposit funding and central bank funding



loan volumes by more following a monetary policy tightening. These results indicate that the structure of bank funding, and in particular the reliance on deposits, plays a key role in shaping the transmission of monetary policy through the bank lending channel.

Figure 12: Response of lending rate to NFCs: high deposit funding and equity funding



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A Additional descriptive statistics

Table A.1: Descriptive statistics

	Obs.	Mean	Median	St. dev	Min	Max
Bank variables						
Interest expense (%)	9133	0.44	0.16	0.65	-0.17	4.26
Interest overn. dep. HH (%)	9133	0.23	0.05	0.43	-0.09	4.26
Interest overn. dep. NFC (%)	9133	0.27	0.04	0.57	-0.41	4.58
Interest saving deposit (%)	8547	0.61	0.28	0.77	-0.31	3.89
Interest time deposit (%)	8390	1.04	0.69	1.09	-0.53	5.26
Interest loans NFC (%)	8922	2.46	2.05	1.29	0.09	8.94
Interest loans HH (%)	8922	3.04	2.67	1.66	0.60	16.34
Loan growth NFC (%)	8873	4.20	4.38	8.53	-44.03	47.11
Loan growth HH (%)	8873	3.22	2.43	6.75	-41.26	46.91
Deposit ratio	9133	51.78	54.50	17.79	8.73	81.20
Loan-to-Deposits ratio (%)	9133	121.77	105.63	68.21	33.73	603.49
Equity ratio (%)	9133	8.74	8.18	3.67	0.00	27.34
MFI deposit share (%)	9133	10.70	8.22	9.68	0.00	66.61
CB loans share (%)	9133	2.82	1.57	3.20	0.00	14.72
Loans NFC/assets (%)	9133	23.60	20.59	12.52	2.85	64.03
Loans HH/assets (%)	9133	32.17	31.19	14.35	3.57	74.56
Debt securities/assets (%)	9133	11.73	10.25	7.99	0.00	42.79
Assets (log)	9133	10.13	9.87	1.42	7.68	14.27
Loans NFC (log)	9133	8.54	8.40	1.43	5.48	12.69
Loans HH (log)	9133	8.87	8.68	1.35	5.67	13.37
Overnight deposits HH (log)	9133	8.60	8.57	1.35	4.33	13.39
Overnight deposits NFC (log)	9133	7.69	7.54	1.51	2.08	12.00
Time deposits (log)	9133	6.52	6.47	1.80	0.00	11.78
Saving deposits (log)	9133	6.83	6.84	2.30	0.00	12.60
Monetary policy shocks						
Change in 1-month OIS (bp)	189	0.13	0.00	2.69	-20.10	14.20
Change in Stoxx 50 (%)	93	-0.14	-0.05	0.93	-3.98	2.01
Macro variables						
Real GDP (log)	1869	9.79	9.83	1.63	6.81	12.62
HICP inflation (%)	1869	2.66	1.80	3.42	-1.80	22.50
Bank concentration	1869	0.13	0.12	0.09	0.02	0.40
Commodity index (log)	189	4.97	4.97	0.26	4.37	5.53
Exchange rate (log)	189	0.20	0.17	0.11	-0.02	0.46
DFR (%)	189	0.26	-0.10	1.11	-0.50	4.00
CISS	189	0.21	0.16	0.15	0.03	0.55

B Results with MP shocks

This section presents the results obtained when changes in the policy rate are instrumented using the monetary policy surprises identified by Altavilla et al. (2019).

Figure 13: Response of lending rate to households

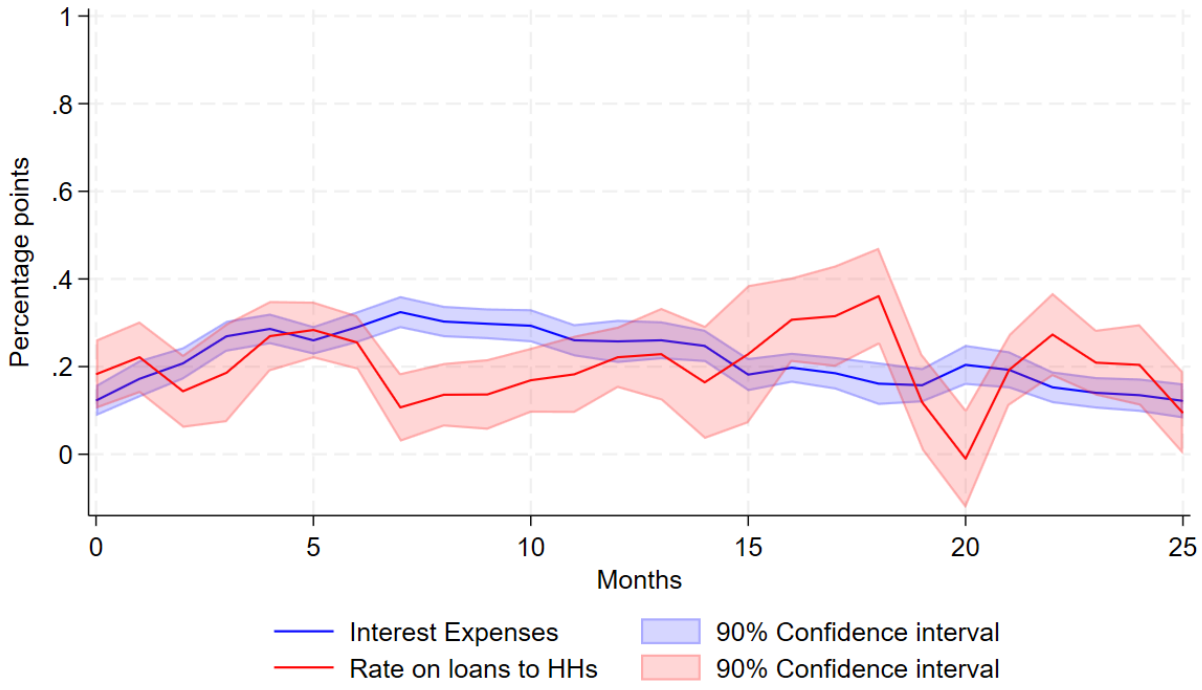

Figure 14: Response of lending rate to NFCs

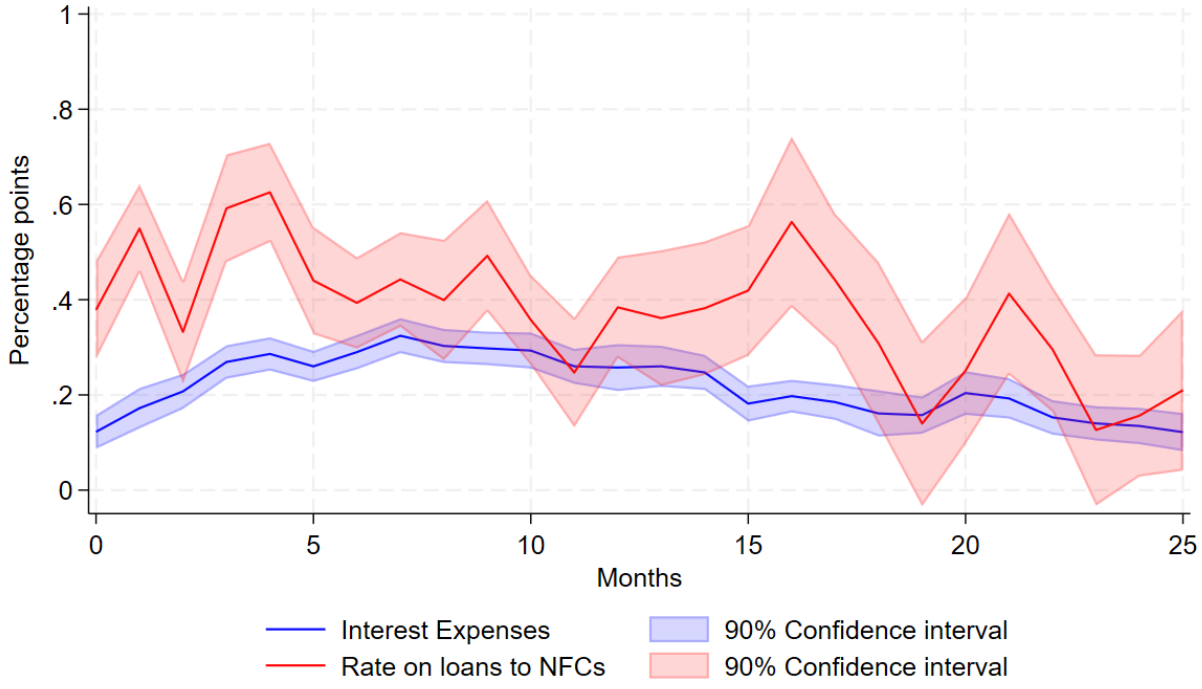

Figure 15: Response of volume of loans

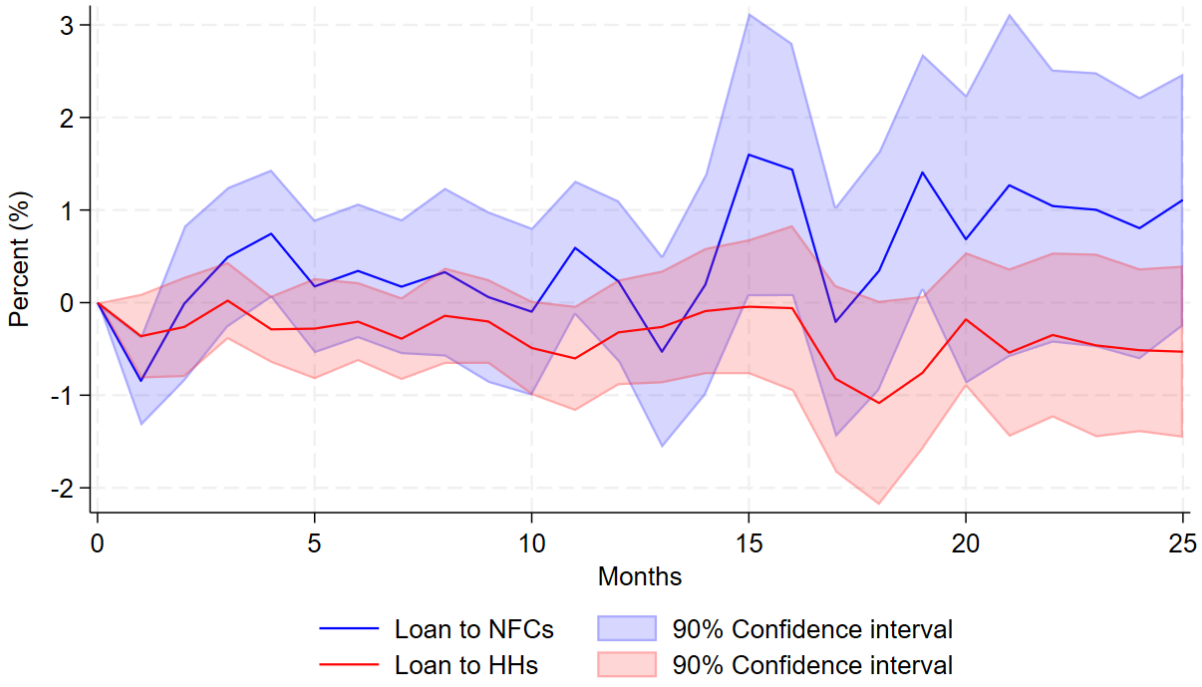

Figure 16: Response of lending rate to households: high deposit funding vs low

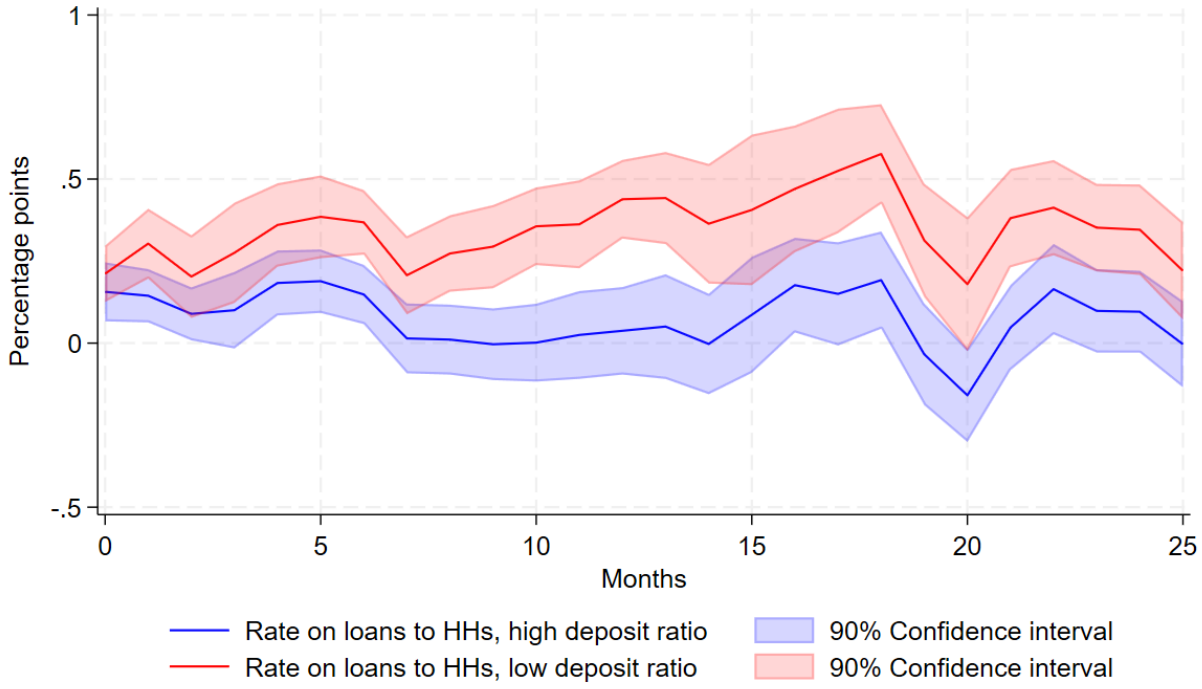

Figure 17: Response of lending rate to NFCs: high deposit funding vs low

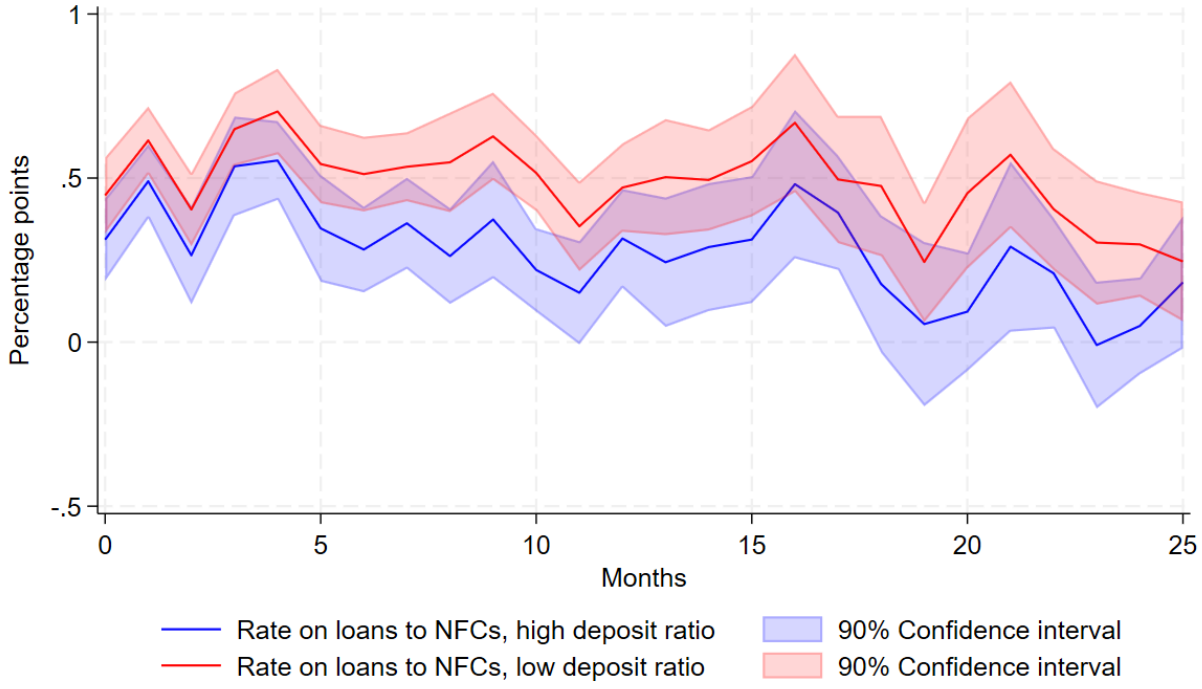

Figure 18: Response of loans to households: high deposit funding vs low

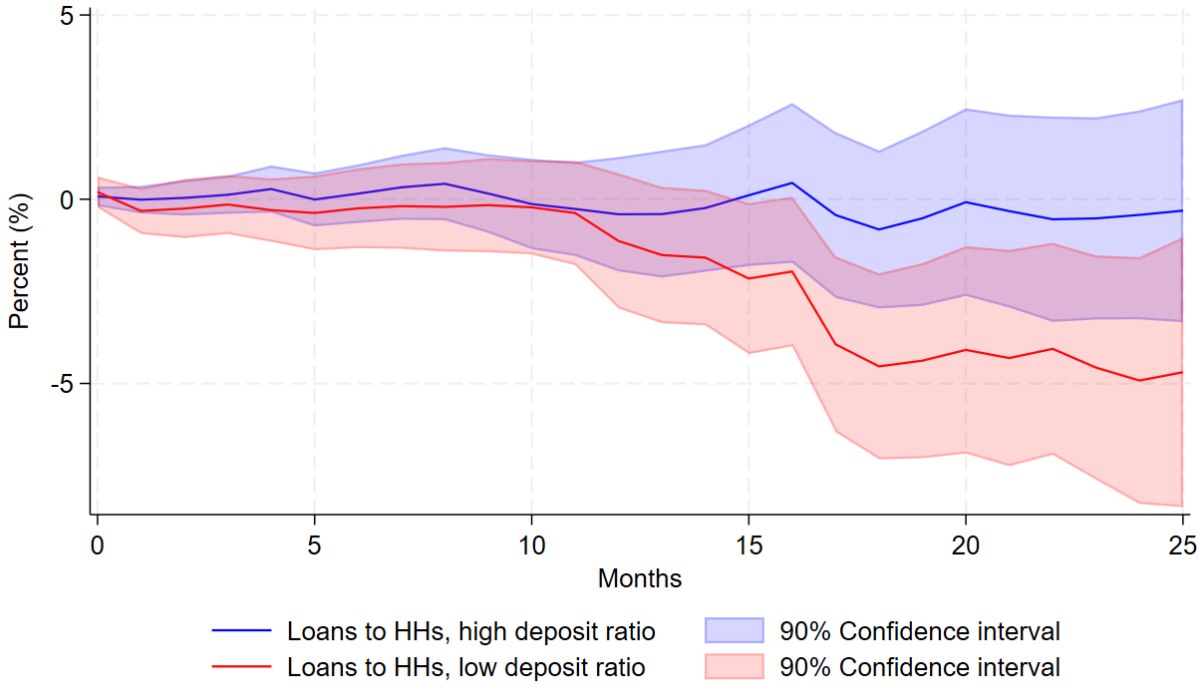

Figure 19: Response of loans to NFCs: high deposit funding vs low

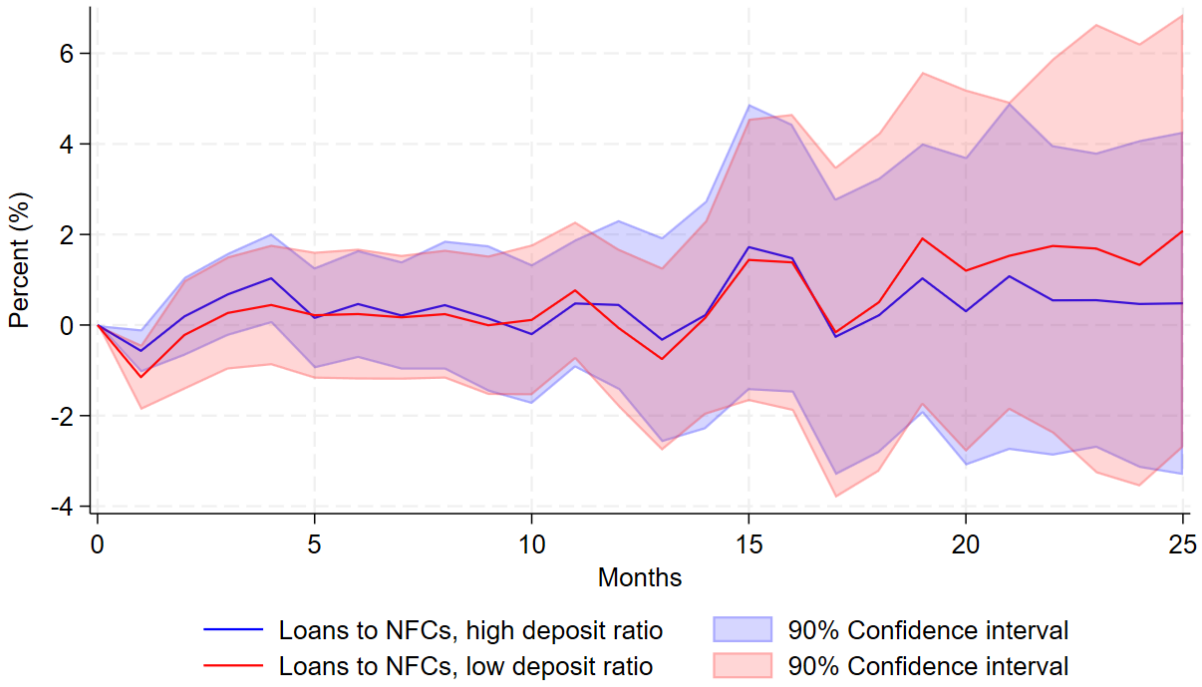

Figure 20: Response of lending rate to NFCs: high deposit funding and interbank funding

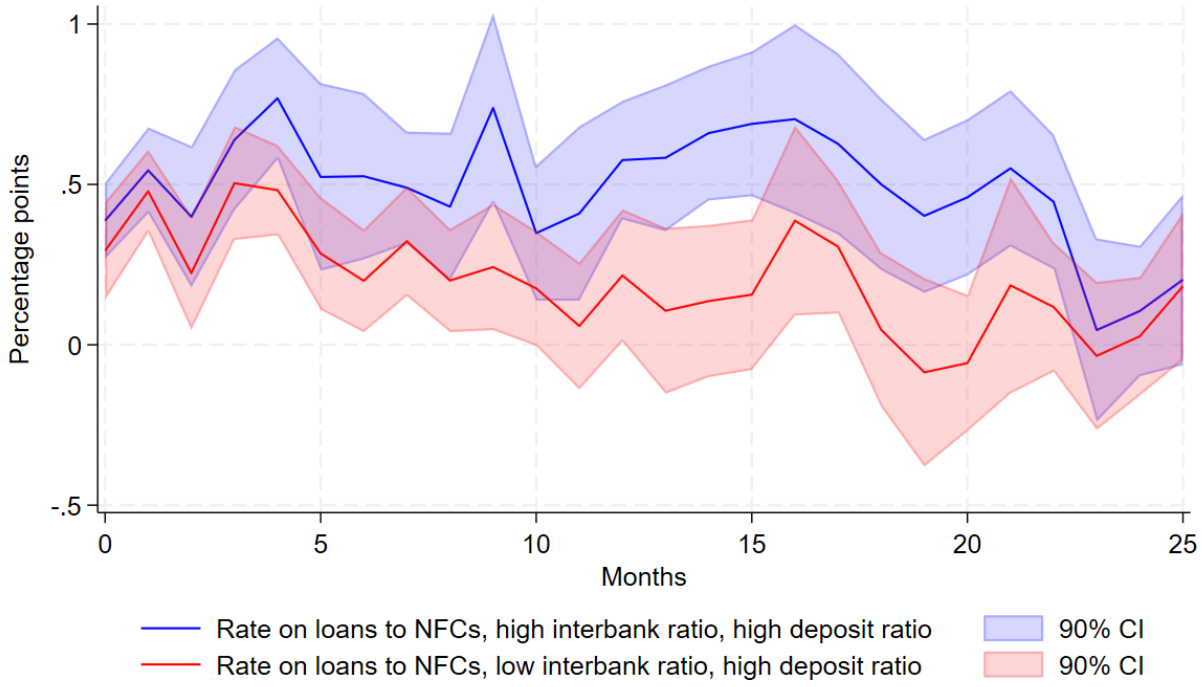

Figure 21: Response of lending rate to NFCs: high deposit funding and central bank funding

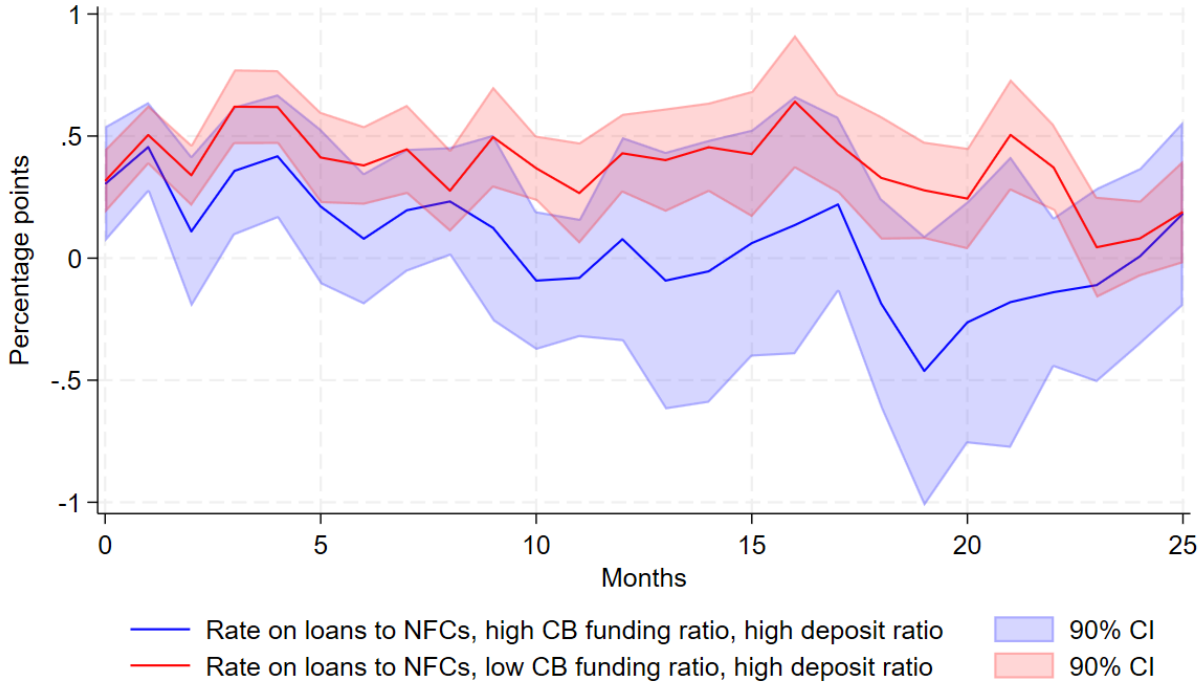

Figure 22: Response of lending rate to NFCs: high deposit funding and equity funding