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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 Gonzalo Paz-Pardo and Jean-David Sigaux (both ECB), 7 central bank advisers and 8 academic consultants.

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DEPOSIT FUNDING, MARKET POWER AND MONETARY POLICY TRANSMISSION

by Simone Auer*, Antonio Maria Conti** and Paolo Farroni***

Abstract

This paper examines the role of banks' deposit funding and deposit market power as potential drivers of the intensity of the pass-through from monetary policy to bank funding costs and broader financing conditions. We document that during the ECB's unprecedentedly forceful monetary tightening cycle in 2022–23, the pass-through from policy rates to overnight deposit rates was extremely muted compared with historical regularities, highlighting a disconnect in monetary policy transmission. Using confidential bank-level data, state-dependent panel local projections and high-frequency monetary policy shocks, we find that higher deposit funding is associated with a lower pass-through to overnight deposit rates, mainly in the short term. The dampening effect of deposit market power is more persistent and extends to lending rates for households and non-financial corporations.

JEL Classification: C32, E51, E52, E58.

Keywords: ECB, monetary policy, deposit rates, pass-through, Bayesian VAR models, state-dependent panel IV local projections.

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1 Introduction[1]

The transmission of monetary policy to banks' funding costs is crucial, as it directly influences intermediaries' decisions about lending rates offered to borrowers, ultimately affecting credit dynamics and, in turn, economic activity. However, the unprecedentedly forceful monetary tightening undertaken in 2022–23 by the European Central Bank (ECB) in response to the sudden awakening of inflation (Neri, 2024) was characterized by a very limited increase in interest rates on overnight deposits (Lane, 2023), the main source of funding for euro-area banks.

In this paper, we evaluate the role of banks' deposit market power — measured as the deposit markdown obtained through a logit demand model — and of deposit funding — defined as the share of deposits over total bank funding — as potential drivers of the intensity of the pass-through (PT) from monetary policy to overnight deposit and lending rates in the euro area (EA). We focus on these two factors because they both became more relevant during the long phase of very accommodative monetary policy that preceded the 2022–23 ECB's tightening cycle.

Between 2015 and 2021, the low opportunity cost of holding money in a low interest rate environment and the large-scale asset purchase programs implemented by the ECB led to a large inflow of deposits for euro-area banks, matched by a corresponding increase in their reserves on the asset side.[2] Banks with higher deposit funding, and with adequate excess reserves, may limit the PT of monetary policy to deposit rates: they have less incentives to attract further deposits by offering

[1]The views expressed in this paper are those of the authors and do not necessarily reflect those of Banca d'Italia or the Eurosystem. We are especially indebted with Alessandro Secchi for several useful discussions leading to this draft. We also thank an anonymous reviewer of the ChaMP Research Network, Borağan Aruoba, Diana Bonfim, Guido Bulligan, Michele Caivano, Luisa Carpinelli, Thomas Drechsel, Andrea Fabiani, Davide Fantino, Giuseppe Ferrero, Victoria Ivashina, Ragnar Juelsrud, Stefano Neri, Sergio Nicoletti Altimari, Alessandro Notarpietro, Nicola Pavanini, Luigi Federico Signorini, Fabrizio Venditti and participants to the 6th ChaMP Workstream 1 Workshop (Eltville, 14-15 April 2025), the 13th Annual Conference of the IAAE (Torino, 25-27 June 2025), the 40th meeting of the EEA (Bordeaux, 25-28 August 2025) and the 3rd Conference on Monetary Policy and Heterogeneity in Households, Firms, and Financial Intermediaries: Insights from Microdata (Roma, 13-14 October 2025).

[2]The asset purchases conducted by the ECB directly result in an equivalent increase in reserve assets and in deposit liabilities unless the debt securities are held by banks in the euro area. Indeed, if the debt securities are held by euro-area banks, the sale of bonds is only matched by a corresponding increase in reserves on the asset side.

a higher remuneration (Messer and Niepmann, 2023) and their cost of losing the marginal depositor is relatively lower. Moreover, a larger deposit base heightens the impact of a repricing of the entire stock of deposits on interest expenses and profitability, making banks less willing to pass on rate hikes to depositors (Gambacorta, 2008; Eggertsson *et al.*, 2024; Cappelletti *et al.*, 2024).

After being remarkably stable over the period 2007–15, banks' deposit market power trended upwards, mirroring the evolution of deposit funding at least until the onset of the 2022–23 ECB's tightening cycle.[3] During a period characterized by a significant increase in aggregate deposits and persistently low interest rates — a condition that limited customers' incentives to reallocate their funds toward alternative financial products — some banks were able to attract a larger share of deposits, thereby strengthening their deposit market power.[4] Facing a lower demand-price elasticity, these banks may have limited the PT of policy rate hikes to earn larger intermediation margins. This mechanism is at the heart of the so-called *deposit channel of monetary policy* in Drechsler *et al.* (2017, 2021). When central banks raise policy rates, the incomplete PT to deposit rates among banks with a greater market power induces deposits to flow out into higher-yielding assets. Since banks rely heavily on deposits for their funding, these outflows induce also a reduction in their loan supply. The deposit channel of monetary policy therefore implies a weaker transmission of monetary policy to deposit rates and a stronger transmission to bank lending.[5]

In a nutshell, our main results are the following. The PT to the overnight de-

[3]We use the standard definition of market power, namely the ability of banks to price deposits below their opportunity cost. Note that these costs include both the reference rate and all other expenses that banks incur to maintain and operate their deposit franchise. Only when the latter are negligible can market power be measured directly by looking at deposit spreads. We provide more details in Section 2.

[4]See Altunbas *et al.* (2023) for evidence on the role of negative interest rate in the increase of bank market power.

[5]The deposit channel of monetary policy, with banks making profits through the difference between what they pay for deposits and what they earn by re-investing deposited funds at or above the policy rate, is hard to reconcile with the period of low or negative policy rates, when banks were making losses on deposits. Basten and Juelsrud (2023) and Basten and Juelsrud (2025) provide a framework that reconciles incomplete PT and temporary losses on deposits with banks offering more attractive deposit rates to retain depositors and gain new ones in the hope of generating future profits through cross-selling activities.

posit rates during the 2022–23 ECB's tightening cycle was lower than implied by historical regularities. Moreover, the increase in banks' deposit funding and in deposit market power both contribute to explaining the muted relationship between policy rates and the remuneration of overnight deposits. While higher banks' deposit funding is associated with a lower sensitivity to monetary policy mainly in the short term, the dampening effect of higher deposit market power is more persistent. Furthermore, the latter effect extends beyond banks' funding costs and affects the broader transmission of monetary policy to financing conditions for households (HHs) and non-financial corporations (NFCs). Finally, banks with higher deposit market power also show a more pronounced and persistent increase in their average loan-deposit spread, as the overall dampening effect on the remuneration of overnight deposits is greater than that on lending rates.

Framework. We assess the PT of changes in monetary policy rates to bank funding costs at both the macro and micro level. At the macro level we rely on Bayesian VAR (BVAR) models, largely used for research (see, among others, Giannone *et al.*, 2015 and references therein) and policy purposes (see, for example, Lane, 2023, and Panetta, 2024). Our small-scale BVAR includes three variables: short- and long-term market rates and the euro-area average interest rates on deposits from NFCs or HHs. After estimating the reduced-form BVAR parameters over the sample spanning from January 2000 to December 2021, we compute counterfactual paths for deposit rates over the period January 2022–December 2023 and compare these patterns to those actually observed, in the spirit of the literature on conditional forecasting (see, among others, Bańbura *et al.*, 2015, Giannone *et al.*, 2019, and Auer and Conti, 2024, for the euro-area economy; Jarocinski and Smets, 2008 and Aastveit *et al.*, 2017, for the US economy). The results inform us about the consistency between the observed PT and that implied by historical regularities, revealing whether there have been any changes in the monetary transmission mechanism to bank funding costs.

At the micro level, we further assess the PT to overnight deposit rates by exploiting the combination of confidential bank-level data and state-dependent local projections techniques in a panel setting (see Jordà, 2005, Jordà and Taylor, 2025, and references therein). Specifically, we use two confidential databases compiled by the Eurosystem: the individual Monetary and financial institutions Interest Rate (iMIR) database, which contains monthly data on deposits and lending rates, and the individual Balance Sheet Indicators (iBSI) database that provides banks' main asset and liability items at an unconsolidated level. We start by assessing the PT from monetary policy to overnight deposit rates using linear panel local projections and compare the results with those obtained at the macro level. We then deepen our analysis by adopting a state-dependent panel local projection framework to assess the extent to which banks' deposit funding and deposit market power affect the transmission of monetary policy to the remuneration of overnight deposit from HHs and NFCs.

To this end, we quantify banks' reliance on deposit funding as the share of deposits in total liabilities at the bank level. We proxy the unobservable deposit market power with a measure of deposit markdown — i.e. the spread between the policy rate and banks' cost of deposits — that is estimated through a logit model of deposit demand similarly to the framework of imperfect bank competition in Albertazzi *et al.* (2022). This methodology allows us to back-out a measure of deposit market power that, differently from other measures like the Herfindahl-Hirschman index, also varies at the bank level. We also conduct a joint assessment on the role of deposit funding and deposit market power in shaping monetary policy transmission to determine their relative importance over the short and medium term.

The monetary policy shocks are based on high-frequency identification approach to compute interest rate surprises around the meetings of the ECB Governing Council (Altavilla *et al.*, 2019; Jarociński and Karadi, 2020).

Results. We document three main findings. First, during the ECB's unprecedentedly forceful monetary tightening cycle in 2022–23 the PT from policy rates to overnight deposit rates was extremely muted compared with historical regularities, highlighting a weakening of the transmission of monetary policy to bank funding costs. The counterfactual path of overnight deposit rates obtained with the BVAR model exhibits an implicit PT of about 0.4 and 0.25 for NFCs and HHs, respectively, and is therefore unable to replicate the limited increase actually observed since January 2022. The PT to the interest rates on deposits with an agreed maturity was instead in line with historical regularities.

Second, we show that both banks' deposit funding and deposit market power contribute to dampening the PT from the ECB's reference rates to overnight deposit rates, computed as the cumulative multiplier using a panel IV local projection framework along the lines of Jordà and Taylor (2025). Specifically, following a 100 bps increase in the reference rate, a bank with a share of deposits over total funding at the 75th percentile, compared with a bank at the 25th percentile, on impact would pass on 10 bps less to the remuneration of overnight deposits from NFCs and 15 bps less to that of overnight deposits from HHs. For deposit market power, the dampening effect on the PT is 5 and 3 bps, respectively, on impact. After 12 months, the attenuation in the PT associated with higher deposit funding disappears almost completely, while higher deposit market power is still associated with a lower PT to overnight deposit rates by 10 and 6 bps for NFCs and HHs, respectively. Although these figures may seem small in magnitude, they account for a significant fraction of the cross-sectional variation in the PT across intermediaries. When assessing the relative importance of these two factors jointly, we find confirmation that banks with higher deposit funding display a lower PT to overnight deposit rates only in the short term, while the dampening effect of deposit market power proves to be more persistent.

Third, we find that only deposit market power has a dampening effect also on the PT from monetary policy to lending rates, suggesting that its influence extends beyond bank funding costs and affects the broader transmission of monetary policy to financing conditions for NFCs and HHs. After 12 months, the attenuation in the

PT associated with higher deposit market power is around 10 bps for NFCs lending rates and 6 bps for mortgage rates.[6] However, the net effect on the loan-deposit spread — defined as the difference between the (volume-weighted) average interest rate on loans and on overnight deposits to NFCs and HHs — is positive. The decrease in the PT to overnight deposit rates more than offsets the corresponding decrease in the PT to lending rates.

Our findings yield important implications for monetary policy. The increase in the share of deposit funding driven by the prolonged period of very accommodative monetary policy likely had only a transitory dampening effect on the transmission of the subsequent tightening impulse to bank funding costs and lending rates. On the other hand, the rise in deposit market power, possibly reflecting a more inelastic demand faced by banks, exerted a more persistent dampening effect on the transmission of monetary policy. These results indicate that an adequate competition in the credit sector may enhance the ability of central bank to ensure an appropriate monetary policy impulse.

Connection to the literature. Our paper belongs to the large empirical literature on the role of banks in the transmission of monetary policy in the euro area. This vast literature can be sorted according to the nature of the approach adopted: looking at aggregate data and using macro-econometric methodologies (Giannone *et al.*, 2012; Peersman, 2012; Albertazzi *et al.*, 2014; Hristov *et al.*, 2014; Ciccarelli *et al.*, 2015; Giannone *et al.*, 2019; Illes *et al.*, 2019; Altavilla *et al.*, 2020); or instead relying on disaggregated data and being inherently based on more micro-econometric oriented techniques (Holton and Rodriguez d'Acri, 2018; Heider *et al.*, 2019; Boeckx *et al.*, 2020; Demiralp *et al.*, 2021; Altavilla *et al.*, 2022; Bittner *et al.*, 2022; Bottero *et al.*, 2022; Eggertsson *et al.*, 2024). In this regard, we combine both macro- and micro-econometric methodologies to assess the PT from monetary policy rates to bank interest rates, with a specific focus on the 2022–23

[6] Since our analysis focuses solely on interest rates and not on credit quantities, we interpret our findings as a lower bound on the total effect on bank lending, which may as well arise from a contraction in lending volumes.

ECB's unprecedentedly forceful monetary tightening.

Our analysis adds in particular to the recent strand of the literature that explores factors possibly contributing to the muted PT from monetary policy to deposit rates in the euro area during 2022-23, for which the evidence is relatively scarce.[7] Kho (2025) documents that deposit rates respond symmetrically to monetary tightening and easing and that more concentrated banking sectors do pass-on monetary policy shocks more slowly than less concentrated ones. Messer and Niepmann (2023) show that, even after controlling for bank competition, the levels of excess reserves explain cross-country variation in the response of deposit rates, suggesting that the low PT was likely associated with the abundance of liquidity introduced by monetary policy interventions during the pandemic period. Fricke *et al.* (2024) explore the effect of large excess reserves on monetary policy transmission using bank-level data, finding instead only a limited impact of reserves-to-assets ratio in explaining the low PT of deposit rates to changes in policy rates. Beyer *et al.* (2024), using country-level data, show that the weakening of the PT to deposit rates at the country level is partly related to higher financial sector concentration, ampler deposits, and liquidity.[8] Bussière *et al.* (2025) find that banks with a higher reliance on deposit funding exhibit a more muted increase in lending rates following monetary policy tightening, highlighting the importance of deposit funding in shaping bank loan supply.

In this respect, our contribution is the joint assessment of the role of deposit market power and deposit funding — the latter partly reflecting on the liability side, the reserve abundance on the asset side stemming from quantitative easing — in explaining the broken link between policy rates and overnight deposit rates during the 2022–23 ECB's tightening cycle. To the best of our knowledge, this is

[7] Several papers focused on the transmission of negative interest rates to deposits rates. Heider *et al.* (2019) document that banks were reluctant to pass on negative rates to depositors, which increased the funding cost of high-deposit banks relative to low-deposit banks. Altavilla *et al.* (2022) show that for sound banks — that is, banks with investment grade ratings — the PT to firm deposits was not impaired when policy rates moved into negative territory.

[8] Fabiani and Piersanti (2023) study the dynamic response of deposit rates and volumes to changes in monetary policy rates in Italy and show that the PT to overnight deposit rates has declined over time, due to the increase in deposit market concentration.

the first study to offer such a comprehensive analysis, relying on bank-level data and state-dependent panel IV local projections.

Outline of the paper. The paper is organised as follows. The next Section documents a set of stylised facts regarding the limited PT of policy rate hikes to deposit rates during the ECB's monetary policy tightening in 2022–23 and the evolution of banks' deposit funding and market power. Section 3 describes the data and the empirical framework. Section 4 presents the results on euro-area deposit rates and the implications for the transmission to lending rates. Finally, Section 5 concludes. A supplementary Appendix including details on the BVAR framework, the estimation of the deposit markdown and several robustness checks is also available.

2 Stylized facts

In this Section we first evaluate in a BVAR framework the PT from policy rates to deposit rates during the 2022–23 ECB's tightening cycle. We then describe the evolution of banks' deposit funding and deposit market power in our sample.

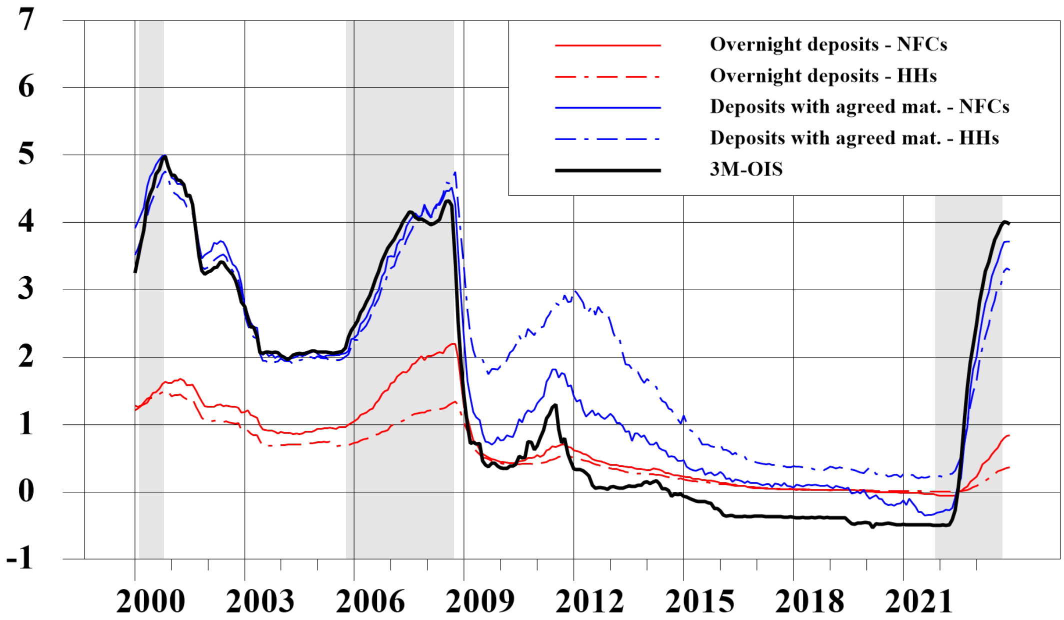
2.1 The missing pass-through to overnight deposit rates

Between July 2022 and September 2023, the ECB has embarked on a rapid tightening cycle amid persistent inflationary pressures. The deposit facility rate was raised by 450 basis points (bps), from its historically low and negative level of -0.5% to 4.0%. Over the same period, the average remuneration of overnight deposits from NFCs and HHs in the euro area showed only very limited increases, remaining close to zero (Figure 1).[9]

After having remained negative for a prolonged period in a low interest rate environment, the differences between the three-month money market rate and the average interest rates on overnight deposits from both NFCs and HHs turned positive

[9] The average interest rate on overnight deposits from NFCs raised from -0.1 to 0.8%, that on overnight deposits from HHs from 0.0 to 0.3%.

Figure 1. Deposit and Reference Market Rates



Notes: The figure shows the evolution of the remuneration of overnight deposits and of deposits with an agreed maturity from households and non-financial corporations in the euro area, together with the 3-month OIS rate. Light grey shaded areas denote ECB's tightening cycles.

again and rapidly approached their respective historical highs by late 2023.[10] The evolution of the remuneration of deposits with agreed maturities was less anomalous over the same period, with increases that were more in line with that of the reference market rate and spreads that remained at much narrower levels.

Although in the literature there is ample evidence of a historically limited PT of policy rate hikes to the remuneration of overnight deposits, an eyeball examination of the data suggests that during the 2022–23 ECB's tightening cycle the PT has been much lower compared with past cycles. To structurally assess this muted PT, we conduct a simple counterfactual analysis within a Bayesian VAR (BVAR) framework, in the spirit of Jarocinski and Smets (2008) and Aastveit *et al.* (2017) for the US economy and of similar analyses specifically focused on lending volumes and rates in the euro area (Giannone *et al.*, 2019; Auer and Conti, 2024; Conti *et al.*,

[10] The spread between the reference market rate and overnight deposit rates was at 320 and 370 basis points, respectively, for NFCs and HHs. The previous peaks were observed at the end of 2000, when the interest rate convergence following the launch of the euro area was still ongoing (with spreads at 335 and 345, respectively), and in the second half of 2008, towards the end of the monetary tightening cycle preceding the outbreak of the Global financial crisis (at 230 and 310 basis points, respectively).

2024). In the baseline specification, the BVAR includes three variables: monthly data for short- and long-term market rates, directly affected by monetary policy, and interest rates on deposits (from NFCs or HHs, one at a time). The model is estimated in levels over the period from January 2000 to December 2021.[11]

In more detail, we design a series of exercises aimed at projecting the evolution of deposit rates for NFCs and HHs in the EA since 2022:M1 using conditional forecasts (Waggoner and Zha, 1999; Bańbura *et al.*, 2015). These projections can be interpreted as counterfactual scenarios that allows for assessing whether the evolution of deposit rates during the 2022–23 ECB's tightening cycle could have been anticipated based on historical regularities. In practice, each exercise consists of three steps. First, we estimate the reduced-form BVAR coefficients over the sample 2000:M1–2021:M12,[12] just prior to the increase in market rates driven by the start of the normalisation process of monetary policy and the consolidation of expectations of imminent policy rate hikes.[13] Second, we compute conditional forecasts for deposits rates over the period 2022:M1–2023:M12, based on the coefficients estimated in the first step and assuming that the evolution of short- and long-term market rates are known for the full sample until 2023:M12 (i.e. these two variables are included in the conditioning set).

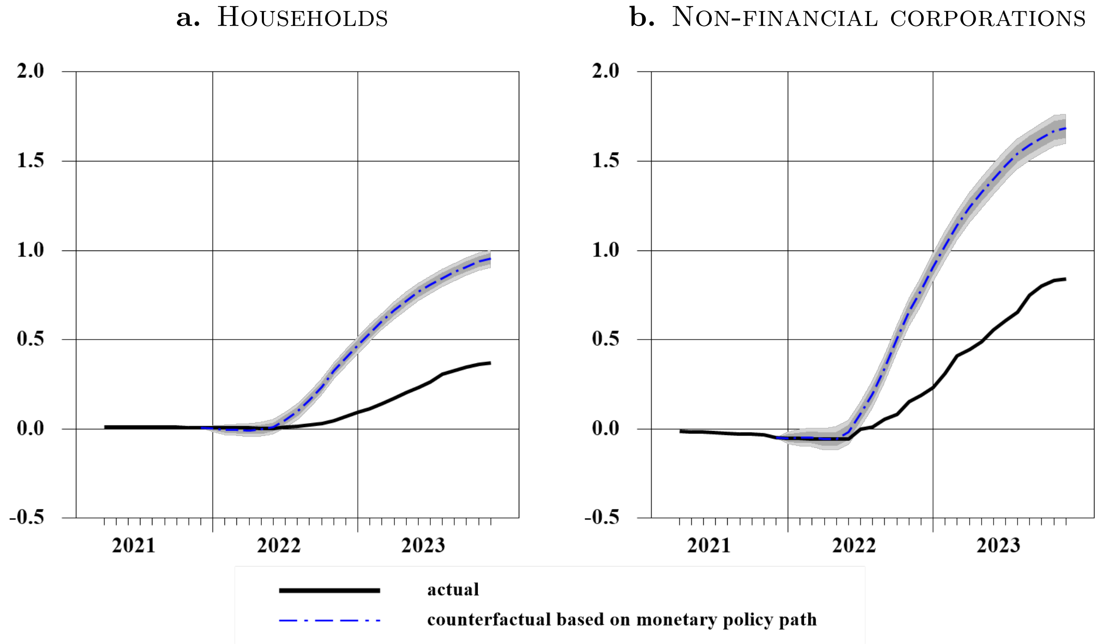
The results confirm the insights of the preliminary visual inspection of the graph, as the PT of monetary policy to deposit rates was sensibly lower relative to previous tightening cycles. The predicted counterfactual paths of overnight deposit rates for NFCs and HHs rise to about 1.6 and 1%, respectively, with implicit pass-through of about 0.4 and 0.25 that are consistent with historical regularities and previous estimates (Figure 2; see De Bondt, 2005).

[11] For further details on the Bayesian VAR model see Appendix A.

[12] To check for the impact of the pandemic period, we also estimate the model until 2019:M12 and then compute counterfactuals since 2022:M1. The results are broadly in line with those presented here.

[13] In December 2021, the ECB started the monetary policy normalisation process by announcing its decision to discontinue the net asset purchases under the Pandemic Emergency Purchases Programme (PEPP) at the end of March 2022. This announcement, along with the rise in inflation, triggered a sizable increase in short- and long-term rates, as the PEPP played an important role in compressing yields in 2020–21 (see, among others, Eser *et al.*, 2023, Bernardini and Conti, 2023 and references therein).

Figure 2. Missing pass-through from policy to overnight deposit rates



Notes. The dark (light) grey shaded area is the 68% (90%) credible interval obtained from the BVAR posterior distribution. Estimation sample is 2000:M1–2021:M12. The counterfactual path in 2022:M1–2023:M12 is obtained assuming that the evolution of short- and long-term market rates are known for the full sample.

It is immediate to see that the actual evolution of the remunerations of overnight deposits was significantly weaker than that obtained in their counterfactual patterns. In contrast, the PT to interest rate on deposits with an agreed maturity (or term deposits) for both NFCs and HHs is perfectly in line with historical regularities (Figure A.1 in the Appendix).[14]

Notice that the missing PT to overnight deposit rates is a unique feature of the 2022–23 ECB's tightening cycle. In fact, first, a counterfactual analysis for the 2005–08 ECB's tightening cycle does a good job in anticipating the evolution of these remunerations when conditioning on the path of market rates: the overnight deposit rates for HHs are perfectly predicted, while those for NFCs are only slightly underestimated (Figure A.2 in the Appendix). Second, the result of a missing PT also holds when conducting the counterfactual based on BVAR coefficients estimated on subsamples ending in 2014:M5 or even in 2007:M6, suggesting that this

[14]We basically conduct the same counterfactual analysis by just replacing overnight deposit rates with term deposit rates. The resulting counterfactuals are almost perfectly overlapping to the actual rates, suggesting a PT in line with historical regularities for term deposit rates.

finding is not driven by the impact of negative interest rate and asset purchases policies (Figures A.3 and A.4).[15] Remarkably, this evidence also speaks to the literature showing that the transmission mechanism of monetary policy is not impaired when policy rates hit negative territory, even though it works differently (Altavilla *et al.*, 2022).

A key concern for our baseline counterfactual analysis is that the 3-variable BVAR model does not adequately capture the substitution between overnight and term deposits, which may also be considered as a proxy of other financial assets. In other words, one may conjecture that the missing pass-through from policy rates to overnight deposit rates is the result of an omitted variable bias in our baseline BVAR, that is the evolution of deposit volumes. The line of reasoning is the following. While the prolonged period of low interest rates limited savers' incentives to reallocate their funds toward alternative products, the recent surge in rates had the opposite effect. The volume of term deposits, whose yields have risen more in line with policy rates, increased sharply, while overnight deposits declined.

To confirm that the evolution of overnight deposit rates during the 2022–23 ECB's tightening cycle was inconsistent with historical regularities, it is therefore crucial to address the issue of substitutability in our counterfactual analysis. To this end, we conduct two exercises. In the first one, we jointly model overnight and term deposit rates together with the corresponding volumes. This entails augmenting the baseline BVAR model by including the volume of overnight deposits as well as both the interest rates and the volume of term deposits. We then re-run our counterfactual analysis in this 6-variable BVAR including only market rates in the conditioning set, and the results are confirmed (Figure A.5). In the second exercise, we rely on the same extended model but we further augment the conditioning set by adding the actual evolution of deposit volumes, in order to better account for the observed substitution across different types of deposits. Results remain virtually

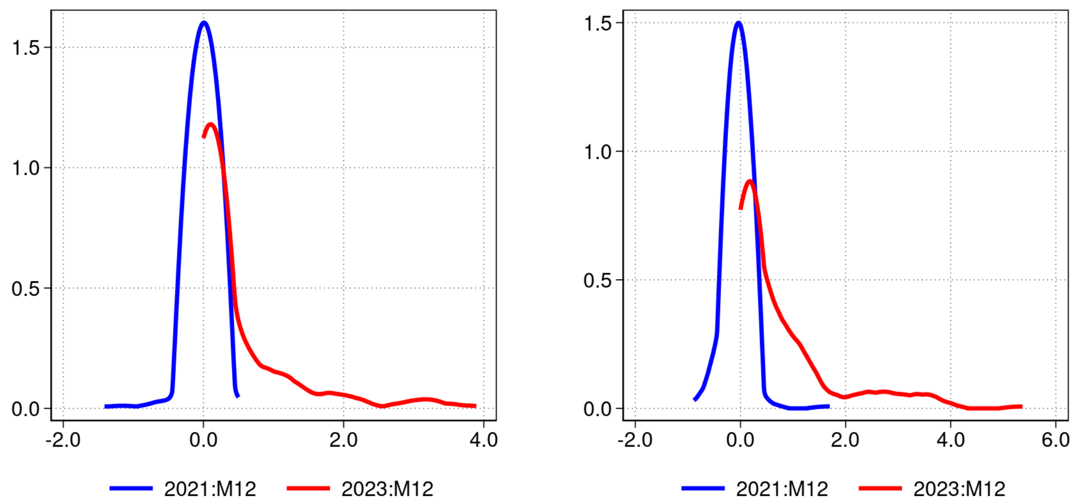
[15] One might be concerned about the somewhat short size of our sample. However, the Bayesian framework helps mitigate this concern as it exploits the incorporation of prior information alongside the evidence provided by the data itself (see, among others, Giannone *et al.*, 2015, Giannone *et al.*, 2019).

unchanged (Figure A.6).

Although the pass-through was more muted than implied by historical regularities at aggregated level, evidence based on aggregate data conceals significant heterogeneity across banks. Some banks were indeed passing on the increases in key policy rates to the remuneration of overnight deposits to a greater extent. Kernel density estimates at the beginning and at the end of the ECB's tightening cycle in 2022–23 show a clear shift in the distribution of overnight deposit rates across banks into positive territory together with a marked increase in dispersion, which had instead been drastically compressed in the low-interest rate environment (Figure 3). The positive skewness indicates that, by December 2023, some customers received a remuneration on their overnight deposits that was significantly above the mean.

Figure 3. Kernel densities of overnight deposit rates

a. Households **b.** Non-financial corporations



Notes. The probability density function is approximated using the Epanechnikov kernel and a bandwidth of 0.2.

2.2 The evolution of banks' deposit funding and market power in the euro area

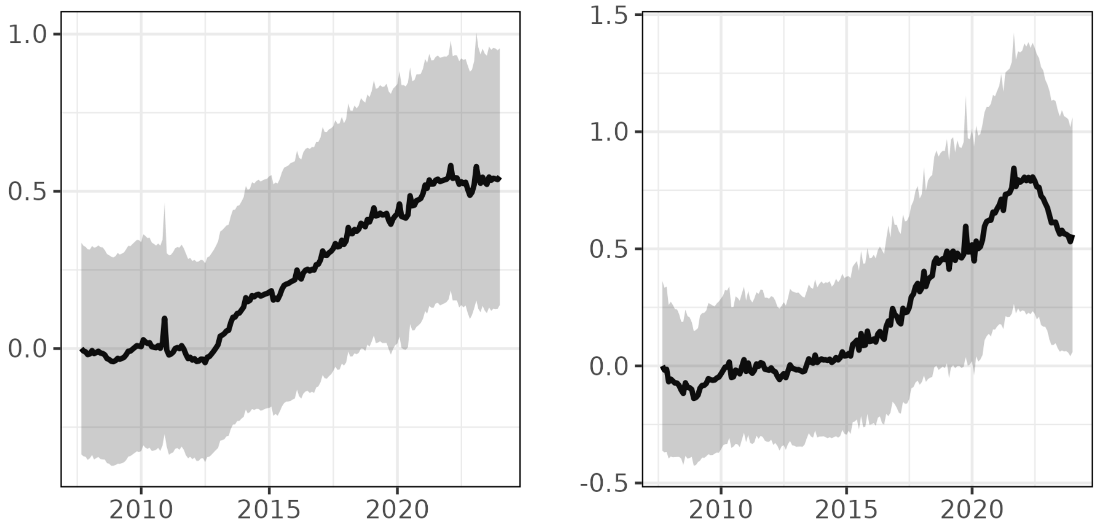
In the bank-level empirical analysis, we investigate whether this heterogeneity in the PT to overnight deposit rates could possibly be associated with two specific characteristics: the incidence of deposit funding and the market power in the deposit market. While previous literature highlights several other potential drivers affecting the intensity of the PT to both deposit and lending rates, we focus on these two characteristics due to their marked and unprecedented changes in the years leading to the start of the tightening cycle.

We measure the incidence of deposit funding as the share of deposits over total liabilities at the bank level. Since deposit market power, namely the ability of banks to price deposits above their opportunity cost, is not directly observable in the data, we estimate it through a model of imperfect bank competition in the spirit of Albertazzi *et al.* (2022). This procedure allows us to recover the unobservable deposit markdown as a measure of banks' market power, i.e. the spread between the policy rate and banks' cost of deposits. We provide more details in the next Section and in the Appendix B.

In Figure 4 we plot the standardized time series of our measures of deposit funding (panel a) and deposit market power (panel b). We note a clear upward trend in both variables especially after 2015. The cross-sectional dispersion (shaded area) also increased, especially for banks' deposit market power.

Figure 4. Evolution of selected banks' characteristics

a. Deposit funding　　**b.** Deposit market power



Notes. The figures show the evolution of our bank-level measure of deposit funding (panel a) and deposit market power (panel b). We standardize each variable by subtracting the mean and dividing by their standard deviation. We also normalize both series to start at 0 at the beginning of our sample. The black solid line denotes the median, while the lower and upper bounds of the shaded area corresponds to the 40^{th} and 60^{th} percentiles, respectively.

The surge in deposit market power and in deposit funding is likely to have been influenced by the very accommodative monetary policy stance undertaken until the beginning of 2022. In a low-interest rate environment, with limited opportunity costs of holding money, banks experienced large inflows of overnight deposits from customers that were less attracted by the still low remunerations of other, potentially riskier, saving options. Moreover, the asset purchases conducted under the APP and the PEPP effectively injected ample liquidity in the banking system. When the Eurosystem purchased bonds from the (non-bank) private sector, the corresponding proceeds were mechanically credited to their bank accounts, thereby increasing on impact their overnight deposits and banks' reserves. Hence, when policy rates were raised in the subsequent tightening cycle, banks may have been less willing to pass on rate hikes to depositors because the cost of losing the marginal depositor was lower compared with a situation in which deposits and reserves were relatively scarce.

The increase in deposit market power went roughly hand in hand with the increase in deposit funding, at least until the beginning of the tightening cycle. In a context of expanding aggregate deposits and persistently low interest rates, some banks were able to attract and retain a larger share of deposits, enhancing their deposit market power.[16] Especially during a monetary tightening, banks with a higher degree of market power can charge customers a higher markdown, meaning a larger (typically positive) spread between the market reference rate and banks' effective cost of deposits.

It is important to highlight that these two bank characteristics can vary independently across different banks. Large banks with high deposit market power do not necessarily have high deposit funding, as they also tend to have an easier access to the wholesale market and to better diversify their funding structure. For the

[16] Altunbas *et al.* (2023) finds that the introduction of negative interest rates was associated with an increase in banks' market power, possibly because, in response to margin compression, euro-area banks implicitly colluded to restore their mark up. The increase in banks' market power was also influenced by the waves of mergers and acquisitions following the Global Financial Crisis (ECB, 2024). The number of credit intermediaries in the euro area decreased by around a third between 2010 and 2023.

opposite reason, small banks with low deposit market power may have a high share of deposits in their total liabilities. We find only a mild correlation between the incidence of deposit funding and market power in the cross-section (with a positive coefficient of 0.23), supporting the idea of analysing separately the impact of these bank characteristics on monetary policy transmission to deposit rates.

3 Empirical framework

In this Section, we first describe the data used in the analysis and then illustrate the empirical methodology.

3.1 Data

Bank-level deposits and lending rates are sourced from the iMIR database, which provides interest rates charged by individual banks resident in the euro area. To construct our measures of deposit funding and market power, we also use data on banks' main asset and liability items at the unconsolidated level from the iBSI database. After the merge with iMIR data, we have information on 332 banks resident in the euro area from July 2007 to December 2023.[17] The sample is overall representative of the banking system, as it covers about 70% of bank total assets in the euro area.[18]

We measure banks' deposit funding as the share of deposits in total liabilities at the bank level. Since the economic mechanism behind a low PT of monetary policy to deposit rates should be theoretically driven by both high deposit funding and adequate reserves to face potential outflows, incorporating information on reserves would, in principle, strengthen our analysis. We do not exploit the heterogeneity in reserves in our baseline specification to assess state-dependency in

[17] About half of reporting banks are located in the four main euro-area countries (60 in Germany, 34 in Spain, 40 in France and 37 in Italy).

[18] The degree of representativeness of reporting banks is more dispersed across countries, but the share of their assets falls below 60% of the banking system only in four countries (Austria, Ireland, Luxembourg and Malta).

the monetary policy transmission for two main reasons. First, iBSI data on bank deposits held with the Eurosystem are not available for a large number of credit intermediaries, thereby limiting cross-sectional variation. Second, the surge in reserve ratios emerged mainly following the implementation of non-standard monetary policy tools, particularly after 2014, thus also limiting the time dimension that can be exploited.[19] Furthermore, we verify that at the aggregate level reserves and deposits strictly comoved after 2014 both in the euro area and in its main countries. Moreover, for the subsample of banks for which data on deposits held with the Eurosystem are available, we find that the ratio of reserves to total assets is highly correlated with our measure of deposit funding. Therefore, looking only at banks' deposit funding should provide a sufficient statistic for capturing the mechanism under consideration.

We compute deposit market power by means of deposit markdown, defined as the (typically positive) spread between the policy rate and banks' cost of deposits. The latter includes both the marginal costs of deposits — including all administrative and operational costs related to their management, such as maintaining a branch network or an efficient digital infrastructure — and the actual interest rate paid to customers.

Following Albertazzi *et al.* (2022), we estimate the deposit markdown using a logit model of deposit demand that allows us to recover a measure of deposit market power that varies both across banks and over time. We extend their framework by considering partial substitutability between overnight and time deposits, with the remuneration of the latter more closely tracking the policy rate, especially during the 2022–23 ECB's tightening cycle.[20] Importantly, we also estimate separately demand systems for NFCs and HHs, allowing for potentially different demand elasticities.

[19] In the Appendix C, we check whether our main results are robust to the replacing of our measure of deposit funding with the ratio of reserves to deposits, even if this approach reduces our sample size by approximately 35%.

[20] Albertazzi *et al.* (2022) instead focus primarily on the distinction between insured and uninsured deposits. Also note that, similarly to their work, agents in our model can either deposit with any bank for which we have available iBSI/iMIR data and that is located in the same country or deposit with the rest of the national banking sector, collapsed as a "fringe bank".

In the Appendix B we provide full details of the methodology.

One might worry that our deposit markdown indicator is inherently linked to the pass-through we aim to estimate, given its resemblance to the standard spread between reference and deposit rates. This concern would only be relevant if banks faced negligible marginal costs in operating their deposit base. If this were the case, banks would be able to easily replicate competitors' deposit franchises at minimal cost, leaving little scope for the substantial cross-sectional dispersion in deposit rates documented in Figure 3.[21]

Some additional remarks are in order on our preferred measure of deposit market power. First, through the lens of the model, the deposit markdown is — up to a proportionality constant — a non-linear transformation of a bank's deposit market share. Importantly, this relationship is an implication of the model rather than an assumption.[22] Second, the deposit markdown is estimated over a sample that spans full monetary policy cycles, encompassing both accommodative and tightening phases. It is therefore unlikely that our results are driven by any particular phase of the policy cycle. Finally, our bank-level measure is better suited to capturing banks' ability to price deposits below their opportunity costs than the country-level Herfindahl-Hirschman Index (HHI) generally used in the macroeconomic literature. Nevertheless, the correlation between our indicator and the HHI is quite high and ranges between 60% and 70%.

We borrow from Jarociński and Karadi (2020) the series of monetary policy shocks in the euro area that is constructed by using a high-frequency identification approach in the spirit of Gürkaynak *et al.* (2005) and Gertler and Karadi (2015). The policy announcement surprises, obtained by observing movements in market rates within an intraday window around monetary policy meetings, are adjusted to account for information shocks, i.e., movements that reflect information that the central bank possesses about future economic conditions, rather than a direct

[21] Related works documenting similar evidence for the US are Xiao (2020) and Egan *et al.* (2017).

[22] We also note that deposit market share refers to the share of a bank's deposits relative to total outstanding deposits in its reference market, while the incidence of deposit funding pertains exclusively to the balance-sheet structure of an individual intermediary.

monetary policy change (Nakamura and Steinsson, 2018). To this extent, the series of pure monetary policy shocks is obtained using the so-called "poor-man's" sign-restriction procedure that keeps the surprises only when there is a negative co-movement with the equity price index within the intraday window.

3.2 Panel IV local projections

Our aim is to assess how bank interest rates respond to changes in their relevant market reference rate that are induced by exogenous monetary policy shocks. To this extent, we use a panel IV local projection framework along the lines of Jordà and Taylor (2025). This allows quantifying the impact of the monetary policy shocks through the cumulative "multiplier" rather than with impulse responses. In our framework, this monetary multiplier could be interpreted as the ratio between the cumulative response of bank interest rate y^j over a predefined horizon (h) and the cumulative response of a market reference rate (i) over the same horizon, conditional on a monetary policy surprise (ε).[23] This simple metric effectively captures the PT of monetary policy shocks to bank interest rates.

In line with Ramey and Zubairy (2018), we estimate the cumulative monetary multiplier in a one-step procedure using the following benchmark specification:

$$y^j_{t+h} - y^j_{t-1} = \delta^h_0 + \delta^h_1(i_{t+h} - i_{t-1}) + \Gamma X^j_{t-1} + \lambda^j + v^j_{t+h} \tag{1}$$

which is estimated using the exogenous monetary policy shock ε_t as an instrument for $i_{t+h} - i_{t-1}$.[24] In equation (1), j denotes banks and t time at monthly frequency. The dependent variable is the long difference of the bank-level interest rate $\Delta_h y^j_{t+h} = y^j_{t+h} - y^j_{t-1}$, with y^j_t being the overnight deposit rate for HHs and NFCs

[23] Alessandri *et al.* (2025) used a similar metric to gauge how successful the Fed is in influencing the economy by shifting the actual funding costs of US firms and households.

[24] The one-step procedure returns the same estimate of a more complex three-steps procedure in which the multiplier is computed as the ratio between the cumulative impulse responses of bank interest rate and market reference rate to monetary policy shocks at each horizon. The one-step procedure has various advantages, among which the direct estimate of the standard error of the multiplier (see Ramey and Zubairy, 2018).

(as in Section 4.2) or the interest rate on new loans (as in Section 4.3).[25] The main regressor $\Delta_h i^j_{t+h} = i^j_{t+h} - i^j_{t-1}$ is the long difference of the relevant market reference rate. We use the 3-month Euribor for overnight deposits, the 1-year IRS for loans to NFCs and the 10-year IRS for mortgages, given their longer average contractual period of fixation of the interest rate. X^j_{t-1} is a vector of (lagged) controls, which in our baseline includes 6 lags of first difference of the bank-level interest rate, Δy^j, 6 lags of the first difference of the market reference rate, Δi, as well as country-level monthly change in consumer price and industrial production indexes, both sourced from Eurostat. Finally, λ^j denotes bank fixed effects. In this benchmark specification, our main interest is in estimating the "unconditional"cumulative multiplier of monetary policy shocks at each horizon h, ϕ^{uncond}_h, which is given by the parameter δ^h_1. We then extend our benchmark specification allowing for a state-dependent PT of monetary policy shocks to bank interest rates. In particular, we include an extra term $S^j_{t-1}(i_{t+h} - i_{t-1})$ where we interact the change in the market reference rate with a predetermined bank-level characteristics leading to the following specification:

$$y^j_{t+h} - y^j_{t-1} = \delta^h_0 + \delta^h_1(i_{t+h} - i_{t-1}) + \beta^h S^j_{t-1}(i_{t+h} - i_{t-1}) + \Gamma X^j_{t-1} + \lambda^j + v^j_{t+h} \quad (2)$$

where S^j_{t-1} is either the indicator of bank deposit funding or deposit market power as defined in the previous Section. Similarly to equation (1), the state-dependent (or conditional) PT at each horizon h, ϕ^{cond}_h is given by $\delta^h_1 + \beta^h S^j_{t-1}$ and consists of an average constant term δ^h_1 plus a bank-level and time-varying term $\beta^h S^j_{t-1}$.

Note that identifying the conditional pass-through (PT) does not require taking a stance on the underlying drivers behind the evolution of our state variables. Nevertheless, a potential concern is that the state may respond endogenously to interest rate shocks, making our inference valid only for relatively small shocks (Gonçalves

[25] As in Jordà and Taylor (2025), we use a specification in long difference rather than in levels to account for the short-sample bias in local projections. For the sake of simplicity, we will hereafter report the first difference of a variable of interest as $\Delta y^j_t = \Delta_1 y^j_t = y^j_t - y^j_{t-1}$.

et al., 2024). To mitigate this potential issue, in our benchmark specification the state S_{t-1}^{j} enters equation (2) as predetermined with respect to the interest rate shock. However, if the speed of adjustment of the state is sufficiently high, or if the interest rate shock is sufficiently large, our methodology may still fail to correctly identify the true impulse responses. In the Appendix C, we address this concern by further lagging the state variable, ensuring that there is no possible feedback between the state and the shock over the forecast horizon.

A related point concerns the interpretation of the β^h coefficient in equation (2). Since states are almost certainly not randomly assigned, all state-dependent evidence should not be interpreted as providing a causal effect of the conditioning variables on the PT of monetary policy. Rather, it should be viewed as a characterization of how the PT varies across the distribution of our states.

4 Results

4.1 Linear evidence

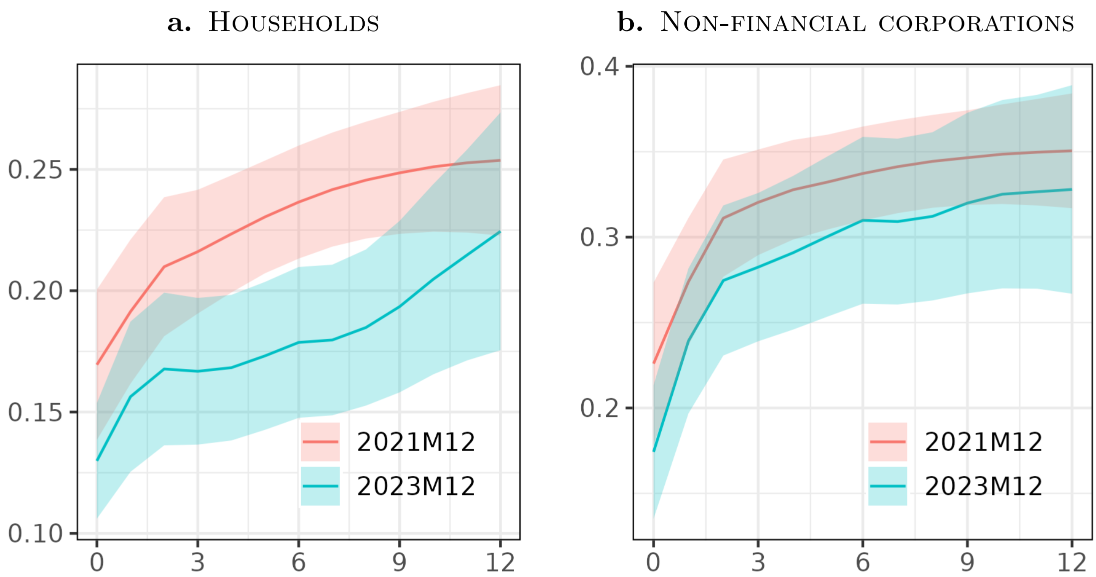
In this Section we present the key findings regarding the unconditional PT of monetary policy to rates on overnight deposits from HHs and NFCs using the methodology outlined in equation (1). Our analysis focuses on the ECB's monetary tightening cycle in 2022–23 by comparing the cumulative monetary multiplier estimated over the whole sample up to December 2023 to that obtained ending the sample in December 2021, i.e. just before the increase in market rates driven by the start of the normalisation process of monetary policy.[26].

In both samples, the unconditional PT from monetary policy to the remuneration of overnight deposits from HHs and NFCs is overall small in magnitude. On average, a 100 bps increase in the reference rate would imply only a 20–25 bps in-

[26]This data split allows us to have enough statistical power to focus on the 2022-23 monetary tightening cycle. However, it is important to note that this exercise differs fundamentally from the BVAR assessment on the PT obtained using conditional forecasts (Section 2.1). Here, we focus solely on the response to the discretionary component of monetary policy, whereas the conditional forecast exercise also accounts for its systematic component.

crease in the average interest rate on overnight deposits from HHs after 12 months (Figure 5, panel a). The PT to the remuneration of overnight deposit from NFCs (Figure 5, panel b) is larger in magnitude, close to 0.35, reflecting the idea that banks are more reactive to change the interest rate on deposits from NFCs rather than those on deposits from HHs. The PT to the interest rates on overnight deposits from HHs is relatively slower when estimated including the 2022–23 ECB's tightening cycle. When considering the remuneration of overnight deposits from NFCs, there is still a difference in the intensity of the PT, but less significant.

Figure 5. Unconditional pass-through to overnight deposit rates



Notes. The figures show the impulse response of interest rates on overnight deposits from HHs (panel a) and NFCs (panel b) to a monetary policy shock estimated as in equation (1) on two samples: from 2008:M7 to 2021:M12 (pre-tightening, denoted as 2021M12) and from 2008:M7 to 2023:M12 (full sample, denoted as 2023M12). We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

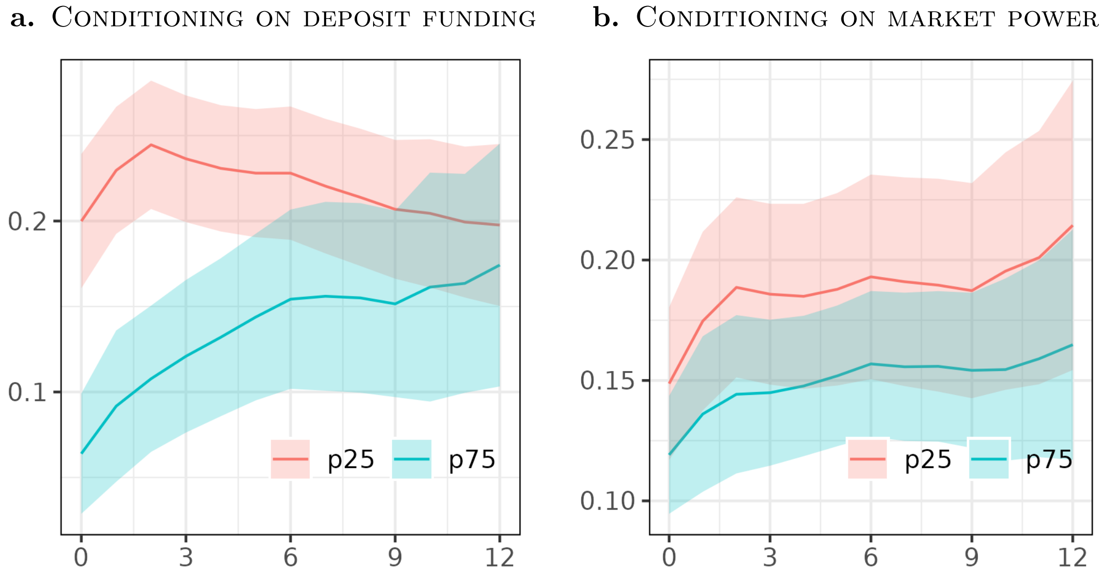
It is important to stress that the PT from monetary policy to overnight deposit rates estimated using the linear panel IV local projection and the sample ending in December 2021 is very similar in terms of magnitude to that implicit in the BVAR analysis with aggregated euro-area data presented in Section 2.1. Moreover, our results are also robust to the use of different monetary policy shocks (Altavilla *et al.*, 2019) and to a simple OLS regression without instrumenting the variation in the policy rate (Figures C.1 and C.2 in the Appendix).

4.2 State-dependent evidence

In this Section, we explore whether the more subdued PT observed during the 2022–23 ECB's tightening cycle could be associated with: i) a higher incidence of deposits in banks' funding, and ii) a greater banks' deposit market power.

We exploit equation (2) to assess separately how both drivers influence the intensity of the PT of monetary policy to overnight deposit rates. This specification effectively implies a state-dependent PT that combines a constant average effect (δ_1^h) with a conditional effect that varies with the bank-level realization of the state variable ($\beta^h S_{t-1}^j$), either deposit funding or deposit market power.

Figure 6. State-dependent pass-through to interest rates on overnight deposits from households



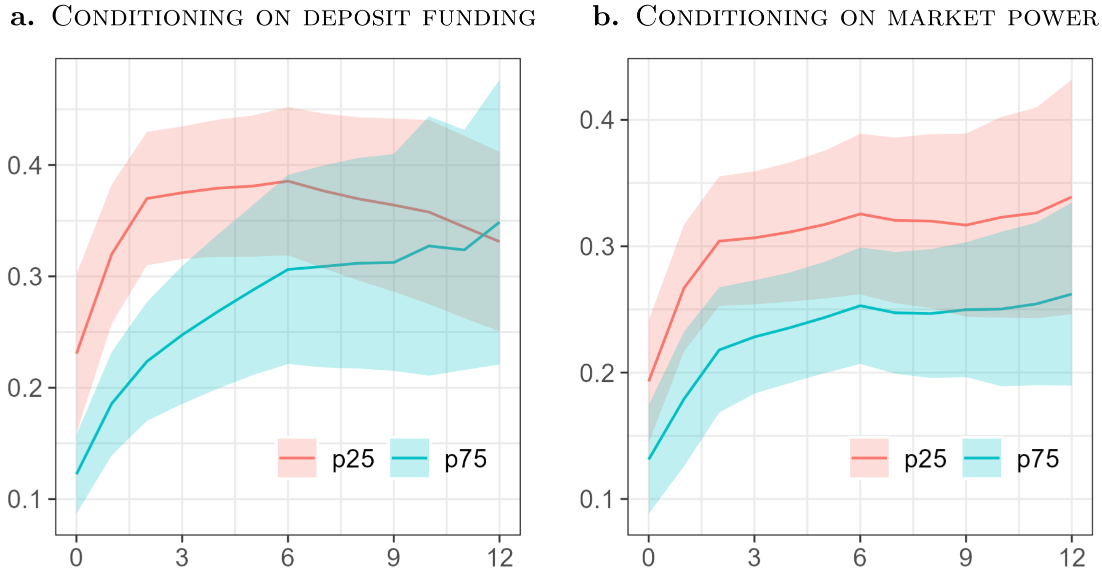
Notes. The figures show the impulse response of interest rates on overnight deposits from HHs conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2). We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figures 6 and 7 report the results for the state-dependent PT to interest rates on overnight deposits from HHs and NFCs, respectively, where we condition on our measures of deposit funding (panel a) and of deposit market power (panel b).[27] For both state variables and depositors types, fixing the state variable at the third

[27]See Figures C.3 and C.4 in the Appendix for a robustness exercise where we use as instrument the monetary policy shocks of Altavilla *et al.* (2019) and Figures C.5 and C.6 for simple OLS regression.

quartile of its distribution (denoted as p75 in the figure) yields a significantly smaller PT than fixing it at the first quartile (p25).[28]

Figure 7. STATE-DEPENDENT PASS-THROUGH TO INTEREST RATES ON OVERNIGHT DEPOSITS FROM NON-FINANCIAL CORPORATIONS



Notes. The figures show the impulse response of interest rates on overnight deposits from NFCs conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2). We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Hence, our estimates indicate that banks with a greater reliance on deposit funding or with a higher deposit market power exhibit a lower PT of policy rate changes to overnight deposit remuneration.[29] Our results are therefore consistent with the mechanism underlying the deposit channel of monetary policy in Drechsler *et al.* (2017, 2021), as well as with the idea that banks with higher deposit funding have fewer incentives to attract further deposits by offering a higher remuneration. As outlined in Section 2, since both measures have increased over the time series (especially after 2015) and in the cross-section, this evidence suggests a possible

[28] See Figure C.7 in the Appendix for a robustness exercise where we further lag the state variable to rule out any possible feedback between the state and the shock over the forecast horizon (Gonçalves *et al.*, 2024). Our results remain robust under this alternative specification and provide further evidence that our state variables primarily capture slow-moving bank characteristics.

[29] Conditioning on the Herfindahl-Hirschman Index (HHI) of market concentration as a proxy of market power our results remain qualitatively unchanged (see Figure C.8 in the Appendix). Nevertheless, since the HHI varies only at the country-time level and captures less adequately banks' ability to price deposits below their opportunity costs, our preferred measure of market power remains the logit-based estimation of deposit markdown.

explanation behind the documented missing PT in the 2022–23 ECB's monetary tightening at aggregated level. As discussed in Section 3, we emphasize that the dampening in PT associated with higher deposit funding and deposit market power should not be interpreted causally. Rather, these state variables capture sources of heterogeneity in the transmission of monetary policy to bank funding costs within our sample.

Similarly to the macro-evidence based on the BVAR in Section 2.1, one potential issue with our estimates is that we are not adequately capturing the substitutability between overnight deposits and other savings instruments, suggesting that the overall PT could be less muted than our findings. We mitigate this concern in a robustness exercise where we also control for both volumes and interest rates of deposits with agreed maturities that are one of the closest substitutes for overnight deposits. Our results remain qualitatively similar (Figure C.9).[30]

Another potential concern is that our measure of deposit funding does not explicitly account for the amount of liquid assets that banks hold to meet potential deposit outflows.[31] To address this issue, we conduct another robustness exercise where we replace our measure of deposit funding with the ratio of reserves to deposits as a state variable in equation (2). Although this alternative specification reduces our sample size by about 35%, the dampening effect on monetary policy transmission continues to hold (Figure C.10).

Finally, to assess the relative importance of the two state variables, we estimate equation (2) jointly conditioning on both deposit funding and deposit market power. To ease the interpretation, before the estimation we standardize the state variables so that the size of the coefficients provides a direct measure of the relative importance of the two factors in influencing the intensity of the PT. Results are qualitatively similar to those obtained when the effects of the two state variables

[30] In an additional analysis (available upon request), we also find evidence of a more muted PT to banks' average cost of funding, which we measure as the volume-weighted average of interest rates on overnight deposits and deposits with agreed maturities, using the corresponding volumes as weights.

[31] See the discussion in Section 3.1

are assessed separately.[32]

Table 1 reports our findings for interest rates on overnight deposit from HHs (panel a) and NFCs (panel b). Higher deposit market power and higher deposit funding are both associated with a lower PT of monetary policy, consistent with the evidence shown in Figures 6 and 7 where the role of the two state variables is assessed separately. For HHs, in the very short term the interaction coefficient associated with banks' deposit funding is statistically significant and more negative than that referring to deposit market power. At longer horizons, the opposite is true with only deposit market power having an interaction coefficient that remains significantly different from zero, therefore maintaining a role in affecting the heterogeneity in monetary policy pass-through. The results for NFCs are qualitatively similar, but with less difference in the impact of the two state variables in the very short term, as the two interaction coefficients are both statistically significant and have a similar magnitude.

We interpret this evidence as suggestive of the fact that higher deposit market power has a more persistent role in lowering the monetary policy PT as compared to deposits funding, which appears to be relevant mainly in the short term.

4.3 Implications for lending rates

In this Section we assess whether deposit market power and deposit funding have a dampening effect also on the PT of monetary policy to lending rates. A positive result would suggest that the influence of these state variables extends beyond bank funding costs, affecting the broader transmission of monetary policy and shaping financing conditions for HHs and NFCs.

To answer this question, we exploit once again the state-dependent local projection framework in equation (2) where we separately condition on our measure of deposit funding and deposit market power.[33] The main difference with respect to

[32]In Table C.1 in the Appendix we also orthogonalize the state variables so that the exercise is closer in spirit to a "true" forecast variance decomposition (although here we are not dealing with structural shocks). Results are qualitatively similar also in this case.

[33]See Figure C.11 in the Appendix for the estimates of the unconditional PT of monetary policy

Table 1. Joint estimation of the conditional pass-through to overnight deposit rates

Horizon (months)	0	1	2	10	11	12
			Panel A: Households			
i	0.126***	0.144***	0.155***	0.160***	0.160***	0.162***
	(0.026)	(0.023)	(0.020)	(0.019)	(0.019)	(0.020)
$i \times$ *Dep. Fund*	−0.091***	−0.095***	−0.093***	−0.045**	−0.039*	−0.033
	(0.034)	(0.029)	(0.026)	(0.022)	(0.023)	(0.023)
$i \times$ *Mkt. Pwr*	−0.013	−0.022	−0.030**	−0.033**	−0.036***	−0.046***
	(0.016)	(0.015)	(0.014)	(0.013)	(0.012)	(0.013)
			Panel B: Non-financial corporations			
i	0.153***	0.205***	0.242***	0.270***	0.270***	0.273***
	(0.027)	(0.023)	(0.021)	(0.024)	(0.024)	(0.024)
$i \times$ *Dep. Fund*	−0.080**	−0.083***	−0.087***	−0.034	−0.027	−0.015
	(0.034)	(0.030)	(0.028)	(0.029)	(0.029)	(0.029)
$i \times$ *Mkt. Pwr*	−0.056***	−0.085***	−0.082***	−0.077***	−0.078***	−0.087***
	(0.020)	(0.019)	(0.017)	(0.017)	(0.016)	(0.017)

Notes. The table reports our estimates of the impulse response of interest rates on overnight deposit from HHs (panel a) and NFCs (panel b) to a monetary policy shock at several horizons (columns) where we jointly condition on both deposit funding ($i \times$ *Dep. Fund*) and market power ($i \times$ *Mkt. Pwr*). The average unconditional PT is given by the coefficient i, while the overall PT can be computed by summing the three terms where the conditioning variables are set at the appropriate values (e.g., sample average in 2022–2023). Standard errors are in parenthesis and are robust to heteroskedasticity and autocorrelation.

the specification for overnight deposits is that we use the 1-year IRS as the reference rate for new loans to NFCs, which better reflects the average contractual period of fixation of interest rates for these loans.

Figure 8 presents our results for deposit funding (panel a) and deposit market power (panel b). Consistently with the evidence on overnight deposits (especially from NFCs), higher deposit market power is associated with a lower PT to lending rates, albeit to a lesser extent. On the contrary, deposit funding does not have a significant impact in shaping the PT to lending rates.

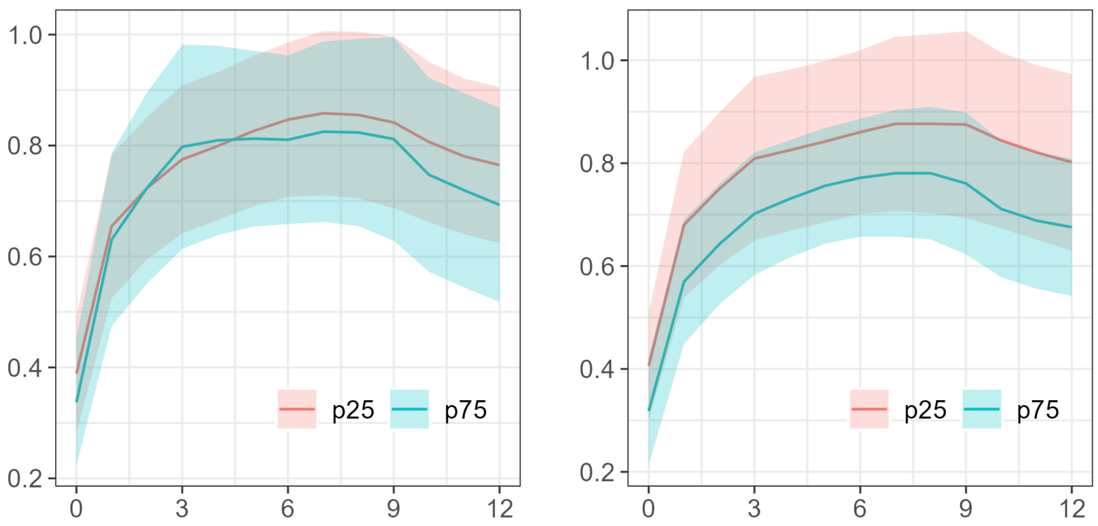
We conduct a similar exercise with mortgage rates for HHs. As for loans to NFCs, we adjust our benchmark specification in equation (2), using the 10-year IRS as market reference rate and the corresponding high-frequency surprises to the 10-year OIS from Altavilla *et al.* (2019) as instrument.[34] This modification better

to lending rates.

[34]Due to data availability of the 10-year OIS surprise, our sample starts in 2011:M7.

Figure 8. State-dependent pass-through to interest rates on new loans to non-financial corporations

a. Conditioning on deposit funding **b.** Conditioning on market power



Notes. The figures show the impulse response of NFC lending rates to a monetary policy shock conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2). We use as reference rate $i_{t+h} - i_{t-1}$ the 1-year IRS and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2011:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

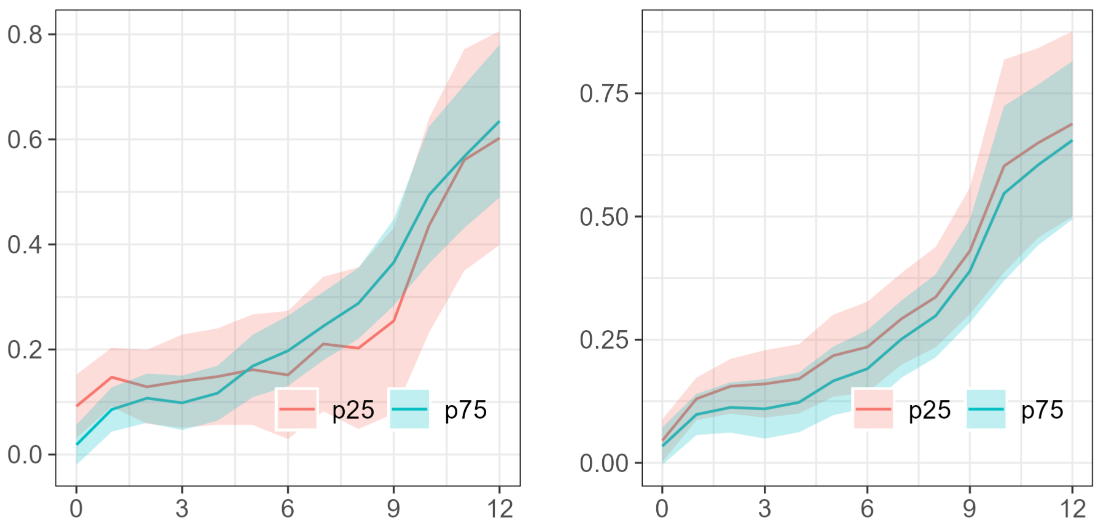
captures the average long-term duration of mortgages in the euro area. Consistently with the evidence for NFCs, we find no effect of deposit funding on the PT to mortgage rates (Figure 9, panel a) and only a limited effect of deposit market power (Figure 9, panel b).[35] Finally, we estimate equation (2) conditioning on both state variables *jointly* to decompose their relative contribution. Table C.2 in the Appendix reports our results and reinforces the findings of Table 1, showing that deposit market power is the main channel through which a dampening effect on overnight deposit rates propagates to lending rates.

To assess the net impact of deposit funding and market power on the sensitivity of banks' interest margins to monetary policy, we estimate the PT to banks' average loan-deposit spread. This is defined as the difference between the (volume-weighted) average interest rate charged on new loans to HHs and NFCs and the (volume-weighted) average interest rate paid on overnight deposits from HHs and NFCs. We adopt the state-dependent local projection framework in equation (2).

[35] The pass-through stabilizes at approximately 0.5–0.7 over a 15-month horizon (not shown).

Figure 9. State-dependent pass-through to interest rates on new loans to households for house purchases

a. Conditioning on deposit funding **b.** Conditioning on market power



Notes. The figures show the impulse response of HH mortgage rates to a monetary policy shock conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2). We use as reference rate $i_{t+h} - i_{t-1}$ the 10-year IRS and as instrument the corresponding high-frequency surprises to the 10-year OIS from Altavilla *et al.* (2019). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

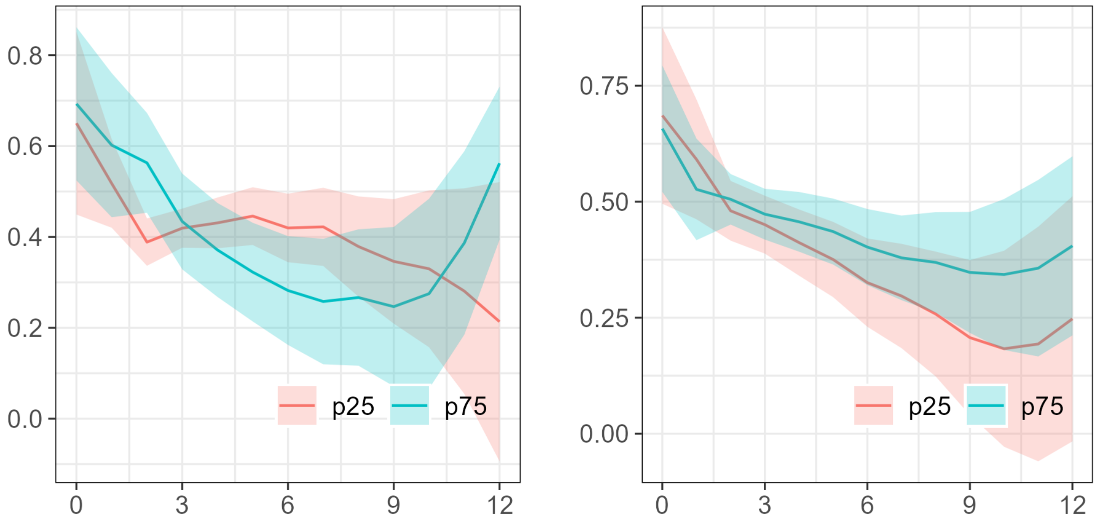
Figure 10 presents our results. According to our estimates, a 100 basis points surprise in the reference rate causes loan-deposit spreads to widen by approximately 60–70 basis points on impact, followed by a gradual decrease over time. This finding is consistent with our previous evidence that overnight deposit rates have a lower sensitivity compared with lending rates. Notably, we also observe that deposit market power contributes to a widening of the spreads. Banks with higher deposit market power are indeed associated with wider loan-deposit spreads over time, as the overall dampening effect on overnight deposit rates overcomes that on lending rates (panel b). In contrast, the results are more ambiguous when conditioning on deposit funding (panel a).

5 Concluding remarks

We show that during the 2022–23 ECB's tightening cycle the pass-through from monetary policy rates to the remuneration of overnight deposits was extremely

Figure 10. State-dependent pass-through to loan-deposit spreads

a. Conditioning on deposit funding **b.** Conditioning on market power



Notes. The figures show the impulse response of the average loan-deposit spread to a monetary policy shock conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2). We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

muted compared with historical regularities. Using granular bank-level information, we also find that higher banks' deposit funding and deposit market power — both of which became very pronounced during the highly accommodative monetary policy stance implemented preceding the onset of inflationary pressures — contribute to explaining this limited pass-through in the subsequent tightening cycle. While higher deposit funding is associated with a dampening in the sensitivity of overnight deposit rates mainly in the short term, the effect of deposit market power is more persistent. The dampening effect of higher deposit market power furthermore extends beyond bank funding costs and affects the broader transmission of monetary policy to financing conditions for households and non-financial corporations, but with a widening in the loan-deposit spread.

Our findings carry relevant policy implications. First, although keeping policy rates low for an extended period and implementing large asset purchase programmes contribute to increasing banks' deposit funding, this per se has overall limited, and in particular temporary, effects on the transmission mechanism of monetary policy to bank funding costs and no impact on lending rates. The benefits of these highly accommodative policy measures — such as stimulating aggregate demand and supporting price and financial stability — are therefore not counterbalanced by the side effect associated with an increase in banks' deposit funding.

Second, higher deposit market power, possibly associated with some banks being more able to attract and retain a larger share of deposits in a context of low interest rates, has a dampening effect on the pass-through of monetary policy that can be more relevant and persistent. Therefore, adequate competition in the credit sector ensures that the central bank can more effectively calibrate its monetary policy impulse and that this impulse is structurally transmitted to the economy.

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Supplementary Appendix to

Deposit Funding, Market Power and Monetary Policy Transmission

Simone Auer   Antonio M. Conti   Paolo Farroni

This Appendix reports additional details, evidences and several robustness checks discussed in the paper.

A Bayesian VAR framework

A.1 Model

To evaluate whether the transmission of policy rates to overnight deposit rates aligns with historical patterns, we employ a Bayesian Vector Autoregression (BVAR) framework to examine the dynamic interactions among key monetary and financial variables. Specifically, we set-up the following small-scale BVAR model:[36]

$$Y_t = c + B(L)Y_{t-1} + u_t \tag{A.3}$$

where Y is a vector of endogenous variables, c is a vector of constant terms, and u is a vector of residuals $u_t \sim n.i.d.(0, \Sigma)$. $B(L)$ is a matrix polynomial in the lag operator L, while t denotes the (quarterly) time frequency and Σ is a variance/covariance matrix.

Our baseline BVAR includes three endogenous variables: short- and long-term market rates (the 3-month EURIBOR and the 10-year IRS, respectively), and deposit rates from NFCs and HHs, one at a time. In the BVAR in equation (A.3), the estimation is conducted in levels. We set the number of lags to 12, which is the minimum to yield uncorrelated residuals. We estimate the model using a Normal-inverted Wishart prior and posterior. The basic prior on the VAR coefficients has a Minnesota structure. The mean prior is set to one for each variable's own first lag and zero elsewhere, with a diffuse prior for the covariance matrix of the error terms. The overall tightness of the prior is set to 0.4, a slightly higher value compared with the standard used in the literature, as it is found optimal according to a grid search (similarly to Aastveit *et al.*, 2017).[37] This value improves the performance of conditional forecasts — that is, their fit with the realized values — because it also helps to deal with Covid-19 observations, making the prior more diffuse and

[36] This BVAR is a simplified version of the larger model developed by Conti *et al.* (2025) for the Italian economy and then used by Auer and Conti (2024) for studying the dynamics of lending volumes in the euro area in 2022–23 and also by Conti *et al.* (2024) for studying the effects of the ECB 2022–23 monetary tightening on real GDP and consumer prices.

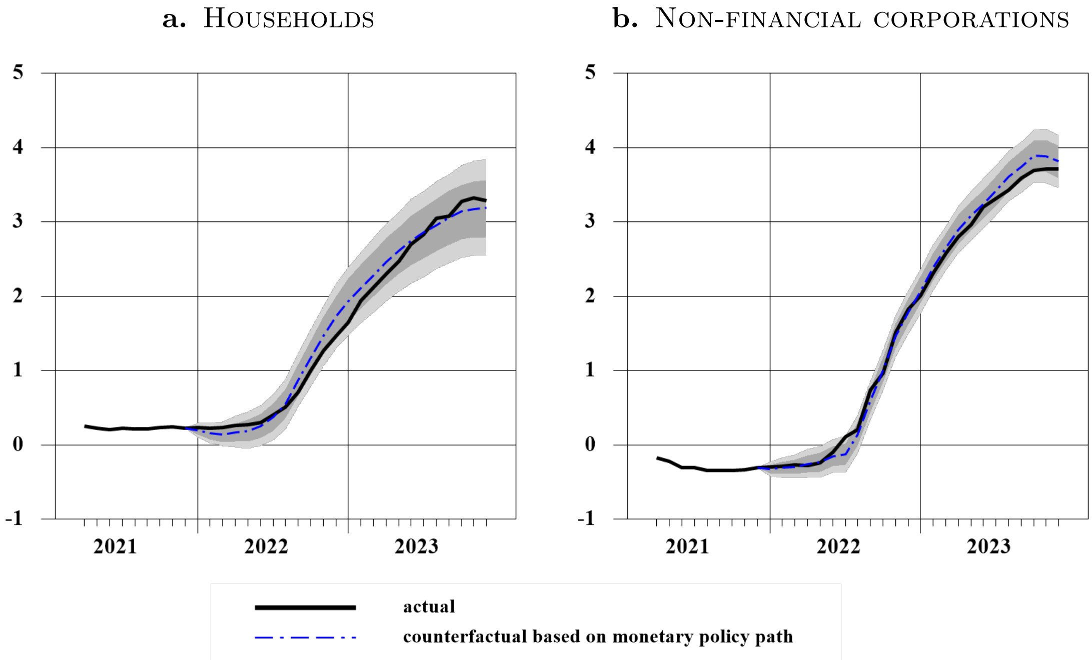
[37] The results are robust to changes in prior settings.

giving more relevance to sample estimation in the posterior.

Finally, we also supplement the usual Minnesota prior with the "sum of coefficients" and "dummy initial observation" priors proposed in Doan *et al.* (1984) and Sims (1993), respectively. In all conditional forecasting exercises, we set the hyperparameters governing the tightness of the sum of coefficients prior and the tightness of the cointegration prior at uninformative values.

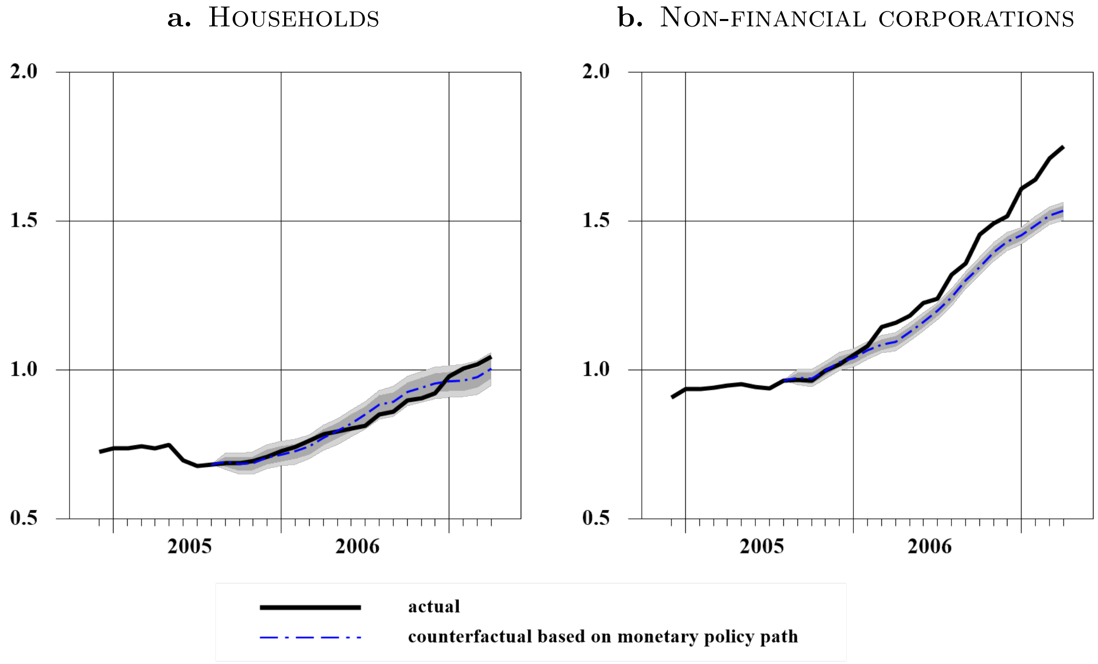
A.2 Additional evidence and robustness exercises

Figure A.1. Pass-through to term deposit rates



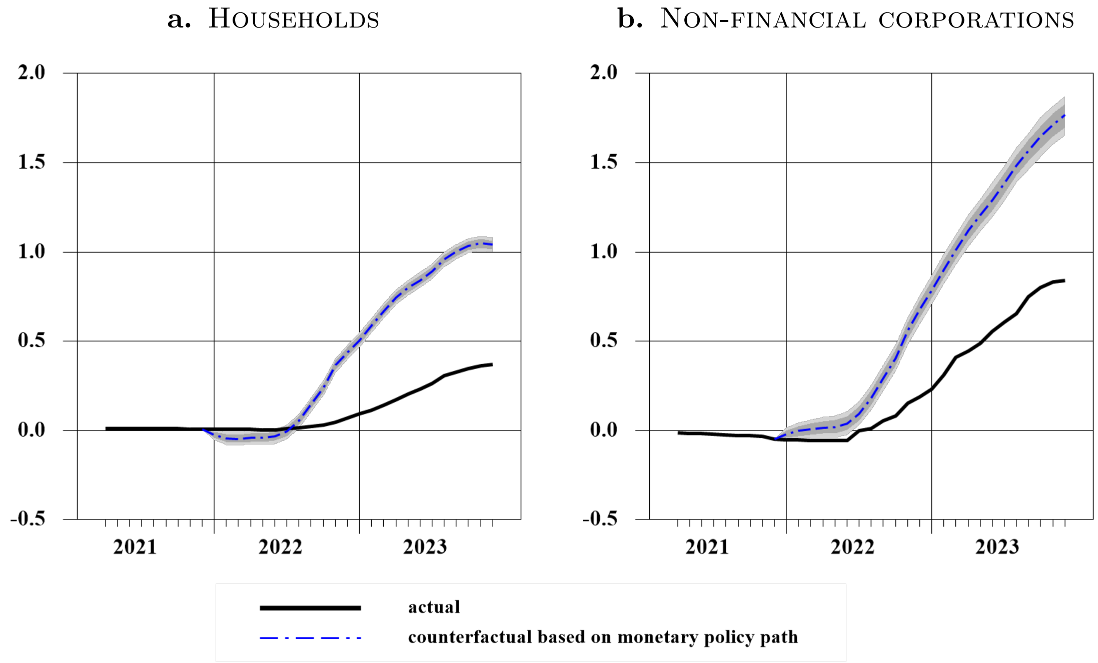
Notes. The dark (light) grey shaded area is the 68% (90%) credible interval obtained from the BVAR posterior distribution. Estimation sample is 2000:M1–2021:M12. The counterfactual path in 2022:M1–2023:M12 is obtained assuming that the evolution of short- and long-term market rates are known for the full sample.

Figure A.2. Pass-through to overnight deposit rates: 2005–08



Notes. The dark (light) grey shaded area is the 68% (90%) credible interval obtained from the BVAR posterior distribution. Estimation sample is 2000:M1–2005:M7. The counterfactual path in 2005:M8–2007:M4 is obtained assuming that the evolution of short- and long-term market rates are known for the full sample.

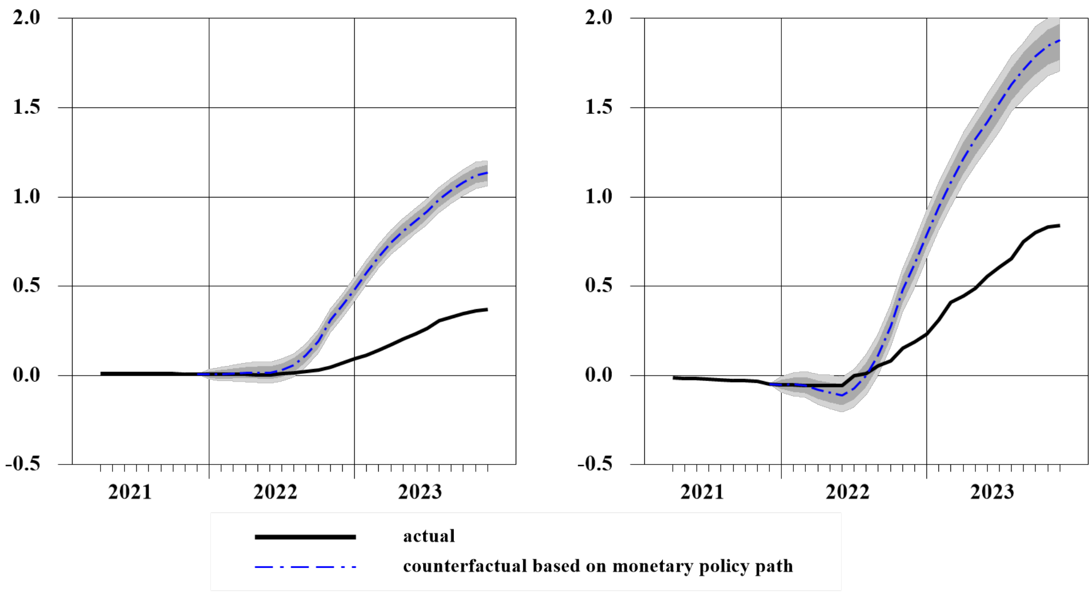
Figure A.3. Pass-through to overnight deposit rates: estimation sample ending before the Global Financial Crisis



Notes. The dark (light) grey shaded area is the 68% (90%) credible interval obtained from the BVAR posterior distribution. Estimation sample is 2000:M1–2007:M6. The counterfactual path in 2022:M1–2023:M12 is obtained assuming that the evolution of short- and long-term market rates are known for the full sample.

Figure A.4. Pass-through to overnight deposit rates: estimation sample ending before NIRP and APP

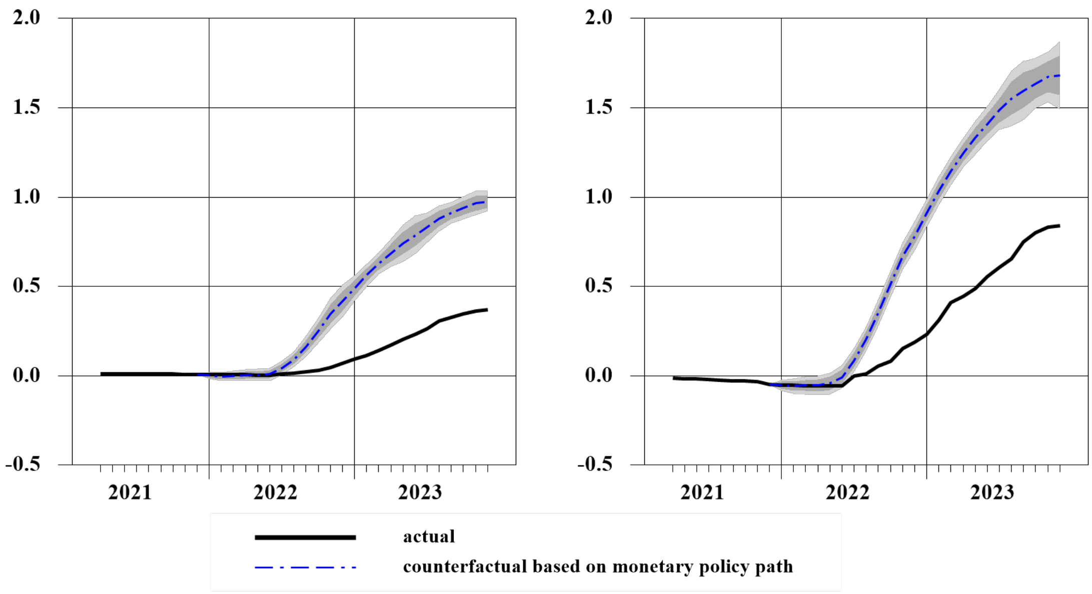
a. Households **b.** Non-financial corporations



Notes. The dark (light) grey shaded area is the 68% (90%) credible interval obtained from the BVAR posterior distribution. Estimation sample is 2000:M1–2014:M5. The counterfactual path in 2022:M1–2023:M12 is obtained assuming that the evolution of short- and long-term market rates are known for the full sample.

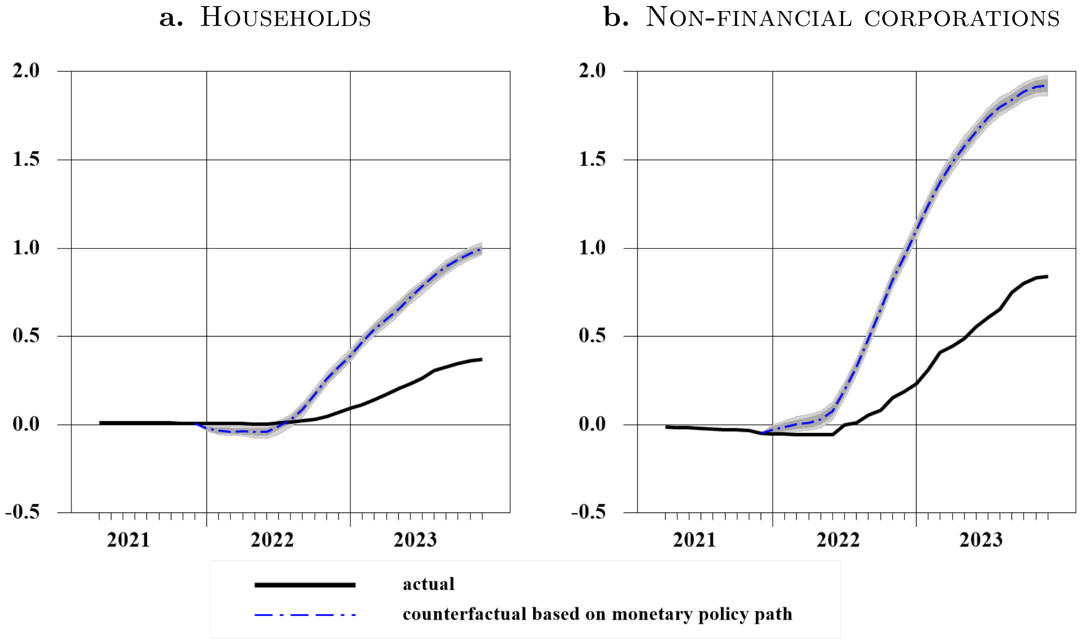
Figure A.5. Pass-through to overnight deposit rates: including deposit volumes

a. Households **b.** Non-financial corporations



Notes. The dark (light) grey shaded area is the 68% (90%) credible interval obtained from the BVAR posterior distribution. Estimation sample is 2000:M1–2021:M12. The counterfactual path in 2022:M1–2023:M12 is obtained assuming that the evolution of short- and long-term market rates are known for the full sample.

Figure A.6. Pass-through to overnight deposit rates: conditioning also on deposit volumes



Notes. The dark (light) grey shaded area is the 68% (90%) credible interval obtained from the BVAR posterior distribution. Estimation sample is 2000:M1–2021:M12. The counterfactual path in 2022:M1–2023:M12 is obtained assuming that the evolution of short- and long-term market rates, and of overnight and term deposit volumes, are known for the full sample.

B Estimation of deposit market power

This Section provides a brief overview of the construction of our measure of deposit market power. For further details on the estimation procedure see Albertazzi *et al.* (2022) and the references therein. The primary difference between our framework and that in Albertazzi *et al.* (2022) — which uses the same iBSI and iMIR data but restricts the sample to banks with quoted CDS spreads — is that we explicitly model the demand for term deposits alongside that for overnight deposits, whereas they focus on the distinction between insured and uninsured *total* deposits.

We model the demand for deposits by specifying the indirect utility U_{ijmt} that agent i derives from the choice of bank j in country m at time t:

$$U_{ijmt} = \alpha(P_t^f - P_{jmt}) + \delta_j + \lambda_{mt} + \xi_{jmt} + \epsilon_{ijmt} \tag{B.4}$$

where P_{jmt} is the interest rate on deposits, P_t^f is the risk-free interest rate, δ_j and λ_{mt} are bank and country-month fixed effects, and ξ_{jmt} are bank-country-month fixed effects, and ξ_{jmt} proxies for a measure of "deposit quality" that is valuable to consumers but that is not observed by the econometrician: it varies at the bank-country-month level and may be correlated with deposit interest rates. Finally, ϵ_{ijmt} is a residual taste shifter that is idiosyncratic to each agent i.

We define a market as a country-month couple, and in each market banks compete on prices and offer two differentiated savings products: overnight and term deposits (or deposits with an agreed maturity). This assumption is a parsimonious way of modelling the imperfect substitutability between the two products that may be especially relevant during a period of rates hikes/cuts. Due to data limitation, we model the outside option as the set of small "fringe" banks that do not report directly in iMIR/iBSI but that are part of the national aggregate figures. Finally, to allow for different demand elasticities (and different market power), the choice sets for households and non-financial corporations are distinct, so that e.g., a household cannot select a remuneration offered to a firm.

Assuming, as is standard in the literature, that agents make mutually exclusive choices and that the random shocks ϵ_{ijmt} are i.i.d. with type I extreme value distribution, we have the standard logistic expression for deposit market shares S_{jmt} and deposit demand[38] $D_{jmt} \propto S_{jmt}$:

$$S_{jmt} = \frac{\exp\left(\alpha(P_t^f - P_{jmt}) + \delta_j + \lambda_{mt} + \xi_{jmt}\right)}{1 + \sum_k \exp\left(\alpha(P_t^f - P_{kmt}) + \delta_k + \lambda_{mt} + \xi_{kmt}\right)} \tag{B.5}$$

that we estimate in log-odds as in Berry (1994), i.e.

$$\log(S_{jmt}) - \log(S_{0mt}) = \alpha(P_t^f - P_{jmt}) + \delta_j + \lambda_{mt} + \xi_{jmt} \tag{B.6}$$

where the unobserved characteristics ξ_{jmt} act as a residual that may be correlated with the deposit spread $P_t^f - P_{jmt}$. To structurally identify α, we construct an instrument in the spirit of Villas-Boas (2007) interacting bank-product dummies with the 3-month Euribor that we use as a cost shifter.

Finally, we assume a simple risk-neutral profit maximizer bank with per-period (expected) profit:

$$\begin{aligned} \max_{P_{jmt}^d} \Pi_{jmt} = A_{jmt}\bar{r}_{jmt} - D_{jmt}\left(P_t^f - P_{jmt}^d\right) \cdot P_{jmt}^d - N_{jmt}P_t^f \\ - D_{jmt}\left(P_t^f - P_{jmt}^d\right) \cdot \phi_{jmt} \end{aligned} \tag{B.7}$$

$$\text{s.t. } A_{jmt} = D_{jmt} + N_{jmt} + E_{jmt} \tag{B.8}$$

with average exogenous return $\bar{r}_{jmt}$ on its assets A_{jmt}, pre-determined equity E_{jmt}, (net) borrowing N_{jmt} at the benchmark rate of P_t^f, and *unobserved* marginal cost

[38] Deposit demand for bank j is simply its market share times the size of the market.

ϕ_{jmt} of taking new deposits. The first-order condition reads:

$$mktpwr_{jmt} = P_t^f - \phi_{jmt} - P_{jmt}^d = -\left(\frac{\partial D_{jmt}}{\partial (P_t^f - P_{jmt})}\frac{1}{D_{jmt}}\right)^{-1} \tag{B.9}$$

$$= -\left(\frac{1}{\alpha(1 - S_{jmt})}\right) \tag{B.10}$$

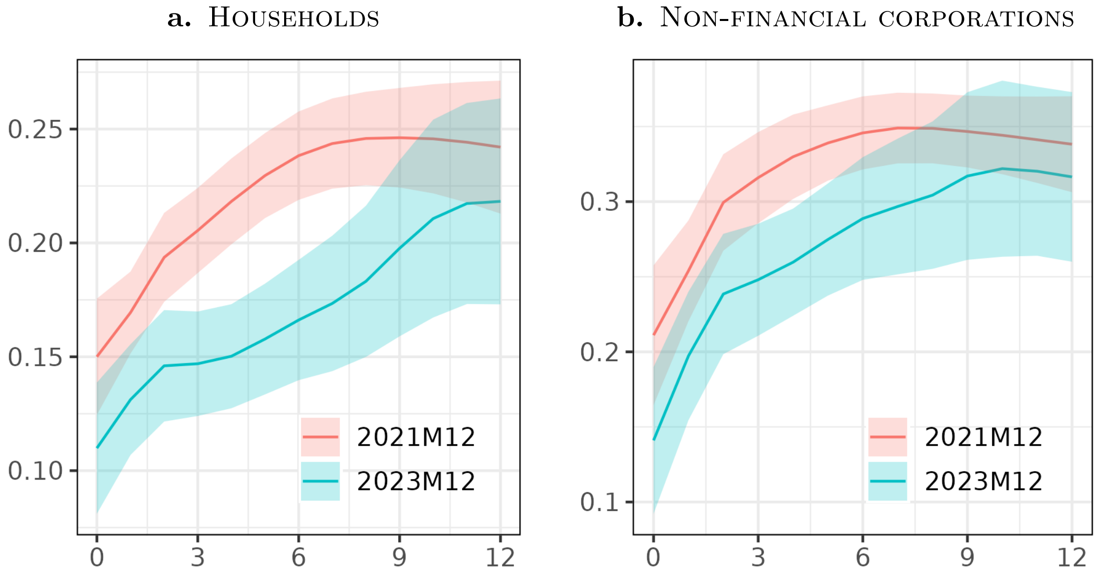
where the last equation follows from the logistic demand (B.5). The (standardized) estimates of banks' $mktpwr$ are plotted in Figure 4.

Note that the model allows us to recover the elasticity of deposit demand with respect to a unit increase in the deposit spread. In principle, one could apply the implicit function theorem to equation (B.9) and derive the contemporaneous response of deposit rates P_{jmt} to changes in the reference rate P_t^f, under the assumption of zero marginal costs ϕ_{jmt}. Given the restrictiveness of this assumption and the inherently static nature of the logit model, we instead adopt this framework to back out an estimate of the deposit markdown. This estimate is then used as input (state variable) in state-dependent panel IV local projections to investigate its role in shaping the dynamic cumulative multipliers of deposit rates in response to a monetary policy shock.

C Panel IV local projections framework

C.1 Additional evidence and robustness exercises

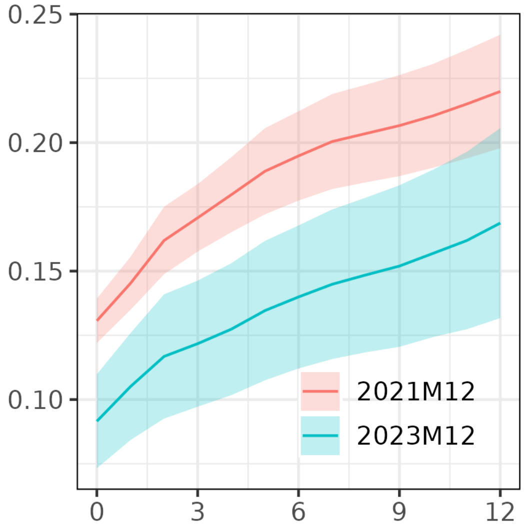
Figure C.1. Unconditional pass-through to overnight deposit rates: different monetary policy shocks



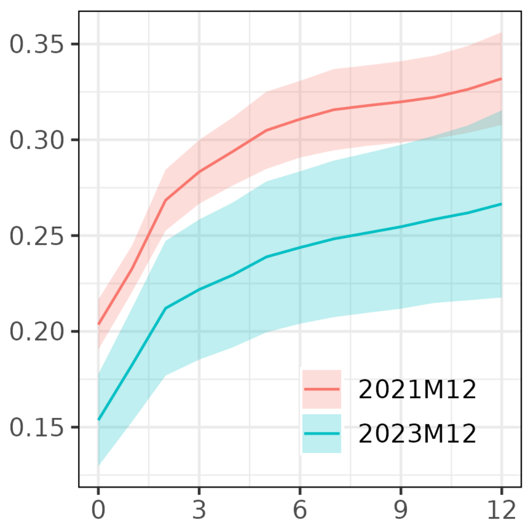
Notes. The figures show the impulse response of interest rates on overnight deposits from HHs (panel a) and NFCs (panel b) to a monetary policy shock estimated as in equation (1) on two samples: from 2008:M7 to 2021:M12 (pre-tightening, denoted as 2021M12) and from 2008:M7 to 2023:M12 (full sample, denoted as 2023M12). We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the corresponding high-frequency monetary policy shocks from Altavilla *et al.* (2019). The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.2. Unconditional pass-through to overnight deposit rates: OLS regression

a. Households



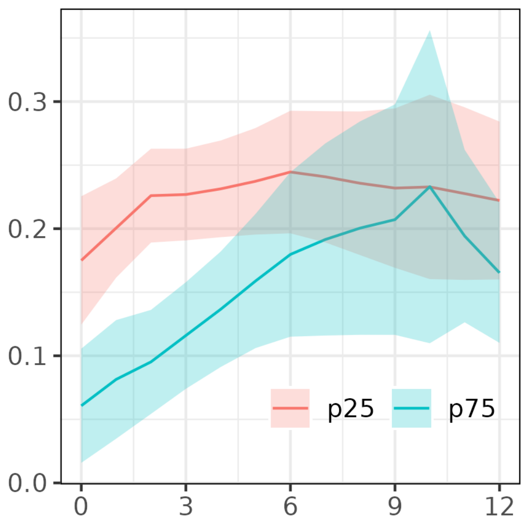
b. Non-financial corporations



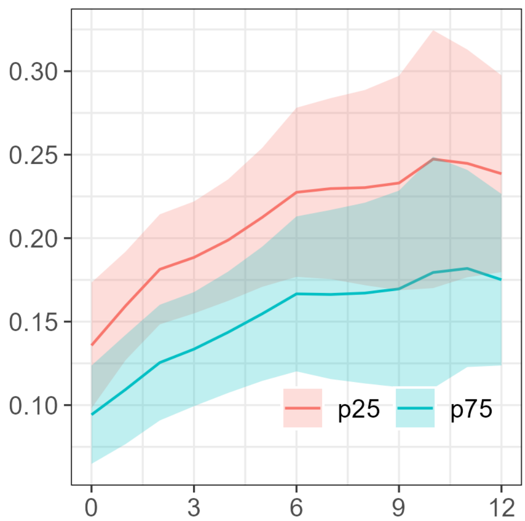
Notes. The figures show the impulse response of interest rates on overnight deposits from HHs (panel a) and NFCs (panel b) to a monetary policy shock estimated as in equation (1) treating the change in the 3-month Euribor as *exogenous*, on two samples: from 2008:M7 to 2021:M12 (pre-tightening, denoted as 2021M12) and from 2008:M7 to 2023:M12 (full sample, denoted as 2023:M12). The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.3. State-dependent pass-through to interest rates on overnight deposits from households: different monetary policy shocks

a. Conditioning on deposit funding



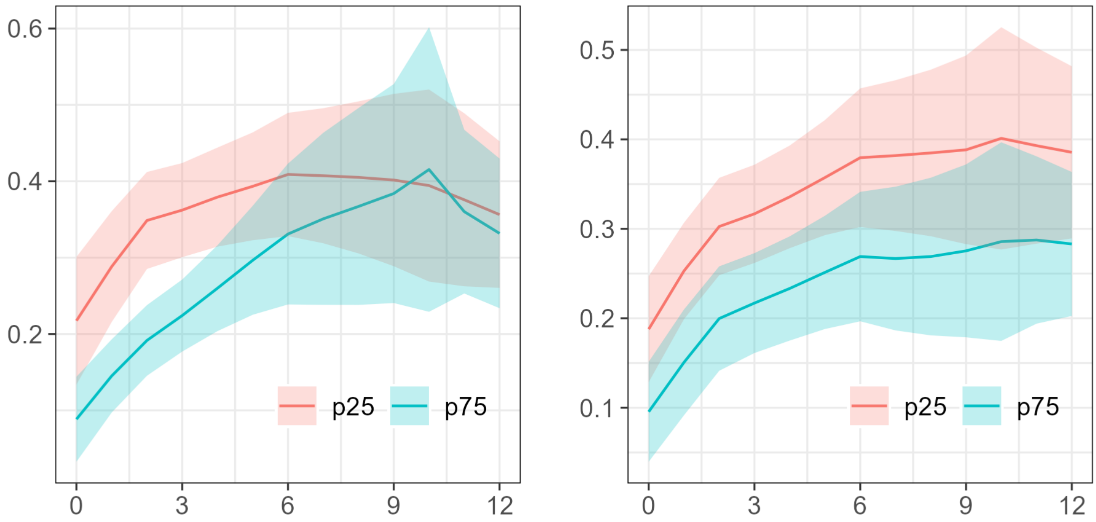
b. Conditioning on market power



Notes. The figures show the impulse response of interest rates on overnight deposits from HHs conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2). We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Altavilla *et al.* (2019). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.4. State-dependent pass-through to interest rates on overnight deposits from non-financial corporations: different monetary policy shocks

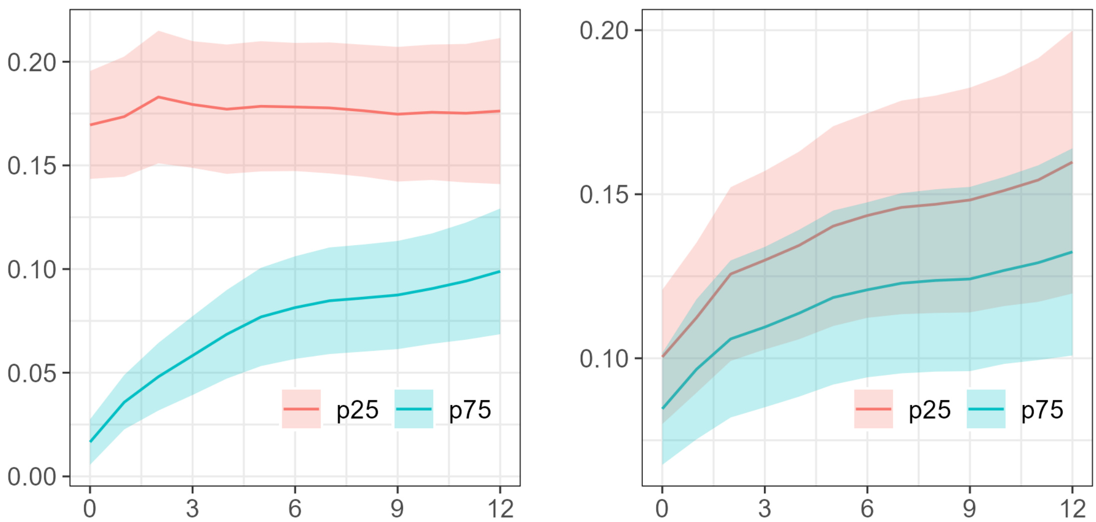
a. Conditioning on deposit funding　　**b.** Conditioning on market power



Notes. The figures show the impulse response of interest rates on overnight deposits from NFCs conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2). We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Altavilla *et al.* (2019). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.5. State-dependent pass-through to interest rates on overnight deposits from households: OLS regression

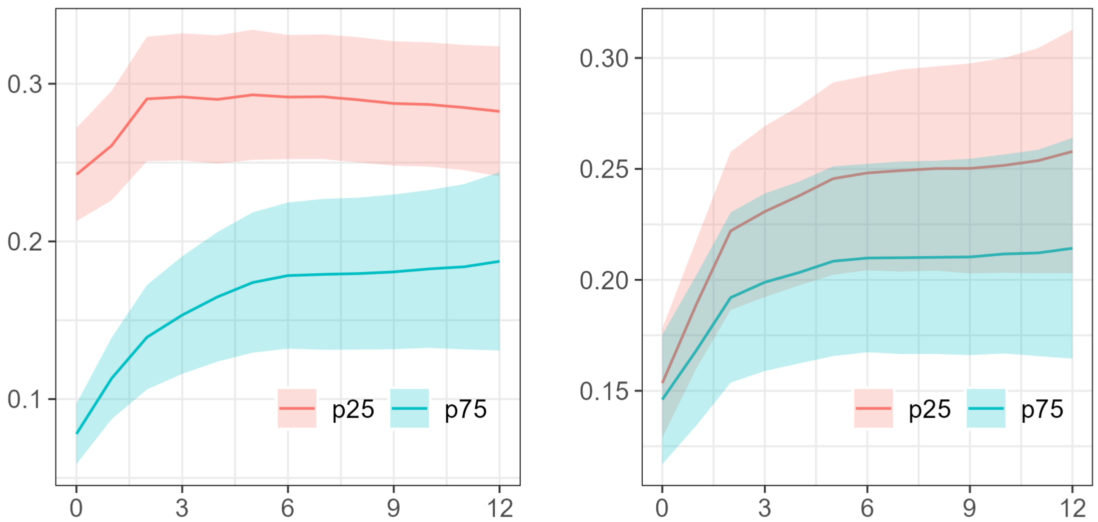
a. Conditioning on deposit funding　　**b.** Conditioning on market power



Notes. The figures show the impulse response of interest rates on overnight deposits from HHs conditioning separately on deposit funding (panel a) and deposit market power (panel b) to a monetary policy shock treating the change in the 3-month Euribor as *exogenous*. The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.6. State-dependent pass-through to interest rates on overnight deposits from non-financial corporations: OLS regression

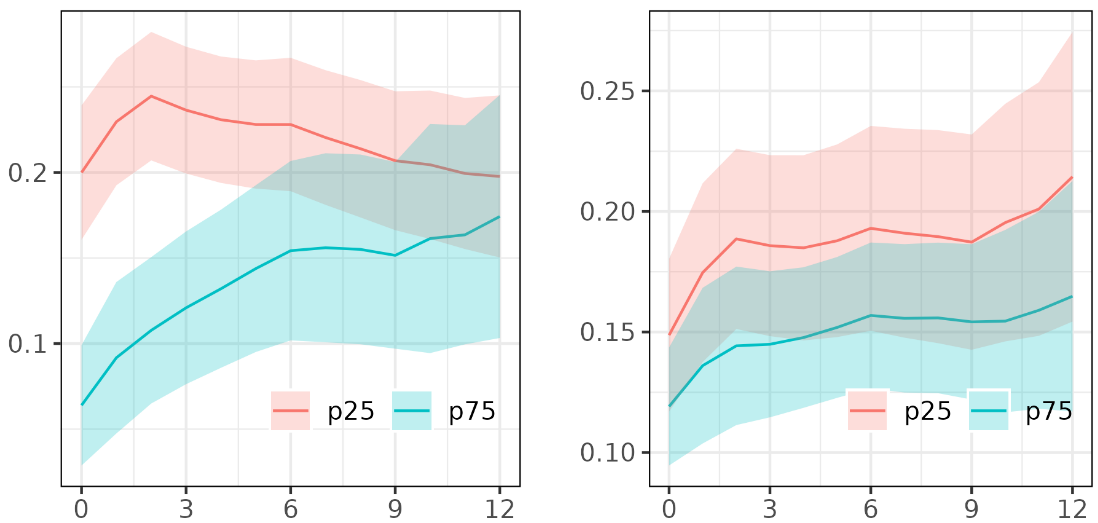
a. Conditioning on deposit funding **b.** Conditioning on market power



Notes. The figures show the impulse response of interest rates on overnight deposits from NFCs conditioning separately on deposit funding (panel a) and deposit market power (panel b) to a monetary policy shock treating the change in the 3-month Euribor as *exogenous*. The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.7. State-dependent pass-through to interest rates on overnight deposits from households: pre-determined state variables

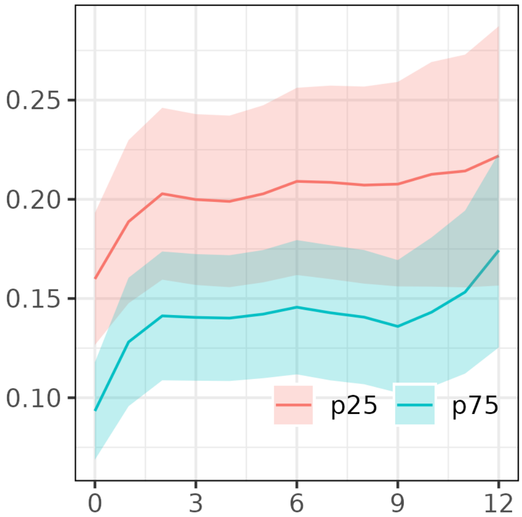
a. Conditioning on deposit funding **b.** Conditioning on market power



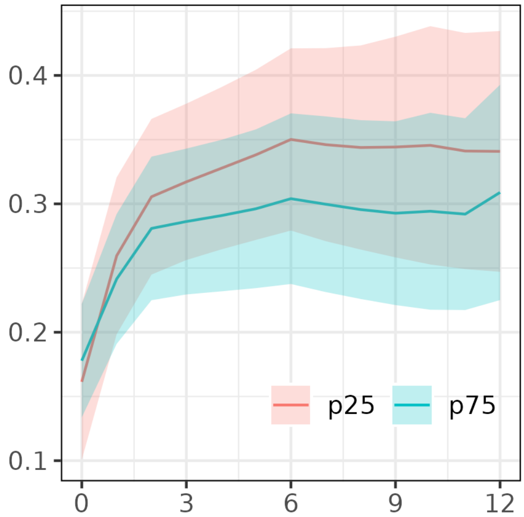
Notes. The figures show the impulse response of interest rates on overnight deposits from HHs conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2) with the state variable lagged by 13 periods (S^j_{t-13}) to rule out any endogenous response of the state to the interest rate shock. We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.8. State-dependent pass-through to overnight deposit rates: conditioning on market concentration

a. Households



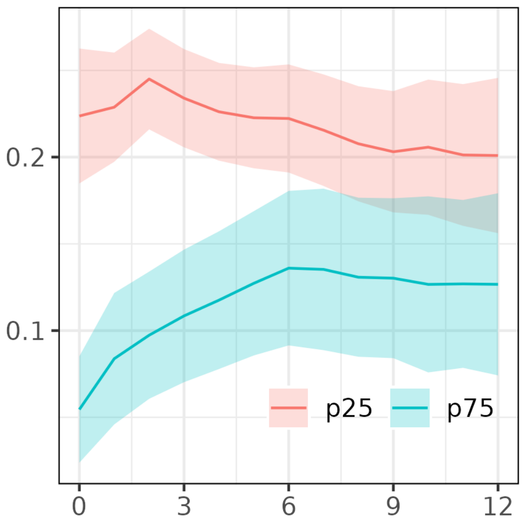
b. Non-financial corporations



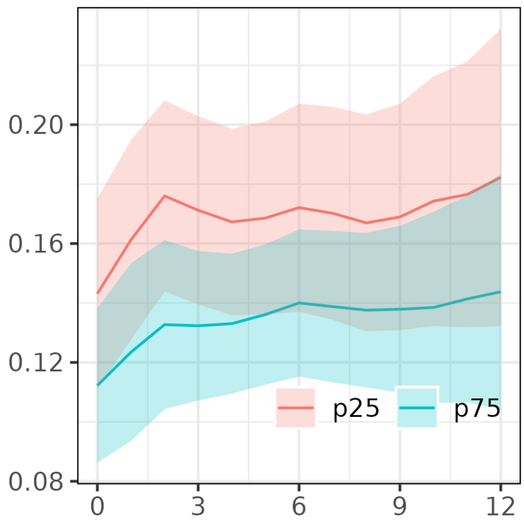
Notes. The figures show the impulse response of interest rates on overnight deposits from HHs (panel a) and NFCs (panel b) from equation (2) conditioning on the Herfindahl-Hirschman Index (HHI) as measure of market concentration. To construct the HHI, we define a market for deposits (both overnight and term) as a month-country pair. We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.9. State-dependent pass-through to interest rates on overnight deposits from households: additional controls

a. Conditioning on deposit funding



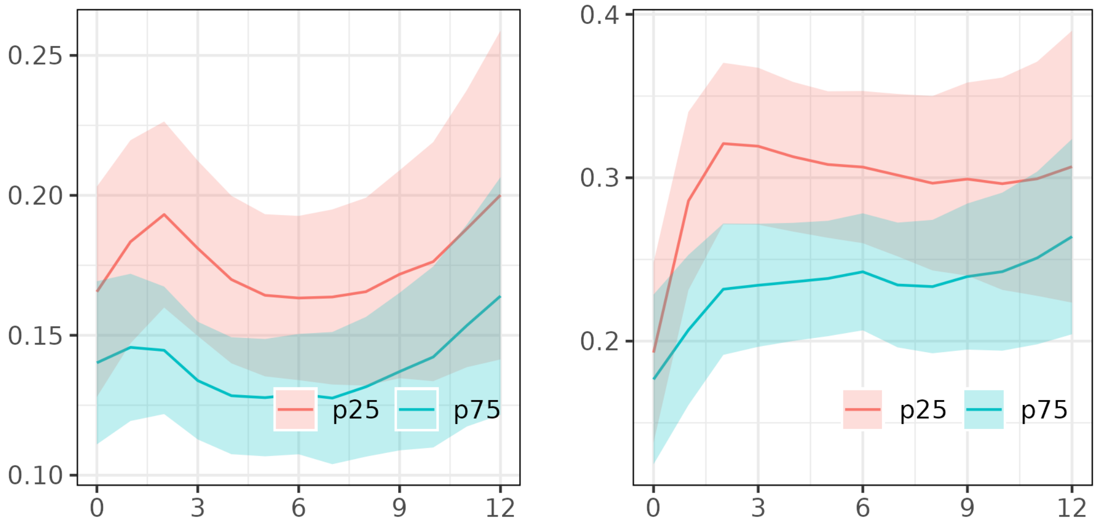
b. Conditioning on market power



Notes. The figures show the impulse response of interest rates on overnight deposits from HHs to a monetary policy shock conditioning separately on deposit funding (panel a) and deposit market power (panel b) estimated as in equation (2): controls also include lagged interest rates on deposits with agreed maturity and their volume in logs. We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.10. State-dependent pass-through to overnight deposit rates: conditioning on reserves-to-deposits ratio

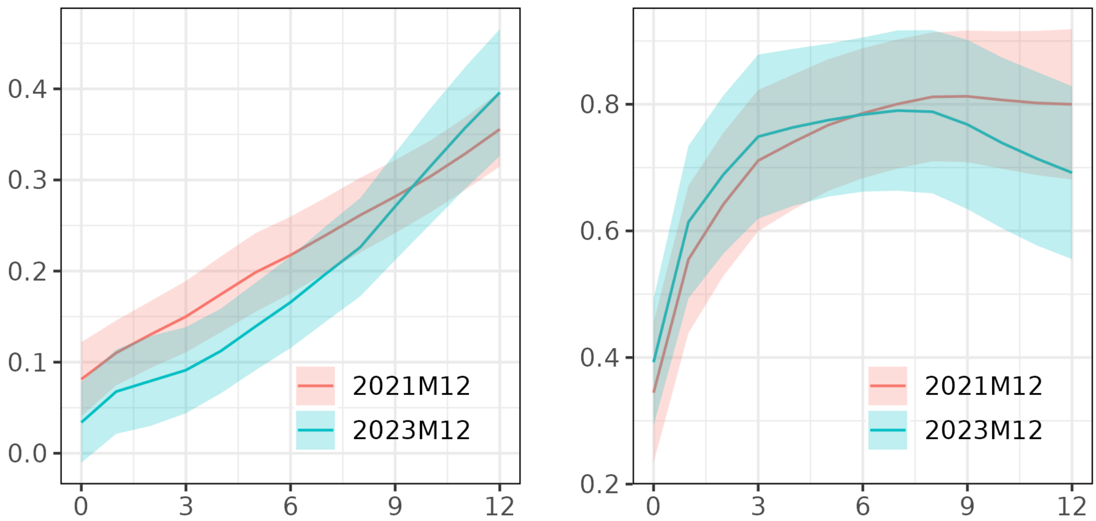
a. Households **b.** Non-financial corporations



Notes. The figures show the impulse response of interest rates on overnight deposits from HHs (panel a) and NFCs (panel b) to a monetary policy shock estimated as in equation (2). Here we replace our measure of deposit funding with the ratio of reserves to deposits, losing about 35% of observations. We use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The two lines p25 and p75 denote, respectively, the first and third quartile of the distribution of our conditioning variable. Our sample spans from 2008:M7 to 2023:M12 at monthly frequency. The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Figure C.11. Unconditional pass-through to lending rates

a. Households **b.** Non-financial corporations



Notes. The figures show the impulse response of interest rates on new loans to HHs for house purchase (panel a) and to NFCs (panel b) to a monetary policy shock estimated as in equation (1) on two samples: ending in 2021:M12 (pre-tightening, denoted as 2021M12) and ending in 2023:M12 (full sample, denoted as 2023M12). For new loans to HHs, we use as reference rate $i_{t+h} - i_{t-1}$ the 10-year IRS and as instrument the corresponding high-frequency surprises to the 10-year OIS from Altavilla *et al.* (2019). For new loans to NFCs, we use as reference rate $i_{t+h} - i_{t-1}$ the 3-month Euribor and as instrument the high-frequency monetary policy shocks from Jarociński and Karadi (2020). The shaded area is the 68% confidence interval computed with Driscoll-Kray standard errors.

Table C.1. Joint estimation of the conditional pass-through to overnight deposit rates: orthogonalized state variables

Horizon (months)	0	1	2	10	11	12
	Panel A: Households					
i	0.116***	0.134***	0.145***	0.155***	0.156***	0.159***
	(0.024)	(0.030)	(0.031)	(0.037)	(0.038)	(0.043)
$i \times Dep.\ Fund$	−0.087***	−0.092***	−0.091***	−0.046**	−0.041*	−0.036
	(0.026)	(0.020)	(0.015)	(0.021)	(0.023)	(0.025)
$i \times Mkt.\ Pwr$	−0.013	−0.021	−0.029**	−0.032*	−0.036**	−0.045**
	(0.017)	(0.014)	(0.012)	(0.018)	(0.017)	(0.018)
	Panel B: Non-financial corporations					
i	0.144***	0.196***	0.233***	0.266***	0.267***	0.272***
	(0.041)	(0.048)	(0.046)	(0.062)	(0.063)	(0.069)
$i \times Dep.\ Fund$	−0.081***	−0.087***	−0.089***	−0.039	−0.033	−0.022
	(0.030)	(0.026)	(0.020)	(0.024)	(0.027)	(0.034)
$i \times Mkt.\ Pwr$	−0.055***	−0.083***	−0.081***	−0.076***	−0.077***	−0.085***
	(0.021)	(0.023)	(0.018)	(0.027)	(0.026)	(0.028)

Notes. The table reports our estimates of the impulse response of interest rates on overnight deposit from HHs (panel a) and NFCs (panel b) to a monetary policy shock at several horizons (columns) where we jointly condition on both deposit funding ($i \times Dep.\ Fund$) and market power ($i \times Mkt.\ Pwr$). Both state variables are orthogonalized before the estimation. The average unconditional PT is given by the coefficient i, while the overall PT can be computed by summing the three terms where the conditioning variables are set at the appropriate values (e.g., sample average in 2022–2023). Standard errors are in parenthesis and are robust to heteroskedasticity and autocorrelation.

Table C.2. Joint estimation of the conditional pass-through to lending rates

Horizon (months)	0	1	2	10	11	12
			Panel A: Households			
i	0.039	0.089**	0.110**	0.260***	0.304***	0.356***
	(0.042)	(0.042)	(0.048)	(0.082)	(0.085)	(0.090)
$i \times Dep.\ Fund$	−0.012	−0.009	0.006	0.046	0.043	0.033
	(0.028)	(0.022)	(0.023)	(0.043)	(0.044)	(0.044)
$i \times Mkt.\ Pwr$	−0.010	−0.032**	−0.047***	−0.061***	−0.060***	−0.061**
	(0.016)	(0.014)	(0.013)	(0.021)	(0.021)	(0.024)
			Panel B: Non-financial corporations			
i	0.326***	0.577***	0.646***	0.719***	0.696***	0.679***
	(0.101)	(0.122)	(0.121)	(0.134)	(0.133)	(0.133)
$i \times Dep.\ Fund$	−0.062	−0.043	−0.035	−0.061	−0.057	−0.050
	(0.047)	(0.047)	(0.048)	(0.049)	(0.051)	(0.054)
$i \times Mkt.\ Pwr$	−0.103	−0.141**	−0.143**	−0.160**	−0.159**	−0.153**
	(0.068)	(0.061)	(0.073)	(0.065)	(0.064)	(0.064)

Notes. The table reports our estimates of the impulse response of interest rates on new loans to HHs for house purchase (panel a) and to NFCs (panel b) to a monetary policy shock at several horizons (columns) where we jointly condition on both deposit funding ($i \times Dep.\ Fund$) and market power ($i \times Mkt.\ Pwr$). The average unconditional PT is given by the coefficient i, while the overall PT can be computed by summing the three terms where the conditioning variables are set at the appropriate values (e.g., sample average in 2022–2023). Standard errors are in parenthesis and are robust to heteroskedasticity and autocorrelation.