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* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

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Deposit market concentration and monetary transmission: evidence from the euro area*

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Abstract

I study the transmission of monetary policy to deposit rates in the euro area with a focus on the role of banking sector concentration. Using a local projections framework with 2003-2022 country-level and bank-level data for thirteen euro area member states, I find that deposit rates respond symmetrically to unexpected changes in monetary policy. However, more concentrated domestic banking sectors do pass on unexpected monetary tightening (easing) more slowly (quickly) than less concentrated banking sectors, which contributes to a temporary divergence of deposit rates across the euro area. These results suggest that heterogeneity in the degree of banking sector concentration matters for the transmission of monetary policy, which in turn may affect banking sector profitability as well as the macro-economic response to monetary policy.

Keyword Monetary transmission, deposit rates, market concentration

JEL E43, E52, D40

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1 Introduction

Central banks rely on commercial banks to transmit monetary policy. The banking sector links policy to households and firms: in the euro area, it is the only sector with direct access to central bank facilities and interest rates and it remains the predominant provider of external finance to households and firms. At the same time, banks rely heavily on deposits as a source of comparatively cheap and stable funding for their lending activities, and banking sectors tend to be relatively concentrated.

Amidst the recent historically rapid increase in European Central Bank (ECB) policy rates, lending rates as charged by banks across the euro area have shot up. In stark contrast, deposit rates have remained quite sticky, displaying an increasingly large dispersion across countries. The transmission of ECB monetary policy to lending rates has been much studied in recent years (see e.g. Altavilla, Canova, and Ciccarelli (2020), Boeckx, Perea, and Peersman (2020) and Hristov, Hülsewig, and Wollmershäuser (2014)), but the behaviour of bank deposit rates remains less well understood. In particular, it is not clear to what extent deposit rates are upward and downward sticky in response to monetary policy, and what the drivers may be of such stickiness. The degree of market concentration is often pointed at, but recent evidence for the euro area is scarce.

In this paper, I provide empirical evidence on the asymmetric response of deposit rates to monetary policy, and relate this to the degree of concentration within a country's banking sector. I estimate the impact of unexpected positive and negative changes in the monetary policy rate on deposit rates. I do so in a panel local projections setting, with country-level data for thirteen euro area member states in the 2003-2022 period and using high-frequency identification for the monetary policy shocks (Altavilla, Brugnolini, et al. (2019)). To assess whether the deposit rate response is (even more) asymmetric in countries with more concentrated banking sectors, in a second step, I also interact the monetary policy shocks with a measure of concentration.

Analogous to prices being downward rigid, deposit rates have been thought to be sticky when pushed up, see e.g. Hannan and Berger (1991) and Neumark and Sharpe (1992). Both papers provide empirical evidence based on US deposit markets showing that deposit rates respond more rigidly to upward changes in market rates than downward changes, especially so in more concentrated markets. A more recent literature has put forward different theories to explain how deposit rates are adjusted in the wake of monetary policy changes, with roles for market power or market concentration: as nominal rates increase, bank deposits which may yield positive interest rates become more attractive than cash thus providing banks more market power and enabling banks in more concentrated markets to pass-on policy rate changes in a more limited fashion (Drechsler, Savov, and Schnabl (2017)). Alternatively, banks may wish to smooth dividends. Given that loans tend to have much longer maturities than deposits, this implies that banks have a strong motive to delay the pass-through of policy rates to deposit rates (Polo (2021)). These papers also provide empirical evidence for their mechanisms, based on US data.

Recent evidence for euro area deposit markets is more scarce. Exploiting error correction models, Bondt, Mojon, and Valla (2005) analysed the issue of pass-through to deposit and lending rates for the euro area around the introduction of the euro. Moreover, Gambacorta and Iannotti (2007) have looked into whether whether the response to monetary policy is asymmetric in Italy between 1985 and 2002. The issue has, however, not much been explored since those early years of the euro, and there also is not much evidence on the role of competition in euro area deposit markets. Leuvensteijn et al. (2013) and Holton and Rodriguez D'Acri (2018) do consider the role of competition or concentration, but largely focus on lending rates.

My contribution, providing evidence for deposit rate rigidity in the euro area, could be of particular interest as in Europe banks are even more important for external finance than banks in the US. Moreover, the European banking landscape has evolved differently in recent decades than the US banking sector, generally seeing much less consolidation across state lines (Corbae and D'Erasmo (2020)). The mechanism I have in mind is similar to the one in Polo (2021): given a dividend-smoothing motive and the long maturities of loans, banks wish to delay passing on increases in the policy rate to the deposit rate. This motive is absent in the case of decreases in the policy rate, speeding up the transmission in that direction. The transmission of negative monetary policy shocks, however, is to some extent constrained by customer aversion to large nominal changes (Rotemberg (1982)). Whether banks are able to set deposit rates that materially differ from policy rates is affected by market concentration: banks in a more concentrated sector (all else equal) hold more market and price setting power.

I also contribute to the earlier (European) empirical evidence by using local projections, which allows for rich non-linear dynamics in the wake of a monetary policy shock (useful given the positive/negative asymmetry and the non-linearity in concentration), and by using high-frequency surprises as shocks, which allow for a cleaner identification of euro area monetary policy (Jordà (2005), Bagliano and Favero (1999) and Kuttner (2001)). One advantage of taking such shocks is that it isolates the source of common monetary policy, excluding the possibility that an external factor that is possibly tied to market concentration is driving changes in the short-term rate. Taking unexpected changes in monetary policy also ensures that the estimates are not contaminated by anticipation effects (such as the ex-ante repricing of loans, deposits and other bank balance sheet items), making statements about causality potentially more credible than when taking also anticipated changes in policy.

The results in this paper imply that, on average, positive and negative shocks do not feed through to deposit rates asymmetrically in the months after a surprise change in monetary policy. However, there is economically meaningful and statistically significant asymmetry in more concentrated sectors, where hikes are passed-through slower and cuts are passed-through faster within the year after a policy surprise. While the effects are short-lived, the magnitude of the temporary divergence is economically significant. Concentration thus appears to matter for how quickly ECB monetary policy has been transmitted to deposit rates across the euro area.

The remainder of the paper is organised as follows. In section 2, I discuss how concentration might matter for the transmission and discuss the predictions that I test. Section 3 is on methods and data. Subsequently, in section 4, I first discuss the specification and results for the first question (whether deposit rates respond asymmetrically to positive and negative shocks, in general) and then discuss the second question (whether deposit rates respond asymmetrically in more concentrated sectors). The final section concludes.

2 Theory and predictions

2.1 Asymmetry

Banks earn a wedge between loan rates and the short-term rate, and the short-term rate and deposit rates. Whereas the vast amount of deposits have a very short maturity or fixed interest rate period, loans tend to have a long(er) maturity or fixed interest rate period. This especially true for fixed-rate loans, but also still for variable-rate loans on which rates may be reset but only at a pre-determined (for example annual) frequency.

An unexpected increase in the short-term rate thus squeezes the wedge between the loan and short-term rate (from here on: 'loan wedge'). A bank that has a profit or dividend smoothing motive, will not want to adjust deposit rates instantaneously: for a given level of profits, this bank will need to widen the wedge between the short-term and deposit rates (from here on: 'deposit wedge') to make up for the squeezed loan wedge (see e.g. Polo (2021)). Banks thus have a motive to be rigid in adjusting deposit rates to a 'positive' monetary policy shock.

An unexpected decrease in the short-term rate, however, does not squeeze the loan wedge. It remains profitable for banks to swiftly decrease the deposit rate still, but banks are faced with depositors disliking large nominal price changes (see e.g. Rotemberg (1982)). While customers are generally inattentive, swift and substantial nominal deposit rate declines may trigger deposit outflows. Unlike in the positive shock case, in the negative shock case banks thus are incentivised to adjust the deposit rate as much as they can.

Beyond the dividend smoothing motive and the depositor dislike of large nominal price changes, the third ingredient is that banks have market power (see e.g. Wang et al. (2021)). There often are relatively few banks in a given sector, not least due to high entry cost. With little competition, the upside to switching is more limited rendering switching costs relatively high. It then is plausible for depositors to have habits or are otherwise inattentive (see e.g. Klemperer (1995) and Reis (2006)). This yields market power to banks, which enables them to translate these motives to some price setting power in the short run. Large and persistent deviations in pricing, vis-à-vis outside options such as cash and bonds, could well lead to deposit outflows, but this is outside of the scope of this paper.

The idea thus is for an asymmetry to appear in the deposit wedge response to unexpected positive and negative changes in the policy rate. I first test whether this is the case, i.e. whether the deposit rate is indeed be 'upward rigid' and 'downward more flexible' in response to surprises, which implies a widening of the deposit wedge on the way up and a stable or narrower deposit wedge on the way down. Note that, to more clearly trace out the evolution of the wedge, I will consider the deposit rate relative to the short-term rate, defining the 'relative deposit rate' as follows.

$$\textit{relative deposit rate} = \textit{deposit rate - short term rate}$$

The inverse of the wedge, the relative deposit rate will allow us to see more clearly how the deposit rate evolves in comparison to the short-term rate. Moreover, table 1 reflects the expected IRF signs in the first months after an unexpected change in the ECB policy rate, for both the deposit rate and the relative deposit rate.

Table 1: Expected IRF signs after policy shock (first prediction)

	Positive shock	Negative shock
ECB policy rate	++	−−
Deposit rate	0	−
Relative deposit rate (Deposit rate - ECB rate)	−−	+

2.2 Role for concentration

All else equal, more concentration ought to translate to market power on the part of banks. After all, more concentration implies fewer alternative deposit-taking banks that compete for deposits for depositors to turn to. This in turn translates to (more pronounced) effects on the transmission of policy to the deposit wedge, reinforcing the asymmetry discussed before. More concentration would mean more rigid deposit rates (and thus an increase in the deposit wedge) in case of positive surprises, and more flexible deposit rates (and thus a decrease in the deposit wedge) in case of negative surprises (see also e.g. Hannan and Berger (1991)). As other related papers have done recently, I take the Herfindahl-Hirschman Index (HHI) as measure of concentration in the remainder of this paper (see e.g. Drechsler, Savov, and Schnabl (2017), Gödl-Hanisch (2021) and Segev et al. (2022)).

I thus test whether the deposit wedge should be asymmetric for more concentrated banking sectors, even if the average sector responds symmetrically. Table 2 shows the expected signs, taking here as given that the average sector responds symmetrically to positive and negative shocks (unlike the prediction before).

Table 2: Expected Expected IRF signs after policy shock (second prediction)

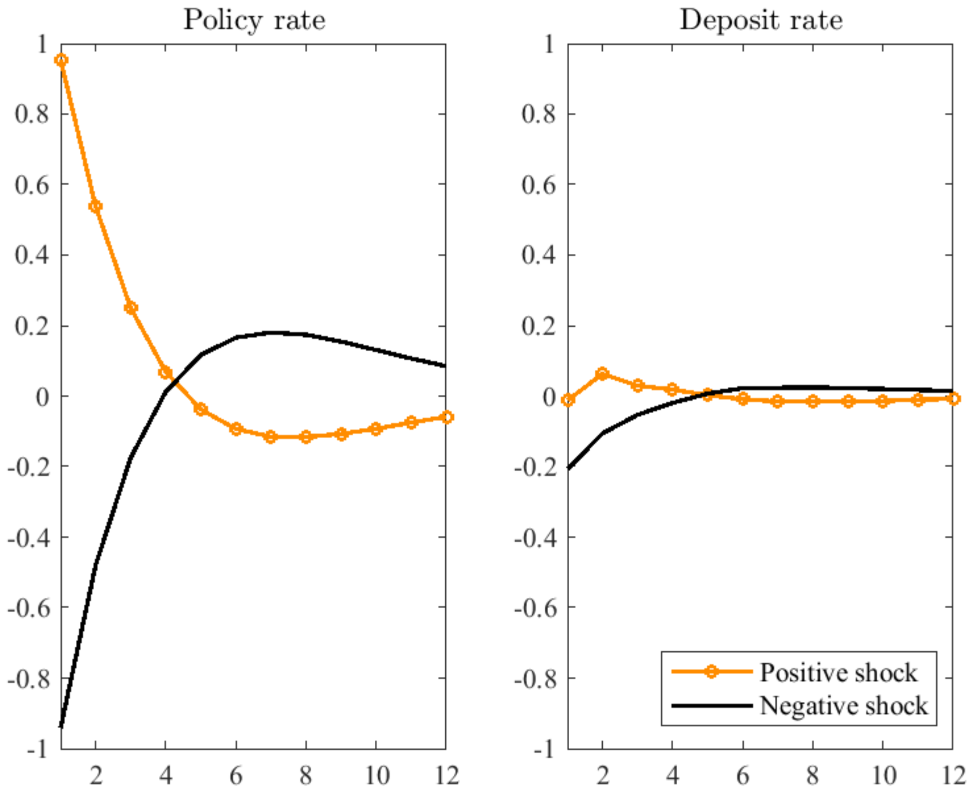
	Positive shock		Negative shock	
	Average	**Concentrated**	Average	**Concentrated**
ECB policy rate	++	++	−−	−−
Deposit rate	+	0	−	−−
Relative deposit rate	−	−−	+	0

To illustrate these predictions, I adapt the Gerali et al. (2010)'s DSGE model with financial frictions and a banking sector, estimated for the euro area. In this model, banks maximise expected discounted profits of offering loans and deposits subject to quadratic rate adjustment costs, to reflect some rigidity in bank loan and deposit rates. In Gerali et al. (2010), these costs are symmetric. Levieuge and Sahuc (2021) introduce an altered-linex adjustment cost for loan rates, capturing that loan rates are downward rigid and upward flexible. I add an altered-linex adjustment cost for deposit rates, to capture the upward rigidity and downward flexibility of deposit rates as well.

The response to 100bps positive and negative policy rate shocks, with the asymmetric adjustment cost for deposit rates that reflect my predictions, are plotted in figure 1. As discussed previously, the deposit rate is particularly rigid in case of a positive shock, reflecting the dividend smoothing motive and bank market power. The deposit rate is more flexible in case of a negative shock, reflecting the same factors, but not fully flexible, as banks are constrained by the customer's aversion to large nominal changes. Without the asymmetric adjustment cost, the response of the deposit rates to positive and negative changes in policy would have been symmetric.

The assumption underpinning the empirical analyses in this paper is that monetary policy does not affect concentration (at least in the short run). This appears a reasonable assumption in general, as market concentration or market shares are slow-moving concepts. In the euro area, notably, concentration as measured by the HHI has been remarkably stable over the past two decades. The banking sector has not meaningfully consolidated across state lines, unlike in the much more studied US, allowing us to take the structural variation in the euro area reasonably as primarily a result of history. Given that the euro area banking sector has not seen this type of structural change, adding European evidence on the role of banking sector concentration in the transmission may be particularly useful.

Figure 1: Dynamic response to 100bps monetary policy shock



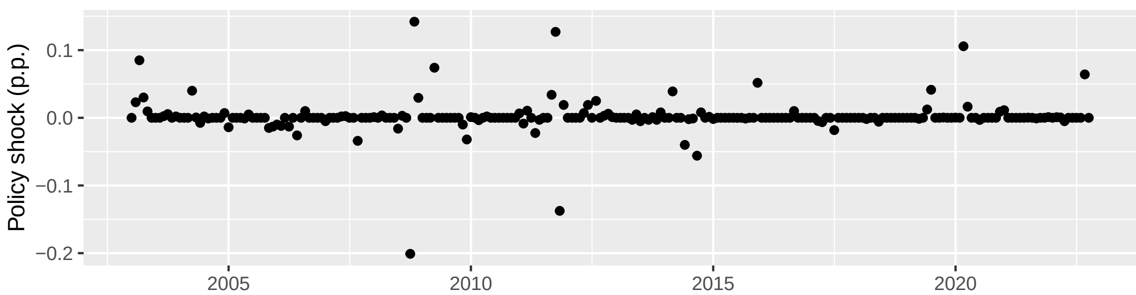
3 Methods and data

I study the dynamic response to an unexpected change in monetary policy on deposit rates in different countries in the euro area. I do so in a panel local projections framework (Jordà (2005)), which notably deals well with asymmetries and non-linearities, a central element of this paper (see e.g. Auerbach and Gorodnichenko (2012), Ramey and Zubairy (2018) and Tenreyro and Thwaites (2016)). In order to assess the potential asymmetry in the response to positive and negative monetary policy shocks, I estimate the equations separately for positive and negative shocks.

Monetary policy shocks are identified using the high-frequency approach. Following the rich literature exploiting high-frequency identification, I take the change in a risk-free short-term rate in minutes before and after a policy announcement. The short window allows us to credibly interpret the change in interest rates, in the euro area most commonly derived from Overnight Index Swaps (OIS), as monetary policy 'surprise'. Specifically, I use surprises to the 1-month OIS in the baseline, seeing its close link to the policy and deposit rates. The data is taken from the Euro Area Monetary Policy Database, created by and for Altavilla, Brugnolini, et al. (2019).[1]

Monetary policy announcements can also convey central bank information on the development of the economy. This can be problematic as the macro-economic, banking and financial market response to 'pure' monetary policy shocks and so-called 'information shocks' may be different. A 'pure' shock generally is expected to imply a worse economic outlook, which can be identified by a decline in stock prices against the background of an increase in interest rates. An 'information shock' entails a release of information on the part of the monetary policy maker to markets implying that the economy is stronger than previously expected, which would drive up stock prices in tandem with interest rates. To deal with this issue, the recent literature has separated out these shocks. I follow the now common procedure suggested by Jarociński and Karadi (2020), using the shock to the EuroStoxx 50, a European stock market index, which allows me to focus in the remainder of this paper on the 'pure' monetary policy shock.

Figure 2: Monetary policy shock time series



[1] I use the full monetary event window, thus taking the difference in the median quote in the 13:25-13:35 window (before the press release) and the median quote in the 15:40-15:50 window (after the press conference).

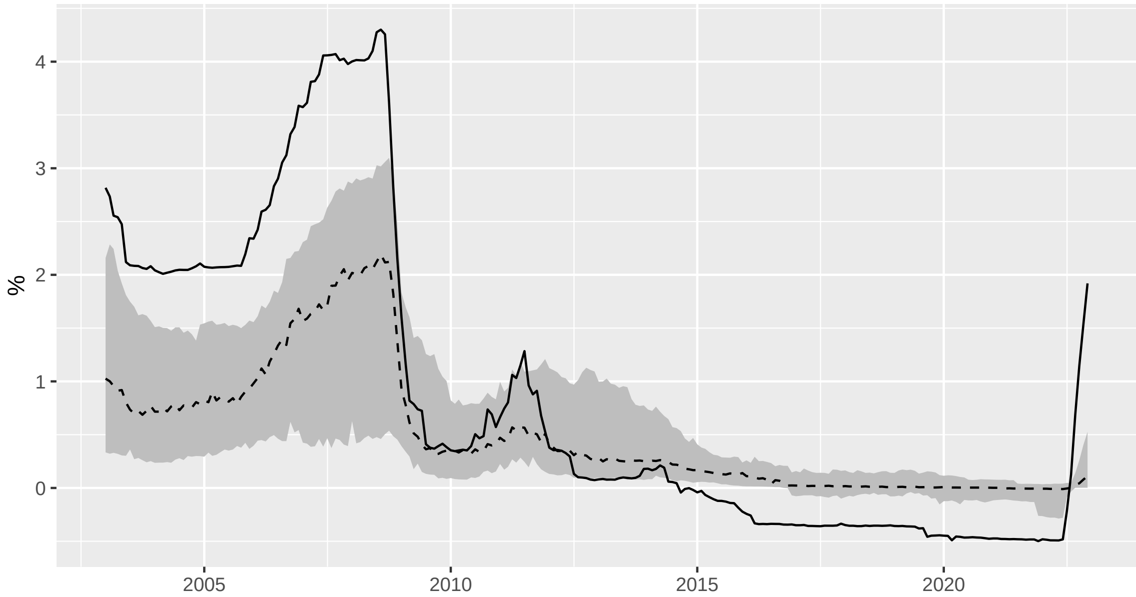
Using these surprises comes at the cost of the potential information value of expected changes in monetary policy - these could indeed have different effects on relevant macro-economic, banking and financial market indicators. The differences in the effects may not be too substantial, as related papers that rely on surprises only have shown macro responses that are in line with conventional wisdom and as regressing deposit rates on all changes in the short-term rate, in a specification similar to the ones in Drechsler, Savov, and Schnabl (2017), show results that are broadly consistent with the exercise I focus on in this paper. More importantly, however, I choose these surprises as my focus is showing the causal link between monetary policy and a structural factor (concentration), for which clean and credible identification is paramount. Expected changes in policy could ultimately be driven by sources that affect the banking sectors in my sample heterogeneously, and also would be associated with anticipatory behaviour by banks which would contaminate estimates. Moreover, high-frequency surprises are increasingly popular in the related literature. Using the same methods has as an important benefit that my results can be placed in the context of this literature, allowing for comparison.

In the baseline, I use country-level data and focus on overnight deposits held by non-financial corporates (firms) and households. This country-level panel runs monthly from January 2003 through July 2022. I include the countries that were euro area member states in 2009 (to allow for a reasonably balanced panel), excluding some particularly small member states. This leaves me with thirteen countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Slovenia and Slovakia, that in the deposit rates have displayed quite a bit of dispersion as illustrated in figure 3. I only include countries from the moment they join the euro area, given the assumption of a common monetary policy. I conduct a range of robustness checks related to the specific sample, which suggest the key results are not driven by the choice of sample. A robustness check, excluding data from the time when nominal rates were close to the 'effective lower bound' on nominal rates, is also done.

Aggregate banking data includes all banking activities conducted within country borders, including those by branches and subsidiaries of banks abroad. Banking data (incl. bank interest rates and the HHI) and most of the macro-economic is sourced from the ECB (BSI, MIR and SSI data bases) and financial market interest rate data comes from Refinitiv. The commodities price index is sourced from the IMF, industrial production data from Eurostat, and the credit risk measure from Banque de France. Summary statistics can be found in table 3.

In an extension, I redo the analysis with individual bank-level data, taken from the ECB's IBSI and IMIR data bases. Country-level data has as a benefit that within the country it weights deposit rates of different banks by volume, whereas the benefit of individual bank data is that it gives more weight to larger countries, as they have more banks included. The results are qualitatively similar, suggesting that the unit of measure is not materially affecting key results.

Figure 3: Deposit rates across the euro area and the risk-free rate



This graph includes the highest and lowest domestic (weighted) average bank deposit rates amongst the founding euro area member states. The dashed lines reflect the bank interest rates of the median sector. The black line shows the 3-month OIS.

Table 3: Summary statistics

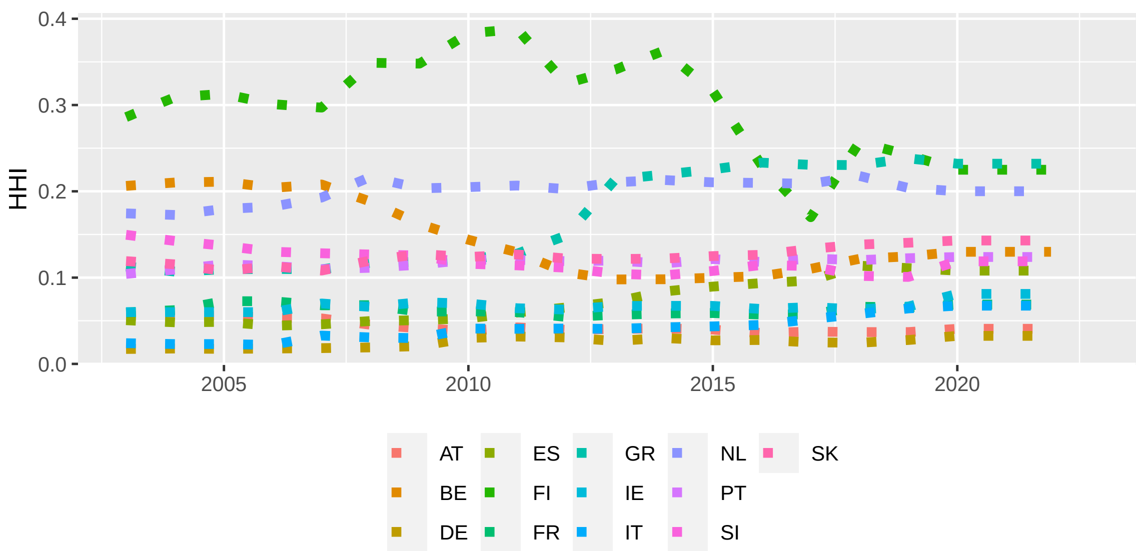
Statistic	N	Mean	St. Dev.	Min	Max
mp shock	2,909	0.002	0.02	−0.14	0.14
hhi	2,935	0.11	0.08	0.02	0.39
short rate	2,935	0.79	1.44	−0.52	4.33
deposit rate	2,934	0.48	0.63	−0.29	3.10
gdp (ea)	2,935	863.73	54.45	748.22	976.80
inflation (ea)	2,935	96.62	8.21	80.30	117.14
commodities price index	2,935	131.63	36.88	61.89	239.86
EUR-USD	2,935	1.25	0.12	1.02	1.58
credit risk measure	2,935	1.38	0.58	0.50	3.70
gdp	2,935	68.22	74.24	2.95	274.75
inflation	2,935	96.70	8.45	76.94	126.02
loan rate	2,935	2.98	1.45	0.37	7.12
deposit volume	2,935	104.27	129.78	1.19	710.13
loan volume	2,935	368.91	371.35	13.18	1,538.37
deposit share	2,935	55.76	22.90	4.58	96.29
loan share	2,813	82.94	10.16	59.13	99.96
bank capital	2,935	159.46	174.37	2.91	721.28

Note that the shock is expressed in basis points, the short rate and loan share in percentages, interest rates in percentage points and exchange rate in EUR. Volumes are expressed in billion euros. Commodities, inflation and GDP are indexed to 2015.

As discussed before, I use the Herfindahl-Hirschman Index (HHI), to indicate concentration in a given domestic banking sector. HHI is obtained by summing the squares of each bank's market share, yielding values between 0 (little concentration or perfect competition) to 1 (high concentration or monopoly). For euro area countries, the average HHI for the banking sector across countries over the sampled time frame is 0.11 with the lowest and highest values being 0.02 and 0.39. Figure 4 shows the evolution of the HHI since the early years of the euro: key to the analysis considering the role of concentration is that this measure of market concentration has remained quite stable over these two decades, despite some major events in the macro economy and financial markets. This stability makes (more) credible that monetary policy does not contemporaneously affect concentration, but also that we can take the dispersion of concentration largely as a result of pre-euro events. The stability in euro area banking sector concentration is also notably different to the US banking sector, which has been studied more in the related literature, which has much consolidated over the past four decades.

When measuring concentration, an important consideration is the relevant market. Constrained by the available data that is grouped by country, I assume that the relevant market is the domestic market. This appears to be a reasonable assumption for most euro area countries. Most countries are sufficiently small that it is feasible for banks to operate throughout the country. This may, however, not be the case for the four large countries in the euro area (France, Germany, Italy and Spain). For the larger countries, as in the US, regional markets exist. Unfortunately, the data is not so granular that this issue can be addressed directly for these four large member states. I keep the four member states in the baseline, but conduct a robustness check excluding them (with results materially the same).

Figure 4: Herfindahl-Hirschman Index (HHI) by market



4 Specification and results

4.1 Do deposit rates respond asymmetrically?

First, I consider whether an average banking sector passes-through a positive monetary policy shock (a surprise increase in the short-term rate) and more quickly a negative shock (a surprise decrease in the short-term rate). To test this, I have the following empirical specification, where i reflects the country, t the month and h the horizon ahead.

$$Y_{i,t+h} = \sum_{s\in\{p,n\}} \mathbb{1}(s_t = s)[\alpha^s_{i,h} + \beta^s_{0,h} mps_t + \gamma^s_h \sum_{l=1}^{L} X^{'}_{t-l} + \theta^s_h \sum_{l=1}^{L} X^{'}_{i,t-l} + \epsilon^s_{i,t+h}] \tag{1}$$

Dependent variables $y_{i,t}$ are the short-term interest rate (3-month OIS rate) and the deposit rate relative to the short term rate (i.e. deposit rate - short-term rate), which for the sake of brevity I will refer to as the 'relative deposit rate'. This is the inverse of the deposit wedge, which will allow us to see directly if the deposit rate is higher or lower relative to the short-term rate after a surprise change in policy. In the baseline, I consider overnight (immediately withdrawable) deposits held by non-financial corporates (NFCs). I will also show results for households (HH), as well as different country samples.

Explanatory variable of interest is the monetary policy shock mps_t, which reflects the response of the 1-month OIS in a narrow window around the ECB press conference (as discussed before). Euro area control variables X_t are real GDP (interpolated using industrial production, following Chow and Lin (1971)), HICP inflation, a commodities price index, the USD-EUR exchange rate, a measure of non-financial corporate credit risk (Gilchrist and Mojon (2018)) and a month dummy. These controls recognise that the monetary policy transmission is likely to be affected by the state of the macro economy and the financial sector, as well as potential seasonal effects. I also include lags of the shock variables, in order to deal with potential serial correlation due to announcement day observations being converted into monthly series (Ramey (2016)).[2]

Domestic control variables $X_{i,t}$ are real GDP, HICP inflation, loan rates, overnight deposit and loan volumes, bank capital, loan volumes as share of both loan and bond volumes ('loan share'), overnight deposit volumes as share of deposit and MMF volumes ('deposit share'), the HHI as well as a dummy for countries with a large proportion of adjustable-rate mortgages (following Albertazzi, Fringuellotti, and Ongena (2019)). The other rates and volumes are meant to capture the interplay between bank assets and other liabilities, as well as the interactions between quantities and prices. The loan and deposit share capture role of non-banks in providing intermediary services to firms and households as alternative to banks. The specification also includes country-horizon fixed effects, meant to soak up time-invariant country-specific factors.

[2] Until 2015, the ECB Governing Council met every month, as a result of which on occasion two meetings could occur within the same calendar month, which are summed in the process of creating a monthly series.

The baseline specification includes six lags for dependent and control variables, a 12 month horizon (h) and Driscoll and Kraay (1998) standard errors, which are robust to general forms of spatial and temporal dependence. All volume variables enter in logs, all rates in percentages. To test whether deposit rates respond asymmetrically to positive and negative monetary policy shocks, I first estimate the response of the deposit rate to these positive and negative shocks separately, depending on the sign of the shock. I introduce the switching variable s_t, where mps_t stands for the policy shock in month t.

$$s_t = \begin{cases} n & \text{for} \quad mps_t < 0 \\ p & \text{for} \quad mps_t > 0 \end{cases}$$

4.1.1 Results

The cumulative impulse responses (both for positive and negative shocks) in the figures referenced below are scaled to a positive 100 basis points change in the short-term rate, with the black lines reflecting the response to positive shocks and the red/dotted lines reflecting the response to negative shocks. 68% and 90% confidence intervals have been plotted. The left-hand graph show the response of the short-term rate, the right-hand graph the relative deposit rate (i.e. the deposit rate minus the short-term rate). For β_0 to be zero implies that the nominal deposit rate changes one-for-one with the short-term rate.

Positive IRFs for the relative deposit rate imply that the deposit rate has increased by more than the short-term rate, narrowing the wedge between the short-term rate and the deposit rate. A negative IRF, conversely, implies that the short-term rate has increased more than the deposit rate; the deposit rate has become relatively low compared to the prevailing short-term rate.

Figure 5 plots the IRFs for the baseline case: overnight deposits held by non-financial corporates. It shows that there's no statistically significant difference between positive and negative shocks, for both the short-term rate and the relative deposit rate. The point estimates for the relative deposit rate are negative at least for the first few months, implying for the positive shock case that the deposit rate is lagging the short-term rate, whereas for the negative shock case it implies that that the short-term rate would be creeping up to the deposit rate. In both cases, however, the deposit rate is relatively rigid, and considering the overlapping confidence intervals symmetrically so.

The response of an average banking sector to positive and negative monetary policy shocks can thus not be said to be asymmetric. If anything, the point estimates for the negative shock case are larger rather than smaller (which was expected). Figure 6 plots the IRFs for deposits held by households. They are identical to those in the baseline with NFCs, which may be somewhat surprising as household and NFC depositor behaviour may be thought of as different, potentially with NFCs more attentive to policy. However it is consistent with the aggregate time-series for deposits held by households and NFCs generally co-moving. In any case, the prediction that deposit rates are upward rigid and downward flexible in response to monetary policy shocks does not seem to hold for the average euro area banking sector.

4.1.2 Robustness

To consider the robustness of the aforementioned results, I conduct a number of tests taking different samples and also using the surprise change in policy as an instrument for the short-term rate rather than as shock directly. Unless indicated differently, I take the baseline specification and alter one element at time only. Overall, the results do not materially change.

In the baseline, I use the surprises identified by the high-frequency approach 'directly' as monetary policy shock. Alternatively, one could use these surprises to instrument for the short-term rate, as it ultimately is surprises in the short-term rate that we're interested in. The dynamics, plotted in figure 7, are however very similar to those in the baseline, with mostly narrower confidence bands.

One could be concerned that the results are affected by the lower bound of nominal interest rates binding in the later years of the 2010s. To address this, I shorten the sample until mid-2014. The impulse responses of the short-term rate, plotted on the left-hand side of figure 8, are qualitatively similar to the dynamics seen in the baseline, though the response to the positive shock does appear to be weaker in the sense that it is shorter-lived. This also feeds through to the relative deposit rate, plotted on the right-hand side. These results are still not in line with the prediction. Due to the lack of persistence in the positive shock case, the impulse responses for the positive and negative shock case do not overlap anymore.

As discussed in the section on identification, the definition of the market matters for the measure of concentration. Specifically, it may be more appropriate to restrict attention to only those small member states that can be said to have one integrated domestic banking sector (rather than a number of regional ones, perhaps alongside a domestic market). The results when excluding the large four economies in the euro area are plotted in figure 9; they are similar to the baseline results which use the full sample. Relatedly, it may not be appropriate to omit the very small member states from the sample. Including them, as done in figure 10, also yields identical results.

4.2 Do deposit rates in more concentrated banking sectors respond asymmetrically?

If the response of deposit rates is asymmetric in more concentrated banking sectors, deposit rates increase slowly in response to a positive shock, but decrease quickly in response to a negative shock in a banking sector that sees more than average concentration. Market power may then explain some of the dispersion seen after (unexpected) changes in policy. To test whether this is the case, I alter the specification from the previous section slightly.

Dynamic response to positive (black) and negative (red) monetary policy shocks (β_0)

Figure 5: NFC, baseline sample

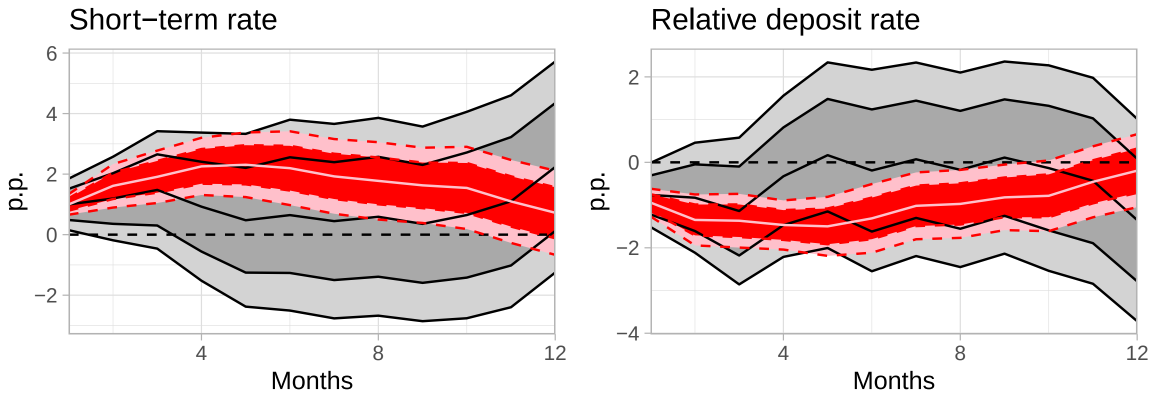


Figure 6: Households

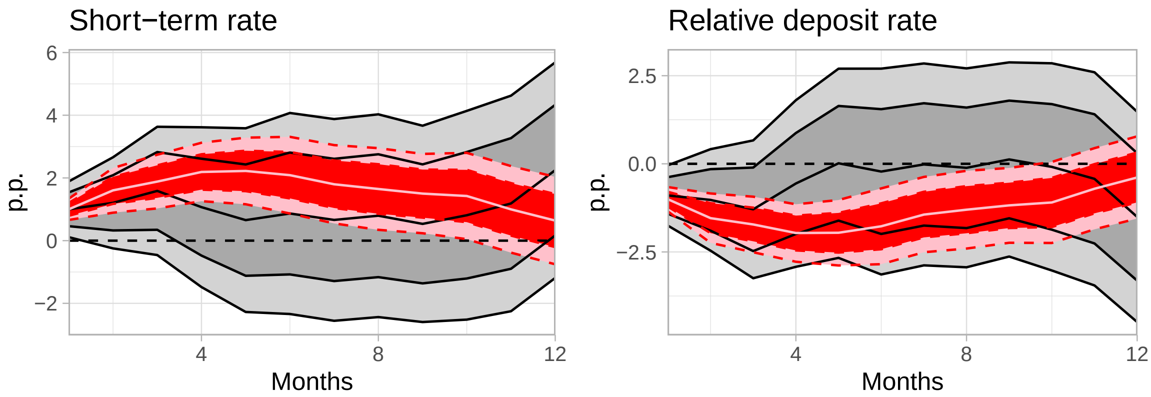
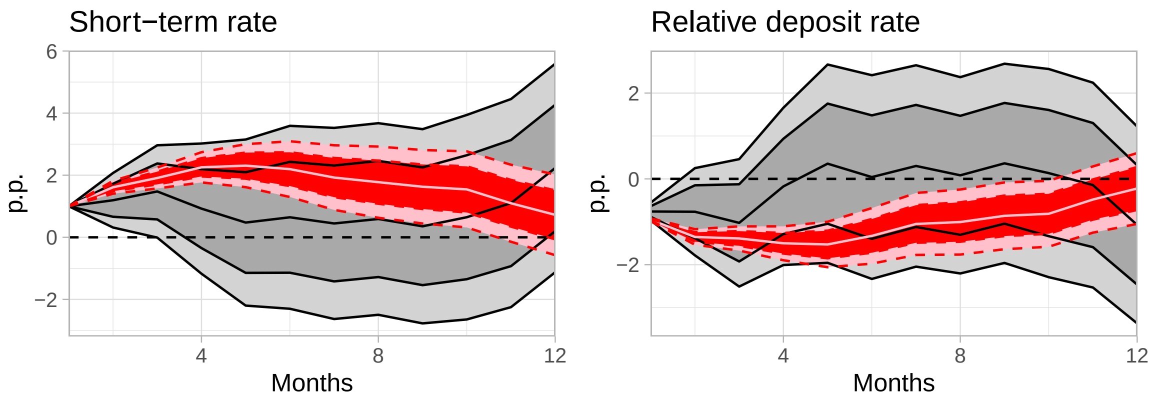


Figure 7: NFC, shocks as instrument



Note that the cumulative impulse responses are scaled to a 100 basis point response of the short-term rate on impact, with 68% and 90% confidence intervals plotted. The negative rate case (in red) has been normalised to 100 basis point positive response, to allow for direct comparison of the positive and negative rate case. The results displayed here are based on the baseline sample (NFC overnight deposit rates, 2003-2022 for the countries discussed previously, high-frequency surprises directly used as shock, etc.) with deviations from this sample indicated in the figure titles.

Dynamic response to positive (black) and negative (red) monetary policy shocks (β_0)

Figure 8: NFC, pre-ELB sample

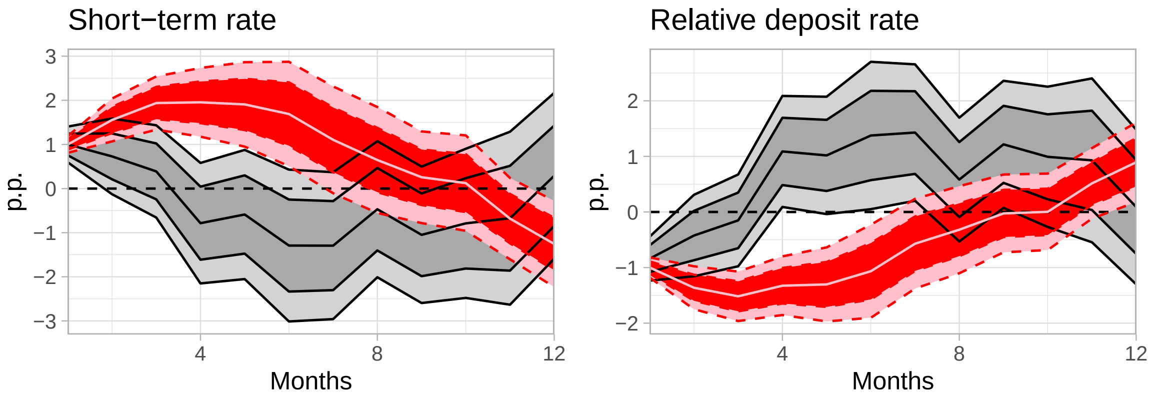


Figure 9: NFC, small member states

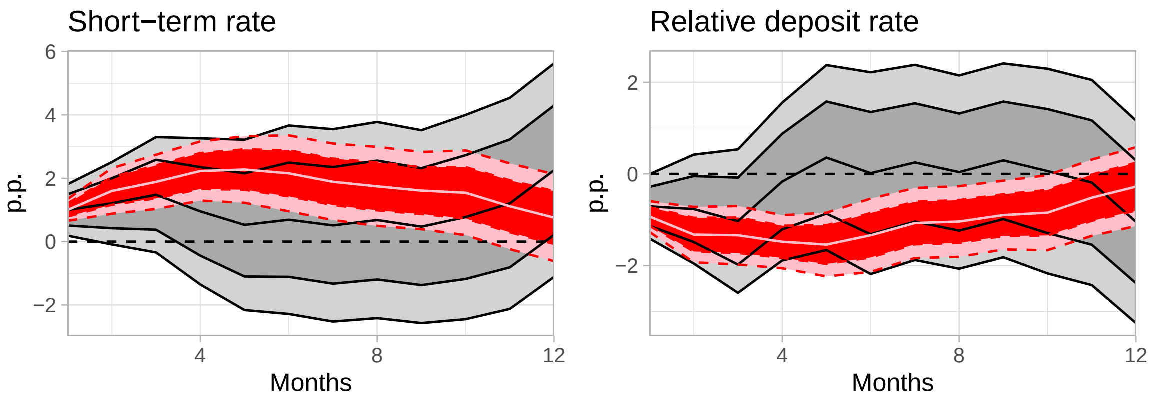
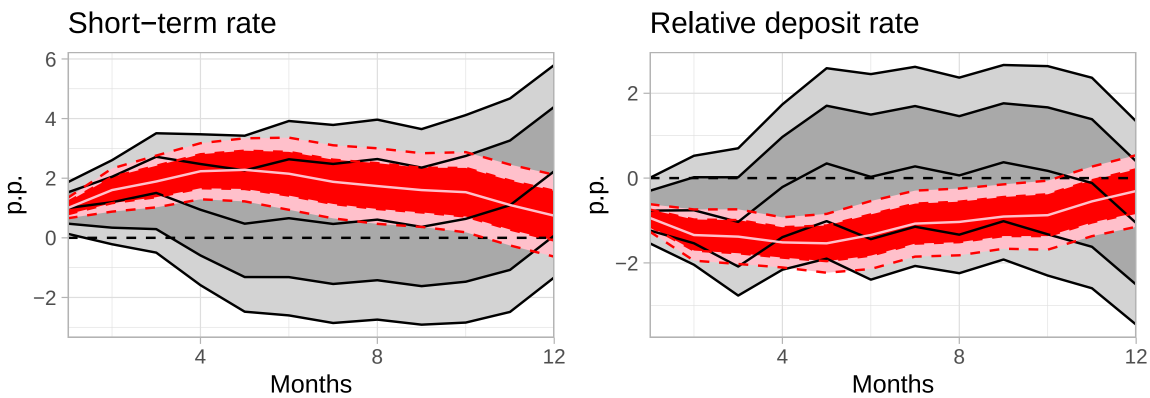


Figure 10: NFC, all member states



Note that the cumulative impulse responses are scaled to a positive 100 basis point response of the short-term rate on impact, with 68% and 90% confidence intervals plotted.

Inspired by Holm-Hadulla and Thürwächter (2021) who consider the impact of non-bank lending on the monetary policy transmission, I interact the measure of concentration with the monetary policy shock. hhi is a country's HHI value demeaned, to facilitate the interpretation of β_0 as the coefficient for the 'average' sector (as in the previous section) and β_1 for the additional effect on sectors with above-average concentration. The rest stays as before. Note that the HHI level had been and continues to be included amongst the control variables.

$$\begin{aligned} Y_{i,t+h} = \sum_{s \in \{p,n\}} \mathbb{1}(s_t = s)[\alpha^s_{i,h} + (\beta^s_{0,h} + \beta^s_{1,h} hhi_{i,t}) mps_t \\ + \gamma^s_h \sum_{l=1}^{L} X^{'}_{t-l} + \theta^s_h \sum_{l=1}^{L} X^{'}_{i,t-l} + \epsilon^s_{i,t+h}] \end{aligned} \tag{2}$$

4.2.1 Results

The graphs containing results are divided in a left-hand and right-hand side, showing respectively β_0, the coefficient on a monetary policy shock for a sector with an average degree of market concentration, and β_1, the additional impact of a monetary policy shock for a market with above average market concentration (expressed in percentage points deviation from the average). I discuss the positive and negative shock cases in turn.

Positive shocks In graph 11, the IRFs for deposits held by non-financial corporates are plotted. We see on the left-hand side that in response to a positive shock β_0's point estimate (capturing the average sector's deposit rate relative to the short-term rate) turns negative for the first three months. This reflects that the nominal deposit rate is sticky and an increase in the short-term rate takes a few months to substantially increase the deposit rate for the average banking sector. A negative IRF here implies that the short-term rate increases by more than the deposit rate, and the deposit rates thus declines relative to the short-term rate.

The graph on the right-hand side shows that the deposit rate takes even longer to increase upward in more concentrated sectors, in response to a positive shock: the deposit rate is more sticky in more concentrated sectors. The wedge between the short-term rate and the deposit rate widens substantially. β_1 is statistically significant for a few months after the shock, and the estimates also suggest that this difference is economically meaningful. β_1 should be taken as the change in the deposit rate for a 100bps shock if the HHI value were to be one point higher than the average. In month four, a 0.1p above-average HHI value would imply a wider wedge by about 60bps. Given that the HHI in the euro area has seen a dispersion of about 0.3p, this would imply a temporary gap between deposit rates in the least and most concentrated banking sectors of about 180bps.

Another way to represent these results is by adding these coefficients (β_0 and β_1) up, to consider how a 100bps monetary policy shock affects the relative deposit rate across a range of HHI values.

Dynamic response to positive monetary policy shocks

Figure 11: NFC rate response (resp. β_0, β_1)

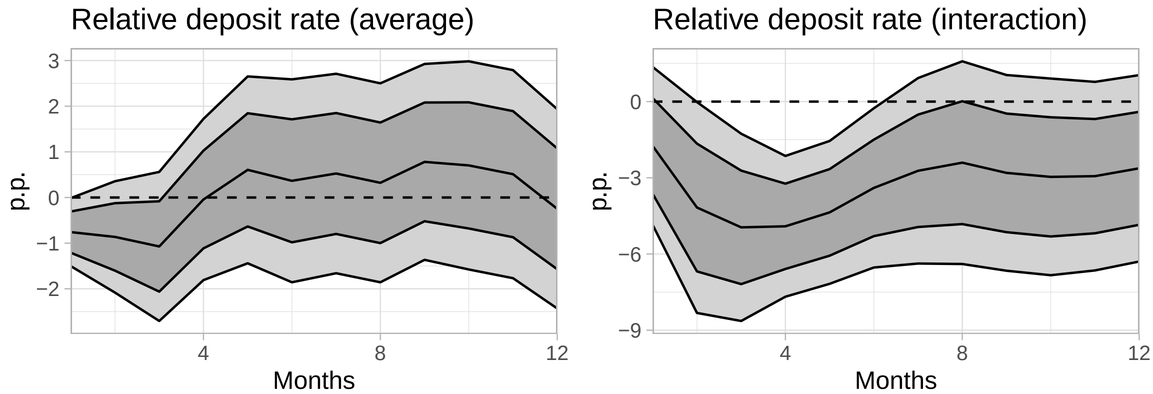


Figure 12: NFC rate response - linear combination of β_0 and β_1

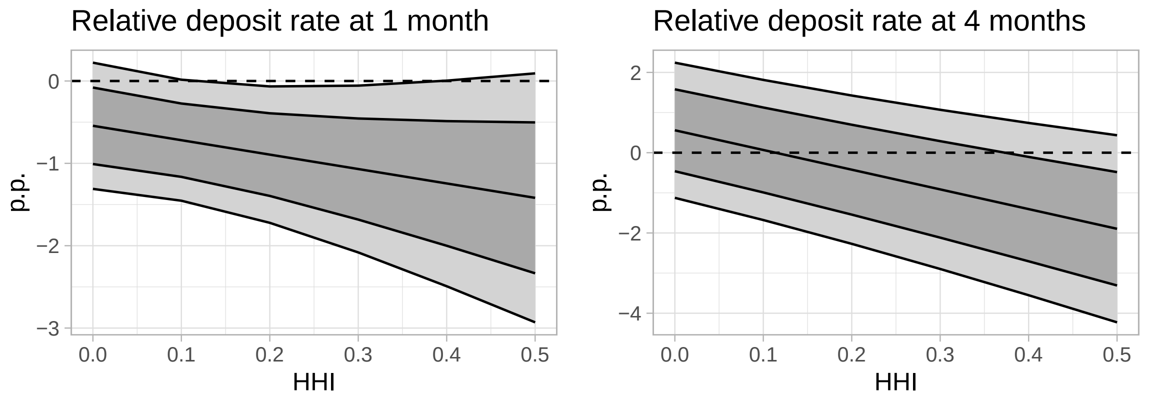
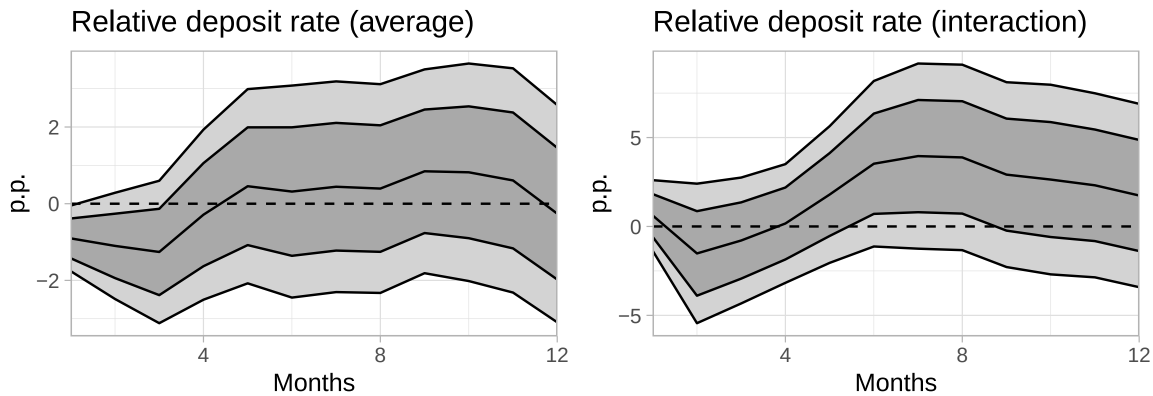


Figure 13: Household rate response (resp. β_0, β_1)



Note that the cumulative impulse responses are scaled to a positive 100 basis point response of the short-term rate on impact, with 68% and 90% confidence intervals plotted.

The prediction was for a higher HHI to imply a lower relative deposit rate, reflecting that higher-HHI banking sectors would keep nominal deposit rates low relative to the short-term rate. The more concentrated the banking sector, the lower the deposit rate in the wake of an unexpected change in policy: this implies a downward slope across the HHIs, which is indeed what we see for month one and four in figure 12 (shown for the NFC case). Note that month four is the trough, and that the effect gradually fades afterwards as seen in the figure before.

Figure 13 shows the IRFs for deposits held by households. While the downward hump for β_1 in the early months, as in the case of deposits held by NFCs, is present, the result is not statistically significant. The economic significance also appears smaller.

Negative shocks Graphs 14, 15 and 16 are scaled to a negative 100bps shock. As in the case of positive shocks, the prediction was for more concentration to lead to lower relative deposit rates in the short term. This is reflected in the right-hand sight of figure 14 for NFCs. As in the positive shock case, we see a clear downward hump in the early months. This means that compared to the average sector (where, according to the IRFs in the left-hand side graph, the relative deposit rate moves up), the relative deposit rate is much lower in more concentrated sectors. The average relative deposit rate moving up after a negative shock is intuitive, as deposit rates are known to be sticky: a surprise decline in the short-term rate thus is likely to lead to a narrowing of the wedge, driven by changes in the short-term rate. The right-hand side graph, however, tells us that sectors with more market concentration are able to set deposit rates differently and more swiftly adjust their deposit rates, such that they move more in tandem with the declining short-term rate.

This can also be seen in the figure 15, which shows again the cross section of HHIs on impact and in month four. The downward slope in these graphs means that for higher HHIs the relative deposit rate increases relatively little. In other words, sectors with little concentration (low HHI) have nominal deposit rates that stay rigid after a surprise decrease in the short-term rate, whereas sectors with higher concentration (high HHI) have more flexible nominal deposit rates that thus do move down more quickly. However, even high-HHI sectors cannot fully pass-through the surprise decline in the short-term rate: the deposit rate remains closer to the short-term rate after four months than it was before the surprise change in policy.

Figure 16 shows the IRFs for deposits held by households. The downward hump in β_1 can be seen, and unlike in the positive shock case, is statistically significant. However, compared to the NFC IRFs the magnitude of the effect does seem to be a bit smaller.

4.2.2 Robustness

As before, I consider whether the sample of member states materially affects the results. Figures 17 and 20 show the results when only small member states are included. β_1 is statistically significant for

Dynamic response to negative monetary policy shocks

Figure 14: NFC rate response (resp. β_0, β_1)

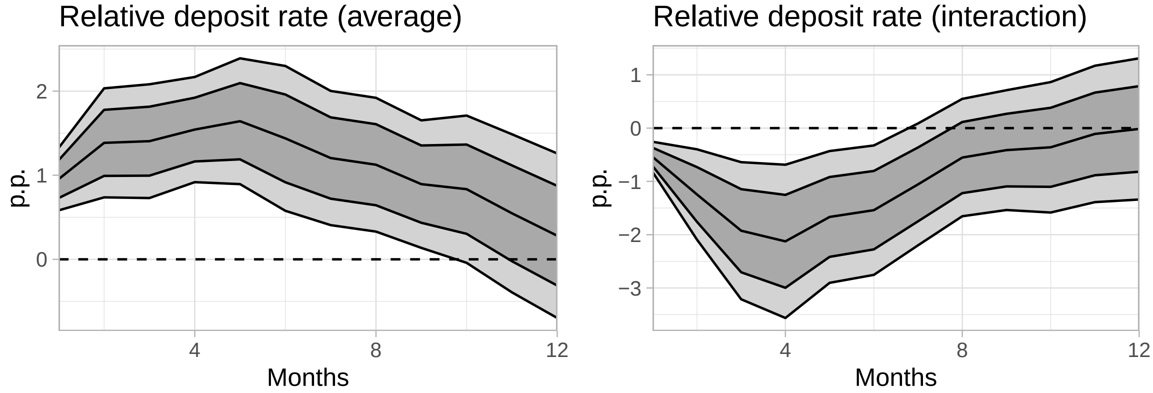


Figure 15: NFC rate response - linear combination of β_0 and β_1

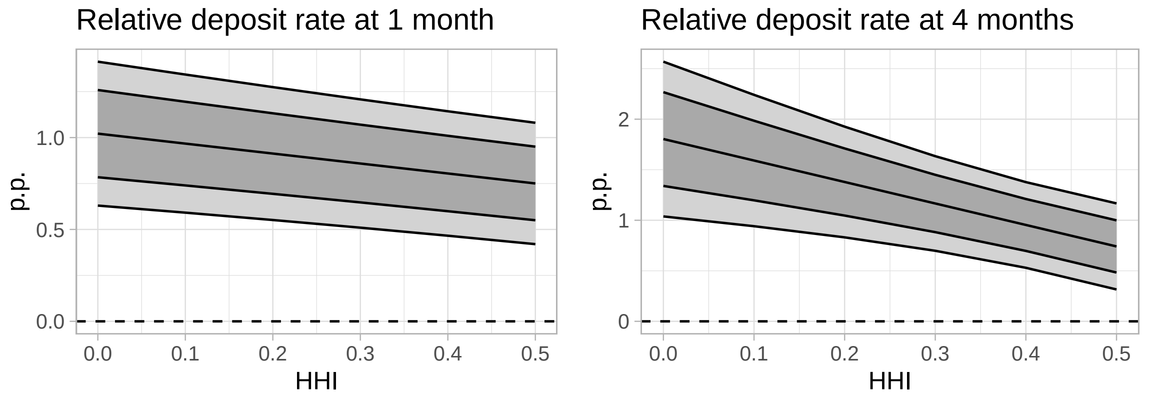
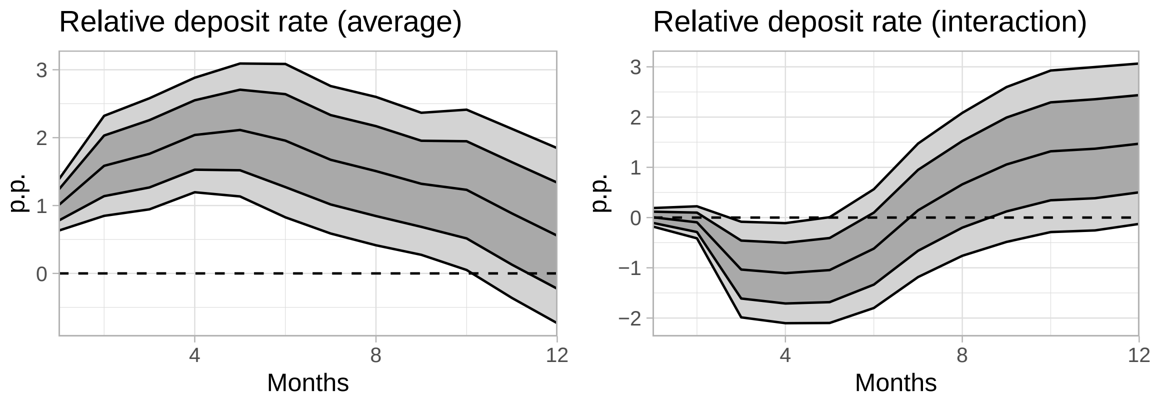


Figure 16: Household rate response (resp. β_0, β_1)



Note that the cumulative impulse responses are scaled to a negative 100 basis point response of the short-term rate on impact, with 68% and 90% confidence intervals plotted.

the same and more horizons than in the baseline case, especially so for the positive shock case, but also for the negative shock case. The point to stress here is that the downward hump in the right-hand side graphs (that reflects that there is a role for concentration in explaining the dispersion in deposit rates after a policy surprise) is universally present. Including all member states, as in figures 18 and 21, yields results that are quite similar to the baseline results, again with the downward hump.

Another latent concern, of monetary policy affecting concentration, is addressed by taking initial (2003) values of the measure of concentration that had not been affected by future unexpected changes to monetary policy. Taking these values rather than current values of HHI yield qualitatively similar results, notably with the hump for β_1 present and statistically significant.

4.3 Individual bank data

Country-level data has the benefit of country-level observations being correctly weighted for the size of individual banks. A downside is that then all countries in turn weighted similarly. To consider whether this matters, I redo the empirical exercise with individual bank data collected by the Eurosystem in the IBSI/IMIR databases. Larger countries tend to have more banks, which should somewhat correct for this issue.

The baseline specification is as before, amended with some bank-level controls and bank-horizon fixed effects. Subscript b denotes a bank-level observation. X_b include a leverage ratio, sovereign debt ratio, assets, deposit volumes, and loan volumes. The panel runs from 2008 until July 2021, and covers between about 60-90% of a given sector.

$$\begin{aligned} Y_{b,i,t+h} = \sum_{s\in\{p,n\}} & \mathbb{1}(s_t = s)[\alpha^s_{b,h} + (\beta^s_{0,h} + \beta^s_{1,h} hhi_{i,t}) mps_t \\ & + \gamma^s_h \sum_{l=1}^{L} X^{'}_{t-l} + \theta^s_h \sum_{l=1}^{L} X^{'}_{i,t-l} + \iota^s_h \sum_{l=1}^{L} X^{'}_{b,t-l} + \epsilon^s_{i,t+h}] \end{aligned} \tag{3}$$

The results as plotted in 19 and 22 are broadly in line with the baseline country-level results. β_1 displays a downward hump (around the fourth month), which is statistically significant for the positive shock case. This suggests that the weighting issues presented by the way the data is aggregated are not of a major concern.

Dynamic responses to positive monetary policy shocks (resp. β_0, β_1)

Figure 17: NFC (small member states)

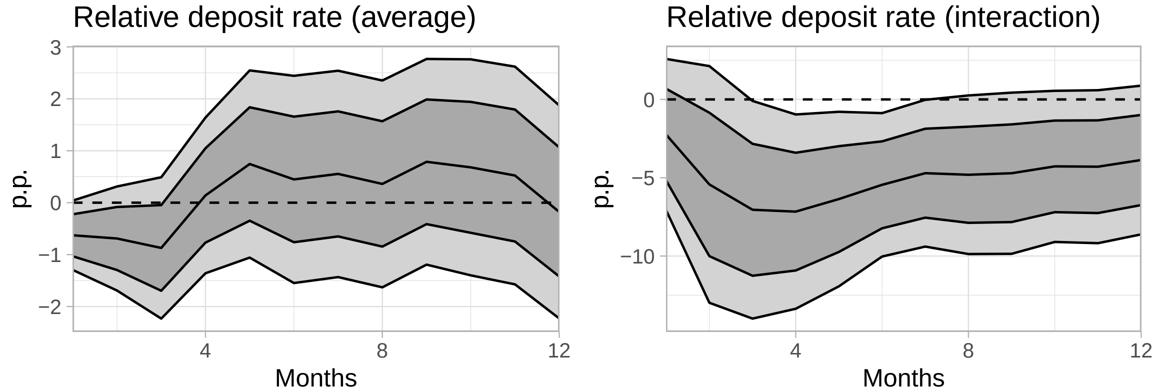


Figure 18: NFC (all member states)

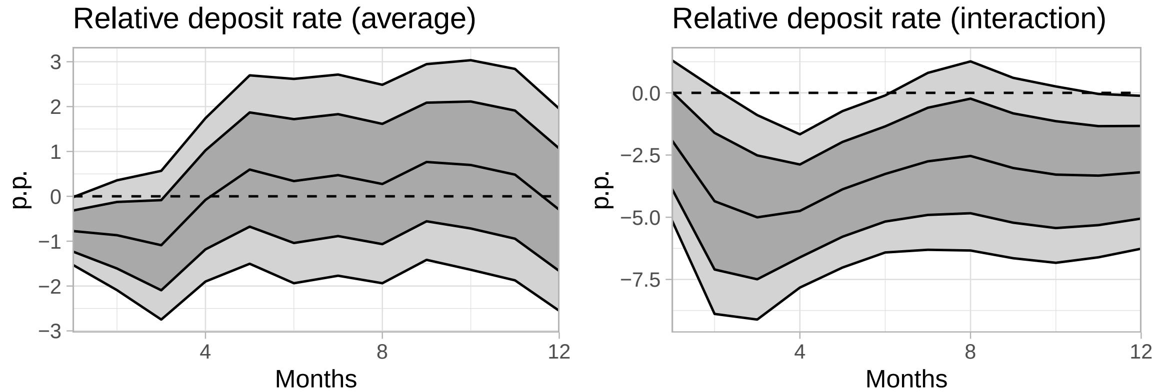
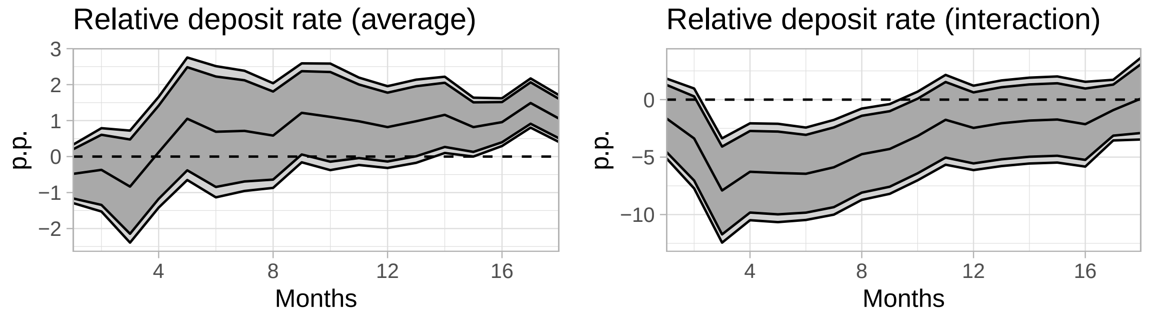


Figure 19: NFC (individual bank-level data)



Note that the cumulative impulse responses are scaled to a positive 100 basis point response of the short-term rate on impact, with 68% and 90% confidence intervals plotted.

Dynamic response to negative monetary policy shocks (resp. β_0, β_1)

Figure 20: NFC (small member states)

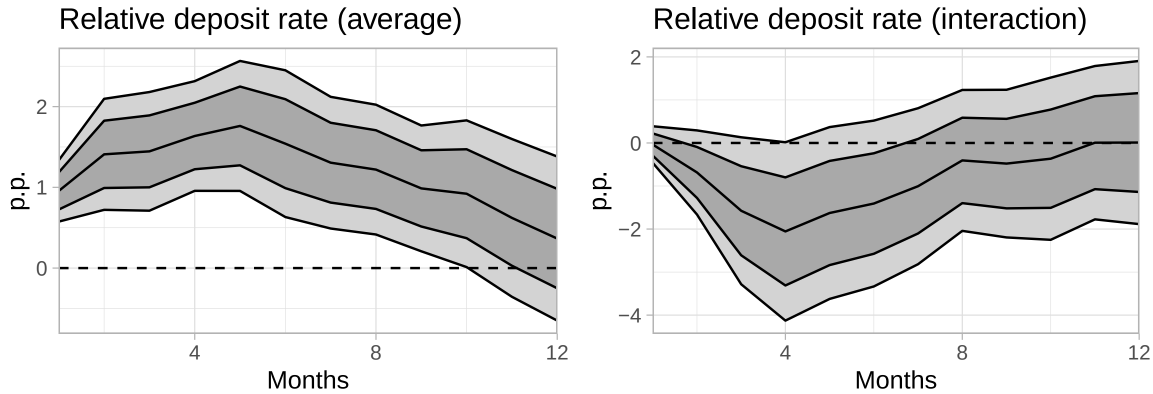


Figure 21: NFC (all member states)

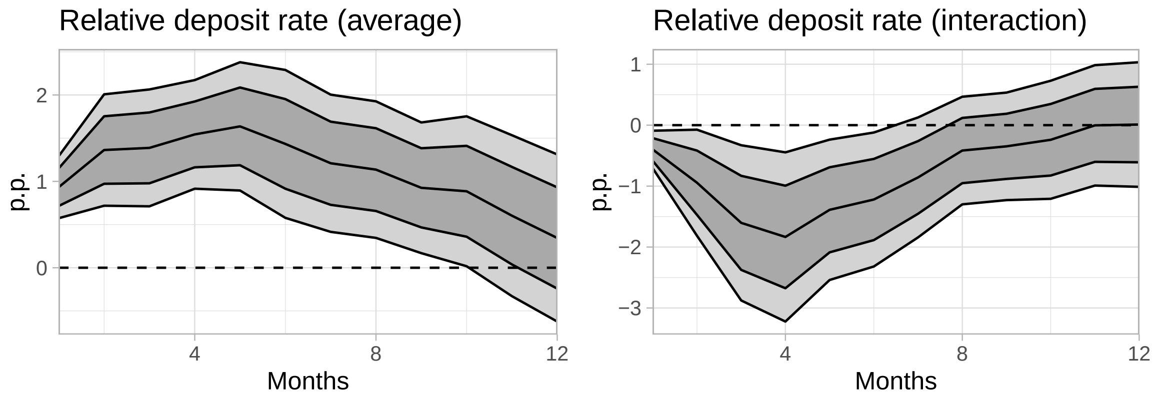
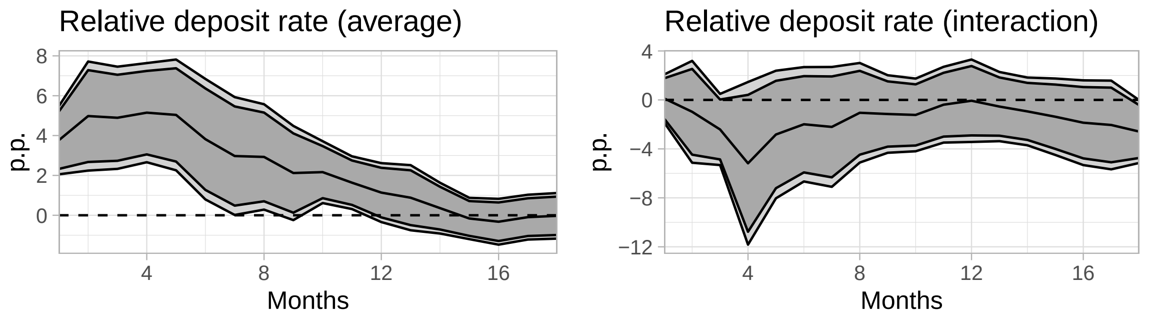


Figure 22: NFC (individual bank data)



Note that the cumulative impulse responses are scaled to a negative 100 basis point response of the short-term rate on impact, with 68% and 90% confidence intervals plotted.

5 Conclusion

In this paper, I consider whether the response of deposit rates in the euro area to positive and negative monetary policy shocks is asymmetric, and whether this may be due to the degree of banking sector concentration. More specifically, I empirically assess - using euro area country-level and bank-level data - whether a surprise increase or decrease in interest rates trigger different responses by deposit-taking banks.

The results show that deposit rates in the euro area are indeed sticky upwards and more flexible downwards for banking sectors that are more concentrated than the average banking sector. The difference is statistically significant and economically meaningful, with deposit rates a few months after a surprise 100 basis point change in monetary policy temporarily diverging by up to about 180 basis points between the most and the least concentrated banking sectors in the euro area. Equivalently, these results imply that the transmission to deposit rates in more concentrated banking sectors is slower when rates rise and faster when rates decline, with differences in the euro area context translating to delays of a few months up to half a year. These results are broadly robust for a range of specifications, and across household and NFC deposits.

This asymmetry in the monetary transmission could matter for the real economy in (at least) two ways: (1) bank profitability may be affected differently depending on the concentration of their local market, which could in turn lead to (undesirably) different effects on bank lending in response to monetary policy surprises. And, (2) how quickly households and NFCs learn about changes in monetary policy, via the deposit rate, may vary across the monetary union. This may well affect how quickly they adjust their economic behaviour, and in so doing creates (further) heterogeneity in the lags of monetary policy to the real economy.

In turn, this stands to be of relevance to monetary policy makers as monetary policy tightening appears to be passed-on relatively slowly in more concentrated sectors. If achieving substantial transmission is desired in those sectors in particular, these results imply that more or swifter tightening would be needed. These results also potentially carry implications for the debate about the future evolution of the economic and monetary union: reducing heterogeneity in concentration across banking sectors may help to make monetary policy transmission more homogeneous in the euro area.

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