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Banking on assumptions? How banks model deposit maturities

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Abstract

How do banks manage the behavioural maturity of non-maturing deposits (NMDs)? Using a rich and confidential dataset, we investigate how banks model deposit maturities based on internal assumptions. Although NMDs are contractually floating-rate liabilities with zero maturity, banks reallocate them across different maturity buckets using models that reflect past customer behaviour. Notably, only 20% of NMDs are treated as having zero maturity, while about 10% are assigned maturities beyond seven years. We assess whether these modelling assumptions align with banks' deposit structures. Results show that banks with more volatile, interest rate-sensitive, and digitalised deposit bases tend to assign shorter maturities, appropriately reflecting underlying risks. However, during the recent monetary policy tightening, banks with more sensitive NMDs did not shorten assumed maturities or update models. These findings underscore the critical importance of timely and accurate calibration of NMD assumptions to support effective asset-liability management and preserve financial stability.

Keywords: Banks; Non-maturing Deposits; Behavioural Assumptions; Financial Stability
JEL Codes: E51; E52; G21

Non-technical summary

Since the 2007 global financial crisis, non-maturing deposits (NMDs) have become an increasingly important funding source for banks. Contractually, NMDs are floating-rate liabilities with no maturity, allowing depositors to withdraw funds at any time without notice or penalty. In practice, however, these deposits tend to be *sticky* and are often held for extended periods. Accordingly, banks rely on internal models based on historical customer behaviours to estimate the stability of these deposits and determine their effective maturity. As a result, banks' internal estimates of the maturity of NMDs can present critical implications for banks' maturity mismatch and asset-liability management strategies, especially in a context of rapid shifts in interest rates.

Therefore, it is crucial to understand whether banks' estimates of behavioural maturities of NMDs accurately reflect their balance sheet structures. For instance, if banks with a larger share of unstable deposits report longer maturities for NMDs, implying greater deposit stability, it may either signal a potential underestimation of deposit outflow risks or, in more concerning cases, a deliberate "window-dressing" startegy. In the latter scenario, banks may attempt to mask asset-liability challenges by banking on NMD assumptions, raising significant concerns for financial stability. This issue becomes particularly relevant in times of changing market conditions, such as shifts in monetary policy rates, which can significantly influence customer behaviours.

In this paper, we leverage granular and confidential supervisory bank-level data from the European Central Bank (ECB) for 67 euro area Significant Institutions (SIs) covering the period from 2019Q2 to 2023Q3. This allows us to provide both descriptive and empirical evidence on the accuracy of banks' estimates of NMD behavioural maturities. Specifically, our dataset includes bank balance sheet variables, combined with a rich set of quarterly cash flow information, allocated across different maturity and repricing buckets based on banks' internal model assumptions.

First, we provide evidence on the significant differences between the contractual treatment of NMD maturities and banks' internal estimates within our sample. Our analysis shows that only 20% of NMDs are effectively treated as floating-rate liabilities with zero maturity, while a non-negligible portion is assigned maturities exceeding seven years. This indicates that generally banks perceive and treat these deposits as highly stable.

Second, based on bank-level panel estimations over the period 2019Q2 to 2023Q3, we find no evidence that banks underestimate risks or mask asset-liability challenges. On the contrary, our results suggest that banks appropriately account for the volatility and sensitivity of their deposit base. Specifically, banks with a higher share of uninsured or digital deposits tend to report shorter assumed NMD maturities. Likewise, banks facing greater deposit sensitivity—captured by the *deposit* β—or a history of frequent deposit outflows also assume shorter maturities. However, our results also indicate that pre-existing differences in liability structures did not influence banks' estimates of NMD maturities during the period of rapidly rising interest rates after the onset of the monetary policy tightening in 2022. Specifically, banks with more volatile or interest rate-sensitive deposits did not assign shorter maturities to NMDs. Nor were these banks more likely to update their internal models following the onset of monetary policy tightening. This finding suggests that banks may have either underestimated the risks associated with deposit volatility in a rising rate environment or that internal models are only gradually adjusted to reflect new conditions.

Our findings provide valuable insights for supervisors and policymakers, underscoring the importance of accurately accounting for depositor behaviours, as effective asset-liability management is essential to safeguarding financial stability. In light of renewed policy rate variability and accelerating digitalization, which may have structurally changed depositor behaviours, banks may need to reassess more frequently the models used to estimate NMD maturities.

1 Introduction

Deposits are a key funding source for euro area banks, accounting for approximately 70% of the total liabilities of Significant Institutions (SIs) in the region (Figure 1a). Non-maturing deposits (NMDs), such as overnight deposits (Figure 1b), represent a large part of total deposits. Contractually, NMDs are floating-rate liabilities with zero maturity, allowing depositors to withdraw funds at any time without notice or penalties. In practice, however, NMDs exhibit "stickiness" and are typically not withdrawn for extended periods (Drechsler et al., 2021; Greenwald et al., 2023; Jermann and Xiang, 2023).[1] While, on one side this peculiarity can support banks in managing interest rate risk in the banking book (IRRBB) and liquidity risk, on the other side it also introduces some unpredictability in their cash flow patterns (Blöchlinger, 2015; Fascione et al., 2024). Indeed, recent events, such as the 2023 U.S. bank failures, serve as a stark reminder of the potential fragility of deposits as a stable funding source, especially in times of high volatility (Beck, 2024).

The extent to which NMDs play a role in influencing banks' IRRBB and liquidity risks largely depends on the assumptions used in their modelling (Hoffmann et al., 2019).[2] A key distinction lies between contractual maturity and banks' expectations about NMD maturity (the so-called behavioural assumptions). Contractual maturity relies strictly on the legal terms of deposits, while banks' assumptions account for customer behaviour patterns and market conditions. Behavioural maturities can substantially deviate from contractual maturities, potentially offering a more realistic representation of the stability of NMDs. Thus, behavioural assumptions have significant implications for banks' asset-liability management strategies. For instance, they can help banks in managing maturity mismatches between asset and liabilities. However, the unpredictability of depositor behaviours can amplify liquidity risk, especially if possible early withdrawals are not adequately incorporated into banks' assumptions (Schlueter et al., 2015). Given the increasing importance of NMDs as a funding source since the 2007 global financial crisis (Figure 2) and the sharp rise in interest rates in the euro area between 2022Q3 and 2023Q3,

[1] The terms "non-maturing deposits" and "overnight deposits" are used interchangeably to describe deposits withdrawable at any time without advance notice or penalties. In other jurisdictions, such as the U.S., these are referred to as "sight" or "demand" deposits.

[2] Kalkbrener and Willing (2004) develop a general quantitative framework for the management of liquidity risk and interest rate risk of non-maturing liabilities. Overall, behavioural models are widely used in the banking industry and are subject to regulatory guidelines under Pillar 2 of the Basel Agreements in relation to the supervisory treatment of IRRBB (Basel Committee on Banking Supervision, 2016).

which has triggered a significant shift in the deposit composition, understanding how banks model deposit maturities has become increasingly critical.[3] The issue is particular relevant in the context of traditional banking theory, which highlights deposit stability as a cornerstone of the banking industry and a key factor in maintaining financial soundness (Diamond and Dybvig, 1983; Goldstein and Pauzner, 2005). In this light, accurate modelling of deposit maturities plays a crucial role for safeguarding financial stability.

This paper begins by providing detailed descriptive evidence on contractual and behavioural maturities of NMDs assumed by banks.[4] Leveraging granular and confidential supervisory data from the European Central Bank (ECB), covering 67 SIs in the euro area from 2019Q2 to 2023Q3, we offer a comprehensive view of how banks model NMD maturities. The dataset includes bank balance sheet variables and a rich set of quarterly bank-level cash flow information. Our study explores both cross-sectional differences and temporal dynamics, and accounts for the sharp and sudden increase in interest rates that began in July 2022.

The data reveal significant differences between contractual and behavioural NMD maturities assumed by banks. Under contractual terms, NMDs are assigned a zero maturity, whereas internal models distribute these deposits across various maturity buckets based on observed customer behaviours. Data show that only 20% of NMDs are effectively considered as floating-rate liabilities with zero maturity. A non-negligible portion (approximately 10%) of NMDs is assigned maturities exceeding 7 years and 1.5% has maturities above 15 years, suggesting that some banks consider these deposits as highly stable. Surprisingly, we also find that the average maturity of NMDs increased by 55 days following the monetary policy tightening, an environment where deposits are typically less stable. To shed light on this pattern, we explore the underlying mechanisms and find that, on aggregate, banks primarily lost deposits allocated to short-term maturity buckets, while retaining those classified as longer-term and more stable.

[3] On July 21, 2022, for the first time since 2011, the ECB increased its three key interest rates by 0.5 percentage points. Specifically, the ECB Governing Council decided to raise the interest rate on the main refinancing operations to 0.50%, the interest rate on the marginal lending facility to 0.75%, and the interest rate on the deposit facility to 0.00%. These changes took effect on July 27, 2022.

[4] While we acknowledge that behavioural assumptions, particularly regarding prepayment behaviours, also influence loan maturity modelling, understanding the dynamics of loan prepayments is not in the focus of this paper. We also believe that this aspect is less relevant relative to the impact on banks of deposit assumed maturities. Nonetheless, we include some considerations on banks' asset side maturities in the online Appendix B.1.

In addition to providing descriptive evidence on the difference between contractual and behavioural maturities, we conduct an empirical analysis to understand whether banks' estimates of NMD maturity accurately reflect their deposits base. For instance, if banks with a larger share of unstable deposits (e.g., more uninsured deposits) or more digital deposits report longer maturities for NMDs, suggesting greater deposit stability, it could signal a potential underestimation of deposit outflow risks or, in worst cases, "window-dressing" behaviour.[5] In such cases, banks may attempt to mask asset-liability challenges by banking on NMD assumptions, which in turn could raise significant concerns for financial stability.

We find no empirical evidence of banks underestimating these risks when looking at the full sample period. Indeed, banks with more volatile or interest rate-sensitive deposit bases tend to assign shorter maturities for NMDs. In particular, banks with a higher share of uninsured deposits report shorter estimated NMD maturities. Similarly, banks with greater deposit sensitivity, as captured by the *deposit* β, or a history of frequent deposit outflows, also assume shorter maturities. By contrast, banks with a higher share of household deposits, which are typically more stable, tend to assume longer NMD maturities.

In a cross-sectional setting, we further explore whether the degree of digitalization of banks' deposit bases influences their NMD maturity assumptions. For this purpose, we exploit a novel confidential dataset from the 2023 Supervisory Review and Evaluation Process (SREP) conducted by the ECB, which provides information on two relevant measures for a subset of banks: the share of digital customers and the share of digital deposits. Our results show that banks consider the degree of deposit digitalization as a relevant factor when modelling the maturity of NMDs, recognizing its potential impact on the stability of their deposit base.

We then proceed to leverage the recent, forceful, and largely unanticipated monetary policy tightening episode to investigate whether pre-existing differences in the deposit mix influenced banks' assumptions on NMD maturities amid rapidly rising interest rates. In principle, banks with more volatile or interest rate-sensitive deposits should face additional pressure to lower their expected NMD maturities to reflect a monetary environment where deposits are less stable.

[5] Window-dressing behaviour can be viewed as a form of regulatory arbitrage aimed at temporarily reducing a bank's risk profile. The Basel Committee on Banking Supervision (BCBS) discusses this issue in a recent consultation document in relation to Global Systemically Important Banks (G-SIBs) and their specific regulatory framework (Basel Committee on Banking Supervision, 2024).

Similarly, one would expect more frequent updates to internal models to account for changes in depositor behaviour in this environment. This is especially relevant given that internal models for depositor behaviour were largely based on a prolonged period of low interest rates, when the opportunity cost of holding higher-yielding deposits or withdrawing funds was low and NMDs tended to be very sticky. However, our results show no evidence of a differential adjustment in the assumed NMD maturities during this tightening episode. Specifically, banks with more volatile or interest rate-sensitive deposits did not reallocate their NMDs towards shorter-term maturity buckets. Moreover, these banks were not more likely to update their internal models following the onset of the monetary policy tightening. This finding suggests either that banks underestimated the potential risks associated with deposit volatility in a rapidly rising interest rate environment, or that their internal models are adjusted slowly to reflect new conditions. Both explanations carry important implications for banks' asset-liability and liquidity management and, ultimately, for financial stability if NMDs prove more volatile than anticipated.

Our work relates to a recent strand of the literature that focuses on the value and behaviour of bank deposits and their implications for financial stability during periods of volatile interest rates and market conditions (Bolton et al., 2023; Greenwald et al., 2023; Koont et al., 2023; Cappelletti et al., 2024; Coulier et al., 2024; Fascione et al., 2024; Jiang et al., 2024).[6] A central contribution that ties these studies is the work by Drechsler et al. (2021), which argues that the maturity transformation inherent in the banking business does not expose banks to IRRBB but rather acts as a hedge due to the "deposit franchise", defined as an intangible asset stemming from the bank's capacity to offer deposit rates below the prevailing market levels.[7] The authors attribute the limited $pass-through$ of interest rate shocks to deposits rates to imperfect market competition and identify the *deposit beta* as a key determinant for this phenomenon. Building on this, and in relation to the 2023 banking turmoil, Drechsler et al. (2023) demonstrate that the deposits franchise, while valuable, is also a runnable asset, introducing fragility into the banking sector in environment of rising interest rates. Greenwald et al. (2023) empirically demonstrate that the *deposit beta* is non-constant, rising in response to increasing market rates,

[6] Our work also connects, from a broader perspective, to the body of literature that empirically examines the impact of a changing interest rate environment on banks' exposure to IRRBB (Samuelson, 1945; Flannery, 1981; Esposito et al., 2015; Chaudron, 2018; Hoffmann et al., 2019; Molyneux et al., 2022; Coulier et al., 2023, among others.)

[7] In a previous influential study, they propose a model that examines the deposit channel in monetary policy transmission, arguing that rising interest rates enable banks, leveraging their market power, to increase the deposit spread, which in turn drives deposit outflows from the banking sector (Drechsler et al., 2017).

which shortens the duration of deposits and has significant adverse implications for banks. By incorporating the element of technology, particularly the concept of the *digital beta*, Koont et al. (2023) show that rising interest rates in the U.S. lead to faster deposit outflows and a greater decline in the deposit franchise value for more digital banks compared to their traditional counterparts. Jiang et al. (2024) highlights how rising interest rates reduce the value of U.S. bank assets, with uninsured deposit leverage emerging as a critical factor driving fragility in the system and the risk of self-fulling solvency runs.

Focusing specifically on NMDs, which represent a major portion of banks' deposit portfolios, some studies take a technical approach by developing quantitative models to support asset and liability risk management. For instance, Kalkbrener and Willing (2004) propose a three-factor model for managing liquidity and IRRBB in non-maturing liabilities, incorporating market rates, deposit rates, and volumes. Similarly, Blöchlinger (2021) introduces a closed-form valuation model for fixed-income banking book instruments, like demand deposits, operating in imperfectly competitive markets. Our work diverges from these studies, as we do not seek to propose new methodologies for calibrating bank assumptions or risk-management strategies related to NMDs. Instead, we aim to contribute to the existing literature by providing a detailed analysis of how banks in our sample practically apply these assumptions when modelling the maturities of NMDs which are liabilities characterized by ex-ante uncertainty in cash flows. As highlighted by Schlueter et al. (2015) in the context of the German banking sector, the cash flow profile of an entire bank, and its effective management, largely depends on the estimated maturity of NMDs. To the best of our knowledge, the existing literature has not explored how banks practically model the maturities of deposits.

In addition to these empirical and technical contributions, recent theoretical works provide insights into the dynamics of deposit behaviour and their implications for banks' stability and regulatory frameworks. Kang (2020) extends the Diamond–Dybvig model by incorporating hyperbolic discounting, demonstrating how myopic depositor decisions complicate the design of run-proof banking contracts and heighten the risk of bank runs. Jermann and Xiang (2023) emphasize the role of endogenous deposit maturity, showing how depositor preferences, shaped by bank leverage and default risk, create time-varying dilution problems that significantly affect bank dynamics. Their findings reveal that interest rate cuts can lead to delayed increases in bank risk, particularly in low-rate environments, with deposit insurance further amplifying these vulnerabilities. The model by Suarez (2023) suggests that when a bank's deposit franchise is small or fragile, the capital required to maintain "super-solvency"—and thus remain insulated from the risk of runs during positive interest rate shocks—aligns with the capital needed to absorb unrealized mark-to-market losses in the banking book. Conversely, if the franchise value is significant and stable, the required capital is substantially lower and may even be zero. Their analysis underscores the critical importance of a robust deposit franchise for maintaining bank solvency in volatile market conditions.

Expanding on these contributions, we focus on the practical implications of deposit modelling for euro area banks, particularly in periods of heightened market volatility. By analysing granular data, we are able to explore the interplay between banks' balance sheet characteristics and assumptions regarding NMD maturities. This approach provides a real-world perspective on how depositor behaviour influences risk management practices that have a clear and significant impact on the overall financial stability of the sector, especially in a rapidly evolving landscape.

The remainder of the paper is structured as follows. Section 2 introduces the data and provides a detailed descriptive analysis. Section 3 discusses the empirical methodology, presents the baseline results, and includes analyses accounting for digital deposits and changes in monetary policy. Section 4 presents a series of robustness checks, and Section 5 concludes the paper.

2 Data and stylized facts

The analysis in this paper relies on confidential supervisory and statistical data from multiple sources. Bank balance sheet characteristics are collected on a quarterly basis from two databases: COREP, which reports on banks' capital positions, and FINREP, which contains detailed financial statements.[8] Confidential quarterly cash flow data on NMDs by maturity bucket are collected by the ECB for supervisory purposes. In addition to reporting cash-flow by bucket, banks are required to notify supervisors whenever they revise their modelling as-

[8]COmmon REPorting (COREP) is the standardized reporting framework issued by the European Banking Authority (EBA) to ensure compliance with the Capital Requirements Directive. It covers credit risk, market risk, operational risk, own funds, and capital adequacy ratios. FINancial REPorting (FINREP) includes balance sheets, income statements, disclosures on financial assets and liabilities, off-balance-sheet activities, and non-financial instrument exposures.

sumptions.[9] These datasets are matched with granular information on loans and deposits—disaggregated by type, maturity, and interest rate—sourced from the Individual Balance Sheet Items (IBSI) statistics and the Individual MFI Interest Rate (IMIR) statistics.[10]

Merging these data sources yields a final sample of 67 banks across 16 euro area countries. These banks are classified as significant institutions, operate under diverse business models, and are subject to the ECB direct supervision under the Single Supervisory Mechanism (SSM). Collectively, they represent approximately 72% of the euro area banking assets. Table 1 presents country-level distribution of the sample. The considered time period spans from 2019Q2 to 2023Q3, excluding as pre and post quarters due to changes in the IRRBB reporting templates required under the SREP framework. This restriction ensures consistency in data collection and inference. Within the dataset, reported cash flows are distributed across 14 time bands, based on either the remaining time to maturity or the instruments' repricing schedule.

Focusing on bank deposits, and particularly on the category of NMDs, Figure 3 compares the average maturity profile of NMDs in our sample, under contractual terms (left panel) and as modelled using banks' behavioural assumptions (right panel) over the analysis period. Under the contractual terms, NMDs have a zero maturity and are effectively treated as overnight deposits, reflecting a conservative assumption that considers these funds highly unstable. In contrast, banks' internal estimates distribute NMDs across a range of maturities, including longer-term ones. This suggests that, despite the absence of a contractual maturity, banks expect a substantial share of NMDs (approximately 80% of the total) to remain stable over extended horizons. While contractual terms reflect depositors' legal right to withdraw funds at any time, banks' behavioural assumptions aim to capture the actual "stickiness" of NMDs based on observed customer behaviours. These assumptions reflect banks perceived deposit stability. Customers' withdrawal decisions are shaped by the trade-off between immediate liquidity benefits and the future, risk-adjusted advantages of retaining funds in the account, causing NMDs to effectively behave like long-term debt (Jermann and Xiang, 2023). This dynamic is further influenced by prevailing market conditions.

[9] In particular, banks are required to answer the question "Have any other material assumptions underlying the calculation of the supervisory standard shock on EVE and/or those underlying the calculation of Earnings measures changed since the STE for SREP data collection was last submitted?" by selecting either 'Yes' or 'No' and may optionally provide comments to explain any changes in assumptions.

[10] IBSI and IMIR are collected by the ECB for monetary policy purposes, serving as inputs to the calculation of credit and monetary aggregates for all banks operating in the euro area.

Figures 4-5-6 present a detailed breakdown of NMDs under banks' behavioural assumptions, categorized according to depositor and account characteristics, in line with the EBA's guidelines on managing IRRBB (EBA/GL/2018/02). Specifically, Figure 4 shows the distribution across maturity buckets of retail transactional NMDs, i.e., "non-interest-bearing and other retail accounts whose remuneration component is not relevant in the client's decision to hold money in the account". Figure 5 reports data for the category of retail non-transactional NMDs, i.e., "retail accounts (including regulated ones) whose remuneration component is relevant in the client's decision to hold money in the account". Retail transactional NMDs show a relatively even distribution across maturity buckets, suggesting a more stable holding pattern. As these accounts are primarily used for day-to-day transactions rather than interest accumulation, they are viewed by banks as a comparatively stable source of funding. In contrast, the maturity distribution of non-transactional NMDs shows pronounced peaks—particularly in shorter-term buckets (e.g., below three months)—reflecting clients' tendency to hold these deposits primarily for their remuneration. As a result, banks consider this category to be more sensitive to external factors, including interest rate changes, and therefore less sticky and more volatile than transactional NMDs. Lastly, Figure 6 displays the distribution of "deposits from corporate and other wholesale clients, excluding interbank accounts or other fully price-sensitive ones" (wholesale non-financial NMDs). A visual comparison with the retail categories reveals that banks, on average, assume these deposits to be more volatile and less predictable, as reflected in their behavioural maturity distributions. Banks tend to adopt a more conservative approach when modelling these deposits, typically classifying them as shorter-term liabilities. On average, approximately 50% of these deposits are allocated to the first two maturity buckets, ranging from overnight to less than one month. It is also worth noting that, for wholesale financial NMDs (i.e., interbank accounts), there is no distinction between contractual terms and banks' modelling, as that these deposits are consistently treated as overnight.

An additional insight emerges when comparing the treatment of deposits other than NMDs under contractual terms versus bank behavioural assumptions. As shown in Figure 7, the difference between the two approaches is less pronounced: even under banks' assumptions, the allocation remains relatively conservative, with a substantial share still classified as short-term. These deposits typically refer to instruments with a fixed maturity date or those requiring advance notice before withdrawal, thereby reducing the need for and reliance on behavioural modelling.

Taken together, the evidence discussed so far suggests that banks in our sample rely extensively on behavioural assumptions to model NMD maturities, aiming to capture the underlying stickiness of their deposit base. In particular, the data indicate that banks perceive retail transactional NMDs as the most stable category, distributing them across a wide range of maturities. By contrast, non-transactional retail deposits and wholesale non-financial deposits are modelled with greater sensitivity to short-term withdrawal risk and changing market conditions.

Turning to the trend analysis, Figure 8 shows the evolution of the weighted average maturity of NMDs over the sample period.[11] As expected, the maturity line based on banks' behavioural assumptions (red) is consistently higher than the contractual maturity line (blue). The dashed vertical line marks the start of the monetary policy tightening cycle in July 2022. Notably, the weighted average maturity of NMDs increased following this shift, rising from 2.00 to 2.15 years. While the change is modest—equivalent to roughly 55 days on average across banks—it is somewhat unexpected during a period of rapidly rising interest rates, when deposits typically become less stable. One possible explanation is that banks may have assumed greater stability in NMDs to mitigate the appearance of asset-liability mismatches in a high-rate environment. Alternatively, the increase could reflect the composition effect of losing more rate-sensitive, short-term deposits while retaining longer-term, stickier ones.

To gain further insight into the observed patterns, we examine the evolution of short- versus long-term NMDs volumes, distinguishing between retail and wholesale deposits. Figure 9 illustrates the time-series trend of total NMDs, disaggregated into short-term (below 1 year - solid blue line), medium-term (between 1 year and 5 year - dashed red line) and long term (above 5 years - dashed green line) categories. The increase in behavioural maturity observed after the onset of monetary tightening in mid-2022 (as shown in Figure 8) appears primarily driven by a decline in short-term NMD volumes. This pattern supports the interpretation that banks lost more volatile deposits while retaining those classified as longer-term and more stable. Figures 10 and 11, further decompose NMDs into retail and wholesale segments. Both figures confirm a decline in short-term NMDs, though with notable differences in timing. Short-term wholesale NMDs (Figure 11) exhibit a sharp decline in the quarter immediately following the onset of monetary tightening, followed by a more gradual decline. In contrast, short-term retail NMDs

[11] In this paper, we focus on the maturity (i.e., the *term* of NMDs) instead of the duration (i.e., the time to receive the cash-flows and thus the sensitivity of NMDs to changes in interest rates). The method for calculating the weighted average maturity is detailed in Appendix A.

declined more slowly but steadily over time (Figure 10), suggesting that wholesale NMDs are more sensitive to monetary policy shocks than retail deposits.

An alternative explanation for the rebound in behavioural maturity could lie in model recalibrations by banks. For instance, in response to the monetary policy tightening, banks may have updated their assumptions to reflect expectations of reduced deposit stickiness. Our confidential data indicate that only about half of the banks in the sample reported a change in their modelling assumptions over the four-year period, while the other half made no such changes. On average, banks revised their assumptions 1.88 times during this timeframe. Figure 12 shows the share of banks reporting a change in modelling assumptions in each quarter. This share averages to 11.3% across the sample. Although the frequency is slightly higher at the beginning of the period (never exceeding 20%), a t-test reveals no statistically significant difference in the share of banks reporting assumption changes before versus after the onset of monetary policy tightening.

Lastly, to complete the picture, we examine the evolution of the weighted average maturity for deposits other than NMDs. As shown in Figure 13, the contractual and behavioural maturities for this category remain closely aligned over time. This supports the notion that banks' modelling assumptions play a significant role primarily in the treatment of NMDs, while having minimal influence on the modelling of other deposit categories. Furthermore, although a slight increase in average maturity is observed following the onset of monetary policy tightening, there is no clear structural break relative to the pre-tightening period. This suggests that, while the volume of deposits other than NMDs may have increased after the tightening, the rise was relatively uniform across maturity buckets, leaving the overall maturity profile largely unchanged.

3 Empirical analysis

3.1 Methodology

A key question that naturally arises is whether banks' assumptions on NMD maturities accurately reflect their underlying balance sheet structures. For instance, if banks with a larger share of unstable deposits (e.g., uninsured deposits) report longer maturities for NMDs, implying greater stability, this may suggest a potential underestimation of deposit outflow risks or even point to "window-dressing" practices, with banks effectively banking on NMD assumptions to mask asset-liability challenges. This, in turn, could pose significant concerns for financial stability.

In this section, we empirically explore whether and to what extent banks' deposit mix influences the estimated maturity of NMDs, which is based on banks' assumptions rather than contractual terms. In principle, changes in a bank's liability composition are typically expected to affect the overall maturity of the liability side mechanically; for example, a reduction in long-term deposits would, *ceteris paribus*, shorten the average liability maturity. However, since we focus on the estimated maturity of NMDs, rather than on their contractual maturity, these mechanical correlations are less likely to be relevant.

We begin by employing a standard panel data estimation, which takes the following form:

$$Y_{i,t} = \alpha_b + \alpha_t + \beta Deposits\_Mix_{i,t-1} + \rho X'_{i,t-1} + \sigma Z'_{i,t} + \varepsilon_{i,t} \tag{1}$$

where $Y_{i,t}$ represents the weighted average maturity of NMDs for bank i at quarter t as estimated by the bank's internal behavioural models. $Deposits\_Mix_{i,t-1}$ is a comprehensive vector of granular deposit metrics, which are essential for understanding the composition and management of banks' liabilities. These variables are: (i) the ratio of deposits to total assets ($Deposits/TA$); (ii) the ratio of overnight deposits to total deposits ($Sh\_ON\_deposits$); (iii) the ratio of term (or time) deposits to total deposits ($Sh\_term\_deposits$); (iv) the ratio of overnight deposits from households to total overnight deposits ($Sh\_ON\_HHs\_deposits$); (v) the ratio of overnight deposits from non-financial corporations to total overnight deposits ($Sh\_ON\_NFCs\_deposits$); (vi) the share of uninsured deposits to total deposits ($Sh\_uninsured\_deposits$); (vii) the share of wholesale uninsured deposits to total deposits ($Sh\_wholesale\_uninsured\_deposits$); (viii) the deposit beta ($deposit\ \beta$); and (ix) a dummy variable equal to 1 if a bank experiences overnight deposit outflows in more than half of the quarters in the sample, and 0 otherwise ($Flighty\_ON\_deposit\_dummy$). Table A1 in Appendix A provides the definitions of all variables and their sources.

$X'_{i,t-1}$ is a vector of time-varying, bank-specific control variables, including: the (i) cash and cash balances at the central bank to total assets ratio ($Cash\_balances\_at\_CB/TA$), (ii) the logarithm of bank total assets (*Log TA*), (iii) the non-performing loans ratio (*NPL ratio*), (iv) the Common Equity Tier 1 ratio (*CET1 ratio*), (v) the ratio of net income to total assets (*ROA*), and (vi) the cost-to-income ratio (*CIR*). These indicators allow us to control for cross-sectional differences in banks' fundamentals, such as liquidity, size, riskiness, capitalization, profitability, and efficiency that may influence the extent to which banks rely on modelling assumptions. This is consistent with findings in the literature on the adoption of internal models for credit risk (Pérez Montes et al., 2018).[12] All bank-specific variables are lagged by one quarter to mitigate endogeneity concerns. Standard errors are clustered at the bank-level.

The vector $Z'_{i,t}$ includes: (i) the logarithmic change in NMD volumes for each maturity bucket, and (ii) a binary indicator equal to 1 if bank i reports a change in its internal NMD modelling assumptions in quarter t, and 0 otherwise. The first variable controls for changes in the weighted average maturity of NMDs that may result from shifts in the overall volume of deposits allocated to each maturity bucket, rather than from a reallocation of existing deposits across buckets. The second variable captures adjustments to NMD maturity stemming from revisions to banks' internal models.

Equation 1 is saturated with bank business model (α_b) and quarter fixed effects (α_t). In this empirical setting, bank business model fixed effects are particularly important, as a bank's asset-liability structure, and the associated challenges, are likely shaped by its business model.[13] Quarter fixed effects are included to account for common time trends affecting the estimated weighted average maturity of NMDs.[14]

[12]We include these control variables simultaneously in all regressions, while the $Deposit\_Mix$ variables are included individually or in combination ensuring that multicollinearity issues are avoided.

[13]For instance, given their size and complexity, G-SIBs typically engage in a wide range of activities, resulting in highly diversified asset and liability structures. This enables them to rely on multiple funding sources, including wholesale and corporate deposits, and to actively manage asset-liability mismatches through sophisticated hedging strategies and the use of derivative instruments. In contrast, retail-oriented and smaller lenders tend to have a narrower focus, relying predominantly on local household deposits and lending to small and medium-sized enterprises (SMEs). These institutions are generally less likely to use derivatives or engage in advanced hedging and are more exposed to local market conditions, making their asset-liability structures less flexible and potentially more vulnerable to shifts in depositor behaviour. While most bank types are heavily engaged in lending, institutions such as asset managers and custodians differ significantly, as their business models are oriented toward fee-based activities such as asset management, securities trading, and safekeeping. We therefore expect a bank's business model to influence its assumptions about NMD maturities, reflecting variation in depositor behaviour, funding stability, and the capacity to manage asset-liability mismatches. The distribution of banks in our sample, classified according to the SSM reporting framework, is shown in Table A2.

[14]It is worth noticing that bank fixed effects are not included, as the maturity of NMDs exhibits limited within-bank variation. Specifically, the within-bank standard deviation is 0.36 years, compared to a between-bank standard deviation of 1.33 years.

Although Equation 1 includes lagged independent variables, the possibility of endogeneity cannot be entirely ruled out. For example, shorter NMD maturities could reflect competitive pressures (i.e., low market power), which may also drive a higher deposit β or increased deposit outflows. In addition, targeted monetary and fiscal interventions during the Covid-19 pandemic may have influenced banks' NMD maturity assumptions independently of their liability structures. To address these concerns, the robustness checks discussed in Section 4.2 augment the baseline specification by including country $\times$ quarter fixed effects and controls for government guarantee schemes and the Targeted Longer-Term Refinancing Operations (i.e., TLTRO III). In addition, in Equation 2 of Section 3.4, we exploit a forceful and largely unanticipated monetary policy event to investigate whether banks' pre-existing balance sheet conditions influence their assumptions about NMD maturity following the tightening of monetary policy.

Table 2 presents the descriptive statistics for the variables used in the analysis. The dependent variable—*weighted average NMD maturity*—has a mean of 1.99 years and a standard deviation of 1.33, reflecting substantial cross-sectional variation in the behavioural assumptions made by banks in our sample regarding the stability of NMDs. In terms of deposit composition, overnight deposits account for 60.39% of total deposits on average, while term deposits represent 32.97%. Uninsured deposits make up 33.48% of total deposits, with wholesale uninsured deposits that are about 28.90% of total deposits. The *deposit beta* captures the responsiveness of a bank's deposit rate to changes in the monetary policy rates and also serves as a proxy for the bank's market power. It is computed as the ratio of the total weighted overnight deposit rates, weighted by deposit volumes across customer segments (NCFs or HHs), to the ECB's deposit facility rate. With a mean value of 0.073, this measure suggests that, on average, banks in our sample *pass through* only a small fraction of market rate changes to their depositors.[15]

3.2 Baseline results

Table 3 presents the baseline results based on Equation 1. Column 1 shows a positive and statistically significant (at the 1% level) association between the deposit-to-total-assets ratio and

[15]When the deposit *beta* is lower than 1, the intermediation margins earned on deposits (i.e., the difference between policy rates and deposit rates) helps to offset a potential reduction in the intermediation margin earned on bank assets (i.e., the difference between the rates paid by those assets and policy rates). Therefore, the lower *deposit beta*, the stronger is this hedging effect (Suarez, 2023).

assumed NMDs maturity. This suggests that banks with a higher proportion deposit funding tend to assign longer behavioural maturities to NMDs. The effect is also economically meaningful: a 10 percentage point increase in *Deposits/TA* corresponds to a rise in estimated NMD maturity of approximately 0.32 years (around 117 days). However, the deposits-to-total-assets ratio remains a relatively broad measure. It lacks the granularity needed to assess whether the resulting assumptions accurately reflect deposit stability. To address this, the subsequent columns introduce a more detailed categorization of deposits.

In columns 2 and 3 of Table 3, we decompose deposits into overnight and term deposits. The results show a negative and statistically significant association (at the 1% level) between the share of term deposits and assumed NMD maturity (column 3): a 10 percentage point increase in *Sh_term_deposits* is associated with a 0.27-year (approximately 99 days) decrease in estimated NMD maturity. This suggests that banks offering more fixed-term deposits—which typically carry higher interest rates—may expect greater NMD volatility, as customers are more likely to shift funds from overnight deposit accounts to term deposits in search of higher returns. By contrast, the share of overnight deposits (column 2) is positively associated with NMD maturity, and the coefficient is statistically significant at the 5% level. In principle, banks could assume longer maturities to NMDs if overnight deposits exhibit "stickiness". However, the actual stability of overnight deposits depends heavily on depositor type. Overnight deposits from households (*Sh_ON_HHs_deposits*) tend to be more stable than those from non-financial corporations (*Sh_ON_NFCs_deposits*), which typically hold larger accounts and often maintain relationships with multiple banks, making it easier to switch in search of better rates and services. This dynamic is even more pronounced in the current environment of internet banking, where transferring funds is fast and frictionless.[16] Figure 14 illustrates this pattern, showing that overnight deposits from NFCs have been notably more volatile than those from households (HHs) during the recent monetary policy tightening cycle. Specifically, the share of NFC overnight deposits declined by 12.33 percentage points, compared to a more modest reduction of 4.78 percentage points for HHs, a difference of 7.55 percentage points.

To better evaluate banks' modelling assumptions on NMDs, it is essential to further decompose overnight deposits by customer type, such as HHs and NFCs. Columns (4) and (5) of

[16] For example, SVB's depositors tried to withdraw $42 billion in only one day (www.bloomberg.com/news/articles/2023-03-11/svb-depositors-investors-tried-to-pull-42-billion-on-thursday)

Table 3 present the results from this decomposition. We find a positive and statistically significant association (at the 1% level) between the share of overnight deposits from HHs and the estimated NMD maturity (column 4). In contrast, the coefficient for NFCs is negative but not statistically significant (column 5). These results suggest that banks take deposit stability into account when calibrating NMD maturity assumptions, lending little support to the idea of risk underestimation or "window-dressing" behaviour—where banks with more volatile deposits would assume longer maturities.

One limitation of using the share of overnight deposits from HHs (NFCs) as a proxy for stable (unstable) deposits is that it does not clearly distinguish between the stable (insured) and the unstable (uninsured) component of deposits. The distinction is critical, as highlighted by the collapse of SVB, where a rapid outflow of uninsured deposits—primarily from NFCs—severely undermined the bank's liquidity position and forced asset sales at significant losses (Dewatripont et al., 2023; Beck et al., 2024). Uninsured deposits are significantly more volatile (Drechsler et al., 2023) as uninsured depositors lack the protection of deposit insurance and thus have stronger incentives to withdraw their funds during periods of uncertainty.[17] To address this issue, we extend the analysis by including two additional explanatory variables: the share of uninsured deposits relative to total deposits, and the share of wholesale uninsured deposits—i.e., those held by NFCs—relative to total deposits. The results are reported in columns (6) and (7) of Table 3. Both variables show a negative and statistically significant association with the estimated NMD maturity (at the 1% level), reinforcing the idea that banks with more volatile deposit bases tend to assume shorter NMD maturities. The coefficients are also economically meaningful, highlighting the importance banks place on deposit stability when calibrating maturity assumptions. Specifically, a 10 percentage point increase in the share of uninsured deposits (*Sh_uninsured_deposits*) is associated with a reduction of approximately 0.68 years (about 248 days) in estimated NMD maturity.

While decomposing deposits by type and customer base helps identify less stable deposits, a comprehensive assessment of how banks calibrate NMD maturity assumptions must also consider the sensitivity of deposits to changes in market and economic conditions. For instance, although HH deposits are typically more stable those from NFCs, they cannot be deemed inherently

[17] As widely discussed in both seminal theoretical contributions (Diamond and Dybvig, 1983) and more recent studies (Goldstein and Pauzner, 2005; Egan et al., 2017), uninsured deposits are particularly prone to runs and constitute a major source of instability in the banking sector.

"sticky" if they respond strongly to policy rate shifts. To capture this dimension of deposit sensitivity, we employ two measures. The first is the bank-level overnight *deposit* β, calculated as the time-varying ratio of the volume-weighted overnight deposit rate (for HHs and NFCs) to the deposit facility rate. By focusing on overnight deposits, we aim to capture the sensitivity of deposits generally perceived as more stable. Prior studies, such as Drechsler et al. (2021) and Cappelletti et al. (2024), show that the *deposit* β is a strong predictor of deposit outflows. However, its relationship with the estimated maturity of NMDs is not clear *a priori*. On one hand, banks with higher sensitivity to monetary policy changes (i.e., banks with a higher *deposit* β) or weaker market power may adopt more conservative modelling assumptions, assigning shorter maturities to NMDs to reflect perceived instability. On the other hand, a higher *deposit* β also implies that banks offer more attractive rates in response to policy changes, which may reduce customers' incentives to withdraw funds, potentially justifying longer assumed maturities. To further capture deposit instability, we introduce a second measure: a dummy variable equal to one if a bank experienced deposit outflows in at least half of the quarters during the sample period. Banks with such frequent outflows are expected to assume shorter NMD maturities, reflecting less stable deposits and thus heightened liquidity risk.[18]

We document a negative, sizeable, and statistically significant association between our variable of interest and both the *deposit* β (column 8) and the frequency of deposit outflows (column 9). In particular, a one standard deviation increase in the *deposit beta* corresponds to a decrease in NMD maturity of approximately 0.2 years (around 73 days). Similarly, banks that experienced multiple episodes of deposit outflows in at least half of the sample quarters exhibit a decrease in estimated NMD maturity of 0.67 years (approximately 275 days) compared to their peers. These findings further support the view that banks account not only for the composition of their deposit base but also for its sensitivity to changing market conditions when calibrating assumptions about NMD maturity.

To assess whether banks prioritize deposit sensitivity (measured by *deposit beta* and frequent deposit outflows) over deposit composition (measured by the share of (wholesale) uninsured deposits) when modelling their NMD maturity, we include multiple variables jointly in columns 10 and 11 of Table 3. The results show that the coefficients on deposit composition remain robust

[18] Table A3 shows that the two measures of deposit sensitivity are not strongly correlated with deposit composition by type or customer base.

even after accounting for deposit sensitivity. However, the effect of frequent deposit outflows becomes statistically insignificant in both columns, and the *deposit beta* loses significance in column 11. Comparing the magnitudes of the coefficients, we find that a 10 percentage point increase in the share of (wholesale) uninsured deposits reduces the estimated NMD maturity by approximately 0.51 years (around 186 days). By contrast, a one standard deviation increase in the *deposit* β is associated with a reduction of 0.16 years (around 58 days) in column 10—a decline of about 15 days relative to the estimate in column 8. These findings suggest that banks place greater emphasis on deposit stability in terms of composition (e.g., the share of uninsured deposits) rather than on the sensitivity of NMDs to changes in market and economic conditions. One possible interpretation is that, while banks can raise deposit rates to retain customers when interest rates increase, the behaviour of uninsured depositors may be driven by non-remunerative factors, such as perceived risks to bank solvency, as illustrated by the SVB case. As a result, banks may adopt a more conservative stance in modelling NMD maturities, giving greater weight to the share of uninsured deposits on their balance sheets.

Regarding bank-specific characteristics, our findings indicate that larger banks assume longer NMD maturities. The coefficients for *Log TA* are consistently positive and statistically significant at the 1% level across all specifications. This suggests that larger banks may perceive their deposits as more stable, potentially due to their reliance on more sophisticated internal models that support detailed and calibrated assumptions about deposit behaviour. We also find that more cost-efficient banks tend to estimate longer NMD maturities, although this result is not consistently significant across all specifications.[19]

3.3 Do Digital Deposits Matter?

Findings by Koont et al. (2023) show that the shift toward digitalization among U.S. banks has significantly affected depositor behaviour, particularly in a rising interest rate environment. Digitalization reduces deposit stickiness and increases rate sensitivity by allowing depositors to more easily compare returns and transfer funds to alternative providers, including non-bank financial institutions. In the European context, Fascione et al. (2024) examine how digitalization affects

[19] In online Appendix B.2, we empirically explore whether and to what extent banks' asset structure influences the estimated maturity of NMDs. We find that asset-side characteristics do not appear to influence NMD modelling assumptions, as most coefficients are statistically insignificant.

the validity of regulatory liquidity requirements under stress. They find that more digitalized banks experience faster and more severe deposit outflows than less digitalized peers, especially during crisis periods. In a recent study, Fascione et al. (2025) further investigate the relationship between digitalisation, social media, and deposit volatility for European banks. Their findings suggest that online banking usage can moderately amplify deposit outflows during periods of financial distress, while mobile app usage does not appear to exacerbate this effect. Crucially, neither digital channel has a causal impact on deposit volatility under normal market conditions.

In this section, we investigate the relationship between the digitalization of banks' deposit base and the estimated maturity of NMDs. To this end, we use supervisory reporting data collected as part of the 2023 SREP conducted by the ECB. This dataset contains unique information on the number of digital customers, defined as customers who accessed the bank's digital channels to perform at least one action or transaction within the past 12 months, and on the volume of deposits held in accounts opened digitally. We scale these two variables by, respectively, the total number of customers and the total deposits held by HHs and NFCs. This yields two key indicators: the share of digital customers (*Sh_digital_customers*) and the share of digital deposits (*Sh_digital_deposits*). Given that the data is only available for a single point in time (2023), we conduct a cross-sectional analysis for 2023Q3. While information on the share of digital customers and digital deposits is limited to 51 and 42 banks, respectively, the analysis nonetheless offers valuable insights into how banks incorporate deposit digitalisation when modelling NMD maturities.[20]

Table 4 presents the results of this additional analysis. We find a positive and statistically significant relationship between the share of digital customers and the estimated maturity of NMDs (column 1). At first sight, this could suggest that banks with a high share of digital customers may underestimate the impact of digitalisation on deposit stability. However, this variable may not accurately capture the degree of deposit digitalisation. From a stability perspective, the *volume* of digital deposits is more relevant than the *number* of digital users. As reported in Table 2, the average bank in our sample has 62.6% of customers using digital apps, while digital deposits represents only 3.4% of total deposits. In column 2, we find a positive and statistically significant coefficient (at the 1% level) for the share of digital deposits, indicat-

[20] As discussed in Fascione et al. (2024), the absence of comprehensive indicators to measure a bank's digitalisation level necessitates reliance on proxy variables.

ing that banks with more digitally originated deposits tend to assign shorter NMD maturities. Specifically, a 10 percentage point increase in this share reduces the estimated NMD maturity by about 0.21 years (77 days). Column 3 shows consistent results when both digitalisation variables are included. Overall, this evidence suggests that banks account for the degree of deposit digitalisation when calibrating their NMD assumptions.

3.4 Interaction with monetary policy changes

In Section 3, we show that banks account for the stability and interest rate-sensitivity of their deposit base when estimating NMD maturities. From a financial stability perspective, however, it is also important to assess whether banks adjust these assumptions in response to sudden changes in market conditions—such as sharp and unexpected interest rate hikes. In this section, we examine whether pre-existing differences in liability structures influenced how banks revised their assumptions on NMD maturities in response to the recent monetary policy tightening. Banks with more volatile or rate-sensitive deposits would be expected to shorten assumed NMD maturities to reflect the reduced stability of their funding base in such an environment. As shown in Figure 14, overnight deposits from both NFCs and HHs declined significantly during the tightening, confirming the increased volatility of deposits in this period.[21] Similarly, one would expect more frequent updates to internal models to reflect changes in depositor behaviour under these conditions. This is particularly relevant given that such models were mostly calibrated during a prolonged period of low interest rates, when the opportunity cost of holding non-interest-bearing deposits was low and NMDs exhibited high stickiness. Moreover, it is crucial to prevent banks from masking asset-liability management challenges by banking on NMD maturity assumptions. In a rising interest rate environment, banks with a higher share of unstable deposits prior to the tightening might refrain from shortening their assumed NMD maturities in order to limit the increase in interest rate risk exposure.[22] This is particularly important given the observed aggregate increase in NMD maturities since the onset of the tightening cycle (Figure 8).

[21] It is worth noting that banks are expected to report shorter assumed NMD maturities not only in response to an actual outflow of deposits, but also based on expectations that rapidly rising interest rates may affect depositor behaviour.

[22] Under the standard assumption of a positive duration gap— i.e., when asset duration exceeds liability duration—a reduction in the maturity of NMD widens, *ceteris paribus*, the duration gap, potentially triggering supervisory reaction.

To empirically investigate these aspects, we exploit the largest and swiftest increase in interest rates since the creation of the euro. The abrupt exit from a low interest rate environment, where deposits tend to be sticky, offers an ideal empirical setting to study changes in NMD maturity assumptions. While some monetary policy tightening was anticipated, the pace and magnitude of the actual increases were largely unexpected. Evidence from the publicly available ECB Survey of Monetary Analysts indicates that market participants' expectations ahead of the July 2022 ECB Governing Council meeting were significantly below the realised policy path, thereby limiting banks' ability to adjust NMD assumptions in anticipation (Figure 15).

To this end, we employ the two following OLS and logit model specifications:

$$Y_{i,t} = \alpha_b + \alpha_t + \beta Deposits\_Mix_{i,pre} + \theta Deposits\_Mix_{i,pre} \times \Delta DFR_t + \rho X'_{i,t-1} + \sigma Z'_{i,t} + \varepsilon_{i,t} \tag{2}$$

$$\begin{aligned} P_{i,t} \;=\; \Pr(Y_{i,t} = 1 \mid \mathbf{Z}_{i,t}) = \Lambda\Big(&\alpha_b + \alpha_t + \beta\, Deposits\_Mix_{i,\text{pre}} \\ &+\theta\, Deposits\_Mix_{i,\text{pre}} \times \Delta DFR_t + \rho\, \mathbf{X}'_{i,t-1} + \sigma Z'_{i,t} + \varepsilon_{i,t}\Big) \end{aligned} \tag{3}$$

In Equation 2, $Y_{i,t}$ indicates the weighted average maturity of NMDs for bank i at quarter t as in equation 1, whereas in Equation 3, it refers to a binary variable equal to 1 if a bank reports a change in its assumptions at quarter t, and 0 otherwise. Deposit mix variables are defined as in Equation 1, but are measured prior to the start of the monetary policy tightening. Specifically, we take the average of each continuous variable over the quarters preceding the tightening. To identify banks with flighty overnight deposits, we use a dummy variable equal to 1 if a bank exhibits overnight deposit outflows in more than half of the quarters before the tightening, and 0 otherwise. ΔDFR_t denotes the quarter-on-quarter change in the deposit facility rate, expressed in percentage points. $X'_{i,t-1}$ and $Z'_{i,t}$ are vectors of time-varying, bank-specific control variables, as defined in Equation 1. Bank business model and quarter fixed effects are included and standard errors are clustered at the bank-level. The sample used to estimate Equation 2 and 3 is restricted to 2021Q1–2023Q3 in order to ensure a balanced time window both before and after the monetary policy tightening.[23]

[23] As reported in Tables B3 and B4 of the Online Appendix, the findings remain robust when the full sample period (2019Q2-2023Q3) is used.

Tables 5 and 6 present the results of Equations 2 and 3. Most interaction terms with ΔDFR are statistically insignificant, suggesting no differential impact of liabilities structures on the estimated maturity of NMDs following the tightening of monetary policy. In particular, banks with more volatile or interest rate-sensitive deposits did not assume shorter NMD maturities during this period (Table 5). Similarly, we find no evidence that these banks were more likely to update their modelling assumptions amid rapidly rising interest rates, as most interaction terms are statistically insignificant. The only exception is the interaction between pre-tightening household overnight deposits *(Sh_ON_HHs deposits (pre)* $\times$ Δ *DFR)*, which is only marginally significant (Table 6).[24]

4 Robustness checks

4.1 Controlling for country-specific characteristics

To ensure the robustness of our findings, we augment the baseline regression with country $\times$ time fixed effects. This approach allows us to control for both observable and unobservable country-specific factors—whether time-varying or time-invariant—that may influence the estimated maturity of NMDs. Such factors include differences in regulatory frameworks, local market conditions, cultural norms, and demographic characteristics, all of which can shape banks' perceptions of deposit stability and, in turn, their NMD maturity assumptions. For instance, cross-country differences in regulatory policies can affect how banks manage deposit maturities. In France, for example, the *Livret A* regulated savings scheme imposes government-set interest rates on certain accounts, which are decoupled from market conditions and limit banks' flexibility in adjusting deposit remuneration.[25] During the recent period of negative interest rates, jurisdiction-specific institutional features imposed legal constraints on the ability of banks to pass through negative rates to customers (Demiralp et al., 2021). Next to the bank-level market power which is controlled for through the inclusion of the *deposit* β, the level of competition within the banking sector may affect banks' ability to retain their deposit base and, conse-

[24] It is important to note that investigating the relationship between banks' liability structure and changes in banks NMD internal models as done in equation 1 is less relevant as changes in internal models are mostly expected following significant shifts in customer behaviour and economic environment.

[25] A *Livret A* deposit is a state-guaranteed, tax-free savings account that can be opened by any individual or non-profit organization and accessed at any time. For further details, see Duquerroy et al. (2020).

quently, influence their assumptions regarding NMD stability. In addition, cultural attitudes toward savings and demographic factors—such as age distribution—can influence depositor behaviour and, in turn, banks' perceptions of deposit stability. However, many of these elements remain unobserved due to data limitations. By including country × time fixed effects, we aim to absorb both observed and unobserved sources of country-level heterogeneity, thereby better isolating the impact of our explanatory variables on the estimated average maturity of NMDs. The results reported in Table 7 remain broadly consistent with our baseline findings.

4.2 Controlling for fiscal and monetary policy measures

Our sample period includes the pandemic years, during which bank balance sheets were significantly affected by extraordinary policy interventions aimed at mitigating the economic fallout and preserving financial stability. These temporary measures included, among others, government loan guarantee schemes and the ECB's TLTRO III. Government loan guarantee schemes aimed to support business lending by reducing the credit risk associated with bank loans, while the TLTRO III program offered banks favourable funding conditions, encouraging them to maintain or expand credit to the real economy during a period of heightened uncertainty. These fiscal and monetary policy interventions, combined with depositors' *flight to safety* behaviour, led to a substantial inflow of deposits during the pandemic (Li et al., 2020; Levine et al., 2021)—see Figure A1. Loans backed by government guarantees were often deposited into borrowers' accounts but not immediately used, due to uncertainties surrounding the evolution of the pandemic, elevated risk sentiment, or delays in planned expenditures. In parallel, the favourable conditions of the TLTRO III program incentivized banks to expand credit to businesses, further amplifying deposit inflows.[26] These substantial deposit inflows likely affected banks' balance sheet structures and, in turn, their assumptions regarding the maturity of NMDs. Moreover, the typical maturity of TLTRO III operations—ranging from three to four years—extended the overall maturity profile of banks' liabilities. This may have led some banks to underestimate the maturity of other liability components, such as NMDs, within their internal modelling frameworks.

In Table 8, we extend the analysis by adding controls for the share of government-guaranteed

[26] By June 2022, borrowing under the TLTRO III program reached €1.9 trillion, accounting for an average of 7.6% of total liabilities among euro area SIs.

loans and the share of outstanding TLTRO amounts relative to total assets. The results remain broadly consistent with our baseline findings, confirming the robustness of the analysis across specifications. Importantly, the inclusion of these variables shows that their coefficients are generally statistically insignificant, suggesting that these temporary policy measures did not materially influence banks' assumptions about NMD maturity during the sample period.

4.3 The SVB fallout

In this section, we exploit the collapse of SVB as an exogenous shock to banks' expectations about the maturity of NMDs. As in Section 3.4, we limit the time period to 2021Q1-2023Q3. While the SVB fallout did not trigger substantial deposit outflows in the euro area, Perdichizzi and Reghezza (2023) document a pronounced market response: euro area banks experienced average cumulative abnormal returns (CAR) of approximately –10% in its immediate aftermath. This heightened market sensitivity may have led banks to reassess the stability of their deposit base and revise the estimated maturity of NMDs. Although our dataset spans only two quarters following the SVB collapse, we argue that the magnitude of the shock is sufficient to expect adjustments in NMD maturity assumptions.

To test this, we define a dummy variable (SVB) equal to 1 from 2023Q2 onward (i.e., after the SVB collapse), and 0 otherwise. We then interact this variable with the liability structure indicators used in our baseline specifications, all measured prior to the SVB event. The results, reported in Table 9 reveals no statistically significant effect of the ex-ante deposit mix on the estimated NMD maturity after the SVB shock. The interaction terms with the SVB dummy are insignificant, suggesting that banks with more volatile deposit bases did not significantly adjust their NMD assumptions in response.

5 Conclusions

This paper offers a comprehensive investigation into how euro area SIs manage the behavioural maturity of their NMDs, using evidence from a period marked by substantial shifts in monetary policy and market conditions.

Bank deposits are of particular importance to both researchers and policymakers for several reasons. First, deposit-taking is a core function unique to the banking sector and depends critically on depositor confidence in the system's stability. Second, a significant share of banks' funding consists of NMDs, which can be withdrawn on demand and therefore pose distinct challenges for liquidity and interest rate risk management. Third, although deposits are traditionally seen as stable—since depositors often leave their funds untouched for extended periods, allowing banks to perform maturity transformation—recent developments have cast doubt on the reliability of this assumption. Periods of financial distress and shifts in the interest rate environment, combined with increased digitalization, have heightened deposit mobility by enabling depositors to swiftly reallocate funds toward alternatives offering higher yields or lower perceived risks.

To manage their asset and liability profiles and associated risks, banks must make assumptions about the effective maturity of NMDs. This typically involves the use of statistical models grounded in assumptions informed by the observed past behaviour of depositors. Our descriptive analysis shows that while only 20% of NMDs are treated as floating-rate liabilities with zero maturity in line with their contractual terms, a notable share—approximately 10%—is assigned significantly longer maturities, exceeding seven years. The empirical evidence suggests that banks in our sample do not appear to underestimate deposit outflow risks or engage in window-dressing to mask asset-liability mismatches. Instead, they seem to calibrate their modelling assumptions in accordance with their balance sheet structures, with particular attention to liability-side features linked to deposit stability.

However, our results also suggest that pre-existing differences in deposit structures did not influence banks' estimates of NMD maturities amid rapidly rising interest rates. Specifically, banks with more volatile or interest rate-sensitive deposits did not shift their NMD assumptions toward shorter-term maturity buckets. Nor were these banks more likely to update their internal models following the onset of monetary policy tightening. This may reflect either an underestimation of the risks associated with deposit volatility in a changing rate environment, or a slow adjustment process in banks' internal modelling frameworks.

The findings in this paper provide valuable insights for supervisors and policymakers. Given that renewed variability in policy rates and increased digitalization may have structurally changed depositor behaviour, banks may need to reassess their internal models to better reflect the influence of deposit characteristics on the estimated maturity of NMDs. Future research could investigate the extent to which these models are equipped to adapt to such structural shifts in customer behaviour—an issue that is central to the evolving policy debate on the appropriate regulatory treatment of bank risks, particularly IRRBB, liquidity risk, and their complex interplay.

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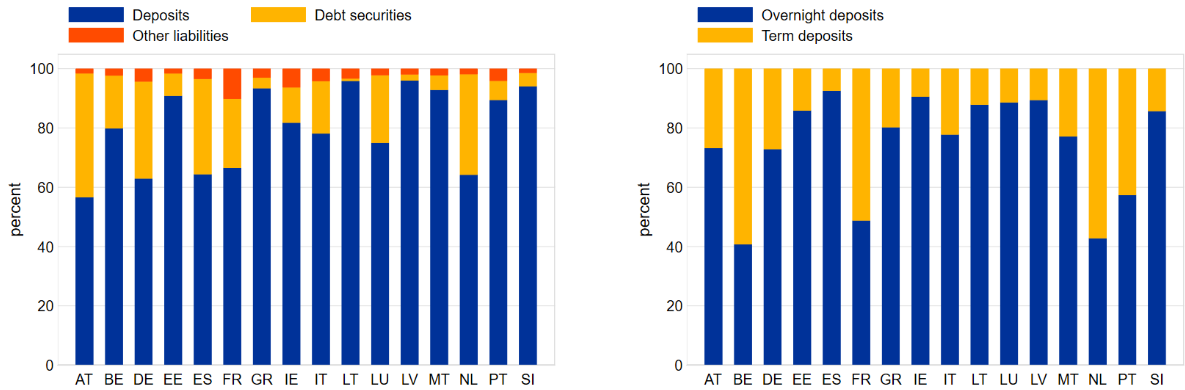
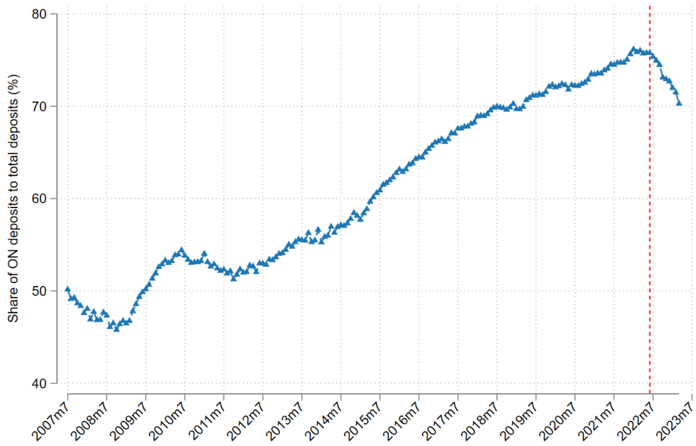
Figure 1: Composition of bank liabilities and deposit types across euro area countries



(a) Shares of deposits, debt securities and other liabilities by euro area countries. Source: ECB Balance Sheet Items.

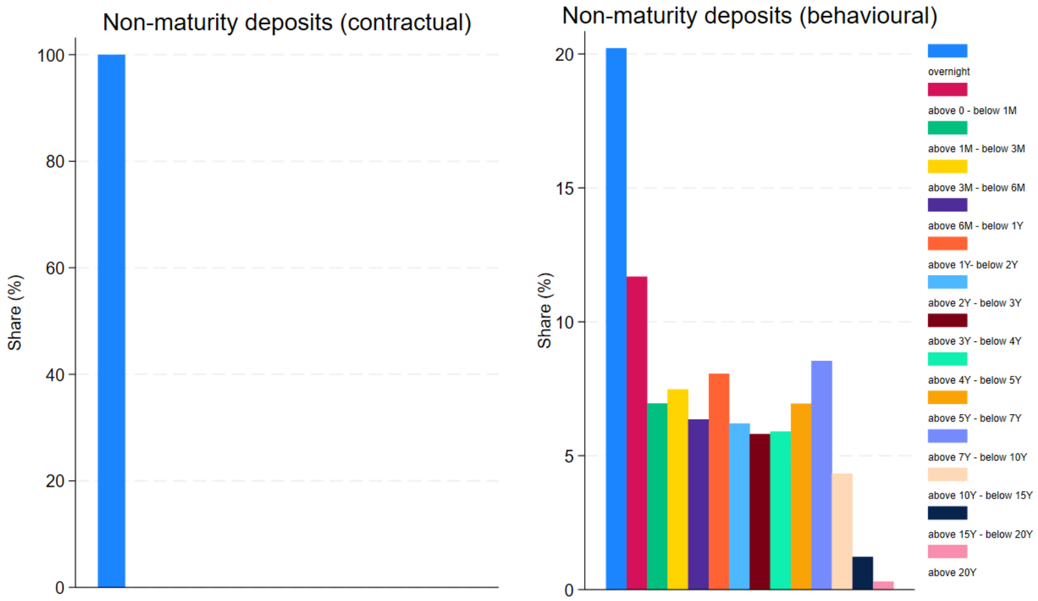
(b) Shares overnight deposits and term deposits by euro area countries. Source: ECB Individual Balance Sheet Items.

Figure 2: Share of overnight deposits (July 2007 - July 2023)



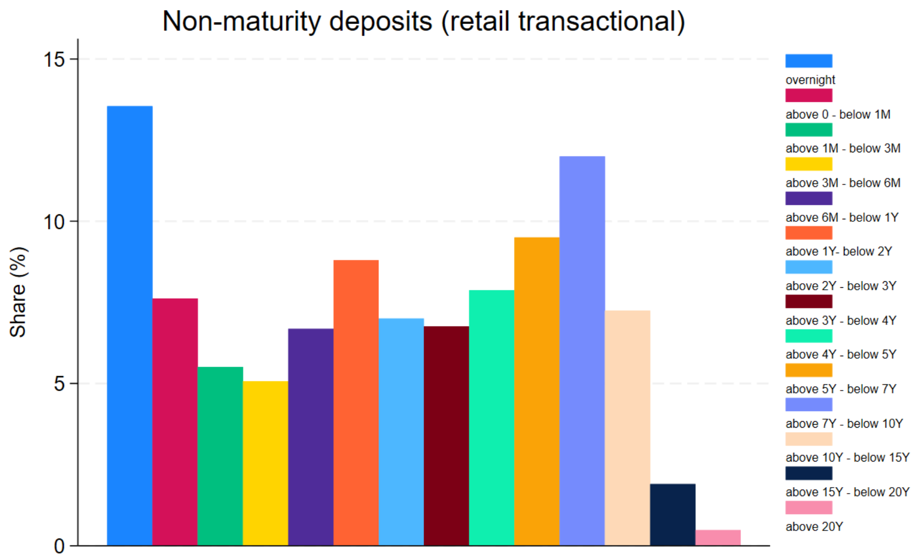
Notes: The dashed line marks the beginning of the monetary policy tightening. Source: ECB Individual Balance sheet Items.

Figure 3: NMDs - contractual versus behavioural assumptions



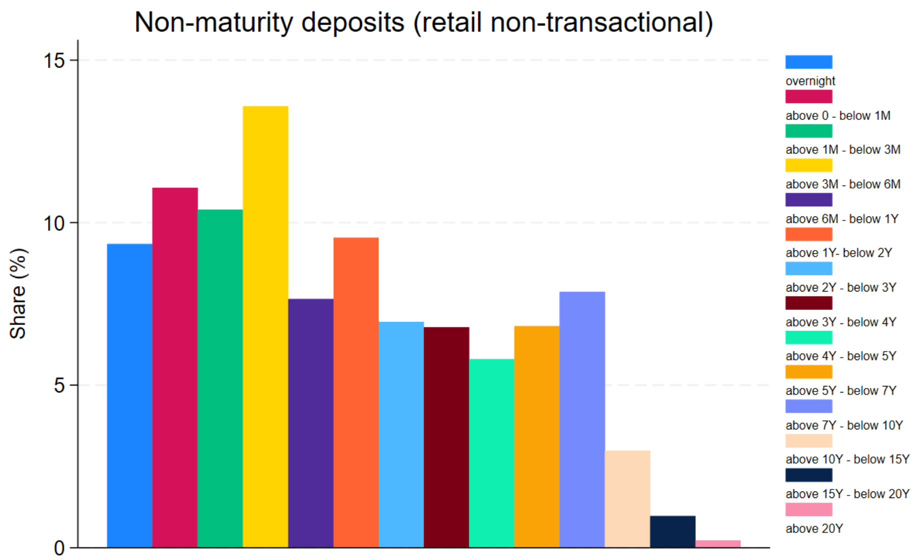
Notes: Each bar shows the average share of cash-flows reported in a specific maturity bucket for our sample of 67 banks across 2019Q2-2023Q3. Source: ECB Supervisory Statistics.

Figure 4: NMDs - Retail Transactional



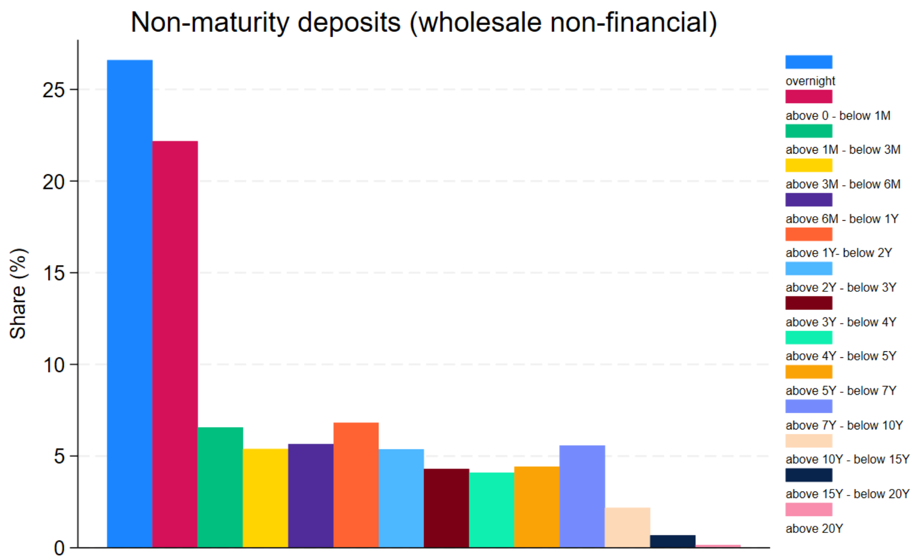
Notes: Each bar shows the average share of cash-flows reported in a specific maturity bucket for our sample of 67 banks across 2019Q2-2023Q3. Source: ECB Supervisory Statistics.

Figure 5: NMDs - Retail Non-Transactional



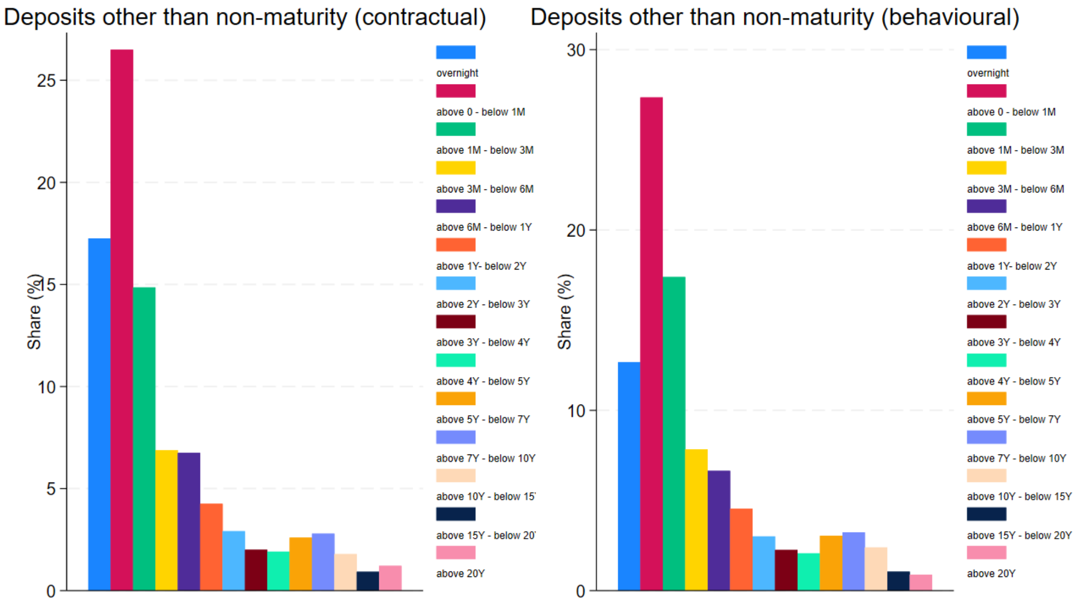
Notes: Each bar shows the average share of cash-flows reported in a specific maturity bucket for our sample of 67 banks across 2019Q2-2023Q3. Source: ECB Supervisory Statistics.

Figure 6: NMDs - Wholesale Non-Financial



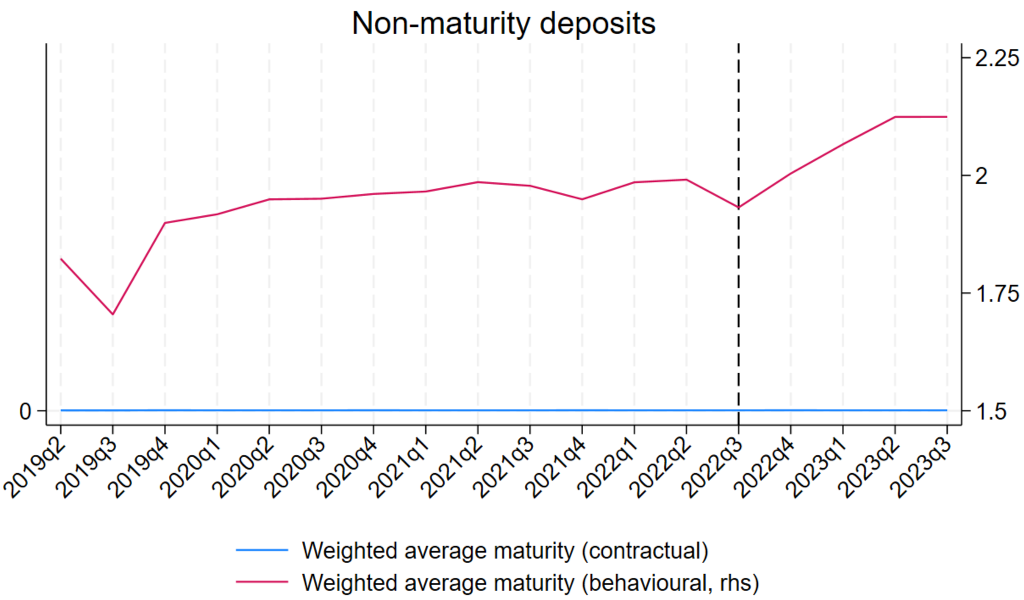
Notes: Each bar shows the average share of cash-flows reported in a specific maturity bucket for our sample of 67 banks across 2019Q2-2023Q3. Source(s): ECB Supervisory Statistics.

Figure 7: Deposits other than NMDs - contractual versus behavioural assumptions



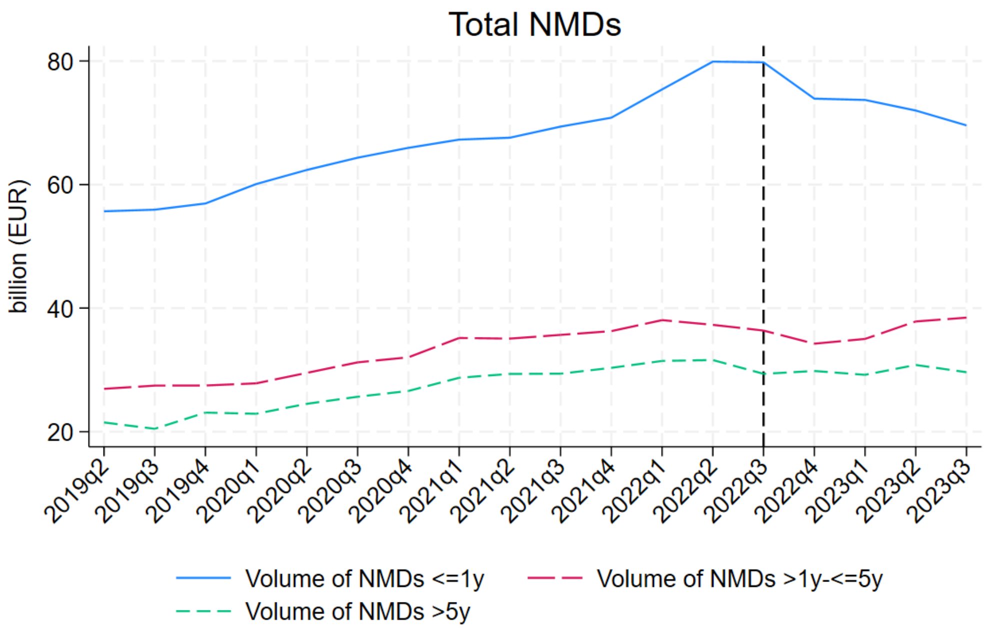
Notes: Each bar shows the average share of cash-flows reported in a specific maturity bucket for our sample of 67 banks across 2019Q2-2023Q3. Source: ECB Supervisory Statistics.

Figure 8: NMDs maturity: Evolution over time



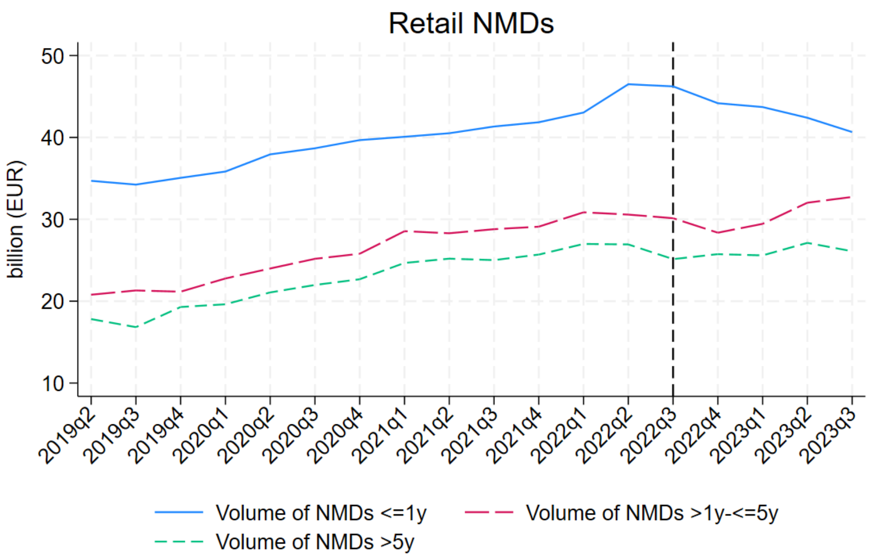
Notes: The dashed line marks the beginning of the monetary policy tightening. The weighted average maturity is calculated as discussed in Section A.1. The lines represent the average values for our sample of 67 banks. Source: ECB Supervisory Statistics.

Figure 9: Total NMDs volumes: Evolution over time



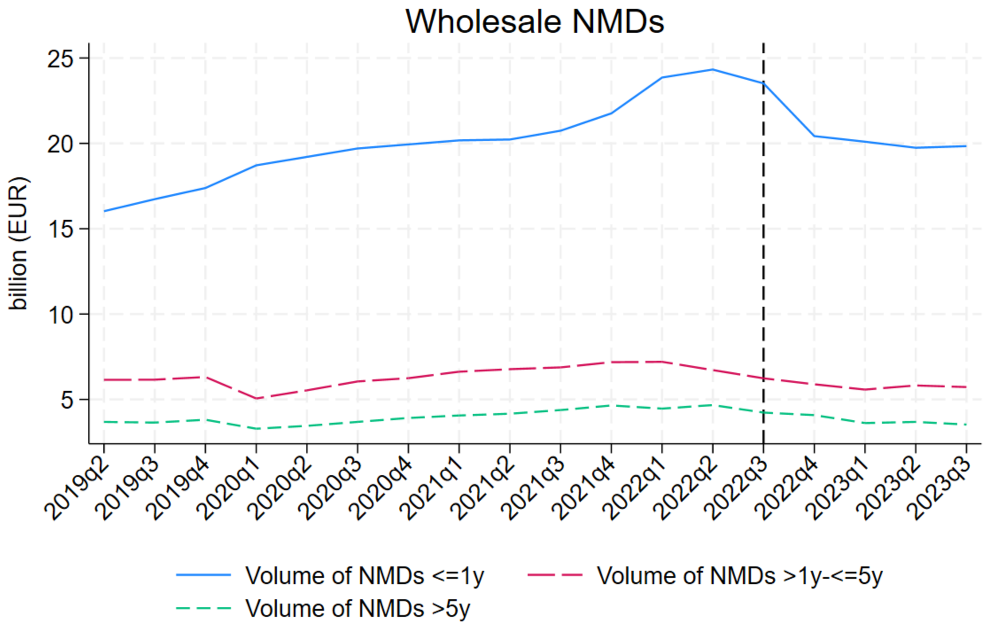
Notes: The dashed line marks the beginning of the monetary policy tightening. The volumes reflect the sum of cash-flows across the relevant maturity buckets. The lines represent the average values for our sample of 67 banks. Source: ECB Supervisory Statistics.

Figure 10: Retail NMDs volumes: Evolution over time



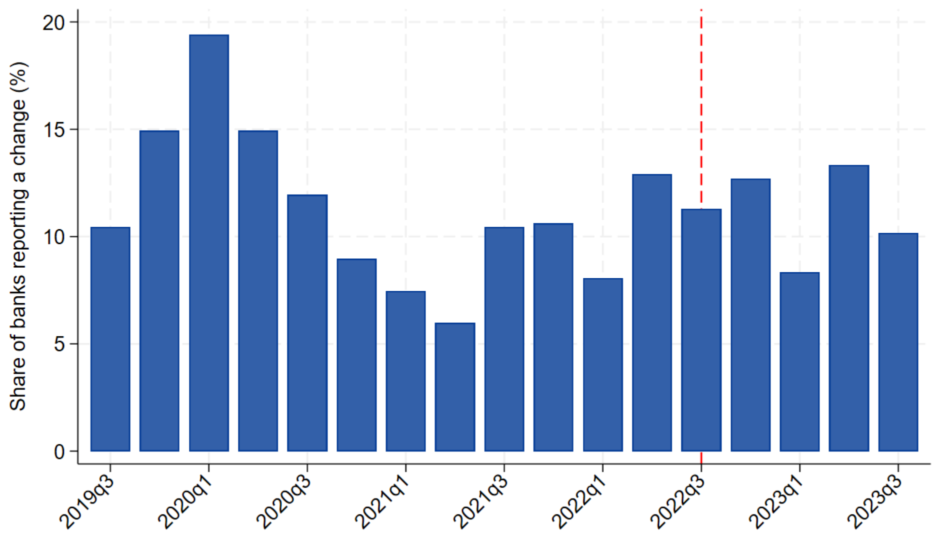
Notes: The dashed line marks the beginning of the monetary policy tightening. The volumes reflect the sum of cash-flows across the relevant maturity buckets. The lines represent the average values for our sample of 67 banks. Source: ECB Supervisory Statistics.

Figure 11: Wholesale NMDs volumes: Evolution over time



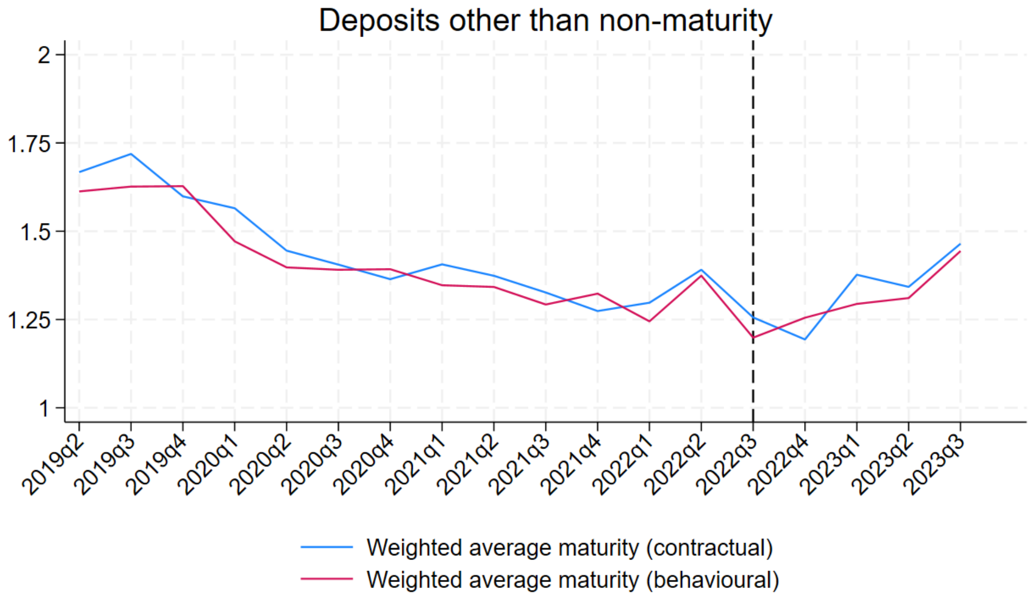
Notes: The dashed line marks the beginning of the monetary policy tightening. The volumes reflect the sum of cash-flows across the relevant maturity buckets. The lines represent the average values for our sample of 67 banks. Source: ECB Supervisory Statistics.

Figure 12: Frequency of reported changes to modelling assumptions over time



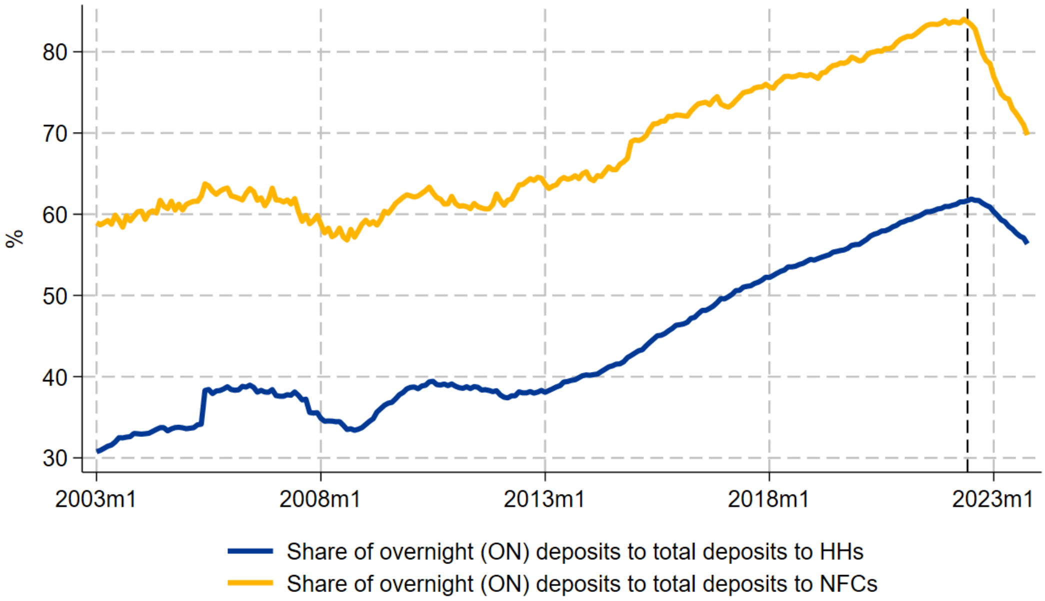
Notes: The dashed line marks the beginning of the monetary policy tightening. Source: ECB Supervisory Statistics.

Figure 13: Deposits other than NMDs duration: Evolution over time



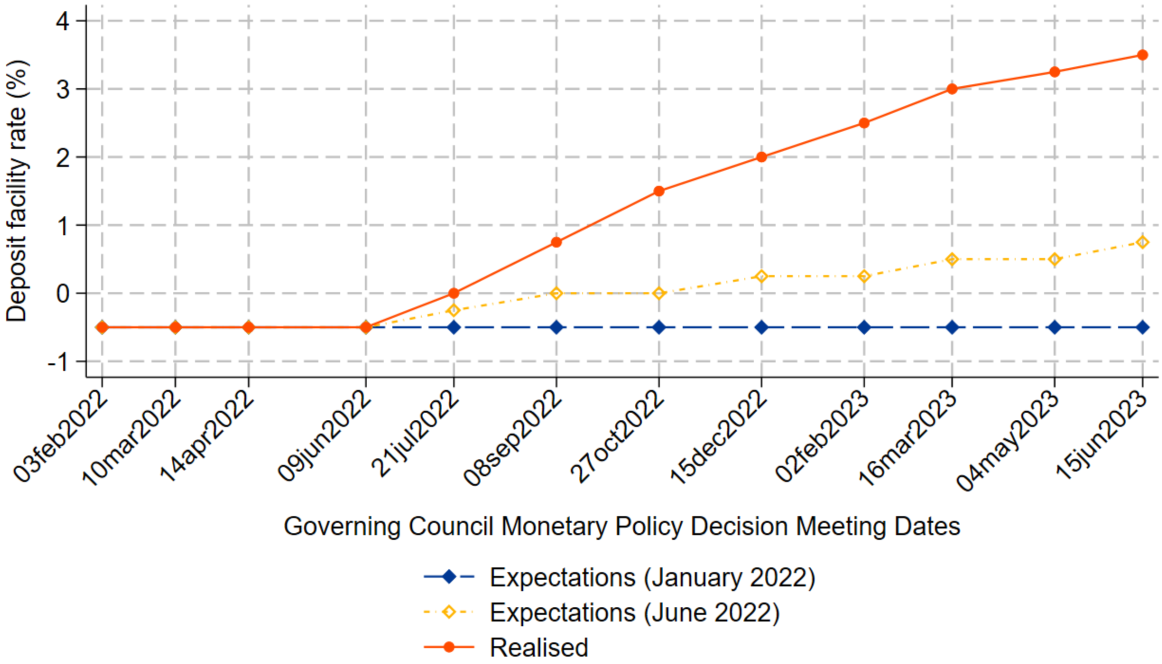
Notes: The dashed line marks the beginning of the monetary policy tightening. The weighted average maturity is calculated as discussed in Section A.1. The lines represent the average values for our sample of 67 banks. Source: ECB Supervisory Statistics.

Figure 14: Share of overnight deposits by customer type (January 2003 - January 2024)



Notes: The dashed dark grey line marks the beginning of the monetary policy tightening. Source: ECB Balance Sheet Items.

Figure 15: Expectations of market participants on the future evolution of the deposit facility rate.



Source: Survey of Monetary Analysts.

Table 1: Country-level breakdown of banks and observations

Country	Nr. of banks	Nr. of obs
Austria	3	47
Belgium	4	72
Estonia	2	30
France	8	144
Germany	14	252
Greece	4	72
Ireland	1	18
Italy	8	144
Lithuania	2	23
Luxembourg	2	35
Latvia	2	28
Malta	1	14
Netherlands	3	54
Portugal	2	36
Slovenia	2	33
Spain	9	162
Total	67	1164

Table 2: Descriptive statistics

	N	Mean	Std.dev.	p25	p75	Min.	Max.
Endogeneous variables:							
Weighted average NMD maturity (years)	1164	1.985	1.333	0.819	2.964	0	5.313
Bank-level variables:							
Cash_balances_at_CB/TA (%)	1163	12.514	11.590	2.580	17.694	0	57.843
Log TA	1163	4.799	1.517	3.907	5.841	1.460	7.629
CET1 ratio (%)	1164	17.931	7.571	13.639	18.326	10.968	57.032
NPL ratio (%)	1163	3.907	6.203	1.130	3.998	0	48.754
ROA (%)	1163	0.451	0.840	0.162	0.729	-3.690	3.174
CIR (%)	1164	61.374	19.650	49.147	71.385	12.905	129.324
Deposits/TA (%)	1163	45.656	23.398	27.688	62.301	0.016	82.453
Sh_ON_deposits (%)	1164	60.385	22.427	44.989	75.636	1.814	100
Sh_ON_HHs_deposits (%)	1164	49.468	25.030	32.515	67.189	0	91.715
Sh_ON_NFCs_deposits (%)	1164	27.328	17.157	17.137	35.307	0.007	96.300
Sh_term_deposits (%)	1164	32.965	20.496	19.620	41.099	0	95.108
Sh_uninsured_deposits (%)	1138	33.478	10.422	25.891	41.918	7.140	50
Sh_wholesale_uninsured_deposits (%)	1138	28.896	12.424	20.091	38.203	5.751	50
Flighty_ON_deposits_dummy	1164	0.155	0.362	0	0	0	1
Deposit β	1093	0.073	0.315	-0.027	0.089	-1.031	1.062
Sh_digital_customers (%)	52	62.620	18.536	56.933	72.462	0	100
Share_digital_deposits (%)	41	3.417	11.630	0.008	1.010	0	70.777
Guaranteed_loans/TA (%)	1164	0.692	1.425	0	0.663	0	8.969
TLTRO/TA (%)	639	8.208	5.505	3.476	12.449	0	24.546

Notes: For each variable, the number of observations (N), mean, standard deviation (Std. Dev.), percentiles (p25 and p75), minimum, and maximum values are reported. The weighted average NMD maturity (years) is the dependent variable, representing the average maturity of non-maturity deposits (NMDs) held by banks. The Cash balances at CB/TA (%) indicate cash and cash balances held at the central bank to total assets. The Log TA is the natural logarithm of banks' total assets, reflecting size. The CET1 ratio (%) is the ratio of Common Equity Tier 1 capital to risk-weighted assets. The NPL ratio (%) measures the ratio of non-performing loans to gross loans, and the ROA (%) represents the return on assets as net income relative to total assets. The CIR (%) is the cost-to-income ratio, calculated as operating expenses divided by operating income. The Deposits/TA (%) is the ratio of total deposits to total assets. The Sh. ON deposits (%) reflects the share of overnight deposits to total deposits, while the Sh. ON HHs deposits (%) and Sh. ON NFCs deposits (%) are the shares of overnight deposits held by households and non-financial corporations, respectively, relative to total overnight deposits. The Sh. term deposits (%) represents the share of term deposits (redeemable upon notice) to total deposits, and the Sh. uninsured deposits (%) reflects the share of deposits not covered by insurance to total deposits. The Sh. wholesale uninsured deposits (%) measures the share of uninsured deposits from non-household entities. The Flighty ON deposits dummy equals 1 if a bank exhibits overnight deposit outflows in more than half of the sample quarters, and 0 otherwise. The Deposit β captures deposit rate pass-through, measuring the sensitivity of deposit rates to central bank policy rate changes. The Sh. digital customers is the ratio of digital customers to total customers (available only for 2023), and the Share of digital deposits reflects the share of digitally opened deposits relative to total deposits from households and non-financial corporations (available only for 2023). The Guaranteed_loans/TA (%) is the ratio of government guaranteed loans to total assets. The TLTRO/TA (%) is the ratio of Targeted Longer-term Refinancing Operation III to total assets. The sample period spans 2019Q2 to 2023Q3. All variables are winsorized at the 1% level.

Table 3: Deposit mix and estimated maturity of NMDs

	Weighted average maturity NMDs										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (lag)	0.032***										
	(6.91)										
Sh_ON_deposits (lag)		0.014**									
		(2.30)									
Sh_term_deposits (lag)			-0.027***								
			(-6.26)								
Sh_ON_HHs_deposits (lag)				0.028***							
				(6.17)							
Sh_ON_NFCs_deposits (lag)					-0.011						
					(-1.42)						
Sh_uninsured_deposits (lag)						-0.068***				-0.060***	
						(-6.69)				(-5.63)	
Sh_wholesale_uninsured_deposits (lag)							-0.057***				-0.051***
							(-6.77)				(-5.59)
Deposit beta (lag)								-0.615*		-0.506*	-0.409
								(-1.73)		(-1.91)	(-1.64)
Flighty_ON_deposits_dummy (lag)									-0.673**	-0.170	-0.095
									(-2.40)	(-0.63)	(-0.33)
Cash_balances_at_CB/TA (lag)	-0.009	-0.008	-0.014*	-0.001	-0.002	-0.007	-0.007	-0.010	-0.003	-0.018*	-0.018*
	(-1.03)	(-0.83)	(-1.72)	(-0.20)	(-0.17)	(-0.79)	(-0.80)	(-0.75)	(-0.32)	(-1.82)	(-1.83)
Log TA (lag)	0.826***	0.746***	0.776***	0.665***	0.705***	0.760***	0.796***	0.704***	0.728***	0.762***	0.791***
	(7.70)	(5.97)	(7.42)	(7.05)	(6.38)	(7.97)	(8.37)	(5.96)	(6.51)	(7.68)	(7.86)
NPL ratio (lag)	0.006	0.020	0.018	0.008	0.032*	0.002	0.003	0.024	0.028	-0.002	-0.000
	(0.38)	(1.28)	(1.21)	(0.51)	(1.83)	(0.10)	(0.17)	(1.45)	(1.65)	(-0.11)	(-0.02)
CET1 ratio (lag)	0.001	-0.018	-0.016	0.002	-0.016	0.002	0.002	-0.045**	-0.011	-0.009	-0.010
	(0.11)	(-1.29)	(-1.48)	(0.20)	(-1.03)	(0.16)	(0.18)	(-2.56)	(-0.52)	(-0.48)	(-0.58)
ROA (lag)	-0.034	0.052	0.019	0.037	0.124*	-0.035	-0.017	0.093	0.104	-0.034	-0.018
	(-0.83)	(0.90)	(0.43)	(0.76)	(1.75)	(-0.76)	(-0.38)	(1.44)	(1.38)	(-0.75)	(-0.42)
CIR (lag)	0.007**	0.007**	0.005	0.005*	0.008**	0.007**	0.007**	0.007*	0.009**	0.006*	0.006*
	(2.10)	(2.11)	(1.50)	(1.67)	(2.25)	(2.23)	(2.16)	(1.95)	(2.30)	(1.83)	(1.75)
Observations	1102	1102	1102	1102	1102	1078	1078	1035	1102	1011	1011
Adjusted R^2	0.614	0.507	0.573	0.618	0.476	0.596	0.602	0.475	0.489	0.595	0.598
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. The description of each variables is provided in Table A1 in Appendix A.*

Table 4: Bank customer digitalization and estimated maturity of NMDs

	Weighted average maturity NMDs		
	(1)	(2)	(3)
Sh_digital_customers	0.030***		0.033***
	(4.26)		(4.09)
Sh_digital_deposits		-0.021**	-0.025***
		(-2.24)	(-4.60)
Cash_balances_at_CB/TA (lag)	-0.063***	-0.036	-0.053*
	(-3.06)	(-0.89)	(-1.86)
Log TA (lag)	0.249**	0.414**	0.280*
	(2.44)	(2.59)	(2.04)
NPL ratio (lag)	-0.006	0.152	-0.017
	(-0.09)	(1.29)	(-0.16)
CET1 ratio (lag)	-0.004	0.024	-0.023
	(-0.16)	(0.44)	(-0.44)
ROA (lag)	-0.292	-0.096	-0.323
	(-1.51)	(-0.28)	(-1.45)
CIR (lag)	0.010	0.014	0.010
	(1.19)	(0.90)	(0.97)
Observations	52	41	41
Adjusted R^2	0.46	0.43	0.62

*Notes: ***: 0.01, **: 0.05, *: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. This is a cross-sectional analysis for 2023Q3. The description of each variables is provided in Table A1 in Appendix A.*

Table 5: Deposit mix and estimated maturity of NMDs pre- and post-monetary policy tightening

	Weighted average maturity NMDs										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (pre)	0.032***										
	(6.22)										
Deposits/TA (pre) × Δ DFR	-0.001										
	(-0.61)										
Sh_ON_deposits (pre)		0.015**									
		(2.19)									
Sh_ON_deposits (pre) × Δ DFR		-0.000									
		(-0.08)									
Sh_term_deposits (pre)			-0.029***								
			(-5.55)								
Sh_term_deposits (pre) × Δ DFR			0.001								
			(0.48)								
Sh_ON_HHs_deposits (pre)				0.028***							
				(5.55)							
Sh_ON_HHs_deposits (pre) × Δ DFR				-0.001							
				(-0.44)							
Sh_ON_NFCs_deposits (pre)					-0.010						
					(-1.23)						
Sh_ON_NFCs_deposits (pre) × Δ DFR					-0.000						
					(-0.03)						
Sh_uninsured_deposits (pre)						-0.074***				-0.063***	
						(-6.15)				(-5.60)	
Sh_uninsured_deposits (pre) × Δ DFR						0.001				0.001	
						(0.31)				(0.20)	
Sh_wholesale_uninsured_deposits (pre)							-0.061***				-0.052***
							(-6.19)				(-5.56)
Sh_wholesale_uninsured_deposits (pre) × Δ DFR							0.002				0.002
							(0.68)				(0.51)
Deposit beta (pre)								-0.820*		-0.643*	-0.539
								(-1.89)		(-1.86)	(-1.59)
Deposit beta (pre) × Δ DFR								0.093		0.093	0.075
								(1.43)		(1.38)	(1.06)
Flighty_ON_deposits_dummy (pre)									-0.624	-0.627***	-0.550**
									(-1.29)	(-2.73)	(-2.24)
Flighty_ON_deposits_dummy (pre) × Δ DFR									-0.097	-0.024	-0.045
									(-1.17)	(-0.28)	(-0.52)
Cash_balances_at_CB/TA (lag)	-0.013	-0.010	-0.020*	-0.004	0.000	-0.011	-0.011	-0.004	0.000	-0.019*	-0.020*
	(-1.04)	(-0.71)	(-1.69)	(-0.39)	(0.04)	(-0.97)	(-0.94)	(-0.27)	(0.02)	(-1.90)	(-1.97)
Log TA (lag)	0.823***	0.765***	0.800***	0.666***	0.725***	0.760***	0.791***	0.724***	0.718***	0.746***	0.768***
	(7.59)	(6.57)	(7.52)	(7.50)	(6.91)	(7.70)	(7.84)	(6.26)	(6.81)	(7.19)	(7.08)
NPL ratio (lag)	-0.001	0.012	0.007	0.007	0.039*	0.003	0.000	0.019	0.028	-0.010	-0.010
	(-0.05)	(0.51)	(0.36)	(0.34)	(1.70)	(0.16)	(0.01)	(0.78)	(1.12)	(-0.49)	(-0.47)
CET1 ratio (lag)	0.001	-0.018	-0.010	0.003	-0.022	0.005	0.003	-0.050**	-0.025	-0.009	-0.013
	(0.07)	(-1.03)	(-0.80)	(0.22)	(-1.19)	(0.32)	(0.23)	(-2.20)	(-1.03)	(-0.47)	(-0.65)
ROA (lag)	-0.035	0.014	0.003	0.021	0.111	-0.039	-0.021	0.018	0.041	-0.088	-0.065
	(-0.68)	(0.21)	(0.06)	(0.38)	(1.47)	(-0.67)	(-0.38)	(0.22)	(0.44)	(-1.55)	(-1.22)
CIR (lag)	0.009***	0.009**	0.007**	0.007**	0.010***	0.009***	0.009***	0.007*	0.009**	0.006**	0.006**
	(2.82)	(2.55)	(2.21)	(2.16)	(2.81)	(2.98)	(2.86)	(1.98)	(2.27)	(2.10)	(2.03)
Observations	700	700	700	700	700	696	696	646	700	642	642
Adjusted R^2	0.630	0.528	0.593	0.639	0.496	0.636	0.637	0.519	0.494	0.651	0.647
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. DFR is the ECB Deposit Facility Rate. The description of each variables is provided in Table A1 in Appendix A.*

Table 6: Deposit mix and changes in NMD modelling assumptions pre- and post-monetary policy tightening (logit)

	Dummy change in NMD modelling assumptions										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (pre)	-0.030*										
	(-1.85)										
Deposits/TA (pre) × Δ DFR	0.016										
	(1.03)										
Sh_ON_deposits (pre)		-0.016									
		(-0.82)									
Sh_ON_deposits (pre) × Δ DFR		-0.006									
		(-0.41)									
Sh_term_deposits (pre)			-0.011								
			(-0.57)								
Sh_term_deposits (pre) × Δ DFR			0.009								
			(0.59)								
Sh_ON_HHs_deposits (pre)				-0.023							
				(-1.47)							
Sh_ON_HHs_deposits (pre) × Δ DFR				0.024*							
				(1.68)							
Sh_ON_NFCs_deposits (pre)					-0.028						
					(-1.13)						
Sh_ON_NFCs_deposits (pre) × Δ DFR					0.006						
					(0.24)						
Sh_uninsured_deposits (pre)						0.053				0.041	
						(1.18)				(0.93)	
Sh_uninsured_deposits (pre) × Δ DFR						-0.029				-0.005	
						(-0.87)				(-0.15)	
Sh_wholesale_uninsured_deposits (pre)							0.028				0.013
							(0.86)				(0.40)
Sh_wholesale_uninsured_deposits (pre) × Δ DFR							-0.028				-0.009
							(-0.96)				(-0.28)
Deposit beta (pre)								-0.202		-0.405	-0.389
								(-0.13)		(-0.27)	(-0.26)
Deposit beta (pre) × Δ DFR								-0.147		-0.142	-0.055
								(-0.11)		(-0.11)	(-0.04)
Flighty_ON_deposits_dummy (pre)									1.045	0.599	0.959
									(1.15)	(0.75)	(0.98)
Flighty_ON_deposits_dummy (pre) × Δ DFR									0.648	0.602	0.702
									(1.56)	(0.73)	(0.75)
Cash_balances_at_CB/TA (lag)	-0.005	-0.009	-0.023	-0.012	-0.017	-0.009	-0.012	-0.039	-0.013	-0.026	-0.026
	(-0.13)	(-0.22)	(-0.60)	(-0.32)	(-0.47)	(-0.22)	(-0.30)	(-0.87)	(-0.33)	(-0.52)	(-0.55)
Log TA (lag)	-1.298***	-1.250**	-1.185**	-1.229**	-1.193**	-1.252**	-1.253**	-1.294**	-1.193**	-1.306***	-1.271***
	(-2.66)	(-2.47)	(-2.35)	(-2.42)	(-2.37)	(-2.54)	(-2.54)	(-2.55)	(-2.32)	(-2.72)	(-2.64)
NPL ratio (lag)	-0.022	-0.017	-0.032	-0.018	-0.027	-0.022	-0.026	-0.027	-0.023	-0.015	-0.016
	(-0.51)	(-0.38)	(-0.60)	(-0.41)	(-0.54)	(-0.46)	(-0.55)	(-0.54)	(-0.47)	(-0.33)	(-0.33)
CET1 ratio (lag)	-0.159***	-0.156**	-0.142**	-0.155**	-0.126*	-0.155**	-0.147**	-0.173**	-0.156**	-0.198**	-0.181**
	(-2.61)	(-2.44)	(-2.28)	(-2.54)	(-1.90)	(-2.50)	(-2.42)	(-2.26)	(-2.39)	(-2.48)	(-2.25)
ROA (lag)	0.191	0.193	0.179	0.212	0.199	0.191	0.187	0.178	0.189	0.185	0.185
	(0.86)	(0.90)	(0.81)	(1.00)	(0.90)	(0.85)	(0.83)	(0.81)	(0.87)	(0.86)	(0.84)
CIR (lag)	-0.011	-0.011	-0.013	-0.010	-0.012	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011
	(-0.89)	(-0.97)	(-1.02)	(-0.88)	(-0.94)	(-0.96)	(-0.91)	(-0.86)	(-0.96)	(-0.86)	(-0.81)
Observations	700	700	700	700	700	696	696	646	700	642	642
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. DFR is the ECB Deposit Facility Rate. The description of each variables is provided in Table A1 in Appendix A.*

Table 7: Deposit mix and estimated maturity of NMDs: controlling for country-specific characteristics

	Weighted average maturity NMDs										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (lag)	0.045***										
	(6.46)										
Sh_ON_deposits (lag)		0.030***									
		(4.21)									
Sh_term_deposits (lag)			-0.033***								
			(-4.69)								
Sh_ON_HHs_deposits (lag)				0.032***							
				(5.37)							
Sh_ON_NFCs_deposits (lag)					-0.009						
					(-0.81)						
Sh_uninsured_deposits (lag)						-0.093***				-0.080***	
						(-6.37)				(-6.34)	
Sh_wholesale_uninsured_deposits (lag)							-0.082***				-0.073***
							(-6.73)				(-6.99)
Deposit beta (lag)								-0.387		-0.482*	-0.400
								(-1.00)		(-1.81)	(-1.58)
Flighty_ON_deposits_dummy (lag)									-0.717	-0.342	-0.310
									(-1.60)	(-1.20)	(-1.07)
Cash_balances_at_CB/TA (lag)	0.005	-0.005	-0.008	0.010	0.005	0.007	0.007	-0.001	0.004	-0.003	-0.003
	(0.44)	(-0.46)	(-0.78)	(1.03)	(0.38)	(0.65)	(0.67)	(-0.07)	(0.30)	(-0.21)	(-0.22)
Log TA (lag)	0.453**	0.443**	0.443**	0.362**	0.624***	0.432**	0.423**	0.758***	0.572**	0.468**	0.467**
	(2.56)	(2.31)	(2.30)	(2.14)	(2.81)	(2.54)	(2.40)	(3.10)	(2.49)	(2.36)	(2.28)
NPL ratio (lag)	0.040	0.038	0.045	0.058	0.051	0.042	0.050	0.041	0.055	0.045	0.052
	(0.94)	(0.82)	(0.99)	(1.10)	(1.11)	(0.84)	(1.14)	(1.00)	(1.26)	(0.92)	(1.18)
CET1 ratio (lag)	0.004	-0.040**	-0.018	-0.015	-0.023	-0.009	-0.005	-0.034	-0.011	-0.025	-0.016
	(0.27)	(-2.27)	(-1.23)	(-0.88)	(-1.28)	(-0.53)	(-0.29)	(-1.39)	(-0.51)	(-1.11)	(-0.72)
ROA (lag)	-0.042	0.044	0.008	0.038	0.072	-0.023	-0.024	0.040	0.067	-0.013	-0.015
	(-0.75)	(0.71)	(0.13)	(0.58)	(1.02)	(-0.33)	(-0.37)	(0.54)	(0.93)	(-0.19)	(-0.23)
CIR (lag)	0.001	0.006	0.003	0.005	0.011**	0.001	0.001	0.009*	0.011**	-0.001	-0.001
	(0.23)	(1.45)	(0.66)	(1.11)	(2.39)	(0.14)	(0.29)	(1.88)	(2.32)	(-0.29)	(-0.21)
Observations	1046	1046	1046	1046	1046	1020	1020	963	1046	937	937
Adjusted R^2	0.670	0.596	0.607	0.646	0.498	0.625	0.640	0.481	0.517	0.611	0.623
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01, **: 0.05, *: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. The description of each variables is provided in Table A1 in Appendix A.*

Table 8: Deposit mix and estimated maturity of NMDs: controlling for fiscal and monetary policy measures

	Weighted average maturity NMDs										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (lag)	0.032***										
	(5.81)										
Sh_ON_deposits (lag)		0.012									
		(1.59)									
Sh_term_deposits (lag)			-0.029***								
			(-5.29)								
Sh_ON_HHs_deposits (lag)				0.024***							
				(4.43)							
Sh_ON_NFCs_deposits (lag)					0.000						
					(0.04)						
Sh_uninsured_deposits (lag)						-0.066***				-0.063***	
						(-5.31)				(-4.88)	
Sh_wholesale_uninsured_deposits (lag)							-0.057***				-0.055***
							(-5.53)				(-4.99)
Deposit beta (lag)								-0.566		-0.524*	-0.427*
								(-1.51)		(-1.91)	(-1.71)
Flighty_ON_deposits_dummy (lag)									-0.768***	-0.138	-0.054
									(-2.92)	(-0.46)	(-0.17)
Cash_balances_at_CB/TA (lag)	-0.020	-0.011	-0.023	-0.005	-0.002	-0.012	-0.014	0.001	-0.015	-0.011	-0.012
	(-1.53)	(-0.59)	(-1.59)	(-0.40)	(-0.12)	(-0.93)	(-1.11)	(0.07)	(-1.02)	(-0.86)	(-0.95)
Log TA (lag)	0.584***	0.449**	0.488***	0.470***	0.436***	0.526***	0.562***	0.495***	0.448***	0.576***	0.602***
	(3.98)	(2.61)	(3.41)	(3.13)	(2.71)	(3.76)	(4.03)	(3.03)	(2.85)	(4.11)	(4.24)
NPL ratio (lag)	-0.026	-0.010	-0.018	-0.012	0.004	-0.022	-0.025	0.002	0.002	-0.024	-0.026
	(-1.39)	(-0.46)	(-0.76)	(-0.60)	(0.19)	(-1.20)	(-1.34)	(0.06)	(0.08)	(-1.33)	(-1.42)
CET1 ratio (lag)	-0.031*	-0.057**	-0.040**	-0.028	-0.072***	-0.026	-0.028	-0.066***	-0.060**	-0.020	-0.023
	(-1.96)	(-2.52)	(-2.43)	(-1.49)	(-3.23)	(-1.34)	(-1.49)	(-3.13)	(-2.65)	(-1.07)	(-1.30)
ROA (lag)	-0.048	0.023	-0.020	0.009	0.055	-0.042	-0.036	0.040	0.069	-0.047	-0.043
	(-0.81)	(0.33)	(-0.32)	(0.14)	(0.74)	(-0.63)	(-0.56)	(0.51)	(0.93)	(-0.71)	(-0.64)
CIR (lag)	0.003	0.003	0.000	0.002	0.003	0.004	0.004	0.003	0.004	0.004	0.004
	(0.95)	(0.84)	(0.12)	(0.68)	(0.94)	(1.12)	(1.14)	(0.97)	(1.14)	(1.18)	(1.16)
Guaranteed loans/TA (lag)	-0.043	0.028	-0.009	0.019	0.082	0.002	-0.020	0.050	0.042	-0.031	-0.044
	(-0.78)	(0.48)	(-0.16)	(0.35)	(1.24)	(0.03)	(-0.37)	(0.76)	(0.68)	(-0.58)	(-0.81)
TLTRO/TA (lag)	0.004	-0.021	-0.008	-0.013	-0.023	-0.005	-0.000	-0.024	-0.021	-0.006	-0.002
	(0.20)	(-0.92)	(-0.35)	(-0.61)	(-0.96)	(-0.22)	(-0.02)	(-0.98)	(-0.92)	(-0.29)	(-0.09)
Observations	636	636	636	636	636	631	631	636	636	631	631
Adj. R^2	0.560	0.416	0.523	0.525	0.385	0.542	0.552	0.402	0.427	0.555	0.560
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. The description of each variables is provided in Table A1 in Appendix A.*

Table 9: Deposit mix and estimated maturity of NMDs pre- and post-SVB fallout

	Weighted average maturity NMDs										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (pre)	0.032***										
	(6.43)										
Deposits/TA (pre) × SVB	0.000										
	(0.02)										
Sh_ON_deposits (pre)		0.015**									
		(2.41)									
Sh_ON_deposits (pre) × SVB		0.000									
		(0.12)									
Sh_term_deposits (pre)			-0.031***								
			(-5.90)								
Sh_term_deposits (pre) × SVB			0.001								
			(0.36)								
Sh_ON_HHs_deposits (pre)				0.028***							
				(5.56)							
Sh_ON_HHs_deposits (pre)× SVB				-0.001							
				(-0.28)							
Sh_ON_NFCs_deposits (pre)					-0.010						
					(-1.29)						
Sh_ON_NFCs_deposits (pre) × SVB					0.000						
					(0.09)						
Sh_uninsured_deposits (pre)						-0.074***				-0.063***	
						(-6.31)				(-5.51)	
Sh_uninsured_deposits (pre) × SVB						0.002				0.005	
						(0.21)				(0.45)	
Sh_wholesale_uninsured_deposits (pre)							-0.061***				-0.052***
							(-6.29)				(-5.39)
Sh_wholesale_uninsured_deposits (pre) × SVB							0.001				0.003
							(0.15)				(0.36)
Deposit beta (pre)								-1.100*		-0.748	-0.594
								(-1.75)		(-1.44)	(-1.16)
Deposit beta (pre) × SVB								0.059		-0.029	-0.020
								(0.42)		(-0.13)	(-0.08)
Flighty_ON_deposits_dummy (pre)									-0.671	-0.629**	-0.539**
									(-1.45)	(-2.55)	(-2.09)
Flighty_ON_deposits_dummy (pre) × SVB									0.062	-0.058	-0.057
									(0.70)	(-0.29)	(-0.26)
Cash_balances_at_CB/TA (lag)	-0.013	-0.011	-0.022*	-0.003	0.000	-0.011	-0.011	-0.004	0.000	-0.020*	-0.020**
	(-1.09)	(-0.80)	(-1.97)	(-0.32)	(0.02)	(-0.97)	(-0.95)	(-0.29)	(0.02)	(-1.98)	(-2.05)
Log TA (lag)	0.825***	0.771***	0.788***	0.666***	0.722***	0.752***	0.783***	0.748***	0.718***	0.753***	0.773***
	(7.67)	(6.42)	(7.45)	(7.50)	(6.88)	(7.66)	(7.83)	(6.31)	(6.81)	(7.18)	(7.09)
NPL ratio (lag)	0.000	0.012	0.006	0.009	0.040*	0.004	0.001	0.017	0.028	-0.009	-0.009
	(0.00)	(0.58)	(0.33)	(0.46)	(1.74)	(0.25)	(0.07)	(0.69)	(1.11)	(-0.48)	(-0.45)
CET1 ratio (lag)	0.003	-0.021	-0.007	0.003	-0.021	0.006	0.005	-0.047*	-0.025	-0.006	-0.009
	(0.26)	(-1.53)	(-0.58)	(0.25)	(-1.14)	(0.41)	(0.37)	(-1.96)	(-1.03)	(-0.29)	(-0.44)
ROA (lag)	-0.046	0.006	-0.010	0.020	0.112	-0.044	-0.030	0.013	0.041	-0.091	-0.069
	(-0.93)	(0.09)	(-0.20)	(0.35)	(1.47)	(-0.73)	(-0.53)	(0.16)	(0.44)	(-1.58)	(-1.30)
CIR (lag)	0.009***	0.008**	0.006**	0.007**	0.010***	0.009***	0.009***	0.007*	0.009**	0.006**	0.006**
	(2.88)	(2.43)	(2.11)	(2.18)	(2.83)	(2.99)	(2.88)	(1.95)	(2.26)	(2.14)	(2.10)
Observations	700	700	700	700	700	696	696	657	700	653	653
Adj. R^2	0.640	0.533	0.611	0.640	0.497	0.641	0.644	0.518	0.494	0.651	0.649
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. SVB is a dummy variable equal to 1 from the second quarter of 2023 onward (post-SVB collapse), and 0 otherwise. The description of each variables is provided in Table A1 in Appendix A.*

A Appendix

A.1 Computation of the weighted average maturity

To measure the maturity of a bank's liability portfolio, we calculate the weighted average maturity for a bank b in a quarter t both under behavioural and contractual assumptions, according to the following formula:

$$WeightedAverageMaturity_{b,t} = \sum_{j=1}^{14} Mat_j \left(\frac{Vol_{b,t,j}}{TotVol_{b,t}} \right) \tag{4}$$

We use confidential quarterly cash flow data for euro area SIs, collected by the ECB for supervisory purposes. In this dataset, the reported cash-flows (i.e., the bank's expected cash-flows) are distributed across 14 buckets (j), according to their remaining time to maturity or repricing schedule. The proportional volume of cash-flows in each maturity bucket $\left(\frac{Vol_{b,t,j}}{TotVol_{b,t}} \right)$ is multiplied by the maturity mid-point (Mat_j) of the respective bucket, expressed in years (e.g., a weight of 2 is assigned to the 1-3 year maturity bucket). The weighted average maturity is tis then obtained by summing these weighted terms across all 14 buckets.

Under contractual assumptions, NMDs are entirely allocated to the overnight bucket. As a result, the contractual weighted average maturity is equal to the midpoint of the overnight maturity bucket, calculated as $1/365 = 0{,}0028$ years.

Table A1: Definitions of variables and their sources

Variable	Label	Definition	Source
Dependent variables:			
NMD maturity	Weighted average maturity of NMDs	See section A.1.	ECB Supervisory Statistics
Bank control variables:			
Bank size	Log (TA)	Logarithm of banks' total assets	ECB Supervisory Statistics
Profitability	ROA	The ratio of net income to total assets	ECB Supervisory Statistics
Non-performing loans	NPL ratio	The ratio of non-performing loans to gross loans	ECB Supervisory Statistics
Capitalisation	CET1 ratio	The ratio of CET1 capital to risk-weighted assets	ECB Supervisory Statistics
Cost efficiency	CIR	The ratio of operating expenses divided by operating income	ECB Supervisory Statistics
Business Model Classification		Banks are classified based on their main source of income, client base, funding sources, size and geographical focus	ECB Supervisory Statistics
Deposit mix variables:			
Deposit composition	Deposits/TA	The ratio of deposits to total assets	ECB Supervisory Statistics
	Sh_ON_deposits	The ratio of overnight deposits to total deposits	ECB Supervisory Statistics
	Sh_of_term_deposits	The ratio of term deposits and deposits redeemable at notice to total deposits	ECB Supervisory Statistics
	Sh_uninsured_deposits	The ratio of uninsured deposits to total deposits	ECB Supervisory Statistics
	Sh_whole_uninsured_deposits	The ratio of uninsured deposits to NFCs to total deposits	ECB Supervisory Statistics
Overnight deposit composition	Sh_ON_HHs_deposits	The ratio of overnight deposits to households to total overnight deposits	ECB Supervisory Statistics
	Sh_ON_NFCs_deposits	The ratio of overnight deposits to non-financial corporations to total overnight deposits	ECB Supervisory Statistics
	Flighty_ON_deposit_dummy	A dummy which is 1 when a bank shows overnight deposit outflows in more than half of the quarters in our sample and zero otherwise	ECB Supervisory Statistics
Deposit rate pass-through	Deposit beta	The ratio of the weighted average deposit rate on overnight deposits to the private non-financial sector and the deposit facility rate (computed each quarter)	ECB Individual MFI Interest Rate Statistics (IMIR)
Asset mix variables:			
Liquidity	HQLA/TA	The ratio of high-quality liquid assets to total assets	ECB Supervisory Statistics

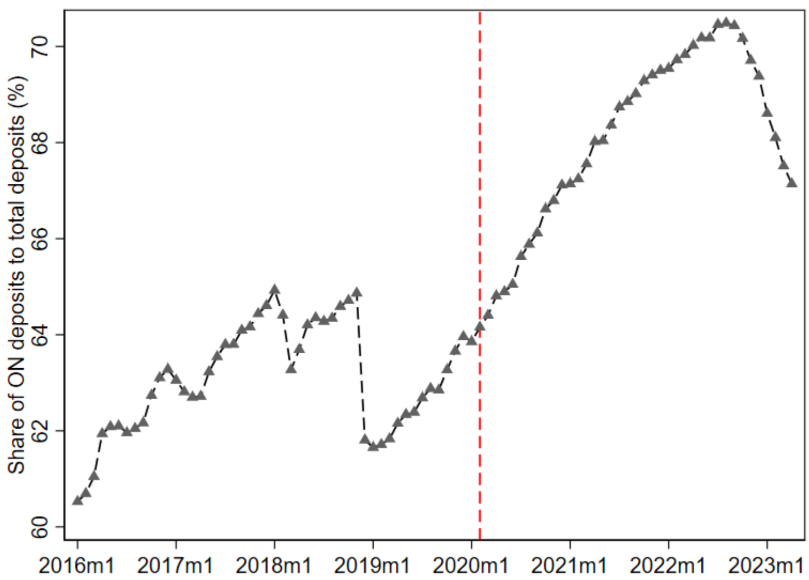
Continued on the next page

Variable	Label	Definition	Source
	Cash/TA	The ratio of cash, cash balances held at the central banks, and other demand deposits to total assets	ECB Supervisory Statistics
	Cash_balances_at_CB/TA	The ratio of cash balances held at the central banks and other demand deposits to total assets	ECB Supervisory Statistics
	Cash_balances_at_CB(net)/TA	The ratio of cash balances held at the central banks to total assets	ECB Supervisory Statistics
Loan composition	Share of fixed-rate assets	The ratio of fixed-rate assets to total assets	ECB Supervisory Statistics
	Sh_floating-rate_loans	The ratio of loans with a maturity or repricing below 1 year to total loans	ECB Individual Balance Sheet Items (IBSI)
	Sh_loans_>10y	Share of mortgages to households with a maturity above 10 years	ECB Individual Balance Sheet Items (IBSI)
Digitalization variables:			
Digital customers	Sh_digital_customers	The ratio of digital customers to total customers (only available for 2023)	ECB Supervisory Statistics
Digital deposits	Sh_digital_deposits	Share of deposit value of digitally opened accounts (only available for 2023) to total deposits from HHs and NFCs	ECB Supervisory Statistics
COVID-19 controls:			
Government loan guarantee schemes	Guaranteed loans/TA	The ratio of newly originated loans and advances subject to public guarantee schemes to HHs and NFCs to total assets	ECB Supervisory Statistics
TLTRO III	TLTRO/TA	The ratio of outstanding amounts in TLTRO programs to total assets (data available between 2019Q4 and 2023Q1)	ECB Market Operations Database

Table A2: Bank business model classification: Breakdown of banks and observations

Cluster	Business Model	Nr. of banks	Nr. of obs
1	G-SIB and Universal Banks	19	342
2	Retail Lenders	14	232
3	Asset Manager and Custodian Banks	4	71
4	Corporate/Wholesale Lenders	27	482
5	Other	3	37
	Total	67	1164

Figure A1: Share of overnight deposits around the pandemic period (January 2016 - May 2023)



Notes: The dashed line marks the beginning of the COVID-19 pandemic. Source: ECB Individual Balance Sheet Items.

Table A3: Correlation matrix

	Log TA	CET1	NPL	ROA	CIR	Deposits /TA	Share of ON dep.	Share of term dep.	Share of ON dep. to HHs	Share of ON dep. to NFCs	Share of unins. dep.	Share of wh. unins. dep.	Deposit beta	Flightly ON dep. dummy	HQLA /TA	Cash /TA	Cash at CB/TA	Cash at CB (net)/TA	Share of fx. assets	Share of fl. loans	Share of loans >10y
Log TA	1																				
CET1	-0.42	1																			
NPL	-0.11	-0.05	1																		
ROA	-0.12	0.03	-0.25	1																	
CIR	0.17	-0.18	-0.12	-0.33	1																
Deposits/TA	-0.31	-0.09	0.16	0.18	-0.05	1															
Share of ON dep.	-0.09	-0.18	0.13	0.11	-0.00	0.68	1														
Share of term dep.	0.04	0.14	-0.00	-0.13	-0.06	-0.78	-0.77	1													
Share of ON dep. to HHs	-0.09	-0.22	0.18	0.01	0.06	0.78	0.61	-0.63	1												
Share of ON dep. to NFCs	0.01	0.31	0.00	0.08	-0.11	-0.20	-0.20	0.28	-0.48	1											
Share of unins. dep.	0.31	0.08	-0.20	-0.16	0.05	-0.93	-0.58	0.70	-0.80	0.33	1										
Share of wh. unins. dep.	0.28	0.10	-0.20	-0.15	0.05	-0.95	-0.62	0.75	-0.82	0.32	0.98	1									
Deposit beta	0.22	0.10	-0.22	0.01	-0.04	-0.37	-0.20	0.20	-0.30	-0.02	0.32	0.35	1								
Flightly ON dep. dummy	0.00	0.13	-0.09	-0.00	0.00	-0.49	-0.58	0.55	-0.57	0.45	0.48	0.51	0.05	1							
HQLA/TA	-0.21	0.11	-0.14	0.14	0.00	0.37	0.38	-0.30	0.16	-0.06	-0.30	-0.31	0.02	-0.32	1						
Cash/TA	-0.21	0.25	-0.14	0.15	-0.06	0.18	0.21	-0.20	-0.05	0.07	-0.11	-0.11	0.14	-0.17	0.68	1					
Cash at CB/TA	-0.08	0.17	-0.13	0.11	-0.10	0.09	0.12	-0.13	-0.06	0.08	-0.02	-0.02	0.20	-0.10	0.56	0.83	1				
Cash at CB (net)/TA	-0.19	0.26	-0.16	0.15	-0.06	0.14	0.18	-0.18	-0.08	0.08	-0.08	-0.07	0.16	-0.15	0.66	0.99	0.84	1			
Share of fx. assets	0.51	-0.27	-0.26	-0.10	0.22	-0.50	-0.34	0.33	-0.34	0.08	0.51	0.48	0.24	0.26	-0.15	-0.14	-0.03	-0.13	1		
Share of fl. loans	-0.14	-0.14	0.22	0.13	-0.16	0.17	0.29	-0.07	0.08	0.19	-0.13	-0.13	-0.02	-0.16	0.15	0.13	0.06	0.12	-0.16	1	
Share of loans >10y	0.24	-0.02	-0.19	0.00	0.19	0.13	-0.14	-0.26	0.18	-0.25	-0.17	-0.17	-0.06	-0.00	-0.18	-0.11	-0.05	-0.10	0.07	-0.66	1

Notes: The table reports the pairwise correlation coefficients for the variables employed in the empirical analysis. Sample period 2019Q2-2023Q3. The description of each variables is provided in Table A1 in Appendix A.

B Online Appendix

B.1 Contractual vs. Behavioural Assumptions for Loans

On the asset side, behavioural assumptions are used to account for loan prepayments. Figure B1 shows the distribution of cash flows across maturity buckets under both contractual and behavioural assumptions. While the overall patterns appear similar, banks allocate a smaller share of loans to the shortest maturity buckets (below 1 month) under behavioural assumptions, and a higher share to maturity buckets between 3 months and 3 years, reflecting expectations of early repayments.

Examining the evolution of the weighted average maturity of total loans over time (Figure B2), we observe that behavioural maturities are generally lower than contractual maturities, although the difference remains limited. Overall, there is an upward trend in total loan maturities. Interestingly, the gap between contractual and behavioural maturities widens slightly over time, suggesting that banks have increasingly anticipated higher levels of prepayments, particularly during the monetary policy tightening.

Figure B1: Total loans - contractual vs behavioural assumptions

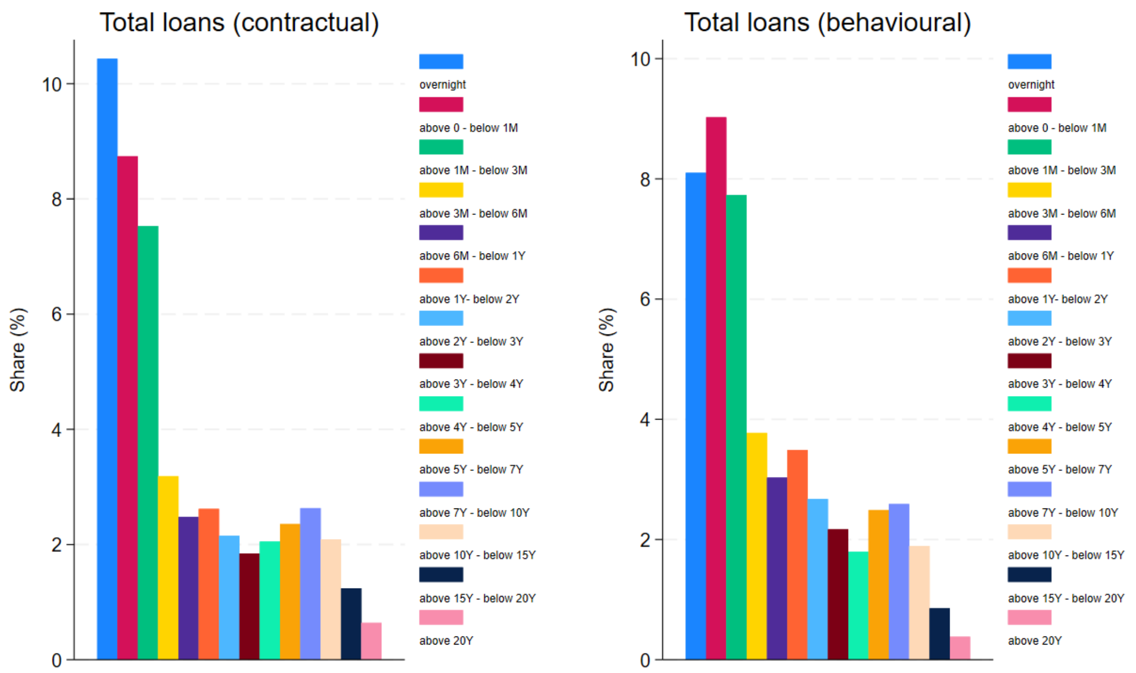
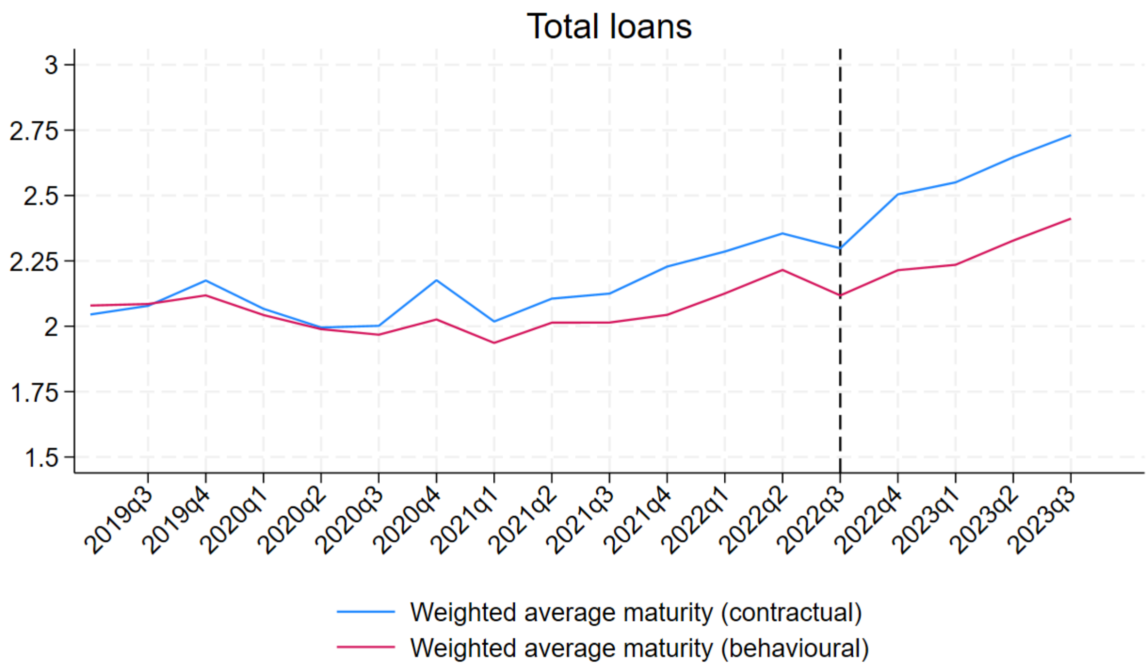


Figure B2: Total loans maturity: Evolution over time



B.2 Banks' asset mix and NMD maturity assumptions

In this section, we empirically investigate whether—and to what extent—banks' asset mix influences the estimated maturity of NMDs. The underlying hypothesis is that banks should not factor in asset-side characteristics when modelling NMD maturities. For instance, if banks with a higher share of fixed-rate, long-term loans systematically assume greater stability in their NMDs, this could be indicative of "window-dressing" behaviour. In such cases, banks may artificially align the maturities of their liabilities with those of longer-term assets to reduce their IRRBB exposure.[27] To test this hypothesis, we examine measures that capture asset liquidity, including the ratio of high-quality liquid assets (HQLA) to total assets, the ratio of central bank cash balances to total assets, and the shares of fixed-rate assets and loans. Since liquid assets generally have shorter maturities than illiquid ones, these indicators provide a comprehensive view of banks' asset composition. We then estimate the relationship using standard panel data techniques on our full sample (2019Q2–2023Q3), applying the following model specification:

$$Y_{i,t} = \alpha_b + \alpha_t + \gamma Assets\_Mix_{i,t-1}[_{i,pre}][\times \Delta DFR_t] + \rho X^{'}_{i,t-1} + \sigma Z^{'}_{i,t} + \varepsilon_{i,t} \qquad (5)$$

where $Assets_M ix_{i,t-1}$ is a vector of asset-side indicators that may influence banks' reliance on NMD modelling assumptions. These variables include: (i) the ratio of high-quality liquid assets to total assets ($HQLA/TA$); (ii) the ratio of cash to total assets ($Cash/TA$); (iii) the ratio of central bank cash balances to total assets (*Cash_balances_at_CB(net)/TA*); (iv) the share of fixed-rate assets (*Sh_fixed_rate_assets*); (v) the share of floating-rate loans (*Sh_floating_rate_loans*); and (vi) the share of mortgages to households with an interest rate fixation period above 10 years (*Sh_loans_>10y*). All other variables are defined as in Equation 1.

Tables B1 and B2 report the results of Equation 5. Under the window-dressing hypothesis, we would expect banks with lower levels of liquid assets and higher shares of illiquid assets to estimate longer NMD maturities. However, the results presented in Table B1 support our original intuition and provide no evidence of window-dressing behaviour by banks. The large majority of coefficients reported in columns 1 through 7 are statistically insignificant, suggesting that banks do not consider asset-side factors when calibrating behavioural assumptions to estimate

[27] Contrarily to the analysis on the deposit mix, the possibility of reverse causality cannot be ruled out in this case. For instance, banks with more stable deposits—and consequently longer NMD maturities—may be better positioned to extend asset maturities by granting more longer-term, fixed-rate loans.

NMD maturities. Similarly, when examining the interaction between asset mix variables and the change in the policy rate, we do not find any differential effects on the estimated NMD maturity associated with ex-ante asset mix characteristics since the onset of monetary policy tightening (Table B2).

Table B1: Asset mix and estimated maturity of NMDs

	Weighted average maturity NMDs						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HQLA/TA (lag)	0.009						
	(0.79)						
Cash/TA (lag)		-0.016					
		(-1.17)					
Cash_balances_at_CB/TA (lag)			-0.008				
			(-0.83)				
Cash_balances_at_CB(net)/TA (lag)				-0.016			
				(-1.14)			
Sh_fixed-rate_assets (lag)					-0.000		
					(-0.04)		
Sh_floating-rate_loans (lag)						-0.010**	
						(-2.17)	
Sh_loans_>10y (lag)							0.007
							(1.63)
Sh_ON_deposits (lag)	0.012*	0.016**	0.014**	0.016**	0.014**	0.014**	0.013**
	(1.71)	(2.39)	(2.30)	(2.40)	(2.20)	(2.09)	(2.36)
Log TA (lag)	0.752***	0.734***	0.746***	0.735***	0.753***	0.658***	0.679***
	(5.90)	(5.98)	(5.97)	(5.98)	(5.68)	(5.04)	(4.71)
NPL ratio (lag)	0.022	0.018	0.020	0.017	0.020	0.027	0.025
	(1.37)	(1.14)	(1.28)	(1.07)	(1.27)	(1.66)	(1.58)
CET1 ratio (lag)	-0.024*	-0.013	-0.018	-0.013	-0.021	-0.049***	-0.019*
	(-1.80)	(-0.83)	(-1.29)	(-0.80)	(-1.51)	(-2.71)	(-1.74)
ROA (lag)	0.050	0.053	0.052	0.046	0.049	0.092	0.029
	(0.90)	(0.90)	(0.90)	(0.77)	(0.88)	(1.46)	(0.51)
CIR (lag)	0.007*	0.008**	0.007**	0.007**	0.007**	0.005*	0.005
	(1.90)	(2.18)	(2.11)	(2.18)	(2.01)	(1.72)	(1.57)
Observations	1102	1102	1102	1102	1102	1035	1102
Adj. R^2	0.507	0.510	0.507	0.510	0.505	0.508	0.521
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. The description of each variables is provided in Table A1 in Appendix A.*

Table B2: Asset mix and estimated maturity of NMDs pre- and post-monetary policy tightening

	Weighted average maturity NMDs						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HQLA/TA (pre)	0.013						
	(0.99)						
HQLA/TA (pre) × Δ DFR	0.005						
	(1.12)						
Cash/TA (pre)		-0.008					
		(-0.47)					
Cash/TA (pre) × Δ DFR		0.005					
		(0.95)					
Cash_balances_at_CB/TA (pre)			-0.008				
			(-0.49)				
Cash_balances_at_CB/TA (pre) × Δ DFR			0.005				
			(0.99)				
Cash_balances_at_CB(net)/TA (pre)				-0.008			
				(-0.48)			
Cash_balances_at_CB(net)/TA (pre) × Δ DFR				0.005			
				(0.99)			
Sh_fixed-rate_assets (pre)					-0.004		
					(-0.42)		
Sh_fixed-rate_assets (pre) × Δ DFR					0.002		
					(0.80)		
Sh_floating-rate_loans (pre)						-0.010*	
						(-1.69)	
Sh_floating-rate_loans (pre) × Δ DFR						0.002	
						(0.85)	
Sh_loans_>10y (pre)							0.004
							(1.07)
Sh_loans_>10y (pre) × Δ DFR							0.000
							(0.02)
L.Sh_ON_deposits (lag)	0.011	0.015**	0.015**	0.015**	0.013**	0.013*	0.014**
	(1.59)	(2.22)	(2.25)	(2.24)	(2.05)	(1.98)	(2.44)
Log TA (lag)	0.750***	0.755***	0.754***	0.755***	0.769***	0.654***	0.707***
	(6.15)	(6.60)	(6.60)	(6.59)	(6.25)	(5.03)	(5.18)
NPL ratio (lag)	0.017	0.015	0.015	0.015	0.015	0.027	0.020
	(0.78)	(0.72)	(0.72)	(0.72)	(0.72)	(1.21)	(0.95)
CET1 ratio (lag)	-0.027*	-0.019	-0.019	-0.019	-0.024	-0.050**	-0.020
	(-1.81)	(-1.07)	(-1.05)	(-1.05)	(-1.46)	(-2.30)	(-1.54)
ROA (lag)	0.006	-0.005	-0.005	-0.005	-0.007	0.049	-0.007
	(0.10)	(-0.08)	(-0.08)	(-0.08)	(-0.12)	(0.76)	(-0.11)
CIR (lag)	0.008**	0.008**	0.008**	0.008**	0.009**	0.007*	0.007*
	(2.31)	(2.33)	(2.33)	(2.33)	(2.46)	(1.95)	(1.90)
Observations	700	700	700	700	700	657	700
Adj. R^2	0.536	0.531	0.531	0.531	0.530	0.528	0.536
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. DFR is the ECB Deposit Facility Rate. The description of each variables is provided in Table A1 in Appendix A.*

Table B3: Deposit mix and estimated maturity of NMDs pre- and post-monetary policy tightening: full sample period (2019Q2-2023Q3)

	Weighted average maturity NMDs										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (pre)	0.033***										
	(6.86)										
Deposits/TA (pre) × Δ DFR	-0.002										
	(-1.22)										
Sh_ON_deposits (pre)		0.015**									
		(2.26)									
Sh_ON_deposits (pre) × Δ DFR		-0.000									
		(-0.22)									
Sh_term_deposits (pre)			-0.029***								
			(-6.26)								
Sh_term_deposits (pre) × Δ DFR			0.001								
			(0.71)								
Sh_ON_HHs_deposits (pre)				0.028***							
				(6.00)							
Sh_ON_HHs_deposits (pre) × Δ DFR				-0.001							
				(-0.31)							
Sh_ON_NFCs_deposits (pre)					-0.012						
					(-1.59)						
Sh_ON_NFCs_deposits (pre) × Δ DFR					0.001						
					(0.26)						
Sh_uninsured_deposits (pre)						-0.077***				-0.068***	
						(-6.71)				(-6.13)	
Sh_uninsured_deposits (pre) × Δ DFR						0.004				0.004	
						(0.81)				(0.59)	
Sh_wholesale_uninsured_deposits (pre)							-0.064***				-0.056***
							(-6.97)				(-6.39)
Sh_wholesale_uninsured_deposits (pre) × Δ DFR							0.005				0.005
							(1.17)				(0.93)
Deposit beta (pre)								-0.820*		-0.662*	-0.543
								(-1.93)		(-1.95)	(-1.62)
Deposit beta (pre) × Δ DFR								0.092		0.096	0.070
								(1.11)		(1.12)	(0.76)
Flighty_ON_deposits_dummy (pre)									-0.705	-0.520**	-0.416*
									(-1.55)	(-2.57)	(-1.98)
Flighty_ON_deposits_dummy (pre) × Δ DFR									-0.048	-0.043	-0.085
									(-0.45)	(-0.30)	(-0.57)
Cash_balances_at_CB/TA (lag)	-0.009	-0.008	-0.014*	-0.003	-0.002	-0.008	-0.008	-0.006	-0.002	-0.018*	-0.019**
	(-1.01)	(-0.83)	(-1.73)	(-0.39)	(-0.17)	(-0.96)	(-0.95)	(-0.46)	(-0.20)	(-1.95)	(-2.01)
Log TA (lag)	0.835***	0.760***	0.805***	0.667***	0.705***	0.777***	0.812***	0.723***	0.704***	0.780***	0.805***
	(7.63)	(5.95)	(7.49)	(6.99)	(6.40)	(8.04)	(8.41)	(6.07)	(6.14)	(7.78)	(7.84)
NPL ratio (lag)	0.003	0.016	0.010	0.008	0.032*	0.001	0.002	0.023	0.028	-0.004	-0.002
	(0.18)	(1.04)	(0.70)	(0.51)	(1.87)	(0.09)	(0.11)	(1.33)	(1.64)	(-0.24)	(-0.14)
CET1 ratio (lag)	-0.000	-0.018	-0.014	0.003	-0.016	0.005	0.004	-0.041**	-0.017	-0.002	-0.006
	(-0.04)	(-1.22)	(-1.32)	(0.26)	(-1.00)	(0.37)	(0.31)	(-2.23)	(-0.81)	(-0.15)	(-0.38)
ROA (lag)	-0.007	0.059	0.031	0.045	0.127*	-0.021	0.006	0.092	0.084	-0.033	-0.006
	(-0.13)	(0.91)	(0.54)	(0.85)	(1.80)	(-0.48)	(0.12)	(1.44)	(1.08)	(-0.77)	(-0.13)
CIR (lag)	0.007**	0.007**	0.005	0.006*	0.008**	0.008**	0.008**	0.006*	0.007*	0.005*	0.005*
	(2.25)	(2.10)	(1.50)	(1.77)	(2.35)	(2.51)	(2.44)	(1.89)	(1.92)	(1.90)	(1.84)
Observations	1102	1102	1102	1102	1102	1092	1092	1035	1102	1025	1025
Adj. R^2	0.612	0.506	0.576	0.616	0.479	0.617	0.622	0.490	0.472	0.629	0.627
Δ NMD modelling assumptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δ NMD volumes by bucket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. DFR is the ECB Deposit Facility Rate. The description of each variables is provided in Table A1 in Appendix A.*

Table B4: Deposit mix and changes in NMD modelling assumptions pre- and post-monetary policy tightening (logit): full sample period (2019Q2-2023Q3)

	Dummy change in NMD modelling assumptions										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Deposits/TA (pre)	-0.024*										
	(-1.94)										
Deposits/TA (pre) × Δ DFR	0.020										
	(1.48)										
Sh_ON_deposits (pre)		-0.009									
		(-0.65)									
Sh_ON_deposits (pre) × Δ DFR		-0.006									
		(-0.46)									
Sh_term_deposits (pre)			0.001								
			(0.08)								
Sh_term_deposits (pre) × Δ DFR			-0.003								
			(-0.25)								
Sh_ON_HHs_deposits (pre)				-0.005							
				(-0.40)							
Sh_ON_HHs_deposits (pre) × Δ DFR				0.020							
				(1.42)							
Sh_ON_NFCs_deposits (pre)					-0.034**						
					(-2.03)						
Sh_ON_NFCs_deposits (pre) × Δ DFR					0.003						
					(0.15)						
Sh_uninsured_deposits (pre)						0.037				0.021	
						(1.22)				(0.66)	
Sh_uninsured_deposits (pre) × Δ DFR						-0.040				-0.015	
						(-1.35)				(-0.52)	
Sh_wholesale_uninsured_deposits (pre)							0.026				0.011
							(1.08)				(0.45)
Sh_wholesale_uninsured_deposits (pre) × Δ DFR							-0.041				-0.025
							(-1.58)				(-0.87)
Deposit beta (pre)								-0.272		-0.295	-0.328
								(-0.31)		(-0.33)	(-0.37)
Deposit beta (pre) × Δ DFR								-0.063		0.014	0.188
								(-0.08)		(0.02)	(0.22)
Flighty_ON_deposits_dummy (pre)									1.249	1.570**	1.670**
									(1.49)	(2.14)	(2.18)
Flighty_ON_deposits_dummy (pre) × Δ DFR									0.012	0.104	0.383
									(0.03)	(0.14)	(0.43)
Cash_balances_at_CB/TA (lag)	-0.004	-0.009	-0.012	-0.005	-0.010	-0.006	-0.005	-0.015	-0.010	-0.005	-0.004
	(-0.26)	(-0.47)	(-0.74)	(-0.28)	(-0.63)	(-0.33)	(-0.28)	(-0.41)	(-0.58)	(-0.13)	(-0.11)
Log TA (lag)	-0.776**	-0.711**	-0.699**	-0.703**	-0.677**	-0.739**	-0.742**	-0.715**	-0.675**	-0.724**	-0.711**
	(-2.50)	(-2.19)	(-2.10)	(-2.09)	(-2.07)	(-2.29)	(-2.29)	(-2.24)	(-2.00)	(-2.35)	(-2.28)
NPL ratio (lag)	0.027	0.021	0.018	0.023	0.017	0.028	0.026	0.017	0.021	0.029	0.028
	(1.16)	(0.87)	(0.74)	(0.93)	(0.74)	(1.16)	(1.12)	(0.72)	(0.89)	(1.23)	(1.22)
CET1 ratio (lag)	-0.077**	-0.075**	-0.072**	-0.070**	-0.055	-0.087**	-0.084**	-0.084**	-0.080**	-0.115***	-0.109***
	(-2.44)	(-2.42)	(-2.28)	(-2.13)	(-1.57)	(-2.46)	(-2.41)	(-2.33)	(-2.48)	(-2.73)	(-2.61)
ROA (lag)	0.175	0.152	0.153	0.160	0.151	0.170	0.170	0.130	0.157	0.150	0.147
	(1.19)	(1.12)	(1.10)	(1.12)	(1.10)	(1.15)	(1.15)	(0.98)	(1.15)	(1.07)	(1.06)
CIR (lag)	-0.011	-0.012*	-0.012	-0.012	-0.013	-0.012	-0.012	-0.013*	-0.012	-0.012*	-0.012
	(-1.45)	(-1.69)	(-1.64)	(-1.62)	(-1.64)	(-1.62)	(-1.55)	(-1.69)	(-1.62)	(-1.67)	(-1.63)
Observations	1102	1102	1102	1102	1102	1092	1092	1018	1102	1008	1008
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business model cluster FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: ***: 0.01,**: 0.05,*: 0.1. Standard errors are clustered at the bank level. T-statistics are reported in parenthesis. DFR is the ECB Deposit Facility Rate. The description of each variables is provided in Table A1 in Appendix A.*

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