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FRIENDS OR FOES? BANKS' DEPOSITS AND DIGITALIZATION DURING MONETARY TIGHTENING

by Federica Ciocchetta*, Raffaele Gallo*, Silvia Magri* and Massimo Molinari*

Abstract

This paper analyzes whether the deposits of high digital banks (i.e. banks whose customers mainly use online money transfers), are more sensitive to changes in interest rates following the monetary tightening phase started in 2022. By relying on a difference-in-difference model estimated for the period from January 2021 to December 2023, we show that there are no significant differences between high digital and other banks in sight deposits and their rate dynamics. In the same period, in contrast, household term deposits and the related interest rates increased at a greater rate for high digital intermediaries, compared with other banks. This larger increase in household term deposits is not correlated with the main indicators of bank vulnerabilities, but it is driven by the results of ex-ante larger and more profitable high digital banks and of intermediaries with a lower initial share of household term deposits. Overall, the stronger sensitivity of high-digital bank deposits seems limited to household term deposits with no negative impact on their profitability.

JEL Classification: E43, E52, E58, G21.

Keywords: deposits, interest rates, digital banks, monetary tightening.

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1. Introduction[1]

Digital innovation in banking has primarily regarded the deposit side of their balance sheets. In the main jurisdictions, almost all banks offer the possibility to transfer money online since the end of the last decade (see Figure A1 for the Italian banking system). The 'digitalization' of deposits is expected to affect the speed of deposit flows and the bank promptness in adjusting deposit rates when market interest rates change. A couple of channels are at work. First, digitalization reduces the search and comparison costs of different investment opportunities and, secondly, it shrinks the market power of banks in the deposit market as it makes frictionless to transfer funds (Dreschler et al., 2017; Liang et al., 2024). In principle, all banks are exposed to these effects as this technology is broadly offered by all intermediaries. In practice, the impact on banks will vary depending on the composition of their depositor base: some customers are far less sticky than others as they pay more attention and are more capable to make comparison between different investment options. Overall, they are more likely to switch from one bank to another or towards different investment opportunities outside the banking system (Xiao, 2020), and the use digital devices allows them to act more quickly.

The stickiness of deposits is key for banks because, when the interest rates rise and the market value of bank assets declines, they can still benefit from a much lower increase in the cost of their funding thanks to the franchise value of their deposits.[2] However, the effect of the increasing digitalization of deposits may be a possible reduction in their stickiness and therefore in their franchise value, with remarkable consequences for banks' business models and for their financial stability, specifically during monetary restrictions (Dreschler et al., 2023, Koont et al., 2023).

In this paper we evaluate the dynamics of deposits across banks during a monetary tightening by focusing on the different level of digitalization of their deposits. On the one hand, the deposits of banks with more digitalized customers may be more sensitive to the changes in money market interest rates and, consequently, these intermediaries could suffer more pronounced deposit withdrawals. On the other hand, the same banks, aware that their customers are more prone to switch, could increase more and at a faster pace the interest rates on their deposits to prevent the outflow and even attract new customers. An empirical analysis is required to assess the net effect of the different dynamics at work. The monetary tightening in 2022 offers a perfect opportunity to appraise this effect.

A crucial point of the analysis is to pinpoint a specific indicator of banks' deposit digitalization. We focus on the intensity of online money transfers usage by customers, which is the cornerstone of the digital change that occurred on the bank deposit side in the past years. More specifically, we consider as banks with more digitalized customers (hereafter 'high digital' banks) those intermediaries operating in Italy that, in the four quarters before the monetary tightening in July 2022, had a share of online money transfer in the highest quintile of the distribution (i.e. higher than 89 per cent). With respect to previous analyses that focused on the number of branches (Erel et al., 2023) or on the popularity of bank digital apps (Koont et al., 2023), we argue that the notion of 'high digital bank' can be more precisely characterized when directly related to bank customer characteristics as the technology of digital money transfer is widely available to all intermediaries. The focus on the

[1] We would like to thank Cinzia Chini and Valeria De Chiara for their excellent research assistance and Paolo Angelini, Nicola Branzoli, Alessio De Vincenzo, Arianna Miglietta, Edoardo Rainone, Federico Maria Signoretti and two anonymous referees for their helpful comments and suggestions. The views and opinions expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy.

[2] Drechsler et al. (2023) refer to the difference between the book and market value of deposits as the deposit franchise value of the bank. Even when interest rates rise and the market value of assets falls below the level of liabilities, the value of the bank can still be positive and the bank survives if this shortfall is lower than the deposit franchise value. This value is directly related to the sensitivity of deposit rates to other interest rates available to depositors.

digitalization of banks' customers allows us to adopt a more flexible definition that includes banks with no or few branches, which by design have a high share of online money transfers, as well as those that attracted more tech-savvy customers, which are more prone to use digital channels.

Key to our analysis is the idea that the intensive use of digital devices to transfer money reflects bank customers' rapidity to switch. Hence, our indicator based on digital money transfers allows us to capture this trait, which is otherwise very difficult to measure at the bank level. At the same time, the period considered provides us with the ideal empirical setting to test its relevance: we exploit the heterogeneity of this unique transition phase, where this technology is made available by all intermediaries and yet its use varies across customers. The depositors' rapidity to switch directly speaks to the possible reduction in deposit stickiness, which is central to the current debate and what matters in the analysis, regardless of its underlying determinants.

Our empirical strategy relies on the estimation of a difference-in-difference model to identify the impact of the monetary tightening in July 2022 on deposit amounts and interest rates across Italian high digital and other banks. We use an extensive dataset with information on sight and term deposits of households and firms as well as on bank balance sheet items between January 2021 and December 2023; we also examine interest rates on deposits applied by a small representative sample of banks reporting them in the MFI interest rate statistics (MIR reports).

After the monetary restriction in 2022, we do not find any significant evidence of stronger deposit outflows for high digital compared to other banks: no difference arises between the two groups for sight deposits, considering both their amount and interest rates. On the contrary, term deposits *increase more* for high digital banks (by 20 percentage points) and this trend is driven only by the household sector (16 percentage points). High digital banks also *raise* more their interest rates on household term deposits (32 basis points). Results are robust to controlling for bank characteristics that, before the tightening, differ for the two groups of banks and saturating our specification to take into account the effects of observable and unobservable time-varying differences across the two categories of banks. Moreover, by focusing on the smaller sample of banks reporting both deposit amount and interest rates, we find evidence of a higher sensitivity of household term deposits to the changes in their interest rates for high digital banks.

Furthermore, we evaluate the effects of the dynamics observed for high digital banks on their activity after the monetary tightening. They increase more than other banks their share of household term on total deposits and end up attracting a larger number of depositors than other banks. Finally, we find that, in the period analyzed (over one year after the start of the monetary tightening) these dynamics do not have a negative effect on the profitability of high digital banks with respect to the other ones. This could be partly due to the fact that high digital banks tend to increase more the investments in assets with high and fixed rate such as mortgages and to the relatively low weight of household term deposits on total deposits.

We finally dive into the possible mechanisms that can drive these results by focusing on the group of high digital banks to single out some heterogeneities. First, we verify whether the increase in household term deposits is stronger for more vulnerable high digital banks, which might have raised interest rates to avoid a possible reduction in their funding. However, we do not find evidence of a different dynamic for high digital banks with a higher NPL ratio, worse liquidity risk indicators, or larger unrealized losses on the portfolio of Government bonds. This suggests that high digital banks do not appear to have reacted to some specific vulnerabilities. Then we test the relevance of other more general bank characteristics that could capture their business model. Results show that the stronger increase in household term deposits is driven by high digital banks that, before the tightening,

were larger and more profitable, and for those with a lower initial share of household term deposits, which may be particularly interested in increasing their reliance on a more stable source of funding.

Overall, the increased sensitivity of deposits of high digital banks appears to be confined to household term deposits; high digital banks seem to have exploited this higher sensitivity to raise their share of a more stable funding. The connected reduction in the franchise value of their deposits is likely to be limited and had no negative impact on their profitability during the period under analysis.

Our paper contributes to the recent literature on the effects of digitalization of deposits on monetary policy and financial stability, focusing on the impact of monetary tightening in 2022 and on the US banking system. Erel et al. (2023) consider as digital banks those that have no or few branches (their share of total deposits was around 5 per cent in 2022); they focus on monetary policy transmission and find that, after the monetary tightening in 2022, these digital banks have *increased* more the interest rates compared to other banks, resulting in a growth in their deposits versus a reduction for the other banks. In line with these results, an analysis on the Community Banks in the US shows that customers of those with fewer branches and that rely more on internet-gathering are more rate sensitive (Greenwald et al., 2024). On the contrary, Koont et al. (2023) classify as digital the banks whose digital apps have more than 300 reviews on the main marketplaces, which are mainly larger banks,[3] and find that, despite the greater increase in their interest rates, digital banks experienced a larger deposit outflow than other banks following the monetary tightening; they underline more the financial stability consequences of these results. While these studies identify digital banks as either those with few branches or larger intermediaries, we offer a more comprehensive identification strategy that takes into account primarily the level of deposit digitalization, which is independent from the size of each bank and does not depend only on the branch network. Moreover, the above-mentioned works analyze the US banking system, which has been affected by several shocks as the monetary tightening was followed by the failure of a subset of banks.[4] In contrast, we focus on a cleaner setting as the Italian banking system has not recorded major bank crises during the examined period. As a result, we are able to investigate deposit dynamics that are more clearly connected with monetary tightening and are not partly driven by run-like behavior originated by specific bank crises. Finally, to the best of our knowledge, this is the first paper presenting evidence for a country different from the US: we hence bring insights on this topic for other banking systems in Europe. [5]

Our paper also relates to the literature on monetary policy transmission through the deposit channel (Dreschler *et al.*, 2017). Messer and Niepmann (2023) show that, after the ECB's first rate hike in July 2022, pass-through into deposit rates in the euro area has been more sluggish, and not stronger, compared to previous tightening episodes; likely this result is consistent with the low incentive for banks to attract additional deposits while liquidity is abundant relative to their capacity to expand lending. Similarly, a FSB report (2024) shows that the sensitivity of bank deposit rates does not seem unusual in the current monetary policy cycle, despite the higher level of digitalization of deposits; indeed, the results find that interest rates betas were, if anything, lower than in the past, not higher. However, in recent years, policy rate hiking cycles have been generally associated with a greater shift

[3] The authors define as digital banks around 1000 of the 4000 US banks in 2022. Considering only banks with total assets between 1 and 250 billion dollars, digital banks are almost two thirds of all banks.

[4] See the literature on the vulnerability in the uninsured deposit segment after the failure of the Silicon Valley Bank (Benmelech et al., 2023; Caglio et al., 2023; Cookson et al., 2023; Drechsler et al., 2023; Jiang et al., 2023).

[5] Fascione et al. (2024) find some descriptive evidence for banks directly supervised by the ECB that suggests that deposit outflows and inflows may be larger for banks with a higher share of digital customers (9 out of a total of 75 banks). However, they argue that historical data on trends in digitalization would be needed to validate this finding as any long-lasting structural effect of digitalization are hard to isolate.

away from sight deposits towards fixed-maturity yield sensitive deposits; the report argues that this increased sensitivity is perhaps the result of changes in technology that allow easier comparison of deposit rates and faster switching. We contribute to this literature by showing the importance of high digital banks in explaining a stronger pass-through on term deposits.

Our analysis finally speaks to the wider literature evaluating how banks are adopting technological innovation and the impact on their business models (Beck et al., 2022; Branzoli et al., 2024). More specifically, Jiang et al. (2022) analyze the relationship between digitalization and financial inclusion. They show that banks with superior digital services have closed costly branches and offer competitive interest rates to their tech-savvy clients, who are typically younger and wealthier. In contrast, banks with a comparative advantage in operating branches have retained their branches, but charge higher prices to their tech-unsavvy, branch dependent clients, who are generally older. Similarly, Kundu et al. (2024) document the emergence of two distinct types of intermediaries in the US over the last two decades: high rate banks, which align their deposit rates with market interest rates, and low rate banks, whose deposit rates are less responsive to market interest rates. The former group operate primarily online and invest more in IT compared to the other intermediaries, attract less sticky depositors, hold shorter-term assets and earn a spread by taking on credit risk through personal and business loans. When interest rates rise, deposits shift significantly from low-rate toward high-rate banks; as a consequence, these extend more credits (personal loans and C&I loans). We contribute to this literature by showing that high digital banks operating in Italy, after the monetary tightening in 2022, are more responsive in raising interest rates on household term deposit, increasing their reliance on this type of funding, and tend to invest more in long-term assets with higher return, such as fixed rate mortgages. We also show that high digital banks are not acting under the pressure of financial vulnerabilities; on the contrary, the result we find is due to ex-ante larger and more profitable intermediaries.

The rest of the paper is organized as follows. In the next section high digital banks are defined and data described. Section 3 shows the graphical evidence on deposit and interest rates trends for the two groups of banks before and after the monetary tightening in 2022. Section 4 describe the difference-in-difference model used in the estimation, while Section 5 reports the results both for deposits and interest rates trends. Section 6 dives into the effects of the observed dynamics on selected outcomes of high digital banks, while Section 7 analyses the possible mechanisms at work in driving the observed results and singles out some heterogeneities in the group of high digital banks. Section 8 evaluates the robustness of the evidence found and section 9 finally discusses the results of the analysis and concludes.

2. Definition of high digital banks and description of the data

2.1. Definition of high digital banks

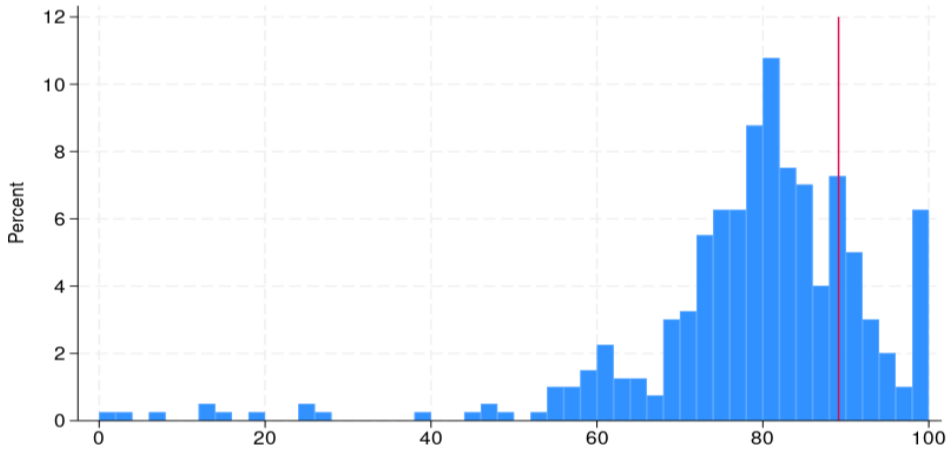
In this paper we rely on a definition of high digital bank specifically connected to the digitalization of the customers, which is the main focus of our analysis. We work with individual banks as in the same banking group there could be banks with a very different customer base and we want to exploit this heterogeneity.[6] First, we retrieve the number of digital money transfers from Italian Banking Supervisory Reports. Then, for each Italian bank we consider the share of the number of digital on

[6] Any structural peculiarity of a bank belonging to a group is captured by the bank fixed effect. In Section 8 we also consider a robustness test by clustering the standard errors at banking group level.

total money transfers and calculate the average of this share in the four quarters preceding the monetary tightening in July 2022 (Figure 1).

The technology of online money transfers is widely used by banks; however, some of them clearly show a much higher share of digital customers. Considering the skewness of the distribution of our indicator, we exploit the potential non-linearity associated with banks having almost exclusively digital customers. To identify these banks, we focus on the highest quintile of this indicator.[7] As of mid-2022, out of almost 380 banks in our sample, we hence define as high digital the 78 banks belonging to the highest quintile of this distribution: these banks have a share of online money transfer higher than 89 per cent (Figure 1).

Figure 1 – Distribution of the share of the number of digital money transfers on total transfers
(average share in the four quarters before July 2022)



Source: Banking Supervisory Reports. Notes: the red line indicates the highest quintile of the distribution.

Among the 78 high digital banks, 20 are cooperative banks, 18 are foreign banks, 21 are small and medium size banks (less significant, LSI), 5 are large banks (significant, SI) and 14 are online banks, which are those that offer banking services mainly through the digital channel as they have few or no branches. We also verify that the intermediaries included in the sample of high digital banks have higher values of deposits-to-branches ratio compared to other banks; they have chosen to operate with fewer branches and ended up attracting customers that are much more inclined to access financial services through home banking.[8]

In our analysis, we exclude from the sample all foreign banks (i.e. Italian branches and subsidiaries of foreign banks) because some balance sheet data are not available and as they are often subject to dynamics largely determined by their foreign parent company.[9] As a consequence, our final sample includes 60 high digital banks and 290 other intermediaries. As of June 2022, the group of selected high digital banks accounted for 28 per cent of total deposits and 32 per cent of term deposits.

[7] In Section 8 we discuss the use of alternative thresholds.
[8] As shown in Figure A2 (panel a) in the Appendix, there are clear differences in the distribution of deposits across branches between the two groups of banks; the median value of the ratio (deposits in millions over the number of branches) for high digital banks is 68.8, whereas for other banks it is 42.4. Similar evidence arises when we consider the share of customers who use home-banking services (Figure A2, panel b, the median values for the two groups are 91.4 and 59.1 per cent, respectively).
[9] In Section 8 we present the results when including foreign banks for which data are available.

2.2. Description of the data

Table 1: Balancing properties before the monetary tightening
(December 2021 – percentages excluding assets)

Bank characteristics	Mean other banks	Mean high digital banks	Mean difference	t-stat	p-value
Log assets***	6.9	7.6	-0.7	-3.1	0.002
LTA – private sector (1) ***	46.9	41.9	5.0	2.6	0.009
LTD (Loans-to-deposits), private sector (1)	76.4	86.9	-10.5	-1.3	0.185
DTA (Deposits-to-assets)***	65.2	59.2	6.0	3.2	0.002
Bonds/total funding	3.0	4.1	1.1	-1.4	0.154
Ratio of SME loans to assets	16.8	16.2	0.6	0.5	0.630
Ratio of consumer credit to assets *	1.8	3.8	-2.0	-1.7	0.087
Share of fixed-interest rate mortgages*	32.9	39.1	-6.2	-1.7	0.086
Ratio of Government bonds to assets***	28.7	21.4	7.4	5.0	0.000
ROE	3.1	3.6	-0.5	-0.3	0.776
ROA*	0.3	0.5	-0.2	-1.7	0.087
CTI (Cost-to-income)	69.6	72.7	-3.1	-1.1	0.255
Diversification index (2)	45.9	46.4	-0.5	-0.2	0.836
Asset management fees on operating income (3)***	1.6	8.2	-6.5	-3.0	0.003
CET1 ratio	24.6	22.7	1.9	1.2	0.233
NSFR (4)	148.2	143.9	4.3	1.01	0.311
LCR (5)	3.2	3.0	0.12	0.3	0.750
NPL ratio**	5.7	7.7	-2.0	-2.3	0.021
Share of term deposits over total	19.7	22.7	-3.0	-1.3	0.204
Share of overnight deposits over total	80.3	77.3	3.0	1.3	0.204
Share of HH deposits ***	75.9	66.3	9.6	4.8	0.000
Share of HH term deposits	18.1	19.1	-1.0	-0.4	0.675
Share of HH sight deposits ***	57.7	47.5	10.2	4.3	0.000
Share of NFC deposits ***	24.1	33.7	9.6	4.8	0.000
Share of NFC term deposits***	1.5	4.0	-2.5	-3.3	0.001
Share of NFC sight deposits***	22.6	29.7	-7.2	-4.2	0.000

Source: Banking Supervisor Reports, Finrep and Corep. Foreign banks and subsidiaries are excluded. Data refer to about 60 high digital banks and 290 other banks. Notes: (1) private sector includes households and non-financial corporations. (2) The diversification index is calculated as the difference between intermediation margin and interest rate margin on intermediation margin. (3) The detailed information on asset management fees is available in Finrep only for banks whose ratio of the total net fee and commission income and operating income is equal to or higher than 10 per cent; for the other banks we assign a zero value to the indicator. (4) Net stable funding ratio (NSFR) is a Basel III liquidity indicator defined as the ratio of the bank's available stable funding to its required stable funding. (5) Liquidity coverage ratio (LCR) is a Basel III liquidity indicator calculated as the amount of high quality liquid assets over total net cash flow. Only for this indicator the reference date is December 2022 (not available for 2021 in Corep). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

We retrieve information on the amount of deposits from Banking Supervisory Reports. These data are at monthly frequency and are broken down by deposit type, i.e. sight and term, and counterparty, i.e. households (HHs) and non-financial firms (NFCs) resident in Italy.[10] We gather data on deposit interest rates from MIR, which collects interest rates applied by a representative list of Italian banks.[11]

[10] Term deposits include those with agreed maturity, redeemable at notice and repos. Deposits from residents in other euro area countries at the end of 2023 accounted for 2 per cent of total deposits (residents of Italy and residents in other euro area countries); we consider them in a robustness exercise in Section 8.

[11] The MIR sample includes 69 banks at the end of 2023, representing 85 per cent of total deposits of households and NFCs. To maintain a representative sample, the list of banks is periodically reassessed (last update in September 2023) to reflect market developments such as mergers and acquisitions, closures, and new market participants.

Finally, we collect information on bank characteristics from their quarterly individual balance sheets in the euro area harmonized Supervisory Reports (Finrep and Corep) as well as Banking Supervisory Reports. By comparing the main characteristics of high digital and other banks before the 2022 monetary tightening (i.e. in December 2021), we observe that there are some differences between the two groups of intermediaries (Table 1).

High digital banks are on average larger and tend to be more profitable (higher ROA); they do not have a more diversified set of activities, although they show a much large share of asset management fees on operating income. They also rely on a lower share of deposits to assets and more on firms' deposits than other banks. High digital banks are characterized by a lower share of loans to the private sector and Government bonds to assets; they have a greater share of fixed rate mortgages on total mortgages and of consumer credit on total assets. As for their vulnerabilities, high digital banks have a higher NPL ratio; no differences can be detected as for the liquidity indicators (LCR e NSFR). In the smaller sample of banks reporting interest rates, the two groups of banks are more similar (Table A1).

To take into account these ex-ante differences across banks, we always include bank fixed effects in our models. Secondly, we add bank controls interacted with time dummies by selecting the bank characteristics for which the differences between the two groups are statistically significant. Finally, we report a robustness check by including bank-time fixed effects in a fully saturated specification.

3. Graphical evidence

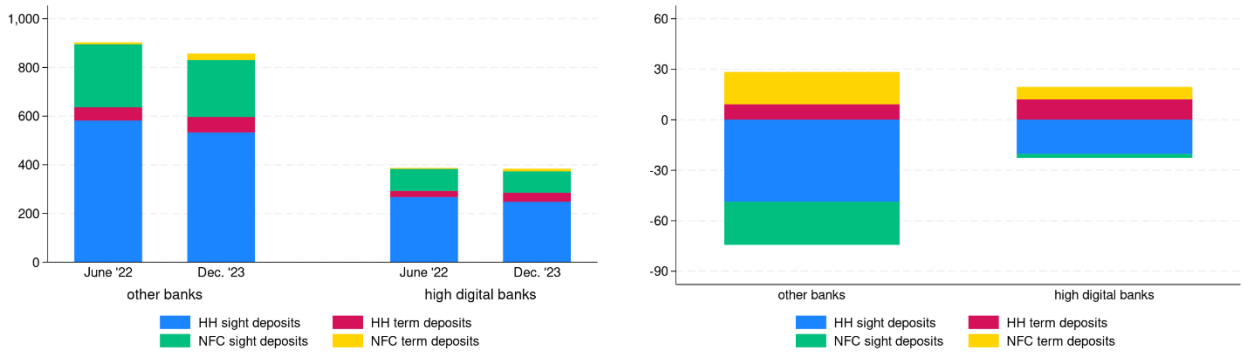
In this section we provide a broad graphical overview of the impact of the 2022 monetary tightening on households and firms' deposits and on related interest rates across high digital and other banks. The analysis refers to the period 2021-23 and considers both sight and term deposits.

Comparing the outstanding amount of deposits of high digital and other banks just before the 2022 monetary tightening (June 2022) and at the end of the period analysed (December 2023), we observe that it decreased for both categories of banks (Figure 2, panel a). This trend was driven by the decline in sight deposits (Figure 2, panel b). Overall, the reduction was much greater for other banks, while for high digital banks the inflow of term deposits was only a bit lower than the outflow of sight deposits.

Figure 2 – Households and firms' total deposits across high digital and other banks

(billions of euro)

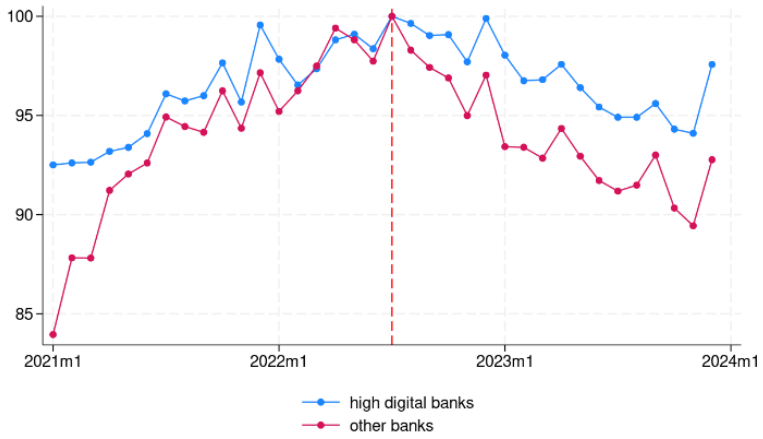
a) outstanding amount of deposits *b) change in deposit amount June 2022-Dec 2023*



Source: Banking Supervisory Reports.

Figure 3 shows a similar evidence by relying on the growth rate of households and firms' deposits over the entire period of the analysis. After the monetary tightening in July 2022, total deposits plunged for both categories of banks; however, the reduction is lower for high digital banks. Sight deposits remarkably declined after the monetary tightening and the dynamics were very similar for the two categories of banks (Figure 4, panel a). On the contrary, term deposits increased as they have become more attractive for customers after the rise in interest rates; the increase in term deposits is stronger for high digital banks (Figure 4, panel b).

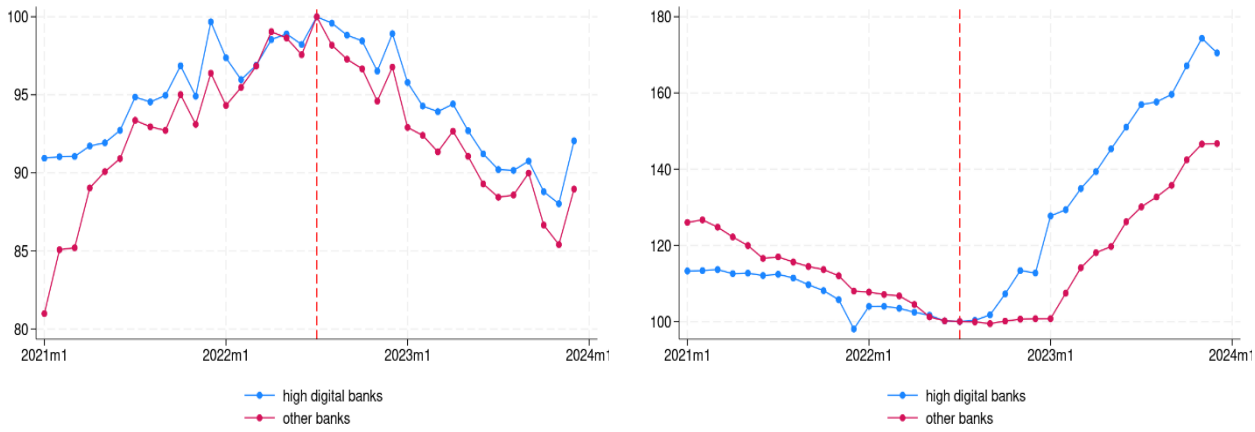
Figure 3 – Households and firms' total deposits
(outstanding amounts – index number=100 in July 2022)



Source: Banking Supervisory Reports. Notes: The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

Figure 4 – Households and firms' total deposit by type of deposits
(outstanding amounts – index number=100 in July 2022)

a) sight deposits *b) term deposits*



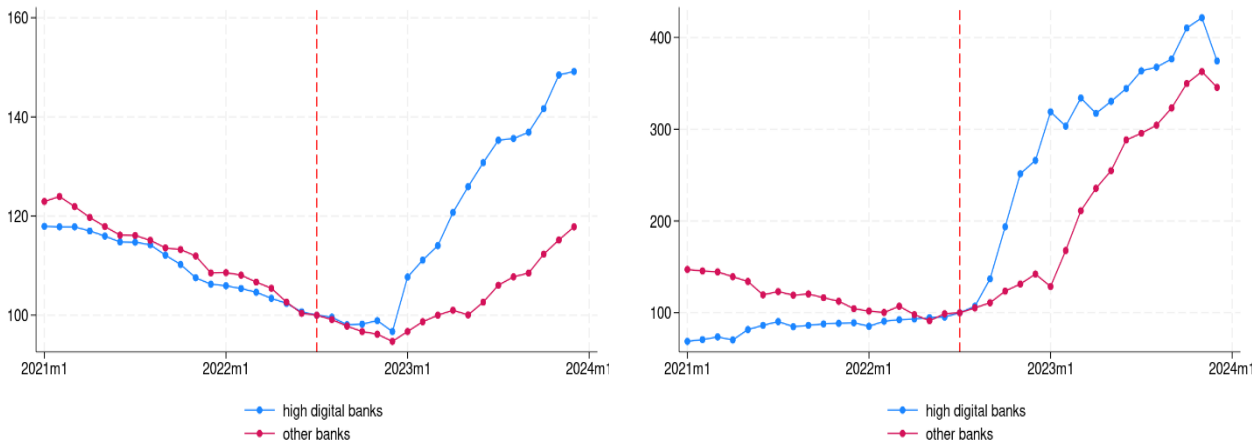
Source: Banking Supervisory Reports. Notes: The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

The higher growth in term deposits for high digital banks over the entire period following the monetary tightening has been driven by households (Figure 5, panel a). In particular, high digital banks show a greater variation in this distribution (Figure A3, panel a), specifically on the upper side; across high digital banks, the strongest increases in households' term deposits are recorded by larger

banks (Figure A3, panel b), i.e. those with total assets above the median in December 2021. In contrast, the difference in firms' term deposits growth between high digital banks and the others is eventually much smaller (Figure 5, panel b).[12]

Figure 5 – Households and firms' term deposits by type of counterparties
(outstanding amounts – index number=100 in July 2022)

a) households *b) firms*

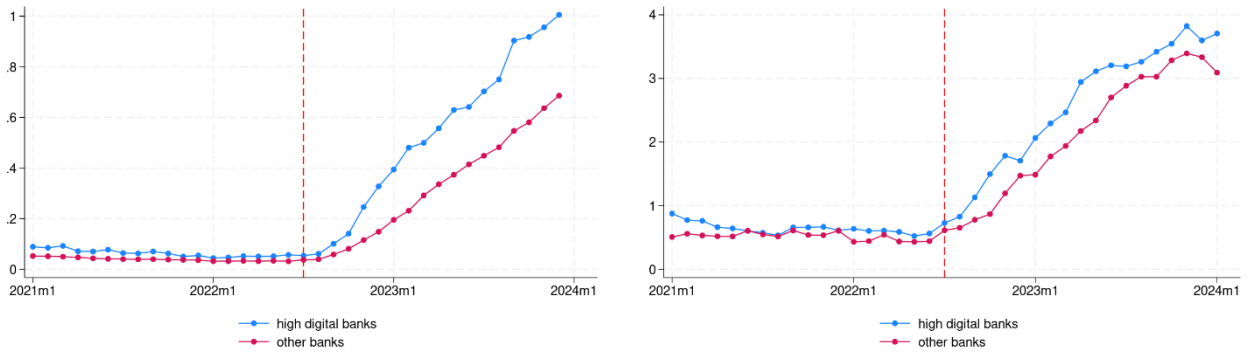


Source: Banking Supervisory Reports. Notes: The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

We finally focus on the restricted sample of banks reporting interest rates on deposits; the difference in deposit growth across high digital and other banks is broadly similar also in this sub-sample. Not controlling for other possible confounding factors, in the months following the monetary tightening high digital banks on average raised their interest rates more than other banks both on sight deposits and on household term deposits (Figure 6).

Figure 6 – Average interest rates on deposits by type of deposits
(percentage points)

a) sight deposits *b) household term deposits (new business)*



Source: MIR Banking Supervisory Reports. Notes: The dashed vertical line indicates the beginning of the monetary tightening in July 2022. For term deposits we consider interest rates on new deposits in each month.

[12] For this type of deposits, the high magnitude of growth rates is explained by their very low initial amount in banks' balance sheet (Table 1).

4. Methodology

For the estimation, we rely on a difference-in-difference (DID) model. In particular, we evaluate the effects of the monetary tightening in July 2022 on the amount of deposits and related interest rates by comparing high digital banks, as defined in Section 1.1, with other banks. The baseline DID model is described in Eq. (1):

$$Y_{i,t} = \alpha + \beta_1 high\ digital_i * post_t + \eta_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

The dependent variable is the log amount of deposits or the applied interest rate for bank *i* in month *t*. In particular, we first examine the amount of total deposits and we then focus on differences across deposit types (sight or term) and counterparties (households or firms). Similarly, we use the same sub-categories to evaluate the impact on interest rates.

Our main variable of interest is the interaction term between *high digital*, a dummy variable equal to 1 for banks with a share of online money transfer in the top quintile of the distribution (higher than 89 per cent; see Section 1), and *post*, a dummy variable equal to 1 from July 2022 onwards. We include bank and time fixed effects to control for bank heterogeneity and average time-varying shocks. Finally, we cluster standard errors at bank level.

In the second step we also include a set of interaction terms between bank control variables and the *post* dummy to verify whether our results are influenced by the interplay of bank characteristics (i.e. other than deposit digitalization) with monetary tightening.[13] To select the set of bank controls we rely on the balancing properties (Table 1); in particular, we include in our model all the variables for which we find a significant difference across high digital and other banks at the end of 2021, only excluding those that are highly collinear; all bank controls are fixed at their values in the last quarter of 2021.[14] In an additional specification, by focusing on the differential impact of the monetary tightening across household and firm term deposits, we also include bank-time fixed effects to take into account all time-varying (observed and unobserved) bank heterogeneity.

In the third step, in order to avoid that smaller banks can drive our results and to have a clearer picture of the effects at the banking system level, we estimate a weighted version of Eq. (1) by using weights equal to the total households and firms' deposits for each bank.

The DID methodology requires the parallel trend assumption: in the absence of the monetary tightening, the difference between the two groups of banks should be constant over time. First, graphical evidence is consistent with this hypothesis: as seen in Section 2, the means of the main categories of deposits for high digital and other banks have a similar trend in the period before the tightening (January 2021-June 2022), in particular for term deposits (Figure 4, panel b), household term deposits (Figure 5, panel a) and the interest rate on deposits (Figure 6). Additionally, in the next section we present an estimation of the monthly average effect for high digital banks also in the period before the monetary tightening. Both evidence supports the existence of parallel trends for the main variables of our analysis.

[13] We include only the interaction terms as the base effects are absorbed by bank fixed effects.
[14] To avoid outliers driving our results, bank variables are winsorized at the 5th and 95th percentiles.

5. Results from the estimation of the difference-in-difference model

5.1. Deposits

Table 2 presents the results obtained by estimating Eq. (1) for the total amount of deposits and for the main sub-samples in terms of customers (i.e. HHs or NFCs) and types (i.e. sight or term).

Consistent with the graphical evidence in Section 2, the results for the baseline model (panel a) show no significant differences between the two group of banks for household and firm sight deposits (column 1, panel a).[15] On the contrary, term deposits have grown more for high digital banks: the positive and statistically significant coefficient of the interaction term between *post* and *high digital* in column (2) suggests that the average growth rate of term deposits for high digital banks, after the monetary tightening, has been 20 percentage points higher than those of other banks; this larger increase is driven by household term deposits (16 percentage points, column 3).[16]

Table 2 – Effects of digitalization on the deposit amount: diff-in-diff model
(dependent variables are in log of deposits)

	(1) HH and NFC sight deposits	(2) HH and NFC term deposits	(3) HH term deposits	(4) HH and NFC total deposits
Panel a: Baseline				
post*high digital	-0.0258	**0.2029***	**0.1596***	-0.0152
	(0.7637)	(0.0821)	(0.0775)	(0.7773)
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Adj. R-squared	0.9779	0.9167	0.9317	0.9828
Observations	12471	12208	12132	12471
Panel b: Controlling for bank characteristics				
post*high digital	0.1075	**0.2131***	**0.2015***	0.0331
	(0.1935)	(0.0943)	(0.0544)	(0.2526)
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Bank controls*post	Yes	Yes	Yes	Yes
Adj. R-squared	0.9915	0.9262	0.9390	0.9950
Observations	11065	11019	10983	11065
Panel c: Weighted regressions				
post*high digital	-0.0143	**0.5958*****	**0.3305****	-0.0003
	(0.5861)	(0.0004)	(0.0100)	(0.9876)
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Adj. R-squared	0.9971	0.9518	0.9554	0.9987
Observations	12471	12208	12132	12471

Note: The table reports the results of Eq. (1). Panel (a) shows the estimates of the baseline model. In panel (b) we include a set of interactions between the dummy *post* and the following bank control variables: log assets, ratio of loans to private sector and assets, the ratio of deposits and assets, the ratio of consumer credit and assets, the share of fixed-interest rate mortgages, ROA, asset management over operating income, NPL ratio, share of HH deposits over total deposits. In panel (c) we run a weighted regression with weights equal to HH and NFC deposits for each bank. In each column the dependent variable is expressed in logarithm. Standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[15] In an unreported estimation, we find that for firm sight deposits the coefficient of the interaction term was negative and significant. However, this evidence is determined only by 5 small digital banks that recorded large negative variations; when those banks are excluded the coefficient of the interaction term is no longer significant.
[16] In an unreported estimation, we do not find any difference between high digital and other banks by estimating Eq. (1) for firm term deposits.

Unlike the graphical evidence in Figure 3, the results of the DID estimation show that there are no significant differences between the two groups of banks in the dynamics of total household and firm deposits after the monetary tightening (column 4). This evidence suggests that, given the low weight of household term deposits on total deposits (the median value is 9 per cent), their larger increase has not been able to translate on a better trend in total deposits due to a slightly larger (but not statistically significant) decrease in sight deposits (column 1).

Our results are confirmed by including a set of interactions between the dummy *post* and bank control characteristics in panel (b):[17] the magnitude of the increase in total and household term deposits is broadly similar with respect to the baseline model in panel (a).

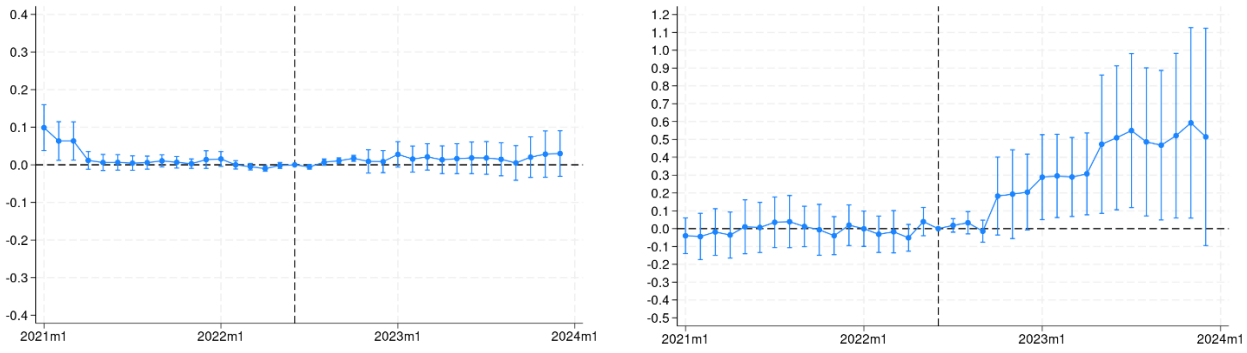
Finally, panel (c) shows the results of a weighted estimation, with weights equal to households and firms deposits for each bank. By analysing the effects of deposit digitalization on the aggregate banking system, we observe that the coefficients of total and households term deposits are much greater than in the baseline estimation, signalling the role played by the largest digital banks. In particular, the weighted average growth rates of total and household term deposits for high digital banks, after the monetary tightening, have been respectively roughly 60 and 30 percentage points higher than those of other banks.

We also assess how the effect of deposit digitalization varies across months after the monetary tightening. Figure 7 shows the monthly average weighted effect of the *high digital* dummy for, respectively, sight deposits and household term deposits between January 2021 and December 2023. In both cases, we confirm that before the monetary tightening the trends were similar across the two categories of banks. However, after the monetary tightening, household term deposits start to increase more for high digital banks; this difference was significant mainly after December 2022.

Figure 7 – The impact of digitalization on deposit amount across time

(change in log of deposits)

a) sight deposits *b) household term deposits*



Notes: The figures show the results of Eq. (1) obtained by estimating the impact of the dummy *high digital* (β_1) in each month, weighting for the total amount of households' and firms' deposits. The points report the point estimate of each coefficient β_1; the bands depict the 90% confidence intervals. The dashed vertical lines indicate the beginning of the monetary tightening in July 2022.

Finally, to take entirely into account the effects of observable and unobservable differences across the two categories of banks, we estimate a more saturated specification of the model described in Eq. (2):

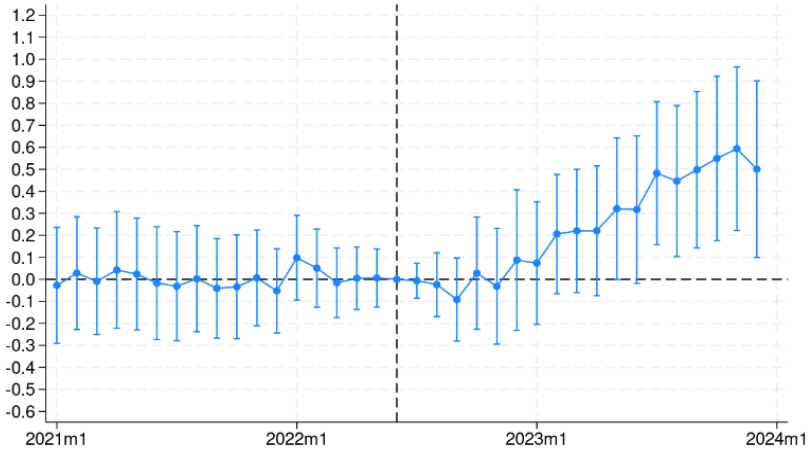
[17] The bank control variables included in this estimation, fixed at the last quarter 2021, are log assets, the ratio of loans to private sector and assets, the ratio of deposits and assets, the ratio of consumer credit and assets, the share of fixed-interest rate mortgages, ROA, asset management over operating income, NPL ratio, share of HH deposits over total deposits.

$$Y_{i,j,t} = \alpha + \beta_1 high\ digital_i * HHdeposit_j * time_t + \theta_{j,t} + \eta_{i,t} + \mu_{i,j} + \varepsilon_{i,j,t} \quad (2)$$

The dependent variable is the log amount of term deposits for the bank *i* in month *t* for the customer type *j* (i.e. firm or household). Our key variable of interest is the triple interaction term between the dummy *high digital*, a dummy variable for each month examined (July 2022 is the baseline group) and *HHdeposit*, which is a dummy variable equal to 1 for household term deposits. By estimating Eq. (2) both for household and firm term deposits, we are able to saturate our model with an extensive set of fixed effects. In particular, we include: bank-time fixed effects, which control for all time-varying bank heterogeneity; deposit type-time fixed effects, which control for potential time-varying shocks to each counterparty (i.e. households or firms); bank-deposit type fixed effects, which control for potential preferences of banks to each deposit type.

Figure 8 shows the results of the estimation of Eq. (2). This test confirms that the average growth rate of household term deposits was 50 p.p. higher with respect to that of firm term deposits for high digital banks versus other banks.

Figure 8 – The impact of digitalization on household versus firm term deposits across time
(change in log of deposits)



Notes: The figure shows the coefficient of the interaction *highdigital*HHdeposit* of Eq. (2) across time. The points report the point estimate of each coefficient; the bands depict the 90% confidence intervals. The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

5.2. Interest rates on deposits

Table 3 displays the estimates of the DID model where the dependent variables are the interest rate on deposits. As mentioned in Section 3, in this analysis the sample size decreases substantially as the number of banks providing this information is much lower.[18]

With this caveat in mind, our results show that on average high digital banks have raised interest rates in the segment of household term deposits more than other banks. During the monetary tightening cycle, high digital banks have paid on average 32 basis points more than other banks on household term deposits (panel a, column 2). This result is driven mainly by large banks as shown by estimates from the weighted regression model (panel b, column 2): high digital banks paid 85 basis

[18] We verify that results on household term deposits hold also when using this smaller sample of banks; due to the lower number of observations the evidence is stronger when we run a weighted estimation.

points more than other banks on household term deposits after the monetary tightening. Similarly to the deposit amounts, also for interest rates we do not find any significant difference for household and firm sight deposits (column 4).[19]

Given the limited number of observations and the fact that the two samples of banks are much more similar (Table A1) we do not estimate our model for interest rates by controlling for bank characteristics interacted with the dummy *post*. However, to take into account observable and unobservable differences across bank categories, we rely on the estimation of a more saturated specification of the model – described in Eq. (2) – also for interest rates. In this case we interact the *high digital*HHdeposit* term with the dummy *post*, given that the lower number of observations does not allow us to estimate the effect of deposit digitalization over months. The results, reported in panel (c) of Table 3, confirm that the increase in interest rates on household term deposits with respect to those on firm deposits was significantly higher (almost 40 basis points) for high digital banks.

Table 3 – Effects of digitalization on deposit interest rates: diff-in-diff model

(dependent variables are in percentage points)

	(1) HH and NFC term deposits (new business)	(2) HH term deposits (new business)	(3) NFC term deposits (new business)	(4) HH and NFC sight deposits	(5) HH and NFC term deposits (new business)
Panel a: Baseline					
post*high digital	0.0546	**0.3231****	-0.0554	0.2698	
	(0.7069)	(0.0422)	(0.6839)	(0.1355)	
Bank FE	Yes	Yes	Yes	Yes	
Time FE	Yes	Yes	Yes	Yes	
Adj. R-squared	0.9049	0.8752	0.8384	0.7319	
Observations	1093	1413	1051	1384	
Panel b: Weighted regressions					
post*high digital	0.0735	**0.8506*****	-0.2615	-0.0242	
	(0.6782)	(0.0005)	(0.1306)	(0.7114)	
Bank FE	Yes	Yes	Yes	Yes	
Time FE	Yes	Yes	Yes	Yes	
Adj. R-squared	0.8035	0.8038	0.6943	0.7541	
Observations	1093	1413	1051	1384	
Panel c: saturated specification					
high digital*HHdeposit*post					**0.3974****
					(0.0401)
Bank-time FE					Yes
Deposit type-time FE					Yes
Bank-deposit type FE					Yes
Adj. R-squared					0.8759
Observations					2190

Note: The table reports the results of Eq. (1) and Eq. (2) for interest rates. Panel (a) shows the estimates of the baseline model. In panel (b) we run a weighted regression with weights equal to HH and NFC deposits for each bank. Panel (c) reports the results for the saturated specification reported in Eq. (2) of the effects of digitalization on interest rates on term deposits across deposit counterparties. The sample adopted in each regression includes around 50 banks. Standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

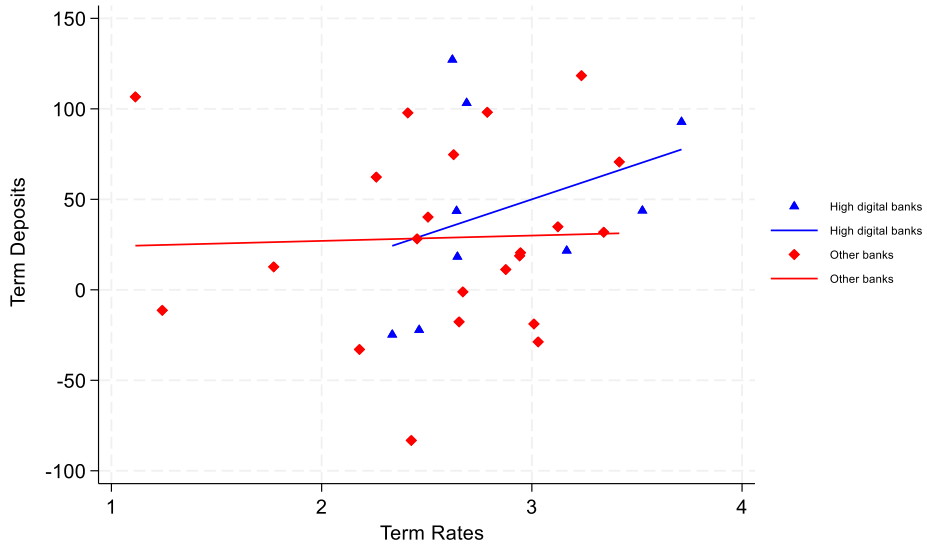
[19] In unreported estimations, we find that high digital banks raised interest rates on firm sight deposits more than other banks during monetary tightening. However, this result is not confirmed in the weighted regression model.

Finally, although we have deposit interest rates only for a smaller subsample of banks, we present some evidence to evaluate the sensitivity of household term deposits to related interest rates by focusing on the smaller sample of banks that report both information.

Figure 9 shows the graphical evidence on the relationship between the cumulated change in the household term deposit rates and the cumulated change in the related amount during the 2022 monetary tightening (i.e., July 2022-December 2023).[20] The sensitivity of household term deposits to the increase in the related interest rates is higher for high digital banks relative to that of the other banks, whose customers appear less responsive to rate changes. While some other banks have increased interest rates similarly to high digital banks, they more frequently observe a weaker response in the growth rate of their deposit volumes over time.[21] The stronger growth in deposit volumes recorded by high digital banks is hence not simply explained by the fact that they pay higher interest rates; while this channel is at work, its impact is amplified by the higher sensitivity of their deposits to the rates.

Figure 9 – Sensitivity of household term deposits to the related interest rates during the 2022-2023 monetary tightening

(percentage changes and percentage points)



Notes: Each marker represents a bank and displays the combination of the change in household term deposits and the corresponding change in interest rates. The x-axis indicates the cumulated change in interest rates on household term deposits (new business) recorded at the end of the period of analysis (i.e., December 2023). The y-axis shows the cumulated percentage change in term deposits recorded in the same period.

Furthermore, we test the higher sensitivity of household term deposits to the related rates for high digital banks by regressing the cumulated change in household term deposits on the cumulated change in deposit interest rates and its interaction with *high digital*, controlling for bank and time fixed effects (Table A2). Consistent with the graphical evidence, the interaction term has a positive and significant

[20] We remove outliers by excluding banks in the top 5 per cent of the deposit growth distribution.

[21] We observe similar dynamics when we replicate the same exercise by scaling the cumulated percentage change in household term deposits by the total deposit amount recorded before the first monetary policy rate hike (Figure A5). This scaling helps us to assess how effectively banks use this type of deposits to adjust their funding composition. Indeed, while term deposits represent a small portion of total deposits, some high digital banks have significantly changed their funding sources, shifting more heavily toward stable funding, compared to other banks.

coefficient, confirming a higher sensitivity of household term deposits to changes in interest rates for high digital banks compared to other banks.[22]

6. The effects on selected outcomes of high digital banks

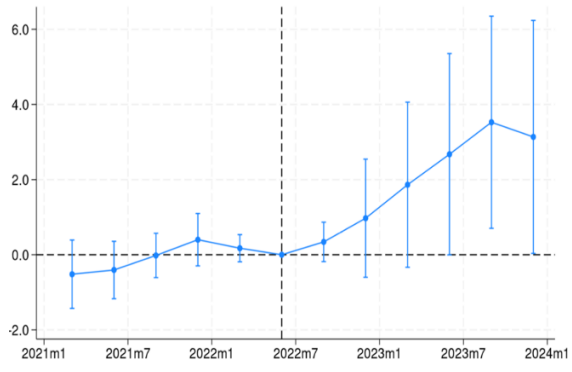
In this section we verify the effects of the dynamics observed on selected outcomes of high digital banks, specifically on their profitability. We hence consider a diff-in-diff regression model, such as in Eq. (1), where the dependent variable is the bank outcome of interest and, among the regressors, we consider the interaction term between the dummy for high digital banks and time. We therefore analyse how the bank outcomes vary across time for the high digital banks with respect to the other intermediaries.

First, we show the impact on the composition of their funding structure. In line with previous results, after the monetary tightening high digital banks show a stronger increase, by a magnitude of 4 percentage points (Figure 10, panels a and b), in the share of term and total household deposits (on their total HH and NFC deposits) with respect to other banks. Regarding other forms of funding different from deposits, we do not find significant differences between the share of bonds over total funding of high digital banks with respect to other intermediaries (Figure 11); this evidence suggests that high digital banks have not changed their reliance on bonds.

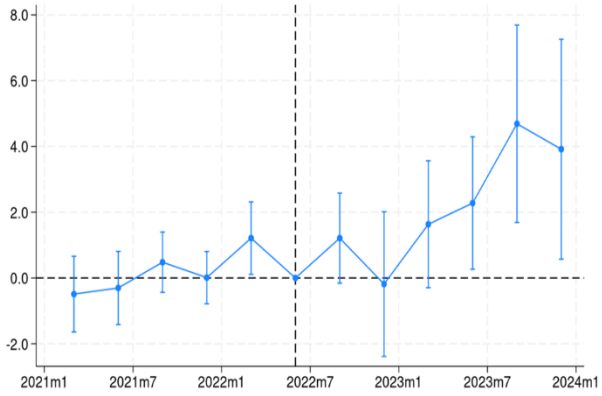
Figure 10 – The impact of digitalization on the share of household deposits

(percentage points)

a) household term deposits



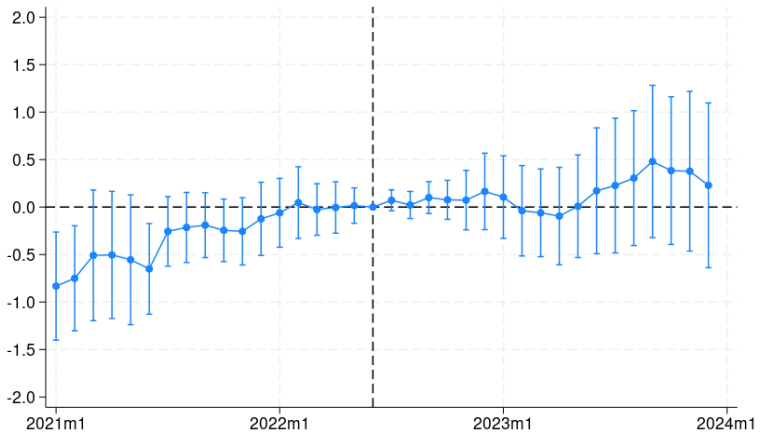
b) household deposits



Note: The figures show the results of Eq. (1) obtained by estimating the impact of the dummy *high digital* in each month and by employing as the dependent variable, respectively, the share of household term deposits and the share of household deposits of total HH and NFC deposits. The points report the point estimate of each coefficient; the bands depict the 90% confidence intervals. The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

[22] Given the smaller sample size, the estimates are very sensitive to outliers; we hence rely on a weighted estimation.

Figure 11 – The impact of digitalization on the share of bonds over total funding
(percentage points)

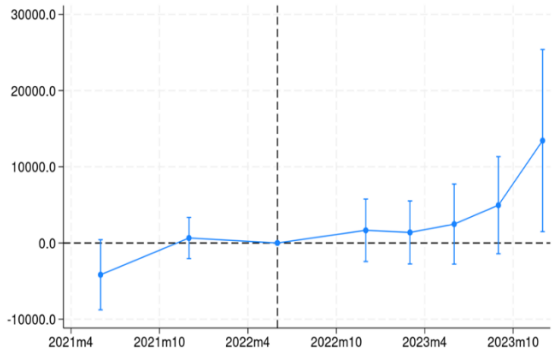


Note: The figure shows the results of Eq. (1) obtained by estimating the impact of the dummy *high digital* in each period and by employing as the dependent variable the share of bonds over total funding. The points report the point estimate of each coefficient; the bands depict the 90% confidence intervals. The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

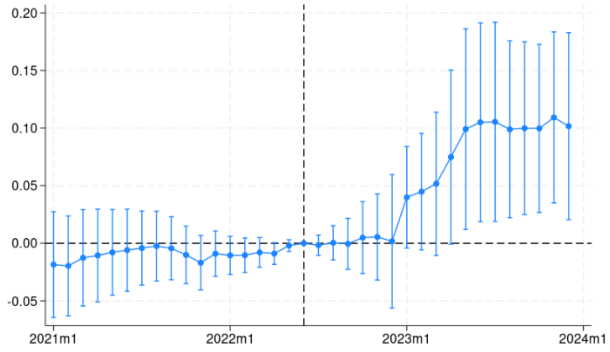
Moreover, we find that high digital banks were better able to attract new depositors (Figure 12, panel a): their number increased more for them than for other banks (over than 10,000 customers at the end of 2023). Finally, they have also on average increased their market share of HH term deposits (Figure 12, panel b).[23]

Figure 12 – The impact of digitalization on the number of deposit costumers and market share of household term deposits

a) number of deposit customers



b) bank market share of HH term deposits



Note: The figures show the results of Eq. (1) obtained by estimating the impact of the dummy *high digital* in each period and by employing as the dependent variable, respectively, the number of deposit customers and the market share of HH term deposits. The market share is calculated as the share of HH term deposits of each banks with respect to the total amount of the banking system. T The points report the point estimate of each coefficient; the bands depict the 90% confidence intervals. he dashed vertical line indicates the beginning of the monetary tightening in July 2022.

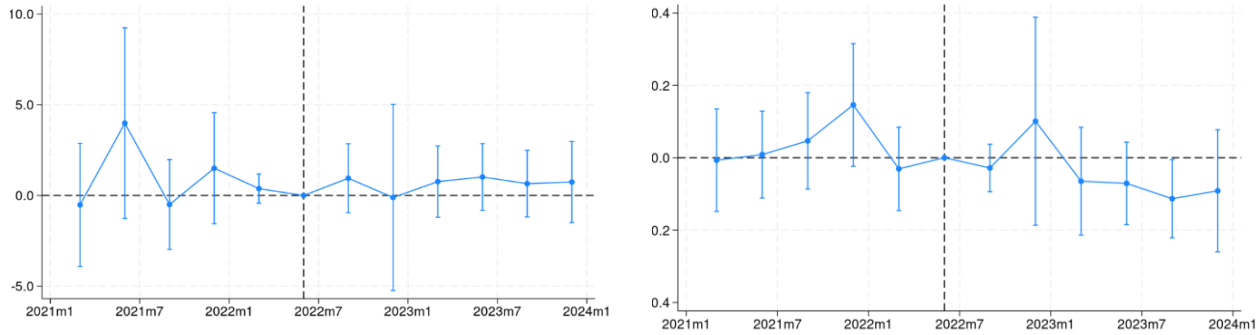
We then focus on the possible impact of high digital banks' decision to attract more household term deposits on their profitability. Indeed, the higher increase in deposit interest rates, observed for

[23] Non-parametric evidence shows that the share of household term deposits of *all* high digital banks increased, after the monetary tightening, by about 5 p.p. (Figure A4).

this category of intermediaries, could have had a negative effect on their returns. However, we do not find significant differences between the ROE and ROA of high digital banks with respect to other intermediaries after the monetary tightening in July 2022 till December 2023 (Figure 13).

Figure 13 – The impact of digitalization on the bank profitability
(percentage points)

a) ROE *b) ROA*

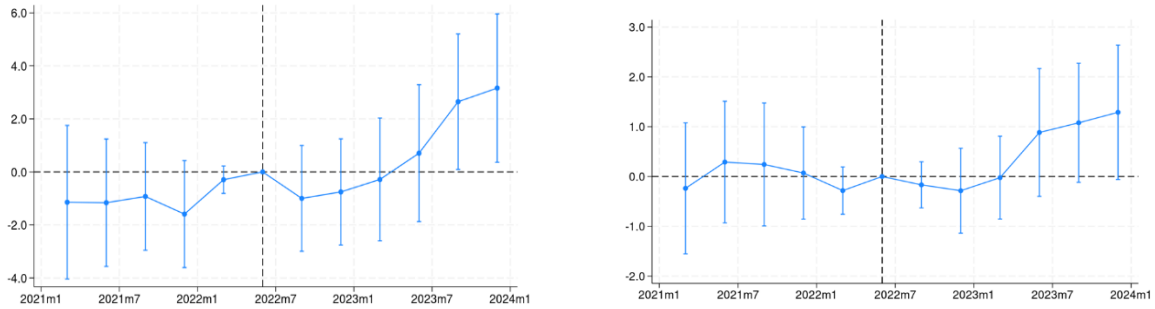


Note: The figures show the results of Eq. (1) obtained by estimating the impact of the dummy *high digital* in each period and by employing as the dependent variable, respectively, ROE and ROA. The points report the point estimate of each coefficient; the bands depict the 90% confidence intervals. The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

We also find evidence of different developments after the monetary tightening for the share of fixed rate mortgages, which increased more (by 2 p.p.) for high digital banks in the last two quarters of 2023 (Figure 14 panel a). There is also a suggestive evidence of a higher increase in the ratio of Government bonds on total assets (by 1 p.p.) at the end of 2023 for high digital banks, though this difference is not statistically significant (Figure 14 panel b).

Figure 14 – The impact of digitalization on selected types of assets
(percentage points)

a) share of fixed rate mortgages *b) government bonds on total assets*



Note: The figures show the results of Eq. (1) obtained by estimating the impact of the dummy *high digital* in each period and by employing as the dependent variable, respectively, the ratio of Government bonds to assets and the share of fixed interest rate mortgages over total mortgages. The points report the point estimate of each coefficient; the bands depict the 90% confidence intervals. The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

All in all, the results of this section suggest that the higher digitalization of customers and their greater attention to the economic conditions of deposits have been used by some high digital banks

to attract a more stable funding (household term deposits) compared to other banks; the negative impact of the higher increase in deposit rates on profitability might have been counterbalanced by investing more on assets that guarantee fixed and high returns in the medium term (e.g. fixed rate mortgages and Government bonds).

7. Mechanisms at work: heterogeneities across high digital banks

In this section we investigate whether the dynamics observed for high digital banks could be the results of a decision based on their business model or they are associated with some of their intrinsic vulnerabilities. Henceforth, we focus on heterogeneities across high digital banks.

We first consider some general characteristics of high digital banks such as their size and profitability.[24] Larger and more profitable banks might increase more their deposits as they have better investment opportunities. We then analyse the effects of other bank characteristics that capture the bank business model, such as the relevance of different types of deposits and loans and the share of Government bonds on total assets.

Secondly, we evaluate the effects of indicators of possible vulnerabilities such as the non-performing loan ratio and of two indicators of liquidity, i.e. the liquidity coverage ratio and the net stable funding.[25] In principle, banks with weaker positions along these dimensions may be more vulnerable to possible deposit outflows and could hence have stronger incentives to increase more interest rates to contain such risk. We also consider the importance of the unrealized losses on the portfolio of Government bonds, evaluated at amortized costs, which could be high for some banks after the strong increase in monetary policy rates: possibly these banks wanted to avoid selling these bonds and, hence, they were more determined to counteract a reduction in their deposits.[26]

To test the relevance of the different mechanisms at work, we enlarge Eq. (1) by including a set of bank characteristics in a triple interaction term, as described in Eq. (3):

$$Y_{i,t} = \alpha + \beta_1 high\ digital_i * post_t * bank\ variables_i + \beta_2 high\ digital_i * post_t + \beta_3 post_t * bank\ variables_i + \eta_i + \mu_t + \varepsilon_{i,t} \quad (3)$$

We focus on the impact on the amount of household term deposits as it is our main outcome variable, while we do not estimate this model for interest rates due to the small sample size. Bank variables is a vector that includes the set of bank characteristics of interest, considered at their level in the last quarter of 2021.[27] For each bank characteristic, we consider a dummy variable for values above the median.[28] Our key variable of interest is the coefficient of the triple interaction term, which

[24] We have not taken into account the CET1 ratio as this indicator is highly negatively collinear with the bank size. In our sample smaller banks have on average a much higher capital ratio.
[25] See Section 1 and Table 1 for details about these indicators.
[26] This information is reported only in consolidated balance sheets; therefore, the estimation is run on a more limited number of observations. We consider the ratio of unrealized losses on total assets.
[27] The unrealized losses on the Government bonds portfolio and the liquidity coverage ratio are measured at the end of 2022 for data availability reasons.
[28] We also include a dummy variable (AMF) equal to 1 if the bank has asset management fees above the Finrep reporting threshold, i.e. when the bank share of net fees and commissions over operating income is equal to or greater than 10 per cent.

indicates how much the increase in household term deposit was higher, after the monetary tightening, for high digital banks that belong to the upper part of the distribution of each bank characteristic.[29]

To help reading the evidence, in Table 4 we include the main results for the triple interaction term; Table A3 in the Appendix contains the other variables that we have considered. Results show that bank size plays a key role for differentiating the group of high digital banks, in line with the stronger effect already assessed in the weighted regression (Table 2, panel c). More specifically, high digital banks whose size is below the median do not show a higher increase in household term deposit compared to other banks (Table 4, column 1, first row). The stronger increase in household term deposits is determined only by high digital banks whose size is above the median: the coefficient of 0.46 implies that these banks show a higher increase in household term deposits of around 40 percentage points (0.46-0.09) than other banks. This effect compares with the *average* larger increase in this type of deposit recorded by *all* high digital banks equal to 0.16 (Table 2, 0.33 in the weighted estimations).[30]

Table 4 –Digitalization on household term deposit: the impact of selected bank characteristics
(dependent variables are in log of deposits)

	(1)	(2)	(3)	(4)	(5)	(6)
post*high digital	-0.0877	-0.035	-0.0043	0.1216	0.1610	**0.2741****
	(0.321)	(0.754)	(0.969)	(0.212)	(0.142)	(0.050)
post*high digital*High Size	**0.4649*****					
	(0.005)					
post*high digital*High Roe		**0.2887***				
		(0.084)				
post*high digital*High Div. index			**0.3078***			
			(0.078)			
post*high digital*AMF				**0.5020****		
				(0.045)		
post*high digital*High CTI					-0.0039	
					(0.983)	
post*high digital*High termHH						**-0.3024***
						(0.072)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.9315	0.9316	0.9314	0.9320	0.9311	0.9319
Observations	12033	12033	12084	12132	12084	12084

Note: The table reports the results of Eq. (3). The dependent variable is the logarithm of household term deposits. *High Size, High Roe, High Diversification index, High CTI* and *High termHH* indicate a dummy equal to 1 if the bank belongs to the upper part of the distribution for the bank characteristics considered. AMF is a dummy variable for high asset management fees (their share of net fees and commissions over operating income is greater than 10 per cent, the Finrep reporting threshold). The interaction terms between these dummies and the post dummy are estimated but not reported in the table. Standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The evidence is similar for bank profitability: even in this case, only high digital banks with a ROE above the median have recorded a stronger increase in household term deposits (Table 4, column 2).

[29] Hence, the coefficient of the term *post*high digital* indicates the impact for high digital banks that belong to the lower part of the distribution of each bank indicator; while for high digital banks that belong to the upper part of the distribution of each bank indicator, the effect is the sum of *post*high digital* and of the triple interaction term coefficients.
[30] As regards the sample of other banks, unreported interaction terms between *post* and the selected dummies suggest that there is no heterogeneity across these banks with a different size; hence size is not relevant per se in explaining the evidence we find.

When we analyse the effects of the three possible different components of bank profitability, such as cost-to-income, diversification index,[31] and asset-management fees, the interaction terms that turns out to be significant are the ones related to diversification and fee indicators (Table 4, columns 3 and 4), whereas costs are not significant (Table 4, column 5). This means that high digital banks with higher increase in household term deposits are those with more diversified revenues and specifically with higher asset management fees.

When we look at the possible different dynamics according to the shares of deposits, we find that household term deposits have grown more *only* for high digital banks that had an initial share of these deposits (on their total deposits) below the median value (Table 4, column 6).[32]

All the other interaction terms with the indicators of bank specific business models are not significant, including those related to the loan side (the shares of different types of loans) or the share of Government bonds on total assets as well as the share of bonds over total funding (Table A3).

Finally, none of the proxy of bank vulnerabilities is significant in the triple interaction term with *high digital* and *post* (Table A3), suggesting that our results are not driven by more vulnerable high digital banks.

In conclusion, the evidence reported in this section suggests that high digital banks do not appear to have reacted to some specific vulnerabilities and that they have decided to attract more household term deposits. Initially larger and more profitable high digital banks and those with an initial lower share of household term deposits were able to attract more inflows on household term deposits.

8. Robustness

In this section we present a set of robustness tests to check the validity of our main findings. First, we verify whether the increase in household term deposits is affected by our sample choice.[33] In particular, we check whether our results hold when we use a higher threshold by identifying high digital banks as those in the top 5 per cent of the distribution (with a ratio of online money transfer higher than 95 per cent). Column (1) of Table 5 shows that the increase in HH term deposits is significant also by replacing *high digital* with *high digital top 5%*, which is a dummy variable equal to 1 for banks with a share of online money transfer in the top 5 per cent of the distribution.

Secondly, we consider a very stringent definition of high digital banks, consistent with that of Erel et al. (2023). We therefore estimate Eq. (1) for household term deposits by replacing the *high digital* dummy with the *online bank* dummy, which is equal to 1 for 14 banks with few or no branches. Column (2) of Table 5 confirms that our results hold when we adopt this definition.[34] Likewise, our main findings on HH term deposit rates are robust to employing both samples of high digital banks. For HH term deposit rates, we report in Column (3) of Table 5 only the results for *online banks:*

[31] The diversification index is calculated as the difference between intermediation margin and interest rate margin on intermediation margin.
[32] As regards the sample of other banks, unreported interaction terms between *post* and the selected dummies suggest that there is no heterogeneity across these banks with a different share of HH term deposits, while we find some evidence that other banks with a ROE above the median have recorded a higher increase, compared to other banks, in household term deposits after July 2022.
[33] The share of digital money transfer is relatively stable for the large majority of banks between 2020 and 2023, therefore our results are quite similar by calculating the threshold in different periods. Our results are also robust to identifying high digital banks by using the amount of digital money transfers (instead of the number), which is however less stable over time.
[34] In unreported tests we verify that our results hold also by replicating the same checks for sight deposits' dynamics.

although in principle the high digital top 5 per cent includes a broader set of digital banks than just the online category, in practice the two groups are identical when limiting the sample to institutions reporting HH term deposit rates.

Our main findings are also robust to estimating Eq. (1) by including in household term deposits also those of residents in other euro area countries (column 1 of Table A4), which are particularly important for some smaller banks, and deposits of foreign branches and subsidiaries in Italy (column 2 of Table A4).[35]

Table 5 – Digitalization on household term deposit: robustness checks

	(1)	(2)	(3)
	HH term deposits amount		HH term deposits rates
	top 5% banks	online banks	online banks
post*high digital top 5%	0.3484*		
	(0.0514)		
post*online bank		0.1316***	0.5353**
		(0.0032)	(0.0289)
Bank FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Adj. R-squared	0.9317	0.9494	0.875
Observations	12132	10724	1421

Notes: The dependent variables are expressed in logarithm in columns (1) and (2), and in percentage points in (3). Columns (1) reports the result of Eq. (1) for household term deposits amount and rates, respectively, by replacing *high digital* with *high digital top 5%*, which is a dummy variable equal to 1 for banks with a share of online money transfer in the top 5 per cent of the distribution (i.e., higher than 95 per cent). Columns (2) and (3) report the results of Eq. (1) for household term deposits amount and rates, respectively, by replacing *high digital* with *online bank*, which is a dummy equal to 1 for banks with few or no branches, and excluding the other high digital banks. In all columns standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Furthermore, we show that the increase in household term deposits is positively correlated to the level of ECB rates by replacing in Eq. (1) the *post* dummy with *ECB rate*, which is the ECB main refinancing operations rate in *t* (column 3 of Table A4); one 1 p.p. increase in ECB rate is associated with a higher rise of 6 p.p. in household term deposits for high digital banks compared to other ones.

We also take into account the effect of mergers and incorporations occurred during the period of analysis. These events involved mainly some smaller intermediaries such as cooperative credit banks. Since this type of event may lead to an increase in deposits for the acquiring bank, we estimate Eq. (1) by assuming that the intermediaries involved in these operations were already merged since the beginning. The results in Table A5 confirm our main findings for deposits (Table 2, panel a) and for interest rates (Table 3, panel a). Furthermore, in order to address the potential correlation of observations within a banking group, this robustness check is replicated, both on deposit quantities and related interest rates, by clustering the standard errors at group level; the results still hold.

Finally, we assess whether our findings on interest rates hold when using a larger sample of about 350 banks, using balance sheet data on interest rate expenses and deposit amounts, which allows us to calculate interest rates on a semi-annual basis. While this approach enables us to significantly expand the sample size, it does not allow us to focus on new deposits or on the differences across counterparties. Due to data limitations, we replicate our model by focusing solely on interest rates for

[35] The same results of the baseline estimations also hold for sight deposits for which no difference appears in the two groups of banks.

sight deposits from households and firms, which are nevertheless very important as they make for the largest share of deposits. Table 6 shows that, even with this larger sample, we find no significant differences between high digital and other banks in the dynamic of sight deposit interest rates during the period of monetary tightening, consistent with the results shown in Table 3.

Table 6 – Effects of digitalization on sight deposit interest rates: diff-in-diff model
(dependent variables are in percentage points)

	(1)	(2)	(3)
	HH and NFC sight deposits	HH and NFC sight deposits	HH and NFC sight deposits
post*high digital	0.0462	0.3331	0.2698
	(0.4886)	(0.1677)	(0.1355)
Bank FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Adj. R-squared	0.5666	0.6543	0.7319
Observations	2006	221	1384

Note: The table presents the results of Eq. (1) using different samples. Column (1) shows the estimates derived from semi-annual bank balance sheet data from Supervisory Reports. Columns (2) and (3) provide estimates based on monthly interest rate data from MIR. Specifically, column (3) replicates the results previously shown in column (4) of Table 3, using all available monthly data, while column (2) displays estimates based on the subset of monthly observations corresponding to the dates used in column (1). The dependent variable is the interest rate on sight deposits. Standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

9. Conclusions

This paper examines the dynamics of deposits of high digital and other banks during a monetary tightening. Focusing on the impact of the monetary restriction started in July 2022, we do not find evidence of a stronger decrease in sight deposits for Italian high digital banks, which we identify as those with a high share of online money transfers. In contrast, for this group of intermediaries we observe a larger increase in household term deposits and in the related interest rates.

Overall, during the monetary tightening high digital banks increased their share of household term deposits and attracted new customers, without any negative impact, compared to other banks, of the larger increase in interest rates on their profitability in the period under analysis (i.e. until December 2023).

The greater rise in household term deposits is not correlated with some intrinsic bank vulnerabilities, while is driven by high digital banks that are ex-ante larger and more profitable and with an initial lower share of household term deposits.

All things considered, household term deposits have become more sensitive to the changes in interest rates for high digital banks and this is a sign of a possible reduction in their deposits' franchise value. However, this result does not arise for the most vulnerable high digital banks. Furthermore, the observed dynamics do not have negative effects on high digital banks' profitability, in the period analysed, either because the weight of household term deposits on total deposits is still relatively small and due to their increasing investments in fixed rate assets purchased at time of high interest rates. Finally, the deposits that have become more sensitive to interest rates are household term deposits that banks consider as a more stable funding.

An important remark is in order. Our results indicate that, for the time being, the digitalization of deposits does not pose a threat to the stability of the banking system in the context of a common shock

such as a monetary tightening affecting all institutions at the same time. This conclusion shall not be generalized: the interplay between deposit digitalization and specific idiosyncratic shocks, for example an abrupt reduction in the bank's liquidity ratio, may be very different; this is a fruitful area of analysis that we leave to future research.

References

Beck, T., S.G. Cecchetti, M. Grothe, M. Kemp, L. Pelizzon and A Sánchez Serrano(2022). Will video kill the radio star? Digitalisation and the future of banking, ESRB: *Advisory Scientific Committee Reports*, N. 12.

Benmelech, E, J. Yang, and M. Zator (2023). Bank Branch Density and Bank Runs, *Technical Report, National Bureau of Economic Research*.

Branzoli, N., E. Rainone, and I. Supino (2024). The Role of Bank Technology in Credit Markets During the Pandemic, *Journal of Financial Stability*, Vol. 71.

Caglio, C., J. Dlugosz, and M. Rezende (2023). Flight to Safety in the Regional Bank Crisis of 2023, *Board of Governors of the Federal Reserve System Working Paper*.

Cookson, A., J. Gil-Bazo, C. Fox, J. F. Imbet, and C. Schiller (2023). Social Media as a Bank Run Catalyst, *Working Paper*.

Drechsler, I., A. Savov, and P. Schnabl (2017). The Deposits Channel of Monetary Policy. *The Quarterly Journal of Economics*, Vol. 132 (4), 1819–1876.

Drechsler, I., A. Savov, P. Schnabl, and O. Wang (2023). Banking on Uninsured Deposits, *NBER Working Paper*, No. 31138.

Erel, I., Liebersohn, J., Yannelis, C., Earnest, S. (2023). Monetary policy transmission though online banks, *NBER Working Paper* No. 31380.

Fascione, I., Oosterhek, K., Scheubel, B., Stracca, L., Wildmann, N. (2024). Keep calm, but watch the outliers: deposit flows in recent crisis episodes and beyond, *ECB Occasional Paper Series* No. 361.

FSB (2024), Deposit Behavior and Interest Rate and Liquidity Risk in the Financial System, Lessons from the March 2023 banking turmoil.

Greenwald, E. (2024). View from the District: Deposits in a Digital World, Federal Reserve Bank of Dallas.

Jiang, E. X., G. Yang Yu, and J. Zhang (2022). Bank competition amid digital disruption: Implications for financial inclusion, *Working paper*.

Jiang, E., G. Matvos, T. Piskorski, and A. Seru (2023). Monetary Tightening and US Bank Fragility in 2023: Mark-to-Market Losses and Uninsured Depositor Runs?, *NBER Working Paper*.

Liang, P., M. Sampaio, and S. Sarkisyan (2024). Digital Payments and Monetary Policy Transmission Digital Payments and Monetary Policy Transmission, *Working Paper*.

Koont N., T. Santos, and L. Zingales (2023), Destabilizing digital "bank walks", *Chicago Booth, Stigler Center, New Working Paper Series*.

Kundu, S., T. Muir and J. Zhang (2024), Diverging Banking Sector: New Facts and Macro Implications, *Working paper*.

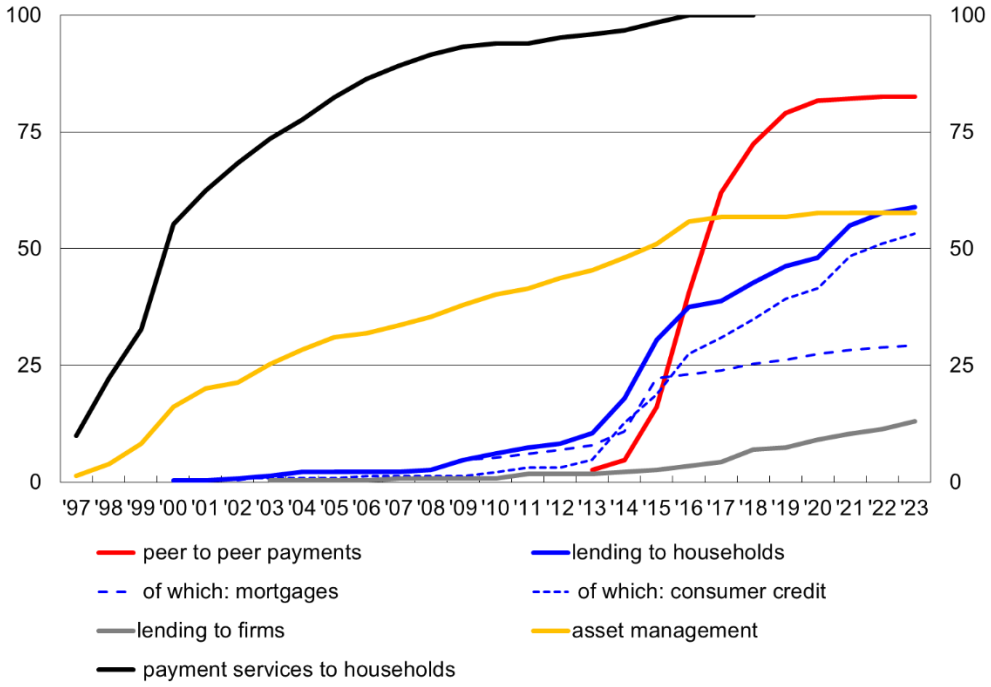
Messer, T. and F. Niepmann, (2023), What determines passthrough of policy rates to deposit rates in the euro area, *FEDS Notes, Board of Governors of the Federal Reserve System*.

Xiao, K. (2020). Monetary Transmission Through Shadow Banks. *The Review of Financial Studies*, Vol. 33 (6), 2379–2420.

Appendix

Figure A1 – Evolution of bank services offered through digital channels

(Share of banks - percentage values)

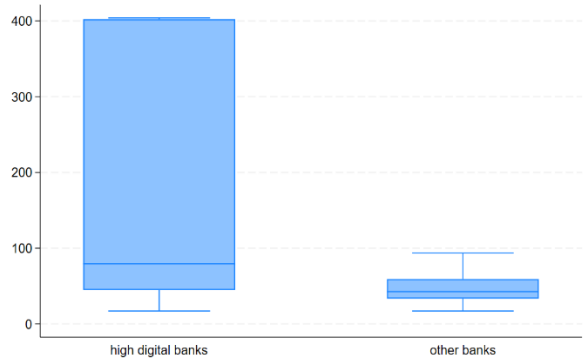


Source: Regional Bank Lending Survey; data are collected over 245 banks which account for around 90 per cent of deposits and loans to Italian customers.

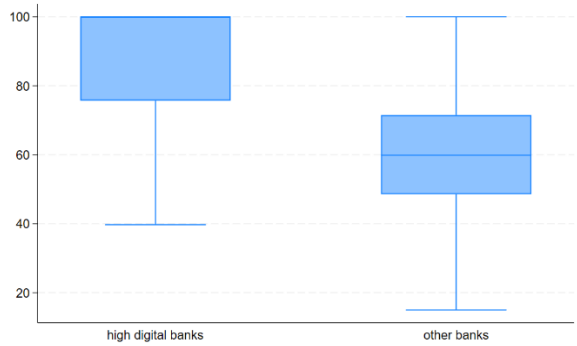
Figure A2 – Distribution of the deposits-to-branches ratio and the share of home-banking for high digital versus other banks

(ratio of deposits in millions over the number of branches - panel a, percentage points – panel b)

a) deposits-to-branches ratio



b) share of home-banking

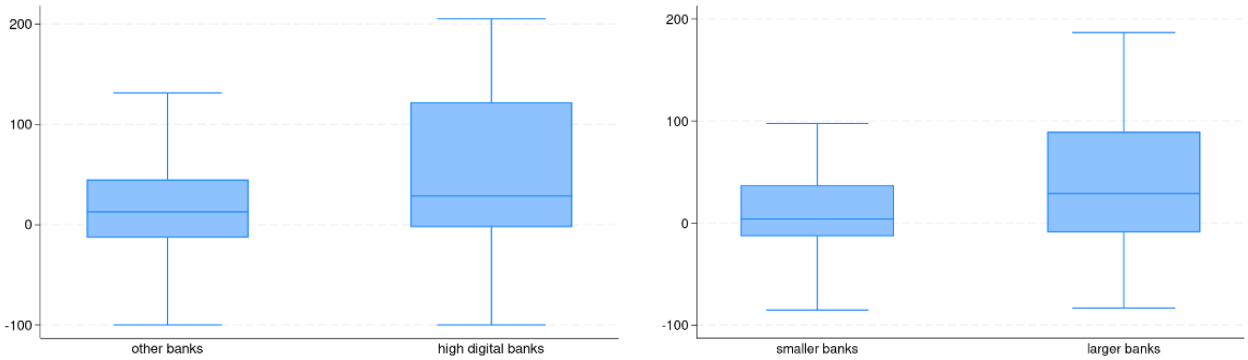


Source: Banking Supervisory Reports. Notes: in the box plots, the two horizontal edge of the box represents the first and third quartile of the indicator, whereas the horizontal line drawn inside denotes the median. The boundaries of the whiskers are based on the 1.5 interquartile range value. Outliers are not reported. The indicator in the panel a) is winsorized at the 5th percentile. The indicator in panel b) is the share of customers with a deposit who used digital channels for banking services.

Figure A3 – Box-plot of the changes in households' term deposits between December 21 and December 23

(percentage points)

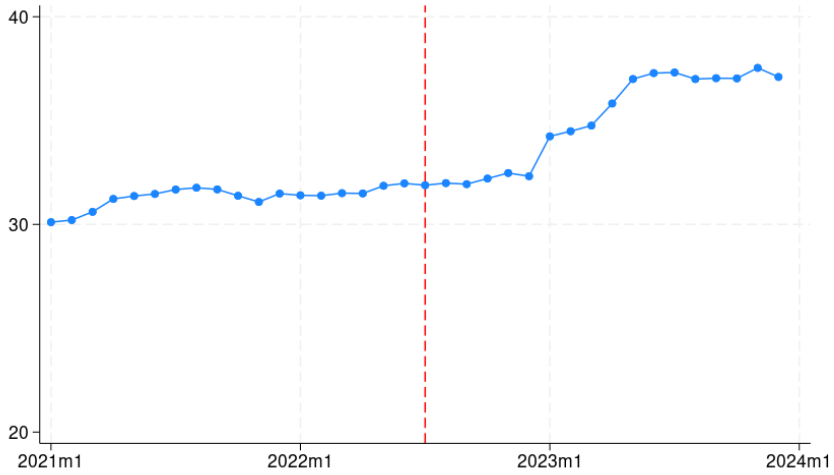
a) all banks *b) high digital banks by size (1)*



Source: Banking Supervisory Reports. Notes: in the box plots, the two horizontal edge of the box represents the first and third quartile of the indicator, whereas the horizontal line drawn inside denotes the median. The boundaries of the whiskers are based on the 1.5 interquartile range value. Outliers are not reported. (1) Larger banks are those with total assets above the median in December 2021.

Figure A4 – Market share of household term deposits of high digital banks over time

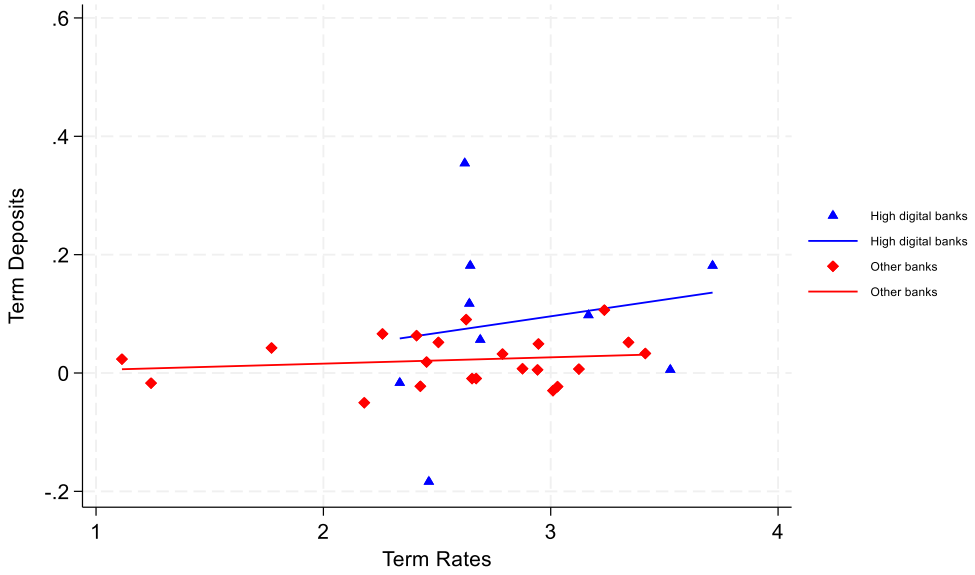
(percentage values)



Source: Banking Supervisory Reports. Note: the market share is calculated as HH term deposits of high digital banks over the correspondent amount at the system level (excluding foreign banks that are not considered in our analysis). The dashed vertical line indicates the beginning of the monetary tightening in July 2022.

Figure A5 – Sensitivity of household term deposits to the related interest rates: impact on this category of deposits on total deposits

(percentage changes and percentage points)



Notes: Each marker represents a bank and displays the combination of the change in household term deposits and the corresponding change in rates. The x-axis indicates the cumulated change in term rates on household deposits (new business) recorded at the end of the period of analysis (i.e., December 2023). The y-axis shows the cumulated percentage change in household term deposits in the same period, scaled by the total deposit amount recorded before the first monetary policy rate hike.

Table A1 – Balancing properties for banks reporting interest rates on deposits

(December 2021 – percentage excluding assets)

Bank characteristics	Mean other banks	Mean high digital banks	Mean difference	t-stat	p-value Ha: diff !=0
Log assets	9.5	9.9	-0.4	-0.7	0.492
LTA, private sector (1)	46.6	42.0	4.6	1.0	0.314
LTD (Loans-to-deposits), private sector (1)	89.5	92.3	-2.8	-0.2	0.844
DTA (Deposit -to-assets)	56.6	50.8	5.7	1.0	0.328
Bonds/total funding	5.9	8.2	6.4	-0.8	0.459
Ratio of SME loans to assets***	17.3	8.9	8.4	2.9	0.007
Ratio of consumer credit to assets*	2.4	7.5	-5.1	-1.9	0.065
Share of fixed-interest-rate mortgages	51.3	46.9	4.4	0.5	0.619
Ratio of Government bonds to assets	15.6	18.4	-2.8	-0.8	0.451
ROE	4.2	10.0	-5.7	-1.5	0.154
ROA***	0.24	0.89	-0.65	-2.8	0.008
CTI	71.8	67.1	4.6	0.6	0.554
Diversification index (2)	55.2	51.5	3.7	0.6	0.544
Asset management over operating income*(3)	6.1	29.0	-22.9	-1.8	0.086
Cet 1 ratio	17.5	19.4	-1.9	-0.8	0.415
NSFR* (4)	144.0	124.6	19.4	2.0	0.0644
LCR (5)	2.1	2.0	0.1	0.54	0.591
NPL ratio	5.4	4.3	1.2	1.1	0.266
Share of term deposits over total	15.1	20.7	-5.6	-0,6	0.571
Share of overnight deposits over total	84.9	79.4	5.6	0,6	0.571
Share of HH deposits	72	64	8	1.2	0.220
Share of HH term deposits	13	10	3	0.5	0.601
Share of HH sight deposits	59	55	4	0.6	0.551
Share of NFC deposits	28	36	8	-1.2	0.220
Share of NFC term deposits**	2	9	7	-2.0	0.047
Share of NFC sight deposits	26	27	1	-0.1	0.894

Banking Supervisor Reports, Finrep and Corep. Foreign branches and subsidiaries are excluded. Data refer to about 10 high digital banks and 28 other banks. Notes: (1) private sector includes households and non-financial corporations; (2) The diversification index is calculated as the difference between intermediation margin and interest rate margin on intermediation margin. (3) The detailed information on asset management fees is available in Finrep only for banks whose ratio of the total net fee and commission income and operating income is equal to or higher than 10 per cent; for the other banks we assign a zero value to the indicator. (4) Net stable funding ratio (NSFR) is a Basel III liquidity indicator calculated as the ratio of the bank's available stable funding to its required stable funding. (5) Liquidity coverage ratio (LCR) is a Basel III liquidity indicator calculated as the amount of high quality liquid assets over total net cash flow. Only for this indicator the reference date is December 2022 (not available for 2021 in Corep). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A2 – Effects of digitalization on the sensitivity of deposits to interest rates

(Cumulative percentage change of HH Term Deposits)

	(1)	(2)
Cumulative change of HH Term Rate	-1.6361	0.9183
	(0.7662)	(0.9202)
Cumulative change of HH Term Rate*high digital	8.6657*	11.3923*
	(0.0626)	(0.0572)
Bank FE	Yes	Yes
Time FE	Yes	Yes
Adj. R-squared	0.5333	0.618
Observations	1255	610

Notes: Columns (1) and (2) present the results of the following regression model: $\Delta Y_{i,t}=\alpha+\beta_1 \Delta Ri,t+\beta_2 high\ digital*\Delta R_{i,t}+\eta_i+\mu_t+\varepsilon_{i,t}$. The model is estimated using weights equal to each bank's total deposits. The dependent variable is the cumulative percentage change of deposits between time *t* and the base period, July 2022, when the first monetary policy hike was implemented. The independent variable $\Delta R_{i,t}$ denotes the cumulative change in HH term deposit interest rates between time *t* and the same base period. The results reported in column (1) use data from January 2021 to December 2023, while column (2) includes only data from July 2022. In all columns standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A3 – Digitalization on household term deposit: the impact of selected bank characteristics
(change in log of deposits)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post*High digital	**0.265***	0.158	**0.237***	0.086	0.237	**0.217***	0.137	0.268	0.246
	(0.065)	(0.243)	(0.082)	(0.535)	(0.123)	(0.064)	(0.193)	(0.173)	(0.167)
Post*High digital*High LTD	-0.191								
	(0.301)								
Post*High digital*High DTA		0.007							
		(0.969)							
Post*High digital*High LTA			-0.170						
			(0.331)						
Post*High digital*High GBond				0.150					
				(0.383)					
Post*High digital*High NPL					-0.142				
					(0.435)				
Post*High digital*High LCR						-0.051			
						(0.718)			
Post*High digital*High NSFR							-0.000		
							(1.000)		
Post*High digital*High Uloss								0.176	
								(0.499)	
Post*High digital*High share bonds									-0.106
									(0.633)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.9305	0.9305	0.9306	0.9319	0.9312	0.9488	0.9479	0.9463	0.9428
Observations	12031	12031	12033	12001	11997	10475	10690	4007	7006

Note: The table reports the results of Eq. (3). The dependent variable is the logarithm of household term deposits. Standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. In the table High stands for a dummy equal to 1 if the bank belongs to the upper part of the distribution for the bank characteristics considered, i.e. this coefficient applies only to banks whose characteristics are above the median values of their distribution. (1) LTD stands for Loans private sector-to-Deposits ratio. (2) DTA stands for Deposit to total assets. (3) LTA stands for Loans to assets. (4) Gbond stands for the share of Government bonds on total assets. (5) NPL stands for Non-performing-loans. (6) LCR is a requirement under Basel III whereby banks are required to hold enough high-quality liquid assets to cover cash outflows for 30 days. (7) NSFR is a liquidity standard indicator under Basel III that aims to promote resilience by limiting banks' reliance on unstable funding sources; it is calculated as the ratio of the bank's available stable funding to its required stable funding. (8) Ratio of unrealized losses on the portfolio of Government bonds, evaluated at amortized costs, on total assets. (9) Share of bonds over total funding.

Table A4 – Digitalization on household term deposit: robustness checks

(dependent variables are in log of deposits)

	(1) HH term deposits – incl. residents in other euro area countries	(2) HH term deposits – incl. foreign branches and subsidiaries	(3) HH term deposits – ECB rates
post*high digital	0.2286**	0.1860**	
	(0.0164)	(0.0337)	
ECB rate*high digital			0.0574**
			(0.0437)
Bank FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Adj. R-squared	0.9286	0.9330	0.9319
Observations	12123	10401	12132

Notes: Column (1) presents the results of Eq. (1) by including in household term deposits also those of residents in other euro area countries. In column (2) we estimate Eq. (1) for household term deposits by including also foreign branches and subsidiaries. Column (3) reports the results of Eq. (1) for household term deposits by replacing the *post* dummy with *ECB rate*, which is the ECB interest rate in *t*. In each column the dependent variable is expressed in logarithm. In all columns standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A5 – Baseline model after treating for mergers and incorporations

(dependent variables are in log of deposits in panel a, percentage points in panel b)

	(1) HH and NFC total deposits	(2) HH and NFC term deposits	(3) HH term deposits	(4) HH and NFC sight deposits
Panel a: deposit amount				
post*high digital	-0.0142	**0.1949***	**0.1481***	-0.0264
	(0.7923)	(0.0978)	(0.0976)	(0.7627)
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Adj. R-squared	0.9839	0.9169	0.9320	0.9786
Observations	11903	11642	11566	11903
	HH and NFC term deposits (new business)	HH term deposits (new business)	NFC term deposits (new business)	HH and NFC sight deposits
Panel b: deposit interest rates				
post*high digital	-0.0227	**0.2678***	-0.1773	0.1376
	(0.8694)	(0.0793)	(0.2287)	(0.3539)
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Adj. R-squared	0.9064	0.8783	0.8313	0.6979
Observations	1073	1407	1097	1508

Note: The table reports the results of Eq. (1) for deposit amount and interest rates, after treating the dataset to take into account mergers and incorporations in the period of analysis. Standard errors are clustered at the bank level; p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

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2023

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MODENA F., S. PEREDA-FERNANDEZ and G. M. TANZI, *On the design of grant assignment rules,* Politica economica/Journal of Economic Policy, v. 1/2023, pp. 3-40, **WP 1307 (December 2020).**

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2024

BALTRUNAITE A. and E. KARMAZIENE, *Fast tracks to boardrooms: director supply and board appointments,* Journal of Corporate Finance, v. 88, Article 102642, **WP 1278 (June 2020).**

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COIBION O., Y. GORODNICHENKO and T. ROPELE, *Inflation expectations and misallocation of resources: evidence from Italy,* American Economic Review: Insights, **WP 1437 (December 2023).**

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2025

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