Diverging Paths in Banks' Business Models: New Facts and Macro Implications

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Abstract

We document the emergence of two distinct types of banks over the past decade: high rate banks which provide deposit rates in line with market interest rates, and low rate banks whose deposits are now even less sensitive to market rates. While the aggregate sensitivity of deposit rates to market interest rates has remained similar, the distribution in deposit rates among large banks is now bimodal. High rate banks operate primarily online with very few physical branches, hold short maturity assets, and earn a lending spread by taking credit risk. In contrast, low rate banks operate far more physical branches, offer deposit rates that are even *less* sensitive to interest rates than before, and they primarily engage in maturity transformation in that they hold longer duration interest rate sensitive assets, but take less credit risk. Deposits shift substantially towards high rate banks when interest rates rise and reduce the ability of the banking sector to engage in maturity transformation. Tracking aggregate deposit flows from the banking sector thus misses a substantial amount of flows within the banking sector. We argue that the distribution of deposits across high and low rate banks is important to understand the transmission of monetary policy, beyond tracking aggregate deposits in the banking sector. Our evidence is consistent with technological changes in banking that lead to the emergence of high rate banks. In response, traditional banks lower rates through the retention of "stickier" depositors.

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1 Introduction

Heterogeneity in deposit rates across banks has increased substantially over the past 20 years. For example, consider the largest banks by total deposits as of May of 2023. JP Morgan Chase, Wells Fargo, and Bank of America pay virtually zero interest on savings accounts as of Q2 of 2023, while PNC, Citi, Marcus, and Capital One pay on average over 400 basis points. This heterogeneity in deposit rates is a new feature—in 2006, when interest rates were similar to today, the difference between the 75th and 25th percentiles of deposit rates among the largest 25 banks was around 75 bps, whereas today it is around 350 bps. We show that the distribution in deposit rates today is bimodal so that there are effectively two types of banks: high rate banks, which offer deposit rates that are near market interest rates, and low rate banks, which all pay similar deposit rates that are very insensitive to market interest rates.

High and low deposit rate banks are different in many other ways. High deposit rate banks have few physical branches (e.g., they operate primarily online) and engage far less in maturity transformation— they make short maturity or floating rate loans and hold short maturity securities that match the duration of their deposits. This makes them more similar to money-market funds. Low rate banks are more traditional banks in the sense that they operate many more physical branches and earn a deposit spread. As high rate banks enter the market in the last 10 to 15 years, we simultaneously see the behavior of low rate banks change – in particular they offer deposit rates that are lower and far *less* sensitive to interest rates than before, and they substantially increase the duration of their assets. High rate banks have attracted a substantial amount of deposit growth over the last two rate hiking cycles (2018 and 2022) while low rate banks have seen much larger deposit outflows. In many ways, this means that the aggregate deposit outflows from the banking sector observed in 2022 and 2023 towards traditional money-market funds are understated – this reallocation has also happened within the banking sector towards money market-like banks.

This paper documents the emergence of these two types of banks and argues that the distribution of deposits across these banks is important to understand the transmission of monetary policy and the ability of the banking sector to engage in maturity transformation as well as liquidity and credit provision. Monetary policy affects this distribution: when rates rise, the rate gap between high and low rate banks widens and deposits migrate to high rate banks. High rate banks lend at much shorter maturities: the average maturity on the asset side for high rate banks is 2.5 years lower than for low rate banks. This shorter asset duration makes sense because high rate banks have effectively shorter duration liabilities. Aside from rate-hiking cycles, there is evidence that the deposits of high rate banks grow faster, though

with a relatively short time series this trend is harder to detect. If deposits continually move toward high rate banks in the future, the banking sectors ability to absorb interest rate risk will substantially change.[1]

Part of the observed emergence in this heterogeneity has come from the emergence of high rate banks. However, a large part comes from low rate banks' deposit rates being even *less* sensitive to interest rate changes than they used to be. For example, the low rate banks used to have a deposit beta of around 0.5, and this number has fallen to around 0.1 for the 2018 and 2022 rate hiking cycles. That is, for every 100 bps increase in the Fed funds rate, low rate banks pass along 10 bps to depositors vs. 50 bps before. We show that low rate banks have actually increased the duration of their assets over time – in line with their liabilities acting even more like fixed rate debt.

What explains the emergence in these two types of banks? We argue that changes in technology and online banking plays a key role. High deposit rate banks operate more heavily online with far fewer physical branches. The ratio of branches to total deposits for high rate banks drops by around 90% since 2009, and this ratio is around 5 times higher for the low rate banks as of 2023. High rate banks tend to locate their smaller number of branches in demographically younger zip codes, suggesting that they have younger customers. Because high rate banks appear to have lower costs and provide fewer services to depositors, they are able to offer higher rates that are closer to market interest rates. However, because they offer rates that vary significantly with market interest rates, these banks hold significantly lower duration assets, similar to a money-market fund. While they earn a small but positive spread between market interest rates and deposit rates (generating a small franchise value of deposits), they take more credit risk on the asset side rather than interest rate risk. The average credit spread earned by high rate banks (loan rates minus maturity matched Treasury yields) is around 200 bps higher than that of low rate banks over the last decade. Charge-offs on loans and leases for high rate banks are also about double that of low rate banks over the past decade, while the average maturity of securities and loans is 2 to 4 years lower than that of low rate banks.

An important part of our findings is also that low rate banks behave quite differently than they used to. Low rate banks in our main sample now all offer *both* online services and physical branches. This distinguishes our work from prior work on digitization in banking which has focused on whether or not a bank offers online banking to characterize digital

[1] Drechsler, Savov and Schnabl (2021) discuss how the sensitivity of deposit rates to the Fed funds rate interact with banks' ability to take duration risk.

banks.[2] We focus on the largest 25 banks, all of which offer online banking services and are thus digital according to prior definitions. Because offering both online banking and physical branches likely raises costs (and provides more services from depositors perspective), this allows these banks to offer low deposit rates that are less sensitive to market interest rates. In turn, because their deposits act more like fixed rate liabilities, these banks hold *longer* duration assets than they previously did. Further, it is possible that as more rate sensitive depositors left low rate banks, they were left with particularly "sleepy" depositor bases and/or depositors who highly value in-person banking. We provide a simple model that captures this intuition. In the model, households differ in preferences for in person banking services. When we allow for online banks to enter and not require in person banking, depositors who do not value in person services migrate to online banks who pay a higher rate. For traditional in-person banks, the remaining depositors value in person services more on average, so that the average depositor is less sensitive to deposit rates.

As deposits flow from low rate to high rate banks, this changes the capacity of the aggregate banking sector to engage in maturity transformation. We show that this reallocation is strong when interest rates rise. For a 1% rise in interest rates, deposits grow by 3% more at high rate banks relative to low rate banks. This generates around a 10% difference in deposits in a typical rate hiking cycle.

The emergence of high rate banks has several important implications. First, an important feature of banks paying low deposit rates is that deposits flow out of the banking sector towards money-market funds when interest rates increase. This can lead to a contraction in lending and has aggregate implications. Importantly, empirical evidence for this channel typically operates through the aggregate quantity of deposits (Drechsler, Savov and Schnabl, 2017). We argue that the emergence of high rate banks leads to a similar effect within the banking sector even if it leaves aggregate deposits unchanged. This suggests that tracking aggregate bank deposit outflows is likely not the correct measure for a contraction in long-term lending. To put this in perspective, from the beginning of 2022 to May of 2023, aggregate deposits shrank by $850 billion as interest rates increased. However, deposits inflows to high rate banks were over 50 billion during this same period. This suggests that the amount of "low rate" deposits useful for funding long duration lending shrunk much more than the aggregate quantity of deposits. A back-of-the-envelope calculation of the banking sector as a whole shows that it originates 13.3% shorter-maturity loans and holds approximately 11.4% more credit risk than

[2] Jiang, Yu and Zhang (2022). See also Koont, Santos and Zingales (2023) who characterize digital banks based on number of reviews for the bank mobile app in the app store. Again, we focus on the top 25 banks, all of which have widely used mobile apps.

in the pre-crisis period. Similarly, deposit inflows and outflows can affect bank fragility and banks' deposit franchise value (Haddad, Hartman-Glaser and Muir (2023)).

Second, demographics suggest that the transition to banks without physical branches (primarily high rate banks) will accelerate as younger customers are less likely to value in person banking services (Jiang, Yu and Zhang, 2022). This implies more competition through rates as geographical location of a bank branch to ones home or place of work would reduce market power. Banks that are purely online are more easily interchangeable. If the overall banking sector migrates towards this model, banks' ability to engage in maturity transformation will be dramatically reduced.

Related Literature

Our paper contributes to several strands of literature. First, our paper contributes to our understanding of monetary policy transmission through the banking sector. The extant literature has documented several channels through which monetary policy passes through banks: the bank lending channel (e.g., Bernanke and Blinder, 1988; Kashyap and Stein, 1994), bank capital channel (e.g., Bolton and Freixas, 2000; Van den Heuvel et al., 2002), and deposit market power channel (e.g., Drechsler, Savov and Schnabl, 2017). To the best of our knowledge, our paper is the first to investigate how the variation in deposit distribution across banks influences the transmission of monetary policy. While there is an extensive body of literature examining the distribution of deposit rates within banks and across branch networks (e.g., Radecki (1998); Heitfield (1999); Biehl (2002); Heitfield and Prager (2004), Park and Pennacchi (2008); Granja and Paixao (2021)), there is little work that examines the distribution of deposit rates across banks. Recent work by Iyer, Kundu and Paltalidis (2023) investigates the variation of deposit rates across banks within a region and documents a significant relation between the average level and dispersion of deposit rates and economic activity at the local level. Iyer, Kundu and Paltalidis (2023) argue that deposit rates reflect the gradual build-up of liquidity shortages. Building on this perspective, our study reveals that the banking landscape now exhibits more heterogeneity in deposit rates. We find that deposits shift substantially towards high rate banks when interest rates rise. Thus, tracking aggregate deposit flows from the banking sector misses a substantial amount of flows within the banking sector to money-market like banks. Understanding this heterogeneity in deposit rates is important for understanding the banking sector's capacity for maturity transformation, liquidity provision, and credit extension.

Second, our paper explores the deposit market power channel and examines the potential factors that explain the emergence of high rate and low rate banks. We provide evidence

in support of the deposit market power channel and find that high rate banks experience bank closures, in contrast to low rate banks that offer brick-and-mortar services. As a result, high rate banks have become more competitive while low rate banks have become more concentrated. Our findings are similar to Jiang, Yu and Zhang (2022) who demonstrate that digital disruption plays a significant role in driving the divergence in deposit rate behavior. Following the roll out of 3G network infrastructure, the authors find that banks that are less dependent on branches close their local branches and instead, these banks leverage digital banking to expand their operations across wider geographical areas. These digital banks cater to younger, wealthier, and more educated depositors. The distinct organizational structures of high rate and low rate banks, coupled with their differing clienteles, have varying effects on their responses to monetary policy and asset management strategies.

Third, our paper contributes to the ongoing discussion regarding the impact of digitization on the transmission of monetary policy within the banking sector. On the one hand, Koont, Santos and Zingales (2023) argue that banks with popular mobile banking platforms attract flighty clientele who tend to swiftly transfer their funds to money market funds when the Federal Funds rate rises. Consequently, digital banks, despite offering competitive rates, experience deposit outflows in response to increases in the Federal Funds rate, which distinguishes them from non-digital banks. Conversely, Erel et al. (2023) use a sample of 17 online banks to show that online banks provide more attractive deposit rates when the Federal Funds Rate increases, attracting more deposits. Our empirical evidence is more in line with Erel et al. (2023) with a few notable distinctions. Our sample differs dramatically from theirs, as we compare the behavior of high rate banks to low rate banks within a sample of all large banks, as identified from the Call Reports. Further, we argue that depositors in low rate banks are not completely rate-insensitive, as suggested in Koont, Santos and Zingales (2023). We provide evidence that that depositors in low rate banks transfer their deposits from low rate banks to high rate banks when the rate differential is sufficiently large. Haddad, Hartman-Glaser and Muir (2023) explore how this can lead to fragility within the banking sector.

Lastly, our paper contributes to our understanding of banks' evolving business models. We show that the alignment of more rate-sensitive borrowers with high rate banks and less rate-sensitive borrowers with low rate banks leads to distinct asset management approaches for these banks. Specifically, we show that when interest rates rise, high rate banks assume greater credit risk while low rate banks assume more duration risk. This finding is consistent with Drechsler, Savov and Schnabl (2021) who propose that banks with high franchise value, i.e., low rate banks, invest in long-term assets to align the duration of their assets and liabilities,

effectively hedging against interest rate risk. High rate banks, in many ways, resemble money-market funds or narrow banks in that they pay (near) market rates on deposits and do not engage in substantial maturity transformation. Thus, the distribution of deposits across high and low rate banks is important to understand the deposit and lending channels of monetary policy.

2 Data and Methodology

In this section, we first describe the data and methodology used in our analysis. We then describe how we classify high and low rate banks. Our sample spans 2001Q1 through 2023Q2. Our sample period covers three rate hiking cycles: 2004Q1-2009Q1, 2015Q2-2020Q2, and 2021Q4-2023Q2.

2.1 Data

Deposit rates. We use data on the interest rates offered for various deposit products from the RateWatch database under S&P Global, spanning from January 2001 through March 2023. S&P RateWatch offers comprehensive coverage of interest rates for depository institutions, including both banks and credit unions, across the United States. This coverage spans over 70 standard retail banking offerings, encompassing a wide range of products such as deposits, consumer loans, and mortgages. While this data is collated weekly, it is important to highlight that banks contribute this information on a voluntary basis. We primarily focus on the 12-month certificate of deposit accounts with a minimum of $10,000 (referred to as 12MCD), due to its comprehensive reporting coverage and its ability to promptly capture banks' rate-setting decisions.[3] To eliminate potential biases from misreporting, we first calculate the average 12MCD10K rate for each branch. We then aggregate this at the bank-quarter level by averaging across the various branches within each bank holding company (BHC). Our findings are robust to alternate levels of aggregation, as suggested by the similar coefficients of determination reported in Appendix Table A.3.

Bank data. We collect data on bank balance sheets and income statements from the Reports

[3]The 12MCD10K is the most common deposit product reported in RateWatch. As evidenced in Panel B of Table A.1, there is a strong correlation of 0.92 between the 12MCD10K rate and the average deposit rate paid by banks, as calculated from the Call Reports data. We further show that the 12MCD10K rates are also strongly correlated with other deposit products such as $25,000 money market deposit accounts (MM) and savings accounts (SAV). The correlation between the 12MCD10K and MM is 0.844, while the correlation between the 12MCD10K and SAV is 0.686.

of Condition and Income (Call Reports) obtained from the Federal Reserve Bank of Chicago. These reports offer information for the majority of FDIC-insured institutions and are presented on a quarterly basis. The data in the Call Reports is subject to regulatory oversight by the Federal Reserve System, FDIC, and the Comptroller of the Currency. We utilize this data spanning from 2001Q1 to 2023Q2 and combine it using the BHC ID as the common identifier. Moreover, we supplement Call Reports data with data from the FDIC Statistics on Depository Institutions (SDI). SDI data provides comprehensive financial and operational information all FDIC-insured institutions on a quarterly basis. The details of the variables are listed in Table A.10.

Branch data. We make use of branch-level bank deposit information obtained from the FDIC. The FDIC administers an annual survey that encompasses all FDIC-insured institutions. The survey, known as the *Summary of Deposits* (SOD), compiles data on a branch's deposits and the corresponding parent bank information as of each June 30th.

Demographics data. To understand the demographic characteristics of high rate and low rate banks, we use a combination of US Census county-level data on age and the FDIC Survey of Consumer Use of Banking and Financial Services. Specifically, we use US Census data to compute the average customer age for each bank by weighting the average age in a county based on the number of branches (from the FDIC SOD) in each county from 2001 to 2023Q2. We also use household survey data from the FDIC Survey of Consumer Use of Banking and Financial Services to examine the characteristics of households that use bank tellers versus mobile banking. The survey was first conducted in 2009, and subsequent surveys were conducted in June 2011, June 2013, June 2015, June 2017, and June 2019. We use data from the 2013, 2015, 2017, and 2019 waves.

3 Bifurcation in Deposit Market

This section documents a recent change in the banking sector: the dispersion of deposit rates has increased over the past decade, characterized by the emergence of high rate and low rate banks.

Our analysis focuses on the top 25 banks, measured by asset size. The top 25 banks account for a large share of the banking sector's assets and deposits. For example, Appendix Figure A.1 illustrates that the collective market share of the top 25 (100) banks is over 65% (80%). As a result, the actions and strategies of the top banks can have a substantial impact on the financial system. Moreover, we show that the behavior of the top banks reflects broader

industry practices; throughout the paper, we show that our findings are consistent for a larger set of banks.

3.1 Dispersion in Deposit Rates

We start with documenting the heterogeneity in deposit rates across banks. The bank deposit market has experienced fragmentation over the past three rate hiking cycles, leading to a distinctive pattern of bimodality in bank deposit rates.

Figure 1 illustrates the dispersion of bank deposit rates at the peak of three rate cycles.[4] To facilitate comparison across the hiking cycles, we normalize the bank deposit rate by the market yield on treasury securities at 1-yr maturity. Figure 1a, Figure 1b, and Figure 1c present the distribution of deposit rates in 2007Q3, 2019Q1, and 2023Q1, respectively. We examine the deposit rate on the 12-month certificate of deposit ("12MCD10K") and the call reports-imputed deposit rate on all deposits ("DepRate"). Both deposit rates exhibit a consistent trend.

The dispersion of deposit rates has increased over the past decade. Deposit rates exhibited a unimodal distribution in 2007Q3, with similar mean and median values.[5] While the mean and median are often equal for unimodal distributions, bimodal distributions can exhibit differences between these measures. In bimodal distributions, the mean is usually pulled towards the larger mode in a bimodal distribution, while the median is not affected by the modes. We observe a trend towards bimodality in the distribution of deposit rates in subsequent rate hiking peaks of 2019Q1 and 2023Q1. The growing divergence in deposit rates is quantified by comparing the dispersion and asymmetry of distributions across rate hiking cycles. From 2007Q3 to 2023Q1, the standard deviation of the 12MCD10K distribution triples, while the skewness doubles.[6] We show that these patterns are robust to the set of all banks in an extended sample from 1993Q1, shown in Appendix Figure A.2.

The distributions illustrate a clear divergence in deposit rates among banks, yet the significance of this divergence remains uncertain. It is plausible that this disparity could be driven by a multitude of very small banks offering exceptionally high rates or conversely, a large number of significantly larger banks offering notably lower rates, possibly without exerting any substantial aggregate impact on the banking sector. Figure 2 assesses the significance and impact of the observed dispersion in deposit rates across different bank sizes. Among the top

[4] The peak of a Fed funds rate is defined as the quarter in which the Fed funds rate reaches its highest level during that cycle.

[5] In 2007Q3, the average Federal Fund rate was 5.17%. Among the top 25 banks, the average 12MCD10K rate was 4.08%, with a corresponding median of 4.05%; and the average Deposit Rate was 3.29%, with a corresponding median of 3.21%.

[6] The standard deviation of 12MCD10K was 0.62 in 2007Q3 and increased to 1.67 in 2023Q1. The skewness was 0.25 in 2007Q3 and rose to 0.58 in 2023Q1.

25 banks, we compare the share of bank assets across the banking sector held in banks reporting deposit rates less than 0.75 times the sample median, between 0.75 times and 1.25 times the sample median, and more than 1.25 times the sample median. Figure 2a and Figure 2b use the 12MCD10K and DepRate rate as the main measure of the deposit rate, respectively. Both figures indicate that banks reported similar deposit rates, tightly clustered close to the median, weighted by bank assets before the Great Financial Crisis. For example, in 2007Q3, 95% of top 25 banks offer deposit rates between 0.75$\times$ and 1.25$\times$ the sample median. Towards the end of our sample, this percentage fell to less than 5%: in 2023 Q1, 59% of banks offer the 12MCD10K rate less than 0.75 times the sample median, while 50% of banks offer the rate more than 1.25 times the sample median. We show that our findings are robust to the set of all banks in an extended sample from 1993Q1, shown in Appendix Figure A.3.

3.2 Classification of High and Low Rate Banks

The divergence in deposit rates highlights the emergence of two distinct categories of banks: those that provide deposit rates closely aligned with market interest rates (referred to as "high rate banks") and those offering lower deposit rates that exhibit minimal sensitivity to market interest rate fluctuations (referred to as "low rate banks"). In our main analysis, we classify banks as high rate and low rate banks using the following methodology.

To classify banks as high rate and low rate banks, we first identify the 25 largest banks each quarter based on their total assets as of the end of the previous quarter. We then calculate a one-year rolling average of the 12MCD10K rate and the DepRate for each bank. Given the occasional absence of the 12MCD10K rate data, especially towards the beginning of the sample, we use a weighted rank method that combines both the 12MCD10K and DepRate. We first rank the banks quarterly, separately using the 12MCD10K rates and DepRate. We then standardize each of these ranks based on the number of observations each quarter. This standardization ensures that the ranks fall within the range of 0 to 1. The standardized ranks are then averaged. When RateWatch data is available, we give equal weight to both rankings. When RateWatch data is not available, we only use the Call Report ranking. Panel B of Table 1 compares the distributions of the 12MCD10K and DepRate.

We classify high rate and low rate banks based on the average rank. The positive skewness of the bimodal distributions of Figure 1 suggests that there are fewer high rate banks (less mass in the rightward part of the distribution) than low rate banks. To capture this asymmetry, our classification strategy designates banks as "high rate" if they rank within the top quantile, while the rest are categorized as "low rate." To ensure stability in classification and avoid fre-

quent alternations over short periods, we further impose a stringent criterion. Specifically, if a bank is identified as a high rate bank in more than 90% of quarters, it is assigned this classification throughout the entire sample period. This safeguard ensures that the classification remains consistent and prevents rapid shifts based on short-term variations. The classification of a select pool of banks can be found in Appendix Table A.2.

In Table 1, we compare various characteristics of high rate and low rate banks between 2001 and 2008 and 2017 and 2023, respectively. These characteristics include measures of the deposit rates, insured deposit share, number of branches, branch-to-deposits ratio, deposit growth, net interest margin, asset maturity, and charge-off rate. Table A.1 compares these characteristics between 2009 and 2016.

3.3 Rate Behavior of High and Low Rate Banks

We apply our classification of high and low rate banks to examine their rate behaviors over time in Figure 4.

Figure 4a presents the time series of average deposit rates for each the two groups. We find that the high and low rate banks exhibited remarkably similar deposit rates between 2000 and 2015, featuring a relatively consistent and narrow rate differential between the two groups. Importantly, the size of the rate gap did not vary much with interest rates during this period, as shown in Figure 4b, suggesting the sensitivity of deposit rates to the Federal Funds Rate ("Fed funds rate") was the same across both groups. However, this changed dramatically starting with the second rate hiking episode of our sample period from 2015Q2. During this period, high rate banks have raised deposit rates aggressively in response to rising interest rates. In contrast, low rate banks have hardly increased rates at all. This has resulted in a dramatic shift in the sensitivity of deposit rates to interest rates across the two groups. Figure 4c illustrates how the responsiveness of individual banks' deposit rates to interest rates has shifted. Under the new banking regime that has emerged, JP Morgan Chase, Wells Fargo, US Bancorp, and Bank of America maintain their position as low rate banks, while Citi, Marcus by Goldman Sachs, and Capital One are situated among the high rate banks. We show that these findings are robust to an expanded set of the 100 largest banks in Appendix Figure A.4.

4 Main Results

Why is it important to understand the bifurcation in the deposit market? In this section, we show that the emergence of high rate and low rate banks carries significant implications

for both monetary policy transmission (Section 4.1) and bank asset-liability management (Section 4.2).

4.1 Transmission of Monetary Policy

This section documents the distinct patterns of monetary policy transmission for high rate and low rate banks.

4.1.1 Deposit Betas for High and Low Rate Banks

We begin by comparing the sensitivity of deposit rate changes to Federal Fund rate adjustments for both high rate and low rate banks across the three rate-hiking cycles in our sample. Interest rate sensitivity is calculated as the deposit beta, which is defined as the change in the deposit rate divided by the change in the Fed Funds rate. Figure 5 plots the deposit betas across the three rate hiking cycles. Consistent with the similar deposit rates in the earlier part of our sample, we find that low rate and high rate banks have similar deposit betas between roughly 0.50 and 0.75 during the first rate hiking cycle of 2004Q1-2008Q2. While the aggregate deposit beta of the banking sector has remained relatively stable in the recent rate hiking cycles between 2015Q4 and 2020Q1, and, 2021Q4 and 2023Q2, we observe a rift in the deposit betas between low rate and high rate banks in the last two cycles. In the 2015Q4-2020Q1 and the 2021Q4-2023Q2 cycles, low rate banks report deposit betas near 0, while high rate banks report strongly positive deposit betas.

We test these relationships rigorously through the following regression framework:

$$\begin{aligned} Y_{i,q} = \alpha &+ \beta_1 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High rate},i} \\ &+ \beta_3 \times \Delta\text{FFTar}_q \times \text{Post}_q + \beta_4 \times \Delta\text{FFTar}_q + \beta_5 \times \mathbb{1}_{\text{High rate},i} \\ &+ \beta_6 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_7 \times ROA_{i,q-1} + \beta_7 \times Tier\ 1_{i,q-1} + \varepsilon_{i,q} \end{aligned}$$

where i and q indicate the bank and quarter-year, respectively, ΔFFTar_q denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), and $\log(\text{Asset})_{i,q-1}$, $\text{ROA}_{i,q-1}$ and $\text{Tier } 1_{i,q-1}$ denote the control variables – log-transformed assets, return on assets and tier 1 capital ratio, respectively. The dependent variable, $Y_{i,q}$ is the change in the 12MCD10K rate (ΔDep. Rate) in column (1), the change in interest expense (ΔInterest Expense) in column (2), the change in net interest income (ΔInterest Income) in column (3), and change in net interest margin (ΔNIM) in column (4).

Table 2 presents the results. We find that high rate banks in the post-crisis period have a deposit beta that is 0.55 higher than low rate banks. That is, a 1 percentage point increase in the Fed funds rate is associated with an additional 0.55 percentage point increase in the deposit rate for high rate banks in the post-crisis period. This difference is economically meaningful as it is almost 20% larger than the typical deposit beta in the sample of around 0.46 and statistically significant at the 1% level. Notably, the coefficient on the interaction term between the change in the Fed funds rate and the post-crisis dummy ($\Delta\text{FFTar}_q \times \text{Post}_q$) dummy is -0.45, indicating that the gap in the deposit betas between high rate and low rate banks comes primarily from low rate banks lowering their deposit betas. That is, low rate banks keep deposit rates low despite rising interest rates. In contrast, high rate banks do not raise their deposit betas.[7] This radical difference in deposit rate behavior between high rate and low rate banks was not present before 2010 – the interaction term between the change in the Fed funds rate and high rate banks ($\Delta\text{FFTar}_q \times \mathbb{1}_{\text{High rate},i}$) has a coefficient of -0.067 and is statistically indistinguishable from 0.

Next, we further examine the interest rate sensitivity of banks' interest expense and interest income. The interest expense betas in column (2) are similar to the deposit betas, but slightly smaller. This is likely due to a timing mismatch between the change in the Fed funds rate and interest expense. Interest expense typically lags the change in the Fed funds rate, as banks may have contracts with their depositors that lock in interest rates for a certain period of time.[8] We find that high rate banks in the post-crisis period have a interest expense beta that is 0.17 higher than low rate banks; a 1 percentage point increase in the Fed funds rate is associated with an additional 0.17 percentage point increase in the interest expense for high rate banks in the post-crisis period. Column (3) similarly shows that high rate banks have relatively higher interest income when the Fed funds rate rises in the post-crisis period compared to low rate banks. In column (5), we directly estimate the interest rate sensitivity of the net interest margin (NIM). We find that the NIM is 0.06 lower for high rate banks compared to low rate banks in the post-crisis period. This finding supports a key conjecture that high rate banks hold more short-term assets with floating interest rates, which are more directly affected by changes in prevailing interest rates than low rate banks, which hold more long-term assets with fixed rates. We decompose the asset side in more detail in Section 4.2.2 and provide evidence in support of this hypothesis. Figure 6 compares the time series of the average interest expense (Figure 6a), average interest income (Figure 6b), and average NIM (Figure 6c) between

[7] The coefficient associated with high rate banks ($\mathbb{1}_{\text{High rate},i} \times \text{Post}_q$) is -0.018. This estimate is neither economically meaningful nor statistically significant.

[8] Column (1) avoids this issue by using the current deposit rates offered from RateWatch. Column (2) computes the interest expense using Call Reports data. See Appendix Table A.10 for details.

high rate and low rate banks, illustrating the same broad patterns. Moreover, we expand our sample to include the 100 largest banks and demonstrate robustness in Appendix Figure A.5 and Appendix Table A.5. Lastly, one may be concerned that the interest rate sensitivities may be driven by other confounding macroeconomic factors and aggregate changes. We account for common shocks through quarter fixed effects and show that our baseline results are robust to quarter fixed effects in Appendix Table A.4. This finding corroborates that the difference in the betas between high and low rate banks increases substantially in the post-crisis period.

Banks commonly secure funding through two primary channels: deposits and wholesale funding. Deposits generally come at a lower cost compared to wholesale funding. However, increasing deposit rates can be costly for banks. Additionally, asset side adjustments can also be challenging due to the illiquidity of assets. These constraints can push banks to rely on wholesale funding, which is a more stable funding source, especially for financing longer-term assets. We examine whether there are differences in the wholesale funding usage for high rate and low rate banks in Appendix Figure A.6. We do not find any difference in the share of wholesale funding between high and low rate banks throughout our sample period. However, we find that high rate banks have a higher wholesale funding rate, suggesting that these banks are riskier. We explore possible explanations behind this in Section 4.2.2.

4.1.2 Flows within the Banking Sector: Deposit and Loan Growth Rates for High and Low Rate Banks

We extend our investigation into how high rate and low rate banks respond to changes in interest rates by examining the growth of their deposits and loans. These findings complement our previous results on deposit betas, providing a comprehensive view of how the interest rate sensitivities interact and affect the overall growth and stability of a bank's deposit base as well as their lending activities.

Figure 7 compares the deposit growth for high rate and low rate banks over the past three rate hiking cycles. As in Figure 5 with deposit betas, we find that high rate and low rate banks exhibit similar deposit growth in the first rate hiking cycle between 2004Q1 and 2007Q4; the cumulative growth over this period is between 50% and 60% for both high and low rate banks. We demonstrate that, overall, the impact of M&A activity during the crisis period was minimal.[9] However, in the last two rate hiking cycles, high rate banks exhibit significantly higher deposit growth than low rate banks, suggesting that there is substantial reallocation of

[9]See Appendix Figure A.7 which illustrates that, during this period, two significant increases in deposit growth occurred as a result of M&A: Wells Fargo's acquisition of Wachovia on October 3, 2008, and PNC's acquisition of National City Bank on October 24, 2008.

deposits when interest rates rise. The cumulative deposit growth over the 2015Q5 to 2019Q4 rate hiking period is over 10% higher for high rate banks compared to low rate banks. The deposit growth markedly diverges in the last rate hiking cycle between 2021Q4 and 2023Q2, over which we observe that low rate banks experience negative deposit growth while high rate banks experience positive deposit growth; the difference between these types exceeds 7%.[10] To illustrate, Appendix Figure A.9 disaggregates high rate and low rate banks and presents the deposit growth experienced by individual banks over the most recent rate hiking cycle. We find that First Republic Bank, Charles Schwab, and Northern Trust are among the low rate banks that experience the largest deposit outflows, while Goldman Sachs, Ally Financial, and Citi are the banks that received the greatest deposit inflows. Lastly, we show that our findings are robust to an expanded set of the 100 largest banks in an extended sample from 1993Q1, shown in Appendix Figure A.10.

We codify these relationships through the following regression framework in Table 3.

$$\begin{aligned}\Delta\text{Deposit}_{i,y} = \alpha &+ \beta_1 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} \\ &+ \beta_3 \times \Delta\text{FFTar}_y \times \text{Post}_q + \beta_4 \times \Delta\text{FFTar}_y + \beta_5 \times \mathbb{1}_{\text{High rate},i} \\ &+ \beta_6 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_7 \times ROA_{i,q-1} + \beta_7 \times Tier\ 1_{i,q-1} + \varepsilon_{i,q},\end{aligned}$$

where i and q indicate the bank and quarter-year, respectively, ΔFFTar_y denotes the annual change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier } 1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively.

We find that the sensitivity of deposit growth to interest rates is higher for high rate banks than for low rate banks in the post-crisis period. Specifically, a 1 percentage point increase in the Fed funds rate is associated with an additional 3.16 to 3.62 percentage points increase in the annual deposit growth of high rate banks in the post-crisis period. This suggests that deposit flows within the banking sector concentrate towards high rate banks when interest rates rise. We further examine the sensitivity of various types of lending growth, including personal loan growth, commercial and industrial (C&I) loan growth, and real estate loan growth, to interest rates in columns (3) through (8). We find that the sensitivity of lending growth to interest rates is most significant for personal loans and C&I extended by high rate banks in the post-crisis period. Personal loans include credit card lending, auto lending, and revolving credit. A 1

[10] One may be concerned that the observed patterns may be due to banks switching between the high and low categories. To address this concern, we fix the set of top 25 banks at the beginning of each rate hiking and show that our findings are robust in an extended sample from 1994Q1 in Appendix Figure A.8.

percentage point increase in the Fed funds rate is associated with an additional 3.84 to 5.54 percentage points increase in the annual personal loan growth of high rate banks in the post-crisis period, and 3.96 to 5.75 percentage points increase in the annual C&I loan growth of high rate banks in the post-crisis period. We do not find any significant difference in real estate loan growth between high and low rate banks in response to changes in the Fed funds rate. We demonstrate robustness in an expanded sample with the 100 largest banks in Appendix Table A.6. We discuss these findings in the context of banks' assets in Section 4.2.2.

4.2 Evolution of Banks' Business Model

Banks' rate-setting decision is endogenous. In this section, we explore the potential factors that explain the divergence in deposit betas and the emergence of high rate and low rate banks. Our findings, so far, suggest that there is reallocation of deposits from low rate banks to high rate banks when interest rates are high. These findings raise two important questions: (1) Which depositors are more likely to be rate-sensitive and switch to high rate banks? (2) Do high rate banks, which attract more flighty deposits, hold short-term assets to reduce potential liquidation costs? This section addresses the first question. Section 4.2.2 addresses the second question through a comparison of high rate and low rate banks' asset holdings.

4.2.1 High Rate Depositors are Digital Customers

What explains the emergence of high and low rate banks? We argue that changes in technology and online banking play a key role.

Figure 3 examines the dispersion of the branch-to-deposits ratio over the peaks of three rate cycles in 2007Q3, 2019Q1, and 2023Q1. To ensure that the results are not influenced by banks primarily engaged in businesses other than retail deposits, we limit our analysis to banks with a minimum of 15 branches (the sample average is 1,214). This restriction excludes Charles Schwab, J.P. Morgan & Co (before 2000), State Street, Merrill Lynch, Morgan Stanley, Bank of New York Mellon, Goldman Sachs, Ally Financial, and ING.[11] We show that the dispersion in the branch-to-deposits ratio has increased substantially across the peaks of three rate cycles, suggesting that over time, banks have have become more divergent in their use of branch networks. A higher branch-to-deposits ratio may suggest that a bank has more branches relative to its deposit size, potentially indicating a broader physical presence and possibly higher

[11] The first seven of these banks focus on broker or investment banking businesses, while the latter two are fintech banks that have emerged in recent years. In Appendix Figure A.12, we provide density plots that include these banks without any exclusions. In Appendix Figure A.12, we show that our findings are robust to an expanded sample of all banks over an extended time horizon from 1994Q4.

operating costs. Conversely, a lower ratio may imply a more concentrated or efficient branch network.

We hypothesize that high rate banks are able to offer higher deposit rates that are closer to market rates by reducing costs and providing fewer services to their depositors. We first examine changes in the organizational structure of banks. Then, we investigate the link between these changes and changes in the demographics of depositors. Figure 8 compares the branches operated by high and low rate banks. We compare the time series of the logged number of branches for high rate and low rate branches in Figure 8a. The number of physical branches a bank affects the way in which banks deliver their products and services to its customers. The number and distribution of these branches can significantly influence a bank's accessibility, customer reach, and local market presence. We draw two observations from this figure. First, from the beginning of our sample, high rate banks consistently maintain a lower number of branches compared to low rate banks throughout our sample. Second, while the number of branches remains relatively stable for low rate banks over the entire period, a distinct pattern emerges for high rate banks. Starting from the post-crisis era, high rate banks experience a dramatic reduction in the number of branches. In aggregate, high rate banks experience a logarithmic change of -2 over the sample duration, signifying a substantial decline of over 85% in the number of branches over our sample. Figure 8b exhibits a similar pattern in the logged ratio of branches to deposits. While the branch deposit ratio has fallen for both low rate and high rate banks, indicating greater efficiency of a bank's branch network, it has fallen at a much steeper rate for high rate banks. The branch deposit ratio for high rate banks falls by $\tilde{9}0\%$ over our sample. By the end of our sample in 2023, low rate banks report a branch deposit ratio that is more than five times higher than that of high rate banks.

These changes are consistent with high rate banks offering primarily online banking services, particularly starting around 2010. Indeed, this is supported by the fact that high rate banks such as Ally and Marcus have a limited number of bank branches. In contrast, the largest low rate banks such as JP Morgan, Bank of America, and Wells Fargo maintain a relatively stable number of branches. The timing of the decline in high rate bank branches coincides with their relatively more competitive deposit rates. Since branches are costly to maintain and operate, a natural explanation is that moving to online banking allows banks to charge customers less for banking services in the form of higher deposit rates.

However, if the number of branches for low rate banks has not changed since 2010, it may seem surprising that they now charge customers more (pay lower deposit rates when interest rates rise) relative to the pre-2010 period. There are a few possible reasons for this. One

possibility is that the costs for these banks have risen. In addition to providing traditional in-person banking services through branches, these banks also provide online banking services (recall that we are focused on the top 25 banks, all of which offer online banking). Given the increased costs, these banks may be charging more from depositors in the form of even lower rates. This could explain why their deposit rates are now near 0. Another possibility is that consumers differ in their desire for in-person banking services (branches and ATMs). When high rate banks focus significantly on online customers, driving down the number of branches in aggregate, there is relatively less competition among banks with significant in-person services. This lower competition (among a smaller number of depositors) can increase the markup that low rate banks charge.

We find that high rate banks tend to locate their smaller number of branches in demographically younger zip codes, suggesting that they have younger customers. Figure 8c presents the time series of the average depositor age for high and low rate banks. A bank's average depositor age is computed as the average age in each county, weighted by the number of bank branches in each county. We find that the average depositor age is similar for high rate and low rate banks before the Great Financial Crisis of 2007-2009. However, in the post-crisis era, the average depositor age at high rate banks is strictly lower than the average depositor age at low rate banks.

Table 4 tests these patterns rigorously through the following regression framework.

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q}$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\log(\text{Asset})_{i,q-1}$, $\text{ROA}_{i,q-1}$ and $\text{Tier1}_{i,q-1}$ denote the control variables – return on assets and tier 1 capital ratio, respectively. The dependent variable, $Y_{i,q}$ is the log-transformed number of branches (log(# of Branches)) in columns (1)-(2), the log-transformed ratio of branches to deposits in billions ($\log(\frac{Branches}{Deposit})$) in columns (3)-(4), and the average customer age in columns (5)-(6).

Consistent with the trends observed above, we find that high rate banks report almost a 48% to 65% reduction in the number of branches, a 38% to 42% decline in the branch deposit ratio, and a 1.47% decline in the average age of depositors during the post-crisis period, in comparison to low rate banks.[12] We show that these magnitudes are stable even after accounting for aggregate shocks through quarter fixed effects, as indicated in the even numbered

[12] We estimate the percentage changes from the log-level estimates using: $e^{\beta} - 1$.

columns. As before, we demonstrate robustness in an expanded sample with the 100 largest banks in Appendix Figure A.11 and Appendix Table A.7.

We further analyze the characteristics of households that use branches and mobile banking in Appendix Figure A.13. Between 2012 and 2018, the average age of households using physical branches increases by 2.77 years (4.92%), compared to an increase of 1.46 years (3.65%) for households using online banking. The average income of households using physical branches also increases by $5.29K (11.63%), compared to $9.96K (17.23%) for households using online banking over the same time period. In terms of education, 50% of households using physical branches have a college degree, compared to over 75% of households using online banking. These findings are consistent with previous research by Jiang, Yu and Zhang (2022), who find that older, less wealthy, and less educated depositors value branch services, while younger, wealthier, and better-educated depositors value digital services. Overall, our findings suggest that there is an increasing divergence in the characteristics of the clientele of low rate banks and high rate banks. The different characteristics of high rate and low rate clientele can have a variety of implications for the assets side of banks. We explore these implications below.

4.2.2 High Rate Banks Have Low Duration but High Credit Risk

In this section, we examine how the alignment of more rate-sensitive borrowers with high rate banks and less rate-sensitive borrowers with low rate banks leads to distinct asset management approaches for these banks

We hypothesize that high rate banks which attract more flighty depositors may be more prone to sudden deposit outflows when market interest rates increase. As a result, these banks may adopt a more conservative asset management strategy and hold more liquid and short-term assets to quickly meet potential withdrawal demands without incurring substantial liquidation costs. On the other hand, low rate banks, which attract "sticky" depositors may not face the same magnitude of deposit flight during interest rate changes. As a result, they may allocate their assets to longer-term investments with higher yields. We investigate these changes and examine how the interest rate sensitivity between high rate and low rate banks affect their asset allocation decisions and risk.

Duration Risk We begin by comparing the duration risk of high rate and low rate banks. We show that high rate banks, which have lower costs and provide fewer services to depositors, offer higher rates that are closer to market interest rates. Because these banks offer rates that

vary significantly with market interest rates, these banks hold significantly lower duration assets, similar to a money-market fund. We investigate this next in Figure 9.

Figure 9a compares the average maturity in years of assets held by high rate banks and low rate banks. Consistent with our hypothesis, we find that high rate banks consistently hold shorter-duration loans and securities than low rate banks. In the pre-crisis period, the average maturity of assets in low rate banks is around 6 years, 50% longer than the 4-year maturity reported by high rate banks. This difference in maturity is consistent with the behavior of deposit rates: since low rate banks pay fixed rates on liabilities, they naturally hold longer duration assets. In the post-crisis period, the average maturity of assets in low rate banks gradually increases to almost 8 years, a 33% increase. In contrast, the average maturity of assets held in high rate banks remains 4 years. In other words, by the end of our sample in 2023, the average maturity of assets held in low rate banks is twice as large as that in high-rate banks.

Next, we compare the share of short-term assets for high rate and low rate banks. We define the share of short-term assets as the proportion of a bank's assets that mature within one year. This variable reflects the liquidity risk of a bank – the risk that a bank will not be able to meet its short-term obligations to its depositors or other creditors. Examination of the differences in the share of short-term assets provides insight into the immediate liquidity needs of high rate and low rate banks and their ability to respond to changing market conditions. Figure 9b compares the share of short-term assets for high rate and low rate banks. We find that high rate banks report a higher share of short-term assets than low rate banks. While the share of short-term assets for high rate banks hovers around 55% across the whole sample period, the share of short-term assets for low rate banks declines from 50% in the pre-crisis period to 35% by the end of our sample in 2023, widening the gap between high and low rate banks. By the end of our sample in 2023, high rate banks report more than a 55% higher share of short-term assets compared to low rate banks. Collectively, our findings are consistent with low rate banks increasing their duration risk.

Credit Risk While high rate banks earn a small but positive spread between market interest rates and deposit rates (generating a small franchise value of deposits), we show that these banks take more credit risk on the asset side rather than interest rate risk.

We examine the credit risk of high rate and low rate banks' assets in Figure 10. Figure 10a compares the average loan rate for assets held in high rate and low rate banks. We find that high rate banks lend at higher rates than low rate banks. In the pre-crisis period, high rate banks report loan rates of approximately 6% to 8%, while low rate banks report loan rates of

approximately 5% to 7%. In the post-crisis period, the lending rate of high rate banks remains stable, while the lending rate of low rate banks declines to between 4% and 6%. As shown in the previous section, the higher lending rate of high rate banks is not attributable to higher duration risk or a term premium.

We explore whether this difference may be attributed to credit risk in Figure 10b. Figure 10b compares the credit spread of loans held by high rate and low rate banks. The credit spread is defined as the difference between the loan rate and the duration-matched Treasury yields. We find that the credit spread of loans held by high rate and low rate banks are quite similar in the pre-crisis period. However, the credit spread markedly diverges in the post-crisis period. The differential in the credit spread widens to over 200 basis points (bps) by the end of the sample. This difference is significant as it represents nearly 65% of the average credit spread. These trends suggest that high rate banks primarily earn a spread from riskier lending, rather than capturing a term premium, in contrast to low rate banks.

As high rate banks assume higher credit risk, it suggests that the risk of borrower default is higher. This elevated risk can lead to portfolio losses, which are reflected in the charge-off rate. The charge-off rate represents the percentage of loans or credit accounts that the bank deems as noncollectable and removes from its books as losses. It is an indicator of the credit quality of the bank's portfolio and reflects the proportion of loans that the banks expects will not be repaid by borrowers. Figure 10c compares the charge-off rate for high rate and low rate banks. Consistent with the previous findings, we observe that generally, the charge-off rate for high rate banks is higher than the charge-off rate for low rate banks. Towards the end of the sample, we find that high rate banks report a charge-off rate that is more than double of that of low rate banks. This finding further corroborates our hypothesis that high rate banks increase their credit risk exposure relative to low rate banks.

Decomposition of Duration and Credit Risks Our findings suggest that banks trade-off between duration risk and credit risk. When interest rates rise, high rate banks increase their interest income by holding shorter-term assets with higher credit risk. In contrast, low rate banks hold longer-term fixed rate assets with lower credit risk. In this section, we take a closer look at the portfolio holdings of high rate banks and low rate banks to identify the main drivers of their duration risk and credit risk.

First, we break down the composition of bank assets for high rate banks and low rate banks into four main asset classes: treasury securities, mortgage-backed securities (MBS), real estate loans, and other loans. We study how the maturities of these asset classes have changed over our sample. Figure 11 presents the results. In line with the finding that low rate banks

take on more duration risk, we find that low rate banks hold a significantly larger share of MBSs and real estate loans in Figure 11a. In contrast to low rate banks, the figure shows that high rate banks hold a larger share of treasury securities. High rate banks hold almost twice as much treasury securities as low rate banks and only half as much in real estate and MBS. High rate banks also report a larger share of other loans compared to low rate banks. Most notably, among other lending, Appendix Figure A.14 indicates that high rate banks conduct more than 2.5 times the amount of credit card lending compared to low rate banks.[13] This observation lends support to our hypothesis that digital customers align more with high rate banks.

We further analyze the dynamics of the maturities associated with these asset classes for high rate banks and low rate banks in Figure 11b. We find that, generally, similar asset classes in high rate and low rate banks have similar maturities.

In Table 5 and Table 6, we rigorously test these dynamics using the following within-quarter estimator with bank-level controls:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q}$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\log(\text{Asset})_{i,q-1}$, $\text{ROA}_{i,q-1}$ and $\text{Tier1}_{i,q-1}$ denote the control variables – return on assets and tier 1 capital ratio, respectively.

In Panel A of Table 5, we estimate how the average maturity of loans and securities and the share of short-term assets in high rate banks compares with low rate banks in the post crisis period. We find that high rate banks hold loans and securities with over 30% shorter maturities and 13% larger share of short-term assets, on average, than low rate banks. In the post-crisis period, the difference in maturity between high rate and low rate banks is even larger. High rate banks hold loans and securities with 42% lower average maturity and 19% higher share of short-term assets, on average. This suggests that low rate banks are more exposed to interest rate risk in the post-crisis period.

The average maturity of banks' loans and securities is determined by two factors: the banks' share by asset class and the maturity associated with each asset class. We examine the underlying determinants of the widening gap in duration risk to determine whether this gap is driven by changes in the maturity of each asset class or by reallocation of funding across asset classes. Panel B examines how the average maturities of real estate loans (column (1)), other

[13] Appendix Figure A.14 breaks down "other lending" into credit card loans, automobile loans, commercial and industrial loans, home equity loans, loans to financial firms, real estate adjustable loans, and revolving credit.

loans (column (2)), MBSs (column (3)), and treasury securities (column (4)) differ between high rate and low rate banks in the pre- and post-crisis periods. Generally, high rate banks hold loans with shorter maturities than their low rate counterparts. In the post-crisis period, high rate banks further shorten the maturities of their assets, particularly their mort based loans and securities and treasury securities. Panel C shows that the difference in the average maturity of loans and securities is primarily driven by reallocation of banks' assets across asset classes. High rate banks typically report a lower exposure to real estate loans and MBSs and a higher exposure to treasuries and other loans. In the post-crisis period, there is a significant reallocation of assets from MBSs to other loans, which we investigate next.

Table 6 compares credit risk for high and low rate banks. Panel A shows that high rate bank lending is associated with 14% higher loan rates, 30% higher credit spread, and 29% higher charge-off rate, on average, than low rate banks. However, in the post-crisis period, the gap between high rate banks and low rate banks widens in terms of loan rates, credit spreads, and charge-off rates. Specifically, high rate banks experience an additional 26% increase in loan rates, a 36% increase in credit spreads, and a 50% higher charge-off rate than low rate banks. Panel B breaks down the charge-off rate to better understand the specific asset classes where high rate banks concentrate their credit risk. Generally, we find that high rate banks assume more credit risk in personal and C&I lending. Specifically, the total increase in the charge-off rate on personal and C&I loans experienced by high rate banks in the post crisis period is between 43% and 50% of the average. The increase in credit risk of high rate banks is consistent with our findings in Table 3 in which we find that the sensitivity of lending to interest rates is most significant for personal and C&I lending conducted by high rate banks in the post crisis period (see Section 4.1.2 for details). Appendix Figure A.14 further corroborates that high rate banks conduct a greater share of personal lending compared to low rate banks.

We demonstrate the robustness of our key findings in an expanded sample with the 100 largest banks in Appendix Figure A.15, Appendix Figure A.16, Appendix Table A.8 and Appendix Table A.9.[14] Overall, our findings indicate that low rate banks and high rate banks have contrasting risk dynamics. In the post-crisis era, low rate banks increasingly assume more duration risk, while high rate banks increasingly assume more credit risk. This divergence in risk appetite is reflected in their respective asset management strategies. High rate banks specialize in short-term floating-rate loans and securities, while low rate banks hold more long-term fixed rate loans and securities.

[14]Note that Appendix Table A.9 Panel B shows that the charge-off rate for C&I loans extended by high rate banks in the post-crisis period is more pronounced than the charge-off rate for personal loans. One potential explanation for this difference is that banks outside of the top 25 have a smaller share of personal lending.

5 Aggregate Effects

In this section, we calculate the banking sector's capacity to originate long-term loans after accounting for the distribution of deposits between high rate and low rate banks. We also quantify the aggregate increase in credit risk resulting from this shift.

As interest rates rise, there is a notable shift of deposits towards high rate banks as documented in Section 4.1.2. To understand the long-term trends in the relative sizes of high rate and low rate banks, we analyze the asset growth of the top 100 banks, comparing high rate and low rate banks in Figure 12. Figure 12a shows that low rate and high rate banks exhibited similar asset growth between 2003Q1 and 2008Q2. However, the growth of assets held by low rate and high rate banks began to diverge starting in the second rate hiking cycle, as shown in Figure 12b. Specifically, by the end of our sample, we find that there is over a 20% cumulative difference in the asset growth experienced by high rate banks compared to low rate banks starting from 2012Q1. Based on this 20% differential, we conduct some back-of-the-envelope calculations to quantify aggregate changes in the banking sector's capacity to originate long-term and risky loans.

Our analysis from Section 4.2.2 indicates that by the end of our sample, the average maturity of assets held in high rate banks is 4 years shorter than in low rate banks (see Figure 9a. Therefore, the banking sector as a whole originates approximately 13.3% shorter-maturity loans.[15] Similarly, we calculate that the banking sector holds a 8% larger share of short-term assets.[16] These findings suggest that the banking sector's capacity for maturity transformation has declined.

However, our findings indicate that while high rate banks have lower duration risk than low rate banks, they assume more credit risk. To quantify the aggregate change in credit risk of the banking sector, we examine the difference in the credit spread between high rate and low rate banks. The difference in the credit spread between high rate and low rate banks is over 200 basis points (bps) by the end of our sample (see Figure 10b). This suggests that the banking sector holds approximately 11.4% more credit risk.[17]

Thus, our findings demonstrate that the allocation of deposits within the banking sector has significant implications for the transmission of monetary policy through deposit and

[15] We calculate the change in the aggregate capacity of the banking sector to originate long-term loans by multiplying the difference in asset growth between low rate and high rate banks (20%) by the difference in maturity, and then dividing by the average maturity. The average maturity of assets is 6 years (see Table 5).

[16] The difference in the share of short-term securities between low rate and high rate banks is 20% by the end of the sample (see Figure 9b). The average share of short-term assets is 50% (see Table 5).

[17] We calculate this by multiplying the difference in asset growth between low rate and high rate banks (20%) by the difference in credit spread (200 bps), and then dividing by the average credit spread (350 bps). The average credit spread is 350 bps (see Table 6).

lending channels on the macroeconomy. A rise in interest rates is accompanied with a reallocation of deposits from low rate banks to high rate banks. This shift affects the banking sector's capacity to originate long-term loans and conduct specific types of lending activities.

6 Conclusion

We document the emergence of two distinct types of banks in the last decade: 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. Despite the aggregate deposit beta of the banking sector showing minimal change, there is now a clear bimodal distribution in deposit rates.

We show that high rate banks have a limited physical branch presence, maintain short-term assets, and primarily earn a spread by taking on credit risk. In many aspects, they resemble money-market funds or narrow banks by offering rates close to market levels on deposits and avoiding substantial maturity transformation. Conversely, low rate banks primarily engage in maturity transformation. They hold longer-duration, interest rate-sensitive assets but assume less credit risk. When interest rates rise, deposits shift significantly toward high rate banks. As a result, a substantial portion of deposit flows within the banking sector moves towards banks resembling money-market like banks, which is ignored when only tracking aggregate deposit flows from the banking sector.

Understanding the distribution of deposits across high and low rate banks is important for a comprehensive understanding of the deposit and lending channels of monetary policy, beyond tracking total deposits in the banking sector.

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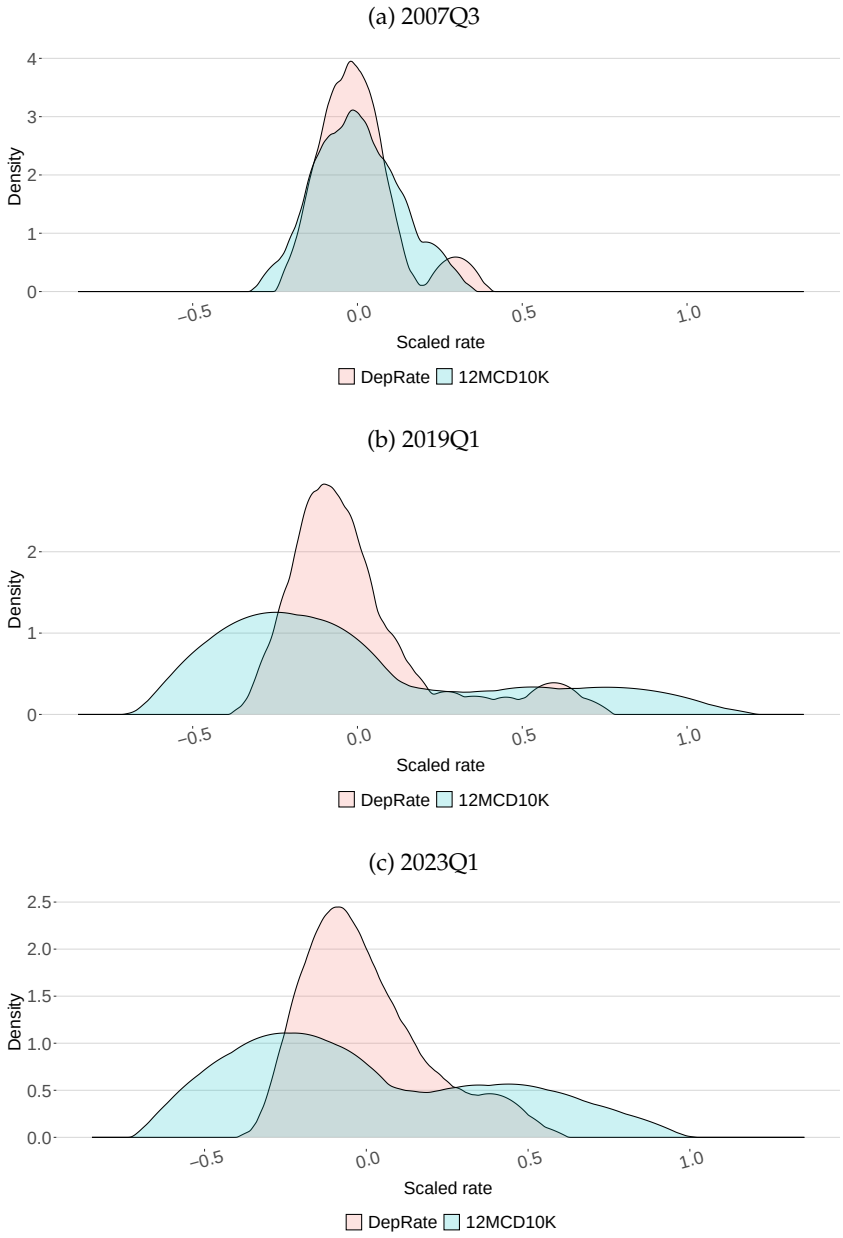
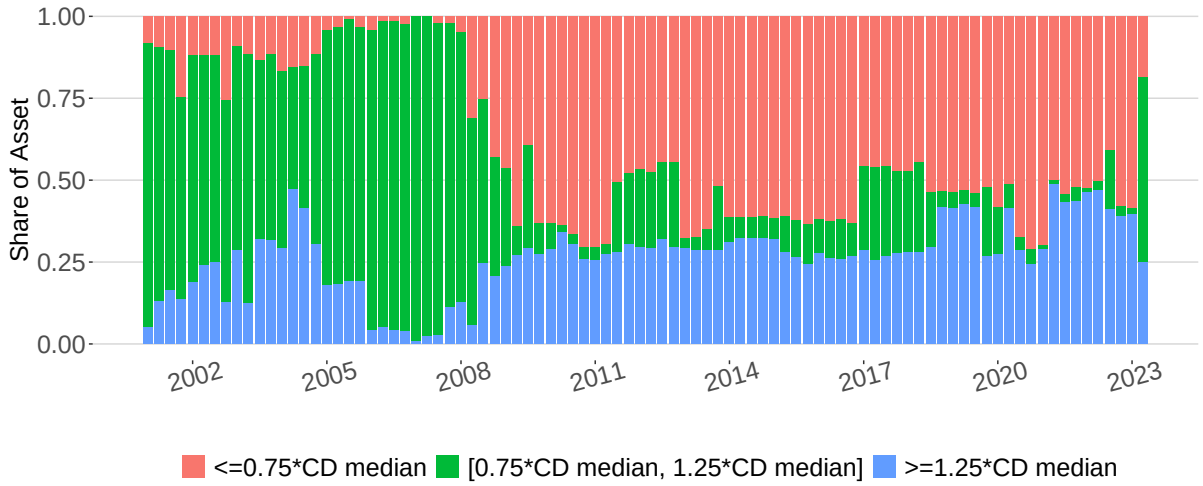
Figure 1: Dispersion of Deposit Rates for Top 25 Banks



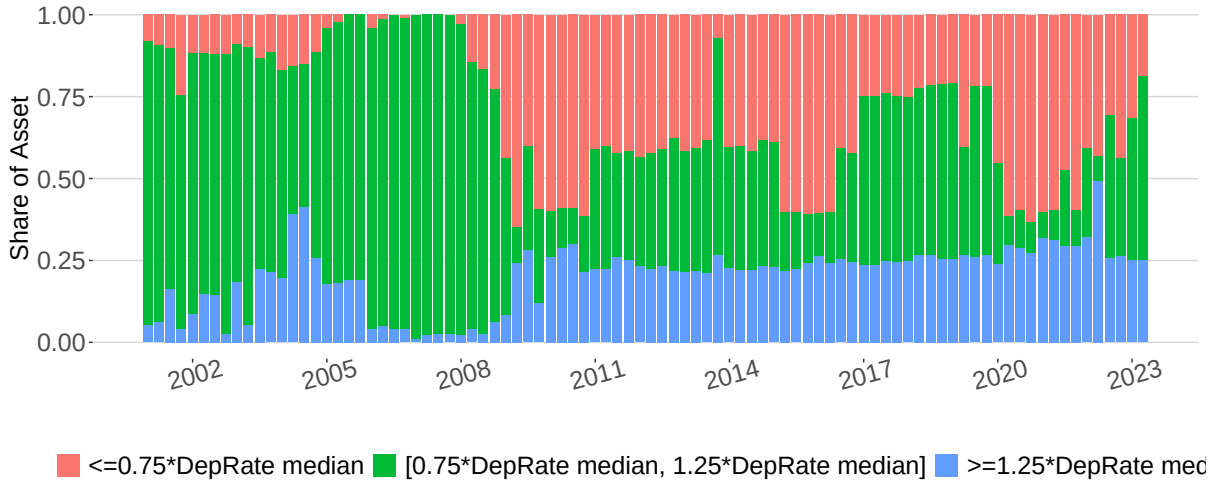
Notes: This figure presents kernel density plots of the scaled and demeaned 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and the scaled and demeaned deposit rates (DepRate) calculated from Call Reports offered by the top 25 banks at the peak of each rate hiking cycle. Figures a, b, c present the kernel density in 2007Q3, 2019Q1, and 2023Q1, respectively. The scaled and demeaned 12MCD10K rates (DepRate) are calculated by first scaling the 12MCD10K rates (DepRate) by the Market Yield on U.S. Treasury Securities at 1-Year Constant Maturity (DGS1 series in FRED) and then demeaning the scaled rates. The top 25 banks are defined according to bank size in the beginning of each quarter.

Figure 2: Asset Distribution of Top 25 Banks

(a) Classification based on 12MCD10K



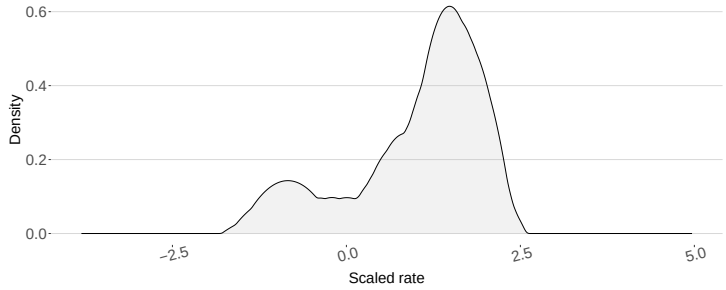
(b) Classification based on DepRate



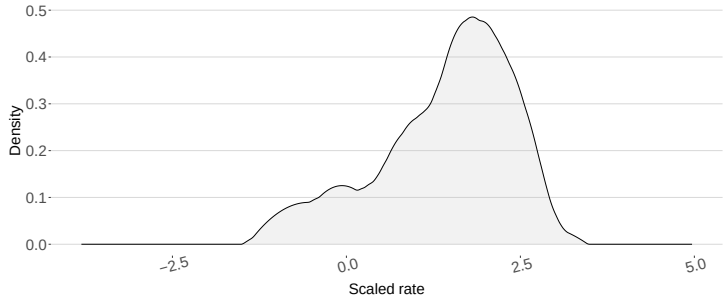
Notes: This figure illustrates the distribution of bank assets among three categories for the top 25 banks: banks with deposit rates below 0.75 times the sample median, banks with deposit rates within the range of 0.75 times to 1.25 times the sample median, and banks with deposit rates exceeding 1.25 times the sample median. Panel a and b present asset distribution classified based on 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and deposit rates (DepRate) calculated from Call Reports. If the 12MCD10K bank rate is unavailable, the classification is determined based on DepRate in Panel a. The top 25 banks are defined according to bank size in the beginning of each quarter.

Figure 3: Dispersion of Branch/Deposits ratio for Top 25 Banks

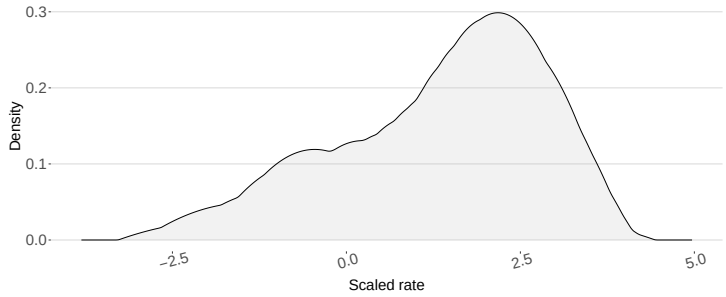
(a) 2007Q3



(b) 2019Q1



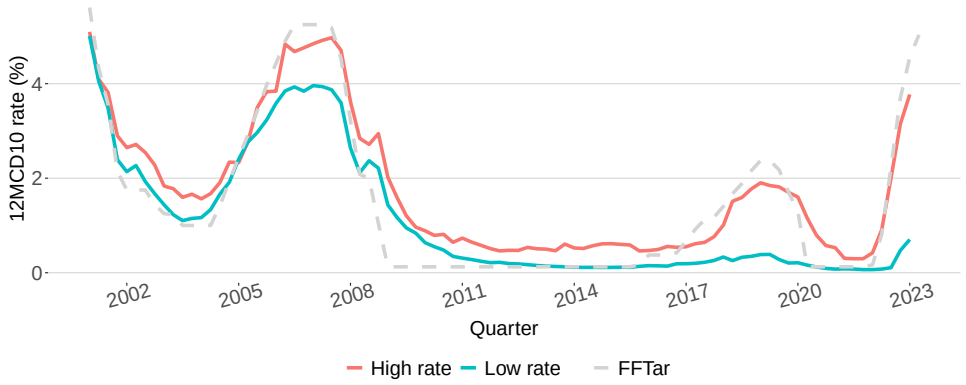
(c) 2022Q2



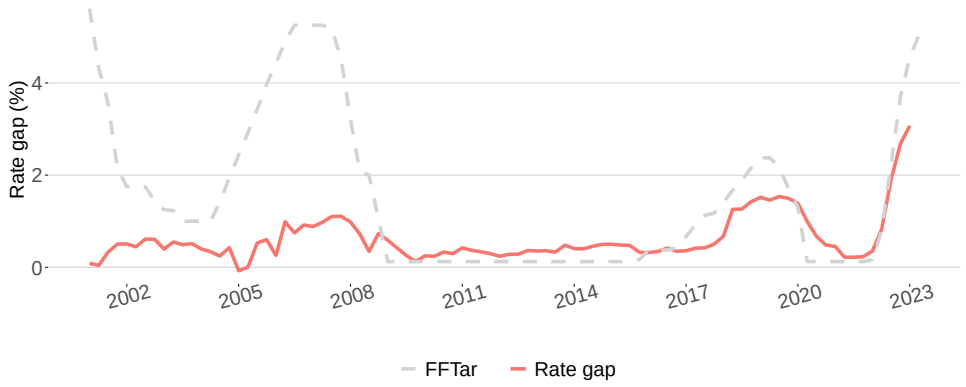
Notes: This figure displays kernel density plots of the demeaned logarithm of branch deposits by the top 25 banks at the peak of each interest rate hiking cycle. Figures a, b, c, and d illustrate the kernel density at the following quarters: 2007Q3, 2019Q1, and 2022Q2 (the last quarter available in SOD database), respectively. The top 25 banks are determined based on bank size at the beginning of each quarter. To ensure that the results are not influenced by banks primarily engaged in businesses other than retail deposits, we limit our analysis to banks with a minimum of 15 branches (the sample average is 1214). This restriction excludes Charles Schwab, J.P. Morgan & Co (before 2000), State Street, Merrill Lynch, Morgan Stanley, Bank of New York Mellon, Goldman Sachs, Ally Financial, and ING. The first seven of these banks focus on broker or investment banking businesses, while the latter two are fintech banks that have emerged in recent years. In the Appendix Figure A.12, we provide density plots that include these banks without any exclusions.

Figure 4: Dispersion of Bank Deposit Rates

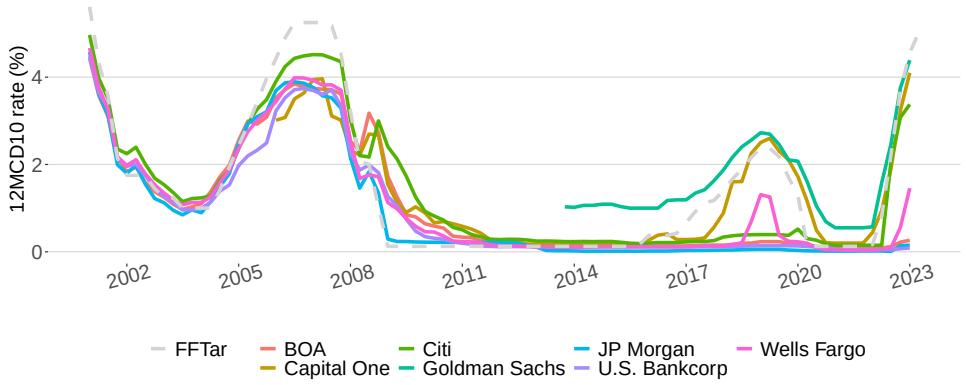
(a) Rate



(b) Rate Gap



(c) Rate by Bank

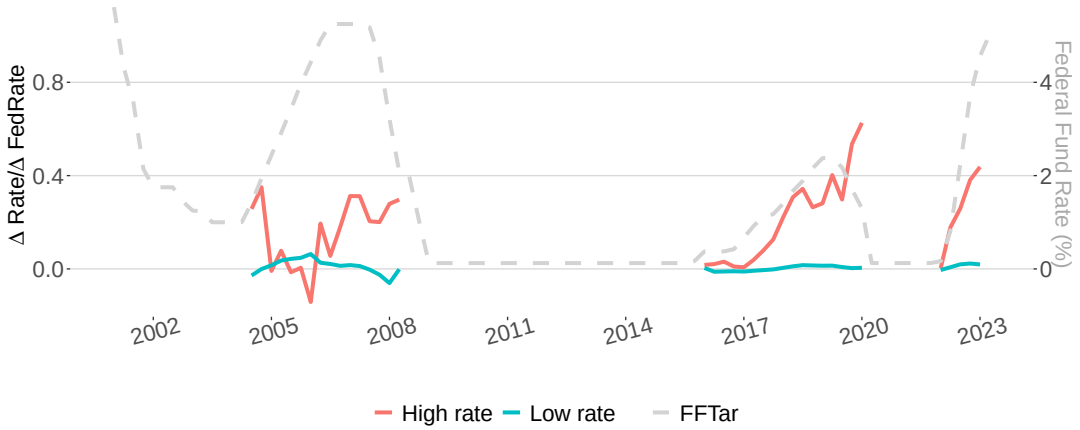


Notes: This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q2 among the top 25 banks. Figure 4a presents a time-series plot of the of 12-month certificate of deposit rates of at least $10,000 (12MCD10K) using RateWatch data for *high rate* (blue) and *low rate* (red) banks. Figure 4b presents the gap in the 12MCD10K rates between high rate and low rate banks. Figure 4c presents the 12MCD10K rate by bank. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

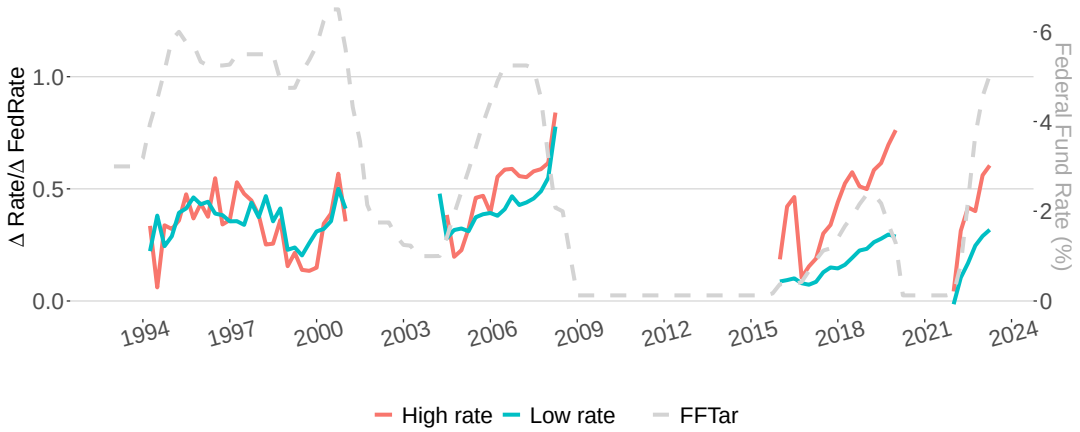
Figure 5: Deposit Beta

(a) 12MCD10K

(b) SAV



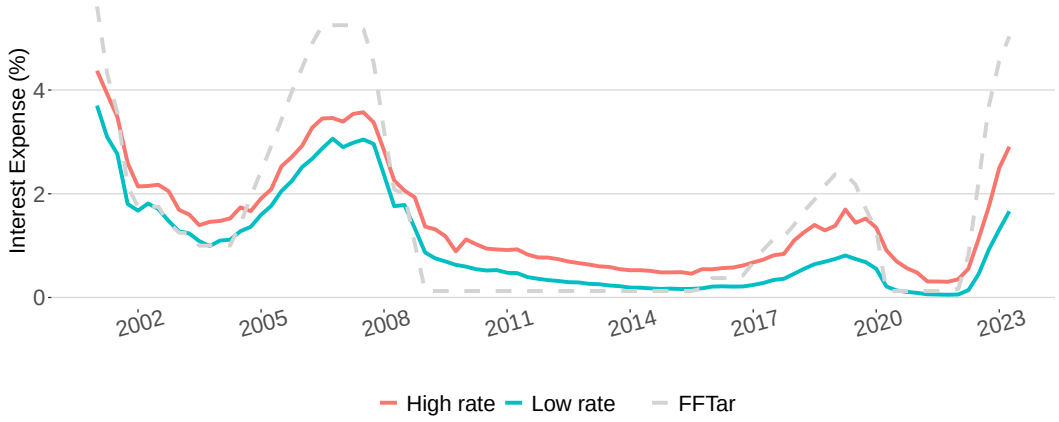
(c) Deposit Rate



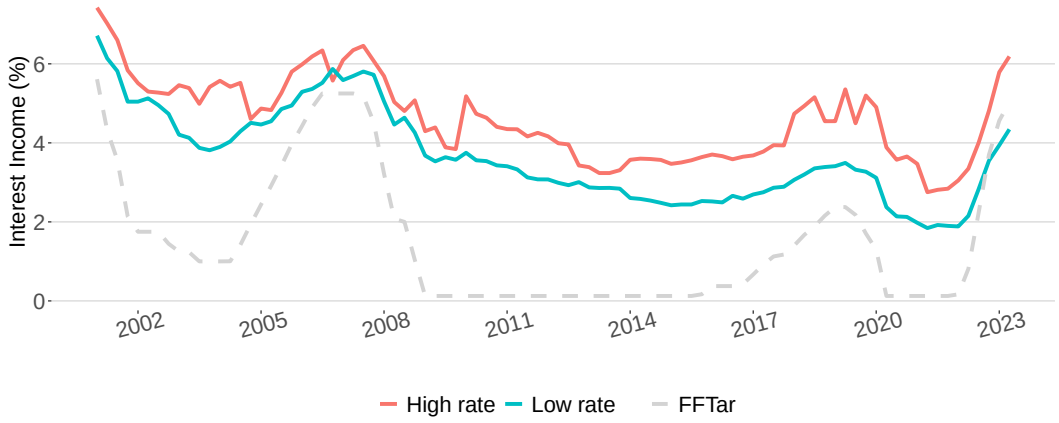
Notes: This figure compares the average deposit beta of high and low rate banks among the top 25 banks over the three recent rate hiking cycles: 2004Q1 through 2008Q2, 2015Q4 through 2020Q1, and 2021Q4 through 2023Q2. The deposit beta is defined as the ratio of the cumulative change in deposit rates from the first quarter of each rate hiking cycle to the corresponding change in the Federal Funds Target rate. We consider three deposit rates: the 12MCD10K rate in panel a, the savings rate in panel b, and the deposit rate calculated from the Call Report in panel c. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 6: Net Interest Margin

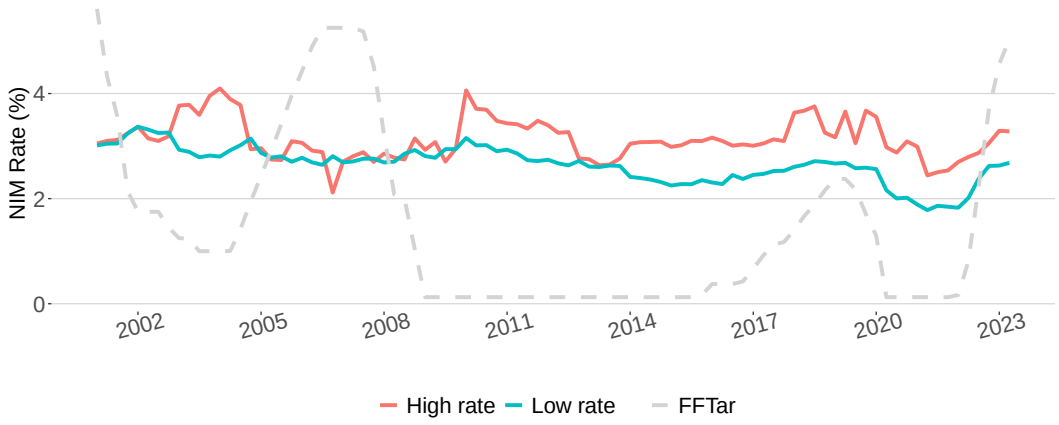
(a) Interest Expense



(b) Interest Income



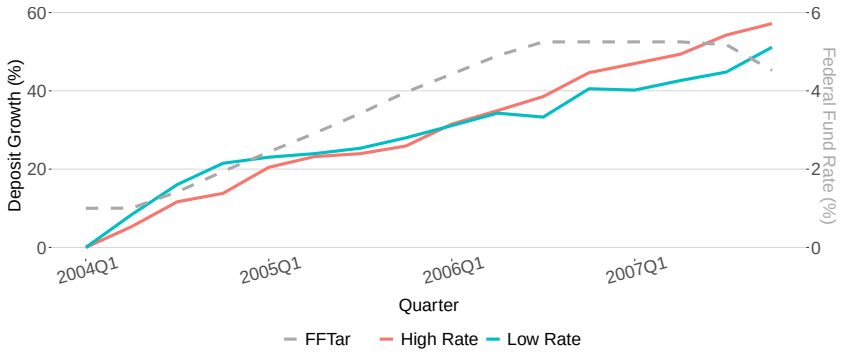
(c) NIM



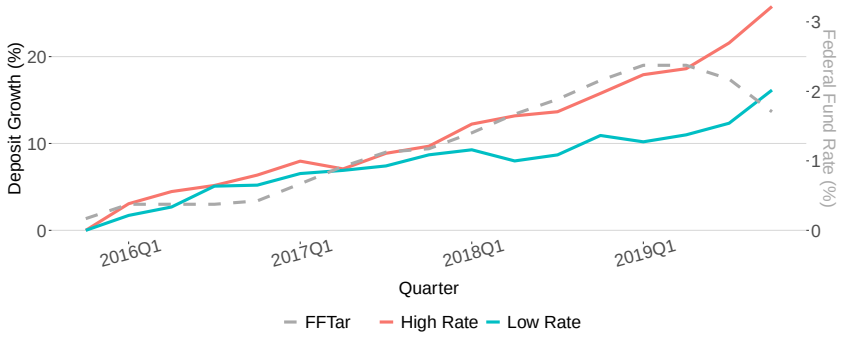
Notes: This figure compares the interest expense, interest income, and net interest margin of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. Figure 6a presents the interest expense (%) of high and low rate banks. Figure 6b presents the interest income (%) of high and low rate banks. Figure 6c presents the net interest margin (NIM) rate (%) for high and low rate banks. See Appendix Table A.10 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 7: Deposit Growth

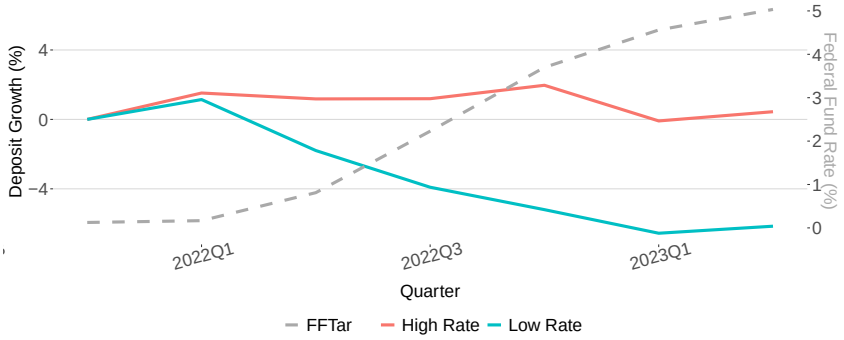
(a) 2004Q1-2007Q4



(b) 2015Q4-2019Q4



(c) 2021Q4-2023Q2

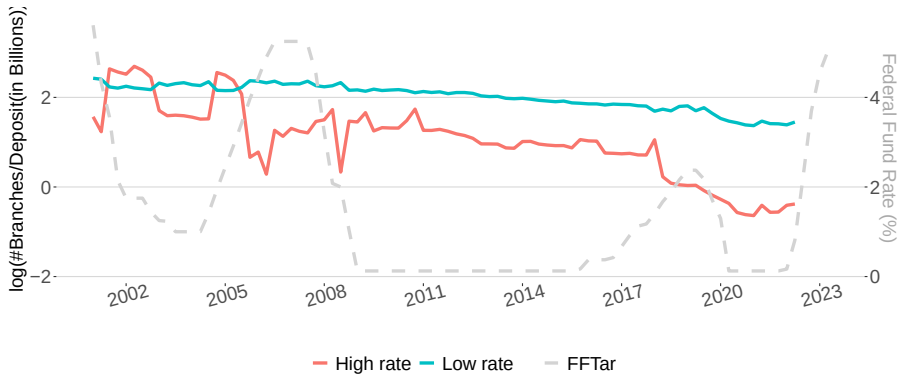


Notes: This figure compares the deposit growth of high and low rate banks among the top 25 banks over the three recent rate hiking cycles. Figures 7a, 7b, and 7c compare the deposit growth experienced by high-rate banks to that of low-rate banks from 2004Q1 through 2007Q4, from 2015Q4 through 2019Q4, and from 2021Q4 through 2023Q2, respectively. To facilitate comparison, the growth rates of high-rate and low-rate banks are normalized to 0% in the first quarter of each rate hiking cycle, i.e. 2004Q1, 2015Q4, and 2021Q4. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

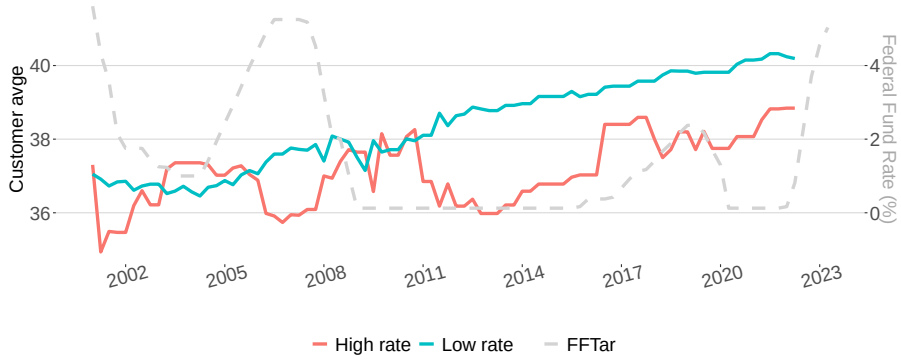
Figure 8: Branches

(a) Growth of Branches

(b) log $\frac{\#Branches}{Deposits}$



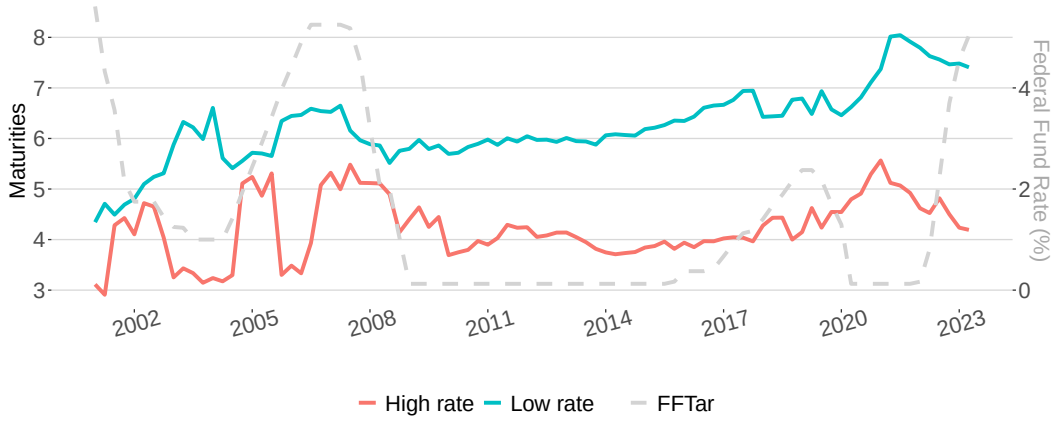
(c) Branch-weighted County Average Age



Notes: This figure compares branches operating by high and low rate banks among the top 25 banks from 2001Q1 through 2022Q2, which is the quarter where the most recent SOD data ends. Figure 8a presents the log-transformed number of branches of high and low rate banks. Figure 8b presents the log-transformed ratio between branches and deposits (in Billions) of high and low rate banks, where deposits are inflation-adjusted. Figure 8c presents the branch-weighted county average age of high and low rate banks. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 9: Duration Risk

(a) Maturity

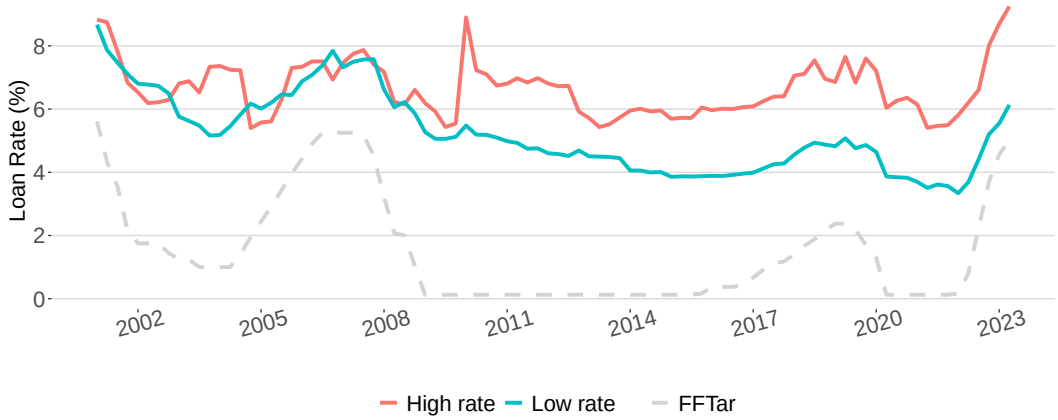


(b) Share of Short-Term Assets

Notes: This figure compares the duration risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. Figure 9a presents the maturity (# of years) of high and low rate banks. Figure 9b presents the share of assets with less-than one-year maturity (short-term assets) for high and low rate banks. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

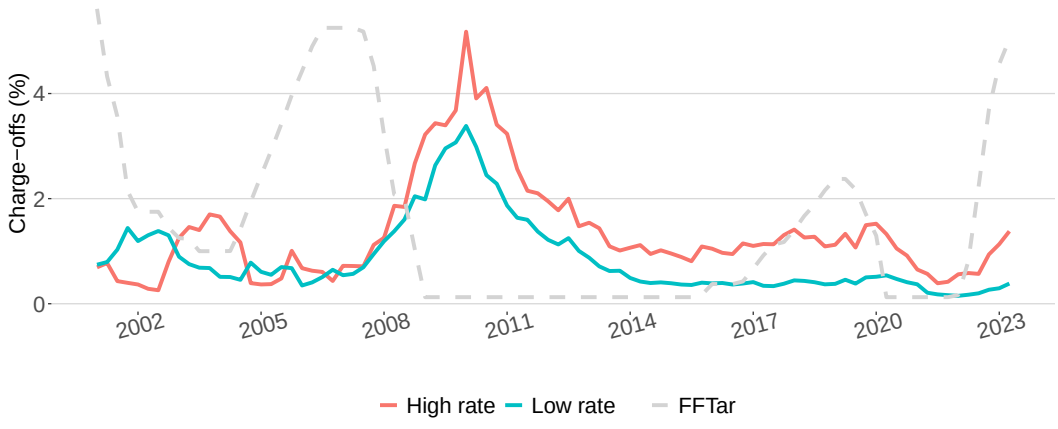
Figure 10: Credit Risk

(a) Loan rate



(b) Credit spread

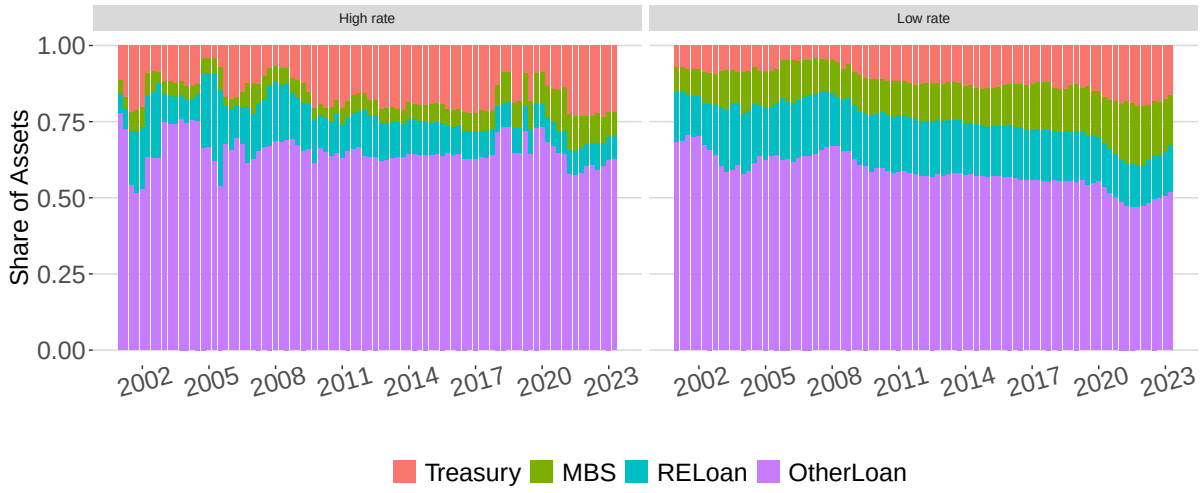
(c) Charge-offs



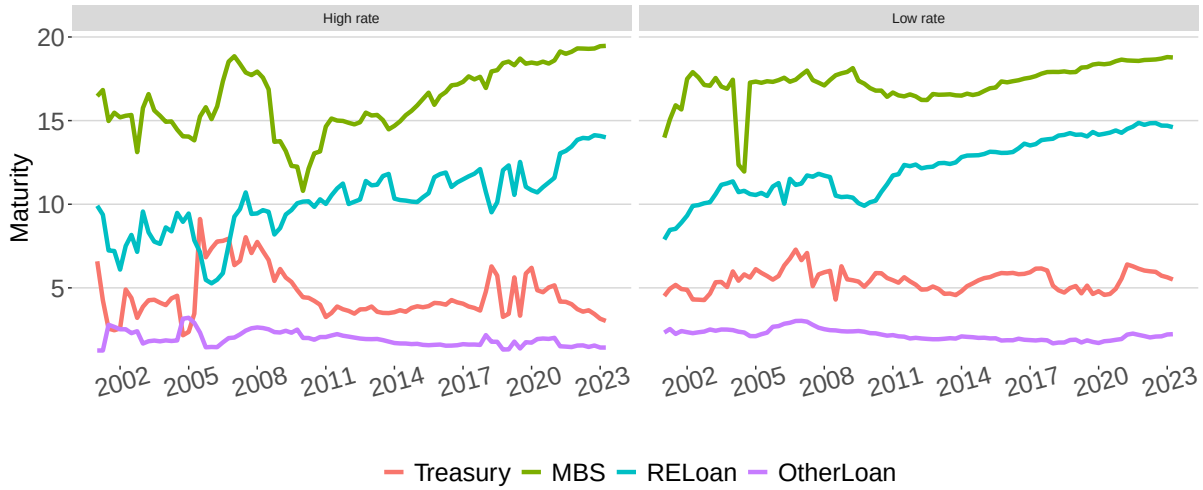
Notes: This figure compares the credit risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. Figure 10a presents the loan rate (%) of high and low rate banks. Figure 10b presents the credit spread (%) of high and low rate banks. The credit spread is computed as the difference between the loan rate and synthetic term rate (average of term treasury yields, weighted by the share of loans with corresponding maturities). Figure 10c presents the charge-off rate (%) for high and low rate banks. See Appendix Table A.10 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 11: Portfolio Composition

(a) Share of Assets



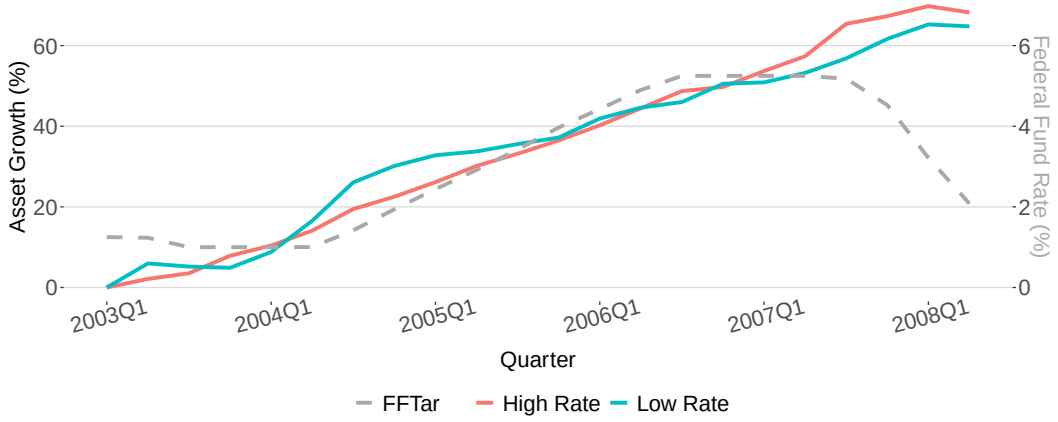
(b) Maturity



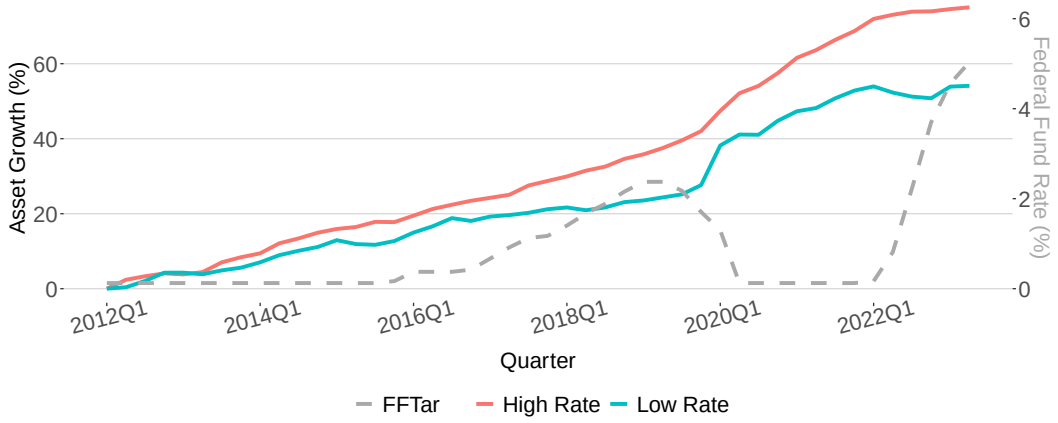
Notes: This figure compares the portfolio characteristics of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. Figure 11a examines the portfolio composition of high rate and low rate banks; share of treasuries (red), mortgage-backed securities (green), real estate loans (blue), and other loans (purple). Figure 11b examines the maturity (years) of these asset classes for high rate and low rate banks. See Appendix Table A.10 for more details on the construction of key variables. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 12: Asset Growth (Top 100 Banks)

(a) 2003Q1-2008Q2



(b) 2012Q1-2023Q2



Notes: This figure compares the asset growth of high and low rate banks for banks with more than $10 billion in assets. Figure 12a compares the asset growth experienced by high rate banks to that of low rate banks from 2003Q1 through 2008Q2. Figure 12b compares the asset growth experienced by high rate banks to that of low rate banks from 2012Q1 through 2023Q2. For ease of comparison, the growth rates of high rate and low rate banks are normalized to 0% in the first quarter, i.e., 2003Q1 and 2012Q1. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Table 1: Summary Statistics

Panel A: High v.s. Low rate Banks Comparison

	2001-2008			2017-2023		
	High	Low	Diff	High	Low	Diff
MCD (%)	2.75	2.15	0.60***	0.77	0.04	0.73***
DepRate (%)	2.14	1.54	0.60***	0.64	0.11	0.53***
Insured Deposits Share	0.43	0.46	-0.02	0.43	0.45	-0.02
#Branches	949	2612	-1663***	406	3270	-2865***
$\log(\frac{\#\text{ Branches}}{\text{Deposits}})$	0.40	1.32	-0.90***	-1.21	0.33	-1.54***
ΔDeposits (%)	2.47	2.75	-0.28	1.36	1.18	0.18
NIM rate (%)	2.54	2.33	0.21	2.52	1.78	0.74***
Maturity (Years)	3.71	5.23	-1.53***	3.93	6.45	-2.53***
Charge-off Rate (%)	0.61	0.41	0.20	0.39	0.03	0.36***

Panel B: Deposit Rate

	Count	Mean	Stdev	Skewness	P5	P25	Median	P75	P95
12MCD10K	1830	1.20	1.37	1.17	0.03	0.15	0.49	1.99	4.03
DepRate	2250	1.11	1.09	1.32	0.04	0.23	0.73	1.67	3.30

Notes: Panel A compares various metrics between high and low rate banks among the top 25 banks from 2001Q1 to 2008Q4 and from 2017Q1 to 2023Q2. The comparison between 2009Q1 to 2006Q4 is reported in Tabel A.1. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile. The averages, weighted by its asset size in the previous quarter, are reported separately for the two types of banks, as well as their difference. Standard errors are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively. CD refers to the 12-month certificate of deposit rate on accounts with at least $10,000, collected from RateWatch. DepRate is the deposit rate calculated from the Call Reports. The share of insured deposits, NIM rate, quarterly growth of deposits, maturity of loans and securities, charge-offs of loans are extracted from the Call Reports. Additionally, we count the number of branches for each bank using the Statement of Deposits (SOD). Panel B presents the summary statistics for DepRate and 12MCD10K from 2001Q1 to 2023Q2.

Table 2: Deposit Betas

	ΔDep. Rate	ΔInterest Expense	ΔInterest Income	ΔNIM
	(1)	(2)	(3)	(4)
ΔFFTar×𝟙(High Rate)×Post	0.546***	0.170***	0.095	-0.066
	(0.115)	(0.037)	(0.070)	(0.048)
ΔFFTar×𝟙(High Rate)	-0.067	-0.031	-0.023	0.000
	(0.113)	(0.035)	(0.066)	(0.041)
ΔFFTar	0.598***	0.463***	0.414***	-0.043
	(0.055)	(0.037)	(0.056)	(0.036)
ΔFFTar×Post	-0.454***	-0.150***	0.110*	0.252***
	(0.100)	(0.050)	(0.065)	(0.044)
𝟙(High Rate)×Post	-0.018	-0.023	0.014	0.036
	(0.039)	(0.018)	(0.051)	(0.042)
𝟙(High Rate)	-0.007	0.014	-0.013	-0.028
	(0.035)	(0.017)	(0.050)	(0.042)
Post	-0.061	-0.004	-0.014	-0.011
	(0.052)	(0.022)	(0.038)	(0.020)
$ROA_{i,q-1}$	0.042**	0.012*	0.002	-0.010
	(0.020)	(0.006)	(0.016)	(0.013)
$Tier1_{i,q-1}$	-0.024**	-0.012**	-0.020	-0.010
	(0.012)	(0.006)	(0.013)	(0.010)
Constant	0.006	-0.013	-0.016	-0.000
	(0.050)	(0.021)	(0.040)	(0.023)
Adjusted R^2	0.561	0.593	0.368	0.098
Observations	1802	2243	2243	2243
Mean of Dep. Variable	-0.023	-0.004	-0.013	-0.009

Notes: This table reports the estimated coefficients from the following regression specification:

$$\begin{aligned} Y_{i,q} = \alpha &+ \beta_1 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High rate},i} \\ &+ \beta_3 \times \Delta\text{FFTar}_q \times \text{Post}_q + \beta_4 \times \Delta\text{FFTar}_q + \beta_5 \times \mathbb{1}_{\text{High rate},i} \\ &+ \beta_6 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_7 \times ROA_{i,q-1} + \beta_7 \times Tier\ 1_{i,q-1} + \varepsilon_{i,q}, \end{aligned}$$

where i and q indicate the bank and quarter-year, respectively, ΔFFTar_q denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), and $ROA_{i,q-1}$ and Tier $1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The dependent variable, $Y_{i,q}$ is the change in the 12MCD10K rate ($\Delta\text{Dep. Rate}_{i,q}$) in column (1), the change in interest expense ($\Delta\text{Interest Expense}_{i,q}$) in column (2), the change in net interest income ($\Delta\text{Interest Income}_{i,q}$) in column (3), and the change in NIM ($\Delta\text{NIM}_{i,q}$) in column (4). All dependent variables are winsorized at the 0.5% and the 99.5% levels. The 12MCD10K rate comes from RateWatch. The change in interest expense, interest income and NIM are computed from the Call Reports. See Table A.10 for more details on the construction of key variables. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table 3: Growth in Deposits and Loans

	ΔDeposit$_{i,y}$		ΔPersonal Loan$_{i,y}$		ΔC&I Loan$_{i,y}$		ΔReal Estate Loan$_{i,y}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔFFTar$_y \times \mathbb{1}$(High Rate)$\times$Post	3.622**	3.163**	4.845*	5.542*	5.748**	3.962	0.395	0.754
	(1.450)	(1.520)	(2.790)	(2.900)	(2.653)	(2.694)	(2.651)	(2.944)
ΔFFTar$_y \times \mathbb{1}$(High Rate)	-0.661	-0.545	-3.566*	-4.028*	-3.611**	-1.842	-0.298	-0.552
	(0.942)	(0.937)	(2.024)	(2.145)	(1.587)	(1.723)	(1.435)	(1.412)
ΔFFTar$_y \times$Post	-5.461***		-0.826		-2.073		-3.069	
	(1.261)		(1.146)		(2.075)		(2.024)	
$\mathbb{1}$(High Rate)$\times$Post	-5.302***	-5.546***	10.851**	9.554**	-7.636**	-6.676**	-9.423***	-10.785***
	(2.055)	(1.918)	(4.416)	(4.540)	(3.111)	(2.845)	(3.460)	(3.674)
$\mathbb{1}$(High Rate)	4.403***	5.057***	-8.237**	-7.356*	5.431**	4.363*	7.490***	8.819***
	(1.706)	(1.452)	(3.920)	(4.086)	(2.644)	(2.272)	(2.842)	(2.935)
Post	-3.345*		-10.365***		-5.681		-11.325***	
	(1.950)		(2.362)		(4.951)		(3.042)	
ROA$_{i,q-1}$	1.186***	1.569***	0.237	0.888	1.091	1.636***	0.600	1.564*
	(0.330)	(0.403)	(0.597)	(0.690)	(1.011)	(0.576)	(0.471)	(0.856)
Tier1$_{i,q-1}$	0.007	0.009	0.004	0.000	-0.010	-0.007	0.018	0.017
	(0.008)	(0.007)	(0.011)	(0.010)	(0.013)	(0.010)	(0.020)	(0.017)
ΔFFTar$_y \times \mathbb{1}$(High Rate)$\times$Crisis	-2.641*	13.162***	48.954***	56.057***	53.129***	34.935***	18.568***	48.267***
	(1.556)	(1.404)	(3.279)	(3.604)	(4.204)	(2.650)	(2.329)	(2.773)
Quarter FE		✓		✓		✓		✓
Adjusted R^2	0.224	0.048	0.031	0.008	0.029	0.015	0.111	0.026
Observations	2244	2244	2233	2233	2176	2176	2208	2208
Mean of Dep. Variable	8.408	8.408	6.494	6.494	5.908	5.908	5.658	5.658

Notes: This table reports the estimated coefficients from the following regression specification:

$$\begin{aligned}\Delta \text{Y}_{i,y} = \alpha + \beta_1 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times \Delta\text{FFTar}_y \times \text{Post}_q \\ + \beta_4 \times \Delta\text{FFTar}_y + \beta_5 \times \mathbb{1}_{\text{High rate},i} + \beta_6 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q \\ \beta_7 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} \times \text{Crisis} + \beta_8 \times ROA_{i,q-1} + \beta_9 \times Tier\ 1_{i,q-1} + \varepsilon_{i,q},\end{aligned}$$

where i and q indicate the bank and quarter-year, respectively, ΔFFTar$_y$ denotes the one-year change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post$_q$ denotes the post-crisis period (post-2009), Crisis is an indicator for the third and fourth quarters of 2008,, and ROA$_{i,q-1}$ and Tier $1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The dependent variable, $\Delta \text{Y}_{i,y}$ is the one-year growth of the total deposit, loans to individuals, C&I loans, and real estate loans of bank i, and are winsorized at the 0.5% and the 99.5% levels. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table 4: Bank Branches

	log(# Branches)		log($\frac{\text{Branches}}{\text{Deposit}}$)		Branch-weighted County Average Age	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}$(High Rate)×Post	-0.648**	-1.049***	-0.477**	-0.547**	-0.568***	-0.567***
	(0.292)	(0.303)	(0.229)	(0.238)	(0.215)	(0.214)
$\mathbb{1}$(High Rate)	-1.136***	-0.861***	-1.120***	-1.151***	-0.470**	-0.557***
	(0.183)	(0.208)	(0.192)	(0.194)	(0.197)	(0.185)
Post			-0.779***		1.820***	
			(0.121)		(0.213)	
$\text{ROA}_{i,q-1}$	-0.088	-0.008	-0.086	0.009	-0.026	-0.373***
	(0.069)	(0.103)	(0.064)	(0.080)	(0.128)	(0.068)
$\text{Tier1}_{i,q-1}$	0.529***	0.568***	0.099**	0.014	-0.290***	-0.155***
	(0.091)	(0.083)	(0.045)	(0.035)	(0.087)	(0.058)
Constant	7.105***		1.740***		37.454***	
	(0.073)		(0.088)		(0.203)	
Quarter FE		✓		✓		✓
Adjusted R^2	0.147	0.156	0.152	0.125	0.322	0.162
Observations	2112	2112	2112	2112	1647	1647
Mean of Dep. Variable	7.088	7.088	0.852	0.852	38.657	38.657

Notes: This table reports the estimated coefficients from the following regression specification:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q},$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier 1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The dependent variable, $Y_{i,q}$ is the log-transformed number of branches (log(# of Branches)) in columns (1)-(2), the log-transformed ratio of branches to deposits in billions (log($\frac{Branches}{Deposit}$)) in columns (3)-(4), and the average customer age in columns (5)-(6). The branch-weighted county average age is calculated as the county average age, which is weighted based on the number of branches in each county. The variable log($\frac{Branches}{Deposit}$) is winsorized at the 0.5% and the 99.5% levels. Branch and deposit data comes from the FDIC Summary of Deposits. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table 5: Duration Risk

Panel A: Loans and Securities

	Maturities (years)	Short-term share (%)
	(1)	(2)
𝟙(High Rate)×Post	-0.691**	2.843*
	(0.333)	(1.578)
𝟙(High Rate)	-1.788***	6.103***
	(0.329)	(1.146)
Quarter FE + Controls	✓	✓
Observations	2153	2153
Mean of Dep. Variable	5.923	47.947

Panel B: Maturity by Asset Class

	Real Estate Loans	Other Loans	MBSs	Treasuries
	(1)	(2)	(3)	(4)
𝟙(High Rate)×Post	0.029	0.131	-0.982**	-1.787***
	(0.281)	(0.175)	(0.399)	(0.590)
𝟙(High Rate)	-1.766***	-0.598***	1.468***	-0.117
	(0.236)	(0.163)	(0.315)	(0.547)
Quarter FE + Controls	✓	✓	✓	✓
Observations	2051	2153	2067	2114
Mean of Dep. Variable	12.219	1.945	17.130	6.001

Panel C: Share by Asset Classes (%)

	Real Estate Loans	Other Loans	MBSs	Treasuries
	(1)	(2)	(3)	(4)
𝟙(High Rate)×Post	-2.169	4.325**	-0.987	-1.170
	(1.999)	(1.940)	(0.657)	(1.993)
𝟙(High Rate)	-3.387*	5.521***	-6.731***	4.597**
	(1.970)	(1.796)	(0.702)	(1.878)
Quarter FE + Controls	✓	✓	✓	✓
Observations	2153	2153	2153	2153
Mean of Dep. Variable	15.120	57.717	12.302	14.861

Notes: This table reports the estimated coefficients from the following regression specification:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q},$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier 1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. In panel A, the dependent variable, $Y_{i,q}$ is the maturity of loans and securities in column (1), and the share of loans and securities with less than one-year maturity in column (2). Panels B and C analyze maturities and asset share by asset classes. The asset classes are real estate loans in column (1), other loans in column (2), mortgage-backed securities in column (3), and treasuries in column (4). The data comes from the Call Reports. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table 6: Credit Risk

Panel A: Loans and Securities

	Loan Rate	Credit Spread	Charge-offs
	(1)	(2)	(3)
$\mathbb{1}$(High Rate)×Post	1.356***	1.227***	0.434***
	(0.206)	(0.280)	(0.137)
$\mathbb{1}$(High Rate)	0.700***	1.015***	0.250**
	(0.189)	(0.269)	(0.124)
Quarter FE + Controls	✓	✓	✓
Adjusted R^2	0.319	0.357	0.161
Observations	2244	2153	2244
Mean of Dep. Variable	5.142	3.371	0.866

Panel B: Charge-off Rates by Asset Class

	Real Estate Loans	C&I Loans	Personal Loans	Other Loans
	(1)	(2)	(3)	(4)
$\mathbb{1}$(High Rate)×Post	0.230**	0.207**	0.600***	0.061
	(0.091)	(0.087)	(0.184)	(0.067)
$\mathbb{1}$(High Rate)	0.049	0.050	0.570***	-0.050
	(0.050)	(0.068)	(0.168)	(0.058)
Quarter FE + Controls	✓	✓	✓	✓
Adjusted R^2	0.080	0.026	0.089	0.000
Observations	2214	2189	2240	2218
Mean of Dep. Variable	0.452	0.600	2.337	0.228

Notes: This table reports the estimated coefficients from the following regression specification:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q}$$

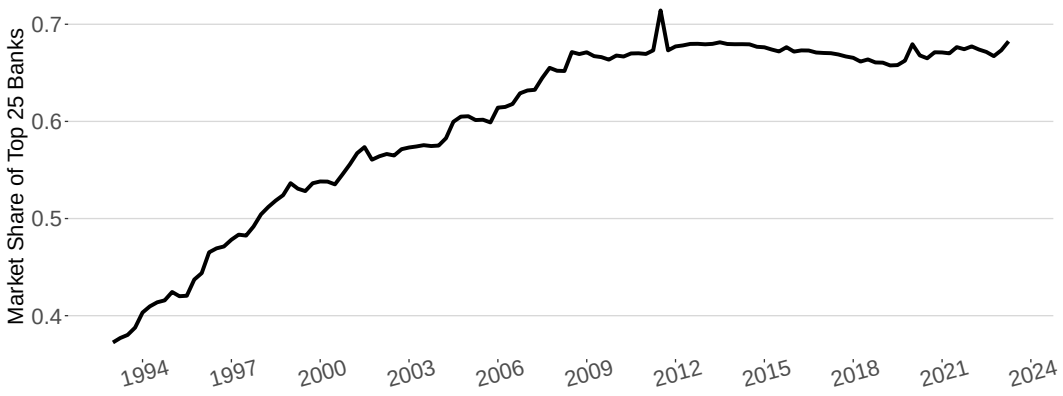
where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier } 1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. In panel A, the dependent variable, $Y_{i,q}$ is the loan rate in column (1), credit spread in column (2), and charge-off rate in column (3). The credit spread is computed as the difference between the loan rate and synthetic term rate (average of treasury yields, weighted by the share of loans with different maturities). Panel B analyzes the charge-off rate by asset class. The asset classes are real estate loans in column (1), other loans in column (2), mortgage-backed securities in column (3), and treasuries in column (4). All dependent variables are winsorized at the 0.5% and 99.5% levels. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Online Appendix for:
The Emergence of High and Low Rate Banks

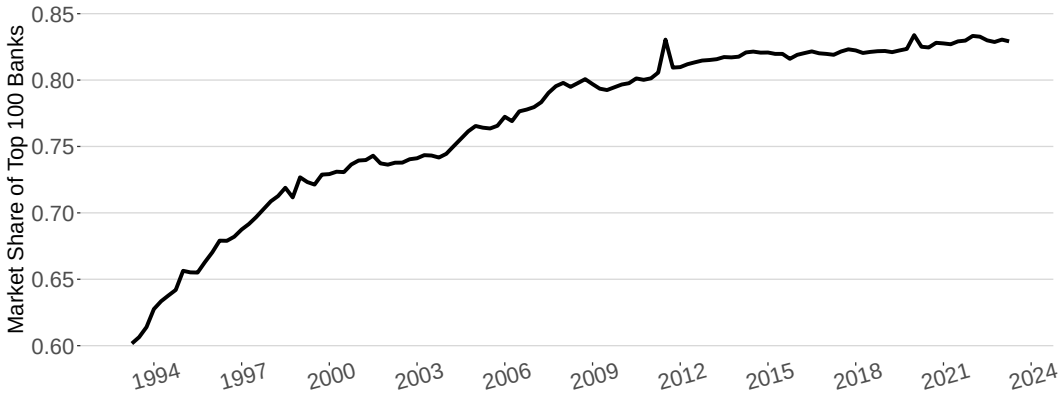
Appendix A Figures and Tables

Figure A.1: Market Share of Top Banks

(a) Top 25



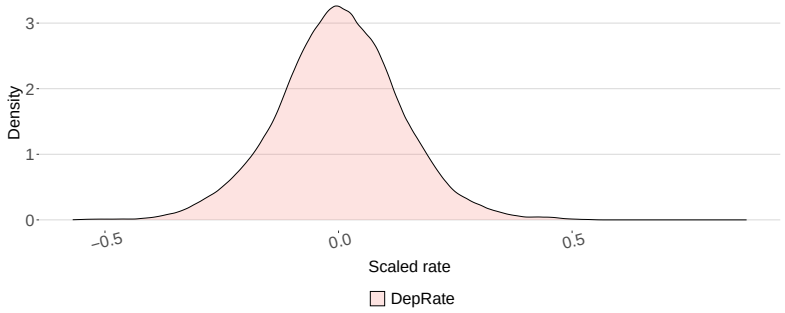
(b) Top 100



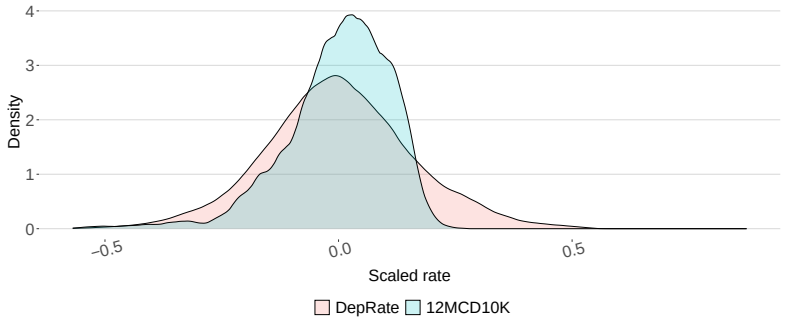
Notes: This figure presents the market share of the top 25 banks (in panel a) and top 100 banks (in panel b) from 2001Q1 through 2023Q2. Market share is measured by total assets. The top 25 (top 100) banks are defined according to bank size in each quarter. The data used to construct this figure comes from the Call Reports.

Figure A.2: Dispersion of Deposit Rates for All Banks

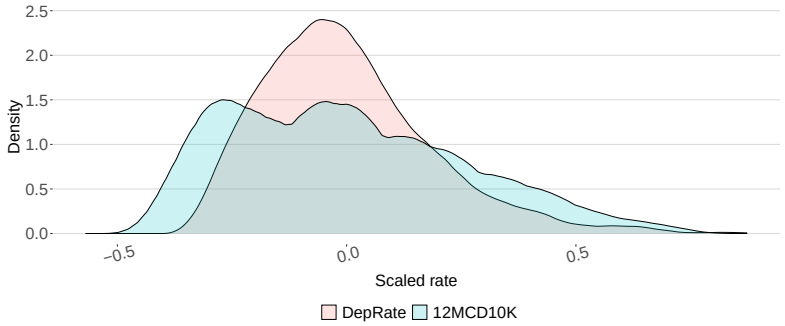
(a) 1994Q4



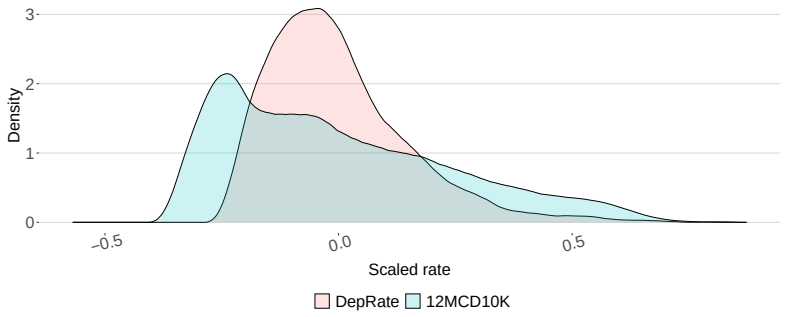
(b) 2007Q3



(c) 2019Q1



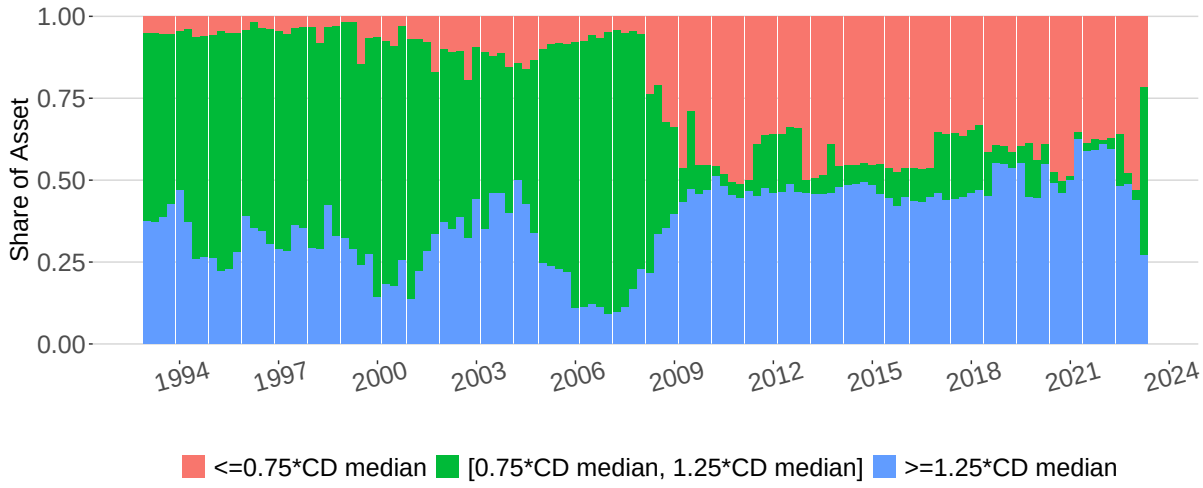
(d) 2023Q1



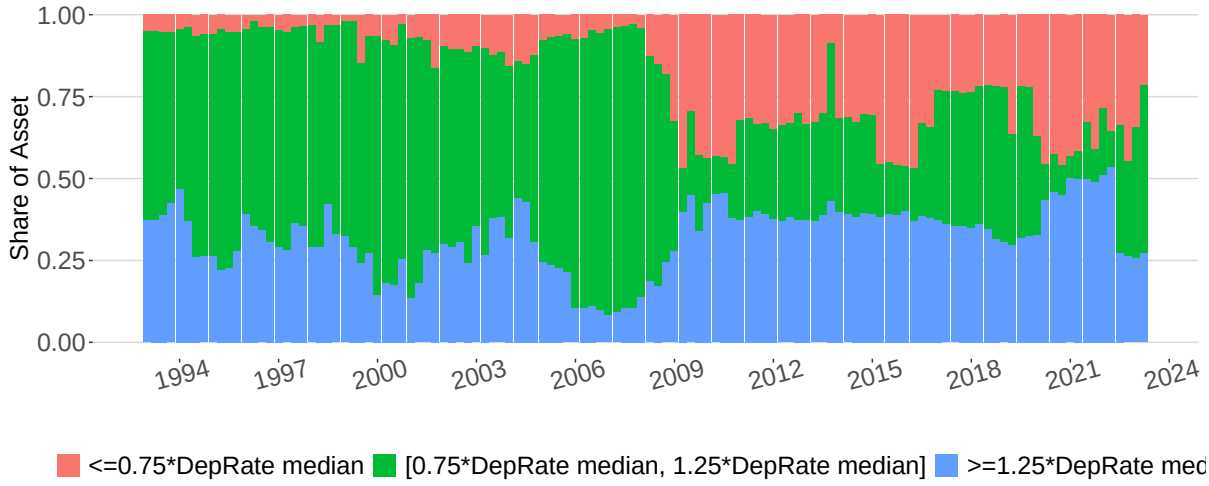
Notes: This figure presents kernel density plots of the scaled and demeaned 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and the scaled and demeaned deposit rates (DepRate) calculated from Call Reports offered by all banks at the peak of each rate hiking cycle. Figures a, b, c and d present the kernel density in 1994Q4, 2007Q3, 2019Q1, and 2023Q1, respectively. The scaled and demeaned 12MCD10K rates (DepRate) are calculated by first scaling the 12MCD10K rates (DepRate) by the Market Yield on U.S. Treasury Securities at 1-Year Constant Maturity (DGS1 series in FRED) and then demeaning the scaled rates.

Figure A.3: Asset Distribution of All Banks

(a) Classification based on 12MCD10K



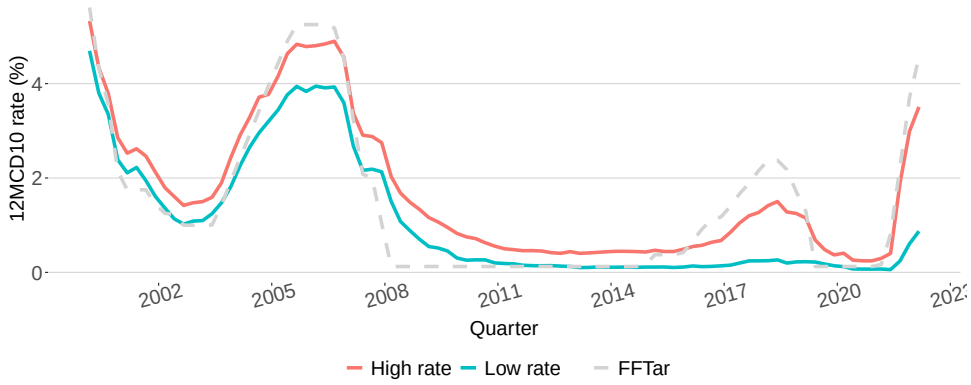
(b) Classification based on DepRate



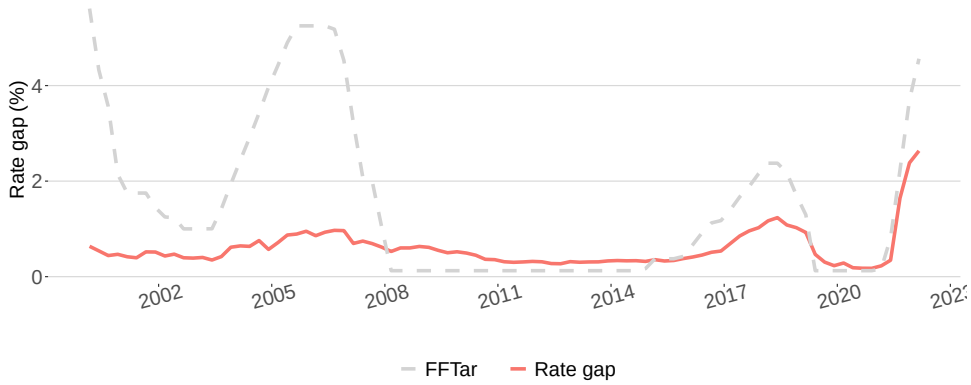
Notes: This figure illustrates the distribution of bank assets among three categories for all banks: banks with deposit rates below 0.75 times the sample median, banks with deposit rates within the range of 0.75 times to 1.25 times the sample median, and banks with deposit rates exceeding 1.25 times the sample median. Panel a and b present asset distribution classified based on 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and deposit rates (DepRate) calculated from Call Reports. If the 12MCD10K bank rate is unavailable, the classification is determined based on DepRate in Panel a. To maintain comparability with Appendix Figure A.2, the sample median is calculated as the median rate of the top 25 banks within each quarter.

Figure A.4: Dispersion of Bank Deposit Rates (Top 100 Banks)

(a) Rate



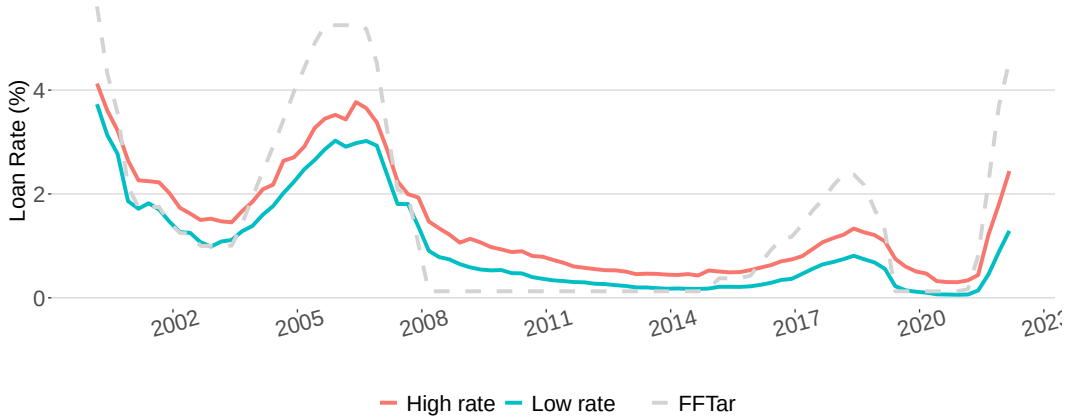
(b) Rate Gap



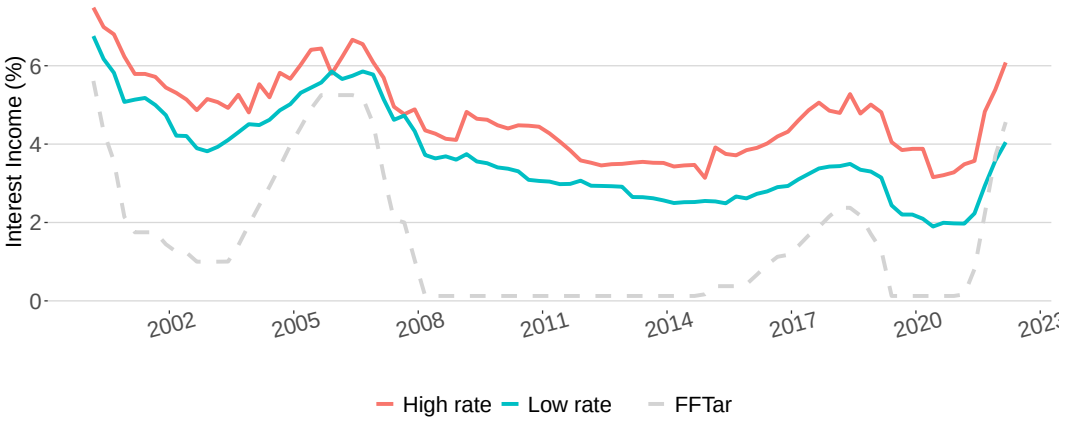
Notes: This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q2 among the top 100 banks. Figure A.4a presents a time-series plot of the of 12-month certificate of deposit rates of at least $10,000 (12MCD10K) using RateWatch data for *high rate* (blue) and *low rate* (red) banks. Figure A.4b presents the gap in the 12MCD10K rates between high rate and low rate banks. Figure 4c presents the 12MCD10K rate by bank. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure A.5: Net Interest Margin (Top 100 Banks)

(a) Interest Expense



(b) Interest Income



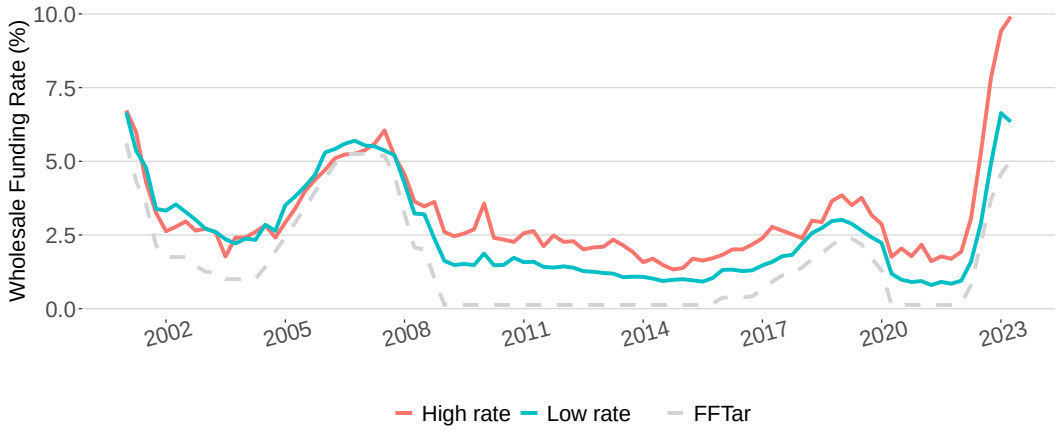
(c) NIM

Notes: This figure compares the interest expense, interest income, and net interest margin of high and low rate banks among the top 100 banks from 2001Q1 through 2023Q2. Figure A.5a presents the interest expense (%) of high and low rate banks. Figure A.5b presents the interest income (%) of high and low rate banks. Figure A.5c presents the net interest margin (NIM) rate (%) for high and low rate banks. See Appendix Table A.10 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure A.6: Wholesale Funding

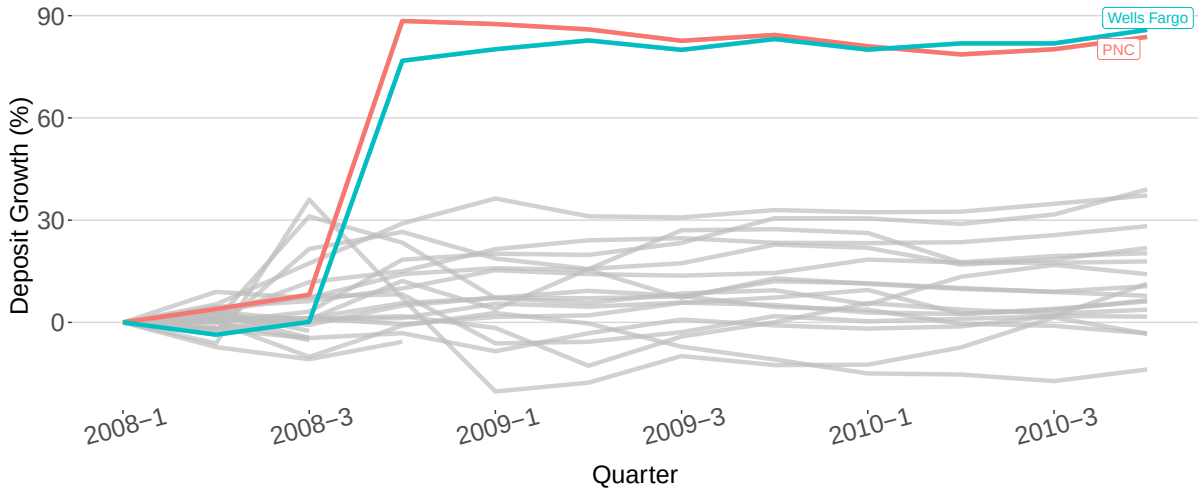
(a) Wholesale Funding Share

(b) Wholesale Funding Rate



Notes: The figures plot the wholesale funding share (in panel A) and rate (in panel B) of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. The wholesale funding includes federal funds purchased and repurchase agreements, subordinated debt, and other borrowed funds. See Appendix Table A.10 for more details on the construction of key variables. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

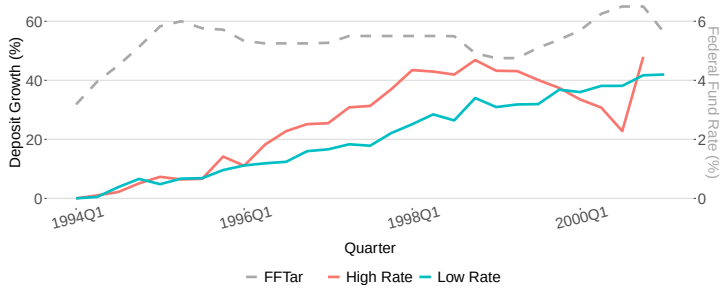
Figure A.7: Deposit Growth in Crisis Period: 2008Q1-2010Q4



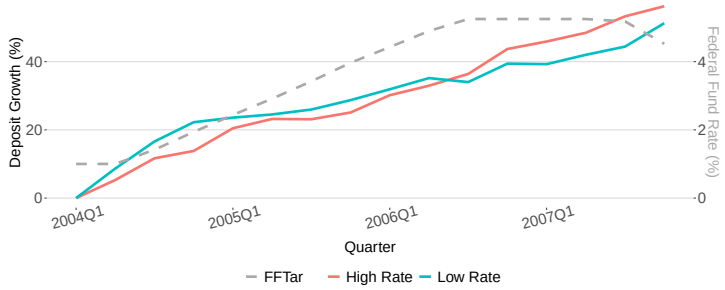
Notes: The figure illustrates the deposit growth of the top 25 banks from 2008Q1 to 2010Q4. The top 25 banks are chosen by their end-of-quarter assets for 2007Q4. The two big jumps in deposit growth are due to M&A: Wells Fargo acquired Wachovia on October 3, 2008, and PNC acquired National City Bank on October 24, 2008. There were many other M&A around the same period, but the effect on deposit growth was relatively small.

Figure A.8: Deposit Growth (Fixed Top 25 Banks)

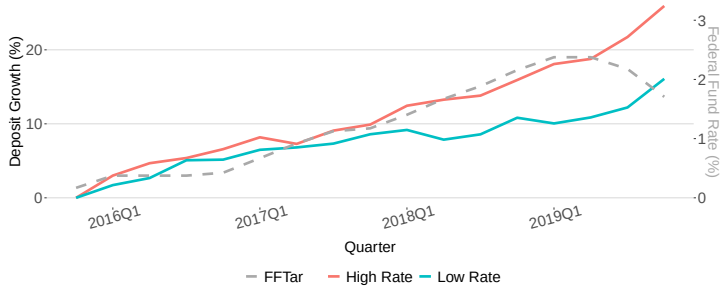
(a) 1993Q4-2001Q1



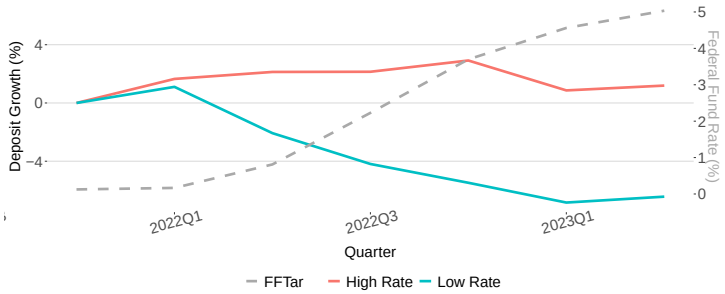
(b) 2004Q1-2007Q4



(c) 2015Q4-2019Q4



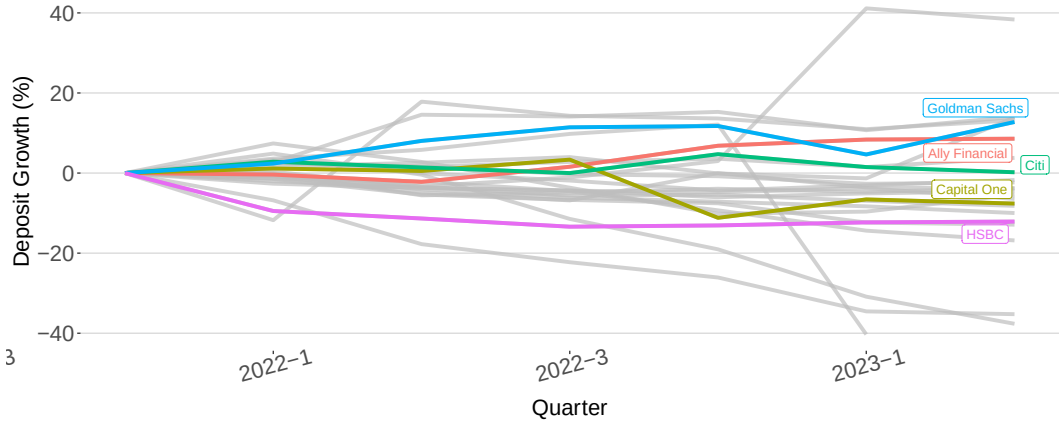
(d) 2021Q4-2023Q2



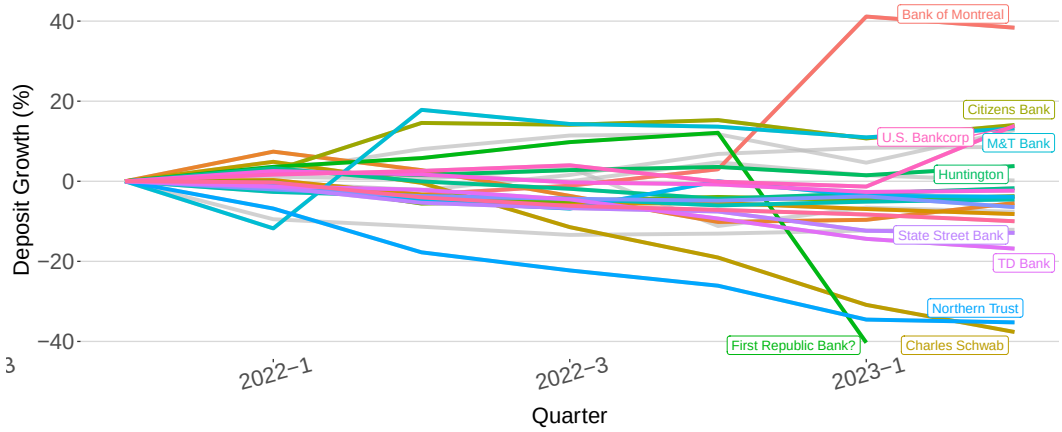
Notes: This figure compares the deposit growth of high and low rate banks among the top 25 banks over the four recent rate hiking cycles. The difference from Figure 7 is that in this exercise we fix the top 25 banks at the beginning of the cycle. Figures A.8a A.8b, A.8c, and A.8d compare the deposit growth experienced by high-rate banks to that of low-rate banks from 1993Q4 through 2001Q1, from 2004Q1 through 2007Q4, from 2015Q4 through 2019Q4, and from 2021Q4 through 2023Q2, respectively. To facilitate comparison, the growth rates of high-rate and low-rate banks are normalized to 0% in the first quarter of each rate hiking cycle, i.e. 2004Q1, 2015Q4, and 2021Q4. To mitigate the impact of large mergers and acquisitions (M&As) or outliers, we exclude BHC-quarter observations when the change in log deposits exceeds 50%. In total, 15 observations are excluded in 1993Q4-2001Q1 (panel a). The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure A.9: Deposit Growth: 2021Q4-2023Q2

(a) High rate Banks



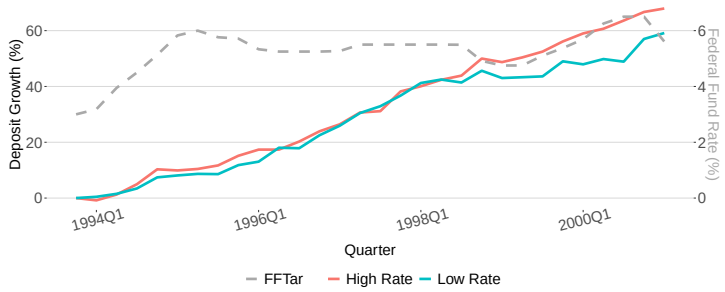
(b) Low rate Banks



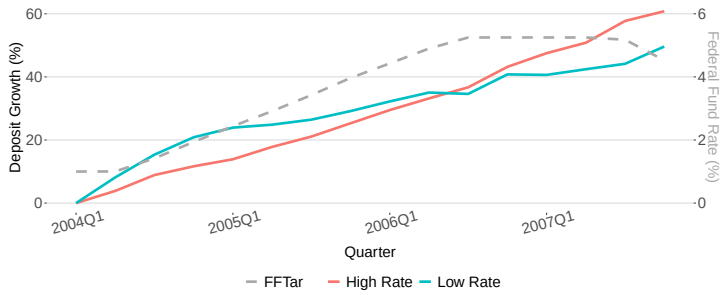
Notes: The figure illustrates the deposit growth of the top 25 banks, categorized by their end-of-quarter assets for 2022Q4. The classification into high-rate and low-rate banks is determined by the deposit rate of the 12-month certificate of deposit on accounts with a minimum balance of $10,000 in 2023Q2. This data is collected from RateWatch.

Figure A.10: Deposit Growth (Top 100 Banks)

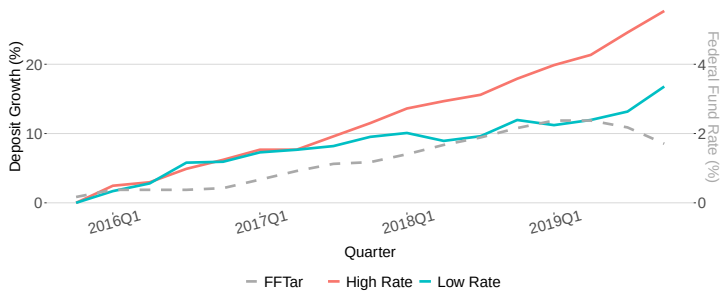
(a) 1993Q4-2001Q1



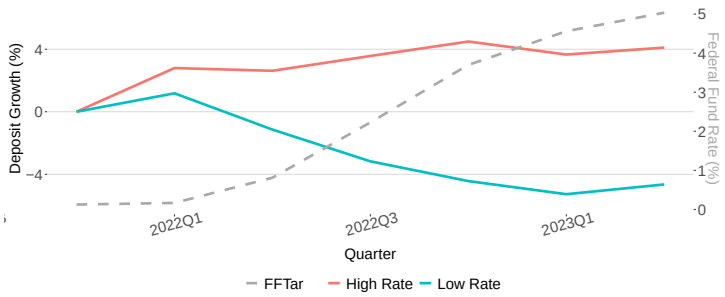
(b) 2004Q1-2007Q4



(c) 2015Q4-2019Q4



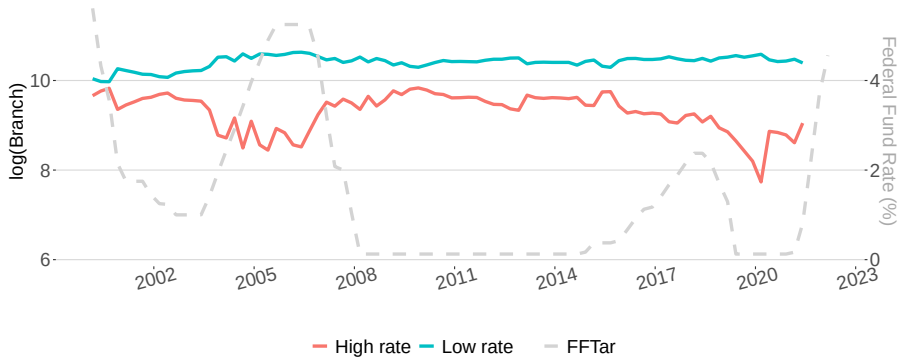
(d) 2021Q4-2023Q2



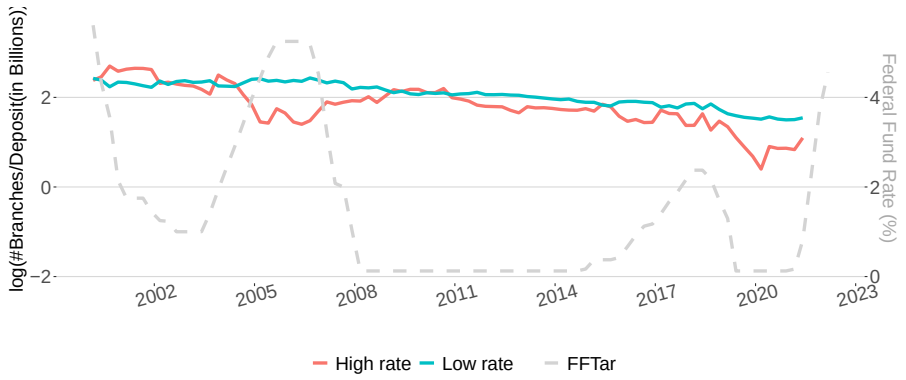
Notes: This figure compares the deposit growth of high and low rate banks among the top 100 banks over the three recent rate hiking cycles. Figures A.10a A.10b, A.10c, and A.10d compare the deposit growth experienced by high-rate banks to that of low-rate banks from 1993Q4 through 2001Q1, from 2004Q1 through 2007Q4, from 2015Q4 through 2019Q4, and from 2021Q4 through 2023Q2, respectively. To facilitate comparison, the growth rates of high-rate and low-rate banks are normalized to 0% in the first quarter of each rate hiking cycle, i.e. 2004Q1, 2015Q4, and 2021Q4. To mitigate the impact of large mergers and acquisitions (M&As) or outliers, we exclude BHC-quarter observations when the change in log deposits exceeds 50%. In total, 15 observations are excluded in 1993Q4-2001Q1 (panel a). The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure A.11: Branches (Top 100 Banks)

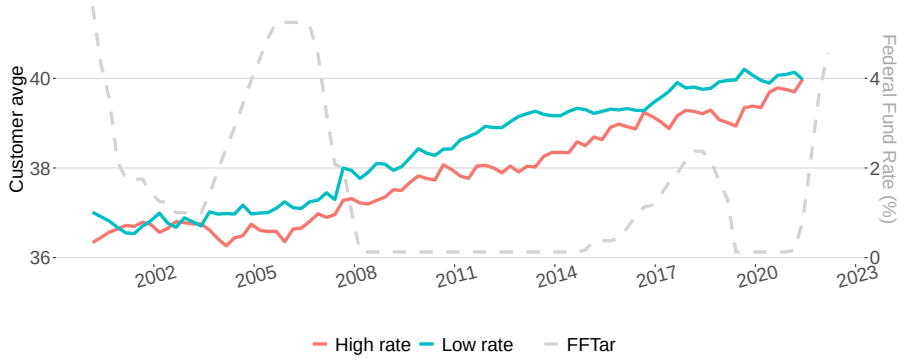
(a) Growth of Branches



(b) log $\frac{\#Branches}{Deposits}$



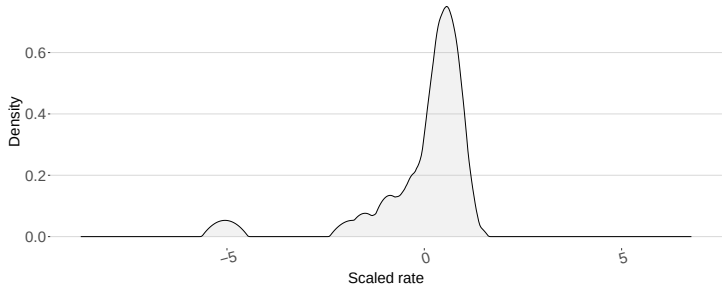
(c) Customer age



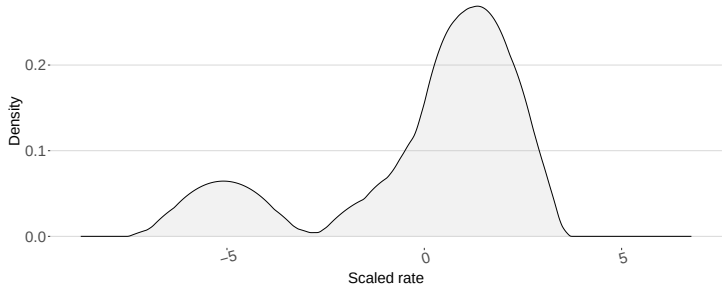
Notes: This figure compares branches operating by high and low rate banks among the top 100 banks from 2001Q1 through 2022Q2, which is the quarter where the most recent SOD data ends. Figure A.11a presents the log-transformed number of branches of high and low rate banks. Figure A.11b presents the log-transformed ratio between branches and deposits (in Billions) of high and low rate banks. Figure A.11c presents the average customer age of high and low rate banks. The average customer age of the bank is calculated as the county average age, which is weighted based on the number of branches in each county. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure A.12: Dispersion of Branch/Deposits Ratio for Top 25 Banks

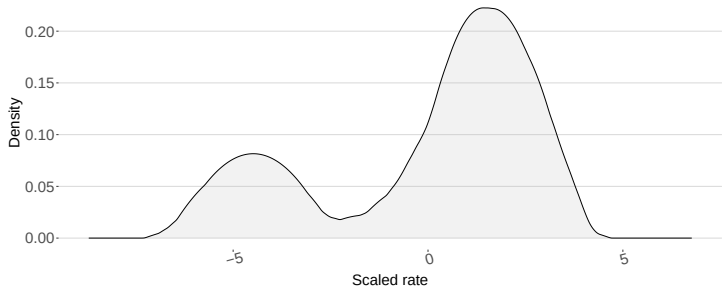
(a) 1994Q4



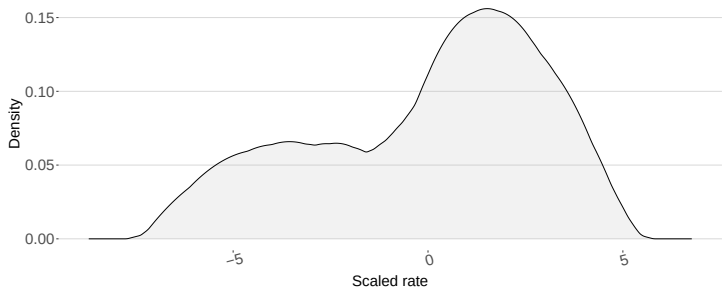
(b) 2007Q3



(c) 2019Q1



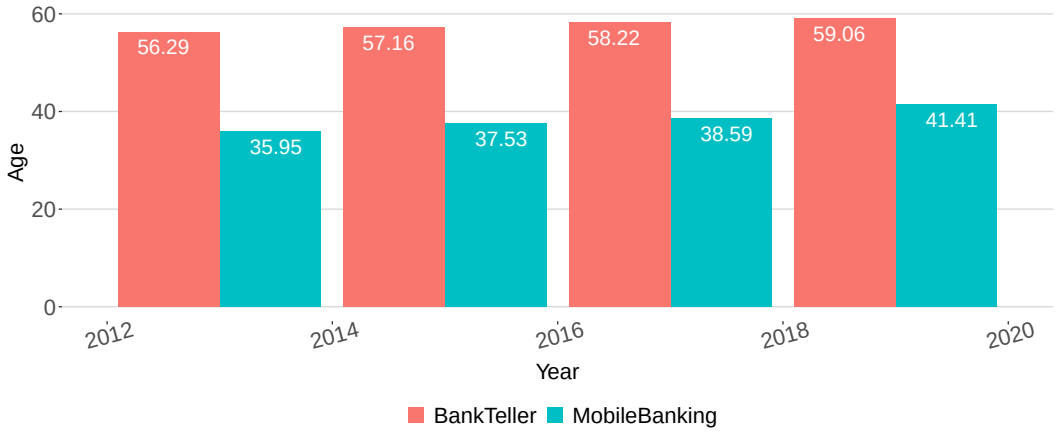
(d) 2022Q2



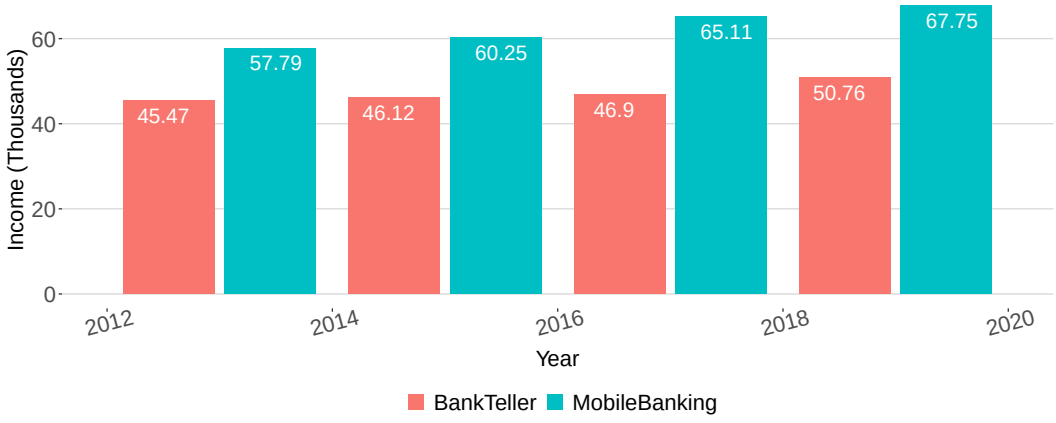
Notes: This figure displays kernel density plots of the demeaned logarithm of branch deposits by the top 25 banks at the peak of each interest rate hiking cycle. Figures a, b, c and d illustrate the kernel density at the following quarters: 1994Q4, 2007Q3, 2019Q1, and 2022Q2 (the last quarter available in SOD database), respectively. The top 25 banks are determined based on bank size at the beginning of each quarter.

Figure A.13: Characteristics of Households Using Branches v.s. Mobile Banking

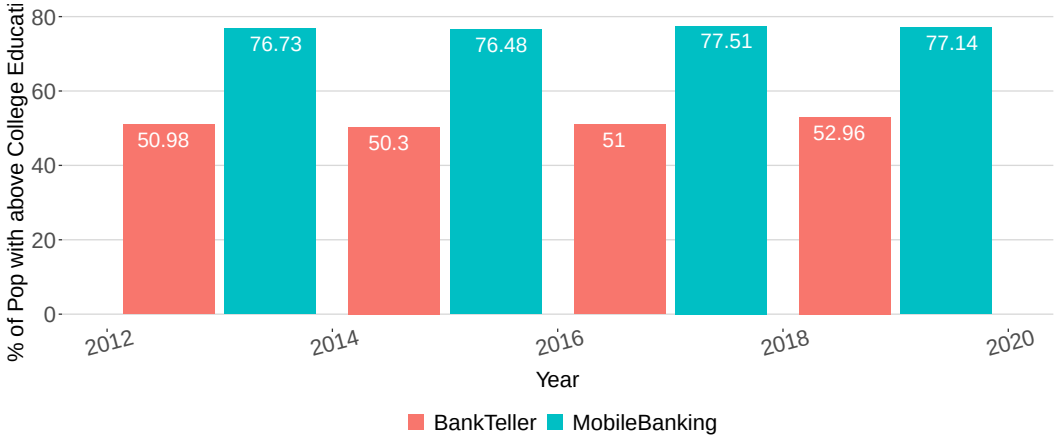
(a) Age



(b) Income

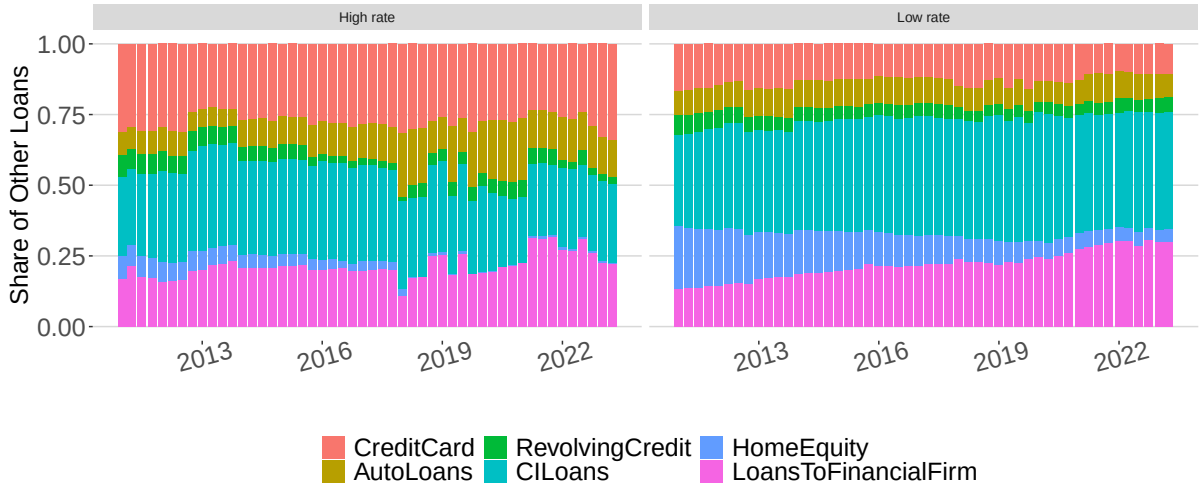


(c) Education



Notes: These figures present the characteristics of households utilizing bank tellers versus mobile banking as their primary means of accessing banking services. The data is derived from the FDIC Survey of Consumer Use of Banking and Financial Services. Respondents were asked to specify their most common method of accessing their accounts, choosing from options such as "Bank teller," "ATM/Kiosk," "Telephone banking," "Online banking," "Mobile banking," and "Other." Panels A, B, and C depict the average age, average income, and the proportion of households with education beyond the college level for households utilizing bank tellers and mobile banking to access banking services over the years.

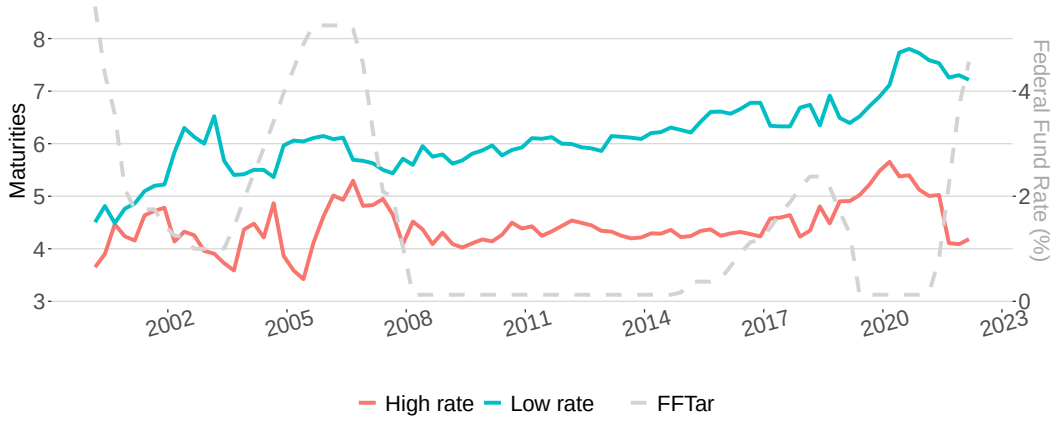
Figure A.14: Share of Non-Real Estate Loans (Top 25 Banks)



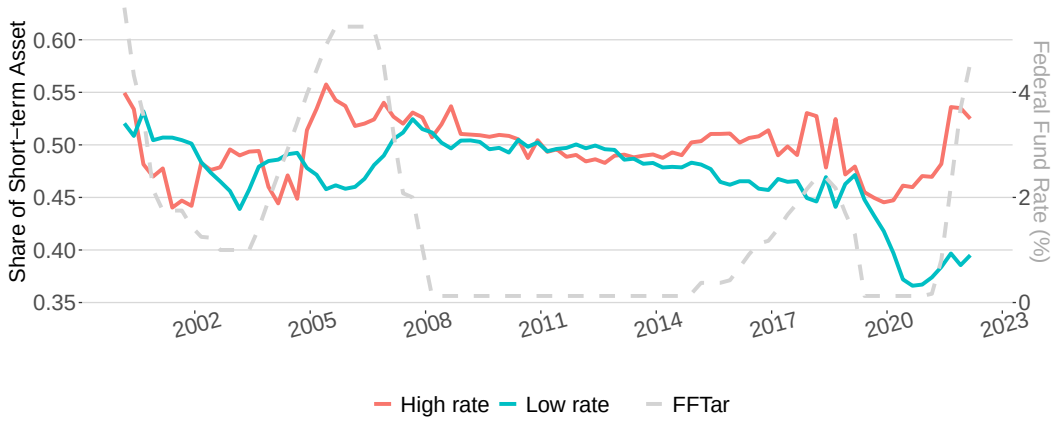
Notes: This figure presents the share of non-real estate loans of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. We consider six categories: credit card loans, auto loans, home equity loans, revolving credit to individuals, commercial and industrial loans, and loans to other financial firms. See Appendix Table A.10 for more details on the construction of key variables. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure A.15: Duration Risk (Top 100 Banks)

(a) Maturity



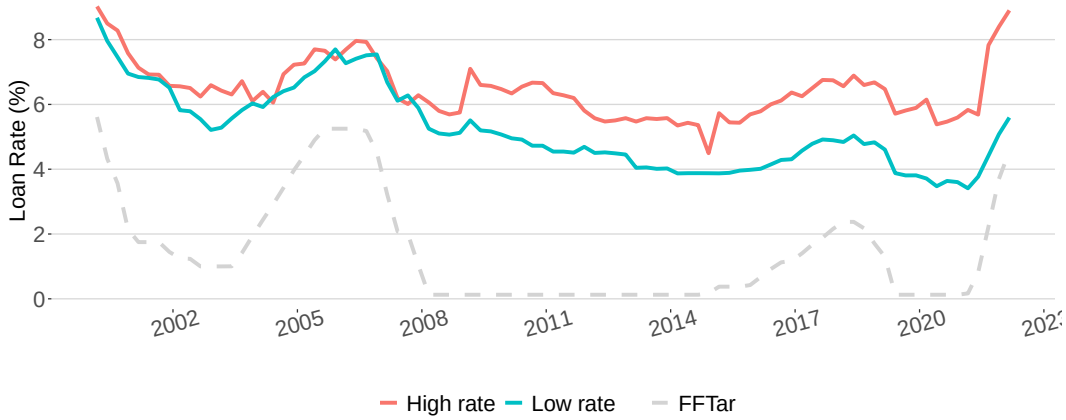
(b) Share of Short-Term Assets



Notes: This figure compares the duration risk of high and low rate banks among the top 100 banks from 2001Q1 through 2023Q2. Figure A.15a presents the maturity (# of years) of high and low rate banks. Figure A.15b presents the share of assets with less-than one-year maturity (short-term assets) for high and low rate banks. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

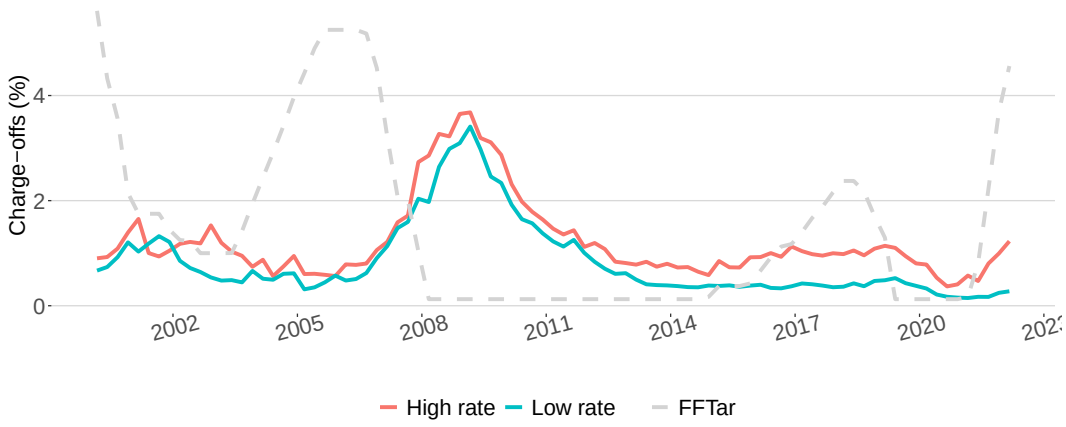
Figure A.16: Credit Risk (Top 100 Banks)

(a) Loan rate



(b) Credit spread

(c) Charge-offs



Notes: This figure compares the credit risk of high and low rate banks among the top 100 banks from 2001Q1 through 2023Q2. Figure A.16a presents the loan rate (%) of high and low rate banks. Figure A.16b presents the credit spread (%) of high and low rate banks. The credit spread is computed as the difference between the loan rate and synthetic term rate (average of term treasury yields, weighted by the share of loans with corresponding maturities). Figure A.16c presents the charge-off rate (%) for high and low rate banks. See Appendix Table A.10 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile.

Table A.1: Summary Statistics

Panel A: High v.s. Low rate Banks Comparison

	2009-2016		
MCD (%)	0.20	0.05	0.15***
DepRate (%)	0.15	0.02	0.13***
Insured Deposits Share	0.39	0.51	-0.11***
#Branches	849	4039	-3189***
$\log(\frac{\#\text{ Branches}}{\text{Deposits}})$	-0.15	0.86	-1.02***
ΔDeposits (%)	1.00	0.95	0.05
NIM rate (%)	2.58	2.09	0.49***
Maturity (Years)	3.35	5.44	-2.09***
Charge-off Rate (%)	1.52	0.70	0.82***

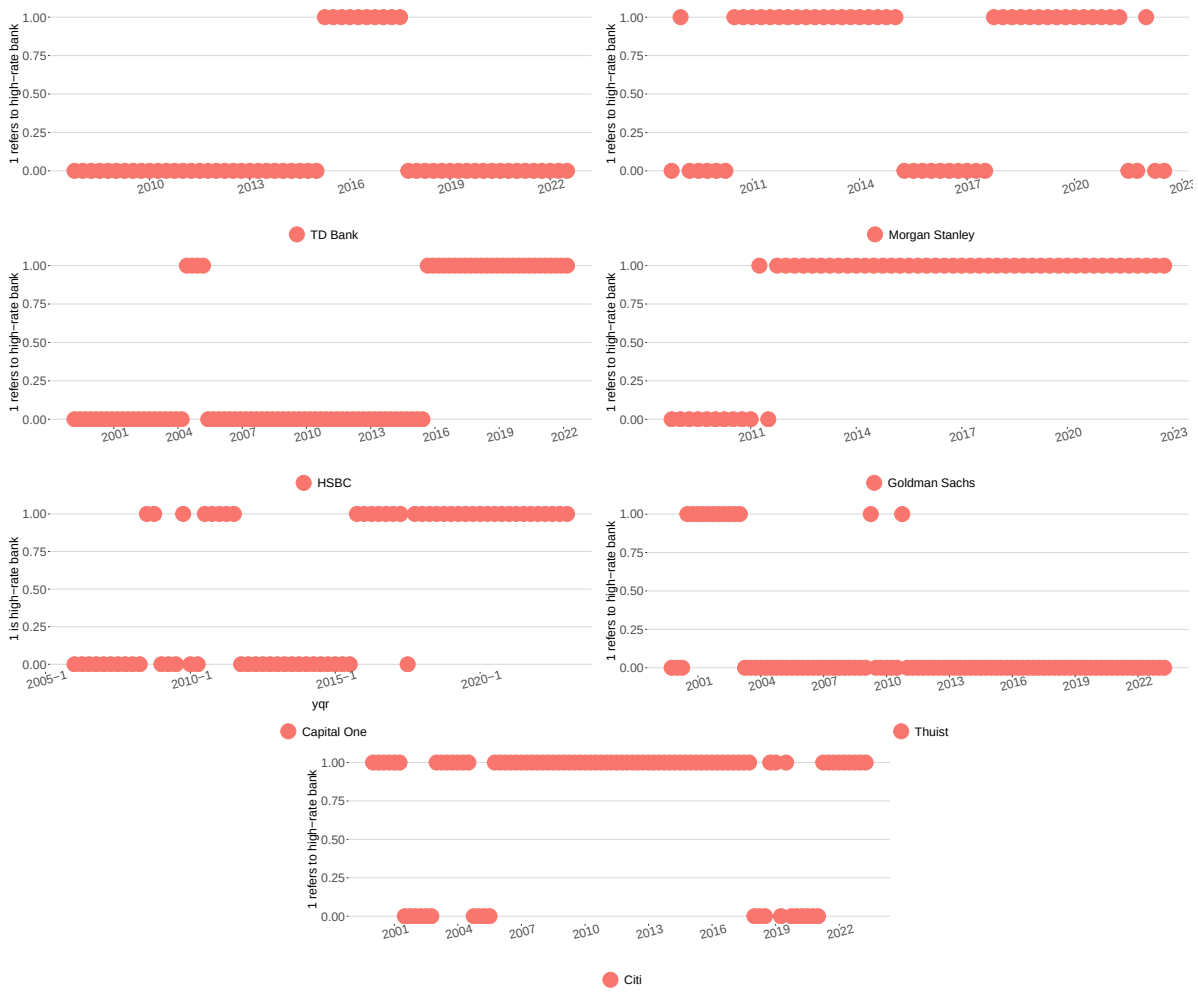
Panel B: Correlation Matrix of Rates

	DepRate	SAV	CD	MM
DepRate	1.000	0.687	0.922	0.843
SAV	0.687	1.000	0.694	0.766
MCD	0.922	0.694	1.000	0.856
MM25	0.843	0.766	0.856	1.000

Notes: Panel A compares various metrics between high and low rate banks among the top 25 banks between 2009Q1 to 2006Q4. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile. The averages are reported separately for the two types of banks, as well as their difference. Standard errors are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively. CD refers to the 12-month certificate of deposit rate on accounts with at least $10,000, collected from RateWatch. DepRate is the deposit rate calculated from the Call Reports. The share of insured deposits, NIM rate, quarterly growth of deposits, maturity of loans and securities, charge-offs of loans are extracted from the Call Reports. Additionally, we count the number of branches for each bank using the Statement of Deposits (SOD). Panel B presents the correlation matrix of various measures of the deposit rate. SAV refers to the savings rate and MM refers to the money market account rate on accounts with at least $25,000. Both are recorded by RateWatch.

Table A.2: Classification of Banks

High rate banks	American Express, Ally Financial
Low rate banks	Charles Schwab, SVB, M&T Bank, JP Morgan, KeyBank, Huntington, PNC, Fifth Third Bank, BOA, State Street Bank, U.S. Bankcorp, Wells Fargo, Citizens Bank, Northern Trust, Bank of Montreal, Regions Financial, Bank of New York, First Republic Bank



Notes: The table lists banks that maintain a consistent classification throughout the entire sample period. The accompanying figures illustrate the shifts in bank types over the sample period. We present the classification for the top 25 by size in the 2022-2023 period.

Table A.3: Variation in Branch Deposit Rates across Largest Banks and BHCs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Time FE	RSSD FE	BHC FE	RSSD+Time FE	BHC+Time FE	RSSD × Time FE	BHC × Time FE
R^2	0.9056	0.0657	0.0674	0.9320	0.9423	0.9423	0.9636
adj. R^2	0.9056	0.0588	0.0669	0.9315	0.9422	0.9363	0.9626
N	916,859	910,276	57,545	910,276	57,545	513,270	57,401

Notes: This table reports the R^2, adj R^2 and number of observations from regressing the 12-month certificate of deposit rate at the Branch × Bank × Quarter-Year level on quarter-year fixed effects (column 1), rssd fixed effects (column 2), bhc fixed effects (column 3), rssd and quarter-year fixed effects (column 4), bhc and quarter-year fixed effects (column 5), rssd × quarter-year fixed effects (column 6), and bhc × quarter-year fixed effects (column 7).

Table A.4: Deposit Betas (Robustness Check)

	ΔDep. Rate	ΔInterest Expense	ΔInterest Income	ΔNIM
	(1)	(2)	(3)	(4)
ΔFFTar×𝟙(High Rate)×Post	0.490***	0.159***	0.121*	-0.026
	(0.114)	(0.033)	(0.068)	(0.048)
ΔFFTar×𝟙(High Rate)	-0.030	-0.004	-0.033	-0.028
	(0.107)	(0.030)	(0.064)	(0.038)
𝟙(High Rate)×Post	-0.008	0.003	0.037	0.044
	(0.054)	(0.018)	(0.047)	(0.040)
𝟙(High Rate)	-0.006	-0.008	-0.039	-0.040
	(0.049)	(0.017)	(0.047)	(0.039)
$\text{ROA}_{i,q-1}$	0.006	-0.009	-0.014	-0.004
	(0.007)	(0.006)	(0.015)	(0.014)
$\text{Tier1}_{i,q-1}$	-0.003	-0.000	-0.014	-0.013
	(0.007)	(0.006)	(0.012)	(0.009)
Quarter FE	✓	✓	✓	✓
Adjusted R^2	0.183	0.026	0.001	0.002
Observations	1802	2244	2244	2244
Mean of Dep. Variable	-0.023	-0.004	-0.013	-0.010

Notes: This table reports the estimated coefficients from the following regression specification:

$$\begin{aligned} Y_{i,q} = {} & \delta_q + \beta_1 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \\ & + \beta_3 \times \Delta\text{FFTar}_q \times \text{Post}_q + \beta_4 \times \Delta\text{FFTar}_q + \beta_5 \times \mathbb{1}_{\text{High Rate},i} \\ & + \beta_6 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_7 \times ROA_{i,q-1} + \beta_7 \times Tier1_{i,q-1} + \varepsilon_{i,q} \end{aligned}$$

where i and q indicate the bank and quarter-year, respectively, ΔFFTar_q denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio, respectively. The dependent variable, $Y_{i,q}$ is the change in the 12MCD10K rate ($\Delta\text{Dep. Rate}_{i,q}$) in column (1), the change in interest expense ($\Delta\text{Interest Expense}_{i,q}$) in column (2), change in net interest income ($\Delta\text{Interest Income}_{i,q}$) in column (3), and change in NIM ($\Delta\text{NIM}_{i,q}$) in column (4). The 12MCD10K rate comes from RateWatch. The change in the loan rate, interest expense, interest income and NIM are computed from the Call Reports. All dependent variables are winsorized at the 0.5% and the 99.5% levels. See Table A.10 for more details on the construction of key variables. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table A.5: Deposit Betas (Top 100 Banks)

	ΔDep. Rate	ΔInterest Expense	ΔInterest Income	ΔNIM
	(1)	(2)	(3)	(4)
ΔFFTar×𝟙(High Rate)×Post	0.477***	0.162***	0.107*	-0.066
	(0.085)	(0.049)	(0.062)	(0.041)
ΔFFTar×𝟙(High Rate)	-0.025	-0.047	-0.040	0.011
	(0.066)	(0.037)	(0.058)	(0.035)
ΔFFTar	0.598***	0.460***	0.434***	-0.029
	(0.053)	(0.036)	(0.054)	(0.032)
ΔFFTar×Post	-0.451***	-0.157***	0.075	0.233***
	(0.095)	(0.047)	(0.064)	(0.042)
𝟙(High Rate)×Post	-0.000	-0.013	0.031	0.040
	(0.029)	(0.019)	(0.035)	(0.026)
𝟙(High Rate)	-0.021	0.002	-0.037	-0.037
	(0.024)	(0.018)	(0.033)	(0.024)
Post	-0.063	-0.004	-0.017	-0.013
	(0.050)	(0.021)	(0.034)	(0.018)
$ROA_{i,q-1}$	0.030**	0.007	-0.005	-0.014
	(0.014)	(0.005)	(0.011)	(0.009)
$Tier1_{i,q-1}$	-0.023**	-0.011*	-0.022	-0.010
	(0.011)	(0.006)	(0.015)	(0.010)
Constant	0.021	-0.010	-0.007	0.005
	(0.044)	(0.020)	(0.031)	(0.017)
Adjusted R^2	0.564	0.554	0.260	0.057
Observations	6881	8870	8870	8870
Mean of Dep. Variable	-0.022	-0.008	-0.020	-0.012

Notes: This table reports the estimated coefficients from the following regression specification for the top 100 banks:

$$\begin{aligned} Y_{i,q} = \alpha &+ \beta_1 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \\ &+ \beta_3 \times \Delta\text{FFTar}_q \times \text{Post}_q + \beta_4 \times \Delta\text{FFTar}_q + \beta_5 \times \mathbb{1}_{\text{High Rate},i} \\ &+ \beta_6 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_7 \times ROA_{i,q-1} + \beta_7 \times Tier1_{i,q-1} + \varepsilon_{i,q} \end{aligned}$$

where i and q indicate the bank and quarter-year, respectively, ΔFFTar_q denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), and $ROA_{i,q-1}$ and Tier $1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The sample includes all banks with an average yearly asset value of over 10 billion. The dependent variable, $Y_{i,q}$ is the change in the 12MCD10K rate (ΔDep. $\text{Rate}_{i,q}$) in column (1), the change in interest expense (ΔInterest $\text{Expense}_{i,q}$) in column (2), the change in net interest income (ΔInterest $\text{Income}_{i,q}$) in column (3), and change in NIM ($\Delta\text{NIM}_{i,q}$) in column (4). The 12MCD10K rate comes from RateWatch. The change in the loan rate, interest expense, interest income and NIM are computed from the Call Reports. All dependent variables are winsorized at the 0.5% and the 99.5% levels. See Table A.10 for more details on the construction of key variables. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table A.6: Deposit Growth and Loans (Top 100 Banks)

	ΔDeposit$_{i,y}$		ΔPersonal Loan$_{i,y}$		ΔC&I Loan$_{i,y}$		ΔReal Estate Loan$_{i,y}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔFFTar$_y \times \mathbb{1}$(High Rate)$\times$Post	6.080***	6.287***	9.022**	9.747**	3.014	2.819	2.848	4.191
	(2.028)	(2.335)	(3.840)	(4.185)	(2.751)	(3.010)	(2.675)	(3.511)
ΔFFTar$_y \times \mathbb{1}$(High Rate)	-3.193**	-2.999*	-7.483**	-7.767**	-0.372	0.446	-2.214	-2.299
	(1.496)	(1.589)	(3.364)	(3.569)	(1.524)	(1.626)	(1.430)	(1.530)
ΔFFTar$_y \times$Post	-7.069***		-2.638		-3.865		-5.514**	0.000
	(1.497)		(1.854)		(2.782)		(2.344)	
$\mathbb{1}$(High Rate)$\times$Post	-9.714**	-10.064**	30.919***	30.443***	-4.768	-8.132**	-11.715**	-11.970**
	(4.180)	(4.120)	(6.705)	(7.013)	(3.588)	(3.744)	(4.698)	(4.915)
$\mathbb{1}$(High Rate)	9.767***	10.953***	-25.312***	-25.053***	5.864**	8.852***	15.217***	16.139***
	(3.771)	(3.726)	(6.455)	(6.794)	(2.719)	(2.778)	(3.158)	(3.301)
Post	-8.383***		-23.133***		-10.767		-24.435***	0.000
	(2.888)		(3.761)		(6.932)		(3.508)	
ROA$_{i,q-1}$	-0.217	0.895	-0.013	1.723	0.883	2.111**	1.634	4.735***
	(1.061)	(1.361)	(0.809)	(1.318)	(1.363)	(0.862)	(1.087)	(1.474)
Tier1$_{i,q-1}$	-0.008	-0.004	0.003	-0.004	-0.038**	-0.036**	0.022	0.017
	(0.013)	(0.010)	(0.015)	(0.014)	(0.017)	(0.015)	(0.027)	(0.023)
ΔFFTar$_y \times \mathbb{1}$(High Rate)$\times$Crisis	4.494***	34.720***	35.649***	49.032***	31.821***	36.805***	42.690***	67.609***
	(1.577)	(1.489)	(3.476)	(4.023)	(4.123)	(2.139)	(1.976)	(1.982)
Quarter FE		✓		✓		✓		✓
Adjusted R^2	0.079	0.016	0.036	0.019	0.027	0.011	0.090	0.016
Observations	8876	8876	8700	8700	8412	8412	8619	8619
Mean of Dep. Variable	20.019	20.019	13.254	13.254	13.906	13.906	14.334	14.334

Notes: This table reports the estimated coefficients from the following regression specification for the top 100 banks:

$$\begin{aligned}\Delta Y_{i,y} = \alpha &+ \beta_1 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times \Delta\text{FFTar}_y \times \text{Post}_q \\ &+ \beta_4 \times \Delta\text{FFTar}_y + \beta_5 \times \mathbb{1}_{\text{High rate},i} + \beta_6 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q \\ &\beta_7 \times \Delta\text{FFTar}_y \times \mathbb{1}_{\text{High rate},i} \times \text{Crisis} + \beta_8 \times ROA_{i,q-1} + \beta_9 \times Tier\ 1_{i,q-1} + \varepsilon_{i,q},\end{aligned}$$

where i and q indicate the bank and quarter-year, respectively, ΔFFTar_y denotes the annual change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), "Crisis" is an indicator for the third and fourth quarters of 2008, and $\text{ROA}_{i,q-1}$ and Tier $1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The dependent variable, $\Delta\text{Deposit}_{i,y}$ is the annual growth of the total deposit of bank i. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table A.7: Bank Branches (Top 100 Banks)

	log(# Branches)		log($\frac{\text{Branches}}{\text{Deposit}}$)		Branch-weighted County Average Age	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}$(High Rate)×Post	-0.418**	-1.031***	-0.275	-0.347	-0.257***	-0.215*
	(0.183)	(0.223)	(0.241)	(0.245)	(0.092)	(0.109)
$\mathbb{1}$(High Rate)	-1.589***	-1.167***	-0.779***	-0.836***	-0.221***	-0.152*
	(0.099)	(0.160)	(0.228)	(0.229)	(0.079)	(0.085)
Post			-0.846***		1.905***	
			(0.125)		(0.203)	
$\text{ROA}_{i,q-1}$	-0.275***	-0.271***	-0.223***	-0.202***	-0.071	-0.257***
	(0.052)	(0.053)	(0.046)	(0.054)	(0.093)	(0.049)
$\text{Tier1}_{i,q-1}$	0.688***	0.729***	0.056	-0.031	-0.243***	-0.056
	(0.086)	(0.078)	(0.042)	(0.043)	(0.083)	(0.041)
Constant	6.988***		1.995***		37.377***	
	(0.091)		(0.105)		(0.144)	
Quarter FE		✓		✓		✓
Adjusted R^2	0.219	0.231	0.110	0.080	0.244	0.041
Observations	8145	8145	8145	8145	7226	7226
Mean of Dep. Variable	6.589	6.589	0.880	0.880	38.603	38.603

Notes: This table reports the estimated coefficients from the following regression specification for the top 100 banks:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High Rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q}$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier 1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The sample includes all banks with an average yearly asset value of over 10 billion. The dependent variable, $Y_{i,q}$ is the log-transformed number of branches (log(# of Branches)) in columns (1)-(2), the log-transformed ratio of branches to deposits in billions (log($\frac{Branches}{Deposit}$)) in columns (3)-(4), and the average customer age in columns (5)-(6). The branch-weighted county average age is calculated as the county average age, which is weighted based on the number of branches in each county. The variable log($\frac{Branches}{Deposit}$) is winsorized at the 0.5% and the 99.5% levels. Branch and deposit data comes from the FDIC Summary of Deposits. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table A.8: Duration Risk (Top 100 Banks)

Panel A: Loans and Securities

	Maturities (years)	Short-term share (%)
	(1)	(2)
𝟙(High Rate)×Post	-0.671***	1.925
	(0.227)	(1.732)
𝟙(High Rate)	-1.405***	3.163**
	(0.216)	(1.389)
Quarter FE + Controls	✓	✓
Observations	8002	8002
Mean of Dep. Variable	5.730	47.661

Panel B: Maturity by Asset Class

	Real Estate Loans	Other Loans	MBSs	Treasuries
	(1)	(2)	(3)	(4)
𝟙(High Rate)×Post	-0.971***	0.262*	-1.640***	-0.632
	(0.314)	(0.140)	(0.534)	(0.533)
𝟙(High Rate)	-1.113***	-0.331**	0.507	-0.677
	(0.251)	(0.135)	(0.533)	(0.456)
Quarter FE + Controls	✓	✓	✓	✓
Observations	7605	8001	7834	7836
Mean of Dep. Variable	11.782	2.093	16.499	6.010

Panel C: Share by Asset Class (%)

	Real Estate Loans	Other Loans	MBSs	Treasuries
	(1)	(2)	(3)	(4)
𝟙(High Rate)×Post	-1.480	5.978***	-0.940	-3.558**
	(1.120)	(1.556)	(0.687)	(1.410)
𝟙(High Rate)	-2.521**	3.299***	-5.391***	4.614***
	(1.072)	(1.232)	(0.599)	(1.207)
Quarter FE + Controls	✓	✓	✓	✓
Observations	8002	8002	8002	8002
Mean of Dep. Variable	15.049	59.557	11.525	13.868

Notes: This table reports the estimated coefficients from the following regression specification for the top 100 banks:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High Rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q}$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier 1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The sample includes all banks with an average yearly asset value of over 10 billion. In panel A, the dependent variable, $Y_{i,q}$ is the maturity of loans and securities in column 1, and the share of loans and securities with less than one-year maturity in column 2. Panels B and C analyze maturities and asset share by asset class. The asset classes are real estate loans in column 1, other loans in column 2, mortgage-backed securities in column 3, and treasuries in column 4. The data comes from the Call Reports. Each observation is weighted by its asset size in the previous quarter. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table A.9: Credit Risk (Top 100 Banks)

Panel A: Loans and Securities

	Loan Rate	Credit Spread	Charge-offs
	(1)	(2)	(3)
$\mathbb{1}$(High Rate)×Post	1.035***	1.021***	0.182**
	(0.135)	(0.167)	(0.076)
$\mathbb{1}$(High Rate)	0.588***	0.747***	0.256***
	(0.095)	(0.143)	(0.067)
Quarter FE + Controls	✓	✓	✓
Adjusted R^2	0.246	0.271	0.062
Observations	8876	8001	8876
Mean of Dep. Variable	5.224	3.459	0.847

Panel B: Charge-off Rates by Asset Class

	Real Estate Loans	C&I Loans	Personal Loans	Other Loans
	(1)	(2)	(3)	(4)
$\mathbb{1}$(High Rate)×Post	0.028	0.339***	0.187	0.079
	(0.047)	(0.080)	(0.161)	(0.054)
$\mathbb{1}$(High Rate)	0.092**	-0.033	0.234*	-0.050
	(0.036)	(0.066)	(0.139)	(0.039)
Quarter FE + Controls	✓	✓	✓	✓
Adjusted R^2	0.031	0.024	0.024	0.001
Observations	8700	8530	8770	8349
Mean of Dep. Variable	0.437	0.639	2.173	0.249

Notes: This table reports the estimated coefficients from the following regression specification for the top 100 banks:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High Rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times Tier1_{i,q-1} + \varepsilon_{i,q}$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier 1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The sample includes all banks with an average yearly asset value of over 10 billion. In panel A, the dependent variable, $Y_{i,q}$ is the loan rate in column 1, credit spread in column 2, and charge-off rate in column 3. The credit spread is computed as the difference between the loan rate and synthetic term rate (average of treasury yields, weighted by the share of loans with different maturities). Panel B analyzes the charge-off rate by asset class. The asset classes are real estate loans in column 1, other loans in column 2, mortgage-backed securities in column 3, and treasuries in column 4. All dependent variables are winsorized at the 0.5% and the 99.5% levels. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MDC10K rate and deposit rate from the Call Report, falls within the top quartile. Each observation is weighted by its asset size in the previous quarter. Standard errors (in parentheses) are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

Table A.10: Construction of Key Variables

Variable Name	Construction
Rate	
Deposit rate (%)	(edepdom$_q$+edepfor$_q$)/dep$_{q-1}$*100*4
Loan rate (%)	(ilndom$_q$+ilnfor$_q$+ils$_q$)/lnlsgr$_{q-1}$*100*4
Interest income (%)	intinc$_q$/asset$_{q-1}$ * 100 * 4
Interest expense (%)	eintexp$_q$/asset$_{q-1}$ * 100 * 4
NIM rate (%)	nim$_q$/asset$_{q-1}$ * 100 * 4
Composition	
MBS	scpt3les + scpt3t12 + scpt1t3 + scpt3t5 + scpt5t15 + scptov15
Treasury	scnm3les + scnm3t12 + scnm1t3 + scnm3t5 + scnm5t15 + scnmov15
RELoan	lnrs3les + lnrs3t12 + lnrs1t3 + lnrs3t5 + lnrs5t15 + lnrsov15
OtherLoan	lnot3les + lnot3t12 + lnot1t3 + lnot3t5 + lnot5t15 + lnotov15
Maturities	
Maturity$_{MBS}$	(0.15*scpt3les + 0.6*scpt3t12 + 2*scpt1t3 + 4*scpt3t5 + 10*scpt5t15 + 20*scptov15)/MBS
Maturity$_{Treasury}$	(0.15*scnm3les + 0.6*scnm3t12 + 2*scnm1t3 + 4*scnm3t5 + 10*scnm5t15 + 20*scnmov15)/Treasury
Maturity$_{RELoan}$	(0.15*lnrs3les + 0.6*lnrs3t12 + 2*lnrs1t3 + 4*lnrs3t5 + 10*lnrs5t15 + 20*lnrsov15) / RELoan
Maturity$_{OtherLoan}$	(0.15*lnot3les + 0.6*lnot3t12 + 2*lnot1t3 + 4*lnot3t5 + 10*lnot5t15 + 20*lnotov15) / OtherLoan
Maturity	(0.15*(scpt3les + scnm3les + lnrs3les + lnot3les) + 0.6*(scpt3t12 + scnm3t12 + lnrs3t12 + lnot3t12) + 2*(scpt1t3 + scnm1t3 + lnrs1t3 + lnot1t3) + 4*(scpt3t5 + scnm3t5 + lnrs3t5 + lnot3t5) + 10*(scpt5t15 + scnm5t15 + lnrs5t15 + lnot5t15) + 20*(scptov15 + scnmov15 + lnrsov15 + lnotov15)) / (MBS + Treasury + RELoan + OtherLoan)
Short-term Share	
ShortTerm$_{MBS}$	(scpt3les + scpt3t12)/ Maturity
ShortTerm$_{Treasury}$	(scnm3les + scnm3t12)/ Treasury
ShortTerm$_{RELoan}$	(lnrs3les + lnrs3t12)/ RELoan
ShortTerm$_{OtherLoan}$	(lnot3les + lnot3t12)/ OtherLoan
ChargeOffs	
ChargeOff$_{RELoan}$	ntre$_q$/lnre$_{q-1}$*100*4
ChargeOff$_{CILoan}$	ntci$_q$/lnci$_{q-1}$*100*4
ChargeOff$_{IndLoan}$	ntcon$_q$/lncon$_{q-1}$*100*4
ChargeOff$_{Other}$	(ntlnls$_q$-ntre$_q$-ntci$_q$-ntcon$_q$)/(lnls$_{q-1}$-lnre$_{q-1}$-lnci$_{q-1}$-lncon$_{q01}$)*100*4
ChargeOff	ntlnls$_q$/lnls$_{q-1}$*100*4

Notes: We follow the variable definitions from the FDIC's Statistics on Depository Institutions. See SDI.