

The Rise of Quasi Money Market Banks

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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 very insensitive to market rates. While the aggregate deposit beta of the banking sector has remained similar, the distribution in deposit rates is now strongly bimodal. High rate banks have few physical branches, hold short maturity assets, and earn a spread primarily by taking credit risk. In many ways they resemble money-market funds or narrow banks in that they pay (near) market rates on deposits and do not engage in substantial maturity transformation. In contrast, low rate banks primarily engage in maturity transformation: they hold longer duration interest rate sensitive assets but take less credit risk. 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 system to money-market like banks. We argue that the distribution of deposits across high and low rate banks is important to understand the deposit and lending channels of monetary policy, beyond tracking aggregate deposits in the banking system.

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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 less than 50 basis points 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 relatively 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. In fact, 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 and engage far less in maturity transformation—they make short maturity loans and hold short maturity securities that match the duration of their deposits. This makes them more similar to money-market funds. 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 effects of monetary policy and the ability of the banking system 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 systems ability to absorb interest rate risk will substantially change.¹

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.

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 more like fixed rate debt.

What explains the emergence in these two types of banks? We argue that changes in technology and online banking likely 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 low rate banks as of 2022. High rate banks tend to locate this smaller number of branches in demographically younger zip codes, suggesting that they have younger customers. Because high rate banks likely 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 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 banks.² We focus on the top 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

²Jiang, 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.

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 who highly valued in person banking.

As deposits flow from low rate to high rate banks, this changes the capacity of the aggregate banking system 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 system towards money-market funds when interest rates increase. This causes 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 system 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 54 billion over this same period. This suggests that the amount of “low rate” deposits useful for backing 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 in the pre-crisis period.

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 system migrates towards this model, banks’ ability to engage in maturity transformation will be 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 deposit distribution 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 deposits across banks. Recent work by [Iyer, Kundu and Paltalidis \(2023\)](#) investigates the variation of deposit rates across banks and documents a significant relation between the average level and dispersion of deposit rates and economic activity. [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 system to money-market like banks. Understanding this heterogeneity in deposit rates is critical for understanding the banking system'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 rollout 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.

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 2023Q1. Our sample period covers three rate hiking cycles: 2004Q1-2009Q1, 2015Q2-2020Q2, and 2021Q4-2023Q1.

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 12MCD 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).

Bank data. We collect data on bank balance sheets and income statements from the Reports 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 2023Q1 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.8.

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

³The 12MCD is the most common deposit product reported in RateWatch. As evidenced in Table A.1, there is a strong correlation of 0.92 between the 12MCD rate and the average deposit rate paid by banks, as calculated from the Call Reports data. We further show that the 12MCD 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 12MCD and MM is 0.844, while the correlation between the 12MCD and SAV is 0.686.

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 2023Q1. 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. We find that 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 2022Q4, respectively. In 2007Q3, we observe a unimodal distribution of deposit rates, while in the subsequent rate hiking peaks of 2019Q1 and 2022Q4, the distribution becomes bimodal. Moreover, in 2007Q3, the mean

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

and median deposit rates were quite similar.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. In line with a trend towards bimodality, we notice a distinct divergence during subsequent rate hiking cycles. To quantify this divergence, we analyze the asymmetry of distributions across rate hiking cycles. The skewness of the distribution increases by 289% from 2007Q3 to 2022Q4.⁶ Hence, the dispersion of deposit rates has increased over the past decade, highlighting the emergence of two distinct categories of banks: those offering high rates and those offering low rates.

3.2 Classification of High and Low Rate Banks

The emergence of a bimodal distribution in bank deposit rates has led to the emergence of two distinct categories of banks over the last decade: 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 12-month certificate of deposit (12MCD) rate and the deposit rate (on all types of deposits) calculated from the Call Report for each bank. Given the occasional absence of the 12-month certificate of deposit (12MCD) rate data, especially towards the beginning of the sample, we use a weighted rank method that combines both the 12MCD and deposit rate data from the Call Report. We first rank the banks quarterly, separately using the 12MCD rates and deposit rates. 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.

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,

⁵In 2007Q3, the average CD rate stands at 4.07%, with a corresponding median of 4.05%.

⁶Skewness is 0.28 in 2007Q3, 1.05 in 2019Q1, and 0.81 in 2022Q4.

while the rest are categorized as “low rate.” To ensure stability in classification and avoid frequent 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 Appendix Table [1](#), we compare various characteristics of high rate and low rate banks in the pre-Great Financial Crisis era. High rate and low rate banks exhibit similar sizes, return on assets, net interest margin rate, and charge-off rate. However, low rate banks report a larger number of branches but lower branch efficiency (as measured by branch-deposit ratio), longer maturity, a smaller share of insured deposits.

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 [2](#).

Figure [2a](#) 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 [2b](#), 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 [2c](#) 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.

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 3 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 2023Q1, 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 2021Q4-2023Q1 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:

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

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 ($\Delta\text{Dep. Rate}$) in column (1), the change in interest expense ($\Delta\text{Interest Expense}$) in column (2), the change in net interest income ($\Delta\text{Interest Income}$) 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 0.62 higher than low rate banks. A 1 percentage point increase in the Fed funds rate is associated with an additional 0.62 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 1.5 times 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 -0.015 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 0.24 higher than low rate banks; a 1 percentage point increase in the Fed funds rate is associated with an additional 0.24 percentage point increase in the interest expense for high rate banks in the post-crisis period. Column (3) shows that interest income also exhibits a similar pattern to interest expense. High rate banks have relatively higher interest income when the Fed funds rate rises in the post-crisis period compared to low rate banks; the interest income beta is 0.14 higher; a 1 percentage point increase in the Fed funds rate is associated with an additional 0.14 percentage point increase in the interest income for high rate banks in the post-crisis period. These findings imply that high rate banks have shorter maturity assets that generate interest income that increases when rates increase. Low rate banks, on the other hand, tend to have longer maturity fixed rate assets. As a result, the composition of a bank's asset portfolio plays a significant role in determining its interest rate sensitivity to the net interest margin (NIM). In column (5), we find that the interest rate sensitivity of the NIM is 0.08 lower for high rate

⁷The coefficient associated with high rate banks ($\mathbb{1}_{\text{High rate},i} \times \text{Post}_q$) is -0.026. This estimate is neither economically meaningful nor statistically significant.

⁸Column (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.8 for details.

banks compared to low rate banks in the post-crisis period. In other words, a 1 percentage point increase in the Fed funds rate is associated with a 0.08 percentage point decrease in the NIM for high rate banks in the post-crisis period. This finding further supports our 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 conjecture. Figure 5 compares the time series of the average interest expense (Figure 5a), average interest income (Figure 5b), and average NIM (Figure 5c) between 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 Table A.4.

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 results are robust in Appendix Table A.3; the deposit, interest expense and interest income betas are stable and remain statistically significant.⁹ This finding corroborates that the difference in the betas between high and low rate banks increases substantially in the post-crisis period, and is driven by low rate banks lowering their deposit betas.

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.5. 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 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

⁹The interest sensitivity of the NIM is economically meaningful but not statistically significant. In the post-crisis period, the NIM is 0.04 lower for high rate banks compared to low rate banks. However, this difference is not statistically significant.

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 4 compares the deposit growth for high rate and low rate banks over the past three rate hiking cycles. As in Figure 3 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. However, in the last two rate hiking cycles, high rate banks exhibit higher deposit growth than low rate banks. 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 2023Q1, 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 5%. Appendix Figure A.3 disaggregates high rate and low rate banks and presents the deposit growth experienced by individual banks over the last rate hiking cycle. Overall, our findings suggest that there is reallocation of deposits from low rate banks to high rate banks when interest rates are high.

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

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

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 2.92 to 3.38 percentage points increase in the deposit growth of high rate banks in the post-crisis period. This suggests that high rate banks have a higher concentration of deposit growth. Moreover, we find that the sensitivity of lending to interest rates is significant for personal loans extended by high rate banks in the post-crisis period. A 1 percentage point increase in the Fed funds rate is associated with

an additional 4.92 to 5.66 percentage points increase in the personal loan growth of high rate banks in the post-crisis period. We come back to this result in Section [4.2.2](#).

We also find that deposit outflows are more sensitive to rate hikes in the post-crisis period. This is indicated by the coefficient of $\Delta\text{FFTar}_q \times \text{Post}_q$ in column (1). The deposit growth of a bank is directly influenced by its ability to attract and retain deposits. This ability is in turn affected by changes in deposit rates and customers' preferences. We study how changes in the post-crisis period influence deposit growth.

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

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 in Figure [6](#). Then, we investigate the link between these changes and changes in the demographics of depositors in Appendix Figure [A.2](#).

We compare the time series of the logged number of branches for high rate and low rate branches in Figure [6a](#). 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 6b 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.

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 investigate the clientele effects associated with high rate banks and low rate banks. Figure 6c 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.

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times \text{ROA}_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

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 ($\log(\# \text{ of Branches})$) in columns (1)-(2), the log-transformed ratio of branches to deposits in billions ($\log(\frac{\text{Branches}}{\text{Deposit}})$) 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 75% reduction in the number of branches, a 50% decline in the branch deposit ratio, and a 1.3% decrease in the average age of depositors during the post-crisis period, in comparison to low rate banks.¹⁰ We show that these magnitudes are stable even after accounting for aggregate shocks through quarter fixed effects, as indicated in the even numbered columns. As before, we demonstrate robustness in an expanded sample with the 100 largest banks in Appendix Table A.5.

We further analyze the characteristics of households that use branches and mobile banking in Appendix Figure A.2. 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.

¹⁰We estimate the percentage changes from the log-level estimates using: $e^\beta - 1$.

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. In Section 4.1.1, we showed that the interest income of high rate banks is more sensitive to interest rates, suggesting that they hold shorter duration assets. We investigate this next.

Figure 7a compares the average maturity in years of assets held by high rate banks and low rate banks. Consistent with our hypothesis, we find that the average maturity of loans and securities held by high rate banks is consistently lower than the average maturity of loans and securities held by low rate banks. The average maturity of assets in low rate banks hovered around 6 years in the pre-crisis period, which is 50% longer than high rate banks, which reported an average maturity of 4 years. This difference in maturity is consistent with the behavior of deposit rates: since low rate banks pay nearly fixed rates on the liabilities side, they naturally hold longer duration assets. However, in the post-crisis period, the average maturity of assets in low rate banks gradually increased to almost 8 years, representing a 33% increase. In contrast, the average maturity of assets held in high rate banks remained 4 years. In other words, the average maturity of assets held in low rate banks is now 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 captures the liquidity risk of a bank, which is the risk that a bank will not be able to meet its obligations to its depositors or other creditors. Looking at 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 7b 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, widening the gap between high and low rate banks. These findings are consistent with low rate banks increasing their duration risk, as suggested in Figure 7a.

Credit Risk Our findings in Section 4.1.1 suggest that high rate banks may hold shorter-term assets that yield interest income, which rises when interest rates increase. To understand the differences in risk exposures, we examine the credit risk of high rate and low rate banks' assets in Figure 8.

Before delving into credit risk, it is useful to compare the time series of the average loan rate for assets held by high rate and low rate banks in Figure 8a. We find that high rate banks lend at higher rates than low rate banks. In the pre-crisis period, high rate banks had loan rates of approximately 6% to 8%, while low rate banks had loan rates of approximately 5% to 7%. In the post-crisis period, the lending rate of high rate banks remained 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 8b. Figure 8b 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. We find that 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 8c 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 9 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 9a. 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.4 indicates that high rate banks conduct more than 2.5 times the amount of credit card lending compared to low rate banks.¹¹ 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 9b. 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:

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times \text{ROA}_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

where i and q indicate the bank and quarter-year, respectively, $\mathbb{1}_{\text{High rate},i}$ denotes whether

¹¹Appendix Figure A.4 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.

bank i is a high rate bank, $Post_t$ denotes the post-crisis period (post-2009), and $\log(\text{Asset})_{i,q-1}$, $ROA_{i,q-1}$ 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 29% shorter maturities and 12% 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 18% 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 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 real-estate 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 a 12% higher loan rates, 27% higher credit spread, and 27% higher charge-off rate. 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 24% increase in loan rates, a 33% increase in credit spreads, and a 51% 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 loans. Specifically, the charge-off rate on personal loans experienced by high rate banks is 19% of

the average. However, in the post-crisis period, high rate banks assume even more credit risk in personal loans. This shift is significant, with the post-crisis increase in the charge-off rate for personal loans extended by high rate banks exceeding 28% of the average charge-off rate. Personal loans include credit card lending, auto lending, and revolving credit. 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 lending conducted by high rate banks in the post crisis period (see Section 4.1.2 for details). Appendix Figure A.4 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 Table A.6 and Appendix Table A.7.¹² 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.

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 10. Figure 4a 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 4b. 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

¹²Note that Appendix Table A.7 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, as shown in our baseline analysis. One potential explanation for this difference is that banks outside of the top 25 have a smaller share of personal lending.

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 7a). Therefore, the banking sector as a whole originates approximately 13.3% shorter-maturity loans.¹³ Similarly, we calculate that the banking sector holds a 8% larger share of short-term assets.¹⁴ 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 system, 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 8b). This suggests that the banking sector holds approximately 11.4% more credit risk.¹⁵

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 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

¹³We 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).

¹⁴The 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 7b). The average share of short-term assets is 50% (see Table 5).

¹⁵We 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).

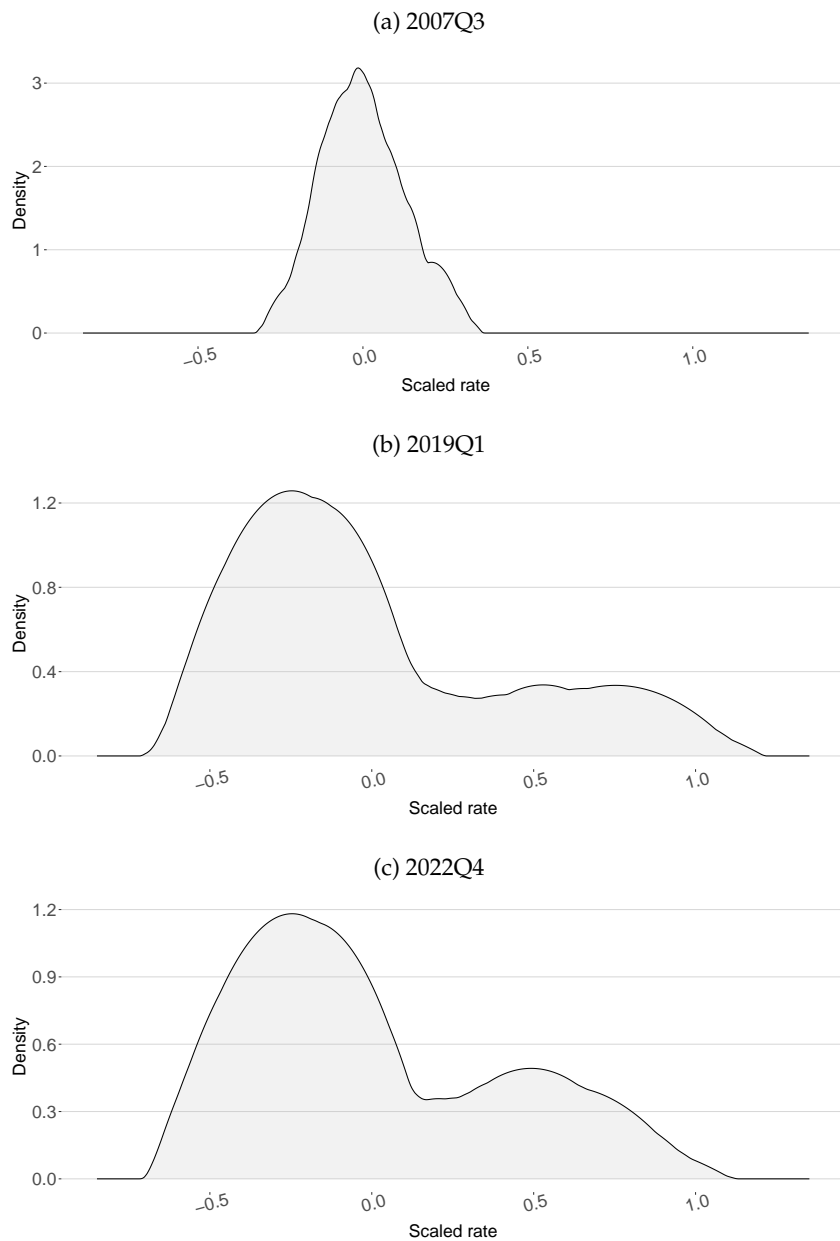
and avoiding substantial maturity transformation. Conversely, low rate banks primarily engage in maturity transformation. They hold longer-duration, interest rate-sensitive assets but assume less credit risk. When interest rates rise, deposits shift significantly toward high rate banks. As a result, a substantial portion of deposit flows within the banking system 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 crucial for a comprehensive understanding of the deposit and lending channels of monetary policy, beyond tracking total deposits in the banking system.

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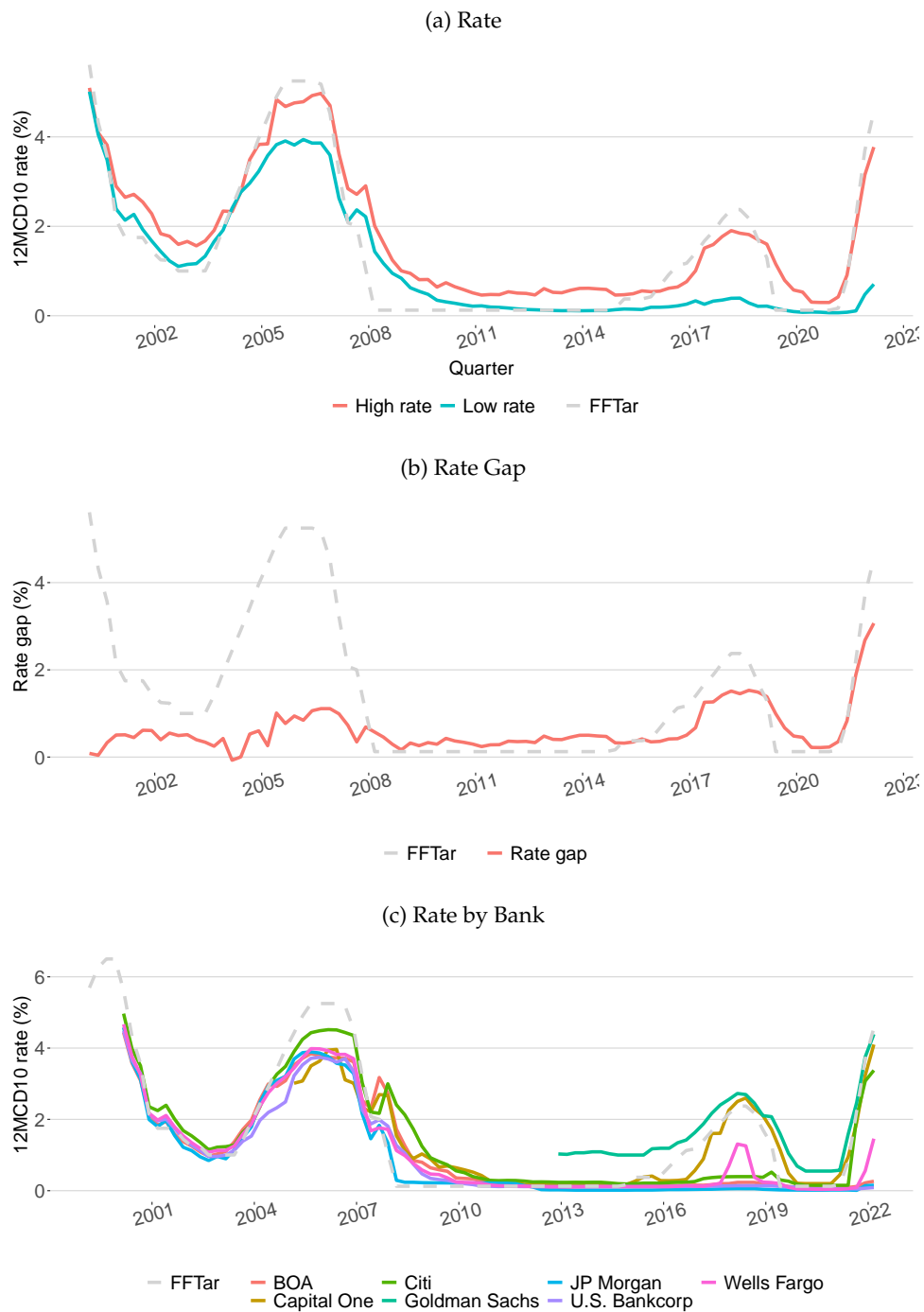
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Figure 1: Dispersion of Deposit Rates for top 25 Banks



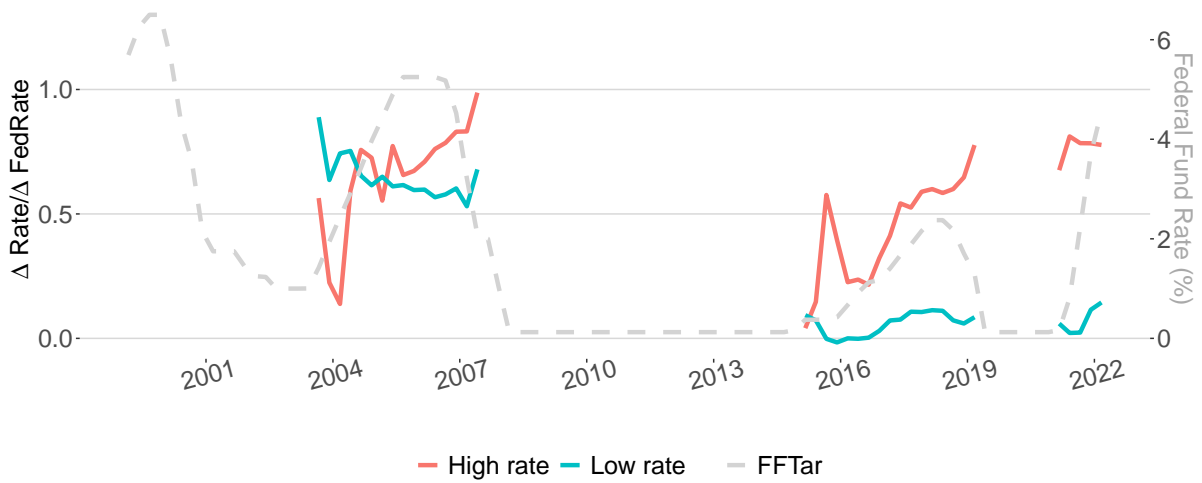
Notes: This figure presents kernel density plots of the scaled and demeaned 12-month certificate of deposit rates of at least \$10,000 (12MCD10K) offered by the top 25 banks at the peak of each rate hiking cycle, using RateWatch data. Figures 1a, 1b, 1c present the kernel density of the scaled and demeaned 12MCD10K rates offered by the top 25 banks in 2007Q3, 2019Q1, and 2022Q4, respectively. The scaled and demeaned 12MCD10K rates are produced by first scaling the 12MCD10K rates 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: Dispersion of Bank Deposit Rates



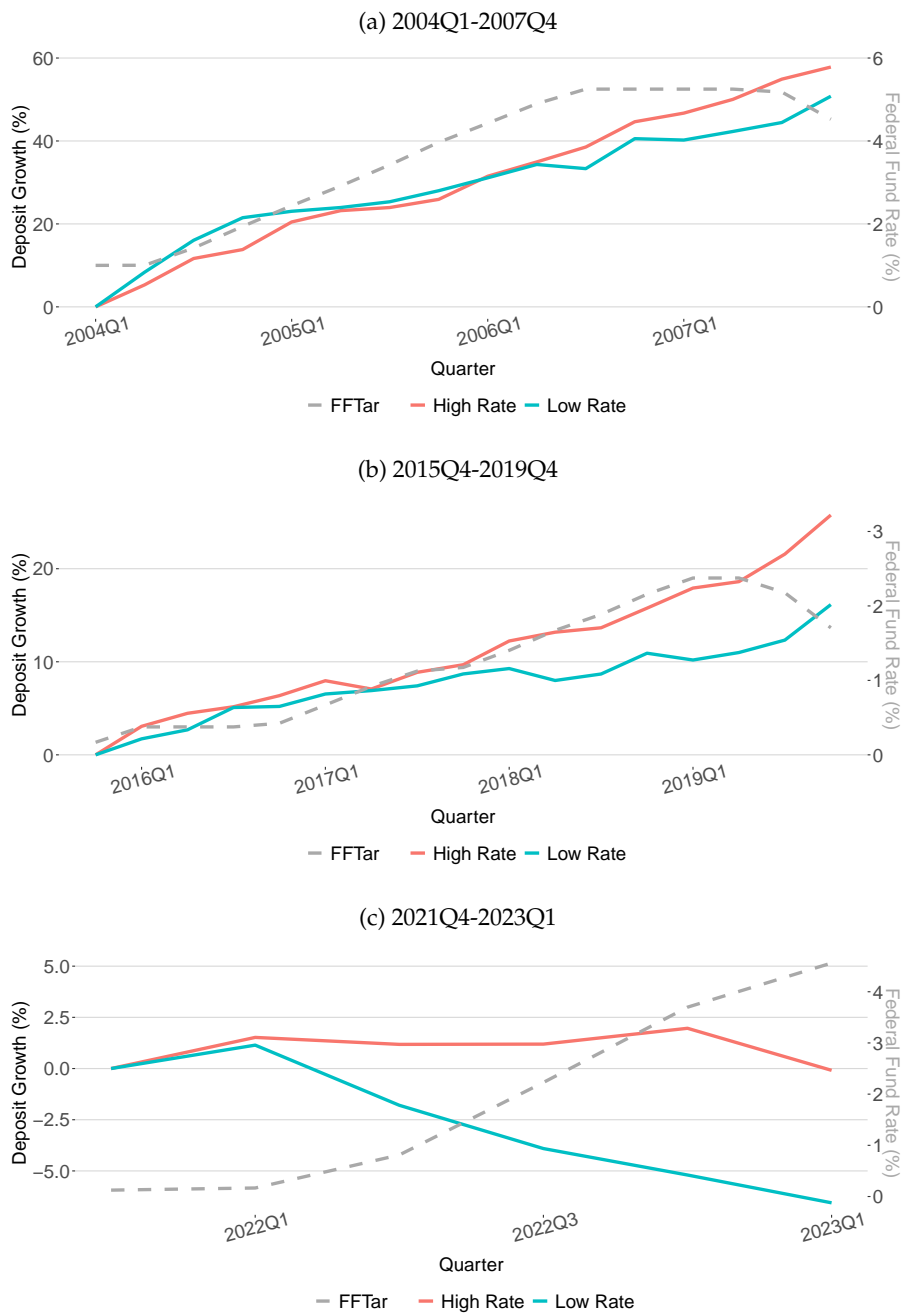
Notes: This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q1 among the top 25 banks. Figure 2a presents a time-series plot of the 12-month certificate of deposit rates of at least \$10,000 (12MCD10K) using RateWatch data for *high rate* (blue) and *low rate* (red) banks. Figure 2b presents the gap in the 12MCD10K rates between high rate and low rate banks. Figure 2c 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 3: Deposit Beta



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 2023Q1. The deposit beta is defined as the ratio of the cumulative change of the 12MDC10K rate from the first quarter in each rate hiking cycle to the corresponding change in the Federal Funds Target rate. 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.

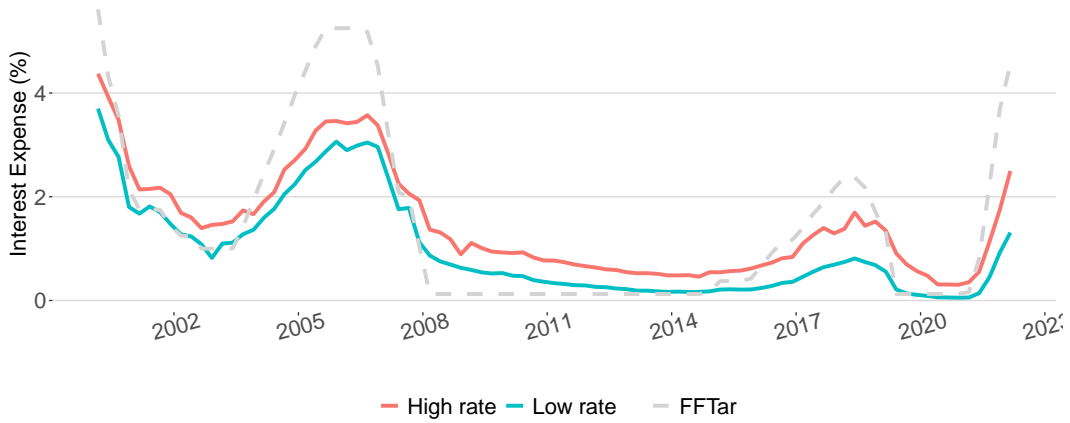
Figure 4: Deposit Growth



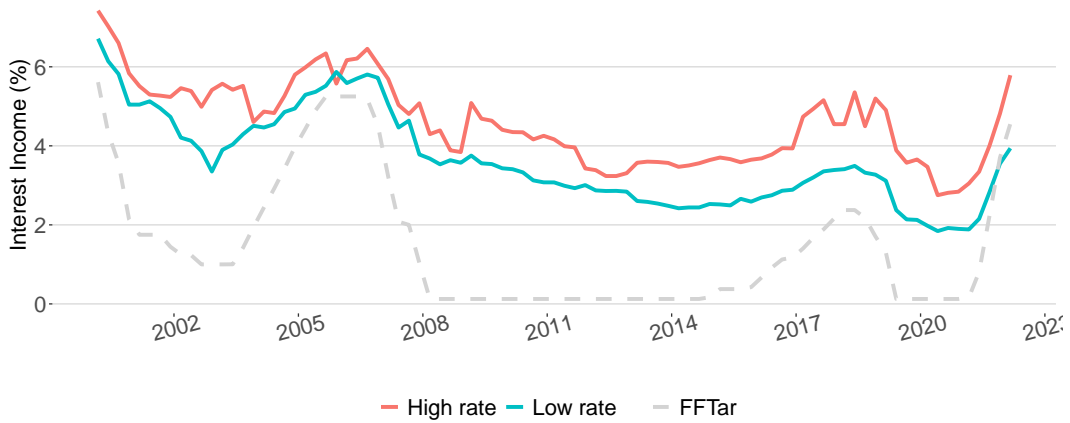
Notes: This figure compares the deposit growth of high and low rate banks among the top 25 banks over the three recent rate hiking cycles. Figure 4a compares the deposit growth experienced by high rate banks to that of low rate banks from 2004Q1 through 2007Q4. Figure 4b compares the deposit growth experienced by high rate banks to that of low rate banks from 2015Q4 through 2019Q4. Figure 4c compares the deposit growth experienced by high rate banks to that of low rate banks from 2021Q4 through 2023Q1. For ease of 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 2022Q4. 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 5: Net Interest Margin

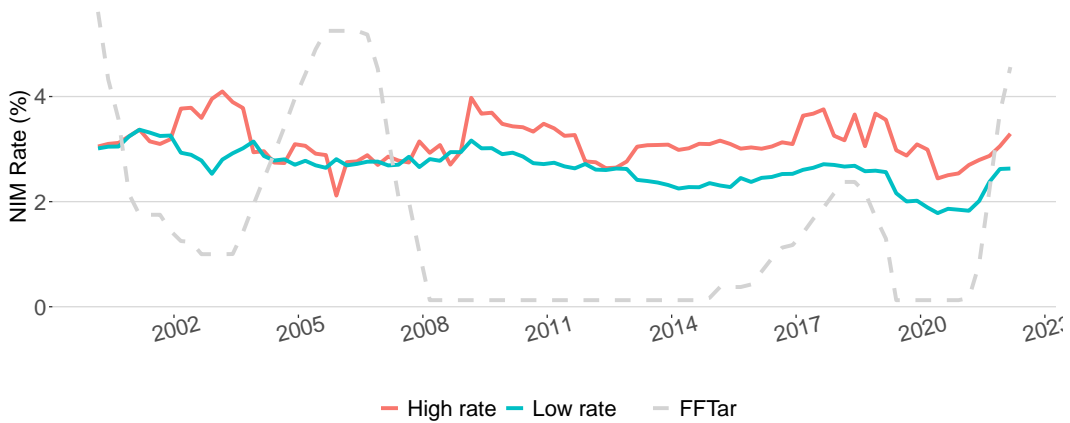
(a) Interest Expense



(b) Interest Income



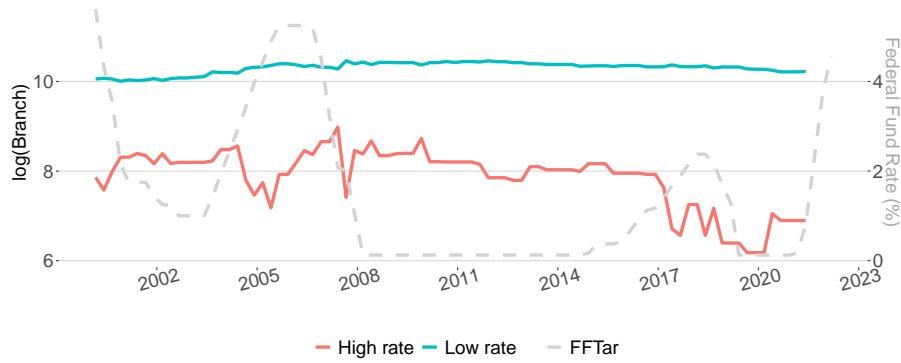
(c) NIM



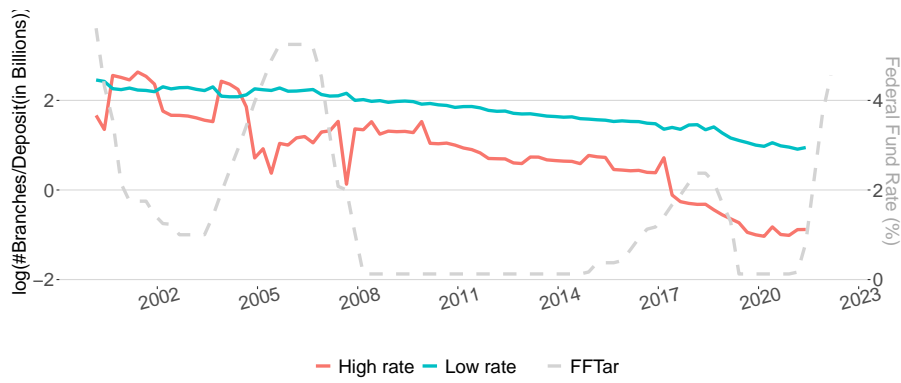
Notes: This figure compares the interest expense, interest income, and net interest margin of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. Figure 5a presents the interest expense (%) of high and low rate banks. Figure 5b presents the interest income (%) of high and low rate banks. Figure 5c presents the net interest margin (NIM) rate (%) for high and low rate banks. See Appendix Table A.8 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 6: Branches

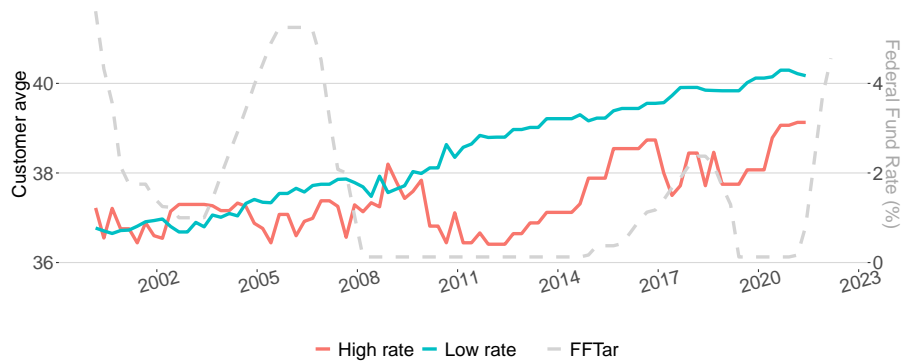
(a) Growth of Branches



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



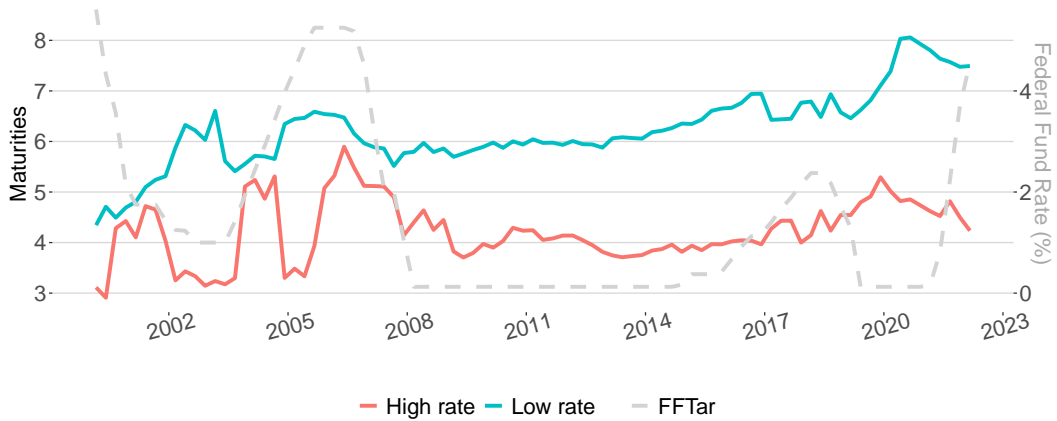
(c) Customer age



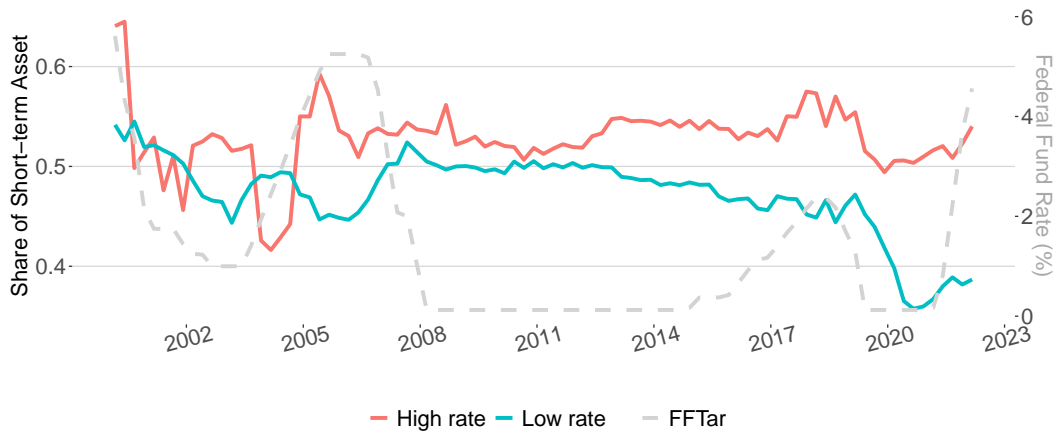
Notes: This figure compares branches operating by high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. Figure 6a presents the log-transformed number of branches of high and low rate banks. Figure 6b presents the log-transformed ratio between branches and deposits (in Billions) of high and low rate banks. Figure 6c 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 7: Duration Risk

(a) Maturity

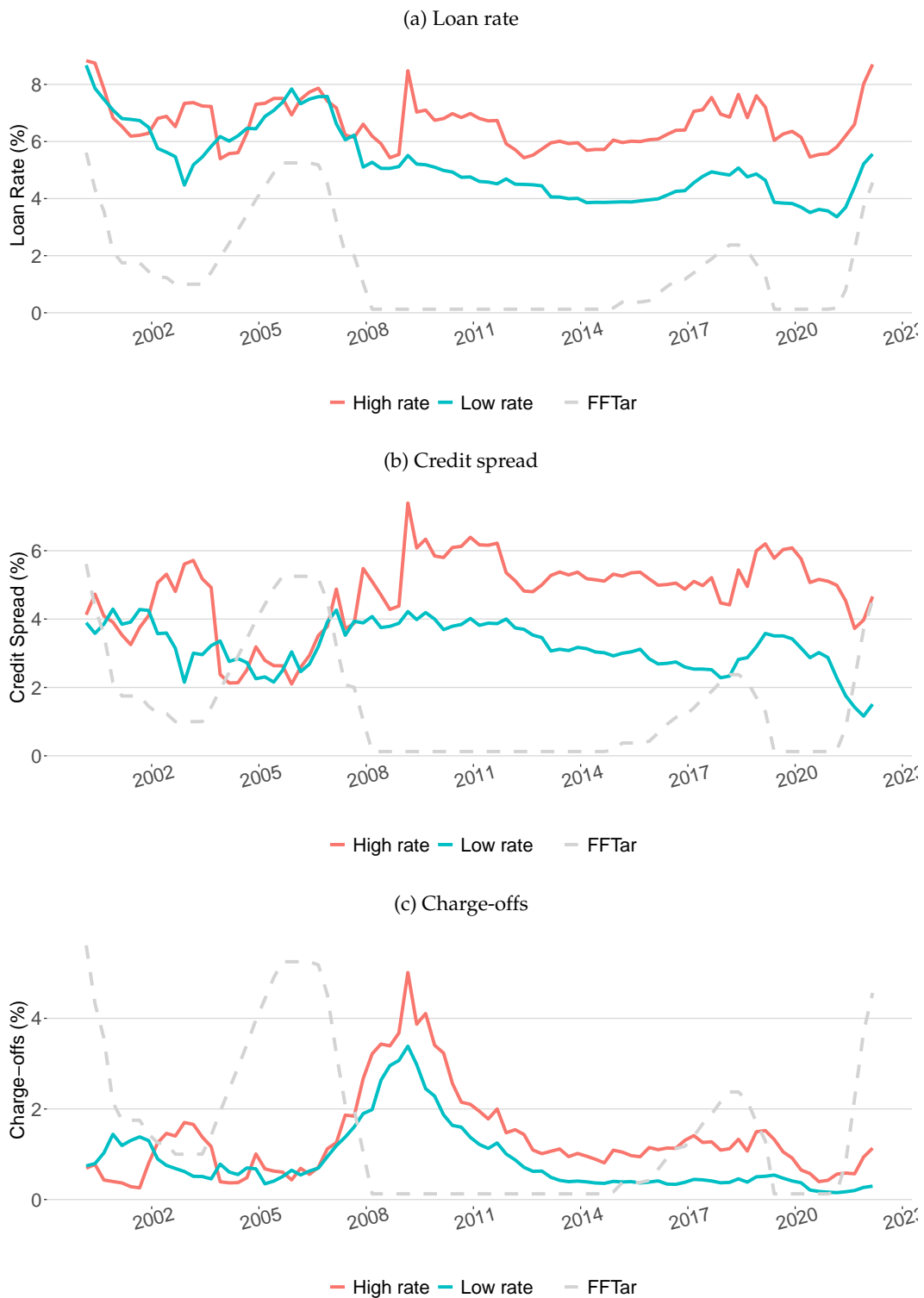


(b) Share of Short-Term Assets



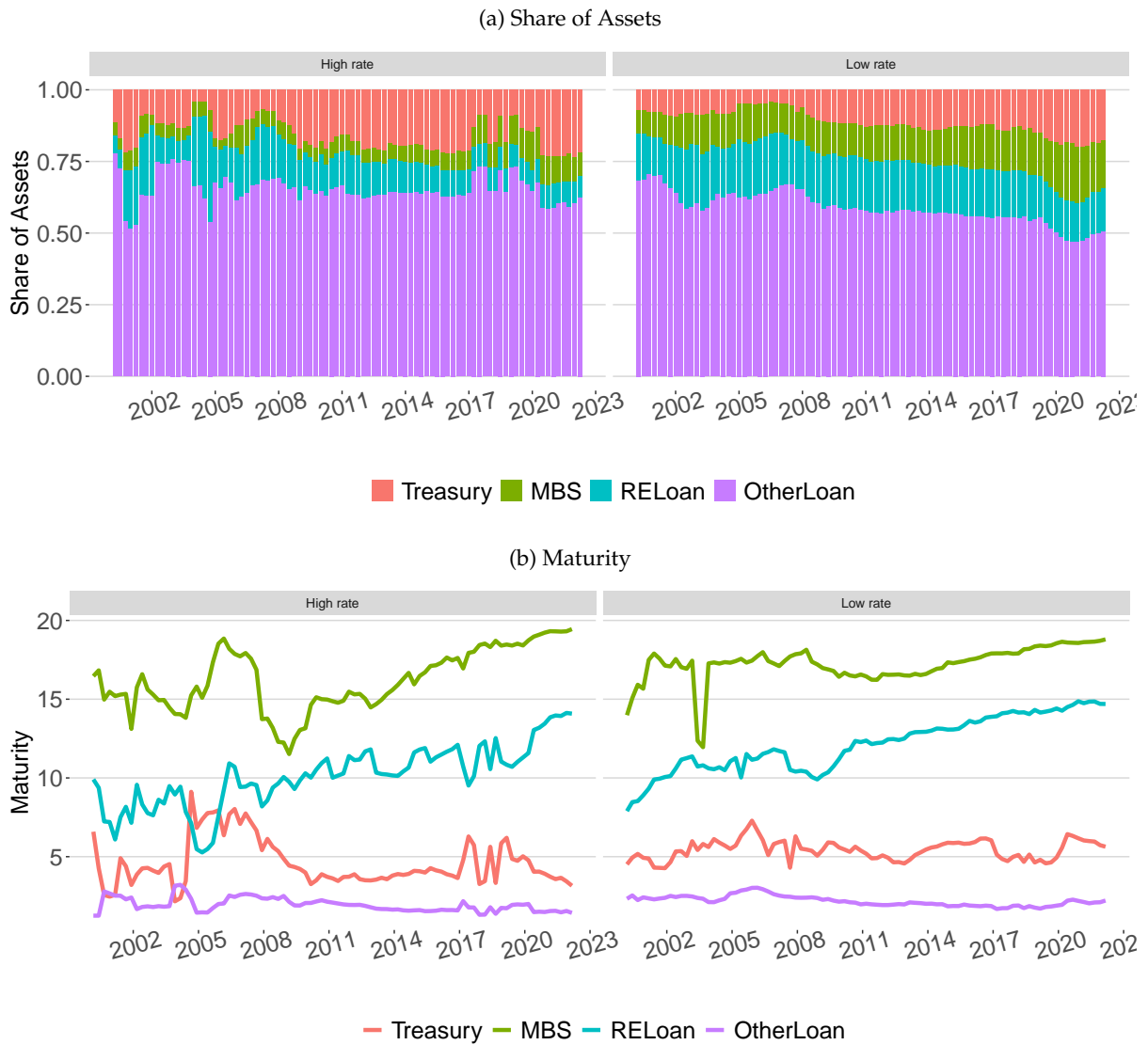
Notes: This figure compares the duration risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. Figure 7a presents the maturity (# of years) of high and low rate banks. Figure 7b presents the share of assets with less-than one-year maturity (short-term assets) for high and 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 8: Credit Risk



Notes: This figure compares the credit risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. Figure 8a presents the loan rate (%) of high and low rate banks. Figure 8b 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 8c presents the charge-off rate (%) for high and low rate banks. See Appendix Table A.8 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 9: Portfolio Composition



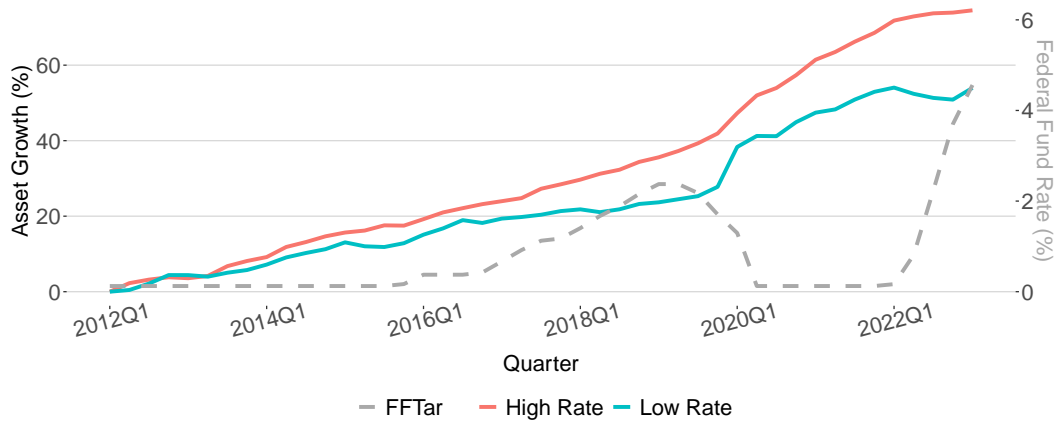
Notes: This figure compares the portfolio characteristics of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. Figure 9a examines the portfolio composition of high rate and low rate banks; share of treasuries (red), mortgage-backed securities (green), real estate loans (blue), and other loans (purple). Figure 9b examines the maturity (years) of these asset classes for high rate and low rate banks. See Appendix Table A.8 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 10: Asset Growth (Top 100 Banks)

(a) 2003Q1-2008Q2



(b) 2012Q1-2023Q1



Notes: This figure compares the asset growth of high and low rate banks for banks with more than \$10 billion in assets. Figure 10a compares the asset growth experienced by high rate banks to that of low rate banks from 2003Q1 through 2008Q2. Figure 10b compares the asset growth experienced by high rate banks to that of low rate banks from 2012Q1 through 2023Q1. 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 12MDC10K 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		
MCD (%)	2.78	2.13	0.64***	0.77	0.04	0.73***
DepRate (%)	2.15	1.53	0.62***	0.54	0.06	0.48***
Insured Deposits Share	0.43	0.46	-0.02	0.44	0.45	-0.01
#Branches	1185	2679	-1494***	406	3270	-2864***
$\log(\frac{\# \text{Branches}}{\text{Deposits}})$	0.53	1.37	-0.84***	-1.21	0.33	-1.54***
Δ Deposits (%)	2.47	2.57	-0.11	1.41	1.20	0.21
NIM rate (%)	2.55	2.33	0.21	2.51	1.80	0.71***
Maturity (Years)	3.80	5.23	-1.43***	3.90	6.44	-2.54***
Charge-off Rate (%)	0.60	0.41	0.19	0.38	0.03	0.35***

Panel B: Deposit Rate									
	Count	Mean	Stdev	Skewness	P5	P25	Median	P75	P95
CD	1828	1.19	1.36	1.17	0.03	0.15	0.49	1.99	4.02
DepRate	2225	1.10	1.08	1.25	0.07	0.22	0.71	1.65	3.29

Notes: Panel A compares various metrics between high and low rate banks among the top 25 banks from 2001Q1 to 2008Q4 and from 2017 Q1 to 2023Q1. 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 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 summary statistics for DepRate and CD.

Table 2: Deposit Betas

	Δ Dep. Rate	Δ Interest Expense	Δ Interest Income	Δ NIM
	(1)	(2)	(3)	(4)
Δ FFTar $\times \mathbb{1}(\text{High Rate}) \times \text{Post}$	0.618*** (0.156)	0.236*** (0.042)	0.142* (0.073)	-0.075*** (0.026)
Δ FFTar $\times \mathbb{1}(\text{High Rate})$	-0.015 (0.124)	-0.054 (0.038)	-0.032 (0.070)	-0.006 (0.030)
Δ FFTar $\times \text{Post}$	-0.453*** (0.101)	-0.213*** (0.048)	0.040 (0.065)	0.235*** (0.018)
Δ FFTar	0.598*** (0.055)	0.497*** (0.041)	0.432*** (0.054)	-0.033** (0.016)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-0.026 (0.044)	-0.015 (0.019)	0.019 (0.048)	0.041*** (0.014)
$\mathbb{1}(\text{High Rate})$	0.004 (0.039)	0.010 (0.018)	-0.015 (0.047)	-0.029** (0.013)
Post	-0.057 (0.053)	-0.009 (0.026)	-0.019 (0.037)	-0.007 (0.011)
$ROA_{i,q-1}$	0.043** (0.020)	0.018* (0.010)	-0.002 (0.019)	-0.011 (0.012)
$\text{Tier1}_{i,q-1}$	-0.023* (0.012)	-0.008 (0.007)	-0.023* (0.013)	-0.013 (0.008)
Constant	0.001 (0.053)	-0.021 (0.027)	-0.007 (0.040)	0.002 (0.023)
Adjusted R^2	0.567	0.552	0.314	0.085
Observations	1800	2219	2219	2219
Mean of Dep. Variable	-0.021	-0.012	-0.021	-0.010

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

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

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 $\text{Tier } 1_{i,q-1}$ 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 change in the 12MCD10K rate (Δ Dep. Rate $_{i,q}$) in column (1), the change in interest expense (Δ Interest Expense $_{i,q}$) in column (2), the change in net interest income (Δ Interest Income $_{i,q}$) in column (3), and the change in NIM (Δ NIM $_{i,q}$) in column (4). The 12MCD10K rate comes from RateWatch. The change in interest expense, interest income and NIM are computed from the Call Reports. See Table A.8 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 3: Growth in Deposits and Loans

	$\Delta\text{Deposit}_{i,y}$		$\Delta\text{Personal Loan}_{i,y}$		$\Delta\text{C\&I Loan}_{i,y}$		$\Delta\text{Real Estate Loan}_{i,y}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta\text{FFTar}_y \times \mathbb{1}(\text{High Rate}) \times \text{Post}$	3.384** (1.514)	2.924* (1.643)	4.918* (2.877)	5.661* (2.943)	3.376 (3.146)	1.900 (2.901)	-1.934 (2.781)	-1.749 (2.989)
$\Delta\text{FFTar}_y \times \mathbb{1}(\text{High Rate})$	0.045 (1.017)	0.131 (1.126)	-3.124 (1.926)	-3.614* (2.054)	-0.410 (2.895)	0.977 (2.625)	2.715 (2.154)	2.692 (2.128)
$\Delta\text{FFTar}_{year}$	0.992 (0.717)		1.347 (0.822)		0.874 (1.787)		1.232 (1.073)	
$\Delta\text{FFTar}_y \times \text{Post}$	-6.317*** (1.359)		-1.325 (1.227)		-0.836 (1.964)		-2.568 (1.913)	
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-4.943** (2.181)	-5.265** (2.076)	13.456*** (4.835)	12.244** (4.947)	-6.482* (3.363)	-5.578** (2.755)	-6.535* (3.524)	-7.922** (3.684)
$\mathbb{1}(\text{High Rate})$	4.352** (1.970)	5.036*** (1.810)	-10.741** (4.554)	-9.960** (4.730)	4.351 (3.218)	3.416 (2.556)	5.102 (3.204)	6.483* (3.325)
Post	-2.650 (2.297)		-12.220*** (2.650)		-6.706 (4.820)		-12.895*** (2.706)	
$\text{ROA}_{i,q-1}$	1.330** (0.623)	2.072*** (0.783)	0.085 (0.922)	1.300 (1.188)	0.310 (1.504)	1.309 (0.898)	0.869 (0.846)	3.025*** (1.054)
$\text{Tier1}_{i,q-1}$	0.010 (0.010)	0.012 (0.009)	-0.001 (0.013)	-0.005 (0.011)	-0.010 (0.014)	-0.008 (0.011)	0.018 (0.020)	0.016 (0.017)
Constant	8.575*** (2.726)		16.018*** (3.087)		11.709** (4.942)		13.376*** (2.999)	
Quarter FE		✓		✓		✓		✓
Adjusted R^2	0.046	0.005	0.032	0.009	0.017	0.003	0.093	0.016
Observations	2205	2205	2196	2196	2135	2135	2168	2168
Mean of Dep. Variable	8.148	8.148	6.469	6.469	5.989	5.989	5.329	5.329

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

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

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. The dependent variable, $\Delta Y_{i,y}$ is the annual growth of the total deposit, loans to individuals, C&I loans, and real estate loans 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 4: Bank Branches

	log(# Branches)		log($\frac{\text{Branches}}{\text{Deposit}}$)		Customer Age	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-1.377*** (0.300)	-1.362*** (0.305)	-0.666*** (0.226)	-0.749*** (0.232)	-0.503*** (0.073)	-0.356*** (0.120)
$\mathbb{1}(\text{High Rate})$	-0.396** (0.188)	-0.464** (0.179)	-0.871*** (0.170)	-0.887*** (0.170)	-0.233*** (0.064)	-0.283*** (0.104)
Post	0.343*** (0.121)		-0.895*** (0.117)		1.835*** (0.431)	
$ROA_{i,q-1}$	-0.066 (0.084)	-0.006 (0.122)	-0.100 (0.088)	0.006 (0.095)	0.018 (0.108)	-0.257** (0.102)
$\text{Tier1}_{i,q-1}$	0.586*** (0.093)	0.561*** (0.085)	0.106** (0.042)	0.010 (0.030)	-0.379*** (0.072)	-0.232*** (0.040)
Constant	6.779*** (0.167)		1.855*** (0.097)		37.462*** (0.190)	
Quarter FE		✓		✓		✓
Adjusted R^2	0.144	0.144	0.158	0.114	0.453	0.127
Observations	2050	2050	2050	2050	2050	2050
Mean of Dep. Variable	7.137	7.137	0.892	0.892	38.484	38.484

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

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times ROA_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

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 $ROA_{i,q-1}$ and $\text{Tier1}_{i,q-1}$ 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($\frac{\text{Branches}}{\text{Deposit}}$)) in columns (3)-(4), and the average customer age in columns (5)-(6). 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. 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 5: Duration Risk

Panel A: Loans and Securities				
	Maturities (years)	Short-term share (%)		
	(1)	(2)		
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-0.765** (0.354)	2.949* (1.552)		
$\mathbb{1}(\text{High Rate})$	-1.699*** (0.349)	5.850*** (1.072)		
Quarter FE + Controls	✓	✓		
Observations	2128	2128		
Mean of Dep. Variable	5.908	48.040		

Panel B: Maturity by Asset Class				
	Real Estate Loans	Other Loans	MBS	Treasuries
	(1)	(2)	(3)	(4)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-0.083 (0.277)	0.118 (0.173)	-1.003** (0.405)	-2.007*** (0.664)
$\mathbb{1}(\text{High Rate})$	-1.670*** (0.237)	-0.569*** (0.162)	1.508*** (0.329)	0.106 (0.619)
Quarter FE + Controls	✓	✓	✓	✓
Observations	2026	2127	2041	2089
Mean of Dep. Variable	12.180	1.947	17.099	6.012

Panel C: Share by Asset Classes (%)				
	Real Estate Loans	Other Loans	MBS	Treasuries
	(1)	(2)	(3)	(4)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-2.142 (1.978)	4.330** (2.050)	-1.329* (0.783)	-0.859 (2.057)
$\mathbb{1}(\text{High Rate})$	-3.278* (1.945)	5.611*** (1.897)	-6.440*** (0.828)	4.108** (1.943)
Quarter FE + Controls	✓	✓	✓	✓
Observations	2128	2128	2128	2128
Mean of Dep. Variable	15.157	57.792	12.234	14.817

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

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times \text{ROA}_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

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 $\text{Tier1}_{i,q-1}$ 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 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 6: Credit Risk

Panel A: Loans and Securities				
	Loan Rate	Credit Spread	Charge-offs	
	(1)	(2)	(3)	
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	1.268*** (0.202)	1.160*** (0.280)	0.447*** (0.142)	
$\mathbb{1}(\text{High Rate})$	0.643*** (0.185)	0.940*** (0.270)	0.240* (0.128)	
Quarter FE + Controls	✓	✓	✓	
Adjusted R^2	0.345	0.378	0.157	
Observations	2219	2127	2219	
Mean of Dep. Variable	5.247	3.521	0.873	

Panel B: Charge-off Rates by Asset Class				
	Real Estate Loans	C&I Loans	Personal Loans	Other Loans
	(1)	(2)	(3)	(4)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	0.059 (0.078)	0.127 (0.136)	0.666*** (0.192)	0.046 (0.073)
$\mathbb{1}(\text{High Rate})$	0.049 (0.068)	0.128 (0.124)	0.448** (0.178)	-0.039 (0.062)
Quarter FE + Controls	✓	✓	✓	✓
Adjusted R^2	0.034	0.019	0.090	0.000
Observations	2190	2163	2215	2194
Mean of Dep. Variable	0.411	0.610	2.324	0.233

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

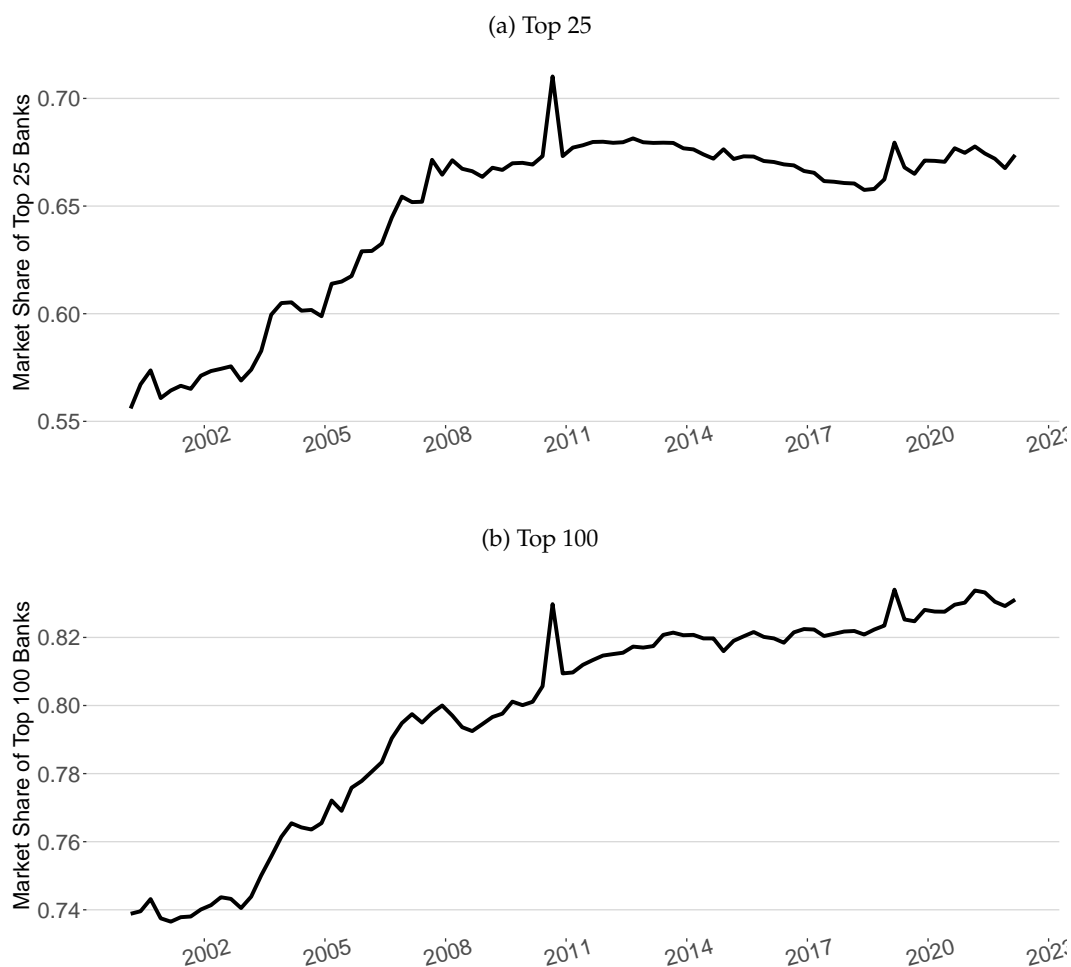
$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times \text{ROA}_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

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 $\text{Tier1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. 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.

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

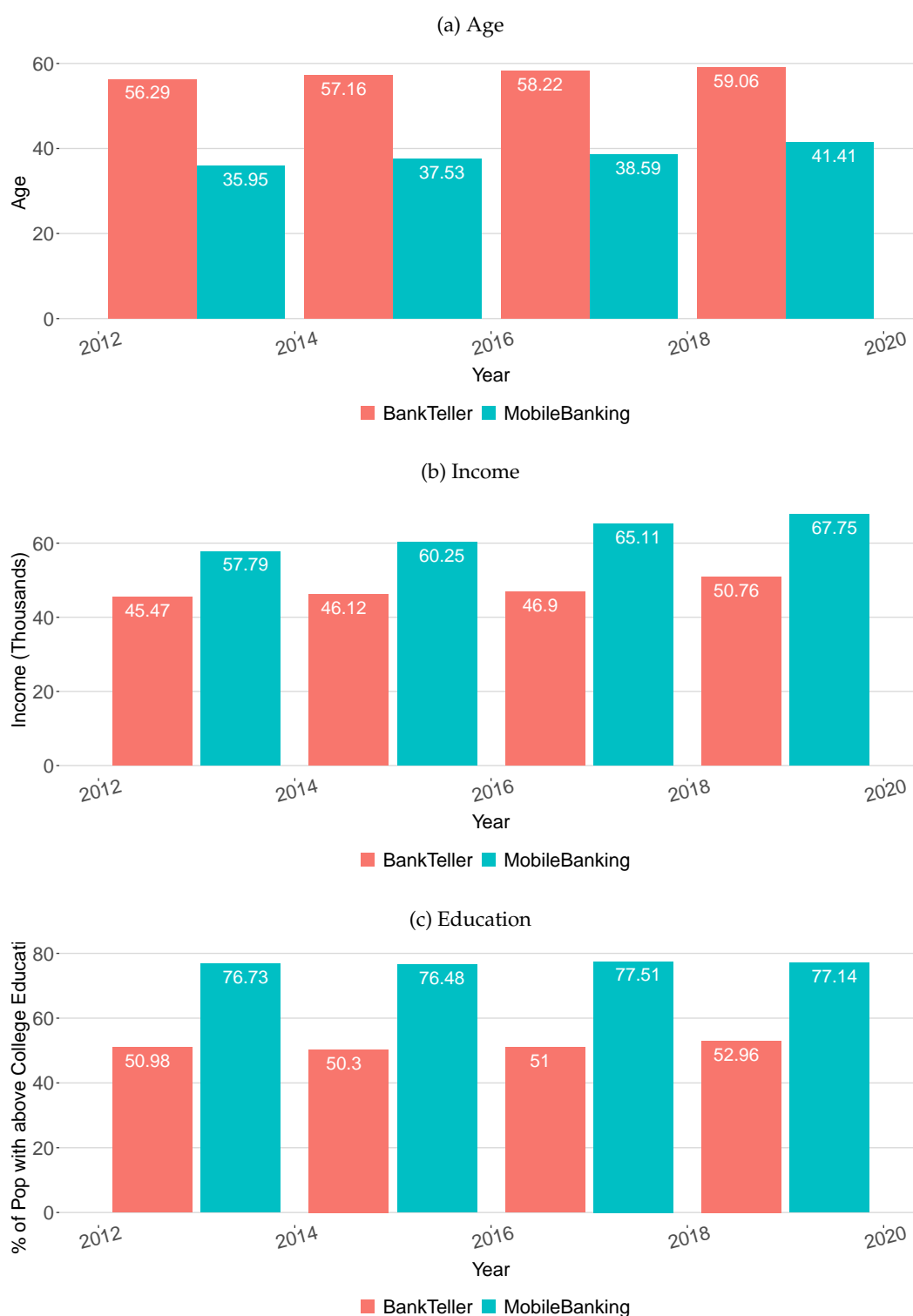
Appendix A Figures and Tables

Figure A.1: Market Share of Top Banks



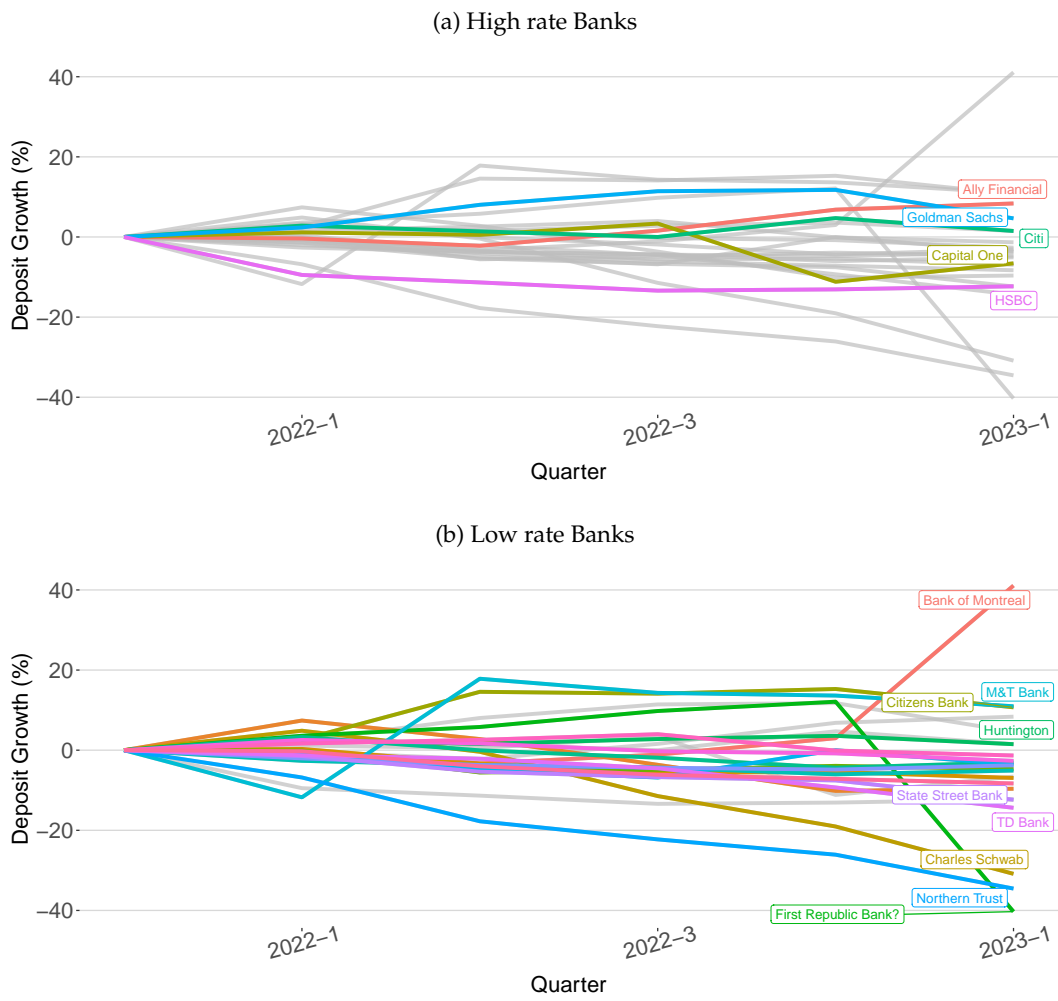
Notes: This figure presents the market share of the top 25 banks (in panel a) and top 100 banks (in panel b) from 2001Q1 through 2023Q1. Market share is measured by total assets. The top 25 (top 100) banks are defined according to bank size in each quarter. The data used to construct this figure comes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

Figure A.2: Characteristics of Households Using Branches v.s. Mobile Banking



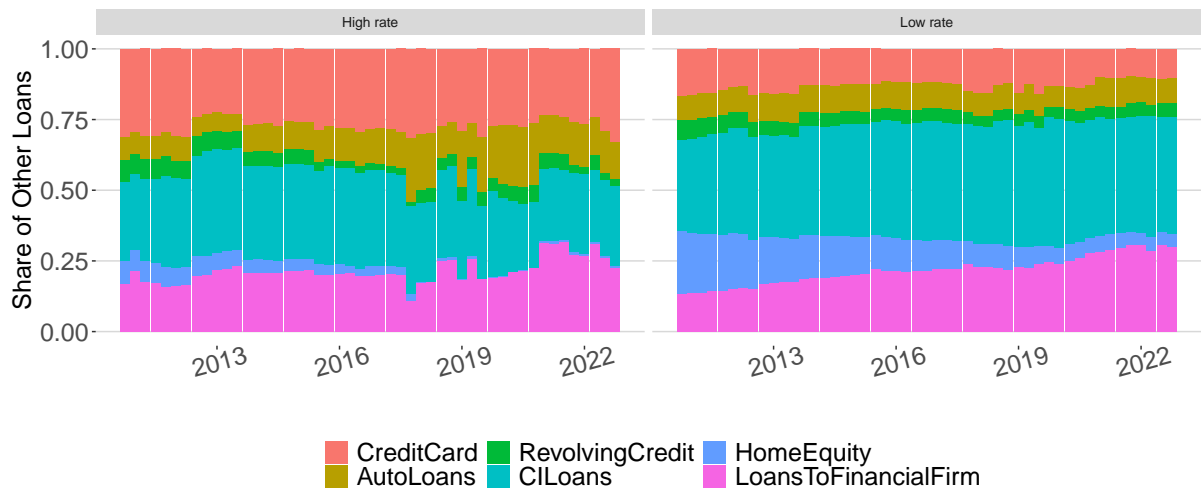
Notes: These figures present the characteristics of households utilizing bank tellers versus mobile banking as their primary means of accessing banking services. The data is derived from the FDIC Survey of Consumer Use of Banking and Financial Services. Respondents were asked to specify their most common 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.3: Deposit Growth: 21Q4-23Q1



Notes: The figure illustrates the deposit growth of the top 25 banks, categorized by their end-of-quarter assets for 2022 Q4. 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 2023 Q1. This data is collected from RateWatch.

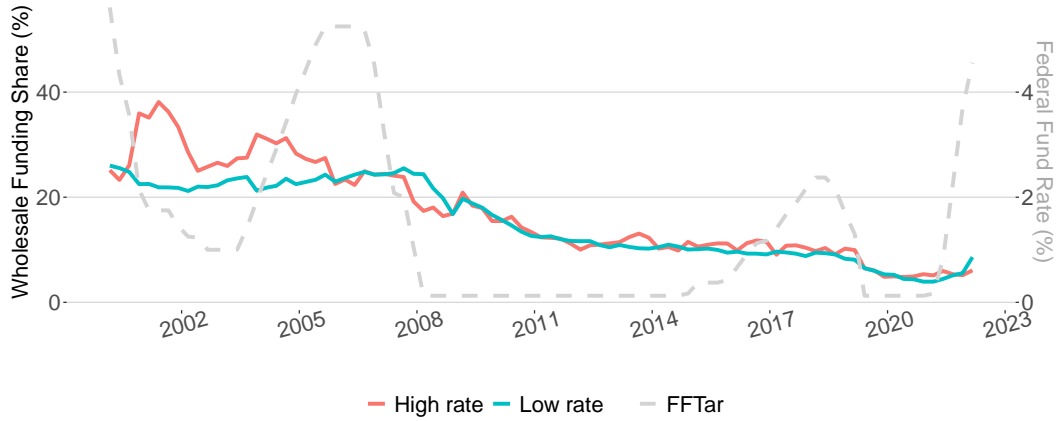
Figure A.4: Comparison of Non-Real Estate Loans



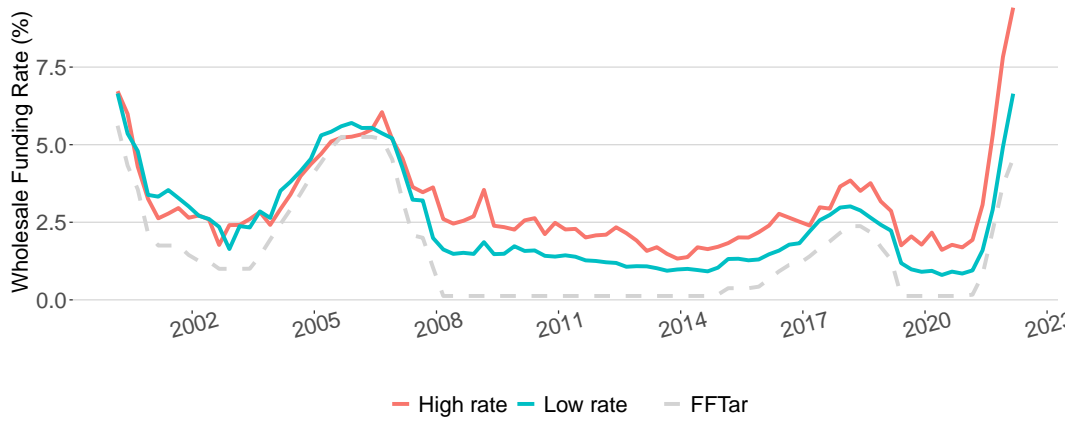
Notes: This figure presents the share of non-real estate loans of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. We consider six categories: credit card loans, auto loans, home equity loans, revolving credit to individuals, commercial and industrial loans, and loans to other financial firms. See Appendix Table A.8 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.5: Wholesale Funding

(a) Wholesale Funding Share

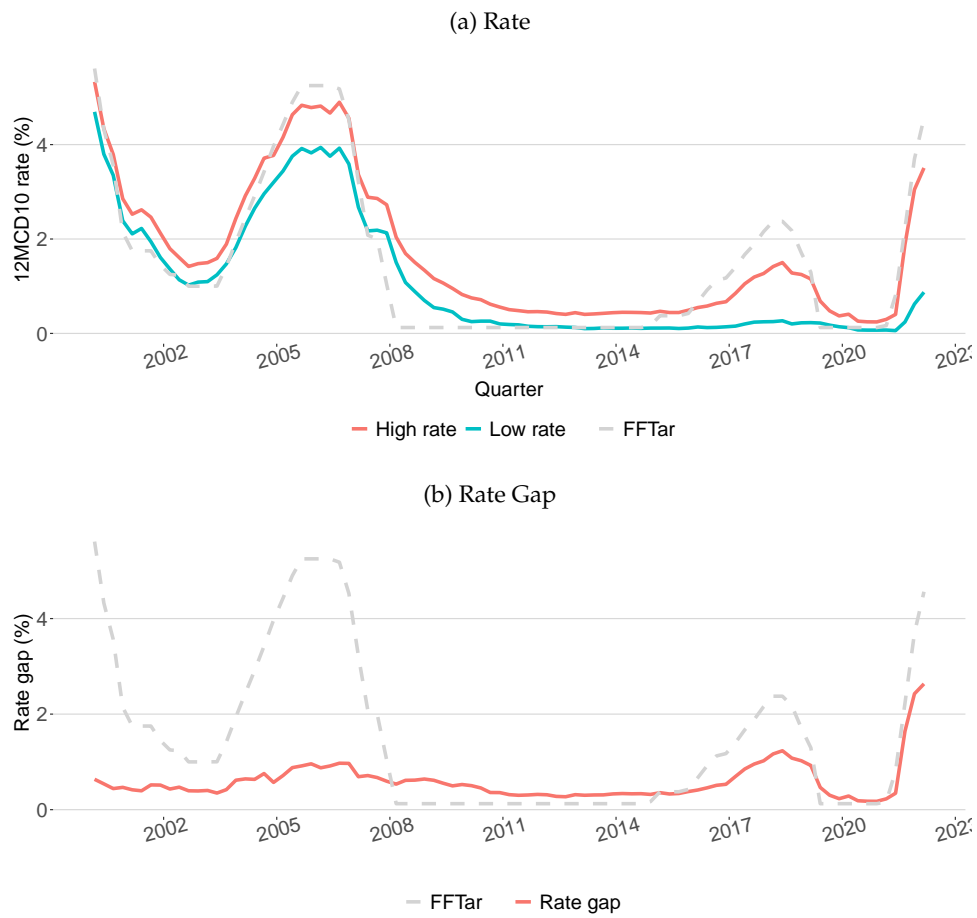


(b) Wholesale Funding Rate



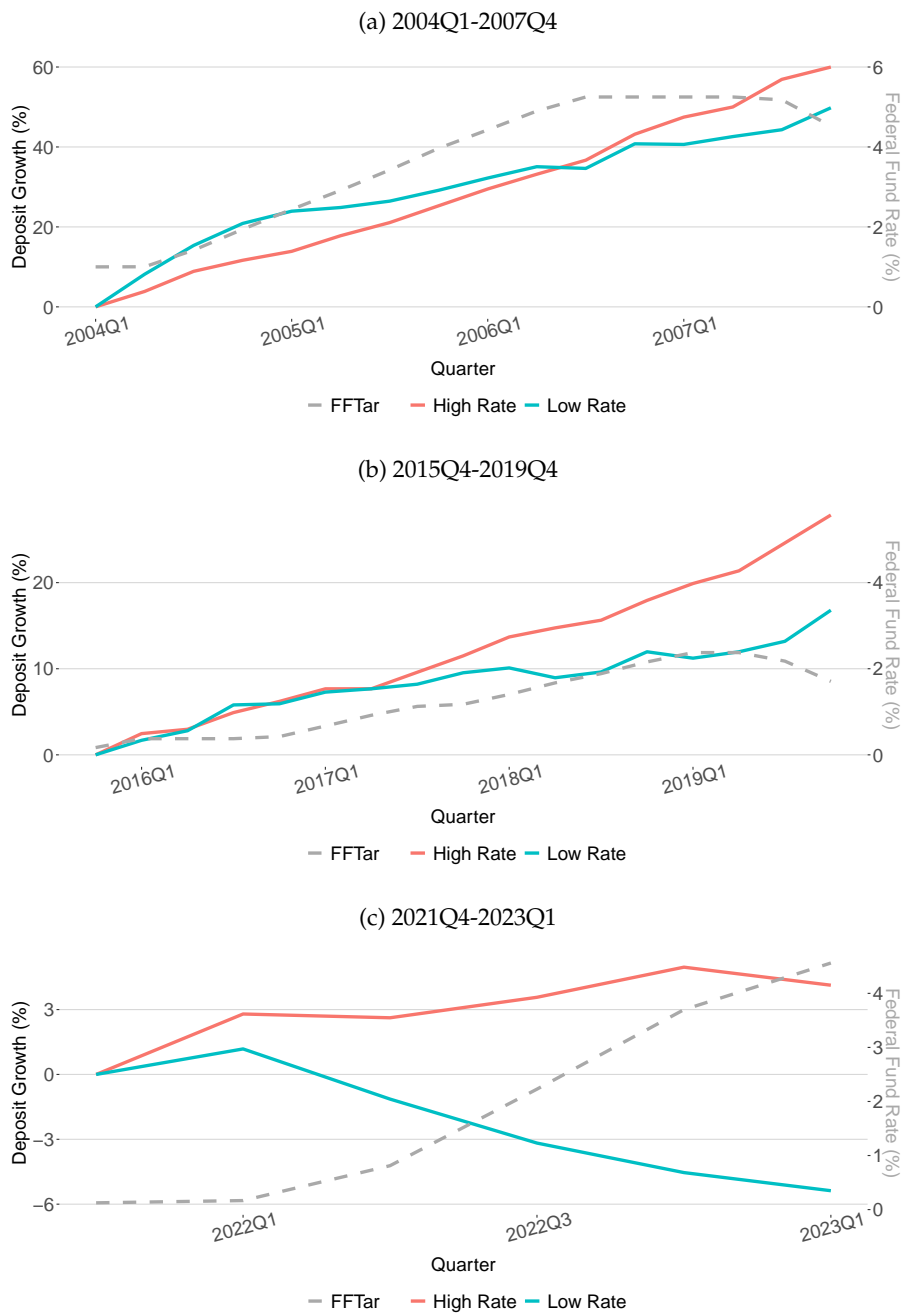
Notes: The figures plot the wholesale funding share (in panel A) and rate (in panel B) of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. The wholesale funding includes federal funds purchased and repurchase agreements, subordinated debt, and other borrowed funds. See Appendix Table A.8 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.6: Dispersion of Bank Deposit Rates (Top 100 Banks)



Notes: This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q1 among the top 100 banks. Figure A.6a presents a time-series plot of the 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.6b presents the gap in the 12MCD10K rates between high rate and low rate banks. Figure 2c 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 A.7: Deposit Growth (Top 100 Banks)



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. Figure A.7a compares the deposit growth experienced by high rate banks to that of low rate banks from 2004Q1 through 2007Q4. Figure A.7b compares the deposit growth experienced by high rate banks to that of low rate banks from 2015Q4 through 2019Q4. Figure A.7c compares the deposit growth experienced by high rate banks to that of low rate banks from 2021Q4 through 2023Q1. For ease of 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 2022Q4. 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.

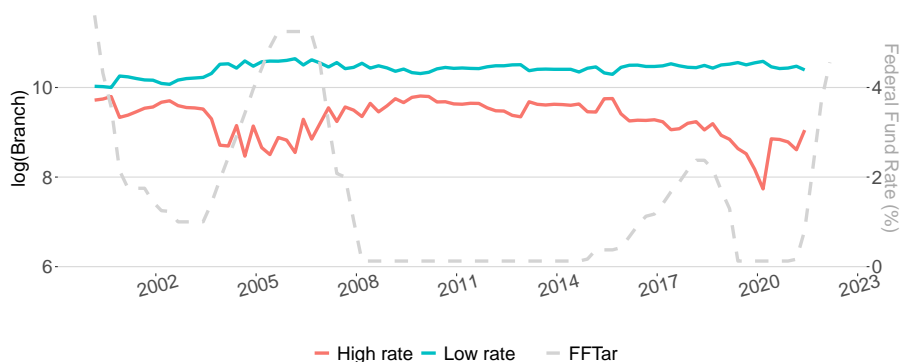
Figure A.8: Net Interest Margin (Top 100 Banks)



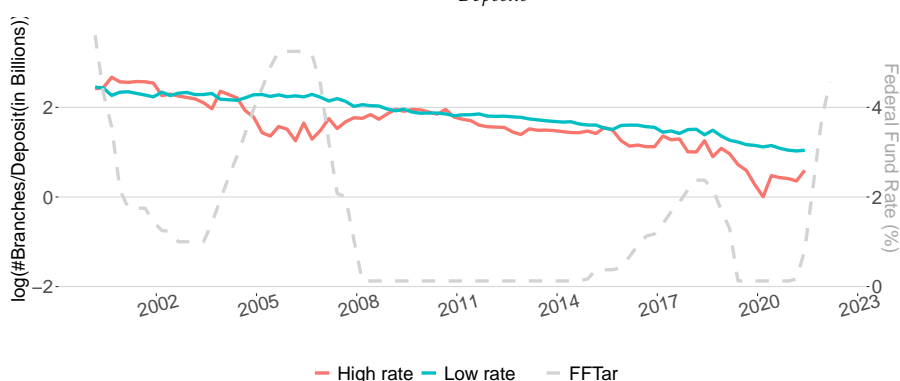
Notes: This figure compares the interest expense, interest income, and net interest margin of high and low rate banks among the top 100 banks from 2001Q1 through 2023Q1. Figure A.8a presents the interest expense (%) of high and low rate banks. Figure A.8b presents the interest income (%) of high and low rate banks. Figure A.8c presents the net interest margin (NIM) rate (%) for high and low rate banks. See Appendix Table A.8 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.9: Branches

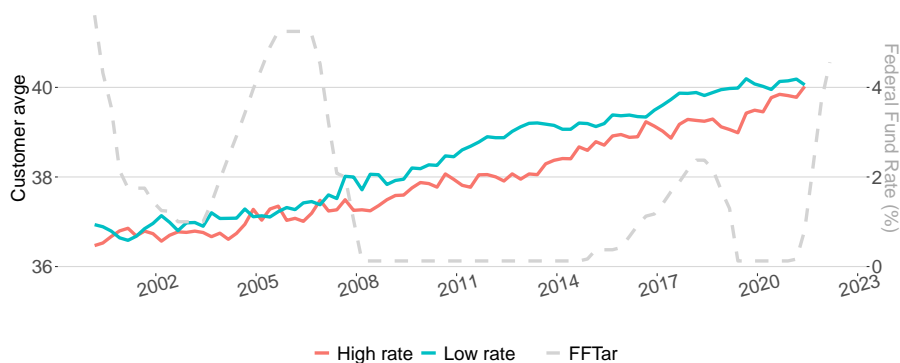
(a) Growth of Branches



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



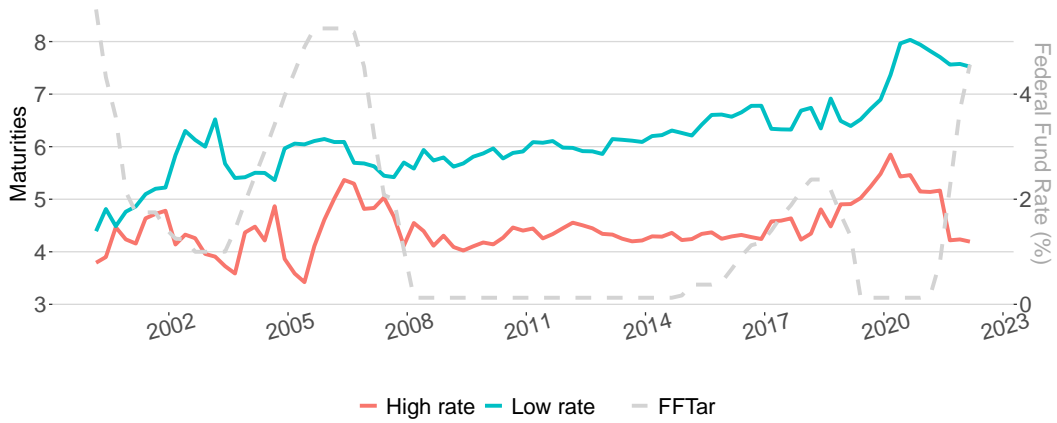
(c) Customer age



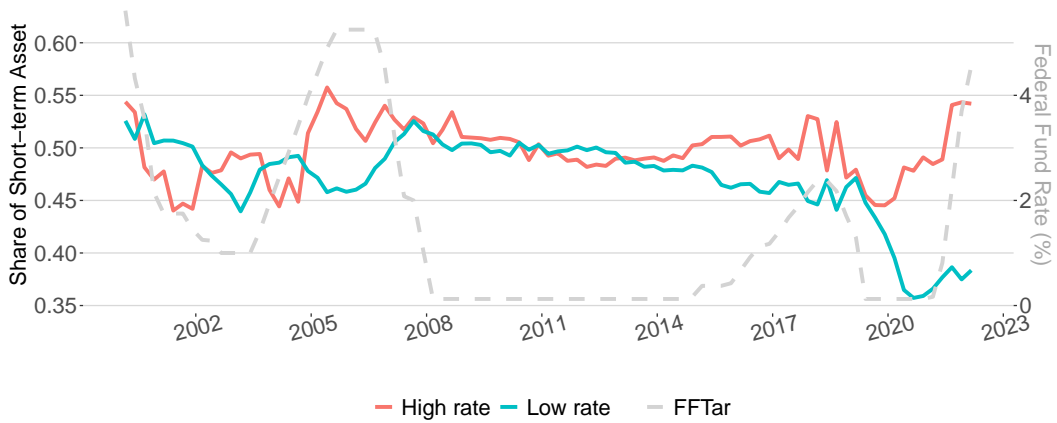
Notes: This figure compares branches operating by high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. Figure A.9a presents the log-transformed number of branches of high and low rate banks. Figure A.9b presents the log-transformed ratio between branches and deposits (in Billions) of high and low rate banks. Figure A.9c 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.10: Duration Risk (Top 100 Banks)

(a) Maturity



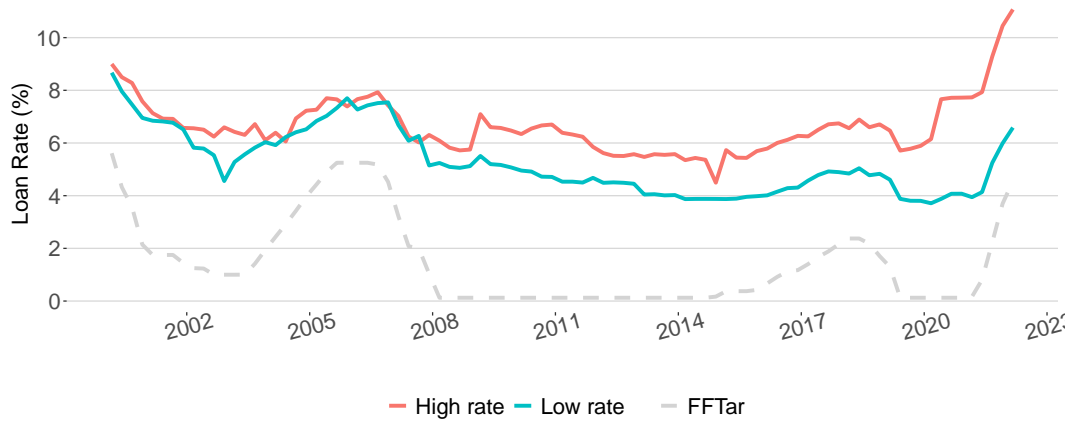
(b) Share of Short-Term Assets



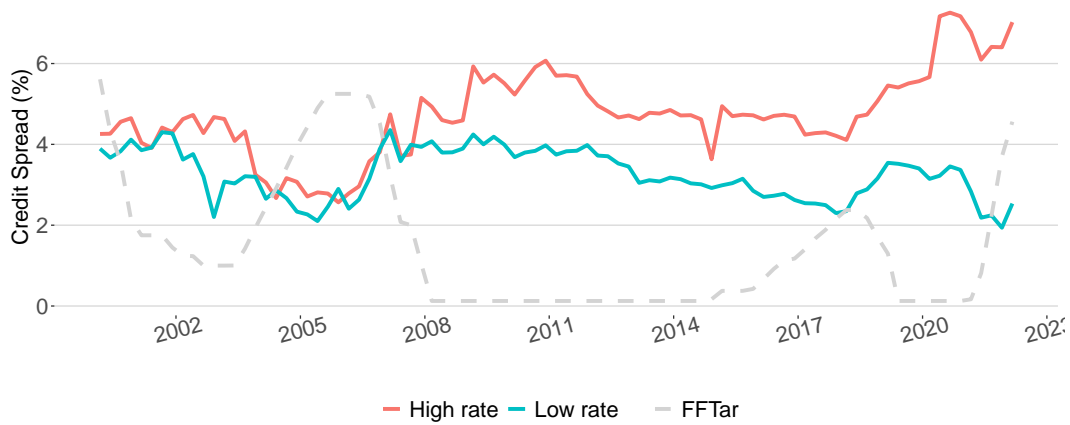
Notes: This figure compares the duration risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q1. Figure A.10a presents the maturity (# of years) of high and low rate banks. Figure A.10b presents the share of assets with less-than one-year maturity (short-term assets) for high 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.11: Credit Risk

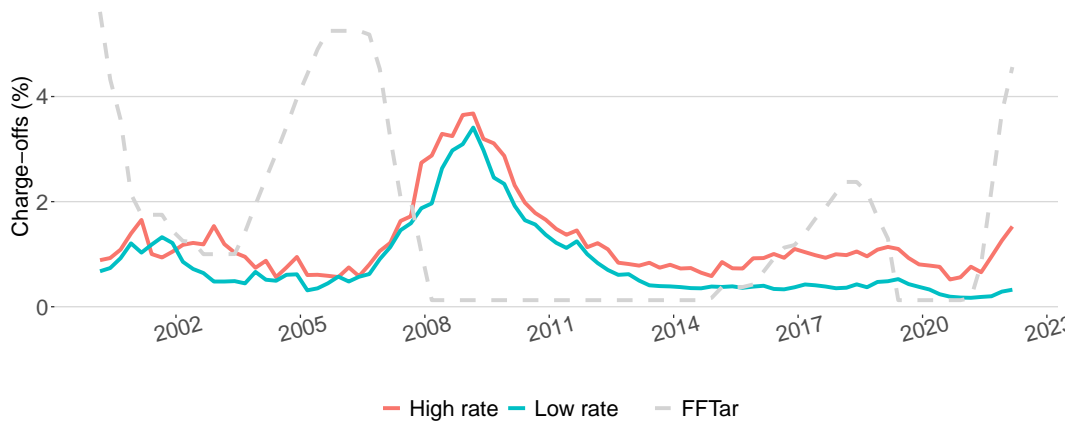
(a) Loan rate



(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 2023Q1. Figure A.11a presents the loan rate (%) of high and low rate banks. Figure A.11b 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.11c presents the charge-off rate (%) for high and low rate banks. See Appendix Table A.8 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 (%)	0.22	0.05	0.17***
DepRate (%)	0.16	0.03	0.14***
Insured Deposits Share	0.40	0.51	-0.11***
#Branches	899	4041	-3142***
$\log\left(\frac{\# \text{Branches}}{\text{Deposits}}\right)$	-0.04	0.88	-0.92***
Δ Deposits (%)	0.95	0.98	-0.03
NIM rate (%)	2.65	2.16	0.49***
Maturity (Years)	3.37	5.38	-2.01***
Charge-off Rate (%)	1.65	0.78	0.87***

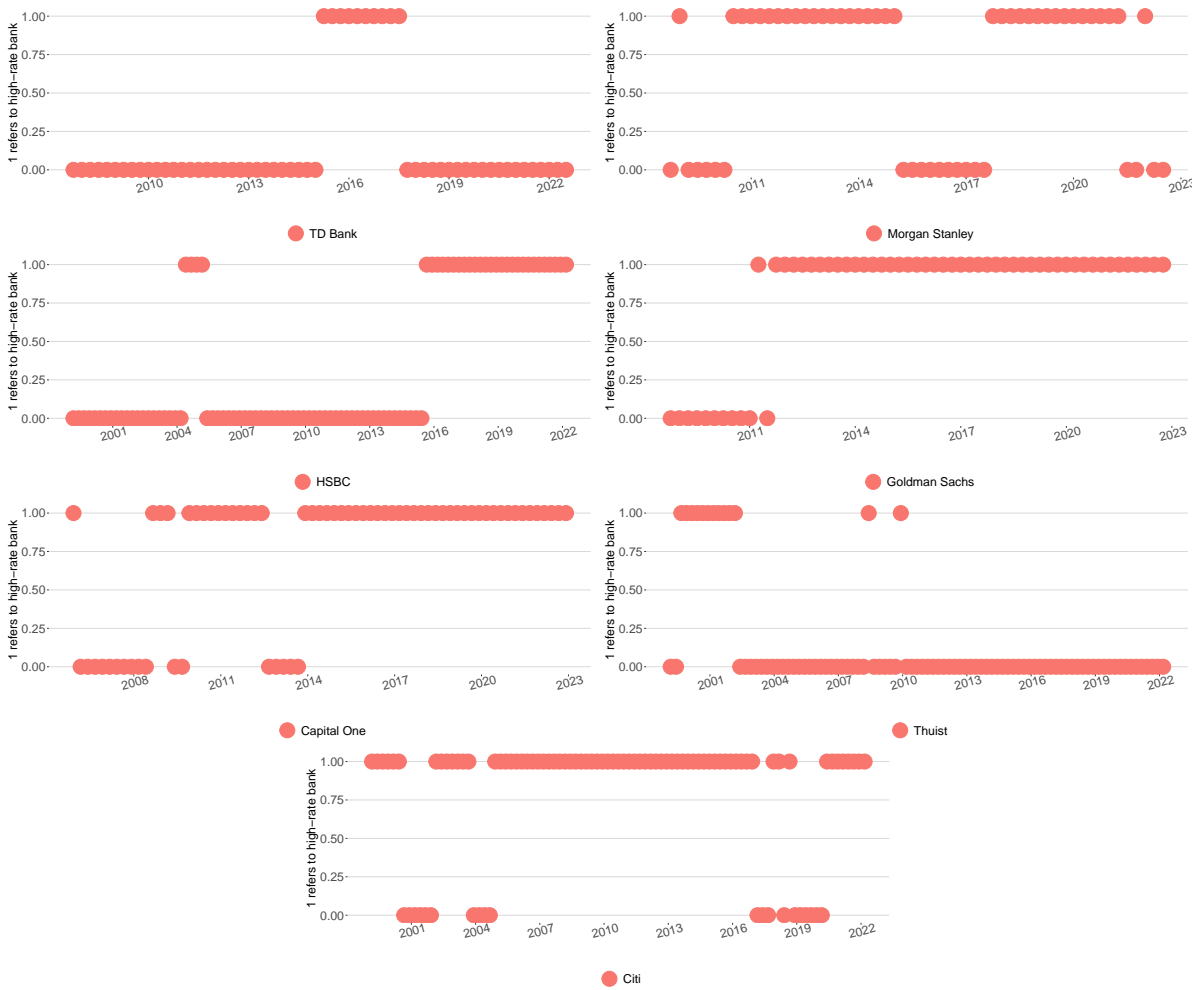
Panel B: Correlation Matrix of Rates

	DepRate	SAV	CD	MM
DepRate	1.000	0.686	0.922	0.844
SAV	0.686	1.000	0.695	0.770
CD	0.922	0.695	1.000	0.857
MM25	0.844	0.770	0.857	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: Deposit Betas (Robustness Check)

	$\Delta\text{Dep. Rate}$	$\Delta\text{Interest Expense}$	$\Delta\text{Interest Income}$	ΔNIM
	(1)	(2)	(3)	(4)
$\Delta\text{FFTar} \times \mathbb{1}(\text{High Rate}) \times \text{Post}$	0.574*** (0.155)	0.213*** (0.040)	0.158** (0.072)	-0.043 (0.048)
$\Delta\text{FFTar} \times \mathbb{1}(\text{High Rate})$	0.010 (0.115)	-0.029 (0.036)	-0.041 (0.070)	-0.032 (0.041)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-0.000 (0.055)	0.002 (0.020)	0.044 (0.047)	0.049 (0.039)
$\mathbb{1}(\text{High Rate})$	-0.011 (0.049)	-0.006 (0.019)	-0.039 (0.046)	-0.040 (0.038)
$\text{ROA}_{i,q-1}$	0.006 (0.008)	-0.009 (0.008)	-0.021 (0.018)	-0.007 (0.016)
$\text{Tier1}_{i,q-1}$	-0.003 (0.007)	0.000 (0.006)	-0.016 (0.012)	-0.015 (0.010)
Quarter FE	✓	✓	✓	✓
Adjusted R^2	0.236	0.026	0.003	0.003
Observations	1800	2219	2219	2219
Mean of Dep. Variable	-0.021	-0.012	-0.021	-0.010

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

$$\begin{aligned}
Y_{i,q} = & \delta_q + \beta_1 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \\
& + \beta_3 \times \Delta\text{FFTar}_q \times \text{Post}_q + \beta_4 \times \Delta\text{FFTar}_q + \beta_5 \times \mathbb{1}_{\text{High Rate},i} \\
& + \beta_6 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_7 \times \text{ROA}_{i,q-1} + \beta_7 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}
\end{aligned}$$

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. See Table A.8 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.4: Deposit Betas (Top 100 Banks)

	Δ Dep. Rate	Δ Interest Expense	Δ Interest Income	Δ NIM
	(1)	(2)	(3)	(4)
Δ FFTar $\times \mathbb{1}(\text{High Rate}) \times \text{Post}$	0.531*** (0.129)	0.250*** (0.065)	0.096 (0.061)	-0.093** (0.040)
Δ FFTar $\times \mathbb{1}(\text{High Rate})$	0.009 (0.074)	-0.089* (0.051)	-0.043 (0.058)	0.005 (0.033)
Δ FFTar	0.598*** (0.054)	0.488*** (0.040)	0.424*** (0.046)	-0.029 (0.031)
Δ FFTar $\times \text{Post}$	-0.451*** (0.099)	-0.209*** (0.048)	0.043 (0.057)	0.231*** (0.038)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-0.004 (0.032)	-0.008 (0.024)	0.028 (0.033)	0.036 (0.026)
$\mathbb{1}(\text{High Rate})$	-0.013 (0.027)	0.001 (0.023)	-0.031 (0.032)	-0.034 (0.025)
Post	-0.059 (0.050)	-0.009 (0.025)	-0.020 (0.032)	-0.010 (0.017)
$ROA_{i,q-1}$	0.032** (0.016)	0.016** (0.007)	-0.002 (0.013)	-0.013 (0.009)
$\text{Tier1}_{i,q-1}$	-0.022* (0.011)	-0.009 (0.007)	-0.022* (0.013)	-0.012 (0.010)
Constant	0.013 (0.046)	-0.020 (0.024)	-0.006 (0.031)	0.007 (0.018)
Adjusted R^2	0.560	0.483	0.245	0.061
Observations	6453	8420	8420	8420
Mean of Dep. Variable	-0.023	-0.015	-0.026	-0.012

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

$$\begin{aligned}
Y_{i,q} = & \alpha + \beta_1 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{FFTar}_q \times \mathbb{1}_{\text{High Rate},i} \\
& + \beta_3 \times \Delta\text{FFTar}_q \times \text{Post}_q + \beta_4 \times \Delta\text{FFTar}_q + \beta_5 \times \mathbb{1}_{\text{High Rate},i} \\
& + \beta_6 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_7 \times ROA_{i,q-1} + \beta_7 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}
\end{aligned}$$

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 $\text{Tier1}_{i,q-1}$ 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 (Δ Dep. Rate $_{i,q}$) in column (1), the change in interest expense (Δ Interest Expense $_{i,q}$) in column (2), the change in net interest income (Δ Interest Income $_{i,q}$) in column (3), and change in NIM (Δ 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. See Table A.8 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: Bank Branches (Top 100 Banks)

	log(# Branches)		log($\frac{\text{Branches}}{\text{Deposit}}$)		Customer Age	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-1.429*** (0.213)	-1.513*** (0.229)	-0.585** (0.249)	-0.682*** (0.254)	-0.307*** (0.077)	-0.180** (0.071)
$\mathbb{1}(\text{High Rate})$	-0.633*** (0.136)	-0.628*** (0.140)	-0.442** (0.223)	-0.485** (0.222)	-0.230*** (0.039)	-0.192*** (0.042)
Post	0.430*** (0.110)		-0.980*** (0.119)		1.864*** (0.214)	
$\text{ROA}_{i,q-1}$	-0.257*** (0.043)	-0.268*** (0.056)	-0.246*** (0.060)	-0.211*** (0.062)	0.004 (0.103)	-0.204*** (0.045)
$\text{Tier1}_{i,q-1}$	0.691*** (0.083)	0.670*** (0.077)	0.041 (0.038)	-0.054 (0.034)	-0.349*** (0.047)	-0.198*** (0.025)
Constant	6.670*** (0.118)		2.149*** (0.104)		37.422*** (0.144)	
Quarter FE		✓		✓		✓
Adjusted R^2	0.210	0.212	0.125	0.072	0.356	0.049
Observations	7293	7293	7293	7293	7293	7293
Mean of Dep. Variable	6.707	6.707	0.935	0.935	38.473	38.473

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

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High Rate},i} + \beta_3 \times \text{ROA}_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

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 $\text{Tier1}_{i,q-1}$ 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 ($\log(\frac{\text{Branches}}{\text{Deposit}})$) in columns 3-4, and the average customer age in columns 5-6. 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. 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.6: Duration Risk (Top 100 Banks)

Panel A: Loans and Securities				
	Maturities (years)		Short-term share (%)	
	(1)		(2)	
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-0.729***		2.185	
	(0.236)		(1.785)	
$\mathbb{1}(\text{High Rate})$	-1.352***		3.020**	
	(0.223)		(1.356)	
Quarter FE + Controls	✓		✓	
Observations	7540		7540	
Mean of Dep. Variable	5.721		47.818	

Panel B: Maturity by Asset Class				
	Real Estate Loans	Other Loans	MBS	Treasuries
	(1)	(2)	(3)	(4)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-0.982***	0.226	-1.600***	-0.805
	(0.314)	(0.144)	(0.531)	(0.578)
$\mathbb{1}(\text{High Rate})$	-1.080***	-0.311**	0.516	-0.543
	(0.244)	(0.132)	(0.525)	(0.504)
Quarter FE + Controls	✓	✓	✓	✓
Observations	7174	7489	7332	7335
Mean of Dep. Variable	11.762	2.075	16.492	5.987

Panel C: Share by Asset Class (%)				
	Real Estate Loans	Other Loans	MBS	Treasuries
	(1)	(2)	(3)	(4)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	-1.398	5.616***	-1.162	-3.056**
	(1.126)	(1.585)	(0.706)	(1.451)
$\mathbb{1}(\text{High Rate})$	-2.473**	3.445***	-5.194***	4.222***
	(1.063)	(1.279)	(0.631)	(1.236)
Quarter FE + Controls	✓	✓	✓	✓
Observations	7540	7540	7540	7540
Mean of Dep. Variable	15.246	59.339	11.494	13.921

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

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High Rate},i} + \beta_3 \times \text{ROA}_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

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 $\text{Tier1}_{i,q-1}$ 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.7: Credit Risk (Top 100 Banks)

Panel A: Loans and Securities				
	Loan Rate	Credit Spread	Charge-offs	
	(1)	(2)	(3)	
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	0.993*** (0.118)	0.963*** (0.155)	0.192** (0.075)	
$\mathbb{1}(\text{High Rate})$	0.535*** (0.094)	0.701*** (0.140)	0.233*** (0.069)	
Quarter FE + Controls	✓	✓	✓	
Adjusted R^2	0.274	0.288	0.060	
Observations	8424	7489	8424	
Mean of Dep. Variable	5.333	3.590	0.852	

Panel B: Charge-off Rates by Asset Class				
	Real Estate Loans	C&I Loans	Personal Loans	Other Loans
	(1)	(2)	(3)	(4)
$\mathbb{1}(\text{High Rate}) \times \text{Post}$	0.032 (0.042)	0.328*** (0.083)	0.249 (0.165)	0.066 (0.057)
$\mathbb{1}(\text{High Rate})$	0.084** (0.033)	-0.004 (0.071)	0.169 (0.138)	-0.049 (0.042)
Quarter FE + Controls	✓	✓	✓	✓
Adjusted R^2	0.040	0.020	0.029	0.000
Observations	8244	8084	8318	7908
Mean of Dep. Variable	0.434	0.654	2.174	0.253

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

$$Y_{i,q} = \delta_q + \beta_1 \times \mathbb{1}_{\text{High Rate},i} \times \text{Post}_q + \beta_2 \times \mathbb{1}_{\text{High Rate},i} + \beta_3 \times \text{ROA}_{i,q-1} + \beta_4 \times \text{Tier1}_{i,q-1} + \varepsilon_{i,q}$$

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 $\text{Tier1}_{i,q-1}$ 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. 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: Construction of Key Variables

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

Notes: We follow the variable definitions from the FDIC's Statistics on Depository Institutions. See [SDI](#).