# Diverging Banking Sector: New Facts and Macro Implications

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**Abstract**

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

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# 1 Introduction

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

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

This paper documents the emergence of these two types of banks and argues that the distribution of deposits across these banks is important to understand the transmission of monetary policy and the ability of the banking sector to engage in maturity transformation as well as liquidity and credit provision. Monetary policy affects this distribution: when rates rise, the rate gap between high and low rate banks widens and deposits migrate to high rate banks. High rate banks lend at much shorter maturities: the average maturity on the asset side for high rate banks is 2.5 years lower than for low rate banks. This shorter asset duration makes sense because high rate banks have effectively shorter duration liabilities. Aside from rate-hiking cycles, there is evidence that the deposits of high rate banks grow faster, though with a relatively short time series this trend is harder to detect. If deposits continually move toward high rate banks in the future, the banking sectors ability to absorb interest rate risk will substantially change.[1]

Part of the observed emergence in this heterogeneity has come from the emergence of high rate banks. However, a large part comes from low rate banks' deposit rates being even *less* sensitive to interest rate changes than they used to be. For example, the low rate banks

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

used to have a deposit beta of around 0.5, and this number has fallen to around 0.1 for the 2018 and 2022 rate hiking cycles. That is, for every 100 bps increase in the Fed funds rate, low rate banks pass along 10 bps to depositors vs. 50 bps before. We show that low rate banks have actually increased the duration of their assets over time – in line with their liabilities acting even more like fixed rate debt.

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

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

As deposits flow from low rate to high rate banks, this changes the capacity of the ag-

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

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

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

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

### Related Literature

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

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

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

Lastly, our paper contributes to our understanding of banks' evolving business models. We show that the alignment of more rate-sensitive borrowers with high rate banks and less rate-sensitive borrowers with low rate banks leads to distinct asset management approaches for these banks. Specifically, we show that when interest rates rise, high rate banks assume greater credit risk while low rate banks assume more maturity 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 Motivating Fact: Divergence in Deposit Rates

This section documents a salient pattern in bank liabilities over the past decade: the increasing dispersion of deposit rates. Prior to the 2008 financial crisis, deposit rates exhibited a unimodal distribution, characterized by similar mean and median values. However, the subsequent period has witnessed a significant shift. Today, deposit rates follow a bimodal distribution, with distinct peaks. Our study concentrates on the 25 largest banks by asset size, given their substantial impact on the banking industry. These banks together account for nearly 70% of the total assets in the sector, as shown in Appendix Figure B.1.[3]

We begin by documenting the heterogeneity in deposit rates across banks. We focus on two interest rates: the 12-month certificates of deposit (12MCD10K") – the most widely offered deposit product from the RateWatch database – and the interest expense rate on deposits (DepRate"), calculated using data from the Call Report. Figure 1 illustrates the dispersion of bank deposit rates at the peak of three rate cycles.[4] In 2007Q3, deposit rates exhibited a unimodal distribution, with similar mean and median values.[5] However, subsequent rate hikes (2019Q1 and 2023Q1) witnessed a shift towards bimodality with diverging mean and median values. We quantify the growing divergence in deposit rates through comparison of the dispersion and asymmetry of distributions across rate hiking cycles. From 2007Q3 to 2023Q1, both standard deviation and skewness of the 12MCD10K distribution tripled.[6] We demonstrate the robustness of these patterns by extending the sample period to 1993Q1 and considering all banks in Appendix Figure B.2.

While the distributions show a clear divergence in deposit rates across banks, its impact on the banking system remains uncertain. A potential concern is whether the variation in rates represents a systemic shift or is influenced by small banks offering very high rates. To explore this, we examine the top 25 banks by categorizing their assets based on deposit rates relative to the sample median: below 0.75 times, between 0.75 and 1.25 times, and above 1.25 times. Figure 2 illustrates a significant shift in the distribution of banks' asset shares. Before

[3]Although our study focuses on the top 25 banks, we validate the consistency of our findings across the largest 100 banks, which collectively command over 80% of the market share. This approach reinforces the broader applicability and generalizability of our conclusions throughout the paper.

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

[5]In 2007Q3, the average Federal Fund rate was 5.18%. Among the top 25 banks, the average 12MCD10K rate was 4.08%, with a corresponding median of 4.06%; and the average DepRate was 3.29%, with a corresponding median of 3.21%.

[6]The standard deviation of 12MCD10K was 0.63 in 2007Q3 and increased to 1.94 in 2023Q1. The skewness was 0.25 in 2007Q3 and rose to 0.69 in 2023Q1.

the 2007Q3 crisis, based on the 12MCD10K classification, 84% of bank assets were associated with rates offered near the median. By 2023Q3, the situation had drastically shifted: 45% of assets were connected to rates offered below 0.75 times the median, and 48% corresponded to rates exceeding 1.25 times the median.

## 3 Endogenous Emergence of a Diverging Banking Sector: A Simple Framework

What drives the divergence in rate offering in the banking sector? How does this divergence impact banks' management of their assets and liabilities? We propose that the emergence of e-banking services, which allow banks to serve customers without physical branches, may underpin the observed divergence in rate offerings.

We present a static model, building upon the framework established by Salop (1979) and Allen and Gale (2004). This model internalizes the strategic choices banks face regarding the operation of physical branches, the setting of deposit rates to entice depositors, and risk choices in lending activities. Crucially, the model also integrates the endogenous adoption of e-banking by banks, as technological advancements make these options feasible. The model not only rationalizes the *endogenous* emergence of a divergent banking sector, but also yields various predictions regarding banks' decisions on branching and risk in lending, guiding our empirical analyses.

### 3.1 Without e-Banking Services

We examine an economic framework featuring two competing banks, labeled as $A$ and $B$, which compete for depositors and extend loans to risky projects. This study assumes that before the advent of e-banking services, the existence of physical branches were crucial in attracting depositors.[7]

**Depositors** These depositors are uniformly distributed around the circle, whose circumference is normalized to be one. Let $s \in [0, 1)$ be the location of a depositor. Every depositor has one dollar and faces a decision regarding the choice of bank for their deposit. The depositors' utility are influenced by two primary factors: the deposit rates offered by the banks and the proximity of the bank to their location:

$$U_i(j) = r_j + \eta(1/2 - d_{i,j})\mathbb{1}(\text{Branch}_j) \quad \forall j \in \{A, B\},$$

where $r_j$ is the deposit rate offered by bank $j$, $d_{i,j}$ represents the distance from depositor $i$ to bank $j$, and $\eta$ presents utility derived from branch services. Depositor $i$ chooses bank $A$ if $U_i(A) > U_i(B)$.

[7] We have deliberately streamlined the model to include only the essential components, ensuring a focused examination of the underlying economic dynamics at play.

**Banks** Two banks choose to situate their branches on a circular layout. To streamline our analysis, we restrict each bank to establishing just one branch, subjecting to a marginal cost per branch ($\kappa$), which includes costs like office rental fees, payable upfront.[8] By operating a local branch, banks set the deposit rate $r_j$ to attract depositors and also decide on the risk level associated with their loan portfolios, represented by a return $L_j$.

Following Allen and Gale (2004), we model the return on a risky loan portfolio using a two-point distribution: it yields a return of $L_j = f + l_j$ with probability $p(l_j)$, and a default return of zero with a probability with a probability $1 - p(l_j)$. Here, $f$ signifies the Federal Funds rate, while $l_j$ represents the risk premium. For simplicity, we assume $p(l_j) = 1 - l_j$ for $l_j \in [0, 1]$, ensuring that as the risk premium $l_j$ increases, the likelihood of achieving the expected return decreases.

Banks' objective is to maximize the following profit function:

$$\max_{l_j, r_j} \; p(l_j)(f + l_j - r_j)D_j - \kappa \mathbb{1}(\text{Branch}_j), \tag{1}$$

where $D_j$ is the amount of depositors choosing bank $j$. Banks encounter two trade-offs. Firstly, offering a higher deposit rate enables a bank to attract more deposits from competitors, yet this approach results in a reduced deposit spread. Secondly, while taking more risk yields a greater risk premium, it concurrently elevates the bank's exposure to the risk of default.[9]

**Results** Given the symmetry of two banks, they position their branches equidistantly around a circle. The unique solution is characterized as below:[10]

$$r_A = r_B = r^* = f + l^* - \eta/2, \quad l_A = l_B = l^* = 1 - \frac{\eta}{2}.$$

Depositors' preference for the geographical proximity of bank branches enables banks to impose a markup of $\frac{\eta}{2}$ on their deposit services. Importantly, equilibrium risk raking $l^*$ inversely correlates with $\eta$, suggesting banks tend to assume lower risks as the deposit markup charged increases. The rationale behind this is that the markup earned on the banks' liabilities side is an almost guaranteed return. When such a return is high, banks are less inclined to pursue risky projects that expose them to default risk.

The markup also helps cover the costs associated with operating branches, resulting in the equilibrium profits for Bank A and Bank B being equal to

$$Prof_A = Prof_B = \frac{\eta^2}{8} - \kappa.$$

[8] To simplify the analysis, we assume an upfront marginal cost per branch. If this cost were assumed to be paid ex-post, it would link it to the banks' survival probabilities, thereby complicating the analysis, especially in scenarios involving asymmetric cases and the presence of e-banking. Furthermore, we believe that the upfront cost assumption accurately reflects the fixed costs associated with branch maintenance per period.

[9] We assume that deposits are insured by the FDIC, thereby providing depositors with a consistent incentive to deposit their capital.

[10] The proof is in Appendix A.1.

We assume that $\frac{\eta^2}{8} - \kappa \geq 0$ ensuring that the equilibrium scenario involves both banks operating branches.

In summary, before the emergence of e-banking, banks were relatively homogeneous, providing similar deposit rates below the Federal funds rate and exhibiting similar levels of risk-taking.

### 3.2 With e-Banking Services

The advent of e-banking services revolutionized banking by allowing them to cater to depositors without being limited by geographical boundaries. We assume depositors gain a utility, represented as $\gamma$, from the convenience of e-banking services offered:

$$V_i(j) = r_j + \eta(1/2 - d_{i,j})\mathbb{1}(\text{Branch}_j) + \gamma\mathbb{1}(\text{E-Banking}_j) \quad \forall j \in \{A, B\}.$$

As banking services are not solely reliant on physical branches, banks are presented with three strategic choices: maintaining existing branches, adopting e-banking services only, or combining both. Then, the banks' objective function is revised to reflect this modification:

$$\max_{l_j, r_j, b_j, e_j} p(l_j)\left(f + l_j - r_j\right)D_j - \kappa\mathbb{1}(b_j) \tag{2}$$

where $b_j$ = Branch if bank $j$ decides to keep branches open, and $e_j$ = E-Banking if bank $j$ offers e-banking services. Under this set-up, we solve the banks' optimal strategies at the Nash Equilibrium, as outlined in Theorem 3.1.

**Theorem 3.1.** *After e-banking service is available, two potential market structures can emerge:*

- *If $\kappa > \frac{109\eta^2}{1000}$, diverging banking sector emerges. The following case and its symmetric case are Nash equilibria.*

| | $b_j$ | $e_j$ | $r_j$ | $l_j$ |
|---|---|---|---|---|
| A | Branch | E-banking | $r^* + \frac{2\eta}{5}$ | $l^* + \frac{2\eta}{10}$ |
| B | - | E-banking | $r^* + \frac{3\eta}{5}$ | $l^* + \frac{3\eta}{10}$ |

- *If $\kappa < \frac{109\eta^2}{1000}$, no diverging pattern emerges. Both banks offer a combination of branch services and e-banking services.*

The above results show that when operating branches is relatively costly, a diverging banking sector endogenously emerges in the e-banking era. One type of banks offer *both branch and e-banking services*, whereas the other only offer *e-banking exclusively*.[11] The specialized business models affect how banks manage their liabilities and assets. Local branches provide a

[11] We also extend to include the marginal cost associated with e-banking to the model. Once this marginal cost is smaller than $\gamma$, depositors' utility gain from e-banking, the results conform our simplified model. Otherwise, the diverging banks sector is composed by banks that operate exclusively through physical branches and those that solely offer e-banking services. Banks that maintain physical branches offer lower deposit rates and allocate their resources to safer loan portfolios. In contrast, banks focusing solely on e-banking provide higher deposit rates and pursue riskier loan portfolios, mirroring the dynamics observed in the simplified model.

competitive advantage in attracting customers concerned about geographical proximity, allowing banks with branches to offer lower deposit rates. This ensures a substantial rent for these banks, prompting them to minimize default risk by selecting loan portfolios that are comparatively safer, albeit yielding lower returns. Conversely, e-banking-only banks need to provide higher deposit rates to attract depositors, leading to a narrow deposit spread. Consequently, they opt for riskier loan portfolios that promise higher returns to maximize profits.

**Empirical predictions** In the e-banking era, two distinct banking business models emerge: 1) banks that maintain branches tend to offer lower deposit rates and focus on investing in safer assets; 2) banks that close their branches provide higher deposit rates and channel their investments into riskier assets.

**Discussion of model limitations** Given that our model is static, it does not offer predictions regarding maturity transformation. Nonetheless, drawing on the arguments made by Drechsler, Savov and Schnabl (2021) that banks hedge against the stable franchise value of branches by investing in longer maturity assets, we can infer that banks that maintain branches are likely to invest in assets with longer maturity. Conversely, banks primarily focused on e-banking invest assets with shorter maturity. Moreover, our model does not consider the dynamic market structure within the banking sector. Jiang, Yu and Zhang (2022) show that digital disruption leads to an influx of new, e-banking-centric banks, intensifying competition within that segment. Concurrently, incumbent banks with branches may gain market power as competitors close their branches. In such a scenario, the dispersion in deposit rates and risk-taking between branch-dependent banks and e-banking-focused banks is likely to be accentuated.

## 4 Data and Methodology

In this section, we first describe the data and methodology used in our analysis. Our sample spans 2001Q1 through 2023Q3. Our sample period covers three rate hiking cycles: 2004Q1-2009Q1, 2015Q2-2020Q2, and 2021Q4-2023Q3.

### 4.1 Data

***Bank data.*** We collect quarterly 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. We utilize this data spanning from 2001Q1 to 2023Q3 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 on all FDIC-insured institutions on a quarterly basis. The details of the variables are listed in Table B.10.

***Deposit rates.*** We source weekly surveyed deposit rate data from the RateWatch database, provided by S&P Global, covering the period from January 2001 to March 2023.[12] 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 capacity to promptly reflect banks' rate-setting choices.[13] To eliminate potential biases from misreporting, we first calculate the average 12MCD10K rate for each branch. We then aggregate this at the bank-quarter level by averaging across the various branches within each bank holding company (BHC).[14]

***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 bank customers, we use the US Census county-level data and data from the FDIC Survey of Consumer Use of Banking and Financial Services. Specifically, we use US Census data to compute the average customer age for each bank by weighting the average age in a county based on the number of branches in each county every quarter. 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 e-banking. The survey was bi-annual conducted from 2009, and we use data from the 2013, 2015, 2017, and 2019 waves.

## 4.2 Methodology

Our conceptual framework suggests that the rise of e-banking has led to the endogenous emergence of two distinct banking models in the industry. We utilize this framework to guide our empirical analysis, which documents this divergence in banks' business models and balance sheets. It's important to clarify that our analysis doesn't claim a causal evidence between the advent of e-banking and these transformations. However, we will present evidence that aligns with this perspective.

The model predicts the emergence of two bank types, differentiating primarily in three aspects: (1) the provision of branch services, (2) the the rates offered on deposits, and (3) the interest rates and risk profiles associated with their loan portfolios. We utilize deposit rates as the primary basis for classifying banks. Deposit rates are frequently updated, providing a readily observable and timely measure for bank classification. For simplicity, we refer to the two types of banks as "high rate" and "low rate" banks. This classification allows us to

[12] While this data is collated weekly, it is important to highlight that banks contribute this information on a voluntary basis.

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

[14] Appendix Table B.3 indicates that deposit rates are primarily determined at the BHC level. BHC fixed effects alone explain as much, or even more of the variation in deposit rates compared to bank-level fixed effects.

examine how banks with higher deposit rates employ distinct strategies in managing their branches and balance sheet.

The empirical strategy employed resembles a difference-in-differences (DiD) design. Figure 2 shows the emergence of two distinct bank types, distinguished by deposit rates, starting from 2009, which we use as our cut-off point. Our baseline empirical specification is the following:

$$Y_{i,q} = \delta_q + \beta \cdot \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \cdot \mathbb{1}_{\text{High rate},i} + \text{Controls}_{i,q-1} + \varepsilon_{i,q}. \quad (3)$$

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-2009 period. We include two control variables, the return on assets and the Tier 1 capital ratio from the previous quarter. Moreover, we weight each observation by the asset size from the preceding quarter, ensuring that the estimated effect reflects the designated bank type. We use Driscoll-Kraay standard errors, clustering at the quarterly frequency to account for heteroskedasticity, cross-sectional dependence, and autocorrelation (4 quarter lags).

The $\beta$ coefficient captures the divergence in $Y_{i,q}$ between the two bank types after 2009, compared to the pre-2009 period. Importantly, $\beta$ alone does not identify which bank type is the primary driver of this divergence, as both are expected to adjust their strategies according to our model. To illustrate the changes in $Y_{i,q}$, we utilize time-series plots that aggregate the balance sheet of banks within each category.

### 4.3 Classification of High and Low Rate Banks

We follow a two-stage process to classify banks based on their deposit rate behavior. In the first stage, we identify the 25 largest banks each quarter based on their total assets as of the previous quarter.[15] We then rank banks quarterly based on both the 12MCD10K and DepRate rates. This multi-source approach mitigates the limitations inherent in each individual measure. While DepRate offers a direct and comprehensive measure of deposit rates paid by banks, it may be slow to adjust. Conversely, 12MCD10K provides more immediate insights into banks' pricing strategies but is limited to a specific product category and may be susceptible to missing data due to potential self-reporting issues. To incorporate rate information from both sources, we employ a weighted rank method. We first calculate a one-year rolling average of the 12MCD10K rate and the DepRate for each bank. We then rank banks using each rate separately. Due to missing observations in 12MCD10K, we standardize them based on the number of observations each quarter, to ensure standardized ranks fall within the same range (0 to 1). We then take an average of the 12MCD10K and DepRate rankings. Lastly, we rerank the banks based on their average deposit rate to produce a combined ranking.[16]

[15] Panel B of Table 1 demonstrates that the distributions of 12MCD10K and DepRate rates are comparable across the analyzed periods.

[16] For illustration, consider the case with three banks: A, B, and C where A offers the highest rate and C offers the lowest rate. B does not report their 12MCD10K. Consequently, based on DepRate alone, their standardized ranking would be is 1/3 (A), 2/3 (B), and 3/3 (C). Based on 12MCD10K (available for A and C only), the standardized ranking is 1/2 (A) and 2/2 (C), respectively. We take an average of the two rankings and produce an average ranking of 5/12 (A), 2/3 (B), and 3/3 (C). Finally, we rerank them based on the averages: A (1), B (2), C (3).

We classify banks using their combined rate rank, taking into account the skewed distribution observed in Figure 1, which shows a smaller number of high rate banks relative to low rate banks. To capture this asymmetry, we define banks ranked in the top quartile as high rate banks and the rest as low rate banks. Moreover, to prevent frequent classification changes due to short-term variations, we apply a stability criterion: banks identified as high rate in over 90% of the analyzed quarters retain this classification throughout the sample period. This ensures consistent bank categorization and avoids misinterpretations based on temporary fluctuations. Detailed classifications for a select group of banks are provided in Appendix Table B.2.

Panel A of Table 1 compares key characteristics of high rate and low rate banks across two periods: 2001-2008 and 2017-2023.[17] Before 2009, high rate banks typically operated fewer branches and held assets with longer maturities compared to low-rate banks. However, after 2009, the gap between the two bank types in these aspects widened further. High rate banks also exhibited significantly higher net interest margins (NIMs) and charge-off rates during this period. Notably, the share of insured deposits remained relatively stable for both types of banks throughout the sample period.

# 5 Diverging Banking Sector

This section examines the growing divide within the banking industry, focusing on the disparity in deposit rates offered by different banks. We investigate the potential link between banks' branch network and deposit rates. We show that low rate banks maintain larger branch networks. This strategy allows low rate banks to cater to customer preferences for geographic proximity. Conversely, high rate banks, with their smaller branch networks and lower operational costs, are incentivized to offer higher deposit rates to attract customers.

We further demonstrate that banks with different liability structures manage their asset portfolios differently. Banks with higher funding costs (high rate banks) seek riskier, shorter-term investments to manage their narrower interest spreads. On the other hand, lower funding costs (low rate banks) allow for longer-term, lower-risk investments. Lastly, we explore alternative explanations that may potentially explain our findings.

## 5.1 Diverging Rate-Setting Behaviors

We validate our classification over time by analyzing the rate behavior of high and low-rate banks in Figure 4. Figure 4a presents the time series of average deposit rates for each of the two groups. We find that the high and low rate banks exhibited remarkably similar deposit rates in the monetary policy cycle before 2009, featuring a relatively consistent and narrow rate differential between the two groups. Importantly, Figure 4b reveals no significant difference in sensitivity to the Federal Funds Rate ("Fed funds rate") during this period, suggesting both groups respond similarly to interest rate changes. However, a dramatic shift occurs starting with the second rate hiking episode of our sample period from 2015Q2. During this period, high rate banks actively raise rates in response to rising interest rates, while low

[17] A similar analysis for the 2009-2016 period is presented in Appendix Table B.1.

rate banks remain largely stagnant. This leads to a considerable disparity between the two groups. Figure 4c further illustrates this shift for individual banks. Notably, under the new banking regime, 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 positioned among the high rate banks. We show that these findings are robust to an expanded set of the 100 largest banks in Appendix Figure B.4.

### 5.2 Diverging Branches

What explains the divergence in deposit rates? We show that the recent widening gap in deposit rates appears to be linked to a divergence in branch networks between high rate and low rate banks.

We start by showing the dispersion of the branch-to-deposits ratio over the peaks of three rate cycles in 2007Q3, 2019Q1, and 2022Q2, see Figure 3.[18] A higher branch-to-deposits ratio may suggest that a bank has more branches relative to its deposit size, potentially indicating a broader physical presence and possibly higher operating costs. Conversely, a lower ratio implies a lesser reliance on physical branches to raise deposits. Similar to Figure 1, we also see a widening gap in branch utilization across banks. The dispersion of the branch-to-deposits ratio across three rate cycles has significantly increased, implying that banks are increasingly divergent in their branch strategies.

We then directly examine differences in banks' branching strategies. Figure 8 compares the branches operated by high and low rate banks. 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. Second, while the number of branches remains relatively stable for low rate banks over the entire period, high rate banks experience over 86% decline in the number of branches in the post-2009 era.[19] To address concerns that branch closures by high rate banks might be driven by deposit withdrawals, we additionally analyze the logged ratio of branches to inflation-adjusted deposits. Figure 8b exhibits that while the branch deposit ratio has fallen for both low rate and high rate banks, indicating overall greater utilization of a bank's branch network, it has fallen at a much steeper rate for high rate banks, dropping by 90% over our sample period.

These changes are in line with our hypothesis that low rate banks prioritize maintaining branch networks, while high rate banks are shifting towards providing primarily e-banking services. For instance, high rate banks like Ally and Marcus have a limited number of branches, whereas major low rate banks such as JP Morgan, Bank of America, and Wells Fargo maintain a relatively stable number of branches. However, it is worth noting that all 25 banks in our sam-

[18] To ensure that the results are not influenced by banks primarily engaged in businesses other than retail deposits, we limit our analysis to banks with more than 15 branches (the sample average is 1,214). This restriction excludes Charles Schwab, J.P. Morgan & Co (before 2000), State Street, Merrill Lynch, Morgan Stanley, Bank of New York Mellon, Goldman Sachs, Ally Financial, and ING. The first seven of these banks focus on broker or investment banking, while the latter two are newer FinTech banks. For a broader view, Appendix Figure B.12 includes density plots without these exclusions. Further, we show that our findings are robust to an expanded sample of all banks over an extended time horizon from 1994Q4 in Appendix Figure B.12.

[19] We estimate the percentage changes from the log-level estimates using: $e^{-\beta} - 1$. A logarithmic change of -2 implies $e^{-2} - 1 = -0.86$.

ple offer e-banking services like mobile and online banking. The reliance of banks' business models on physical branches is the key determinant of this change.

Moreover, e-banks appear to cater to distinct customer demographics. We find that high rate banks tend to locate their smaller number of branches in demographically younger counties. Figure 8c shows the time series of the average age of populations in areas with high rate and low rate bank branches, indicating a diverging trend after 2009. Prior to 2009, both bank types operated branches in areas with similar average population ages. However, high rate banks are increasingly concentrating their branches in regions with an average population roughly two years younger than those served by low rate banks. We further analyze the target clientele of branch-based banks and mobile banks in Appendix Figure B.13 using FDIC Survey of Consumer Use of Banking and Financial Services. We find that physical branches tend to attract a clientele that is older, less educated, and has a lower income compared to mobile banking users.[20]

While the figures illustrate clear time-series trends, they cannot definitively establish the statistical significance of the divergence or rule out systemic changes within the banking sector. To address these limitations, we employ a regression analysis based on Equation (3) and present the results in Table 2. Consistent with the trends observed above, we find that high rate banks report almost a 65% to 66% additional reduction in the number of branches, a 38% to 42% additional decline in the branch deposit ratio, and a 1.47% additional decline in the average age after 2009, in comparison to low rate banks.[21] 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 Figure B.11 and Appendix Table B.7.

Thus far, our analysis may raise concerns that the observed trends could be driven by two key factors: (1) within-bank changes, and (2) compositional changes. Specifically, the observed patterns may be driven by changes within individual banks, such as branch closures, or by shifts in the composition of banks within each group. Comparing our findings in Table 2 to an expanded sample of the largest 100 banks in Appendix Table C.3 reveals that the observed trends are influenced by changes within individual banks as well as compositional changes across banks.

### 5.3 Diverging Asset Management

With different liability structures, banks may adopt distinct asset management strategies. To understand this, we first compare the average earning yields by high rate and low rate banks throughout our sample period. We then decompose the earning yields into two key components: credit spread and term structure spread. This decomposition allows us to

[20] From 2012 and 2018, the average age of households using physical branches increases by 2.77 years (4.92%), while the average age of households using mobile banks increases by 1.46 years (3.65%) over the same period. The average income of households using physical branches also increases by \$5.29K (11.63%), compared to \$9.96K (17.23%) for households using e-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 e-banking.

[21] We compute these changes in columns 1-4 using: $e^{-\beta} - 1$. In columns 5-6, we estimate the coefficient as a percent of the mean of the dependent variable.

investigate the specific types of risks that high rate and low rate banks tend to concentrate on in their investment portfolios.

#### 5.3.1 Net Interest Margin

Thus far, we have established that high rate banks offer higher deposit rates compared to low rate banks. Assuming both types of banks maintain identical portfolios, all else being equal, this would lead to lower net interest margin (NIM) for high rate banks. We compare the changes in interest expense, interest income and NIM for high rate and low rate banks throughout our sample in Figure 6.

Figure 6a exhibits a consistent difference in interest expense, with high rate banks incurring significantly higher costs throughout the sample period. This gap widens during the recent two rate hike cycles, but the increase is not as pronounced as compared to Figure 4.[22] Similarly, Figure 6b demonstrates that prior to 2009, both categories of banks generate comparable levels of interest income. However, a significant divergence emerges after 2009. Consequently, the NIM which represents the difference between interest income and interest expense, does not decline for high rate banks. In contrast, Figure 6c reveals a diverging pattern in NIM between the two banks, with high rate banks maintaining a roughly 50 basis-point advantage. These patterns suggest that high rate banks tilt their portfolio towards higher-yielding assets.

There are two primary strategies through which banks can achieve higher interest income: taking on more credit risk or investing in longer-maturity assets to capture the term premium. The following sections delve into how high rate and low rate banks differentially manage their credit risk and maturity risk exposures.

#### 5.3.2 Credit Risk

A bank's assets typically comprise securities and loans. However, credit risk is primarily associated with loan portfolios, as securities like treasuries and mortgage-backed securities (MBSs) often benefit from government backing. Therefore, we focus on loan portfolios to analyze the risk-taking behavior of the two bank types.

Consistent with the observed pattern in interest income, our analysis reveals a similar divergence in loan rates across banks in Figure 10a. Both low rate and high rate banks report similar loan rates, ranging between 6% and 8% before 2009. Following this period, the lending rate of high rate banks remains stable, while those of low rate banks decreases to a range of 4% to 6%. By the end of our sample, high rate banks charge loan rates of 10% compared to 6% for low rate banks. This divergence pattern is further supported by the results in column (1) of Panel A in Table 6, as per the regression model specified in Equation 3.

To calculate the credit spread in loans, we subtract the term spread from the loan rate. The term spread is itself derived from the yields of maturity-matched Treasury bonds. This

[22] In addition to the interest paid on deposits, interest expense also encompasses wholesale funding costs, as well as interest paid on bonds or other debt securities. This provides a more complete picture of the overall cost of funds for a bank, as it captures borrowings from various sources, not just customer deposits. As interest accrues over time and payments are spread out, the pattern of interest expenses tends to change more gradually compared to the 12MCD10K rate. Therefore, the resulting divergence in patterns is less pronounced.

helps isolate the portion of the loan rate that reflects the borrower's creditworthiness, or credit risk premium. Figure 10b illustrates the evolution of credit spreads over time for two types of banks. Analogous to loan rates, we observe a significant divergence in credit spreads after 2009, exceeding 200 basis points by the end of the sample. Column 2 of Panel A in Table 6 further supports this finding, indicating a 35% greater increase in credit spreads for high-rate banks compared to low-rate banks after 2009. This implies that high rate banks predominantly generate a spread from riskier lending activities, as opposed to capturing a term premium, in contrast to low rate banks.

As high rate banks assume higher credit risk, it suggests that the risk of borrower default is higher. This elevated risk can lead to portfolio losses, which are reflected in the charge-off rate. The charge-off rate represents the percentage of loans or credit accounts that the bank deems as noncollectable and removes from its books as losses. It is an indicator of the credit quality of the bank's portfolio and reflects the proportion of loans that the banks expects will not be repaid by borrowers. Figure 10c compares the charge-off rate for high rate and low rate banks. Consistent with the previous findings, we observe that generally, the charge-off rate for high rate banks is higher than the charge-off rate for low rate banks. Towards the end of the sample period, we discover that high rate banks report a charge-off rate that is more than double that of low rate banks. We observe a similar magnitude in column 3 of Panel A in Table 6. This finding provides additional evidence supporting our hypothesis that high rate banks amplify their exposure to credit risk compared to low rate banks.

#### 5.3.3 Maturity Risk

Next, we investigate whether the observed divergence in deposit rates affects their maturity risk exposures. High rate banks, aiming to boost asset yields, may invest in longer-maturity assets. However, this strategy could expose them to significant interest rate risk due to potential maturity mismatches within their balance sheets (Drechsler, Savov and Schnabl (2021)). Banks often employ duration matching to mitigate interest rate risk by aligning the average maturities of their assets and liabilities. Figure 9 compares the maturity profiles of high rate and low rate banks, encompassing both securities and loans to assess potential differences in their exposure to maturity risk.

Figure 9a shows the average maturity in years of assets held by high rate banks and low rate banks. In the pre-crisis period, the average maturity of assets in low rate banks is around 6 years, which is 50% longer than the 4-year maturity reported by high rate banks. After 2009, the average maturity of assets in low rate banks gradually increases to almost 8 years, representing a 33% increase. In contrast, the average maturity of assets held in high rate banks remains around 4 years. Thus, by the end of our sample in 2023, the average maturity of assets held in low rate banks is twice as large as that in high rate banks. Similarly, we compare the share of short-term assets – the proportion of a bank's assets that mature within one year – and find that high rate banks report a higher share of short-term assets than low rate banks in Figure 9b. 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 35-40% by the end of our sample in 2023.

Panel A of Table 5 tests the significance of divergence in maturity of assets across two types of banks. Before 2009, we observe that high rate banks, hold assets with 30% shorter maturities and a 13% larger share of short-term assets, on average, compared to low rate banks. However, focusing specifically after 2009, we find that high rate banks maintain loans and securities with an additional 12% lower average maturity and a 6% higher share of short-term assets than low rate banks. These findings indicate that low rate banks hold longer-maturity assets, relative to their high rate counterparts.

Collectively, our findings suggest contrasting risk-taking behavior between low rate and high rate banks. We find that low rate banks opt for safe, long-term investments. This aligns with our key conjecture that low rate banks, benefiting from a large spread from depositors, choose a safer asset portfolio to minimize default risk. These banks also hedge their franchise value against fluctuations by investing in long maturity assets. Conversely, high rate banks, which operate with a narrower margin from depositors remain cautious of interest rate risk. As a result, high rate banks favor investments with higher credit risk but shorter maturities. In the following section, we explore the specific asset categories banks employ to meet their strategic needs.

#### 5.3.4 Decomposition of Maturity and Credit Risks

In this section, we take a closer look at the portfolio holdings of high rate banks and low rate banks to examine how their strategies differ in managing maturity risk and credit risk.

We begin by categorizing bank assets into four key classes: treasury securities, mortgage-backed securities (MBS), real estate loans, and other loans. MBS exhibit the longest maturity, exceeding 15 years, followed by real estate loans with a maturity of around 10 years, treasuries with a 5-year maturity, and other loans with an average maturity of approximately 2 years.

Banks can adjust their asset maturity profile in two ways: by altering the composition of different asset classes within their portfolios and by investing in longer-maturity assets within each class. We first examine how the composition of asset classes has changed over time. Figure 11a shows low rate banks maintain a significantly larger share of MBSs and real estate loans. Conversely, high-rate banks invest only half as much in these longer-maturity assets, opting instead for a larger proportion of shorter-maturity instruments like other loans and treasuries.[23] Panel B of Table 5 quantifies the effects. Specifically, the share of other loans in high rate banks increases by an additional 8% after 2009. This significant shift in portfolio composition towards shorter-maturity asset contributes to the lower average maturity observed in high rate banks, as discussed earlier.

Figure 11b further dissects the dynamics of the maturities associated with each asset class for high rate banks and low rate banks. We observe that high rate banks generally maintain shorter-maturity real estate loans, other loans, and treasuries. However, after 2009, we notice greater disparities in the maturity of MBSs and treasuries between high rate and low rate

[23] Upon disaggregating the category of other loans in Appendix Figure B.14 into credit card loans, automobile loans, commercial and industrial loans, home equity loans, loans to financial firms, real estate adjustable loans, and revolving credit, we find that high rate banks engage in over 2.5 times the volume of credit card lending compared to low rate banks, further highlighting their focus on shorter-term instruments.

banks. Panel C of Table 5 corroborates this finding. Specifically, Columns (3) and (4) indicate that high rate banks hold MBS with an additional 6% shorter maturity and treasuries with 30% shorter maturities after 2009.

Our findings suggest that the divergence in asset maturity between high rate and low rate banks stems from two key factors: changes in portfolio composition and adjustments within individual asset classes. High rate banks demonstrably hold shorter-maturity assets across the board, contributing to their lower overall maturity profile compared to low rate banks. However, this preference for shorter maturities comes at the cost of increased credit risk. Next, we investigate how high-rate banks adjust their loan portfolios to achieve higher yields despite this inherent risk.

Panel B of Table 6 breaks down the charge-off rate to better understand the specific asset classes where high rate banks concentrate their credit risk. We find that high rate banks typically assume a significant amount of credit risk in personal lending relative to low rate banks. High rate banks face a 24% higher charge-off rate on personal loans compared to low rate banks.[24] Notably, the post-2009 era further amplifies this difference, with high rate banks experiencing increased charge-off rates across various asset classes: 50% higher for real estate, 35% higher for C&I loans, and 26% higher for personal loans, compared to low rate banks. These findings suggest that high rate banks' preference for specific asset classes, while potentially mitigating interest rate risk, exposes them to potentially higher credit risk.

We demonstrate the robustness of our key findings in an expanded sample comprising the 100 largest banks in Appendix Figure B.15, Appendix Figure B.16, Appendix Table B.8 and Appendix Table B.9.[25] Overall, our findings indicate that low rate banks and high rate banks exhibit contrasting risk dynamics. In the post-2009 era, low rate banks increasingly assume more maturity risk, while high rate banks increasingly take on more credit risk. This divergence in risk appetite is reflected in their respective asset management strategies, with high rate banks specializing in short-term floating-rate loans and securities, and low rate banks favoring more long-term fixed rate loans and securities.

## 6 Macroeconomic Implications

Thus far, we have documented the divergence in banks' business models, highlighting the growing disparity within the banking sector. This divergence suggests that high rate and low rate banks may respond differently to interest rate changes. Understanding these varied responses is crucial for assessing the effectiveness of monetary policy across different segments of the banking system. This section investigates the implications of divergent bank deposit funding costs for two key aspects: monetary policy transmission (Section 5.3) and aggregate banking sector outcomes (Section 6.2).

[24] Appendix Figure B.14 also corroborates that high rate banks conduct a greater share of personal lending compared to low rate banks.

[25] Note that Appendix Table B.9 Panel B shows that the charge-off rate for C&I loans extended by high rate banks in the post-2009 era is more pronounced than the charge-off rate for personal loans. One potential explanation for this difference is that banks outside of the top 25 have a smaller share of personal lending.

### 6.1 Transmission of Monetary Policy

This section investigates how high rate and low rate banks respond differently to monetary policy transmission through the deposit and lending channels, examining the impact on both prices and quantities.

#### 6.1.1 Deposit Betas

We begin by examining 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, defined as the change in the deposit rate divided by the change in the Fed Funds rate. Figure 5 illustrates the deposit betas across the three rate-hiking cycles.

Initially, consistent with the similar deposit rates during the early part of our sample, we find that low rate and high rate banks have similar deposit betas ranging between roughly 0.50 and 0.75 during the first rate hiking cycle of 2004Q1 to 2008Q2. While the overall banking sector has maintained a relatively stable aggregate deposit beta in the recent rate hiking cycles between 2015Q4 and 2020Q1, and, 2021Q4 and 2023Q3, a clear divide has emerged between the two groups. In the 2015Q4-2020Q1 and the 2021Q4-2023Q3 cycles, low rate banks report minimal change in their deposit rates (deposit betas near 0), while high rate banks exhibit strongly positive deposit betas, indicating a more pronounced response to rising Fed Funds rates.

We test these relationships rigorously through the following regression framework:

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

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

Table 3 reveals a striking difference in deposit behavior between high and low rate banks after 2009. We find that high rate banks after 2009 have a deposit beta that is 0.55 higher than low rate banks. That is, a 1 percentage point increase in the Fed funds rate is associated with an additional 0.55 percentage point increase in the deposit rate for high rate banks after 2009. This difference is economically meaningful as it is almost 20% larger than the typical deposit beta in the sample of around 0.46 and statistically significant at the 1% level.

The divergence in deposit betas between high rate and low rate banks primarily stems from low rate banks reducing their deposit betas, while high rate banks do not significantly adjust theirs. Notably, the coefficient on the interaction term between the change in the Fed funds rate and the post-2009 dummy ($\Delta\text{FFTar}_q \times \text{Post}_q$) dummy is -0.46, indicating that low rate banks maintain low deposit rates despite increasing interest rates. In contrast, high rate banks do not raise their deposit betas in response to changes in the Fed funds rate.[26] This stark difference in deposit rate behavior between high rate and low rate banks was absent 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 -0.066 which is statistically indistinguishable from 0, indicating no significant difference in deposit betas between high rate and low rate banks.

Given our finding that the number of branches for low rate banks has remained unchanged since 2010, it may seem puzzling that these banks now charge customers more (offering lower deposit rates when interest rates rise) compared to the pre-2010 period. There are a few potential explanations for this. One possibility is that the operational costs for these banks have risen. In addition to providing traditional in-person banking services through branches, these banks also provide e-banking services (recall that we are focused on the top 25 banks, all of which offer e-banking). To offset these increased costs, these banks may be charging more from depositors in the form of even lower rates, thus driving rates closer to zero. Another plausible explanation is that consumers differ in their preferences for in-person banking services, such as branches and ATMs. As high rate banks increasingly cater to online customers, resulting in a reduction in the number of branches in aggregate, there is relatively less competition among banks with significant in-person services. The lower competition, among a smaller pool of depositors, could lead to an increase in the markups that low rate banks charge on their services.

We further examine how high and low rate banks manage their liabilities by studying the the interest rate sensitivity of their interest expense and interest income. While similar to deposit betas in direction, interest expense betas (column 2) are slightly lower due to timing mismatches with deposit contracts.[27] We find that high rate banks after 2009 have a 0.17 higher interest expense beta compared to low rate banks; a 1 percentage point increase in the Fed funds rate is associated with an additional 0.17 percentage points increase in the interest expense for high rate banks after 2009. Similarly, we observe in column (3) that high rate banks enjoy relatively higher interest income during rising rates after 2009. Column 4 directly assesses the net interest margin (NIM) sensitivity, revealing a 0.06 lower NIM for high rate banks post-2009. This finding is consistent with our findings in Section 5.3, where we show that high rate banks hold more short-term, floating-rate assets. These assets are more sensitive to interest rate changes than the fixed-rate, long-term assets favored by low rate banks.[28]

For robustness, we expand our sample to include the largest 100 banks (Appendix Figure B.5 and Appendix Table B.5). Additionally, we control for common macroeconomic factors

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

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

[28] Short-term, floating-rate assets are directly affected by prevailing interest rates, unlike the fixed-rate assets held in low rate banks' portfolios.

using quarter fixed effects, confirming that the observed differences in betas between high and low rate banks are indeed driven by post-2009 changes (Appendix Table B.4).

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. Adjusting assets can also be challenging due to their illiquidity. These constraints can push banks towards wholesale funding, a more stable funding source for financing longer-term assets. We investigate whether high and low rate banks differ in their reliance on wholesale funding. While the share of wholesale funding remains similar for both groups (Appendix Figure B.6), we find that high rate banks pay higher rates for this funding. This suggests that they are perceived as riskier. We explore possible explanations for this in Section 5.3.

#### 6.1.2 Flows within the Banking Sector

We extend our analysis to examine how high rate and low rate banks adjust their deposits and loans in response to interest rate changes. This builds on our findings about deposit betas, providing a holistic understanding of how interest rate sensitivity interacts with bank growth and stability across both funding and lending activities.

Figure 7 compares the deposit growth for high rate and low rate banks over the past three rate hiking cycles. As in Figure 5 with deposit betas, we find that high rate and low rate banks exhibit similar deposit growth in the first rate hiking cycle between 2004Q1 and 2007Q4; the cumulative growth over this period is between 50% and 60% for both high and low rate banks. However, in the last two rate hiking cycles, high rate banks exhibit significantly higher deposit growth than low rate banks, suggesting that there is substantial reallocation of deposits when interest rates rise. The cumulative deposit growth over the 2015Q5 to 2019Q4 rate hiking period is over 10% higher for high rate banks compared to low rate banks. This trend intensifies in the most recent rate hiking cycle between 2021Q4 and 2023Q3, with low rate banks experiencing negative deposit growth while high rate banks experience positive deposit growth; the difference between these types exceeds 7%.

We address potential concerns that our findings might be influenced by M&A activity, bank category switching, aggregation, or sample limitations. First, we show that the impact of M&A activity during the crisis period was minimal; see Appendix Figure B.7.[29] Second, we address the concern that the observed patterns may be due to banks switching between the high and low categories. To address this concern, we fix the set of top 25 banks at the beginning of each rate hiking and show that our findings are robust in an extended sample from 1994Q1 in Appendix Figure B.8. This approach confirms the observed differences in deposit growth are not driven by banks shifting categories. Third, Appendix Figure B.9 provides a granular view by disaggregating high rate and low rate banks and presenting individual bank performance. This allows us to identify specific institutions with significant deposit inflows or outflows within each category. We find that First Republic Bank, Charles Schwab, and Northern Trust are among the low rate banks that experience the largest deposit outflows, while

[29] During this period, two significant increases in deposit growth occurred as a result of M&A: Wells Fargo's acquisition of Wachovia on October 3, 2008, and PNC's acquisition of National City Bank on October 24, 2008.

Goldman Sachs, Ally Financial, and Citi are the banks that received the greatest deposit inflows. Finally, we demonstrate the robustness of our findings by expanding the analysis to the largest 100 banks over a broader horizon from 1993Q1 in Appendix Figure B.10. This wider scope confirms the observed patterns hold true beyond the specific sample used in the main analysis.

We test these relationships rigorously through the following regression framework in Table 4.

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

where $i$ and $q$ indicate the bank and quarter-year, respectively, $\Delta \mathrm{Y}_{i,y}$ denote measures of deposit and lending growth, $\Delta \mathrm{FFTar}_y$ 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, $\mathrm{Post}_q$ denotes the post-2009 period, and $\mathrm{ROA}_{i,q-1}$ and Tier $1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively.

In Table 4, we find that high rate banks attract higher deposits during interest rate hikes. Specifically, high rate banks experience higher deposit growth than low rate banks when interest rates rise in the post-2009 era. This suggests that deposits flow towards high rate banks offering higher deposit rates during these periods. A 1 percentage point increase in the Fed funds rate is associated with an additional 2.93 to 3.36 percentage points increase in the annual deposit growth of high rate banks after 2009. The reallocation of deposits within the banking sector towards high rate banks during rate hikes can significantly impact the lending capacity of these banks, and consequently, the banking sector as a whole. We return to this in Section 6.2.

We further examine the sensitivity of various types of lending growth, including personal loan growth, commercial and industrial (C&I) loan growth, and real estate loan growth, to interest rates in columns (3) through (8). We find that the sensitivity of lending growth to interest rates is most significant for personal loans and C&I extended by high rate banks after 2009. Personal loans include credit card lending, auto lending, and revolving credit. A 1 percentage point increase in the Fed funds rate is associated with an additional 4.74 to 5.43 percentage points increase in the annual personal loan growth of high rate banks after 2009, and 3.71 to 5.48 percentage points increase in the annual C&I loan growth of high rate banks after 2009. We do not find any significant difference in real estate loan growth between high and low rate banks in response to changes in the Fed funds rate.[30] These findings are robust in an expanded sample with the 100 largest banks (Appendix Table B.6).

[30] These results are consistent with our findings in Panel B of Table 6 which shows that high rate banks assume a significant amount of credit risk in personal lending relative to low rate banks.

### 6.2 Aggregate Effects

In this section, we explore how rising interest rates influence the banking sector's capacity to originate long-term loans, considering the distribution of deposits between high and low rate banks. We also quantify the resulting changes in credit risk.

As documented in Section 6.1.2, there is a notable shift of deposits towards high rate banks when interest rates rise. To understand the long-term trends in the relative sizes of high rate and low rate banks, we analyze the asset growth of the largest 100 banks, comparing high rate and low rate banks in Figure 12. While Figure 12a shows similar asset growth between 2003Q1 and 2008Q2, a divergence emerges in the second rate rise cycle, as shown in Figure 12b. By the end of our sample, we find that there is over a 20% cumulative difference in the asset growth experienced by high rate banks compared to low rate banks starting from 2012Q1. Based on this 20% differential, we conduct some back-of-the-envelope calculations to quantify aggregate changes in the banking sector's capacity to originate long-term and risky loans.

We estimate the impact on the banking sector's ability to originate long-term loans. Our analysis in Section 5.3.3 indicates that high rate banks hold assets with an average maturity 4 years shorter than low rate banks (Figure 9a). Consequently, the banking sector as a whole originates approximately 13.3% shorter-maturity loans.[31] Similarly, we calculate that the banking sector holds an 8% larger share of short-term assets.[32] These findings suggest a decline in the banking sector's capacity for maturity transformation, potentially impacting its ability to provide long-term financing for infrastructure, businesses, and mortgages.

However, our findings indicate that while high rate banks have lower maturity risk, they assume more credit risk. To quantify the aggregate change in the credit risk originating from the banking sector, we examine the difference in the credit spread between high rate and low rate banks. By the end of our sample, the difference in the credit spread between high rate and low rate banks is over 200 basis points (bps) (see Figure 10b). This translates to an estimated 11.4% increase in credit risk for the banking sector as a whole.[33]

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.

## 7 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

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

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

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

deposit rates are less responsive to market interest rates. Despite the aggregate deposit beta of the banking sector showing minimal change, there is now a clear bimodal distribution in deposit rates.

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

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

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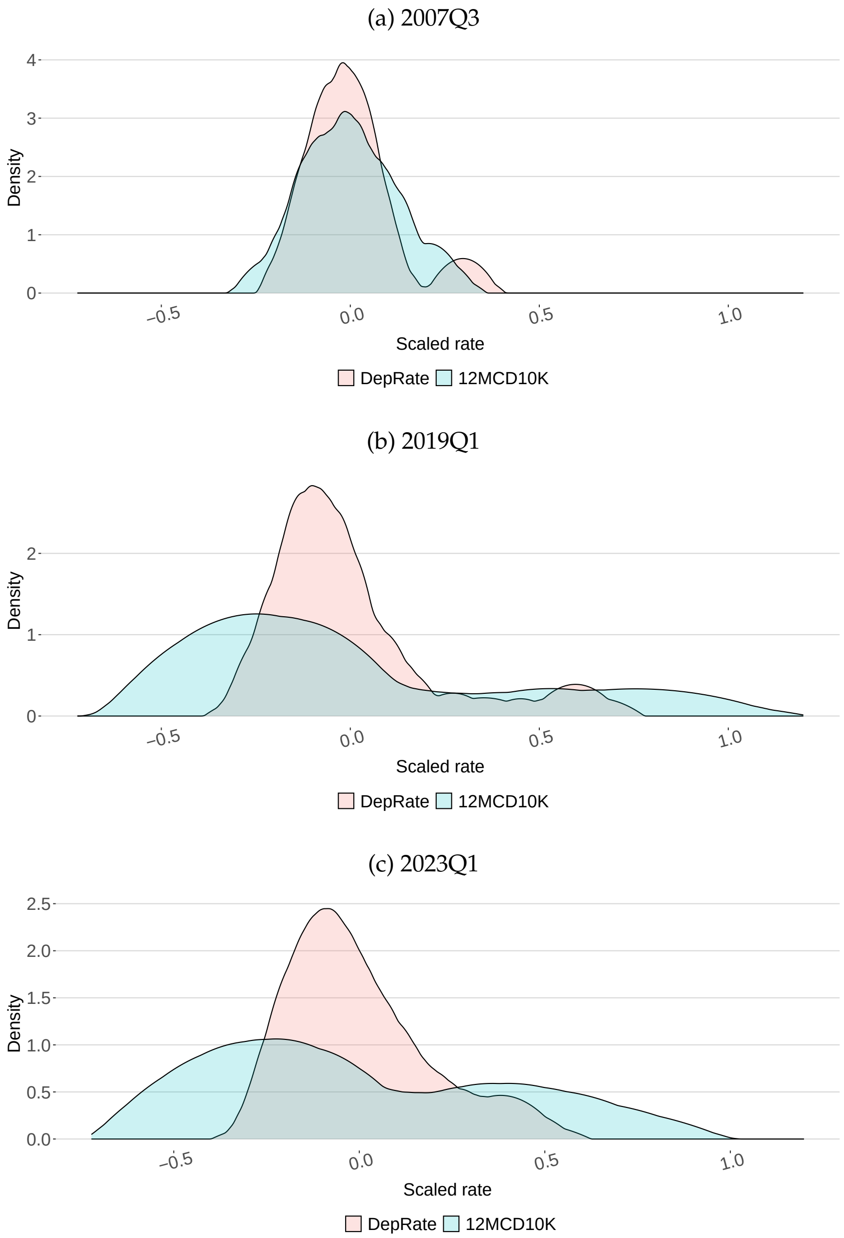
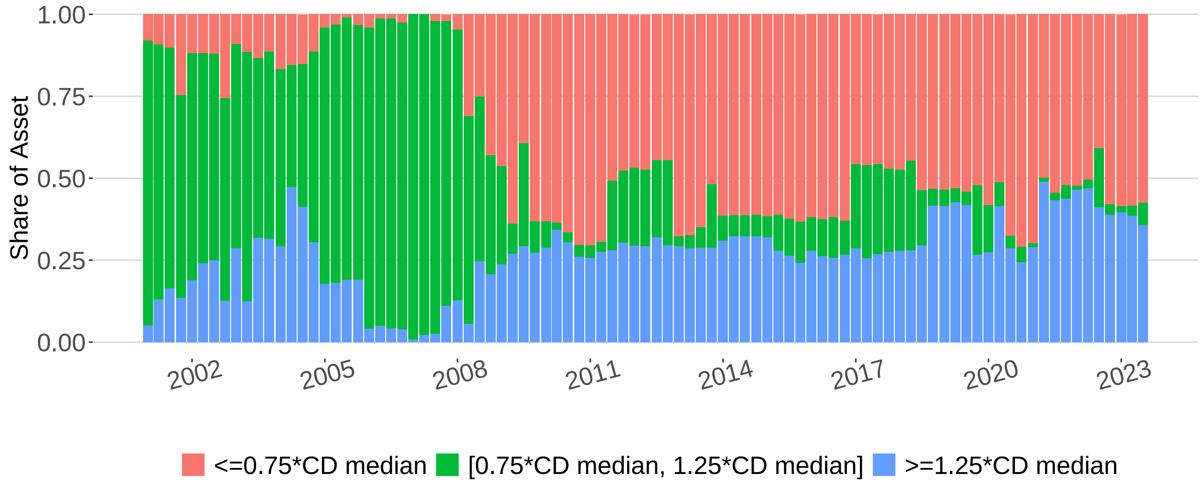
Figure 1: Dispersion of Deposit Rates for Top 25 Banks



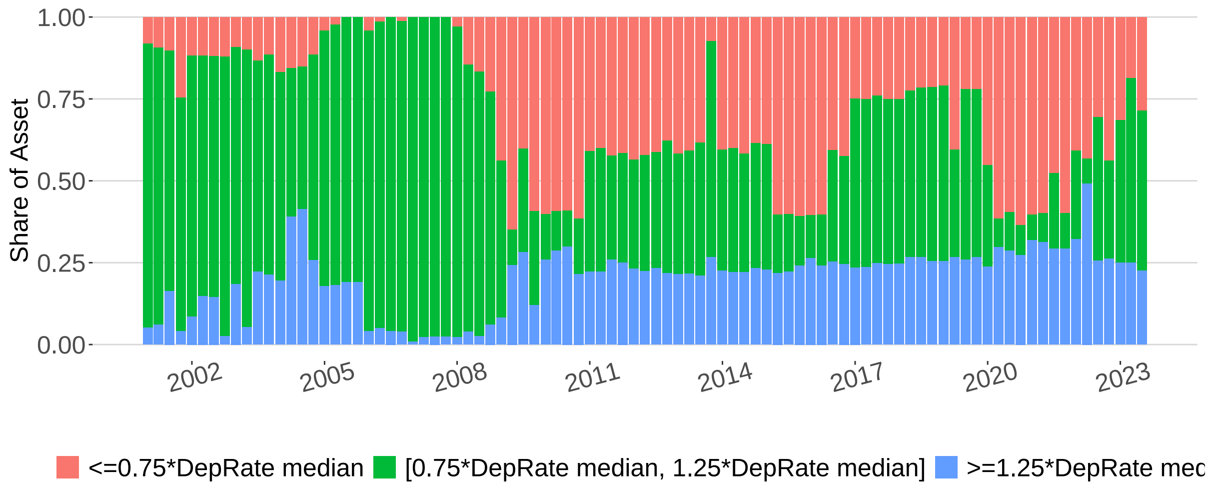

*Notes:* This figure presents kernel density plots of the scaled and demeaned 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and the scaled and demeaned deposit rates (DepRate) calculated from Call Reports offered by the top 25 banks at the peak of each rate hiking cycle. Figures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

Figure 2: Asset Distribution of Top 25 Banks

(a) Classification based on 12MCD10K

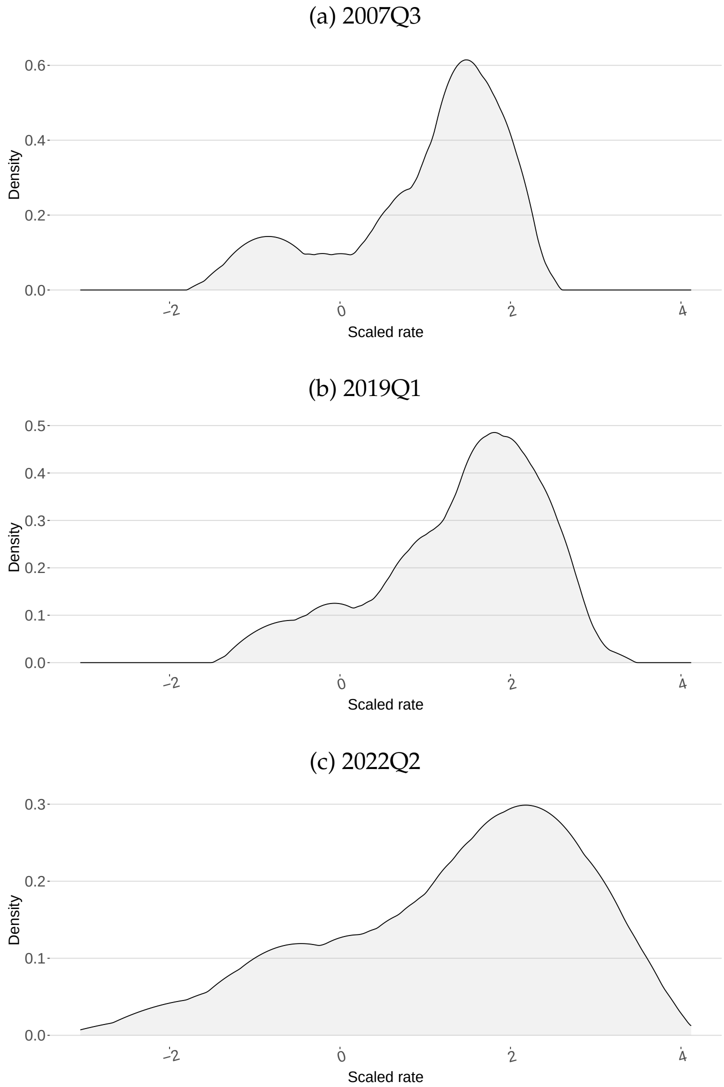



(b) Classification based on DepRate




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

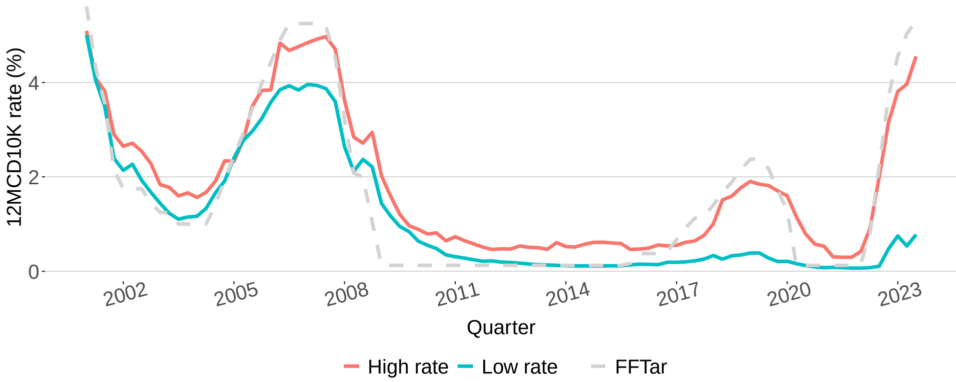
Figure 3: Dispersion of Branch/Deposits ratio for Top 25 Banks



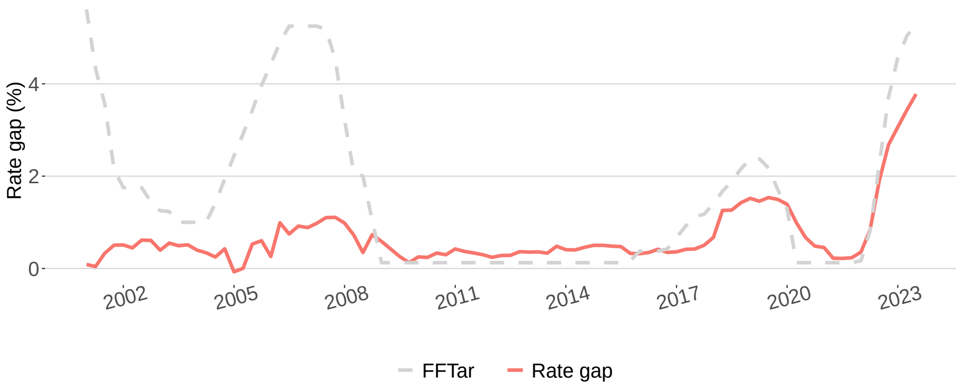

*Notes:* This figure displays kernel density plots of the demeaned logarithm of branch deposits by the top 25 banks at the peak of each interest rate hiking cycle. Figures a, b, c, and d illustrate the kernel density at the following quarters: 2007Q3, 2019Q1, and 2022Q2 (the last quarter available in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

Figure 4: Dispersion of Bank Deposit Rates

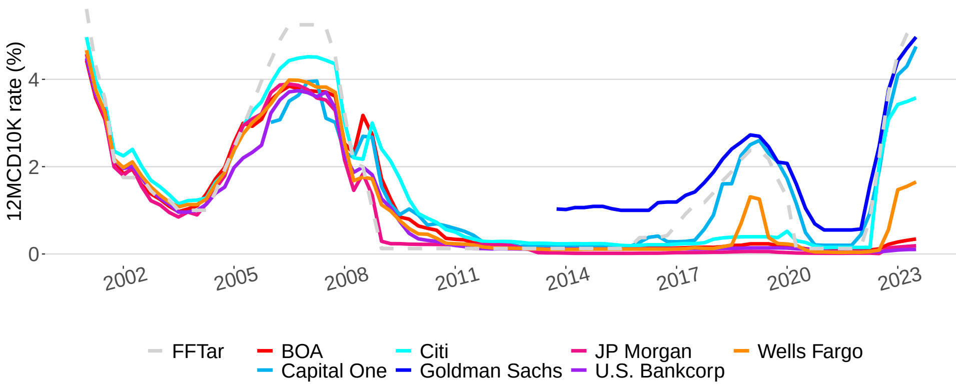
(a) Rate




(b) Rate Gap




(c) Rate by Bank

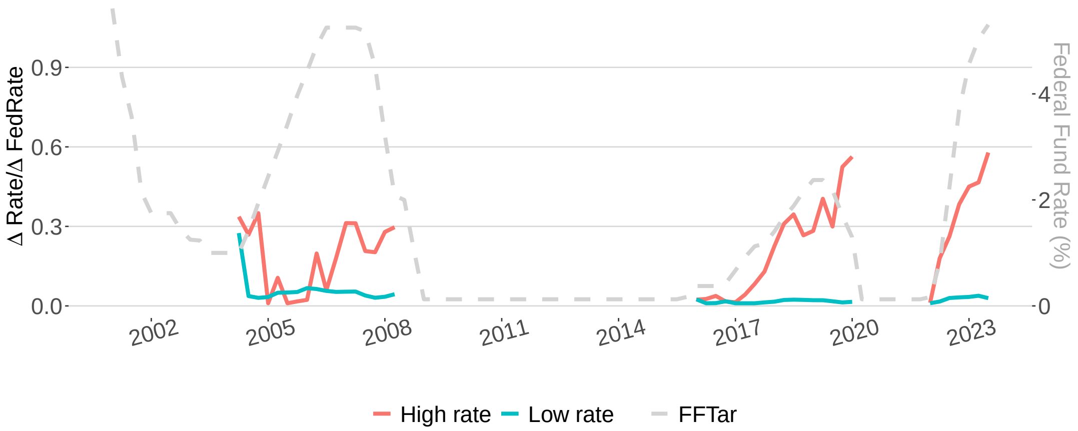



*Notes:* This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q3 among the top 25 banks. We construct the time-series for each bank type by taking an average of the banks' 12MCD10K rates, weighted by assets. Figure 4a presents a time-series plot of average 12MCD10K for *high rate* (blue) and *low rate* (red) banks. Figure 4b presents the gap in the 12MCD10K rates between high rate and low rate banks. Figure 4c presents the 12MCD10K rate by bank. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

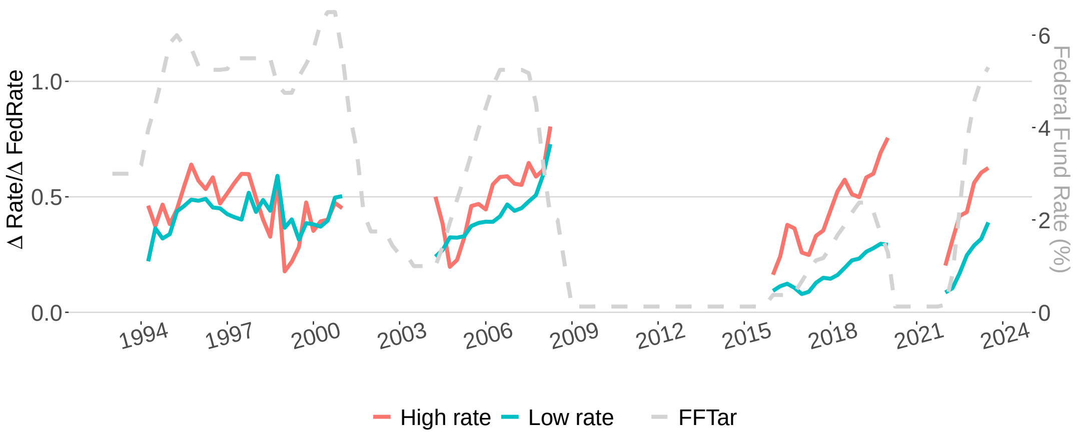
Figure 5: Deposit Beta

(a) 12MCD10K


(b) SAV



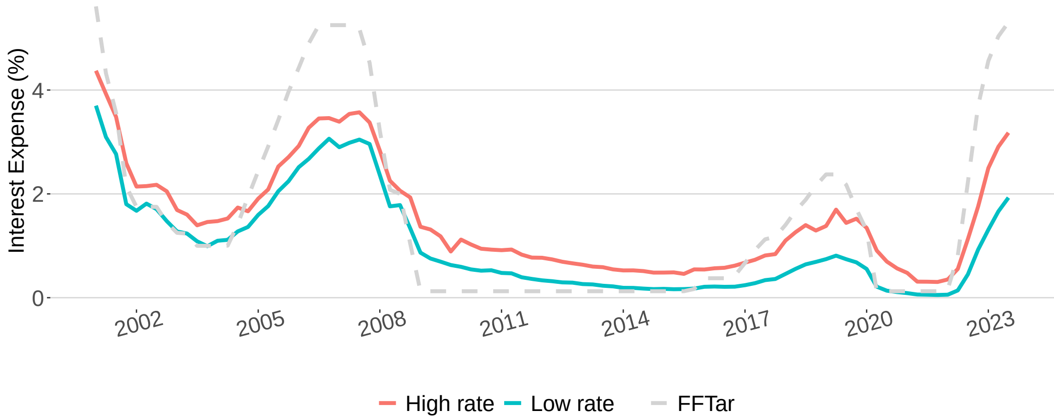

(c) Deposit Rate



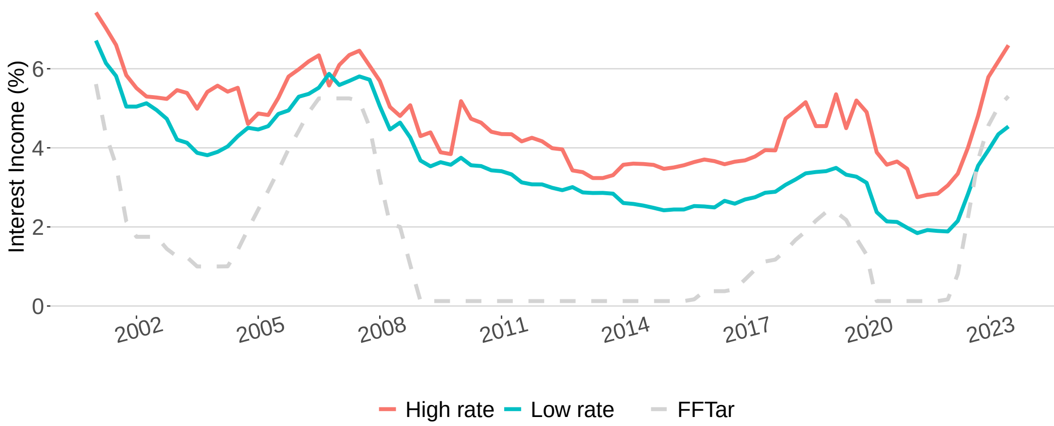

*Notes:* This figure compares the average deposit beta of high and low rate banks among the top 25 banks over the three recent rate hiking cycles: 2004Q1 through 2008Q2, 2015Q4 through 2020Q1, and 2021Q4 through 2023Q3. The deposit beta is defined as the ratio of the cumulative change in deposit rates from the first quarter of each rate hiking cycle to the corresponding change in the Federal Funds Target rate. We consider three deposit rates: the 12MCD10K rate in panel a, the savings rate in panel b, and the deposit rate calculated from the Call Report in panel c. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 6: Net Interest Margin

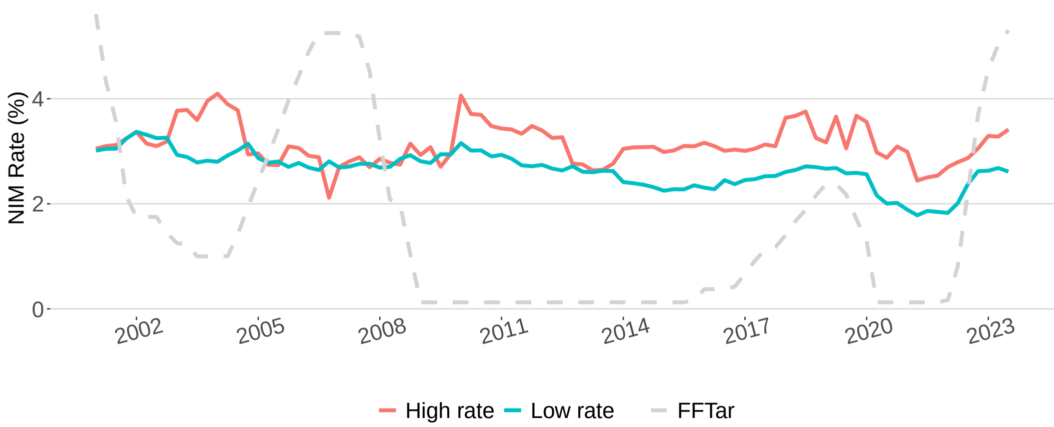
(a) Interest Expense




(b) Interest Income



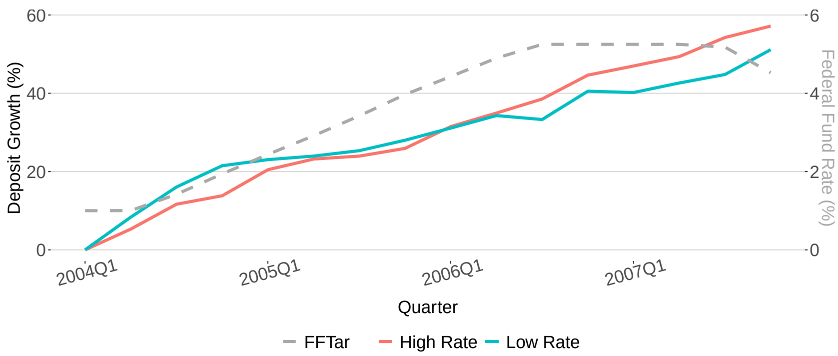

(c) NIM



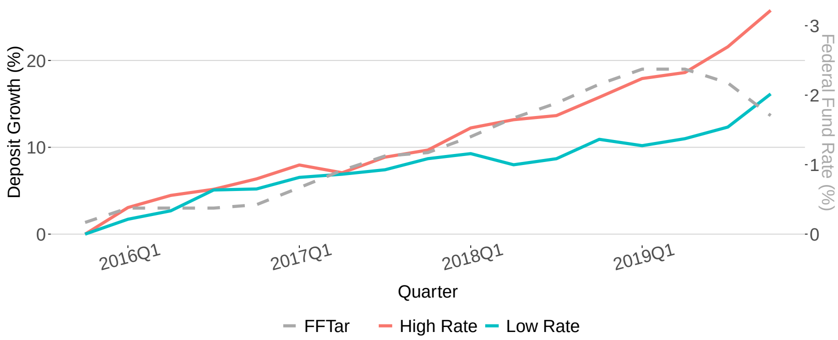

*Notes:* This figure compares the interest expense, interest income, and net interest margin of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 6a presents the interest expense (%) of high and low rate banks. Figure 6b presents the interest income (%) of high and low rate banks. Figure 6c presents the net interest margin (NIM) rate (%) for high and low rate banks. See Appendix Table B.10 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 7: Deposit Growth

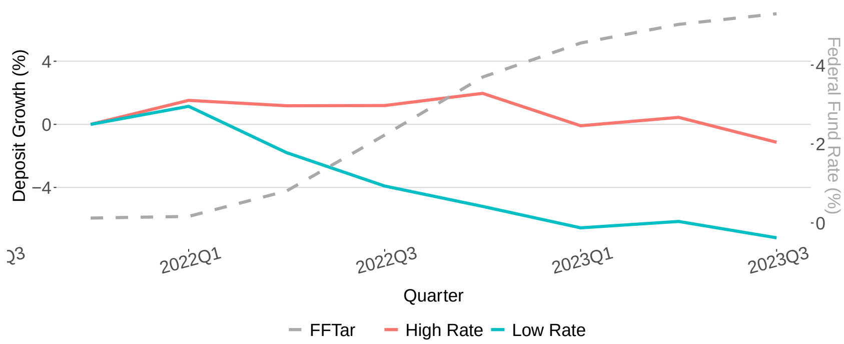
(a) 2004Q1-2007Q4




(b) 2015Q4-2019Q4



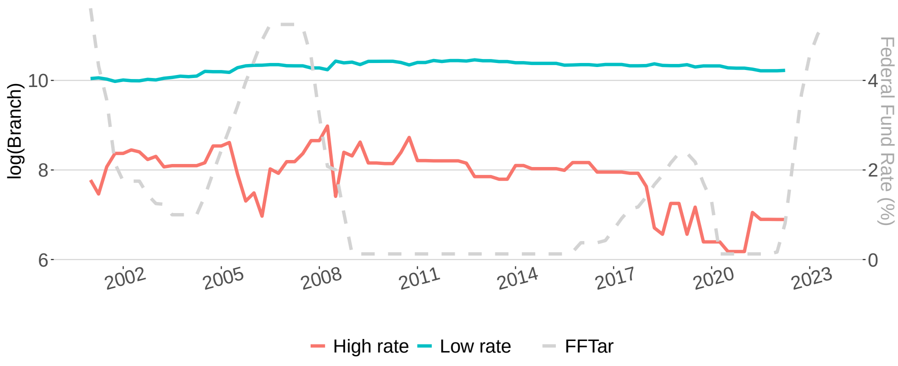

(c) 2021Q4-2023Q3



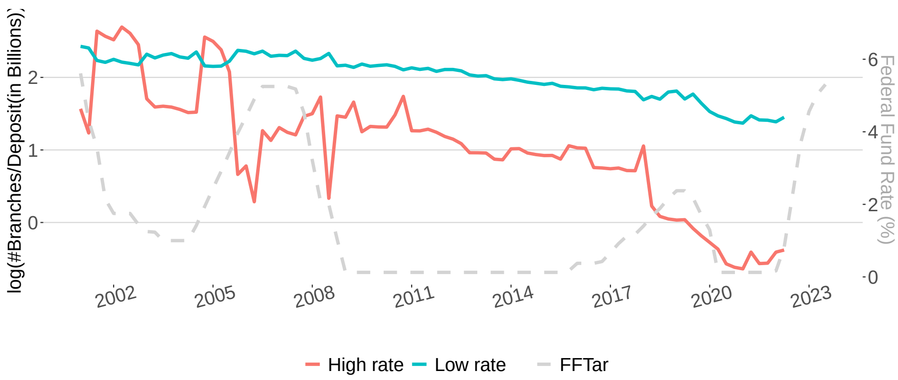

*Notes:* This figure compares the deposit growth of high and low rate banks among the top 25 banks over the three recent rate hiking cycles. Figures 7a, 7b, and 7c compare the deposit growth experienced by high rate banks to that of low rate banks from 2004Q1 through 2007Q4, from 2015Q4 through 2019Q4, and from 2021Q4 through 2023Q3, respectively. To facilitate comparison, the growth rates of high rate and low rate banks are normalized to 0% in the first quarter of each rate hiking cycle, i.e. 2004Q1, 2015Q4, and 2021Q4. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 8: Branches

(a) Growth of Branches




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

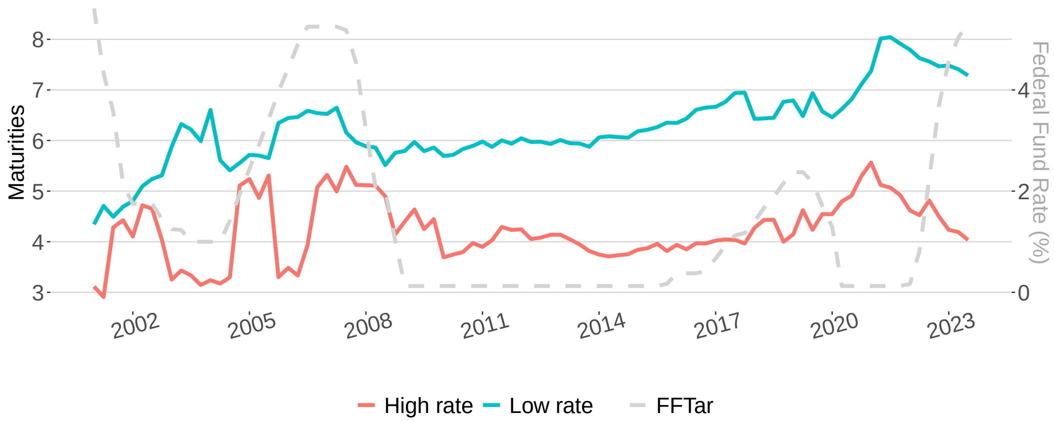



(c) Branch-weighted County Average Age

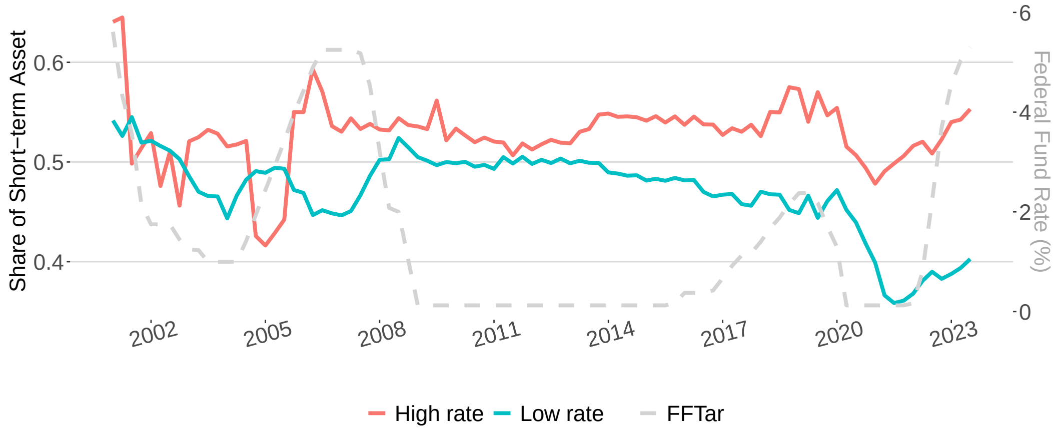

*Notes:* This figure compares branches operating by high and low rate banks among the top 25 banks from 2001Q1 through 2022Q2, which is the quarter where the most recent SOD data ends. Figure 8a presents the log-transformed number of branches of high and low rate banks. Figure 8b presents the log-transformed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

Figure 9: maturity risk

(a) Maturity



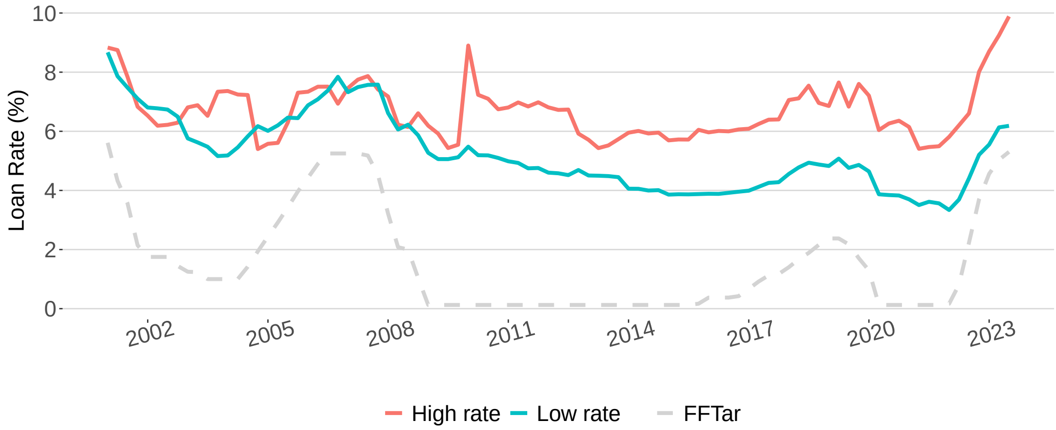

(b) Share of Short-Term Assets




*Notes:* This figure compares the maturity risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 9a presents the maturity (# of years) of high and low rate banks. Figure 9b presents the share of assets with less-than one-year maturity (short-term assets) for high and low rate banks. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

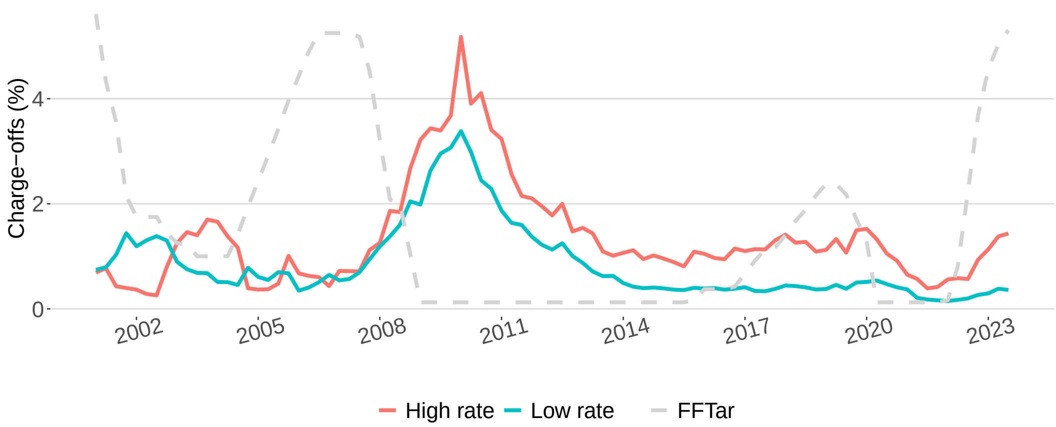
Figure 10: Credit Risk

(a) Loan rate




(b) Credit spread

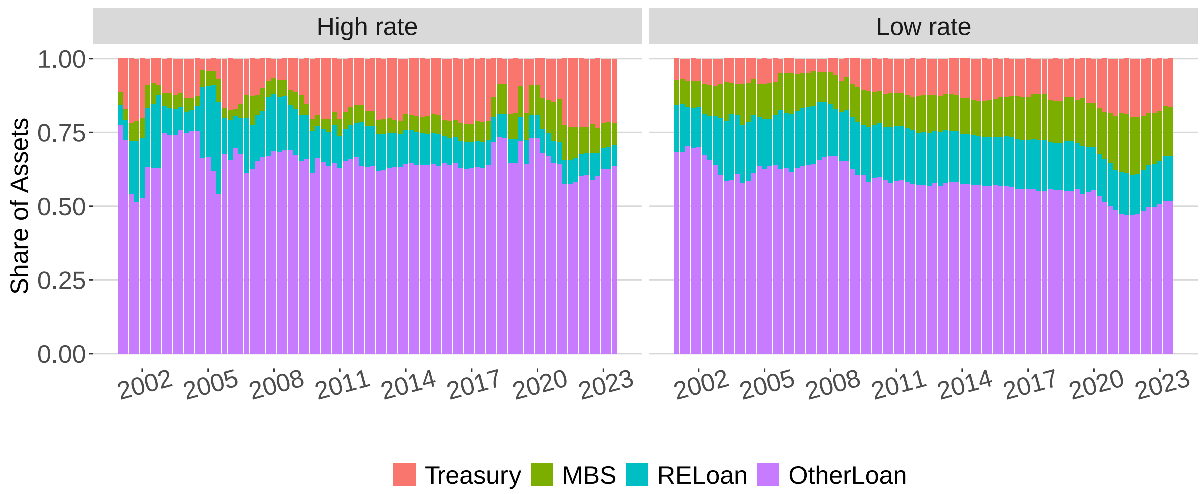

(c) Charge-offs



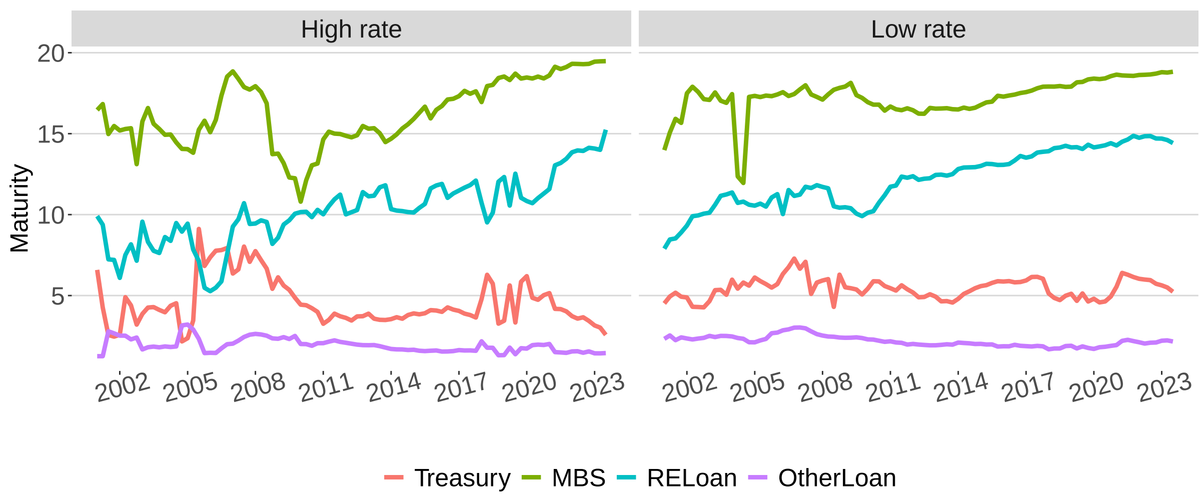

*Notes:* This figure compares the credit risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 10a presents the loan rate (%) of high and low rate banks. Figure 10b presents the credit spread (%) of high and low rate banks. The credit spread is computed as the difference between the loan rate and synthetic term rate (average of term treasury yields, weighted by the share of loans with corresponding maturities). Figure 10c presents the charge-off rate (%) for high and low rate banks. See Appendix Table B.10 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 11: Portfolio Composition

(a) Share of Assets



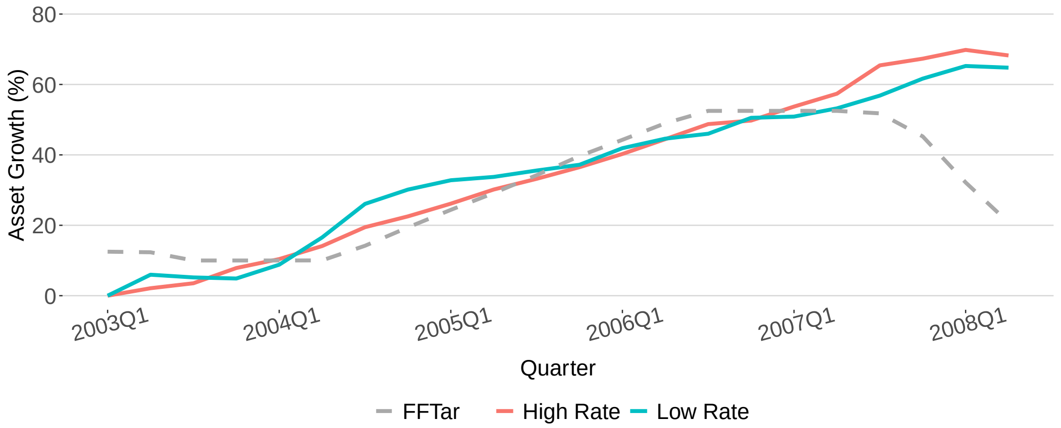

(b) Maturity



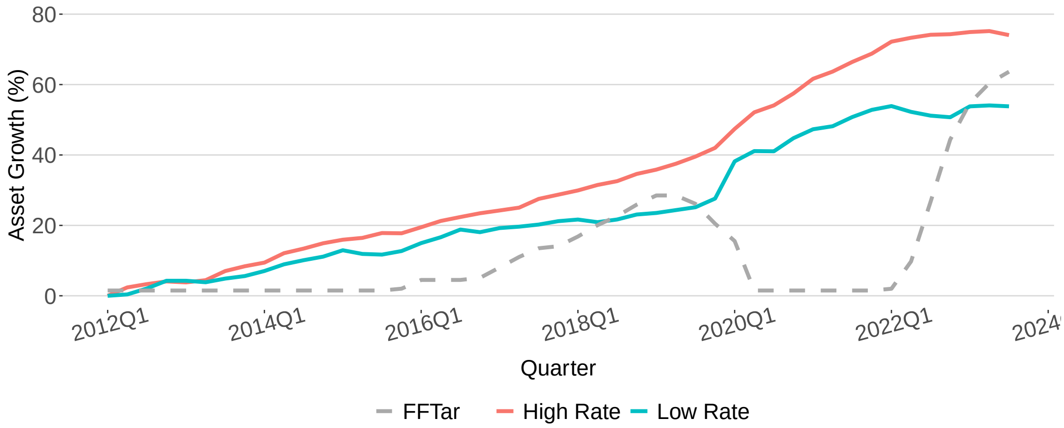

*Notes:* This figure compares the portfolio characteristics of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 11a examines the portfolio composition of high rate and low rate banks; share of treasuries (red), mortgage-backed securities (green), real estate loans (blue), and other loans (purple). Figure 11b examines the maturity (years) of these asset classes for high rate and low rate banks. See Appendix Table B.10 for more details on the construction of key variables. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Figure 12: Asset Growth (Top 100 Banks)

(a) 2003Q1-2008Q2




(b) 2012Q1-2023Q3




*Notes:* This figure compares the asset growth of high and low rate banks for banks with more than $10 billion in assets. Figure 12a compares the asset growth experienced by high rate banks to that of low rate banks from 2003Q1 through 2008Q2. Figure 12b compares the asset growth experienced by high rate banks to that of low rate banks from 2012Q1 through 2023Q3. For ease of comparison, the growth rates of high rate and low rate banks are normalized to 0% in the first quarter, i.e., 2003Q1 and 2012Q1. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile.

Table 1: Summary Statistics

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

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

Panel B: Deposit Rate

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

*Notes:* Panel A compares various metrics between high and low rate banks among the top 25 banks from 2001Q1 to 2008Q4 and from 2017Q1 to 2023Q3. The comparison between 2009Q1 to 2006Q4 is reported in Tabel B.1. A bank is categorized as a *high rate* bank if its average rank, calculated based on the 12MCD10K rate and deposit rate from the Call Report, falls within the top quartile. The averages, weighted by its asset size in the previous quarter, are reported separately for the two types of banks, as well as their difference. Standard errors are clustered at the quarter-year levels and are accounted for autocorrelation consistent errors using Driscoll-Kraay with 4-quarter lags. *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively. CD refers to the 12-month certificate of deposit rate on accounts with at least $10,000, collected from RateWatch. DepRate is the deposit rate calculated from the Call Reports. The share of insured deposits, NIM rate, quarterly growth of deposits, maturity of loans and securities, charge-offs of loans are extracted from the Call Reports. Additionally, we count the number of branches for each bank using the Statement of Deposits (SOD). Panel B presents the summary statistics for DepRate and 12MCD10K from 2001Q1 to 2023Q3.

Table 2: Bank Branches

| | log(# Branches) | | $\log(\frac{\text{Branches}}{\text{Deposit}})$ | | Branch-weighted County Average Age | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}$(High Rate)×Post | -1.072*** | -1.049*** | -0.477** | -0.547** | -0.568*** | -0.567*** |
| | (0.298) | (0.303) | (0.229) | (0.238) | (0.215) | (0.214) |
| $\mathbb{1}$(High Rate) | -0.785*** | -0.861*** | -1.120*** | -1.151*** | -0.470** | -0.557*** |
| | (0.218) | (0.208) | (0.192) | (0.194) | (0.197) | (0.185) |
| Post | 0.443*** | | -0.779*** | | 1.820*** | |
| | (0.126) | | (0.121) | | (0.213) | |
| $\text{ROA}_{i,q-1}$ | -0.059 | -0.008 | -0.086 | 0.009 | -0.026 | -0.373*** |
| | (0.070) | (0.103) | (0.064) | (0.080) | (0.128) | (0.068) |
| Tier $1_{i,q-1}$ | 0.585*** | 0.568*** | 0.099** | 0.014 | -0.290*** | -0.155*** |
| | (0.089) | (0.083) | (0.045) | (0.035) | (0.087) | (0.058) |
| Constant | 6.692*** | | 1.740*** | | 37.454*** | |
| | (0.161) | | (0.088) | | (0.203) | |
| Quarter FE | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.152 | 0.156 | 0.152 | 0.125 | 0.322 | 0.162 |
| Observations | 2112 | 2112 | 2112 | 2112 | 1647 | 1647 |
| Mean of Dep. Variable | 7.088 | 7.088 | 0.852 | 0.852 | 38.657 | 38.657 |

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

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

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

Table 3: Deposit Betas

| | ΔDep. Rate | ΔInterest Expense | ΔInterest Income | ΔNIM |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ΔFFTar×$\mathbb{1}$(High Rate)×Post | 0.545*** | 0.170*** | 0.097 | -0.064 |
| | (0.115) | (0.037) | (0.070) | (0.049) |
| ΔFFTar×$\mathbb{1}$(High Rate) | -0.066 | -0.032 | -0.025 | -0.001 |
| | (0.113) | (0.035) | (0.066) | (0.041) |
| ΔFFTar | 0.599*** | 0.463*** | 0.413*** | -0.043 |
| | (0.055) | (0.037) | (0.056) | (0.036) |
| ΔFFTar×Post | -0.455*** | -0.147*** | 0.112* | 0.250*** |
| | (0.099) | (0.051) | (0.065) | (0.044) |
| $\mathbb{1}$(High Rate)×Post | -0.018 | -0.022 | 0.015 | 0.037 |
| | (0.039) | (0.018) | (0.051) | (0.042) |
| $\mathbb{1}$(High Rate) | -0.007 | 0.014 | -0.013 | -0.027 |
| | (0.035) | (0.017) | (0.050) | (0.042) |
| Post | -0.061 | -0.001 | -0.012 | -0.012 |
| | (0.052) | (0.022) | (0.038) | (0.020) |
| $\text{ROA}_{i,q-1}$ | 0.041** | 0.014** | 0.005 | -0.009 |
| | (0.019) | (0.007) | (0.016) | (0.013) |
| Tier $1_{i,q-1}$ | -0.024** | -0.013** | -0.021 | -0.009 |
| | (0.012) | (0.006) | (0.013) | (0.010) |
| Constant | 0.008 | -0.014 | -0.019 | -0.002 |
| | (0.050) | (0.021) | (0.040) | (0.023) |
| Adjusted $R^2$ | 0.558 | 0.592 | 0.367 | 0.095 |
| Observations | 1846 | 2268 | 2268 | 2268 |
| Mean of Dep. Variable | -0.020 | 0.001 | -0.009 | -0.010 |

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

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

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

## Table 4: Growth in Deposits and Loans

| | $\Delta$Deposit$_{i,y}$ | | $\Delta$Personal Loan$_{i,y}$ | | $\Delta$C&I Loan$_{i,y}$ | | $\Delta$Real Estate Loan$_{i,y}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\Delta$FFTar$_y$ $\times$ $\mathbb{1}$(High Rate)$\times$Post | 3.365** | 2.931** | 4.742* | 5.427* | 5.484** | 3.705 | 0.053 | 0.419 |
| | (1.404) | (1.471) | (2.695) | (2.805) | (2.528) | (2.583) | (2.533) | (2.814) |
| $\Delta$FFTar$_y$ $\times$ $\mathbb{1}$(High Rate) | -0.658 | -0.544 | -3.575* | -4.035* | -3.559** | -1.784 | -0.302 | -0.566 |
| | (0.942) | (0.935) | (2.026) | (2.146) | (1.591) | (1.737) | (1.438) | (1.413) |
| $\Delta$FFTar$_y$ | 0.712 | | 0.815 | | 1.877 | | 2.530*** | |
| | (0.679) | | (0.875) | | (1.866) | | (0.971) | |
| $\Delta$FFTar$_y$$\times$Post | -5.299*** | | -0.858 | | -2.131 | | -2.732 | 0 |
| | (1.194) | | (1.112) | | (2.063) | | (1.927) | |
| $\mathbb{1}$(High Rate) | 4.388** | 5.045*** | -8.213** | -7.334* | 5.390** | 4.325* | 7.528*** | 8.870*** |
| | (1.706) | (1.452) | (3.919) | (4.086) | (2.650) | (2.292) | (2.841) | (2.933) |
| Post | -3.285* | | -10.351*** | | -5.672 | | -11.139*** | 0.000 |
| | (1.969) | | (2.359) | | (4.946) | | (3.095) | |
| ROA$_{i,q-1}$ | 1.185*** | 1.585*** | 0.262 | 0.905 | 1.129 | 1.656*** | 0.575 | 1.582* |
| | (0.326) | (0.401) | (0.594) | (0.686) | (1.004) | (0.570) | (0.465) | (0.855) |
| Tier 1$_{i,q-1}$ | 0.007 | 0.009 | 0.005 | 0.001 | -0.010 | -0.007 | 0.019 | 0.018 |
| | (0.008) | (0.007) | (0.011) | (0.010) | (0.013) | (0.010) | (0.020) | (0.017) |
| $\Delta$FFTar$_y$ $\times$ $\mathbb{1}$(High Rate)$\times$Crisis | -2.642* | 13.224*** | 49.028*** | 56.091*** | 53.206*** | 34.935*** | 18.474*** | 48.266*** |
| | (1.551) | (1.401) | (3.273) | (3.598) | (4.196) | (2.654) | (2.334) | (2.801) |
| Quarter FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.227 | 0.047 | 0.031 | 0.008 | 0.029 | 0.015 | 0.109 | 0.026 |
| Observations | 2269 | 2269 | 2257 | 2257 | 2201 | 2201 | 2232 | 2232 |
| Mean of Dep. Variable | 8.231 | 8.231 | 6.444 | 6.444 | 5.819 | 5.819 | 5.724 | 5.724 |

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

$$\Delta Y_{i,y} = \alpha + \beta_1 \times \Delta FFTar_y \times \mathbb{1}_{\text{High rate},i} \times Post_q + \beta_2 \times \Delta FFTar_y \times \mathbb{1}_{\text{High rate},i} + \beta_3 \times \Delta FFTar_y \times Post_q$$
$$+ \beta_4 \times \Delta FFTar_y + \beta_5 \times \mathbb{1}_{\text{High rate},i} + \beta_6 \times \mathbb{1}_{\text{High rate},i} \times Post_q$$
$$\beta_7 \times \Delta FFTar_y \times \mathbb{1}_{\text{High rate},i} \times Crisis + \beta_8 \times ROA_{i,q-1} + \beta_9 \times Tier\ 1_{i,q-1} + \varepsilon_{i,q},$$

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

Table 5: maturity risk

Panel A: Loans and Securities

| | Maturities (years) | Short-term share (%) |
|---|---|---|
| | (1) | (2) |
| $\mathbb{1}$(High Rate)×Post | -0.710** | 3.012* |
| | (0.332) | (1.582) |
| $\mathbb{1}$(High Rate) | -1.793*** | 6.140*** |
| | (0.327) | (1.142) |
| Quarter FE + Controls | ✓ | ✓ |
| Adjusted $R^2$ | 0.227 | 0.129 |
| Observations | 2178 | 2178 |
| Mean of Dep. Variable | 5.934 | 47.872 |

Panel B: Share by Asset Classes (%)

| | Real Estate Loans | Other Loans | MBSs | Treasuries |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}$(High Rate)×Post | -2.214 | 4.378** | -1.015 | -1.149 |
| | (2.001) | (1.931) | (0.650) | (1.995) |
| $\mathbb{1}$(High Rate) | -3.385* | 5.525*** | -6.759*** | 4.619** |
| | (1.971) | (1.791) | (0.695) | (1.886) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ |
| Adjusted $R^2$ | 0.111 | 0.093 | 0.142 | 0.032 |
| Observations | 2178 | 2178 | 2178 | 2178 |
| Mean of Dep. Variable | 15.092 | 57.634 | 12.340 | 14.933 |

Panel C: Maturity by Asset Class

| | Real Estate Loans | Other Loans | MBSs | Treasuries |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}$(High Rate)×Post | 0.059 | 0.120 | -0.958** | -1.795*** |
| | (0.280) | (0.175) | (0.398) | (0.587) |
| $\mathbb{1}$(High Rate) | -1.764*** | -0.599*** | 1.464*** | -0.119 |
| | (0.236) | (0.163) | (0.315) | (0.546) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ |
| Adjusted $R^2$ | 0.073 | 0.106 | 0.095 | 0.055 |
| Observations | 2074 | 2178 | 2091 | 2139 |
| Mean of Dep. Variable | 12.255 | 1.944 | 17.161 | 5.982 |

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

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

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

Table 6: Credit Risk

Panel A: Loans and Securities

| | Loan Rate | Credit Spread | Charge-offs |
|---|---|---|---|
| | (1) | (2) | (3) |
| $\mathbb{1}$(High Rate)×Post | 1.385*** | 1.194*** | 0.440*** |
| | (0.212) | (0.278) | (0.136) |
| $\mathbb{1}$(High Rate) | 0.703*** | 1.011*** | 0.251** |
| | (0.189) | (0.269) | (0.124) |
| Quarter FE + Controls | ✓ | ✓ | ✓ |
| Adjusted $R^2$ | 0.327 | 0.346 | 0.166 |
| Observations | 2269 | 2103 | 2269 |
| Mean of Dep. Variable | 5.172 | 3.411 | 0.859 |

Panel B: Charge-off Rates by Asset Class

| | Real Estate Loans | C&I Loans | Personal Loans | Other Loans |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}$(High Rate)×Post | 0.224** | 0.209** | 0.614*** | 0.062 |
| | (0.089) | (0.086) | (0.185) | (0.067) |
| $\mathbb{1}$(High Rate) | 0.049 | 0.049 | 0.570*** | -0.050 |
| | (0.050) | (0.067) | (0.168) | (0.058) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ |
| Adjusted $R^2$ | 0.079 | 0.027 | 0.092 | 0.001 |
| Observations | 2239 | 2214 | 2264 | 2243 |
| Mean of Dep. Variable | 0.445 | 0.594 | 2.328 | 0.226 |

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

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

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

# Online Appendix for:

*Diverging Banking Sector: New Facts and Macro Implications*

# Appendix A Proofs

## A.1 Solving the Model without Remote Banking Services

Considering the symmetry of the banks, two banks position their branches equidistantly around a circle. Without loss of generality, we assume that Bank A is located at position 0, while Bank B is located at position $1/2$. Depositors located at $s$ and $1-s$ has a distance $s$ to bank A and $1/2 - s$ to bank B. In the case, depositors located at $\tilde{s} = \frac{r_A - r_B + \eta/2}{2\eta}$ and $1-\tilde{s}$ are indifferent between bank A and B. This leads to the following demands for two banks:

$$D_A = \frac{\eta/2 + (r_A - r_B)}{\eta}, \qquad D_B = \frac{\eta/2 - (r_A - r_B)}{\eta}.$$

Solving the equations (1), the first order conditions with respect to deposit rates are

$$r_A = \frac{1}{2}(f - \eta/2 + l_A + r_B), \quad r_B = \frac{1}{2}(f - \eta/2 + l_B + r_A).$$

Solving the equations (1), the first order conditions with respect to risk levels are

$$p(l_A) + (f + l_A - r_A)p'(l_A) = 0, \quad p(l_B) + (f + l_B - r_B)p'(l_B) = 0.$$

Based on the first two questions, we have

$$f + l_A - r_A = r_A - r_B + \eta/2, \quad f + l_B - r_B = r_B - r_A + \eta/2.$$

This gives

$$p(l_A) + (r_A - r_B + \eta/2)p'(l_A) = p(l_B) + (r_B - r_A + \eta/2)p'(l_B) = 0.$$

$$\Longrightarrow p(l_A) - p(l_B) = \frac{\eta}{2}\Big(p'(l_B) - p'(l_A)\Big) + \frac{l_B - l_A}{3}\Big(p'(l_B) + p'(l_A)\Big).$$

If $l_A > l_B$, the left side of the equation becomes negative, owing to the condition $p'(\cdot) < 0$. In contrast, the right side remains positive because of $p''(\cdot) \leq 0$. Such a scenario is not feasible, leading to the conclusion that $l_A \leq l_B$. Applying the same reasoning, we can also deduce that $l_A \geq l_B$. Consequently, it follows that $l_A = l_B = l^*$, where $p(l^*) + \frac{\eta}{2}p'(l^*) = 0$, and $r_A = r_B = f + l^* - \eta/2$.

## A.2 Solving the Model during Mobile Banking Era

We separately discuss all possible equilibria during mobile banking era.

- Case 1 {A: MobileBanking only, B: MobileBanking only}. In this case, two banks provide homogeneous deposit products, and hence the deposit market is perfectly competitive, resulting in 0 profit for both banks:

$$prof_A^1 = prof_B^1 = 0.$$

- Case 2 {A: Branch + MobileBanking, B: Branch + MobileBanking}. In this case, the banks maintain their symmetry. Proceeding with the methodology as in the baseline model, we derive the following results:

$$r_A = r_B = f + l^* - \eta/2 = r^*, \qquad prof_A^2 = prof_B^2 = \frac{\eta}{4}p(l^*) = \frac{\eta^2}{8} - \kappa,$$

where $-\frac{p'(l^*)}{p(l^*)} = \frac{2}{\eta} \Longrightarrow l^* = \frac{2-\eta}{2}$, the same as in the case without mobile banking.

- Case 3 {A: Branch only, B: Branch + MobileBanking}. In this case, the objective functions of banks can be written as follows:

$$\max_{l_A, r_A} p(l_A)(f + l_A - r_A)\frac{\eta/2 + r_A - r_B - \gamma}{\eta} - \kappa,$$

$$\max_{l_B, r_B} p(l_B)(f + l_B - r_B)\frac{\eta/2 + r_B - r_A + \gamma}{\eta} - \kappa.$$

  The equilibrium is characterized as

$$r_A = r^* + \frac{2\gamma}{5}, \quad r_B = r^* - \frac{3c_M + 2\gamma}{5}$$

$$l_A = l^* + \frac{\gamma}{5}, \quad l_B = l^* - \frac{\gamma}{5},$$

$$Prof_A^3 = \frac{(-2\gamma + 5\eta)^3}{1000\eta} - \kappa, \quad Prof_B^3 = \frac{(2\gamma + 5\eta)^3}{1000\eta} - \kappa.$$

- Case 4 {A: Branch only, B: MobileBanking only}. In this case, the objective functions of banks can be written as follows:

$$\max_{l_A, r_A} p(l_A)(f + l_A - r_A)\frac{\eta + 2r_A - 2r_B - 2\gamma}{\eta} - \kappa,$$

$$\max_{l_B, r_B} p(l_B)(f + l_B - r_B)\frac{2r_B - 2r_A + 2\gamma}{\eta}.$$

  The equilibrium is characterized as

$$r_A = r^* + \frac{2\gamma + 2\eta}{5}, \quad r_B = r^* + \frac{-2\gamma + 3\eta}{5}$$

$$l_A = l^* + \frac{2\gamma + 2\eta}{10}, \quad l_B = l^* + \frac{-2\gamma + 3\eta}{10},$$

$$Prof_A^4 = \frac{(-2\gamma + 3\eta)^3}{500\eta} - \kappa, \quad Prof_B^4 = \frac{2(\gamma + \eta)^3}{125\eta}.$$

- Case 5 {A: Branch + MobileBanking, A: MobileBanking only}. In this case, the objective functions of banks can be written as follows:

$$\max_{l_A, r_A} p(l_A)(f + l_A - r_A)\frac{\eta + 2r_A - 2r_B}{\eta} - \kappa,$$

$$\max_{l_B, r_B} p(l_B)(f + l_B - r_B)\frac{2r_B - 2r_A}{\eta}.$$

  The equilibrium is characterized as

$$r_A = r^* + \frac{2\eta}{5}, \quad r_B = r^* + \frac{3\eta}{5}, \quad r_B - r_A = \frac{\eta}{5} > 0$$

$$l_A = l^* + \frac{\eta}{5}, \quad l_B = l^* + \frac{3\eta}{10}, \quad l_B - l_A = \frac{\eta}{10}.$$

$$Prof_A^5 = \frac{(3\eta)^3}{500\eta} - \kappa, \quad Prof_B^5 = \frac{2(\eta)^3}{125\eta}.$$

The table below summarizes the profits of two banks under all possible scenarios. Then we can determine the Nash equilibria by comparing profits under different strategies.

| | | Bank B | | |
|---|---|---|---|---|
| | | Branch only | Branch + MobileBanking | MobileBanking only |
| Bank A | Branch only | $(\frac{\eta^2}{8} - \kappa, \frac{\eta^2}{8} - \kappa)$ | $(Prof_A^3, Prof_B^3)$ | $(Prof_A^4, Prof_B^4)$ |
| | Branch + MobileBanking | $(Prof_B^3, Prof_A^3)$ | $(\frac{\eta^2}{8} - \kappa, \frac{\eta^2}{8} - \kappa)$ | $(Prof_A^5, Prof_B^5)$ |
| | MobileBanking only | $(Prof_B^4, Prof_A^4)$ | $(Prof_B^5, Prof_A^5)$ | $(0, 0)$ |

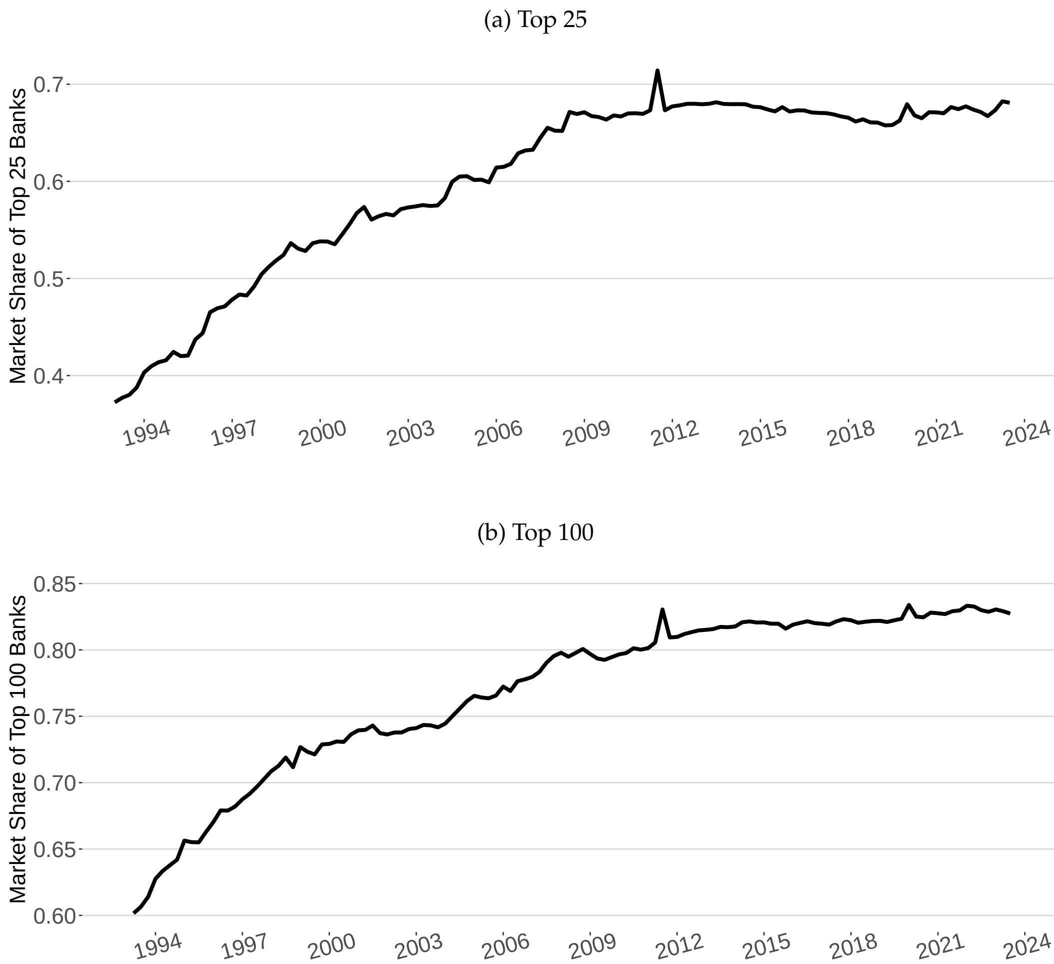
We have $Prof_A^3 < \frac{\eta^2}{8} - \kappa$, $Prof_B^3 > \frac{\eta^2}{8} - \kappa$, $Prof_A^4 < Prof_A^5$, and $Prof_B^4 > Prof_B^5$. Then, we can solve the Nash equilibria when mobile banking option is available.

– If $Prof_B^5 > \frac{\eta^2}{8} - \kappa$, then Case 5 {A: Branch + MobileBanking, A: MobileBanking only} and its symmetric case {A: MobileBanking, A: Branch + MobileBanking} are Nash equilibria.

– If $Prof_B^5 < \frac{\eta^2}{8} - \kappa$, then Case 2 {A: Branch + MobileBanking, B: Branch + MobileBanking} is Nash equilibrium.

# Appendix B Additional Figures and Tables

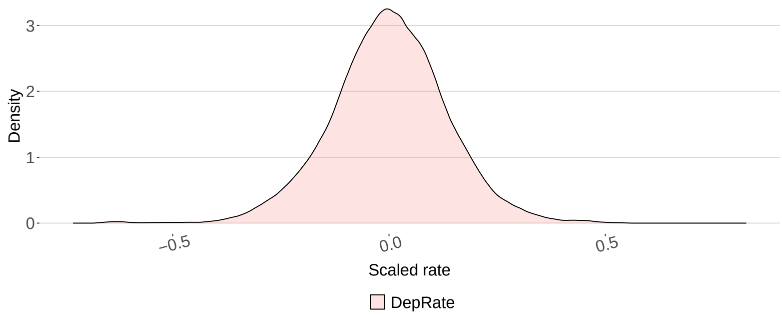
Figure B.1: Market Share of Top Banks



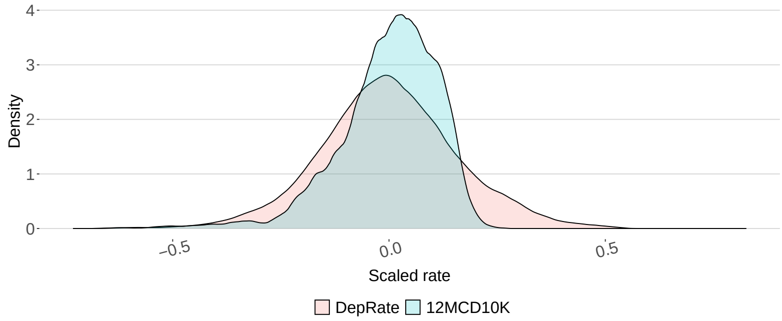

*Notes:* This figure presents the market share of the top 25 banks (in panel a) and top 100 banks (in panel b) from 2001Q1 through 2023Q2. Market share is measured by total assets. The top 25 (top 100) banks are defined according to bank size in each quarter. The data used to construct this figure comes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

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

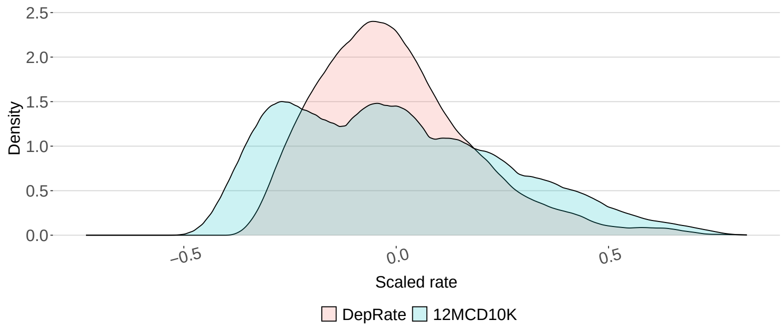
(a) 1994Q4



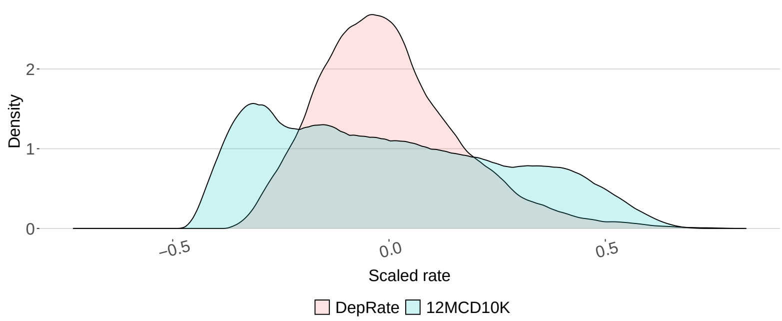

(b) 2007Q3




(c) 2019Q1



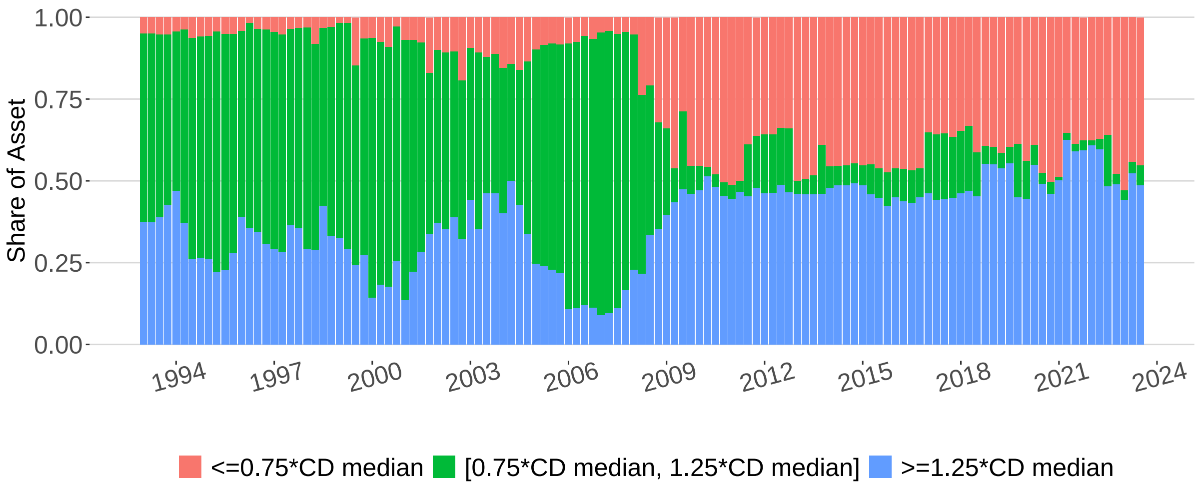

(d) 2023Q3



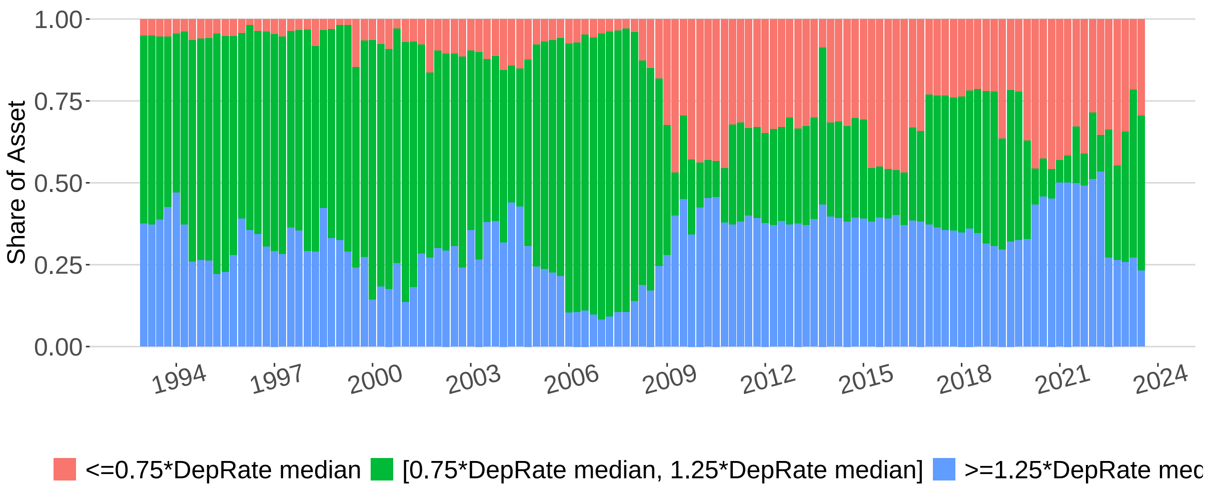

*Notes:* This figure presents kernel density plots of the scaled and demeaned 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and the scaled and demeaned deposit rates (DepRate) calculated from Call Reports offered by all banks at the peak of each rate hiking cycle. Figures a, b,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

Figure B.3: Asset Distribution of All Banks

(a) Classification based on 12MCD10K



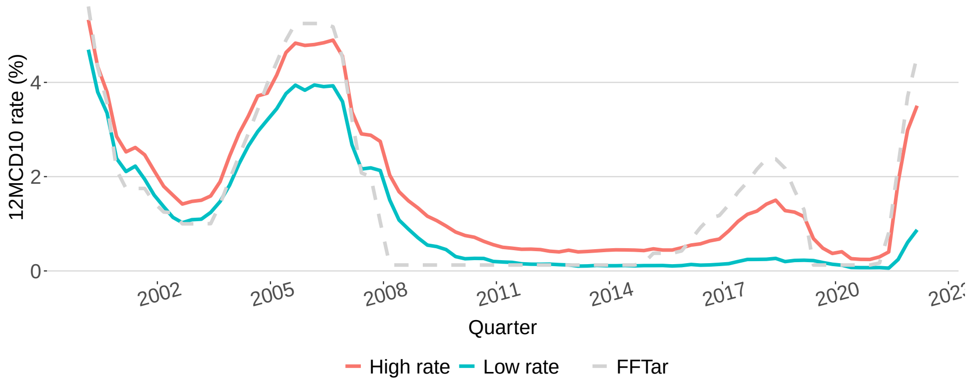

(b) Classification based on DepRate



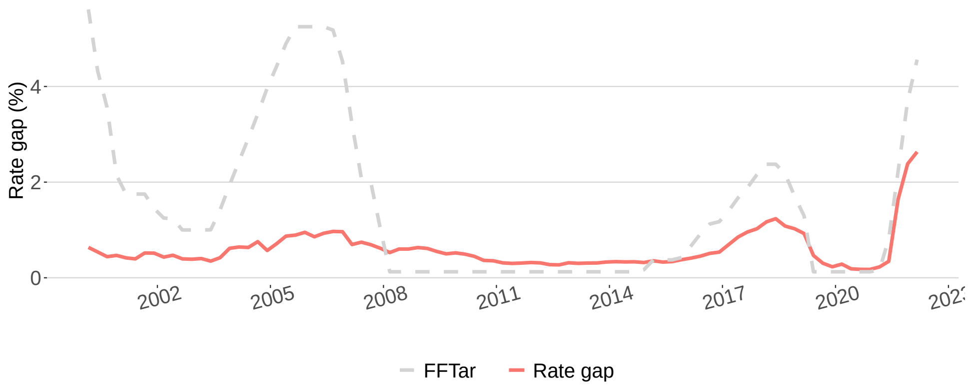

*Notes:* This figure illustrates the distribution of bank assets among three categories for all banks: banks with deposit rates below 0.75 times the sample median, banks with deposit rates within the range of 0.75 times to 1.25 times the sample median, and banks with deposit rates exceeding 1.25 times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

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

(a) Rate



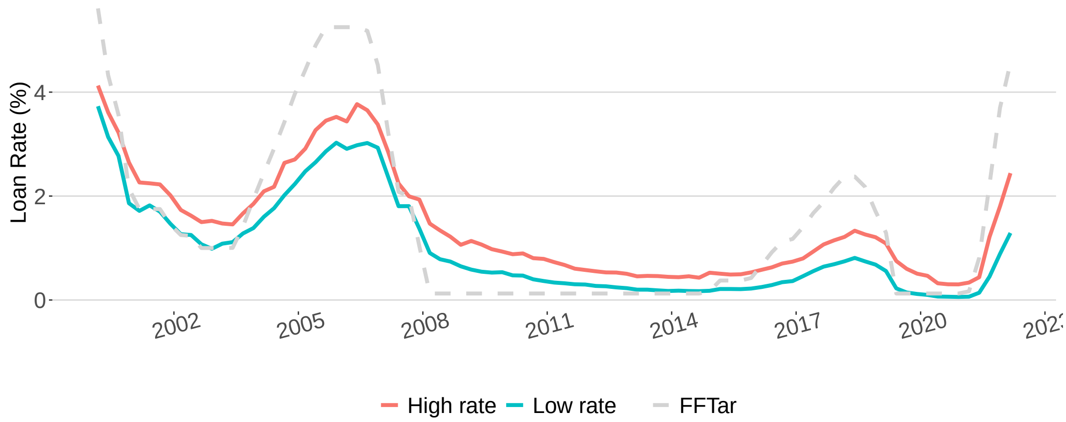

(b) Rate Gap



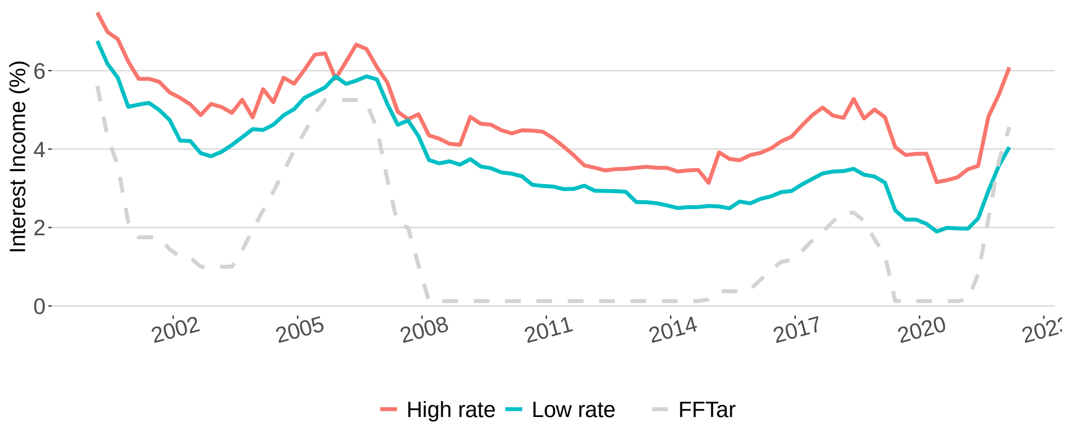

*Notes:* This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q2 among the top 100 banks. Figure B.4a presents a time-series plot of the of 12-month certificate of deposit rates of at least $10,000 (12MCD10K) using RateWatch data for *high rate*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

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

(a) Interest Expense




(b) Interest Income



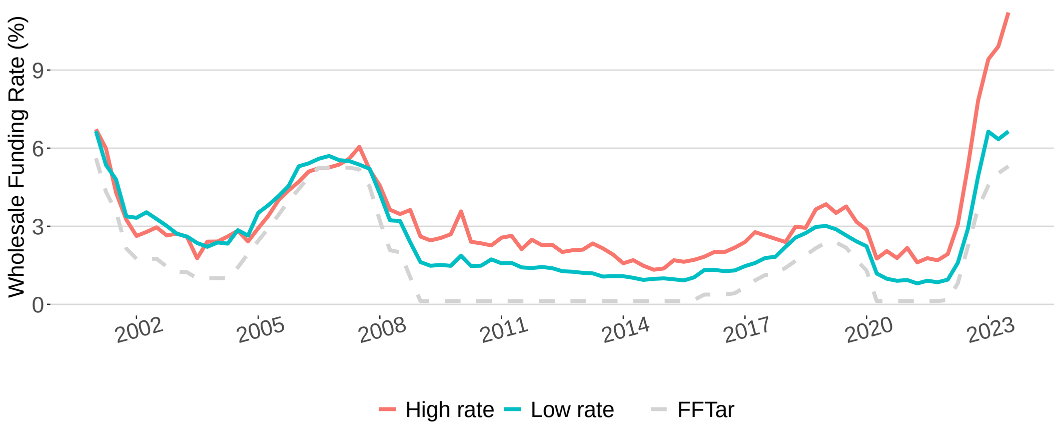

(c) NIM


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

Figure B.6: Wholesale Funding

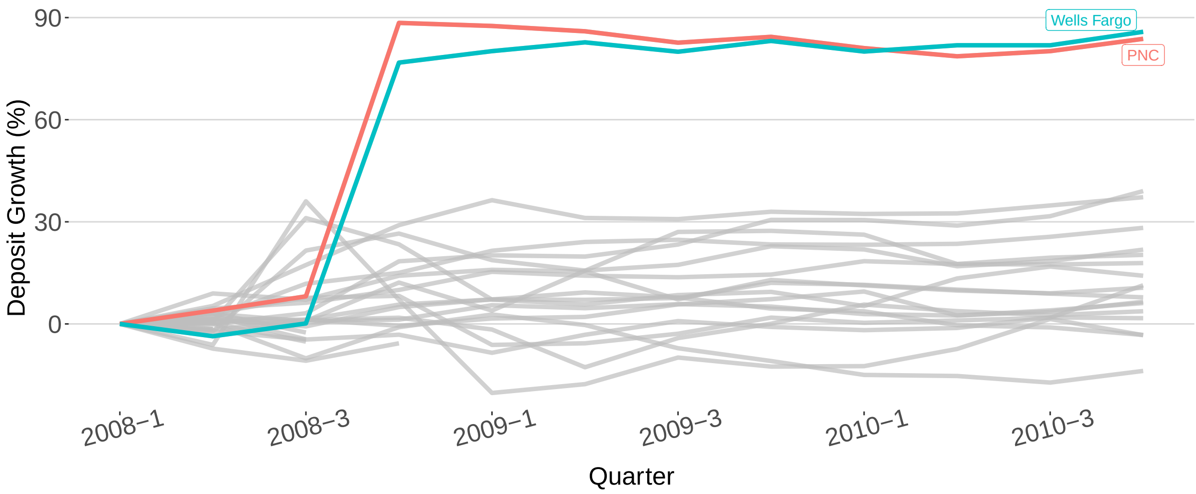
(a) Wholesale Funding Share


(b) Wholesale Funding Rate




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

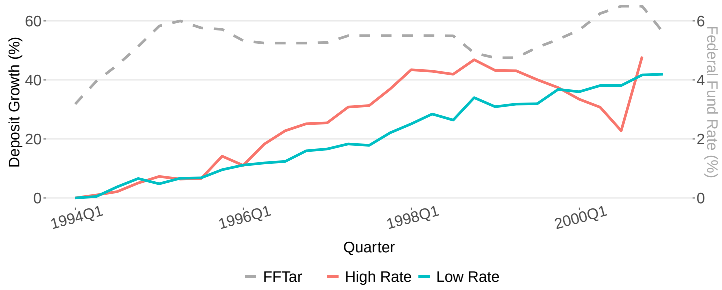
Figure B.7: Deposit Growth in Crisis Period: 2008Q1-2010Q4



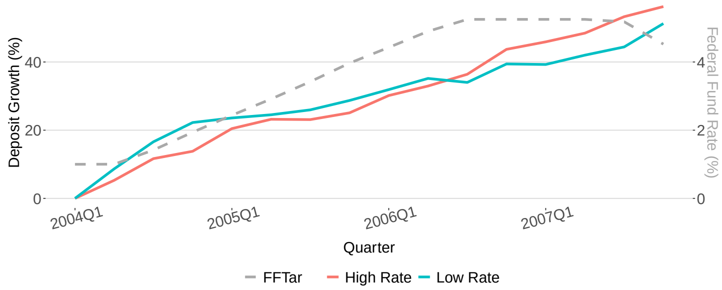

*Notes:* The figure illustrates the deposit growth of the top 25 banks from 2008Q1 to 2010Q4. The top 25 banks are chosen by their end-of-quarter assets for 2007Q4. The two big jumps in deposit growth are due to M&A: Wells Fargo acquired Wachovia on October 3, 2008, and PNC acquired National City Bank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

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

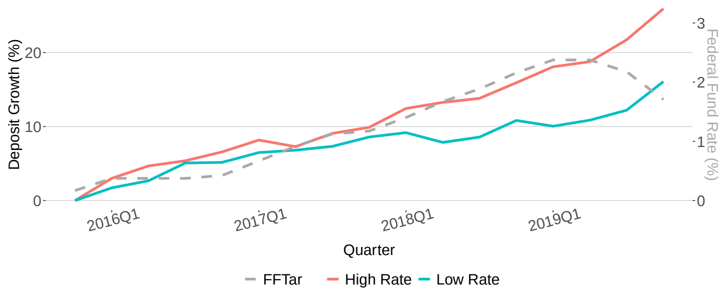
(a) 1993Q4-2001Q1



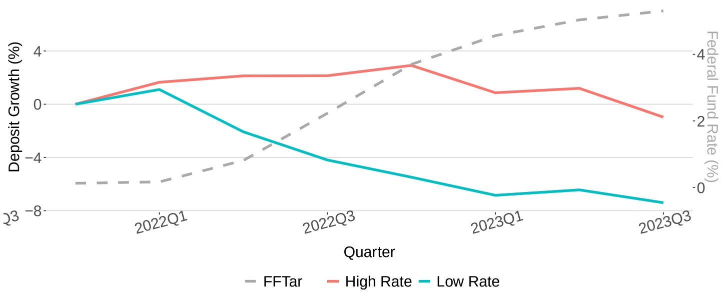

(b) 2004Q1-2007Q4




(c) 2015Q4-2019Q4



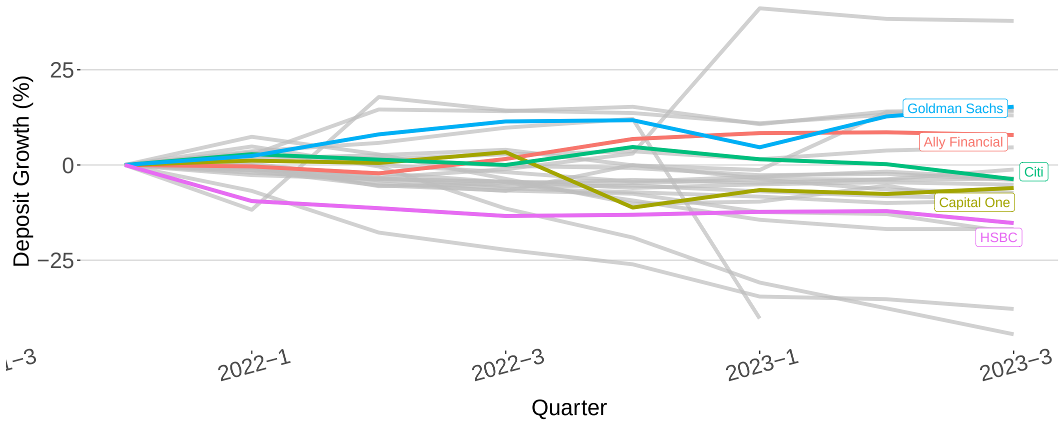

(d) 2021Q4-2023Q2



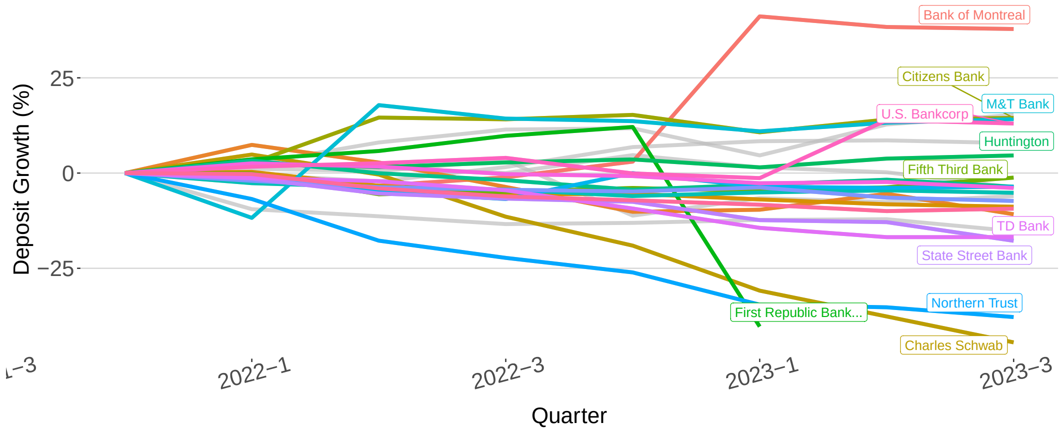

*Notes:* This figure compares the deposit growth of high and low rate banks among the top 25 banks over the four recent rate hiking cycles. The difference from Figure 7 is that in this exercise we fix the top 25 banks at the beginning of the cycle. Figures B.8a B.8b, B.8c, and B.8d compare the deposit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

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

(a) High rate Banks



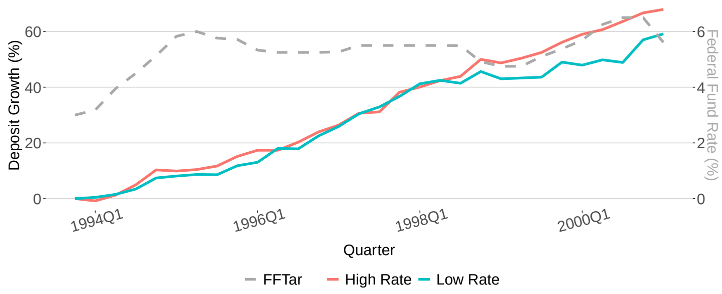

(b) Low rate Banks



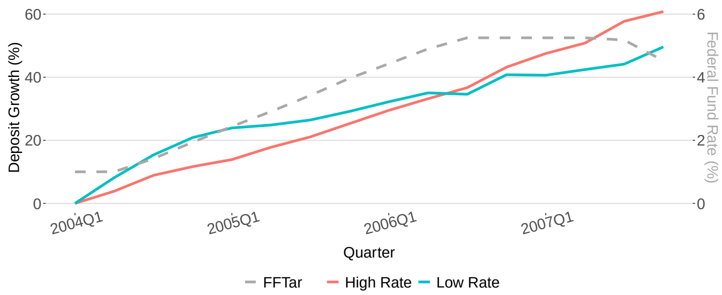

*Notes:* The figure illustrates the deposit growth of the top 25 banks, categorized by their end-of-quarter assets for 2022Q4. The classification into high-rate and low-rate banks is determined by the deposit rate of the 12-month certificate of deposit on accounts with a minimum balance of $10,000 in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

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

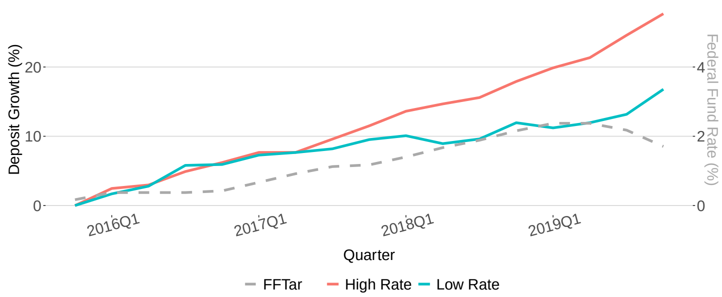
(a) 1993Q4-2001Q1



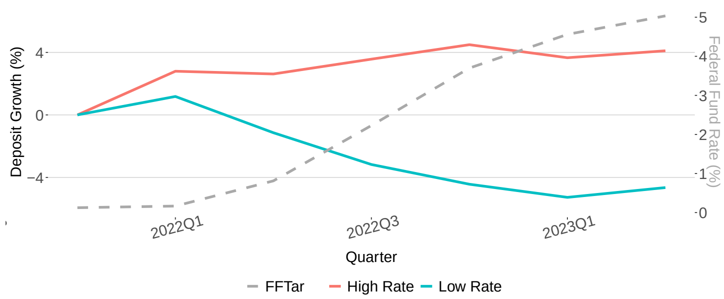

(b) 2004Q1-2007Q4




(c) 2015Q4-2019Q4



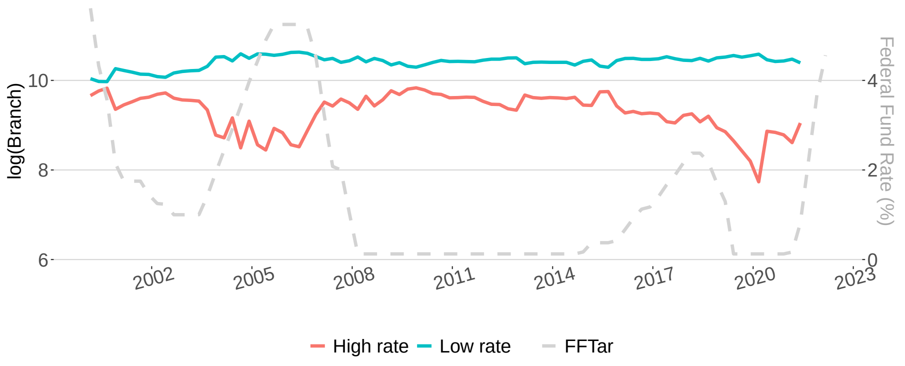

(d) 2021Q4-2023Q2



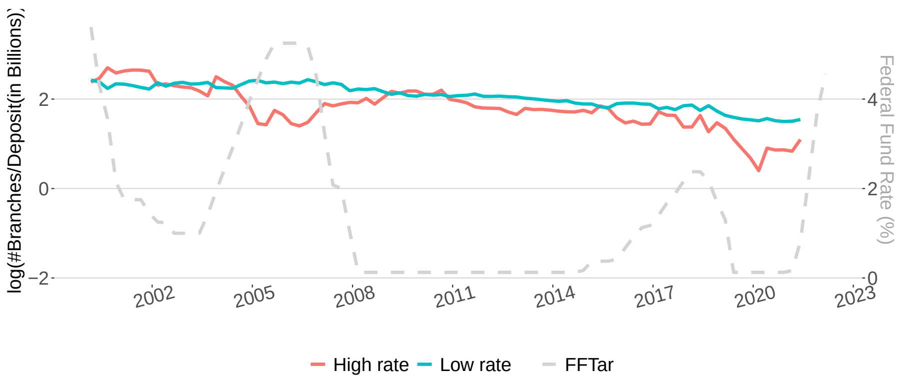

*Notes:* This figure compares the deposit growth of high and low rate banks among the top 100 banks over the three recent rate hiking cycles. Figures B.10a B.10b, B.10c, and B.10d compare the deposit growth experienced by high-rate banks to that of low-rate banks from 1993Q4 through 2001Q1, from 2004Q1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

Figure B.11: Branches (Top 100 Banks)

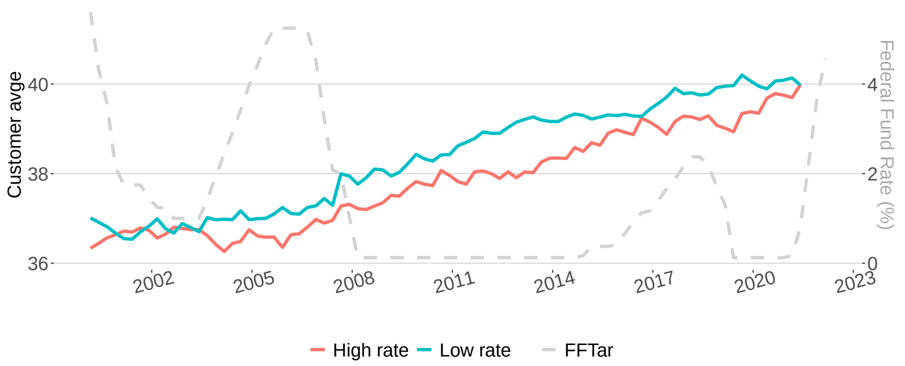
(a) Growth of Branches




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



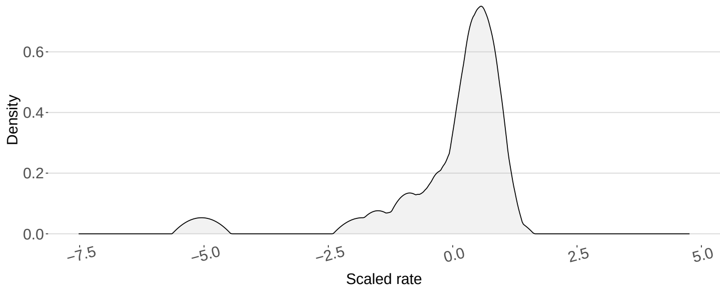

(c) Customer age



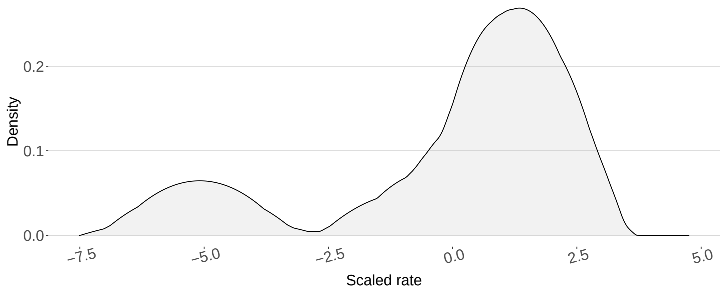

*Notes:* This figure compares branches operating by high and low rate banks among the top 100 banks from 2001Q1 through 2022Q2, which is the quarter where the most recent SOD data ends. Figure B.11a presents the log-transformed number of branches of high and low rate banks. Figure B.11b presents the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

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

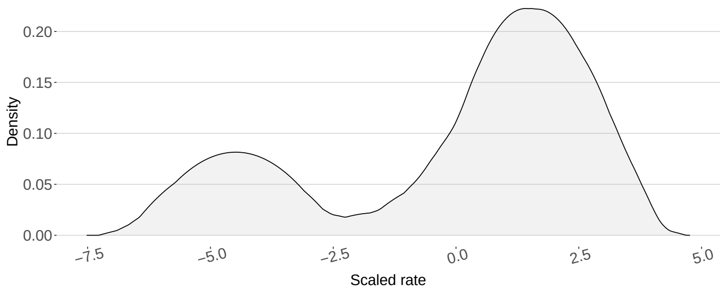
(a) 1994Q4



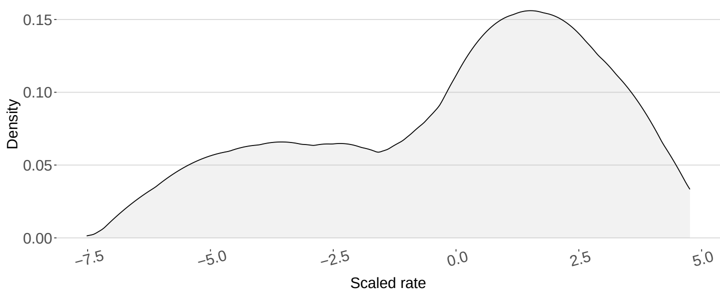

(b) 2007Q3




(c) 2019Q1



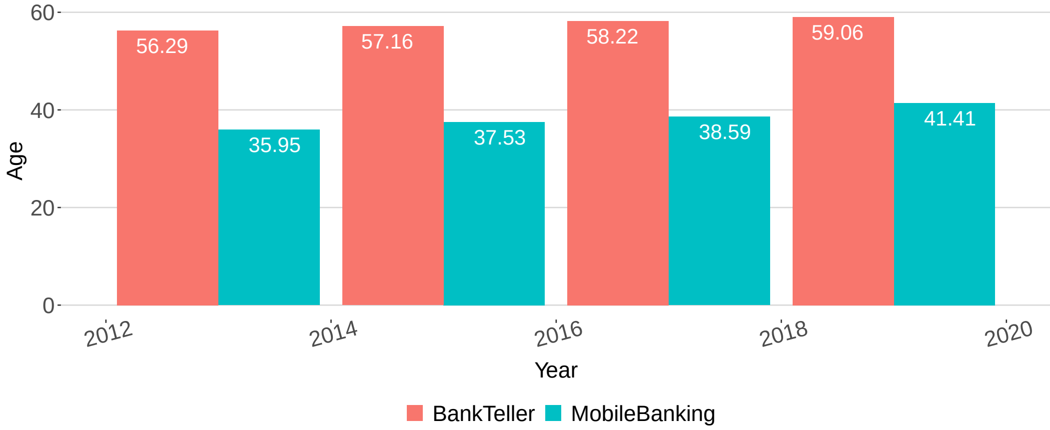

(d) 2022Q2



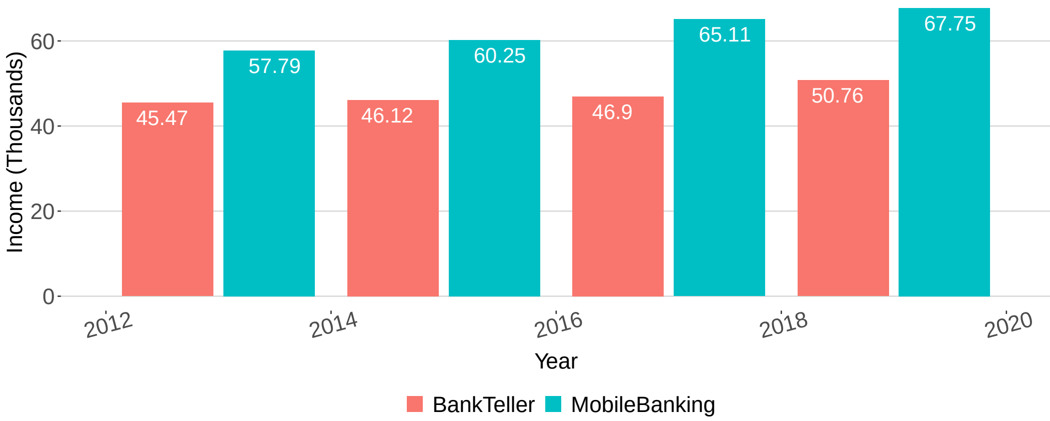

*Notes:* This figure displays kernel density plots of the demeaned logarithm of branch deposits by the top 25 banks at the peak of each interest rate hiking cycle. Figures a, b, c and d illustrate the kernel density at the following quarters: 1994Q4, 2007Q3, 2019Q1, and 2022Q2 (the last quarter available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

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

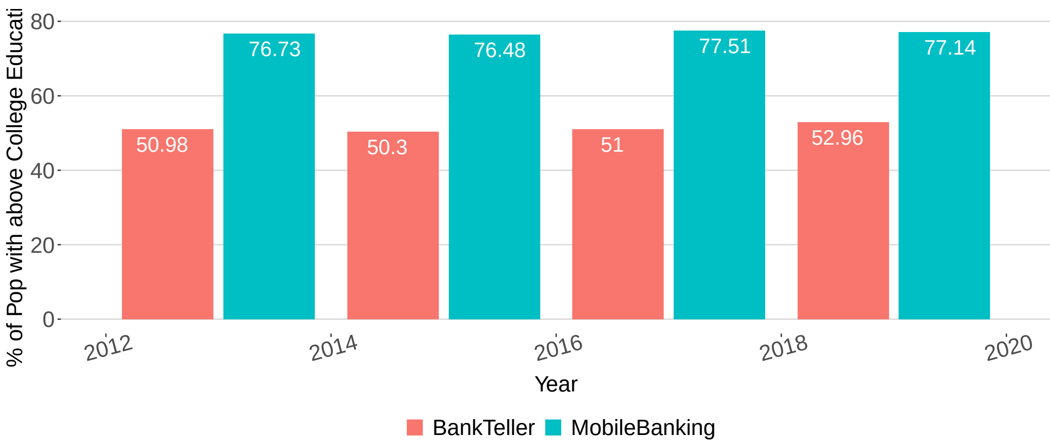
(a) Age




(b) Income

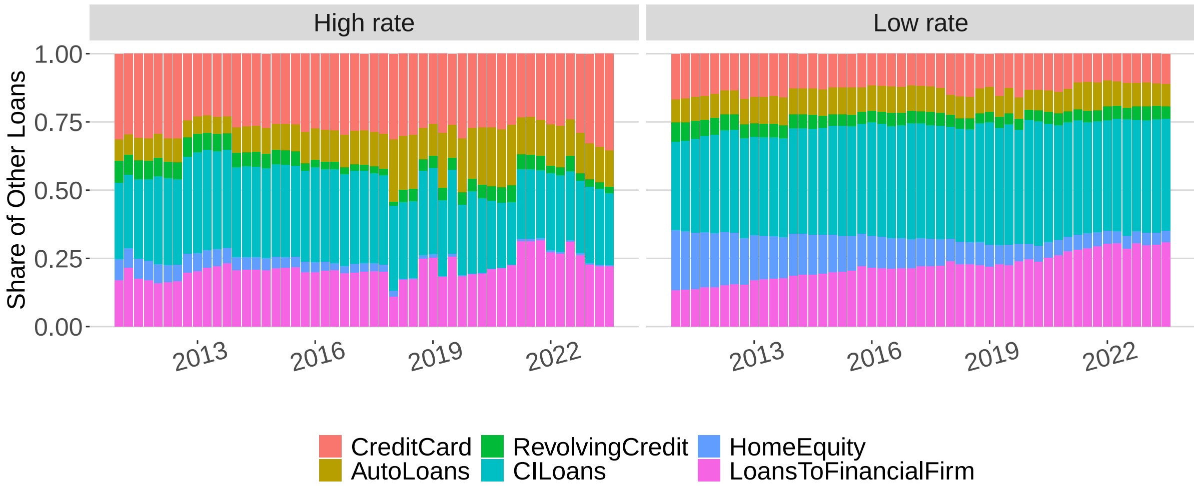



(c) Education




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

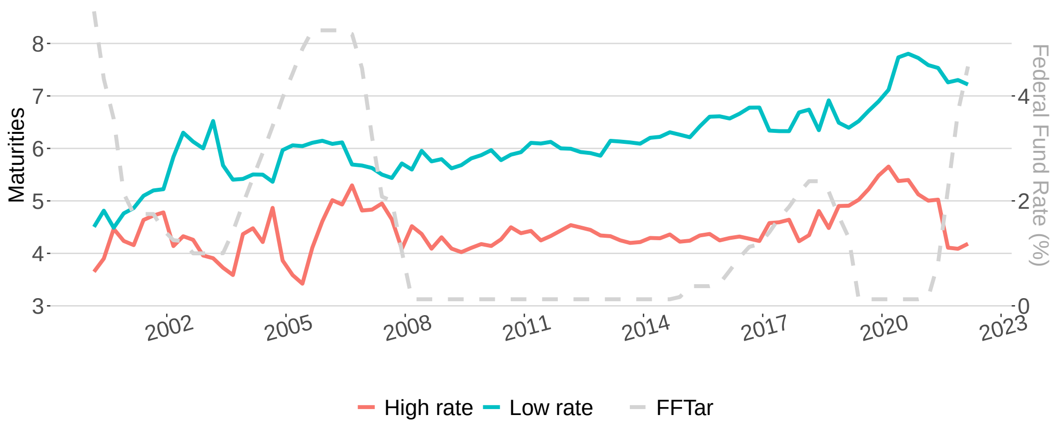
Figure B.14: Share of Non-Real Estate Loans (Top 25 Banks)



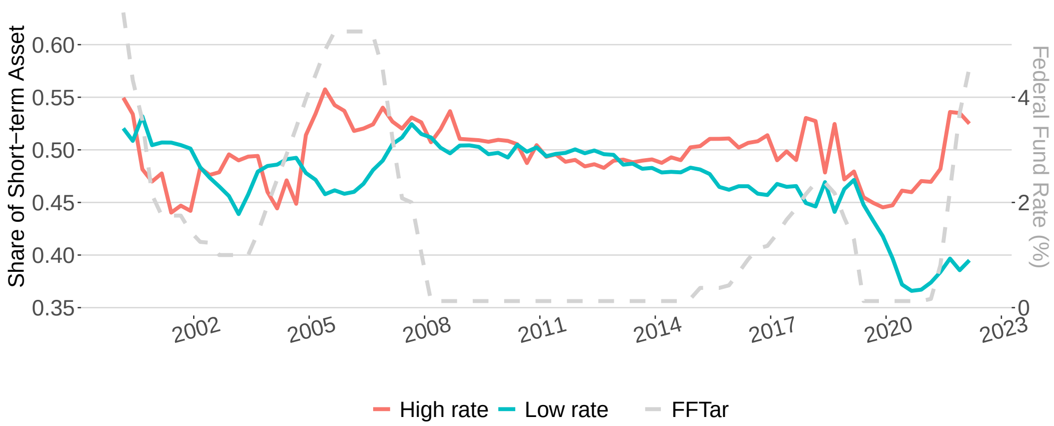

*Notes:* This figure presents the share of non-real estate loans of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. We consider six categories: credit card loans, auto loans, home equity loans, revolving credit to individuals, commercial and industrial loans, and loans to other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

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

(a) Maturity



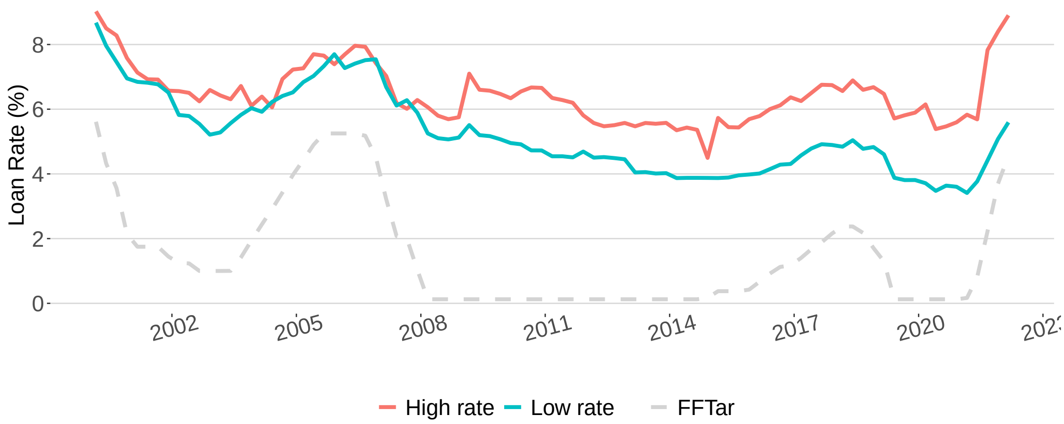

(b) Share of Short-Term Assets




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

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

(a) Loan rate




(b) Credit spread


(c) Charge-offs


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

Table B.1: Summary Statistics

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

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

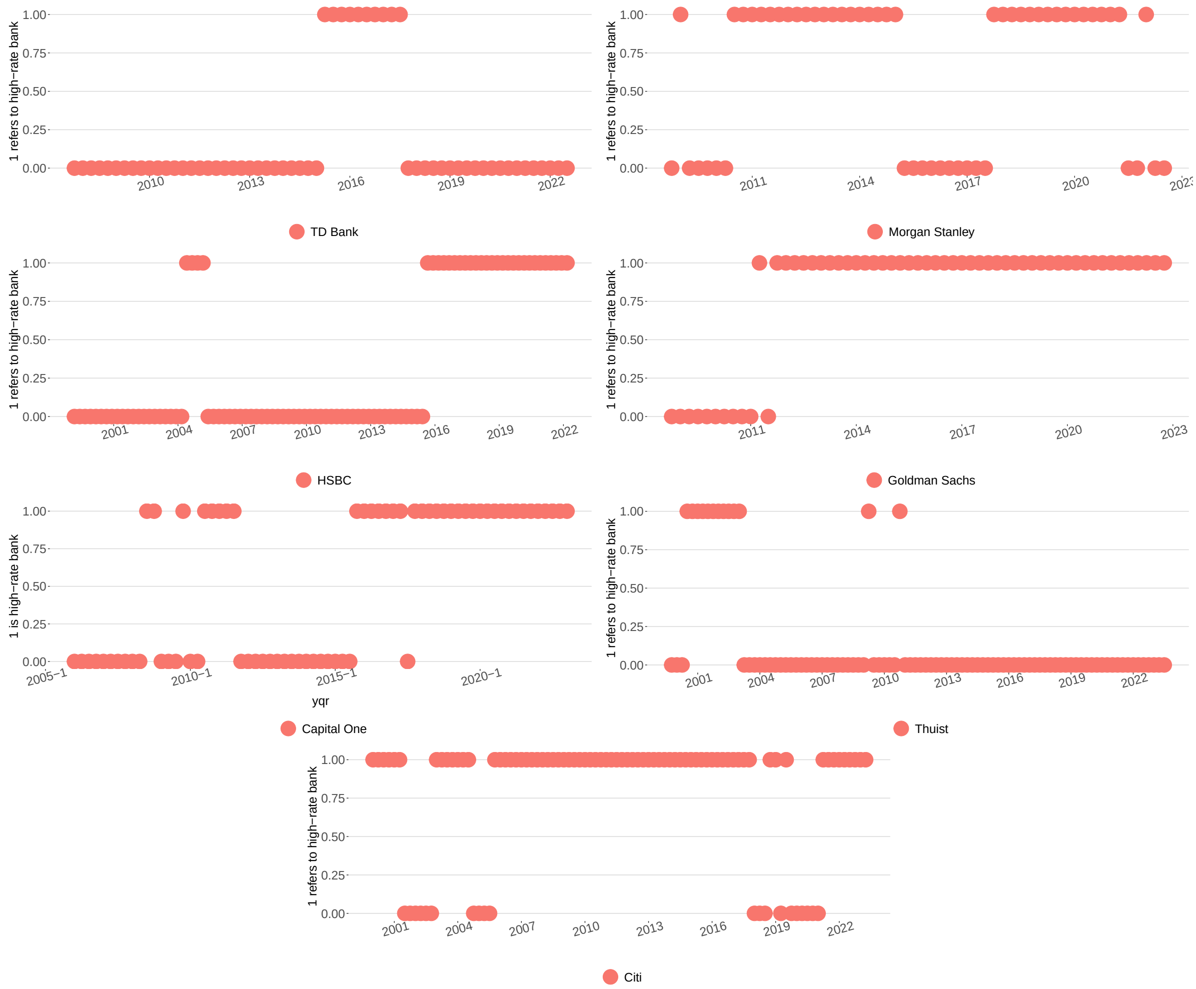
Panel B: Correlation Matrix of Rates

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

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

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

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

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

Table B.4: Deposit Betas (Robustness Check)

| | ΔDep. Rate | ΔInterest Expense | ΔInterest Income | ΔNIM |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ΔFFTar×𝟙(High Rate)×Post | 0.504*** | 0.150*** | 0.111 | -0.028 |
| | (0.114) | (0.039) | (0.068) | (0.049) |
| ΔFFTar×𝟙(High Rate) | -0.042 | -0.013 | -0.032 | -0.028 |
| | (0.108) | (0.036) | (0.064) | (0.039) |
| 𝟙(High Rate)×Post | 0.008 | -0.009 | 0.037 | 0.045 |
| | (0.050) | (0.018) | (0.049) | (0.041) |
| 𝟙(High Rate) | -0.024 | 0.003 | -0.035 | -0.039 |
| | (0.045) | (0.017) | (0.049) | (0.041) |
| $ROA_{i,q-1}$ | 0.006 | -0.008* | -0.013 | -0.005 |
| | (0.007) | (0.005) | (0.015) | (0.015) |
| $Tier1_{i,q-1}$ | -0.004 | -0.003 | -0.014 | -0.013 |
| | (0.007) | (0.006) | (0.012) | (0.010) |
| Quarter FE | ✓ | ✓ | ✓ | ✓ |
| Adjusted $R^2$ | 0.185 | 0.018 | 0.001 | 0.001 |
| Observations | 1846 | 2268 | 2268 | 2268 |
| Mean of Dep. Variable | -0.020 | 0.001 | -0.009 | -0.010 |

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

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

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

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

| | ΔDep. Rate | ΔInterest Expense | ΔInterest Income | ΔNIM |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ΔFFTar×$\mathbb{1}$(High Rate)×Post | 0.505*** | 0.169*** | 0.119* | -0.062 |
| | (0.096) | (0.049) | (0.062) | (0.041) |
| ΔFFTar×$\mathbb{1}$(High Rate) | -0.023 | -0.048 | -0.042 | 0.009 |
| | (0.066) | (0.037) | (0.058) | (0.035) |
| ΔFFTar | 0.599*** | 0.459*** | 0.433*** | -0.029 |
| | (0.053) | (0.036) | (0.054) | (0.032) |
| ΔFFTar×Post | -0.446*** | -0.150*** | 0.077 | 0.227*** |
| | (0.095) | (0.050) | (0.065) | (0.043) |
| $\mathbb{1}$(High Rate)×Post | -0.001 | -0.014 | 0.033 | 0.043 |
| | (0.029) | (0.019) | (0.035) | (0.026) |
| $\mathbb{1}$(High Rate) | -0.023 | 0.001 | -0.037 | -0.036 |
| | (0.024) | (0.018) | (0.033) | (0.025) |
| Post | -0.063 | 0.001 | -0.013 | -0.015 |
| | (0.050) | (0.022) | (0.034) | (0.018) |
| $\text{ROA}_{i,q-1}$ | 0.027* | 0.009* | -0.001 | -0.011 |
| | (0.014) | (0.005) | (0.011) | (0.009) |
| $\text{Tier1}_{i,q-1}$ | -0.024** | -0.013** | -0.021 | -0.008 |
| | (0.011) | (0.007) | (0.015) | (0.011) |
| Constant | 0.025 | -0.010 | -0.012 | 0.000 |
| | (0.044) | (0.020) | (0.032) | (0.018) |
| Adjusted $R^2$ | 0.554 | 0.552 | 0.263 | 0.053 |
| Observations | 7065 | 9047 | 9047 | 9047 |
| Mean of Dep. Variable | -0.016 | -0.000 | -0.013 | -0.013 |

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

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

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

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

| | $\Delta$Deposit$_{i,y}$ | | $\Delta$Personal Loan$_{i,y}$ | | $\Delta$C&I Loan$_{i,y}$ | | $\Delta$Real Estate Loan$_{i,y}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\Delta$FFTar$_y$ $\times$ $\mathbb{1}$(High Rate)$\times$Post | 5.601*** | 5.587** | 9.402** | 9.969** | 2.408 | 1.879 | 2.025 | 2.663 |
| | (1.935) | (2.155) | (3.717) | (3.999) | (2.481) | (2.678) | (2.482) | (3.107) |
| $\Delta$FFTar$_y$ $\times$ $\mathbb{1}$(High Rate) | -3.208** | -3.005* | -7.560** | -7.848** | -0.396 | 0.410 | -2.216 | -2.300 |
| | (1.514) | (1.609) | (3.384) | (3.593) | (1.513) | (1.605) | (1.431) | (1.537) |
| $\Delta$FFTar$_y$$\times$Post | -6.897*** | 0.000 | -2.544 | 0.000 | -3.100 | 0.000 | -4.632** | 0.000 |
| | (1.368) | (.) | (1.752) | (.) | (2.767) | (.) | (2.173) | (.) |
| $\mathbb{1}$(High Rate)$\times$Post | -9.837** | -10.235** | 31.060*** | 30.577*** | -5.052 | -8.411** | -12.002** | -12.327** |
| | (4.216) | (4.169) | (6.694) | (7.011) | (3.653) | (3.802) | (4.760) | (5.028) |
| $\mathbb{1}$(High Rate) | 9.714** | 10.907*** | -25.375*** | -25.120*** | 5.789** | 8.785*** | 15.179*** | 16.155*** |
| | (3.790) | (3.748) | (6.455) | (6.799) | (2.731) | (2.765) | (3.157) | (3.311) |
| Post | -8.288*** | 0.000 | -23.028*** | 0.000 | -10.392 | 0.000 | -24.093*** | 0.000 |
| | (2.898) | (.) | (3.781) | (.) | (6.970) | (.) | (3.624) | (.) |
| ROA$_{i,q-1}$ | 0.103 | 1.262 | 0.381 | 2.193 | 1.276 | 2.665*** | 1.741 | 4.906*** |
| | (1.047) | (1.364) | (0.914) | (1.377) | (1.389) | (1.007) | (1.079) | (1.432) |
| Tier1$_{i,q-1}$ | -0.009 | -0.005 | 0.002 | -0.004 | -0.039** | -0.037** | 0.021 | 0.017 |
| | (0.013) | (0.010) | (0.015) | (0.014) | (0.017) | (0.015) | (0.027) | (0.023) |
| $\Delta$FFTar$_y$ $\times$ $\mathbb{1}$(High Rate)$\times$Crisis | 4.874*** | 35.064*** | 36.090*** | 49.424*** | 32.399*** | 37.458*** | 42.950*** | 67.869*** |
| | (1.579) | (1.536) | (3.525) | (4.054) | (4.144) | (2.223) | (1.989) | (1.984) |
| Quarter FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.084 | 0.016 | 0.036 | 0.019 | 0.025 | 0.012 | 0.087 | 0.016 |
| Observations | 9053 | 9053 | 8876 | 8876 | 8586 | 8586 | 8795 | 8795 |
| Mean of Dep. Variable | 19.611 | 19.611 | 13.355 | 13.355 | 14.046 | 14.046 | 14.455 | 14.455 |

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

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

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

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

| | log(# Branches) | | $\log(\frac{\text{Branches}}{\text{Deposit}})$ | | Branch-weighted County Average Age | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}$(High Rate)×Post | -0.955*** | -1.031*** | -0.274 | -0.347 | -0.257*** | -0.215* |
| | (0.207) | (0.224) | (0.241) | (0.245) | (0.092) | (0.109) |
| $\mathbb{1}$(High Rate) | -1.161*** | -1.168*** | -0.781*** | -0.838*** | -0.221*** | -0.151* |
| | (0.154) | (0.161) | (0.228) | (0.229) | (0.079) | (0.085) |
| Post | 0.557*** | | -0.846*** | | 1.905*** | |
| | (0.119) | | (0.125) | | (0.203) | |
| $\text{ROA}_{i,q-1}$ | -0.252*** | -0.271*** | -0.223*** | -0.202*** | -0.071 | -0.257*** |
| | (0.050) | (0.053) | (0.046) | (0.054) | (0.093) | (0.049) |
| $\text{Tier1}_{i,q-1}$ | 0.747*** | 0.729*** | 0.056 | -0.031 | -0.243*** | -0.056 |
| | (0.084) | (0.078) | (0.042) | (0.043) | (0.083) | (0.041) |
| Constant | 6.500*** | | 1.995*** | | 37.377*** | |
| | (0.127) | | (0.105) | | (0.144) | |
| Quarter FE | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.225 | 0.231 | 0.111 | 0.080 | 0.244 | 0.041 |
| Observations | 8145 | 8145 | 8145 | 8145 | 7226 | 7226 |
| Mean of Dep. Variable | 6.589 | 6.589 | 0.880 | 0.880 | 38.603 | 38.603 |

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

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

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

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

Panel A: Loans and Securities

| | Maturities (years) | Short-term share (%) |
|---|---|---|
| | (1) | (2) |
| $\mathbb{1}$(High Rate)×Post | -0.705*** | 2.266 |
| | (0.232) | (1.784) |
| $\mathbb{1}$(High Rate) | -1.409*** | 3.221** |
| | (0.216) | (1.380) |
| Quarter FE + Controls | ✓ | ✓ |
| Observations | 8179 | 8179 |
| Mean of Dep. Variable | 5.738 | 47.590 |

Panel B: Maturity by Asset Class

| | Real Estate Loans | Other Loans | MBSs | Treasuries |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}$(High Rate)×Post | -0.933*** | 0.226 | -1.580*** | -0.665 |
| | (0.315) | (0.148) | (0.538) | (0.530) |
| $\mathbb{1}$(High Rate) | -1.121*** | -0.342** | 0.512 | -0.681 |
| | (0.251) | (0.135) | (0.531) | (0.455) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ |
| Observations | 7777 | 8178 | 8007 | 8013 |
| Mean of Dep. Variable | 11.836 | 2.092 | 16.537 | 5.984 |

Panel C: Share by Asset Class (%)

| | Real Estate Loans | Other Loans | MBSs | Treasuries |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}$(High Rate)×Post | -1.595 | 5.935*** | -0.979 | -3.361** |
| | (1.132) | (1.541) | (0.684) | (1.417) |
| $\mathbb{1}$(High Rate) | -2.513** | 3.249** | -5.382*** | 4.646*** |
| | (1.078) | (1.235) | (0.598) | (1.211) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ |
| Observations | 8179 | 8179 | 8179 | 8179 |
| Mean of Dep. Variable | 14.998 | 59.490 | 11.539 | 13.972 |

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

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

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

## Table B.9: Credit Risk (Top 100 Banks)

Panel A: Loans and Securities

| | Loan Rate | Credit Spread | Charge-offs |
|---|---|---|---|
| | (1) | (2) | (3) |
| $\mathbb{1}$(High Rate)×Post | 1.068*** | 0.980*** | 0.194** |
| | (0.144) | (0.160) | (0.077) |
| $\mathbb{1}$(High Rate) | 0.587*** | 0.744*** | 0.256*** |
| | (0.095) | (0.143) | (0.067) |
| Quarter FE + Controls | ✓ | ✓ | ✓ |
| Observations | 9053 | 7878 | 9053 |
| Mean of Dep. Variable | 5.267 | 3.495 | 0.839 |

Panel B: Charge-off Rates by Asset Class

| | Real Estate Loans | C&I Loans | Personal Loans | Other Loans |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}$(High Rate)×Post | 0.034 | 0.334*** | 0.218 | 0.082 |
| | (0.046) | (0.079) | (0.166) | (0.052) |
| $\mathbb{1}$(High Rate) | 0.093** | -0.033 | 0.234* | -0.055 |
| | (0.036) | (0.066) | (0.139) | (0.038) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ |
| Observations | 8877 | 8704 | 8946 | 8523 |
| Mean of Dep. Variable | 0.429 | 0.629 | 2.162 | 0.248 |

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

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

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

Table B.10: Construction of Key Variables

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

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

# Appendix C Main Results for Top 100 Banks with Bank FE

This section replicates our baseline analysis with the inclusion of bank fixed effects.

Table C.1: Deposit Betas

| | ΔDep. Rate | | ΔInterest Expense | | ΔInterest Income | | ΔNIM | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| ΔFFTar×$\mathbb{1}$(High Rate)×Post | 0.501*** | 0.507*** | 0.169*** | 0.174*** | 0.148** | 0.146** | -0.033 | -0.039 |
| | (0.099) | (0.099) | (0.045) | (0.046) | (0.063) | (0.059) | (0.045) | (0.046) |
| ΔFFTar×$\mathbb{1}$(High Rate) | -0.026 | -0.032 | -0.049 | -0.054 | -0.070 | -0.077 | -0.017 | -0.021 |
| | (0.066) | (0.073) | (0.035) | (0.037) | (0.060) | (0.059) | (0.039) | (0.037) |
| $\mathbb{1}$(High Rate)×Post | 0.012 | -0.001 | -0.003 | -0.003 | 0.045 | 0.068 | 0.044* | 0.066* |
| | (0.037) | (0.046) | (0.019) | (0.022) | (0.035) | (0.047) | (0.026) | (0.035) |
| $\mathbb{1}$(High Rate) | -0.025 | -0.049 | -0.002 | -0.002 | -0.049 | -0.062 | -0.045* | -0.063* |
| | (0.032) | (0.043) | (0.019) | (0.024) | (0.034) | (0.048) | (0.025) | (0.034) |
| $\text{ROA}_{i,q-1}$ | 0.005 | 0.003 | -0.002 | -0.002 | -0.010 | -0.013 | -0.008 | -0.012 |
| | (0.005) | (0.006) | (0.003) | (0.004) | (0.009) | (0.012) | (0.009) | (0.013) |
| $\text{Tier1}_{i,q-1}$ | -0.005 | -0.012 | -0.004 | -0.009 | -0.015 | -0.044** | -0.012 | -0.035** |
| | (0.007) | (0.011) | (0.006) | (0.008) | (0.015) | (0.017) | (0.010) | (0.013) |
| Quarter FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.195 | 0.166 | 0.016 | -0.014 | 0.002 | -0.026 | 0.002 | -0.025 |
| Observations | 7065 | 7058 | 9047 | 9036 | 9047 | 9036 | 9047 | 9036 |
| Mean of Dep. Variable | -0.016 | -0.016 | -0.000 | -0.000 | -0.013 | -0.013 | -0.013 | -0.013 |

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

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

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

Table C.2: Growth in Deposits and Loans

| | $\Delta$Deposit$_{i,y}$ | | $\Delta$Personal Loan$_{i,y}$ | | $\Delta$C&I Loan$_{i,y}$ | | $\Delta$Real Estate Loan$_{i,y}$ | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\Delta$FFTar$_y$ × $\mathbb{1}$(High Rate)×Post | 5.587** | 7.318*** | 9.969** | 10.192*** | 1.879 | 3.504 | 2.663 | 4.621* |
| | (2.155) | (1.320) | (3.999) | (3.362) | (2.678) | (2.678) | (3.107) | (2.630) |
| $\Delta$FFTar$_y$ × $\mathbb{1}$(High Rate) | -3.005* | -3.808*** | -7.848** | -7.331** | 0.410 | -0.210 | -2.300 | -2.742* |
| | (1.609) | (0.771) | (3.593) | (3.030) | (1.605) | (2.143) | (1.537) | (1.519) |
| $\mathbb{1}$(High Rate) | 10.907*** | 10.738*** | -25.120*** | -16.158** | 8.785*** | 14.355*** | 16.155*** | 15.781*** |
| | (3.748) | (1.904) | (6.799) | (6.958) | (2.765) | (4.544) | (3.311) | (3.809) |
| ROA$_{i,q-1}$ | 1.262 | 1.051 | 2.193 | 0.820 | 2.665*** | 2.458** | 4.906*** | 2.467** |
| | (1.364) | (0.725) | (1.377) | (1.314) | (1.007) | (0.978) | (1.432) | (1.008) |
| Tier1$_{i,q-1}$ | -0.005 | 0.018 | -0.004 | 0.026 | -0.037** | 0.018 | 0.017 | 0.062* |
| | (0.010) | (0.016) | (0.014) | (0.017) | (0.015) | (0.018) | (0.023) | (0.031) |
| $\Delta$FFTar$_y$ × $\mathbb{1}$(High Rate)×Crisis | 35.064*** | 32.780*** | 49.424*** | 40.732*** | 37.458*** | 40.622*** | 67.869*** | 69.519*** |
| | (1.536) | (3.182) | (4.054) | (8.908) | (2.223) | (5.385) | (1.984) | (6.486) |
| Quarter FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.016 | -0.004 | 0.019 | -0.019 | 0.012 | -0.019 | 0.016 | -0.006 |
| Observations | 9053 | 9042 | 8876 | 8865 | 8586 | 8576 | 8795 | 8784 |
| Mean of Dep. Variable | 19.611 | 19.612 | 13.355 | 13.358 | 14.046 | 14.047 | 14.455 | 14.454 |

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

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

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

Table C.3: Bank Branches

| | log(# Branches) | | $\log(\frac{\text{Branches}}{\text{Deposit}})$ | | Branch-weighted County Average Age | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}$(High Rate)×Post | -1.031*** | -0.145** | -0.347 | 0.055 | -0.215* | 0.180*** |
| | (0.224) | (0.066) | (0.245) | (0.066) | (0.109) | (0.048) |
| $\mathbb{1}$(High Rate) | -1.168*** | 0.127** | -0.838*** | -0.036 | -0.151* | -0.061* |
| | (0.161) | (0.051) | (0.229) | (0.064) | (0.085) | (0.036) |
| $\text{ROA}_{i,q-1}$ | -0.271*** | 0.012 | -0.202*** | 0.014 | -0.257*** | -0.007 |
| | (0.053) | (0.013) | (0.054) | (0.011) | (0.049) | (0.015) |
| $\text{Tier1}_{i,q-1}$ | 0.729*** | -0.012 | -0.031 | 0.038 | -0.056 | -0.149*** |
| | (0.078) | (0.035) | (0.043) | (0.031) | (0.041) | (0.039) |
| Quarter FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.231 | -0.025 | 0.080 | -0.026 | 0.041 | -0.011 |
| Observations | 8145 | 8135 | 8145 | 8135 | 7226 | 7217 |
| Mean of Dep. Variable | 6.589 | 6.589 | 0.880 | 0.880 | 38.603 | 38.603 |

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

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

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

## Table C.4: Duration Risk

Panel A: Loans and Securities

| | Maturities (years) | | Short-term share (%) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{1}$(High Rate)×Post | -0.705*** | -0.051 | 2.266 | -0.439 |
| | (0.232) | (0.195) | (1.784) | (0.987) |
| $\mathbb{1}$(High Rate) | -1.409*** | 0.032 | 3.221** | -0.102 |
| | (0.216) | (0.170) | (1.380) | (0.731) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.180 | 0.036 | 0.054 | 0.002 |
| Observations | 8179 | 8168 | 8179 | 8168 |
| Mean of Dep. Variable | 5.738 | 5.738 | 47.590 | 47.590 |

Panel B: Maturity by Asset Class

| | Real Estate Loans | | Other Loans | | MBSs | | Treasuries | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\mathbb{1}$(High Rate)×Post | -0.933*** | 0.530 | 0.226 | 0.115 | -1.580*** | -0.884** | -0.665 | -0.853** |
| | (0.315) | (0.341) | (0.148) | (0.114) | (0.538) | (0.407) | (0.530) | (0.376) |
| $\mathbb{1}$(High Rate) | -1.121*** | -0.894*** | -0.342** | -0.042 | 0.512 | 0.408 | -0.681 | 0.697** |
| | (0.251) | (0.318) | (0.135) | (0.089) | (0.531) | (0.433) | (0.455) | (0.342) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.071 | 0.062 | 0.058 | -0.018 | 0.109 | -0.009 | 0.031 | -0.018 |
| Observations | 7777 | 7767 | 8178 | 8167 | 8007 | 7995 | 8013 | 8002 |
| Mean of Dep. Variable | 11.836 | 11.837 | 2.092 | 2.092 | 16.537 | 16.538 | 5.984 | 5.984 |

Panel C: Share by Asset Classes (%)

| | Real Estate Loans | | Other Loans | | MBSs | | Treasuries | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\mathbb{1}$(High Rate)×Post | -1.595 | 0.185 | 5.935*** | -1.596 | -0.979 | 0.984* | -3.361** | 0.427 |
| | (1.132) | (1.583) | (1.541) | (1.207) | (0.684) | (0.548) | (1.417) | (1.358) |
| $\mathbb{1}$(High Rate) | -2.513** | -0.232 | 3.249** | 1.391 | -5.382*** | -0.877 | 4.646*** | -0.282 |
| | (1.078) | (1.463) | (1.235) | (1.306) | (0.598) | (0.543) | (1.211) | (1.452) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.060 | -0.027 | 0.100 | -0.014 | 0.111 | -0.019 | 0.021 | -0.026 |
| Observations | 8179 | 8168 | 8179 | 8168 | 8179 | 8168 | 8179 | 8168 |
| Mean of Dep. Variable | 14.998 | 14.998 | 59.490 | 59.489 | 11.539 | 11.540 | 13.972 | 13.973 |

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

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

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

Table C.5: Credit Risk with Bank Fixed Effects

Panel A: Loans and Securities

| | Loan Rate | | Credit Spread | | Charge-offs | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}$(High Rate)×Post | 1.068*** | 0.633*** | 0.980*** | 0.588** | 0.194** | 0.170* |
| | (0.144) | (0.171) | (0.160) | (0.228) | (0.077) | (0.088) |
| $\mathbb{1}$(High Rate) | 0.587*** | -0.381*** | 0.744*** | -0.387** | 0.256*** | -0.172** |
| | (0.095) | (0.134) | (0.143) | (0.184) | (0.067) | (0.072) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.248 | 0.019 | 0.266 | 0.029 | 0.065 | 0.010 |
| Observations | 9053 | 9042 | 7878 | 7866 | 9053 | 9042 |
| Mean of Dep. Variable | 5.267 | 5.267 | 3.495 | 3.495 | 0.839 | 0.839 |

Panel B: Charge-off Rates by Asset Class

| | Real Estate Loans | | C&I Loans | | Personal Loans | | Other Loans | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\mathbb{1}$(High Rate)×Post | 0.034 | 0.262*** | 0.334*** | 0.194** | 0.218 | 0.201 | 0.082 | 0.038 |
| | (0.046) | (0.074) | (0.079) | (0.092) | (0.166) | (0.201) | (0.052) | (0.051) |
| $\mathbb{1}$(High Rate) | 0.093** | -0.103*** | -0.033 | -0.123 | 0.234* | -0.295* | -0.055 | -0.005 |
| | (0.036) | (0.039) | (0.066) | (0.085) | (0.139) | (0.164) | (0.038) | (0.037) |
| Quarter FE + Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bank FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Adjusted $R^2$ | 0.031 | 0.003 | 0.024 | -0.017 | 0.026 | -0.020 | 0.001 | -0.030 |
| Observations | 8877 | 8867 | 8704 | 8692 | 8946 | 8935 | 8523 | 8509 |
| Mean of Dep. Variable | 0.429 | 0.429 | 0.629 | 0.629 | 2.162 | 2.162 | 0.248 | 0.248 |

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

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

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