Diverging Banking Sector: New Facts and Macro Implications[*]

Shohini Kundu[†] Tyler Muir[‡] Jinyuan Zhang[§]

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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 very insensitive to interest 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. Thus, 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 points to 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.

Keywords: Banking, monetary policy, technology

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[†]Shohini Kundu is at the Anderson School of Management, University of California Los Angeles. email: shohini.kundu@anderson.ucla.edu

[‡]Tyler Muir is at the Anderson School of Management, University of California Los Angeles. email: tyler.muir@anderson.ucla.edu

[§]Jinyuan Zhang is at the Anderson School of Management, University of California Los Angeles. email: jinyuan.zhang@anderson.ucla.edu

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 2023. JP Morgan Chase, Wells Fargo, and Bank of America pay virtually zero interest on savings accounts, while PNC, Citi, Marcus, and Capital One pay an average of nearly 450 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.

We show that high and low deposit rate banks are different in many other ways, and we argue that the divergence in deposit rates proxies for a broader shift into two very different types of banks. High deposit rate banks have few physical branches (i.e., they operate primarily online as "e-banks") 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. Low rate banks are more traditional banks in the sense that they operate many more physical branches and earn a large 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 changes in 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 going forward. Monetary policy affects the distribution between these two types of banks: 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. Thus, increases in interest rates substantially lowers the amount of maturity transformation performed by the banking sector. Aside from rate-hiking cycles, there is evidence that the deposits of high rate banks have been growing 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 duration risk will likely fall substantially.[1] This trend is more likely to continue if interest rates remain elevated and if depositors increasingly prefer mobile and online banking rather than physical branches.

[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.

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, low rate banks used to have a deposit beta of around 0.5, and this number has fallen to around 0.1 for the 2018 and 2022 rate hiking cycles. That is, for every 100 bps increase in the Fed funds rate, low rate banks pass along only 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, and provide a model that explains our main facts when we introduce e-banking. We find support for this technology channel empirically. 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. They also invest more in IT compared to low rate banks. 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. 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. In our model, the higher franchise value for low rate banks incentivizes them to take less risk so as to preserve this franchise value, while the opposite is true for high 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 mobile and 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, as more rate sensitive depositors leave low rate banks, they are left with particularly "sleepy" depositor bases and/or depositors who highly value in-person banking, allowing them to charge higher markups in the form of lower deposit rates.

[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. We focus on the top 25 banks, all of which have widely used mobile apps.

We provide a simple model in the style of Salop (1979) and Allen and Gale (2004), where we add an "e-banking" technology in order to speak to these facts and understand the effect this technology has on the banking landscape. We analyze the strategies of two banks competing for deposits and determining loans with varying risk profiles. Depositors have a preference for in-person services and favor branches located in close proximity. In equilibrium, the two banks locate at opposite points on a circle, offer identical deposit rates, and earn rents from depositors' valuation of branch accessibility by offering deposit rates lower than the risk-free rate. We then introduce the option of "e-banking," a service model independent of physical location. Depositors value e-banking, for example for the convenience of mobile or online banking. In response to this new technology, both banks integrate e-banking into their service offerings. However, when operating branches is relatively costly, a divergent banking sector emerges; one bank transitions entirely to an e-banking model, raising its deposit rates to attract a broader base of depositors while yielding lower rents per depositor. In contrast, the other bank maintains its branches, catering to depositors who prioritize location, thus securing higher rents through relatively lower deposit rates. This generates a positive deposit spread between e-banks and branch banks, as in the data, and this spread drives deposit flows toward e-banks. Turning to the lending side, the bank that retains its branches chooses a less risky loan portfolio, aiming to safeguard the rents it earns from its depositors. Conversely, the e-bank, which gathers lower rents from its depositor base, pursues riskier loans to achieve higher lending rates. This divergence mirrors empirical trends in branch operations, deposit rates, and lending practices.

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

An important feature of banks paying low deposit rates emphasized in the literature is that deposits flow out of the banking sector towards money-market funds when interest rates increase, leading to an aggregate contraction in bank lending. 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 by \$100 billion 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). This has important implications for the design of regulatory policy.

Our findings also indicate that the shift towards banks operating without physical branches, particularly high rate banks, is likely to accelerate, driven by the preferences of younger customers who are more sensitive to rate and place less value on in-person banking services (Jiang, Yu and Zhang, 2022). This suggests that competition among banks, especially regarding deposit rates, will intensify, as the geographical proximity of a bank branch to one's home or workplace becomes less significant. As the banking sector as a whole moves towards this model, banks' capacity for maturity transformation—a key function in the financial system—could be substantially reduced.

Overall, our evidence indicates that the growing divergence within the banking sector is connected to the advent of e-banking services.[3] However, the rise of e-banking services coincides with the Financial Crisis of 2008, prompting concerns that our findings may be influenced by shifts during the 2008 crisis. We explore alternative explanations, primarily focusing on regulatory changes and liquidity injections from the Federal Reserve. Our findings show that these factors are insufficient in explaining the divergence observed in the banking sector.

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 literature highlights 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). Traditional studies on monetary policy transmission often focus on the aggregate quantity of deposits, treating the banking sector as a homogenous entity. This perspective suggests that rising interest rates lead to a net outflow of deposits and a reduction in overall bank lending. Our research, however, sheds light on a more nuanced dynamic within the evolving banking landscape. We move beyond aggregate measures by examining how interest rates influence deposit movement across different types of banks. This approach allows us to identify how these internal shifts potentially alter the trajectory of monetary policy transmission. Our findings reveal a significant shift in deposit behavior when interest rates rise. Deposits migrate from low rate banks to high rate banks. Thus, tracking aggregate deposit flows from the banking sector misses a substantial amount of flows within the banking sector. Understanding this heterogeneity in deposit rates is important for understanding the banking sector's capacity for maturity transformation, liquidity provision, and credit extension.

While recent research has highlighted the distinct behavior of FinTech banks in response to monetary policy, existing research presents contrasting views. Koont, Santos and Zingales (2023) suggest digital banks may experience deposit outflows despite competitive rates due

[3] Jiang, Yu and Zhang (2022) provides compelling causal evidence demonstrating that the rollover of 3G network infrastructure results in the divergence in deposit rate strategies among banks. The study finds that, following the 3G expansion, banks with reduced reliance on branches close branches and target tech-savvy customers, while banks maintaining a strong branch network pivot towards serving branch-captive consumers. Consequently, the former group offers higher deposit rates to attract tech-savvy consumers, while the latter group offers lower rates, extracting rents from branch-captive consumers.

to "flighty" clientele. Conversely, Erel et al. (2023) use a sample of 17 online banks to show that online banks attract more deposits with rising rates. Our research bridges this gap by examining both the deposit and lending behavior within a broader sample of all large banks. We differentiate high rate and low rate banks, revealing that depositors in low rate banks are not entirely rate-insensitive as suggested by Koont, Santos and Zingales (2023). Our findings show significant deposit migration to high rate banks when the interest rate differential is substantial. Haddad, Hartman-Glaser and Muir (2023) explore potential fragility within the banking sector due to such deposit movements.

Broadly, we explore how digital disruption affects the banking sector. While prior research has documented the role of regulatory arbitrage in driving the rapid growth of shadow banks (e.g., Buchak et al., 2018), we argue that technological innovation can produce similar effects within the banking sector, regardless of regulatory differences or flows between banks and non-banks. Specifically, we offer evidence that technology significantly influences the closure of branches among high-rate banks, while low rate banks that maintain brick-and-mortar services. Our results are consistent with the findings in Jiang, Yu and Zhang (2022) who demonstrate that digital disruption plays a significant role in driving the divergence in deposit rate behavior. They emphasize the implications for financial inclusion. Our paper complements theirs by providing evidence of how these digital disruptions lead to heterogeneous asset and liability management strategies across banks.

To the best of our knowledge, this paper provides the first empirical analysis of how deposit distribution patterns vary within the banking sector, with potentially significant financial and macroeconomic implications. 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 in 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 within the 25 largest banks, deposits shift substantially towards high rate banks when interest rates rise. This complements d'Avernas et al. (2023) which provides evidence of variation in deposit-pricing behavior of large and small banks. Thus, we argue that tracking aggregate deposit flows from the banking sector misses a substantial amount of flows within the banking sector. Understanding this heterogeneity in deposit rates is important for understanding the banking sector's capacity for maturity transformation, liquidity provision, and credit extension.

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. 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

We document a salient pattern in banking over the past decade: the increasing dispersion of deposit rates. Prior to the 2008 financial crisis, deposit rates were similar across banks – the standard deviation of deposit rates was low. However, the subsequent period has witnessed a significant shift. Today, deposit rates follow a bimodal distribution, with two distinct peaks and an economically large spread in deposit rates.

Figure 1 illustrates the dispersion of bank deposit rates for the 25 largest banks at the peak of three rate cycles.[4] We measure deposit rates using two rates: the 12-month certificate of deposit ("CD rate") – 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. In 2007Q3, deposit rates exhibited a unimodal distribution, with similar mean and median values, and low standard deviation.[5] However, subsequent rate cycles (2019Q1 and 2023Q1) show a shift towards bimodality with diverging mean and median values. The divergence is quantitatively very large: from 2007Q3 to 2023Q1, the standard deviation of the CD rate tripled from 0.63 to 1.94. We demonstrate the robustness of these patterns by extending the sample period to 1993Q1 and considering all banks in Appendix Figure D.2.

While we focus on the 25 largest banks by asset size, which account for nearly 70% of the total assets in the banking sector, the results are similar using the top 100 banks as we show later.[6]

While the distributions show a clear divergence in deposit rates across banks, a potential concern is whether the variation in rates represents a systemic shift or is influenced by a few relatively smaller banks offering very high rates. We study the share of bank assets corresponding to different measures of CD rates relative to the sample median: below 0.75 times the median, between 0.75 and 1.25 times the median, and above 1.25 times the median. Figure 2 illustrates a significant shift in the distribution of banks' asset shares. Before the 2008 financial crisis, 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.

[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 CD 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] Appendix Figure D.1 shows the share of assets from 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.

3 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.

3.1 Data

Bank data. We collect quarterly data on bank balance sheets and income statements from the Reports of Condition and Income (Call Reports) from 2001Q1 to 2023Q3.[7] We aggregate to the bank holding company level using BHC ID as the common identifier. We supplement this 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 C.1.

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.[8] We primarily focus on the 12-month certificate of deposit accounts with a minimum of $10,000, due to its comprehensive reporting coverage and its capacity to promptly reflect banks' overall rate-setting choices.[9] To eliminate potential biases from misreporting, we first calculate the average CD 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).[10]

Branch data. We use branch-level bank deposit information 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

[7]Data obtained from the Federal Reserve Bank of Chicago.

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

[9]The 12MCD10K is the most common deposit product reported in RateWatch. As shown in Panel B of Table C.2, there is a strong correlation of 0.92 between this CD rate and the average deposit rate paid by banks, as calculated from the Call Reports data. We further show that the CD 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 CD and MM rates is 0.844, while the correlation between the CD and SAV rates is 0.686.

[10]Appendix Table C.4 indicates that deposit rates are primarily determined at the BHC level. BHC fixed effects alone explain as much of the variation in deposit rates as bank-level fixed effects.

that use bank tellers versus e-banking. The survey is conducted biannually from 2009, and we use data from the 2013, 2015, 2017, and 2019 waves.

3.2 Methodology

We document 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. Then we examine how banks with higher deposit rates employ distinct strategies in managing their branches and balance sheets.

The empirical strategy employed resembles a difference-in-differences (DiD) design. It is important to clarify that our analysis doesn't claim causal evidence between the advent of e-banking and these transformations. However, we will present evidence that aligns with this perspective. 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:

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

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 we use a lag length of 4 quarters to account for autocorrelation.

The β coefficient captures the divergence in $Y_{i,q}$ between the high and low rate banks after 2009, compared to the pre-2009 period. Moreover, β 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 regression model. To illustrate the changes in $Y_{i,q}$, we utilize time-series plots that aggregate the balance sheet of banks within each category.

3.3 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.[11] We then rank banks quarterly based on both the CD and DepRate rates. This multi-source approach mitigates noise and 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, the CD rate provides more immediate insight into

[11]Panel B of Table 2 demonstrates that the distributions of CD and DepRate rates are comparable across the analyzed periods.

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 CD rate and the DepRate for each bank. We then rank banks using each rate separately. Due to missing observations in the CD rate, we standardize 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 CD rate and DepRate rankings. Lastly, we rerank the banks based on their average deposit rate to produce a combined ranking.[12]

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 misinterpretation based on temporary fluctuations. Detailed classifications for a select group of banks are provided in Appendix Table C.3.

4 Diverging Banking Sector

Panel A of Table 2 compares key characteristics of high rate and low rate banks across two periods: 2001-2008 and 2017-2023.[13] 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. In terms of the average rate on deposits, the 12-month CD rate also shows a slightly widening gap in the later sample, but the realized rate paid on deposits does not on average. As we will show, this simply reflects low nominal interest rates over the latter period – for example when the Fed funds rate is near 0, as it was for much of the 2017-2023 sample, both banks set deposit rates near 0.

We now dig in to each of these summary statistics in more detail.

4.1 Diverging Deposit Rates

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 through the monetary policy cycle before 2009, featuring a relatively consistent

[12]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 CD rate. Consequently, based on DepRate alone, their standardized ranking would be is 1/3 (A), 2/3 (B), and 3/3 (C). Based on the CD rate (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: 1 (A), 2 (B), 3 (C).

[13]A similar analysis for the 2009-2016 period is presented in Appendix Table C.2.

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 rate banks remain largely stagnant. This leads to considerable disparity between the two groups. Figure 4c further illustrates this shift for a select subset of 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 E.5.

4.2 Diverging Branches

What explains the divergence in deposit rates? We show that the recent widening gap in deposit rates is strongly linked to a divergence in branch networks between high rate and low rate banks. High rate banks have few physical branches and operate largely online. Low rate banks maintain physical branches. This suggests technological change affecting the e-banking sector is an important driver of the observed divergence.

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.[14] A higher branch-to-deposits ratio indicates that a bank has more branches relative to its deposit size, suggesting 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 see a widening gap in branch utilization across banks over time. 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 note that we pick these three dates for ease of comparison to the rest of our analysis but that the divergence is branches is a lower frequency trend not directly connected to the monetary policy cycle.

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 (note that the figure is on a log scale).[15] To address concerns that branch closures by high rate banks might be driven by

[14]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 D.6 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 D.6.

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

deposit withdrawals, we additionally analyze the logged ratio of branches to the real value of deposits (deposits normalized by the consumer price index). Figure 8b shows that while the branch deposit ratio has fallen for both low rate and high rate banks, 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 sample offer e-banking services including mobile and online banking. The reliance of banks' business models on physical branches is the key determinant of this change. Consistent with this interpretation, column 1 of Table 8 shows that banks' IT spending, including both data processing expenses and telecommunications expenses, also exhibits a diverging pattern between high rate and low rate banks after 2009. This evidence substantiates our primary hypothesis that high rate banks are transitioning towards e-banking services, enabling them to cater to customers without the need for physical branches.

Moreover, e-banks appear to cater to distinct customer demographics. We find that high rate banks tend to locate their much 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.1 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.[16]

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 (1) and present the results in Table 3. Consistent with the trends observed above, we find that high rate banks report about a 65% additional reduction in the number of branches, about a 40% additional decline in the branch deposit ratio, and a 1.5% additional decline in the average age after 2009, in comparison to low rate banks.[17] 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 E.2 and Appendix Table E.3. Moreover, we show, in Ap-

[16]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.

[17]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.

pendix Table F.3, that this divergence is driven both by changes within individual banks, such as branch closures, and by compositional shifts, illustrated by the rapid growth of high rate banks propelling them into the largest bank category by asset size.

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) compared to the pre-2010 period. There are two potential explanations. One possibility is that the operational costs for high rate banks have risen, in part because they now provide both traditional in-person banking services through branches and also provide e-banking services (recall that we are focused on the top 25 banks, all of which offer e-banking). Another plausible explanation is that low rate banks may implement higher markups in their deposit businesses. This could stem from several factors, including the reduction in branch networks due to closures by high rate banks, or the increased reliance of their customer base on branches as less branch-reliant customers migrate toward banks offering more appealing interest rates. To assess the dominant explanation, we examine the non-interest expense as a ratio of asset between two types of banks in column (2) in Table 8. This analysis aims to determine if low rate banks exhibit higher operating costs compared to high rate banks. The result indicate that low rate banks do not exhibit higher non-interest expenses, contradicting the marginal cost-based hypothesis. In the next section, we examine the differences on the asset side of banks' balance sheets, providing evidence in support of the market power explanation.

4.3 Divergence on the the Asset Side

With different liability structures, high rate and low rate banks may adopt distinct asset management strategies. We first show that high rate banks have a slightly higher net interest margin, despite offering higher deposit rates. Since net interest margin is the difference between interest earned (for example, on loans), and interest paid (for example, on deposits), this immediately indicates that high rate banks earn higher rates on their assets. We show this comes from credit risk in the form of riskier lending. In contrast, we show high rate banks have less duration on the asset side and thus engage in less maturity transformation.

4.3.1 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 on the asset side, 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 the rate gap in Figure 4.[18] Similarly, Figure 6b demonstrates that prior to 2009, high and low rate banks

[18] 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

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 75 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. We find all of the effect on interest income comes from credit risk, while maturity goes in the opposite direction. The following sections delve into how high rate and low rate banks differentially manage their credit risk and maturity risk exposures.

4.3.2 Credit Risk

A bank's assets typically comprise of 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% as overall interest rates decline. 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 7, as per the regression model specified in Equation 1.

To calculate the credit spread in loans, we subtract the equivalent maturity Treasury yield from the loan rate. This isolates 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 7 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.

We provide direct evidence that high rate banks assume higher credit risk by looking at proxies for default risk. Elevated default risk leads to portfolio losses, which are reflected in the charge-off rate – the percentage of loans or credit accounts that the bank deems as noncollectable and removes from its books as losses. The charge-off rate 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

time and payments are spread out, the pattern of interest expenses tends to change more gradually compared to the CD rate. Therefore, the resulting divergence in patterns is less pronounced.

banks. Consistent with the previous findings, we observe that the charge-off rate for high rate banks is typically higher than for low rate banks. Towards the end of the sample period, 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 7. This finding provides additional evidence supporting our hypothesis that high rate banks amplify their exposure to credit risk compared to low rate banks.

4.3.3 Maturity Transformation

Next, we investigate whether the observed divergence in deposit rates affects their maturity 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 6 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. Deposits at low rate banks resemble fixed rate debt, as deposit rates don't fluctuate with market interest rates. Holding fixed rate securities (e.g., long-maturity Treasuries and MBS) makes sense from a risk-management perspective. 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. This aligns earning “floating rate” on both the asset and liabilities side but adds a spread coming from credit risk. In the following section, we explore the specific asset categories banks employ to meet their strategic needs.

4.3.4 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.[19] 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, see Figure 11b.

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 a decreasing trend in the proportion of other loans within the portfolios of low rate banks, a change offset by an uptick in their Treasury and MBS holdings. Conversely, high rate banks invest only half as much in these longer-maturity real estate loans, opting instead for a larger proportion of shorter-maturity instruments like other loans. Panel B of Table 6 quantifies the effects. Specifically, the share of other loans in low rate banks decreases 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 banks. Panel C of Table 6 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.

[19] Upon disaggregating the category of other loans in Appendix Figure D.8 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 conduct over 2.5 times the volume of credit card lending compared to low rate banks, further highlighting their focus on shorter-term instruments.

Panel B of Table 7 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.[20] 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 E.[21] 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.

4.4 Alternative Explanations

Our evidence supports the idea that the growing divergence within the banking sector is connected to the advent of e-banking services. However, the timing of the divergence coincides with the onset of the Great Financial Crisis of 2008. This section explores alternative GFC-related explanations that might account for the observed divergence.

Regulatory Changes Following the financial crisis, the implementation of Basel III and the Dodd-Frank Act marked a significant shift towards stricter capital requirements and more robust liquidity provisions, aiming to enhance the resilience of the banking sector, particularly among large banks. Specifically, Basel III mandated a 3% Tier 1 supplementary leverage ratio for large BHCs with assets exceeding $250 billion. Similarly, the Dodd-Frank Act subjected all BHCs with more than $50 billion in assets to Enhanced Prudential Regulation (EPR). Despite all top 25 banks in our sample surpassing the $50 billion threshold, only about one-third possess assets over $250 billion. This regulatory disparity could influence the divergent business models within the banking sector. To examine this hypothesis, we investigate the differences in Tier 1/2 ratios between the two bank types before and after 2009.[22] Columns 2-4 in Table 8 present results. The lack of significant differences across the three columns suggests that the

[20] Appendix Figure D.8 also corroborates that high rate banks conduct a greater share of personal lending compared to low rate banks.

[21] Note that Appendix Table E.5 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.

[22] Note that supplementary leverage ratio data became available starting Q2 2016

regulatory shifts post-financial crisis may not be the primary catalyst for the sector's divergence.[23]

Liquidity Injection from the Federal Reserve After the financial crisis of 2008, the Federal Reserve launched a series of quantitative easing (QE) programs, designed in part to bolster liquidity within the banking system. Initially, these QE programs focused on purchasing US government-backed securities. As illustrated in Figure 11a, low rate banks exhibit a marginally higher proportion of MBS and Treasuries. In 2008, for instance, low rate banks hold 15.5% of their portfolios in Treasuries and MBS, compared to 12% for high rate banks. Diamond, Jiang and Ma (2023) argues that the infusion of reserves by crowding out lending activities due to balance sheet constraints. It is possible that this could contribute to some of the observed divergence within the banking sector.

To explore this hypothesis, we compare the volume of reserves for high rate and low rate banks, as reserve levels are significantly influenced by QE operations (see e.g., Acharya et al. (2023)). We analyze the data presented in Column 5 of Table 8 and the temporal trends in Figure B.3. The coefficient on the interaction between the high rate indicator and post-2009 indicator coefficient is insignificant. This suggests that the observed divergences in the banking sector are unlikely to be explained by the differential impact of QE on reserve levels between high and low rate banks.

5 Macroeconomic Implications

The overall financial landscape is transforming as banks adopt increasingly divergent strategies. This evolution could alter the traditional channels for the transmission of monetary policy and alter the distribution of risks within the banking sector. This section studies the broader macroeconomic implications of a divergent banking system.

5.1 Transmission of Monetary Policy

This section delves into the differential responses of two types of banks to the transmission of monetary policy, assessing its effects on both pricing and quantity metrics.

5.1.1 Rate Sensitivity to Federal Funds Rate Changes

We initiate our analysis by exploring how deposit rates of both high-rate and low-rate banks respond to adjustments in the Federal Funds rate across three rate-hiking cycles within our dataset. Specifically, we calculate the "deposit beta," which represents the ratio of the cumulative change in deposit rates, starting from the first quarter of each rate-hiking cycle, to the respective change in the Federal Funds Target rate.

Figure 5 illustrates the deposit betas across the three rate-hiking cycles for CD rate, savings deposit rate, and DepRate. We find that low rate and high rate banks have similar deposit

[23]Figure B.2 plots how Tier 1/2 ratios involves over time for two types of banks. Right after the financial crisis, there was a increases in Tier 1 ratio, which is mainly driven by the $33 billion equity injection to Citi. At the same time, Citi redeemed $24.2 billion of subordinated notes, which lowers Tier 2 ratio, see 10-K file.

betas during the first rate hiking cycle of 2004Q1 to 2008Q2.[24] While the average deposit beta remains relatively stable between 2015Q4 and 2020Q1, and between 2021Q4 and 2023Q3, a significant divergence emerges between low rate and high rate banks. In these recent cycles, low rate banks barely adjust their deposit rates in response to Federal Funds rate hikes, resulting in deposit betas close to zero. Conversely, high-rate banks exhibit a marked increase in their deposit rates, reflected in strongly positive deposit betas. This figure also helps explain why the average deposit rates between the two groups were relatively low on average from 2010-2023: the Fed set interest rates near 0 through most of this period, which meant a small spread. The strong divergence between the two types of banks is much more clearly visible during a period where the Fed raises rates, and suggests this divergence may be stronger going forward if we are in a period of elevated short-term interest rates.

We test these relationships rigorously through the following regression framework:

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

where $\Delta\text{Fed Funds}_q$ denotes the quarterly change in the Federal Funds Target Rate.

The first two columns in Table 4 reveal a striking divergence in deposit rate setting between two types of banks after 2009. We find that high rate banks after 2009 have a deposit beta that is 0.55 higher than low rate banks, both for CD and savings deposit rates. That is, a 1 percentage point increase in the Fed funds rate is associated with an additional 0.55 percentage point relative increase in the deposit rate for high rate banks after 2009. This divergence primarily stems from low rate banks reducing their deposit betas, while high rate banks only slightly increase theirs. For example, the CD deposit beta of low rate banks decreases from 0.60 to 0.15 after 2009, while that of high rate banks only moderately changes from 0.53 to 0.62 afterward.[25]

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.[26] 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

[24] Between the 2004Q1 and 2008Q2, the savings deposit rate showed minimal sensitivity to changes in the Federal Funds rate, whereas the CD rate demonstrated considerable responsiveness. Interestingly, despite these differences in responsiveness, both bank types displayed similar deposit betas for both products.

[25] The deposit beta of high rate banks before 2009 is calculated as 0.599-0.066; after 2009 is 0.599-0.066 - 0.455 + 0.545.

[26] 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 which will reflect the lag. See Appendix Table C.1 for details.

banks post-2009. This finding is consistent with our findings in Section 4.3, 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.[27]

For robustness, we expand our sample to include the largest 100 banks (Appendix Figure E.6 and Appendix Table E.1). Additionally, we control for common macroeconomic factors 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 C.5).

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. These constraints can push banks towards wholesale funding. 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.4), 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 4.3.

5.1.2 Deposit Flows within the Banking Sector

We extend our analysis to examine how monetary policy affects quantities by studying how high rate and low rate banks deposits and loans adjust 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. This makes sense: as interest rates rise, the deposit spread between high and low rate banks widens, and deposits flow towards high rate banks. The cumulative deposit growth over the 2015Q5 to 2019Q4 rate hiking period is over 10% higher for high rate banks compared to that of low rate banks. We see the same trend 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%. Importantly, this suggests that monetary policy affects the distribution of deposits between high and low rate banks. Given the differences on the asset side, it suggests that a rate hiking cycle leads the banking sector as a whole to engage less in maturity transformation and more in taking credit risk, while the opposite is true when rates are lowered.

We test these relationships rigorously through the following regression framework in

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

Table 5.

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

where i and q indicate the bank and quarter-year, respectively, $\Delta Y_{i,y}$ denote measures of deposit and lending growth, $\Delta\text{Fed Funds Rate}_y$ 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-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.

Table 5 shows 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 one percentage point increase in the Fed funds rate is associated with an additional 3 to 3.4 percentage point 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 5.2.

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 4.7 to 5.4 percentage point increase in the annual personal loan growth of high rate banks after 2009, and 3.7 to 5.5 percentage point 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.[28] These findings are robust in an expanded sample with the 100 largest banks (Appendix Table E.2).

Finally, we address potential concerns that some of these 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 D.4.[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 D.7. This approach confirms the observed differences in deposit growth are not driven by banks shifting categories. Third, Appendix Figure D.5 provides

[28] These results are consistent with our findings in Panel B of Table 7 which shows that high rate banks assume a significant amount of credit risk in personal lending relative to low rate banks.

[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.

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 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 E.1. This wider scope confirms the observed patterns hold true beyond the specific sample used in the main analysis.

5.2 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. Lastly, we explore how these differences are reflected in regulatory capital buffers.

As documented in Section 5.1.2, 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 hiking 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 4.3.3 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% shorter-maturity loans.[30] Similarly, we calculate that the banking sector holds an 8% larger share of short-term assets.[31] 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. If rates remain elevated for an extended period, our analysis suggests these effects will continue to grow.

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

[30] 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 6).

[31] The difference in the share of short-term securities between low rate and high rate banks is $\approx 20\%$ by the end of the sample (Figure 9b). The average share of short-term assets is 50% (see Table 6).

low rate banks is over 200 basis points (bps) (see Figure 10b). This translates to an estimated 11% increase in credit risk for the banking sector as a whole.[32]

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.

5.3 Implications for Regulators

Our findings indicate that diverging banks face distinct risk profiles: low rate banks are more susceptible to interest rate risk (Haddad, Hartman-Glaser and Muir (2023)), while high rate banks are more susceptible to credit risk. Though both risks can precipitate bank runs, their dynamics differ significantly. Interest rate risk becomes particularly salient during Federal Fund rate hikes, typically occurring in stronger economic conditions, whereas credit risk escalates during economic downturns, prompting potential Federal Fund rate reductions. As discussed earlier in Section 4.4, the existing regulatory capital requirements may not fully account for the differential risks within the banking sector. The uniformity in capital ratios, despite varying risk exposures, suggests that current regulatory practices may overlook potential vulnerabilities with important implications for systemic risk evaluation and the formulation of macroprudential policies and monetary interventions.

6 Endogenous Emergence of a Diverging Banking Sector: A Simple Framework

We propose that the emergence of e-banking services, which allow banks to serve customers without physical branches, explains the observed divergence in rate offerings.

Our static model builds on the framework established by Salop (1979) and Allen and Gale (2004). The key feature of the model is to integrate the endogenous adoption of e-banking by banks, as technological advancements make these options feasible.

6.1 Without e-Banking Services

The economy has two banks, labeled A and B, which compete for depositors and extend loans to risky projects. We assume that before the advent of e-banking services, the existence of physical branches were crucial in attracting depositors.[33]

Depositors 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

[32]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 – see Table 7).

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

dollar and faces a decision regarding the choice of bank for their deposit. The depositors' utility is 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 η presents utility derived from branch services. Depositor i chooses bank A if $U_i(A) > U_i(B)$.

Banks Banks A and B choose to situate their branches on a circular layout. To streamline our analysis, we restrict each bank to establishing just one branch, with cost per branch (κ), which includes costs like office rental fees, payable upfront.[34] 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 $p(l_j) = \alpha - l_j$ for $l_j \in [0, \alpha]$, so that riskier lending has a higher default probability.

Banks' maximize the following profit function:

$$\max_{l_j, r_j} \; p(l_j)(f + l_j - r_j)D_j - \kappa\mathbb{1}(\text{Branch}_j), \tag{2}$$

where D_j is the amount of depositors choosing bank j. Banks encounter two trade-offs. First, offering a higher deposit rate attracts more deposits from competitors, but results in a reduced deposit spread. Second, while taking more risk yields a greater risk premium, it also elevates the bank's exposure to the risk of default.[35]

Results Given the symmetry of the two banks, they position their branches equidistantly around a circle. The unique solution is characterized as below:[36]

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

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 η. Banks take less risk as the deposit markup charged increases. The rationale behind this is that the markup earned on the banks' liabilities side is an almost guaranteed

[34] 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.

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

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

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

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

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 are homogeneous, providing similar deposit rates below the Federal funds rate and exhibiting similar levels of risk-taking.

6.2 With e-Banking Services

The advent of e-banking services revolutionized banking by allowing banks to cater to depositors without being limited by geographical boundaries. We assume depositors gain utility, represented as γ, 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. The banks' objective function is revised to reflect this modification:

$$\max_{l_j, r_j, b_j, e_j} p(l_j)\left(f + l_j - r_j\right)D_j - \kappa\mathbb{1}(b_j) \tag{3}$$

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 6.1.

Theorem 6.1. *After e-banking service is available, two potential market structures can emerge:*

- *If $\kappa > \frac{109\eta^2}{1000}$, a diverging banking sector emerges. {A: Branch + E-Banking, B: E-Banking only} and its symmetric case are Nash equilibria. In this case, $r_B - r_A = \frac{\eta}{5}$ and $l_B - l_A = \frac{\eta}{10}$.*
- *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*. The specialized business models affect how banks manage their liabilities and assets. Local branches provide a 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.

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.

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 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. 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 from low rate banks to high rate banks, which is ignored when only tracking aggregate deposit flows from the banking sector.

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

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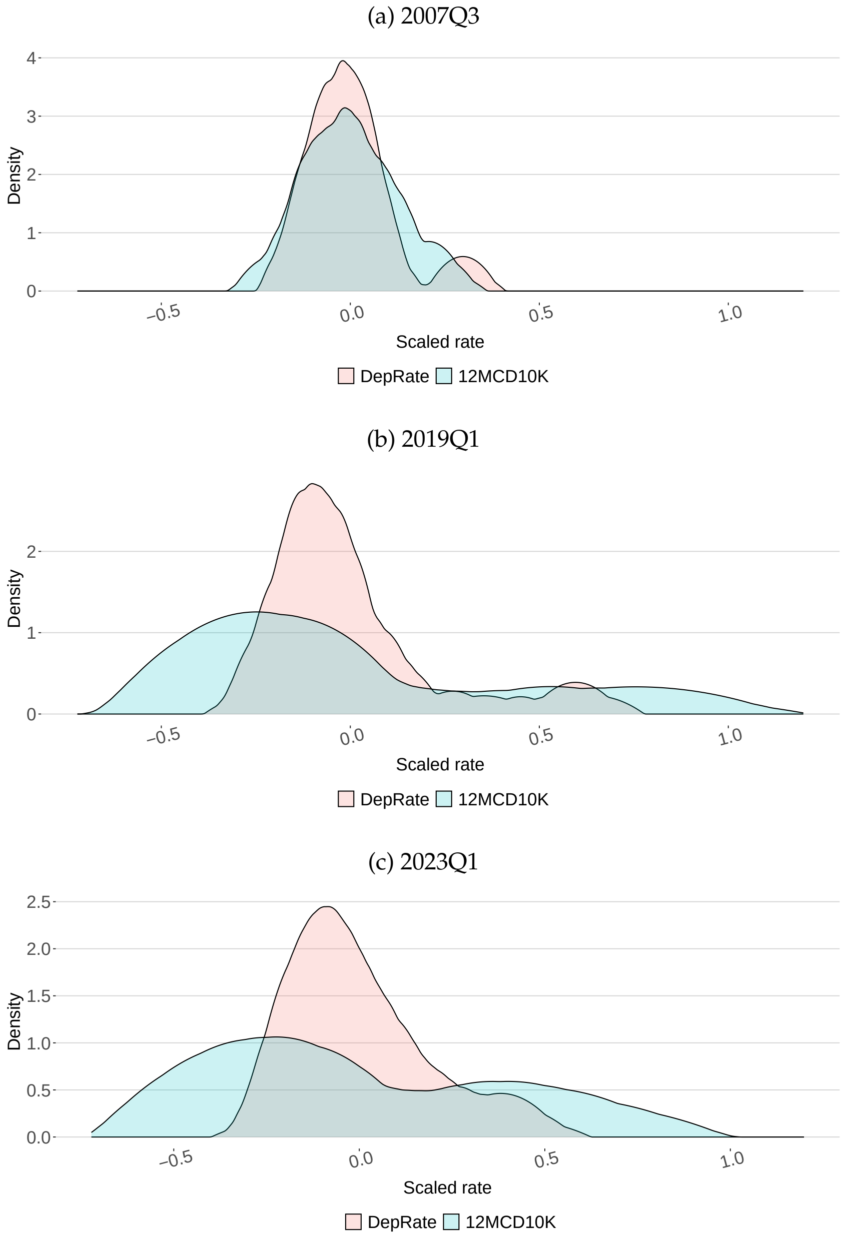
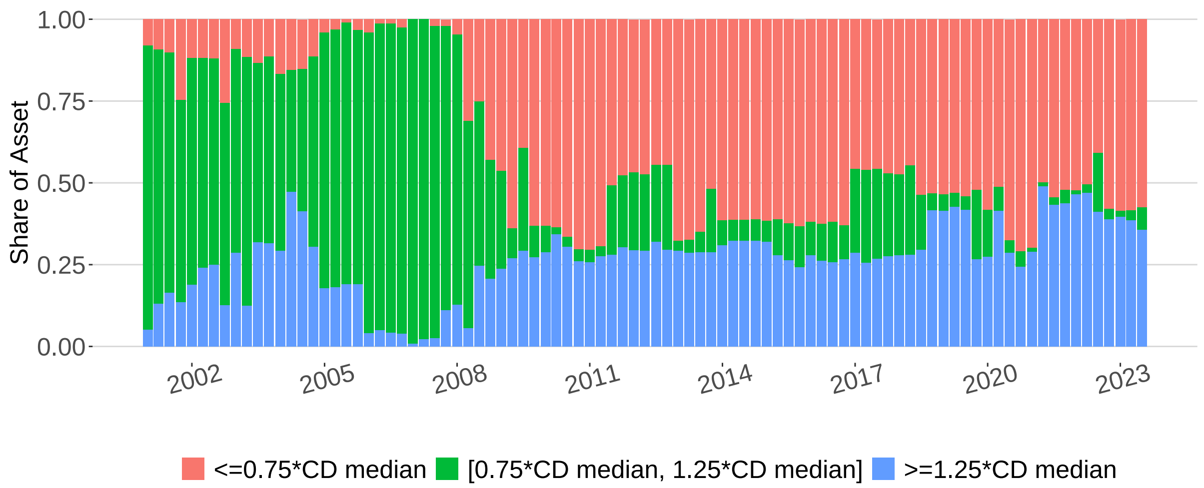
Figure 1: Dispersion of Deposit Rates for Top 25 Banks



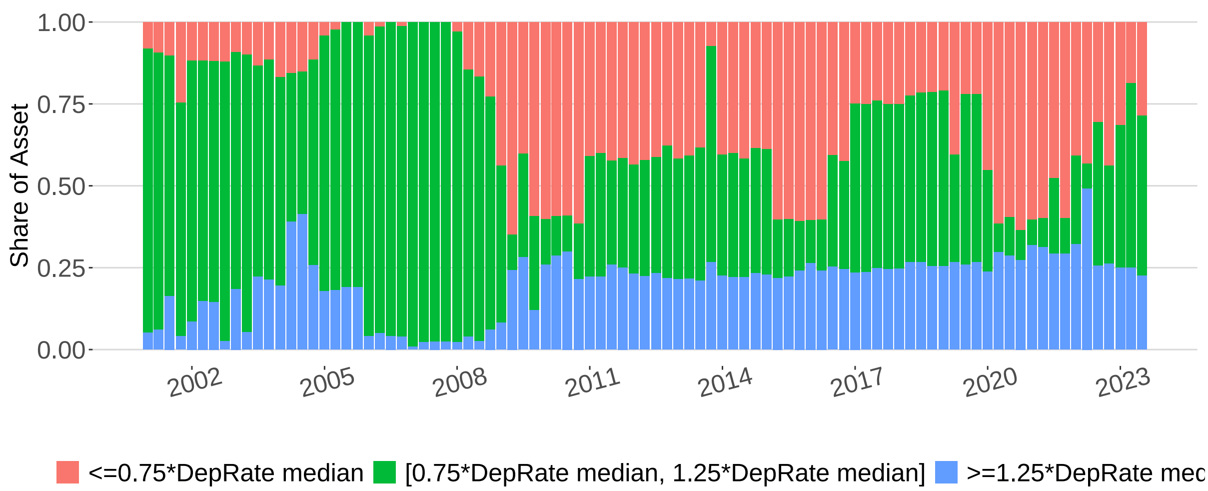
Notes: This figure presents kernel density plots of the scaled and demeaned 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and the scaled and demeaned deposit rates (DepRate) calculated from Call Reports offered by the top 25 banks at the peak of each rate hiking cycle. Figures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

Figure 2: Asset Distribution of Top 25 Banks

(a) Classification based on 12MCD10K



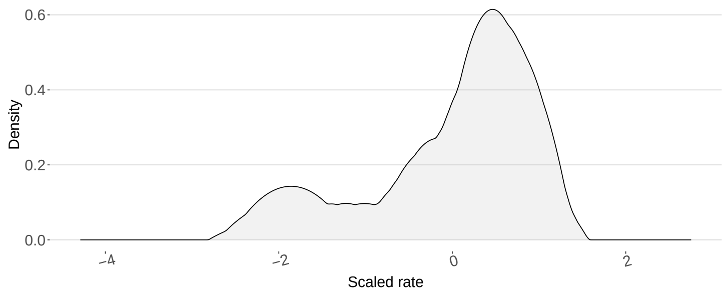
(b) Classification based on DepRate



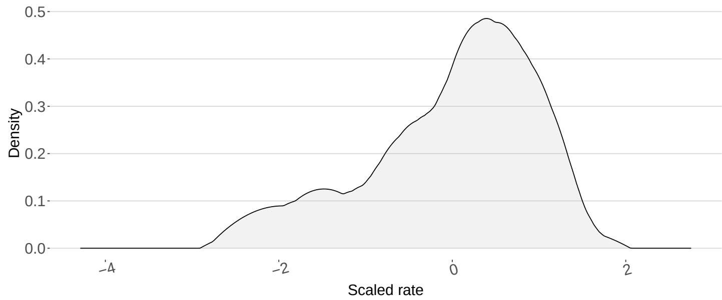
Notes: This figure illustrates the distribution of bank assets among three categories for the top 25 banks: banks with deposit rates below 0.75 times the sample median, banks with deposit rates within the range of 0.75 times to 1.25 times the sample median, and banks with deposit rates exceeding 1.25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

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

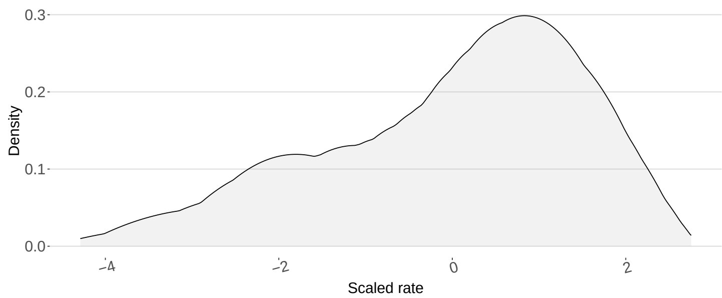
(a) 2007Q3



(b) 2019Q1



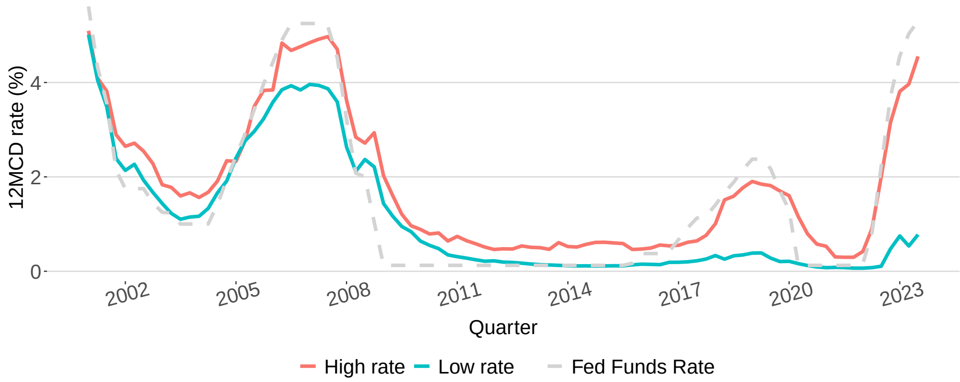
(c) 2022Q2



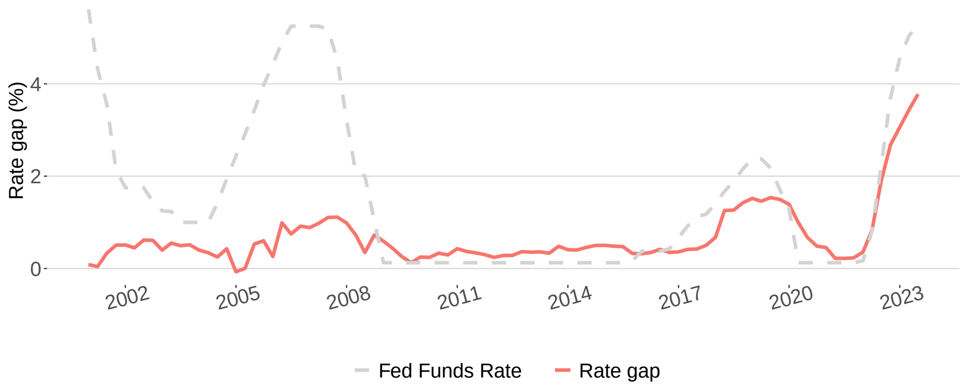
Notes: This figure displays kernel density plots of the demeaned logarithm of branch deposits by the top 25 banks at the peak of each interest rate hiking cycle. Figures a, b, c, and d illustrate the kernel density at the following quarters: 2007Q3, 2019Q1, and 2022Q2 (the last quarter available in SOD database), respectively. The top 25 banks are determined based on bank size at the beginning of each quarter. To ensure that the results are not influenced by banks primarily engaged in businesses other than retail deposits, we limit our analysis to banks with a minimum of 15 branches (the sample average is 1214). This restriction excludes Charles Schwab, J.P. Morgan & Co (before 2000), State Street, Merrill Lynch, Morgan Stanley, Bank of New York Mellon, Goldman Sachs, Ally Financial, and ING. The first seven of these banks focus on broker or investment banking businesses, while the latter two are fintech banks that have emerged in recent years. In the Appendix Figure D.6, we provide density plots that include these banks without any exclusions.

Figure 4: Dispersion of Bank Deposit Rates

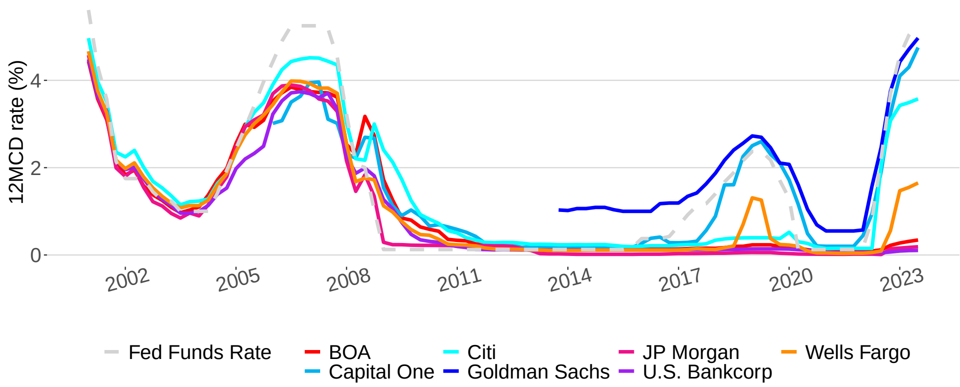
(a) Rate



(b) Rate Gap



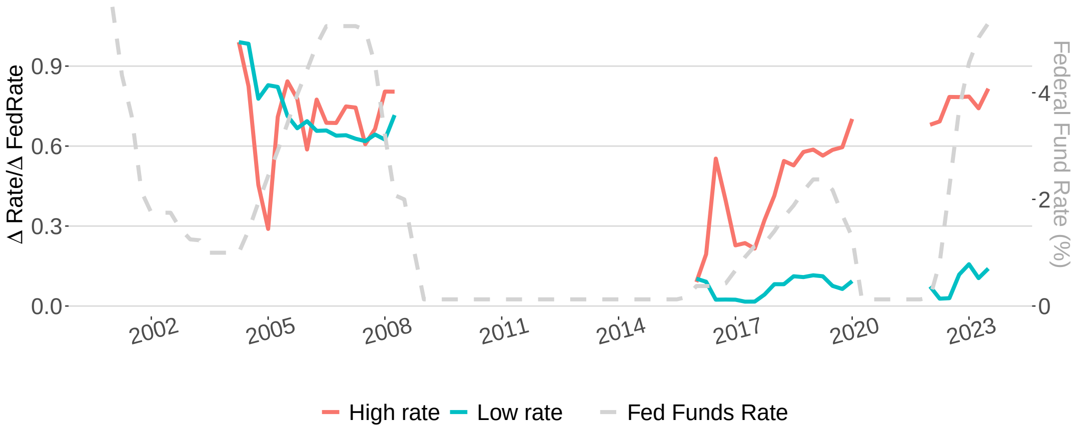
(c) Rate by Bank for Select Banks



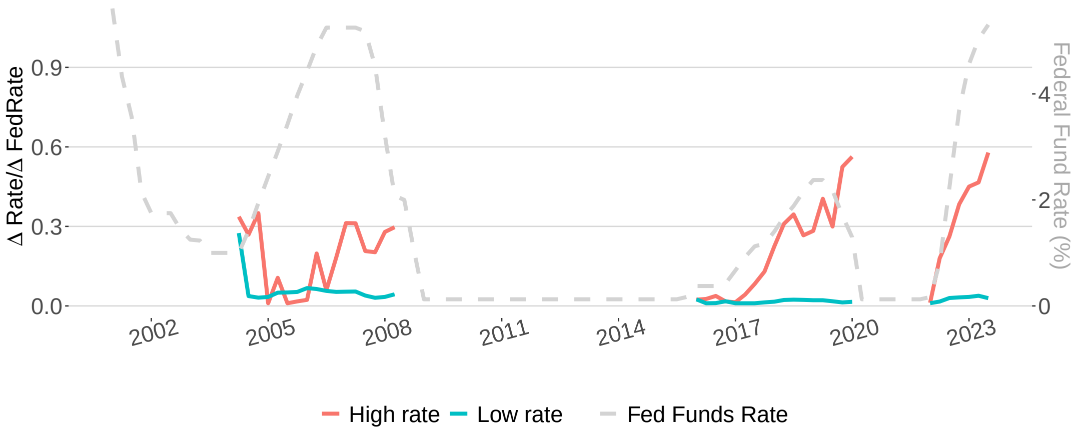
Notes: This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q3 among the top 25 banks. We construct the time-series for each bank type by taking an average of the banks' 12MCD10K rates, weighted by assets. Figure 4a presents a time-series plot of 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

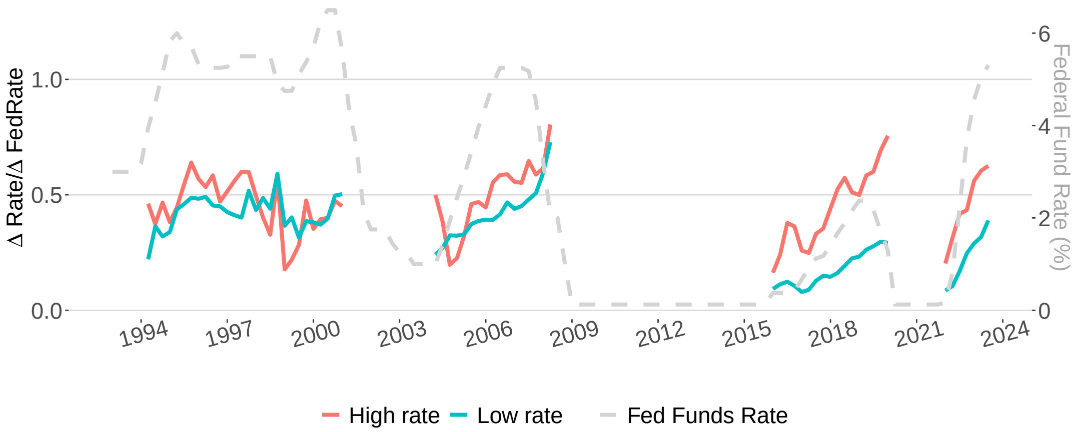
(a) 12MCD10K



(b) SAV



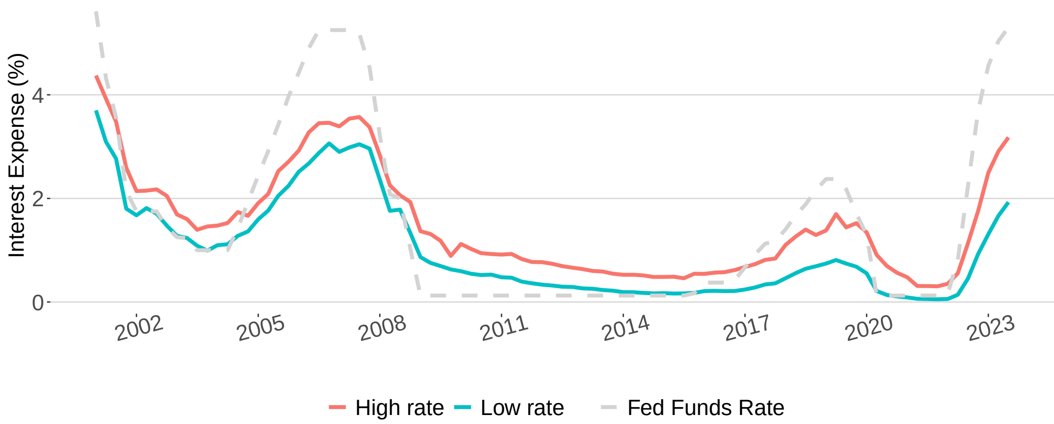
(c) DepRate



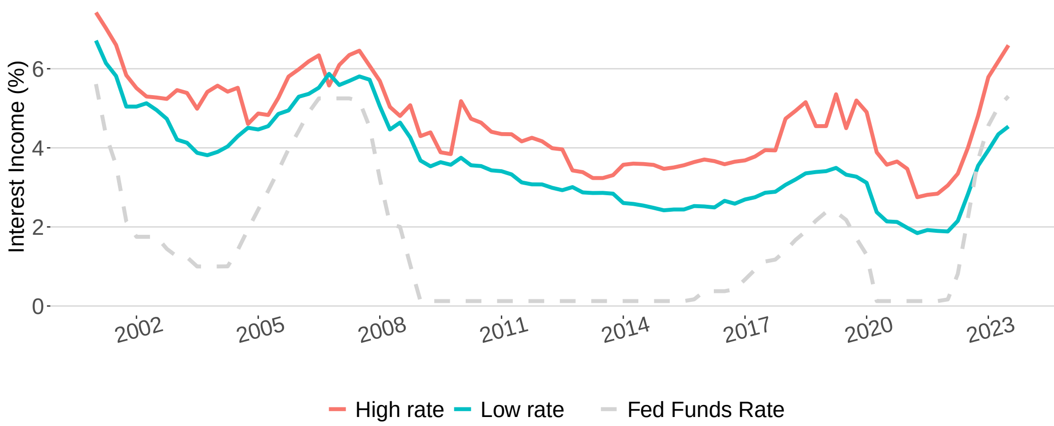
Notes: This figure compares the average deposit beta of high and low rate banks among the top 25 banks over the three recent rate hiking cycles: 2004Q1 through 2008Q2, 2015Q4 through 2020Q1, and 2021Q4 through 2023Q3. The deposit beta is defined as the ratio of the cumulative change in deposit rates 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 (DepRate) in panel c. The left y-axis represents the quarterly average Federal Fund Target rate (Fed Funds Rate). 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

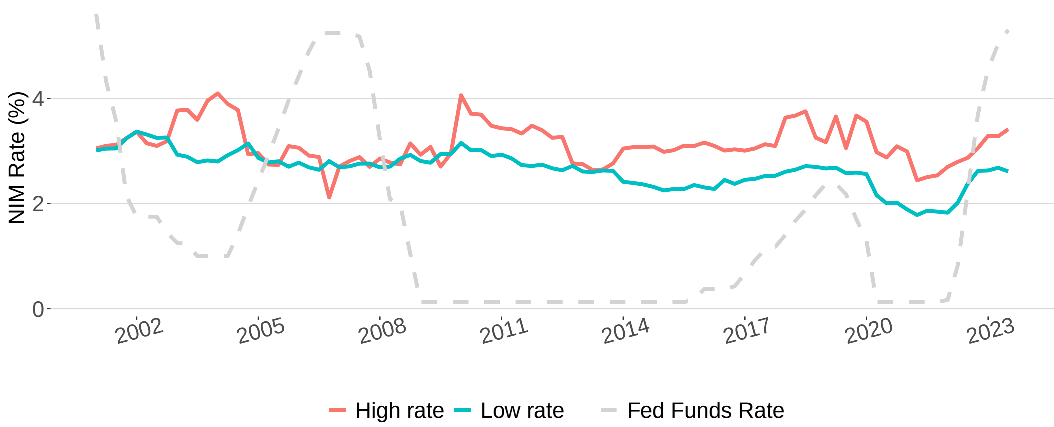
(a) Interest Expense



(b) Interest Income



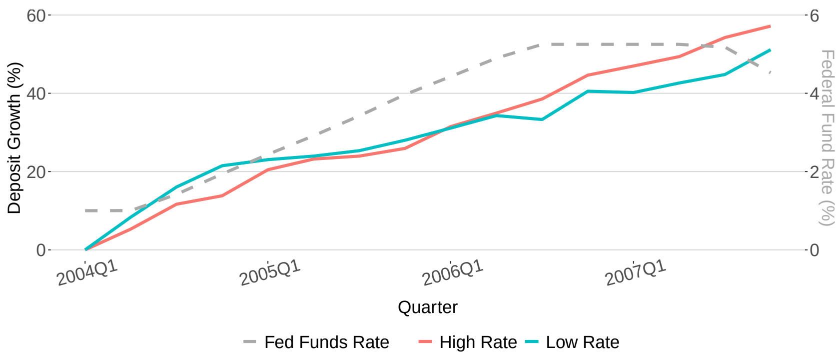
(c) NIM



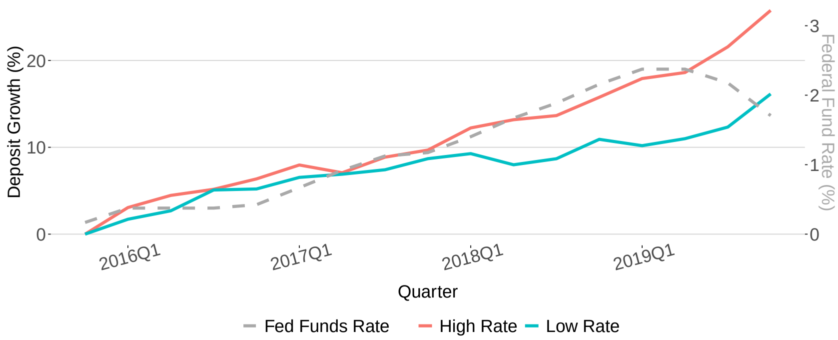
Notes: This figure compares the interest expense, interest income, and net interest margin of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 6a presents the interest expense (%) of high and low rate banks. Figure 6b presents the interest income (%) of high and low rate banks. Figure 6c presents the net interest margin (NIM) rate (%) for high and low rate banks. See Appendix Table C.1 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (Fed Funds Rate). 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

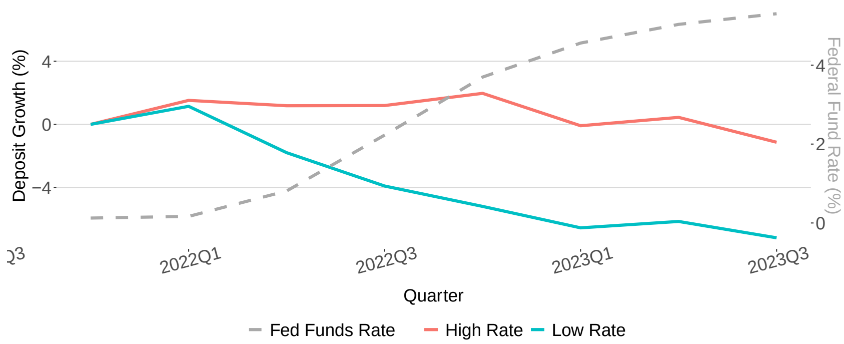
(a) 2004Q1-2007Q4



(b) 2015Q4-2019Q4



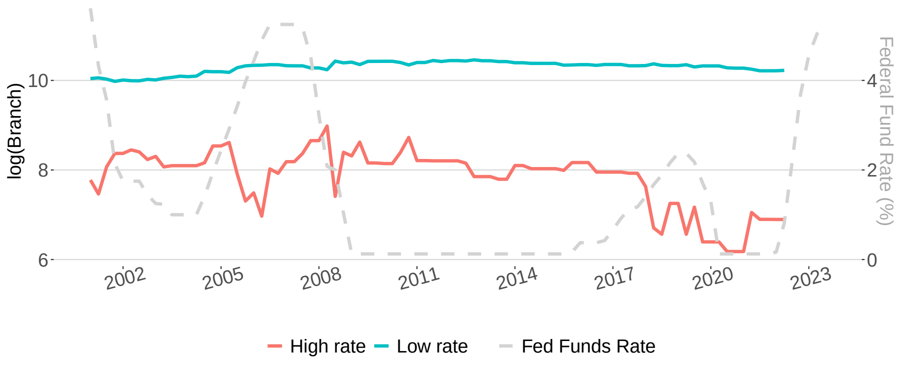
(c) 2021Q4-2023Q3



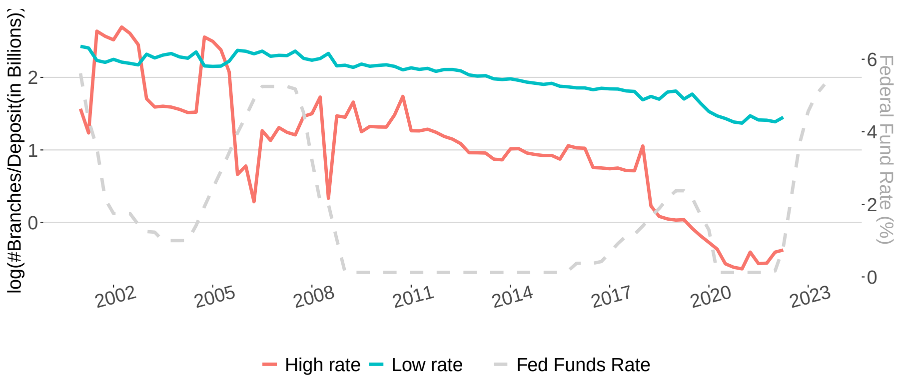
Notes: This figure compares the deposit growth of high and low rate banks among the top 25 banks over the three recent rate hiking cycles. Figures 7a, 7b, and 7c compare the deposit growth experienced by high rate banks to that of low rate banks from 2004Q1 through 2007Q4, from 2015Q4 through 2019Q4, 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 (Fed Funds Rate). 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

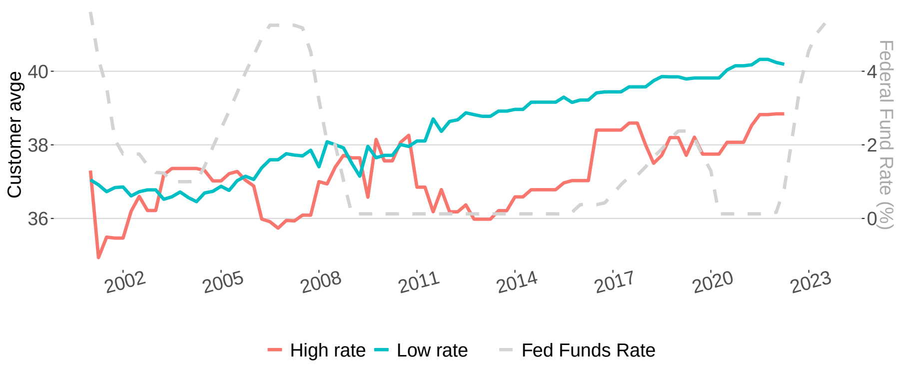
(a) Growth of Branches



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



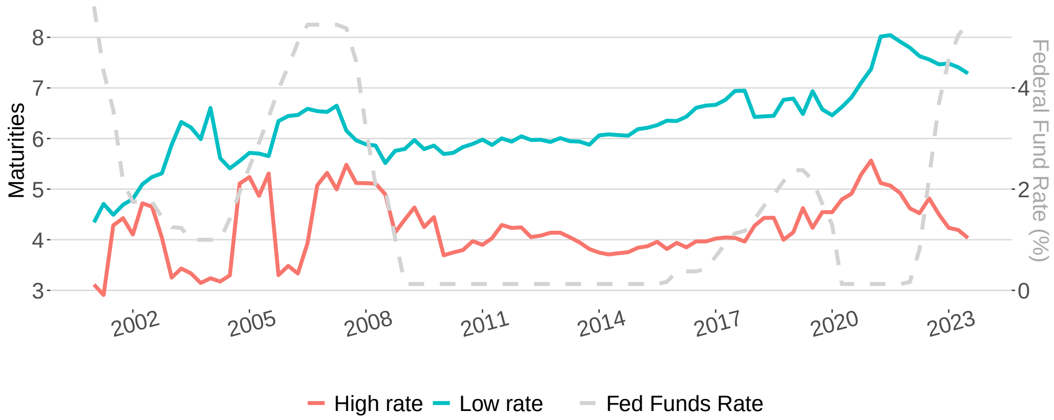
(c) Branch-weighted County Average Age



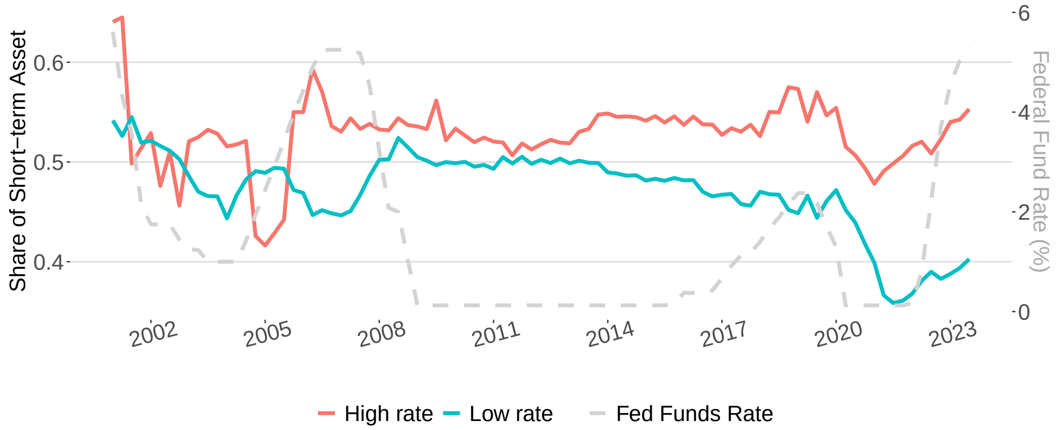
Notes: This figure compares branches operating by high and low rate banks among the top 25 banks from 2001Q1 through 2022Q2, which is the quarter where the most recent SOD data ends. Figure 8a presents the log-transformed number of branches of high and low rate banks. Figure 8b presents the log-transformed 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 (Fed Funds Rate). 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



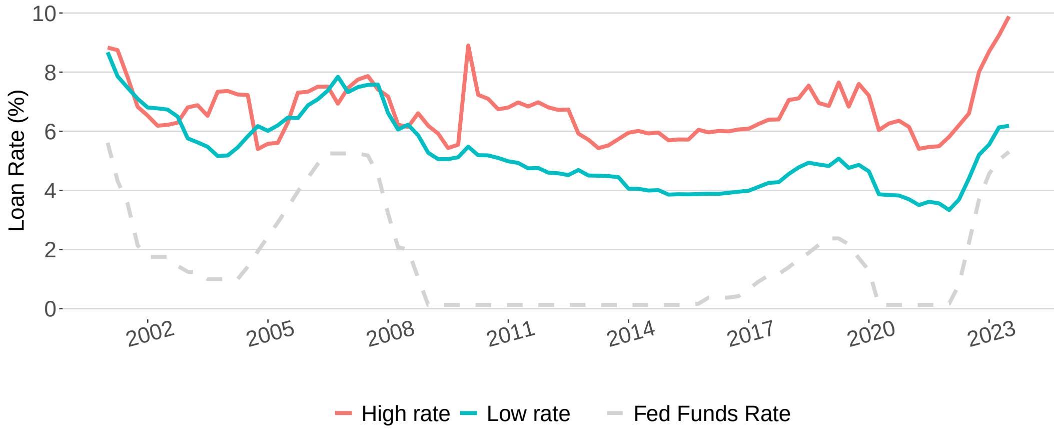
(b) Share of Short-Term Assets



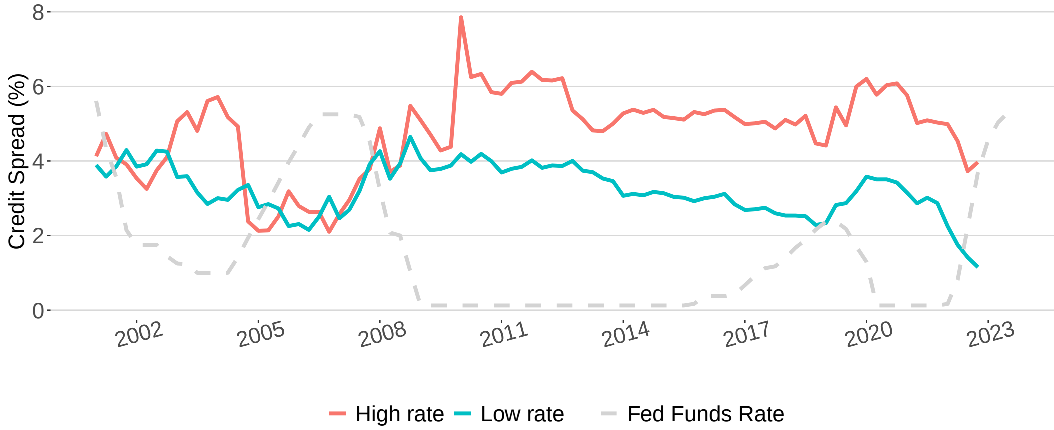
Notes: This figure compares the maturity risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 9a presents the maturity (# of years) of high and low rate banks. Figure 9b presents the share of assets with less-than one-year maturity (short-term assets) for high and low rate banks. The left y-axis represents the quarterly average Federal Fund Target rate (Fed Funds Rate). 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

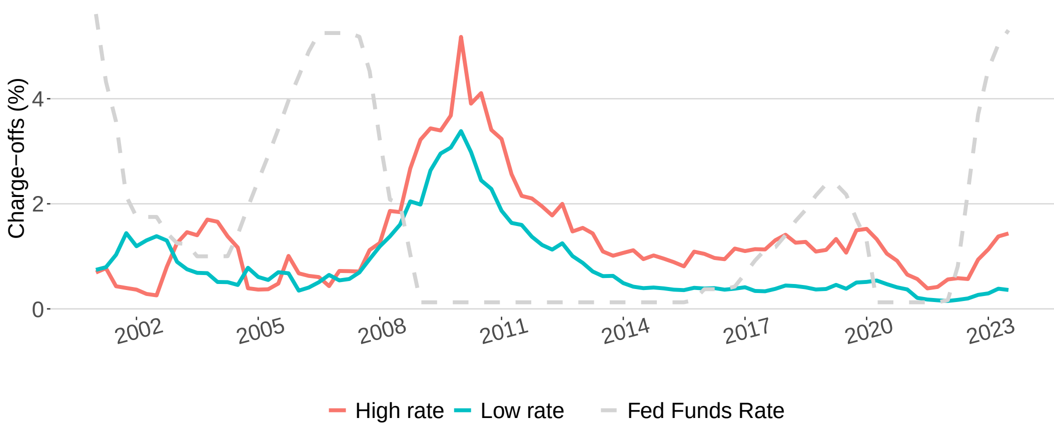
(a) Loan rate



(b) Credit spread



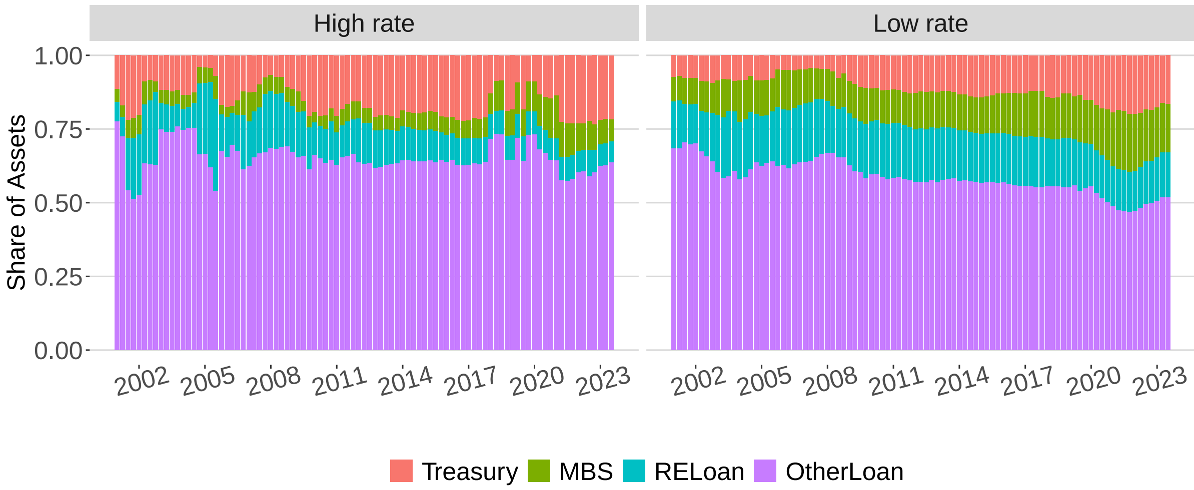
(c) Charge-offs



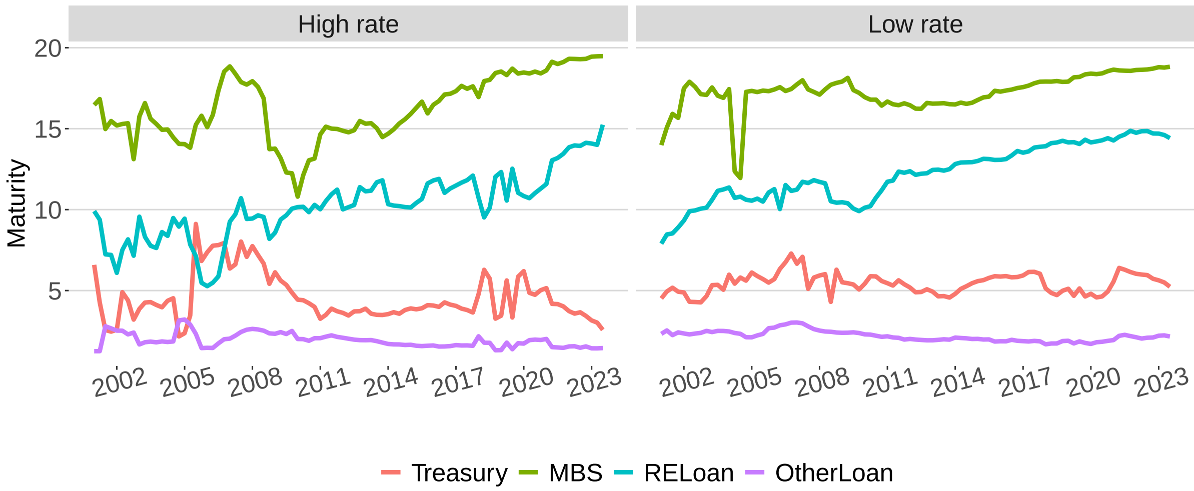
Notes: This figure compares the credit risk of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 10a presents the loan rate (%) of high and low rate banks. Figure 10b presents the credit spread (%) of high and low rate banks. The credit spread is computed as the difference 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 C.1 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (Fed Funds Rate). 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



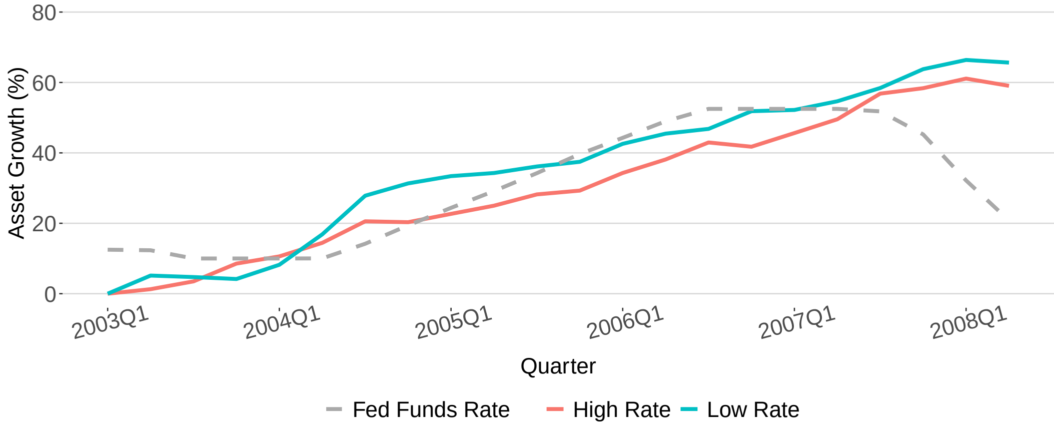
(b) Maturity



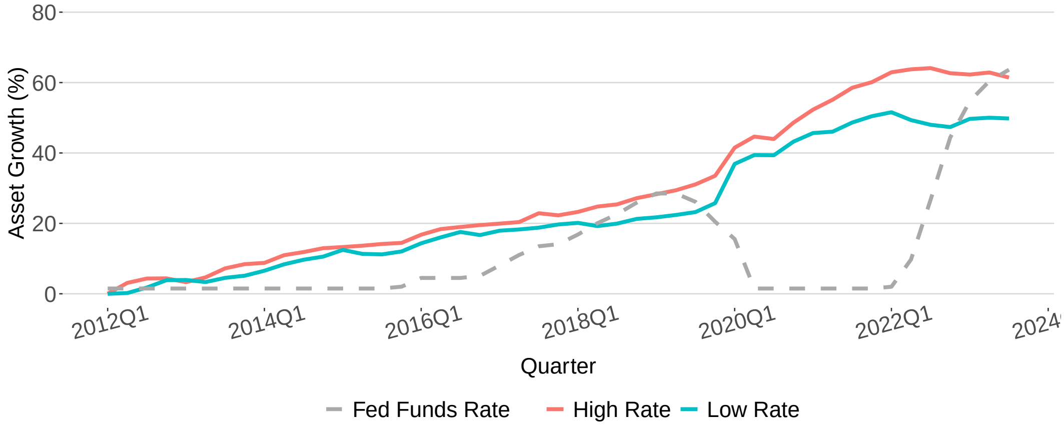
Notes: This figure compares the portfolio characteristics of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. Figure 11a examines the portfolio composition of high rate and low rate banks; share of treasuries (red), mortgage-backed securities (green), real estate loans (blue), and other loans (purple). Figure 11b examines the maturity (years) of these asset classes for high rate and low rate banks. See Appendix Table C.1 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 (Fed Funds Rate). 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: Annual Percentage Yield Comparison

Financial institution	**Savings deposit rate (APY)**	**Minimum opening balance**
TAB Bank	5.27%	$0
UFB Direct	5.25%	$0
Bread Financial	5.15%	$100
Bask Bank	5.10%	$0
LendingClub Bank	5.00%	$100
Synchrony Bank	4.75%	$0
Marcus by Goldman Sachs	4.50%	$0
Ally Bank	4.35%	$0
Capital One	4.35%	$0
Discover Bank	4.30%	$0
TD Bank	0.02%	$0
Chase	0.01%	$0
U.S. Bank	0.01%	$25
Wells Fargo	0.01%	$25
Bank of America	0.01%	$100

[Shohini's note: Citi PNC] *Notes:* This table lists the annual percentage yield (APY) of saving accounts offered by financial institutions that are broadly available as well as some of the nation's largest banks, as of March 21, 2024. *Source:* BankRate.com

Table 2: Summary Statistics

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

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

Panel B: Deposit Rate

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

Notes: Panel A compares various metrics between high and low rate banks among the top 25 banks from 2001Q1 to 2008Q4 and from 2017Q1 to 2023Q3. The comparison between 2009Q1 to 2006Q4 is reported in Tabel C.2. 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 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	-1.072***	-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 4: Transmission of Monetary Policy: Deposit and Lending Rates

	Liabilities			Assets	Assets - Liability
	Δ12MCD10K	SavRate	ΔInterest Expense	ΔInterest Income	ΔNIM
	(1)	(2)	(3)	(4)	
ΔFed Funds × 𝟙(High Rate) × Post	0.545***	0.588***	0.170***	0.097	-0.064
	(0.115)	(0.178)	(0.037)	(0.070)	(0.049)
ΔFed Funds × 𝟙(High Rate)	-0.066	-0.261***	-0.032	-0.025	-0.001
	(0.113)	(0.050)	(0.035)	(0.066)	(0.041)
ΔFed Funds	0.599***	0.103***	0.463***	0.413***	-0.043
	(0.055)	(0.035)	(0.037)	(0.056)	(0.036)
ΔFed Funds × Post	-0.455***	-0.088**	-0.147***	0.112*	0.250***
	(0.099)	(0.037)	(0.051)	(0.065)	(0.044)
𝟙(High Rate) × Post	-0.018	0.110	-0.022	0.015	0.037
	(0.039)	(0.161)	(0.018)	(0.051)	(0.042)
𝟙(High Rate)	-0.007	0.168***	0.014	-0.013	-0.027
	(0.035)	(0.044)	(0.017)	(0.050)	(0.042)
Post	-0.061	-0.063*	-0.001	-0.012	-0.012
	(0.052)	(0.036)	(0.022)	(0.038)	(0.020)
$\text{ROA}_{i,q-1}$	0.041**	0.062*	0.014**	0.005	-0.009
	(0.019)	(0.034)	(0.007)	(0.016)	(0.013)
$\text{Tier1}_{i,q-1}$	-0.024**	-0.038**	-0.013**	-0.021	-0.009
	(0.012)	(0.016)	(0.006)	(0.013)	(0.010)
Constant	0.008	0.027	-0.014	-0.019	-0.002
	(0.050)	(0.057)	(0.021)	(0.040)	(0.023)
Adjusted R^2	0.558	0.150	0.592	0.367	0.095
Observations	1846	863	2268	2268	2268
Mean of Dep. Variable	-0.020	0.096	0.001	-0.009	-0.010

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

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

where i and q indicate the bank and quarter-year, respectively, $\Delta\text{Fed Funds}_q$ denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-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, $\Delta Y_{i,q}$ is the change in the 12MCD10K rate in column (1), the change in the saving rate in column (2), the change in interest expense in column (3), the change in net interest income in column (4), and the change in NIM in column (5). All dependent variables are winsorized at the 0.5% and the 99.5% levels. The 12MCD10K and saving rates comes from RateWatch. The change in interest expense, interest income and NIM are computed from the Call Reports. See Table C.1 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 5: Growth in Deposits and Loans

	ΔDeposit$_{i,y}$		ΔPersonal Loan$_{i,y}$		ΔC&I Loan$_{i,y}$		ΔReal Estate Loan$_{i,y}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔFed Funds Rate$_y$ $\times$ $\mathbb{1}$(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)
ΔFed Funds Rate$_y$ $\times$ $\mathbb{1}$(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)
ΔFed Funds Rate$_y$	0.712		0.815		1.877		2.530***	
	(0.679)		(0.875)		(1.866)		(0.971)	
ΔFed Funds Rate$_y$$\times$Post	-5.299***		-0.858		-2.131		-2.732	
	(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)
ΔFed Funds Rate$_y$ $\times$ $\mathbb{1}$(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:

$$\begin{aligned}\Delta Y_{i,y} = \alpha &+ \beta_1 \times \Delta\text{Fed Funds Rate}_y \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q + \beta_2 \times \Delta\text{Fed Funds Rate}_y \times \mathbb{1}_{\text{High rate},i} + \\ &\beta_3 \times \Delta\text{Fed Funds Rate}_y \times \text{Post}_q + \beta_4 \times \Delta\text{Fed Funds Rate}_y + \beta_5 \times \mathbb{1}_{\text{High rate},i} + \beta_6 \times \mathbb{1}_{\text{High rate},i} \times \text{Post}_q \\ &\beta_7 \times \Delta\text{Fed Funds Rate}_y \times \mathbb{1}_{\text{High rate},i} \times \text{Crisis} + \beta_8 \times ROA_{i,q-1} + \beta_9 \times \mathit{Tier}\ 1_{i,q-1} + \varepsilon_{i,q},\end{aligned} \tag{4}$$

where i and q indicate the bank and quarter-year, respectively, ΔFed Funds Rate$_y$ 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 6: 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 7: 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.

Table 8: Additional Results

	IT Exp	Noninterest Exp	Noninterest Inc	Tier 1+2	Reserve	Insured Deposits	Wholesale Share	Wholesale Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{1}$(High Rate)×Post	0.021***	-0.040	0.072	0.028	-0.004	-0.033	-0.026**	1.178***
	(0.006)	(0.166)	(0.209)	(0.208)	(0.008)	(0.035)	(0.013)	(0.226)
$\mathbb{1}$(High Rate)	-0.004	0.189	-0.197	1.325***	0.007**	-0.057*	0.032**	-0.016
	(0.005)	(0.144)	(0.198)	(0.165)	(0.003)	(0.029)	(0.013)	(0.107)
$\text{ROA}_{i,q-1}$	0.002**	0.275**	0.500***	-0.223*	-0.004	0.054***	0.002	-0.083
	(0.001)	(0.109)	(0.120)	(0.123)	(0.002)	(0.019)	(0.002)	(0.065)
$\text{Tier1}_{i,q-1}$	-0.007***	0.108***	0.160***	0.109	0.011**	-0.064***	0.007*	-0.124***
	(0.002)	(0.033)	(0.027)	(0.138)	(0.005)	(0.012)	(0.004)	(0.046)
Quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.225	0.044	0.125	0.066	0.024	0.088	0.018	0.057
Observations	1312	2269	2269	2269	2269	2269	2269	2234
Mean of Dep. Variable	0.033	2.646	1.823	14.306	0.064	0.458	0.130	2.753

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

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

where i and q indicate the bank and quarter-year, respectively, $\Delta\text{Fed Funds Rate}_y$ 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 $\text{ROA}_{i,q-1}$ and Tier $1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The dependent variable, $\Delta\text{Y}_{i,y}$ is IT expense ratio, non-interest expense, non-interest income, Tier 1 and 2 ratio, reserve ratio, insured deposit share, wholesale funding share and wholesale funding rate. 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.

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 (2), 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 (2), 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: E-banking only, B: E-banking 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 + E-banking, B: Branch + E-banking}. 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 + E-banking}. 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: E-banking 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 + E-banking, A: E-banking 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 + E-banking	E-banking 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 + E-banking	$(Prof_B^3, Prof_A^3)$	$(\frac{\eta^2}{8}-\kappa, \frac{\eta^2}{8}-\kappa)$	$(Prof_A^5, Prof_B^5)$
	E-banking 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.

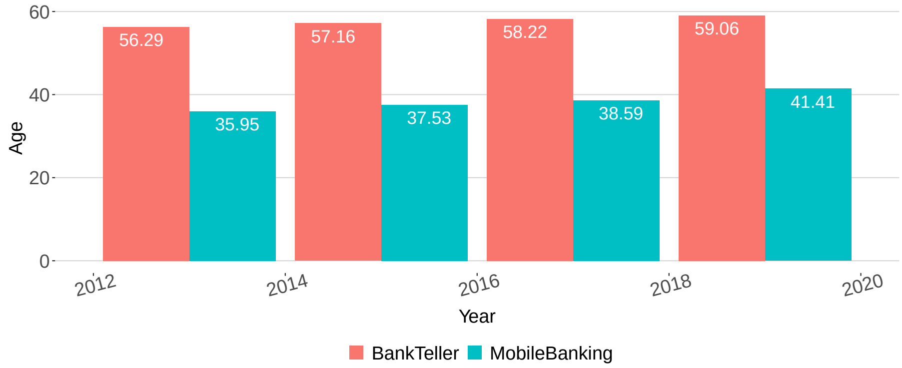
– If $Prof_B^5 > \frac{\eta^2}{8} - \kappa$, then Case 5 {A: Branch + E-banking, A: E-banking only} and its symmetric case {A: E-banking, A: Branch + E-banking} are Nash equilibria.

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

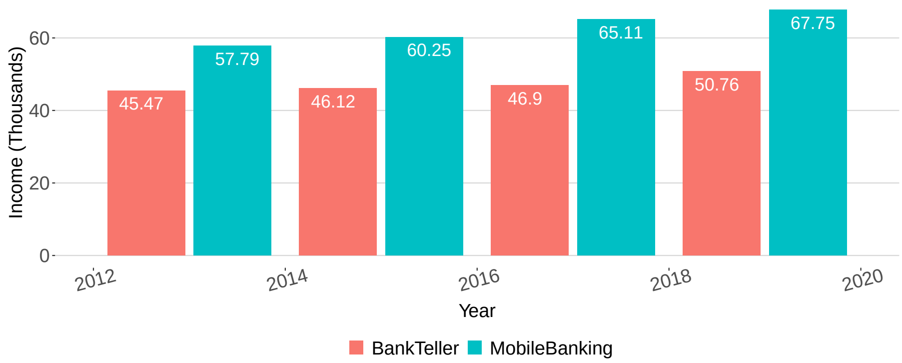
B Figures for Additional Supporting Evidence and Alternative Channels

Figure B.1: Characteristics of Households Using Branches v.s. Mobile Banking

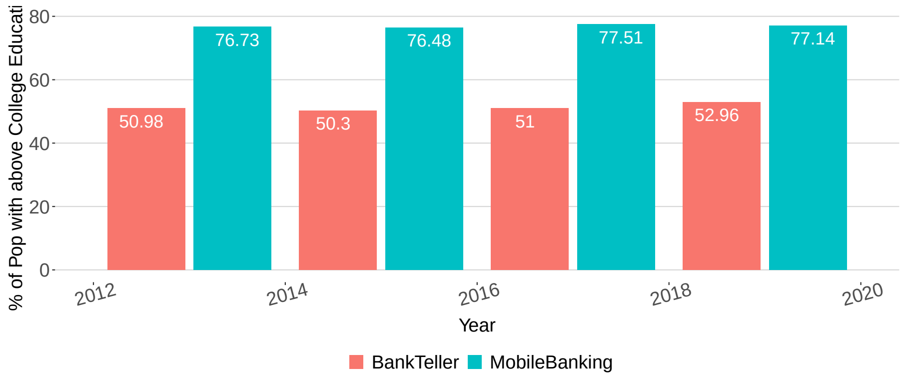
(a) Age



(b) Income



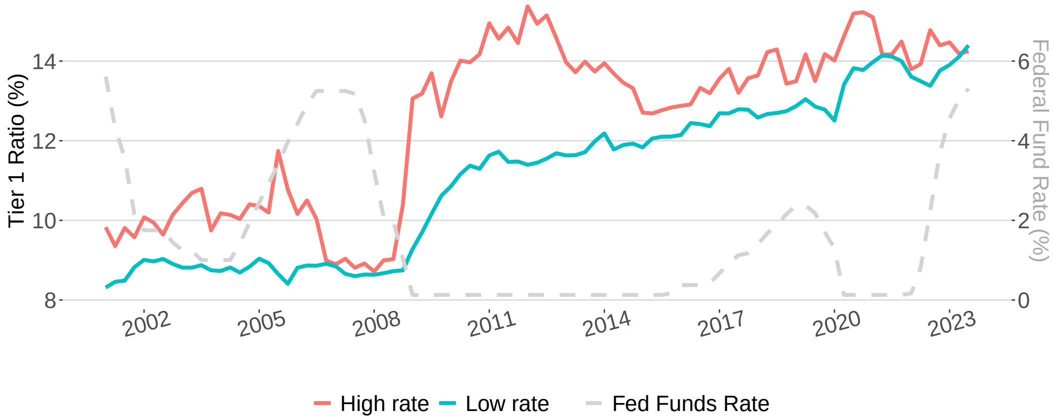
(c) Education



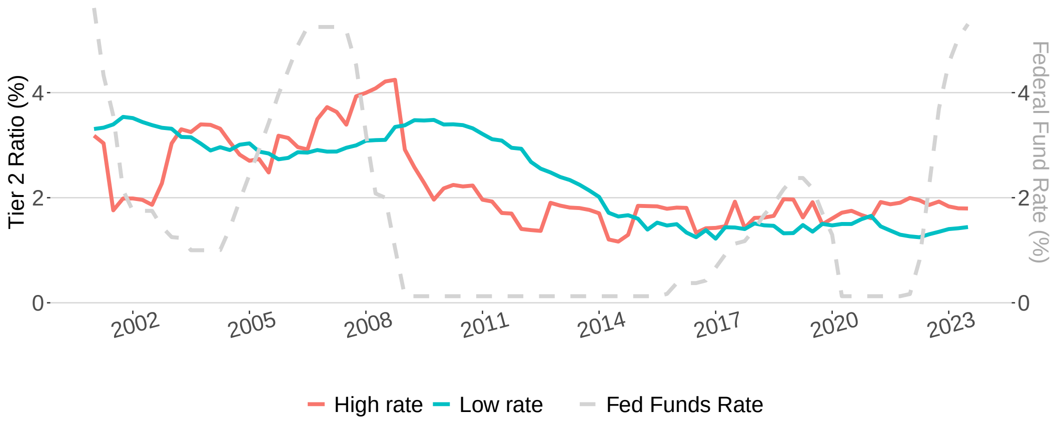
Notes: These figures present the characteristics of households utilizing bank tellers versus mobile banking as their primary means of accessing banking services. The data is derived from the FDIC Survey of Consumer Use of Banking and Financial Services. Respondents were asked to specify their most common 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.2: Tier 1 or Tier 2 Ratio

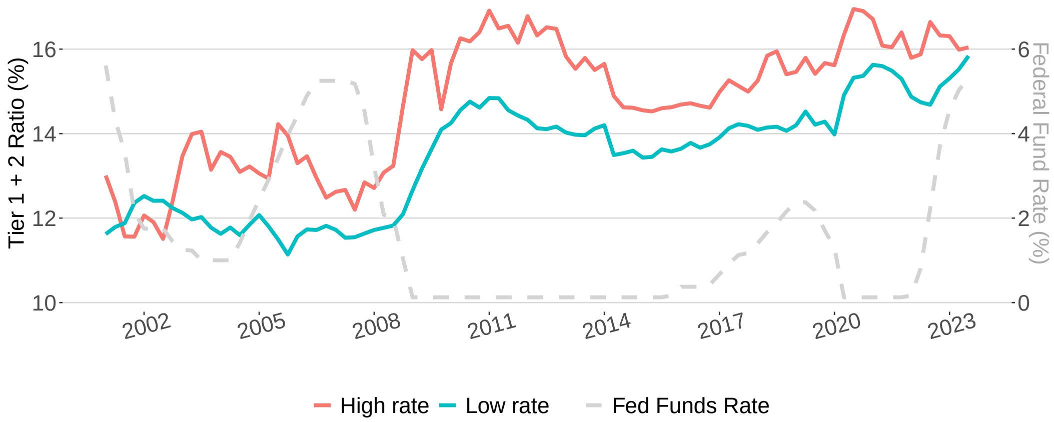
(a) Tier 1 Ratio



(b) Tier 2 Ratio



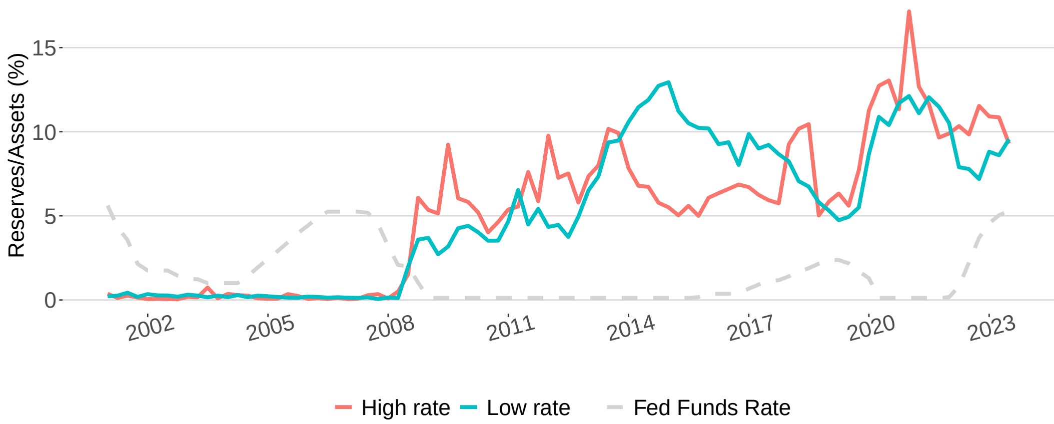
(c) Tier 1+2 Ratio



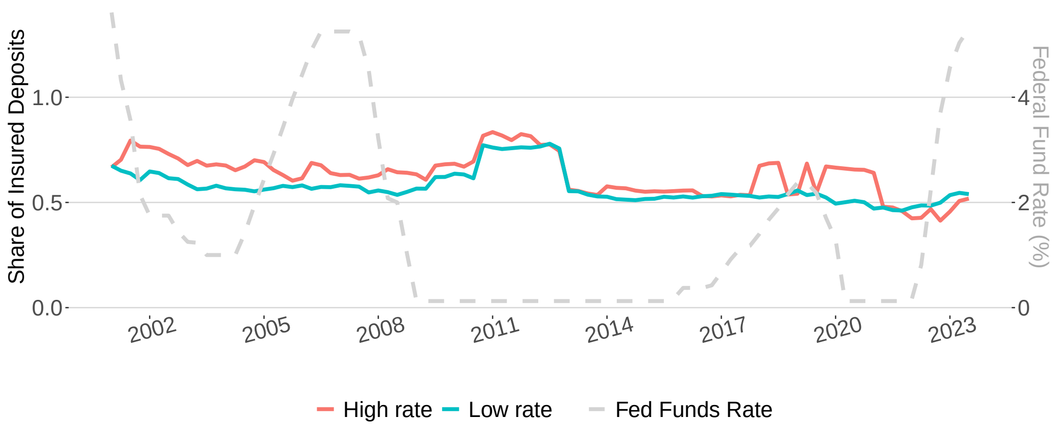
Notes: This figure compares the Tier 1/2 ratio of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. See Appendix Table C.1 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized 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 B.3: Reserves

(a) Reserves



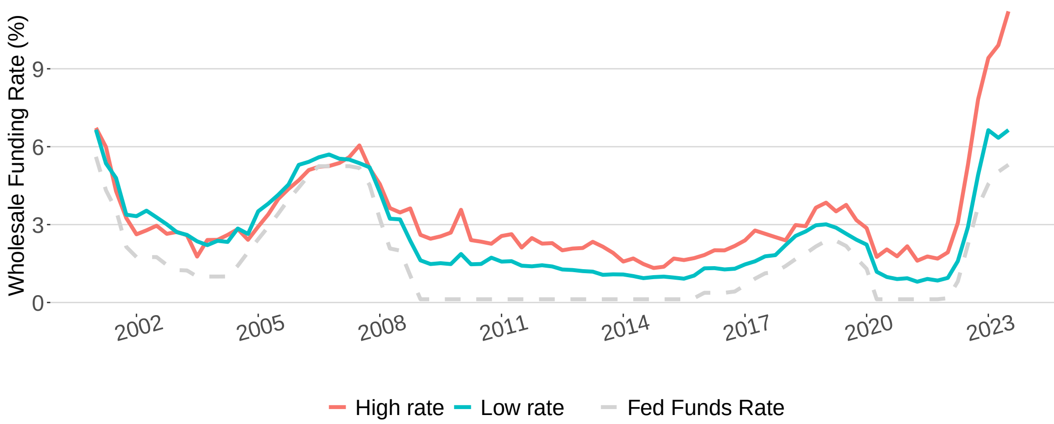
(b) Insured Deposit Share



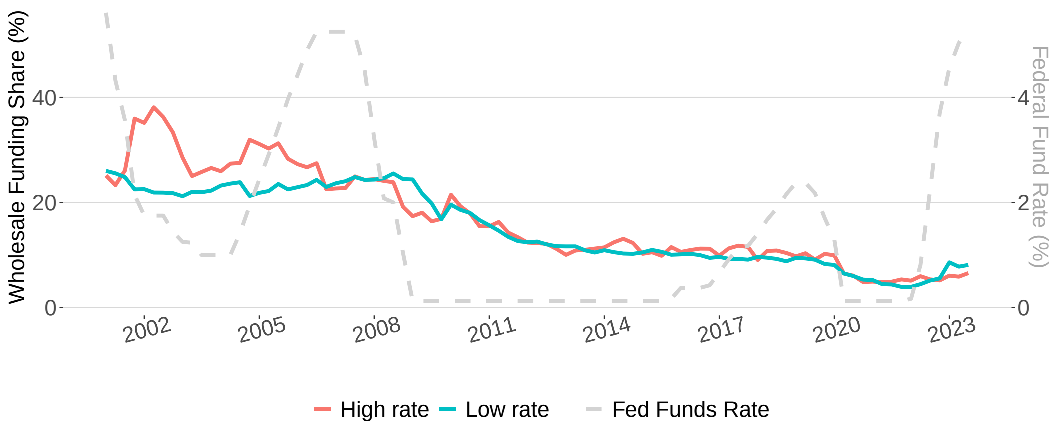
Notes: This figure compares the reserve holding of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q3. See Appendix Table C.1 for more details on the construction of key variables. The left y-axis represents the quarterly average Federal Fund Target rate (FFTar). A bank is categorized 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 B.4: Wholesale Funding

(a) Wholesale Funding Rate



(b) Wholesale Funding Share



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 C.1 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.

C Table Appendix

Table C.1: Construction of Key Variables

Variable Name	Construction
Rate	
Deposit rate (%)	$(\text{edepdom}_q + \text{edepfor}_q)/\text{dep}_{q-1}$*100*4
Loan rate (%)	$(\text{ilndom}_q + \text{ilnfor}_q + \text{ils}_q)/\text{lnlsgr}_{q-1}$*100*4
Interest income (%)	$\text{intinc}_q/\text{asset}_{q-1}$ * 100 * 4
Interest expense (%)	$\text{eintexp}_q/\text{asset}_{q-1}$ * 100 * 4
NIM rate (%)	$\text{nim}_q/\text{asset}_{q-1}$ * 100 * 4
Composition	
MBS	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
$\text{Maturity}_{Treasury}$	(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
$\text{Maturity}_{OtherLoan}$	(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
$\text{ShortTerm}_{Treasury}$	(scnm3les + scnm3t12)/ Treasury
$\text{ShortTerm}_{RELoan}$	(lnrs3les + lnrs3t12)/ RELoan
$\text{ShortTerm}_{OtherLoan}$	(lnot3les + lnot3t12)/ OtherLoan
ChargeOffs	
$\text{ChargeOff}_{RELoan}$	$\text{ntre}_q/\text{lnre}_{q-1}$*100*4
$\text{ChargeOff}_{CILoan}$	$\text{ntci}_q/\text{lnci}_{q-1}$*100*4
$\text{ChargeOff}_{IndLoan}$	$\text{ntcon}_q/\text{lncon}_{q-1}$*100*4
ChargeOff_{Other}	$(\text{ntlnls}_q\text{-ntre}_q\text{-ntci}_q\text{-ntcon}_q)/(\text{lnls}_{q-1}\text{-lnre}_{q-1}\text{-lnci}_{q-1}\text{-lncon}_{q01})$*100*4
ChargeOff	$\text{ntlnls}_q/\text{lnls}_{q-1}$*100*4
Liquidity Measures	
Tier 1 Ratio (%)	RBCT1J/RWAJT*100
Tier 2 Ratio (%)	RBCT2/RWAJT*100

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

Table C.2: 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***

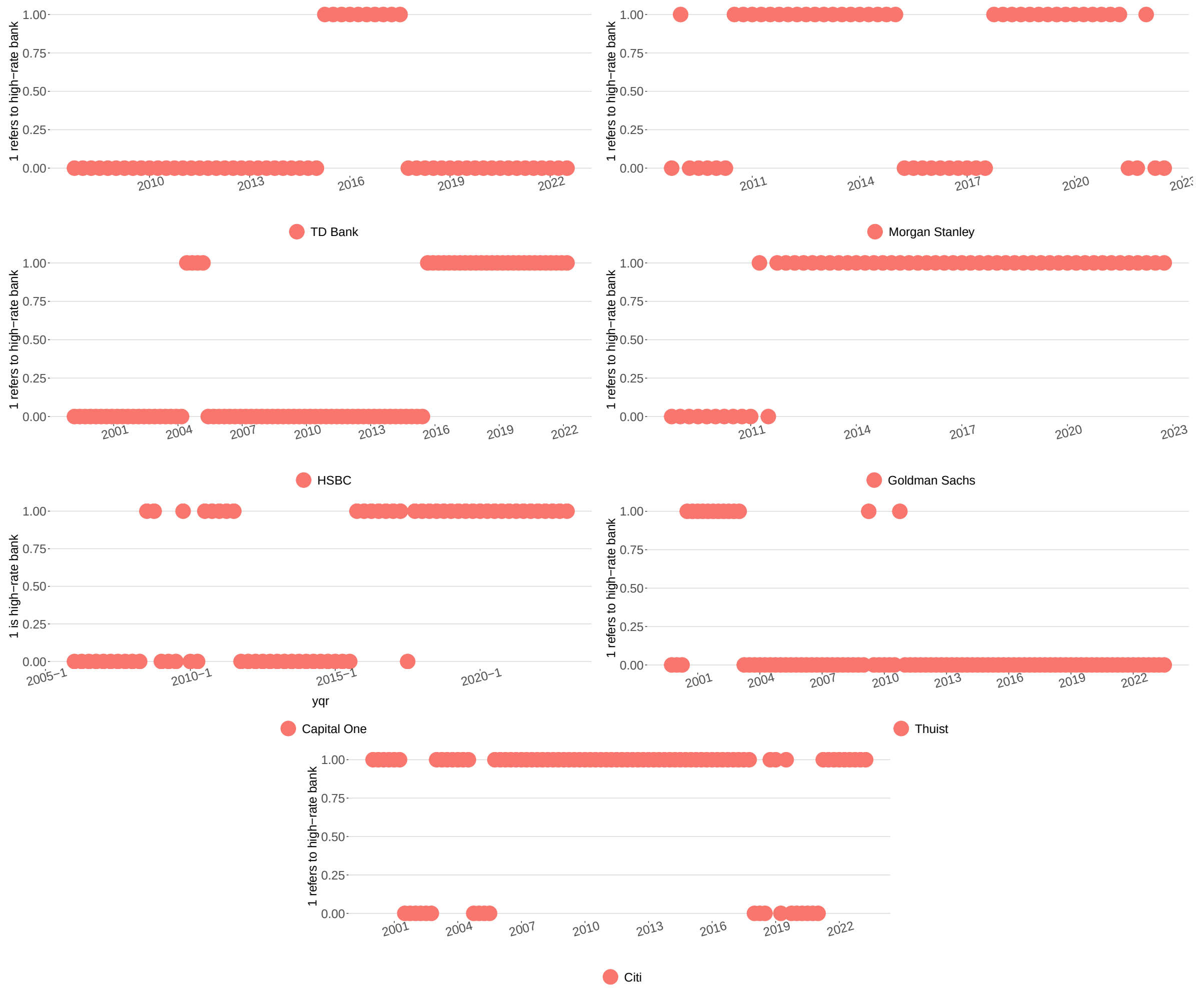
Panel B: Correlation Matrix of Rates

	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 C.3: 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 C.4: 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 $\times$ Time FE	BHC $\times$ 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 $\times$ Bank $\times$ 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 $\times$ quarter-year fixed effects (column 6), and bhc $\times$ quarter-year fixed effects (column 7).

Table C.5: Deposit Betas (Robustness Check with Quarter FE)

	ΔDep. Rate	ΔInterest Expense	ΔInterest Income	ΔNIM
	(1)	(2)	(3)	(4)
ΔFFTar$\times\mathbb{1}$(High Rate)$\times$Post	0.504***	0.150***	0.111	-0.028
	(0.114)	(0.039)	(0.068)	(0.049)
ΔFFTar$\times\mathbb{1}$(High Rate)	-0.042	-0.013	-0.032	-0.028
	(0.108)	(0.036)	(0.064)	(0.039)
$\mathbb{1}$(High Rate)$\times$Post	0.008	-0.009	0.037	0.045
	(0.050)	(0.018)	(0.049)	(0.041)
$\mathbb{1}$(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:

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

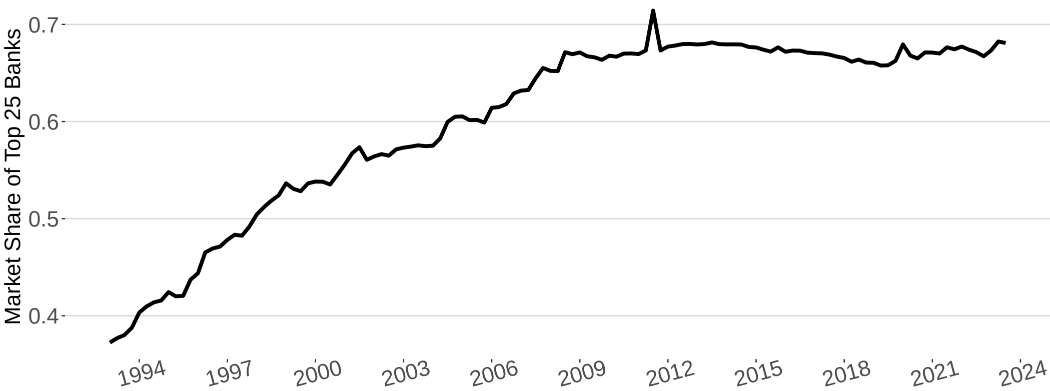
where i and q indicate the bank and quarter-year, respectively, ΔFFTar_q denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, Post$_q$ denotes the post-crisis period (post-2009), and ROA$_{i,q-1}$ and Tier1$_{i,q-1}$ denote 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 in column (1), the change in interest expense (ΔInterest Expense$_{i,q}$) in column (2), change in net interest income (ΔInterest Income$_{i,q}$) in column (3), and change in NIM (ΔNIM$_{i,q}$) 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 C.1 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.

Appendix for Online Publication

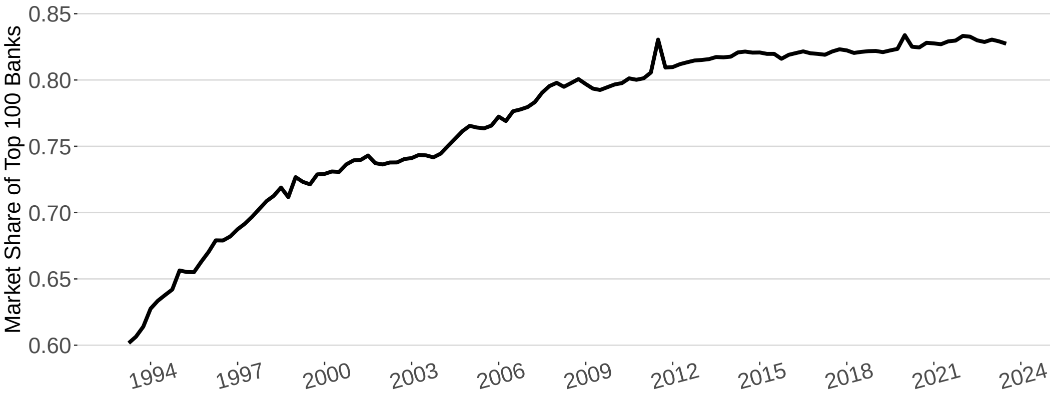
D Figures and Tables for Robustness

Figure D.1: Market Share of Top Banks

(a) Top 25

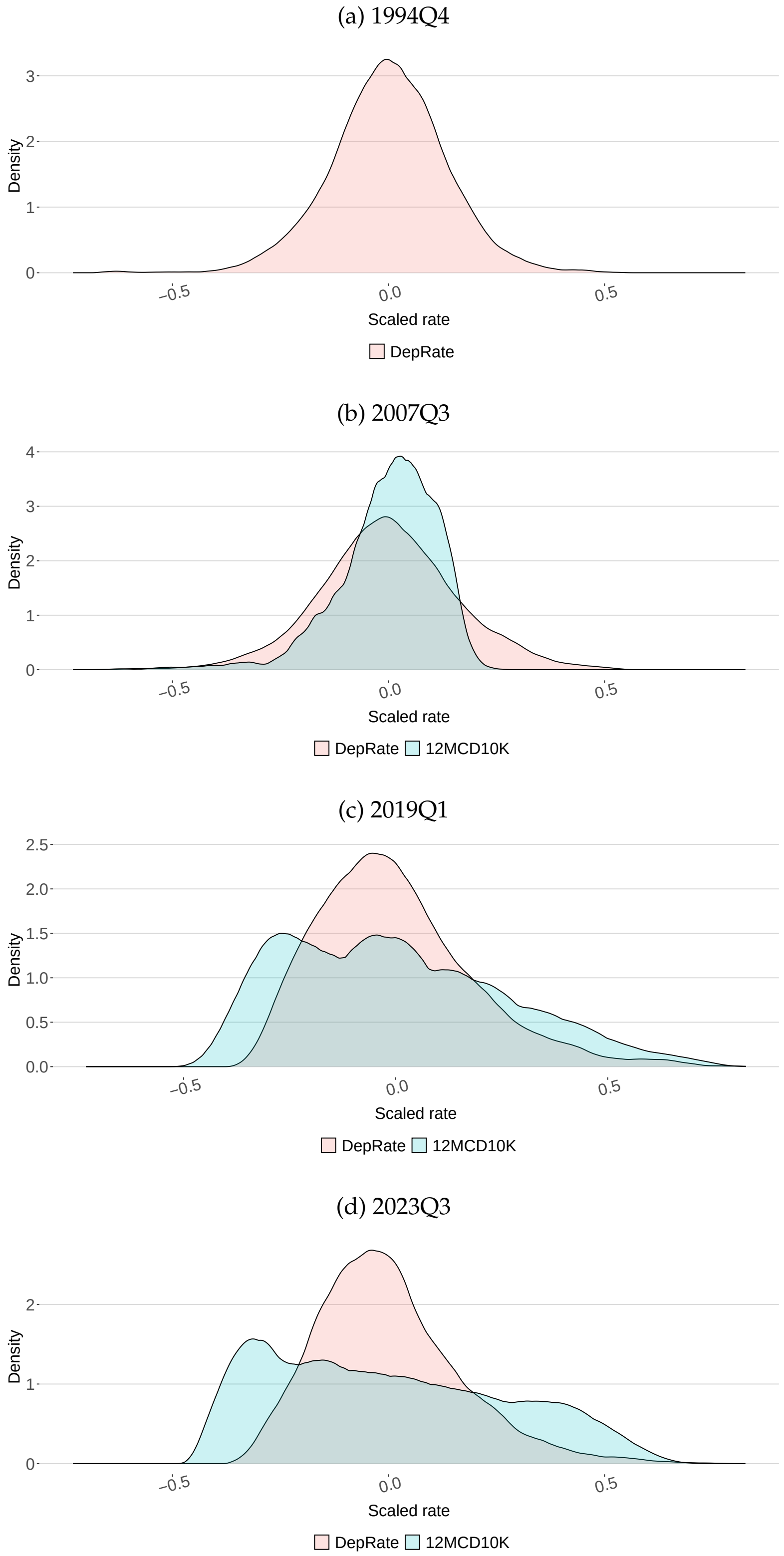


(b) Top 100



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

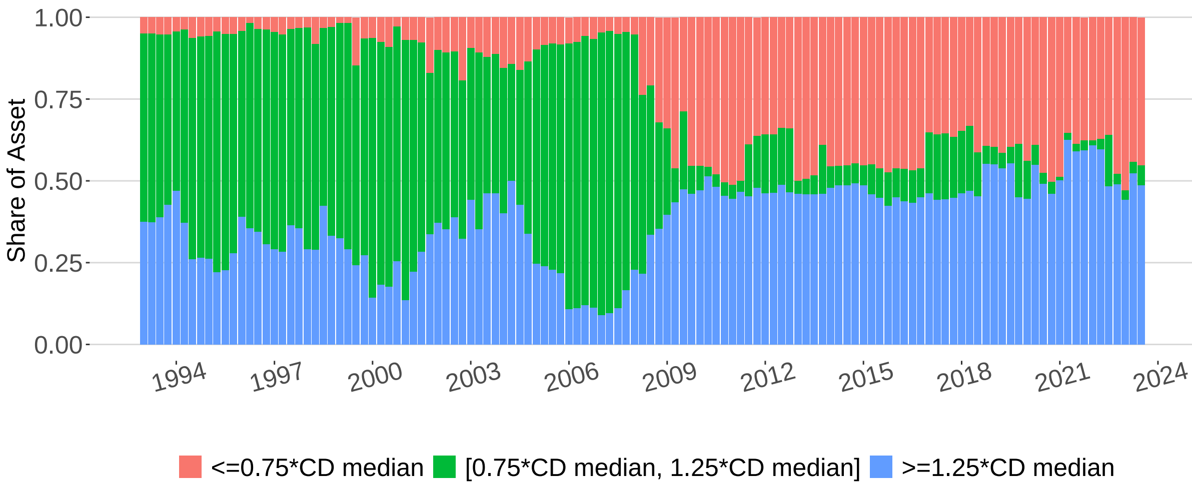
Figure D.2: Dispersion of Deposit Rates for All Banks



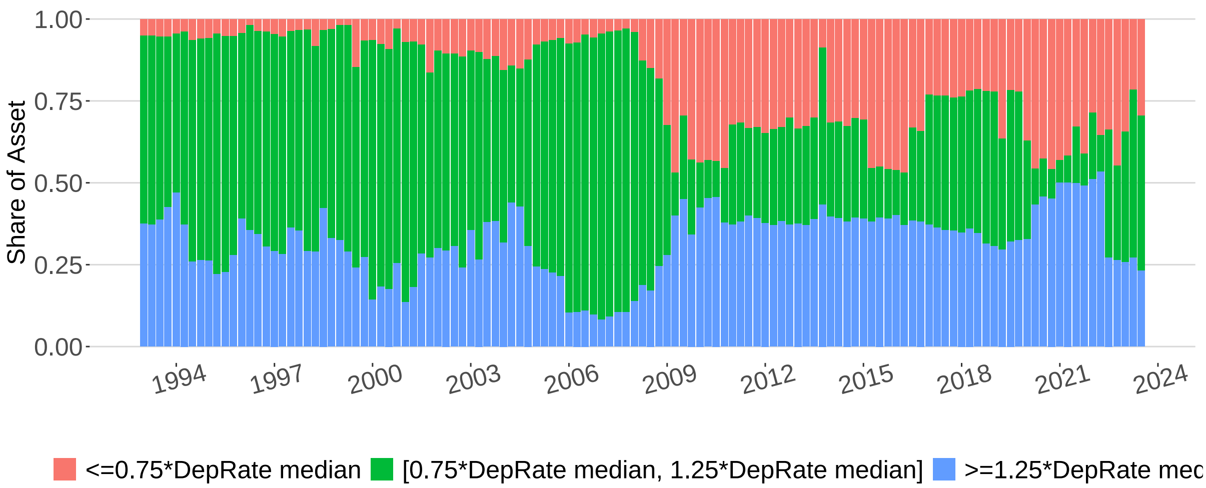
Notes: This figure presents kernel density plots of the scaled and demeaned 12-month certificate of deposit rates of at least $10,000 (12MCD10K) and the scaled and demeaned deposit rates (DepRate) calculated from Call Reports offered by all banks at the peak of each rate hiking cycle. Figures a, b, c 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 D.3: Asset Distribution of All Banks

(a) Classification based on 12MCD10K

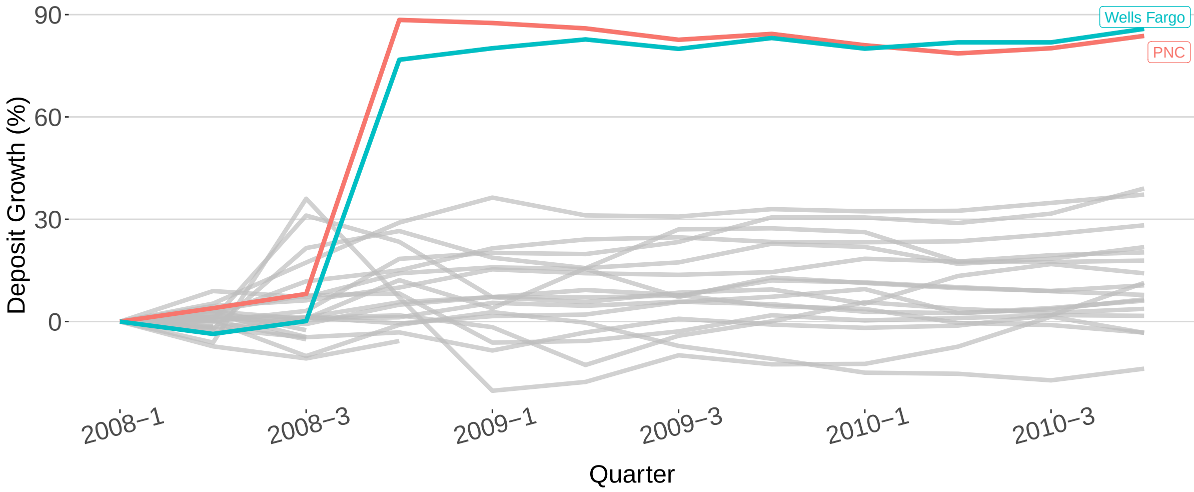


(b) Classification based on DepRate



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 D.2, the sample median is calculated as the median rate of the top 25 banks within each quarter.

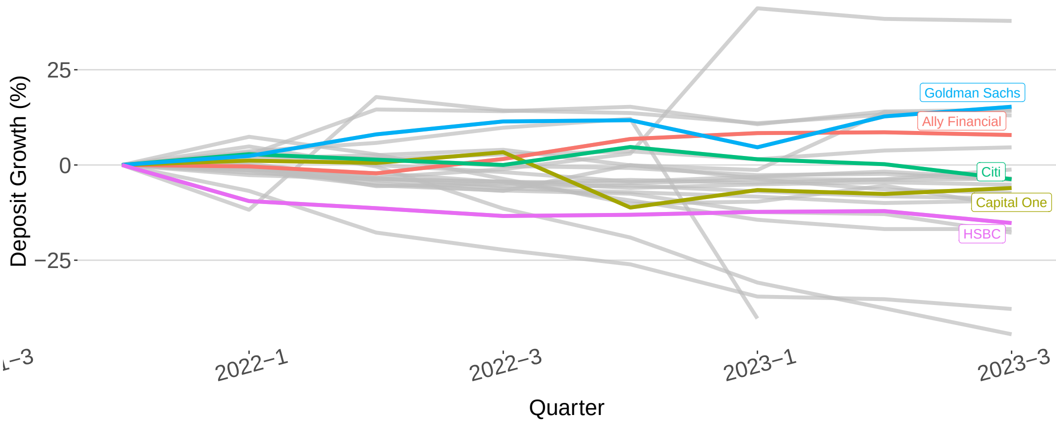
Figure D.4: Deposit Growth in Crisis Period: 2008Q1-2010Q4



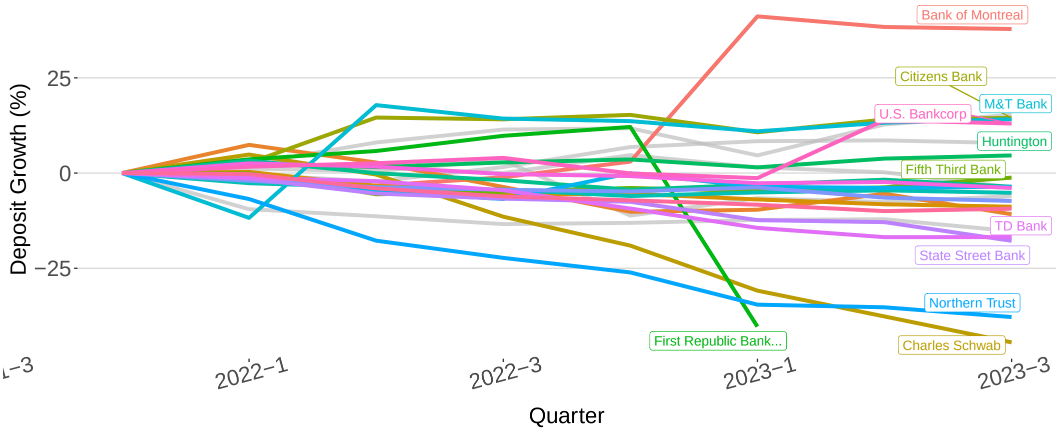
Notes: The figure illustrates the deposit growth of the top 25 banks from 2008Q1 to 2010Q4. The top 25 banks are chosen by their end-of-quarter assets for 2007Q4. The two big jumps in deposit growth are due to M&A: Wells Fargo acquired Wachovia on October 3, 2008, and PNC acquired National City Bank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

Figure D.5: Deposit Growth: 2021Q4-2023Q2

(a) High rate Banks



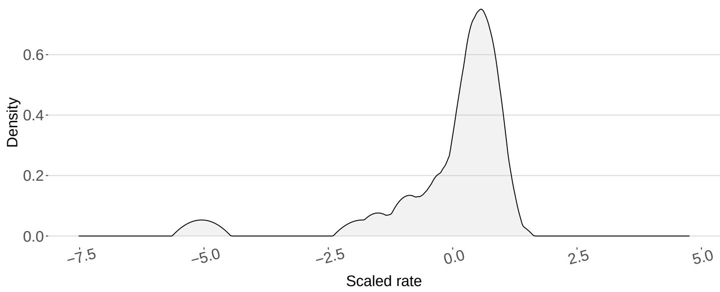
(b) Low rate Banks



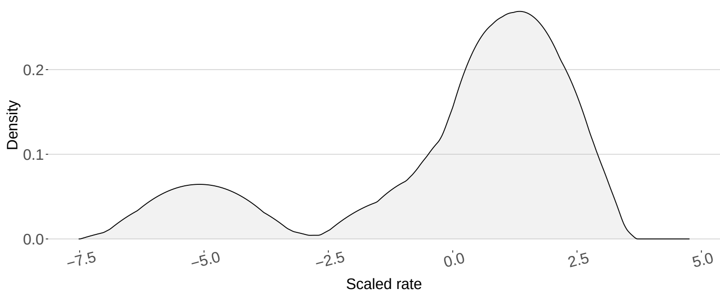
Notes: The figure illustrates the deposit growth of the top 25 banks, categorized by their end-of-quarter assets for 2022Q4. The classification into high-rate and low-rate banks is determined by the deposit rate of the 12-month certificate of deposit on accounts with a minimum balance of $10,000 in 2023Q2.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

Figure D.6: Dispersion of Branch/Deposits Ratio for Top 25 Banks

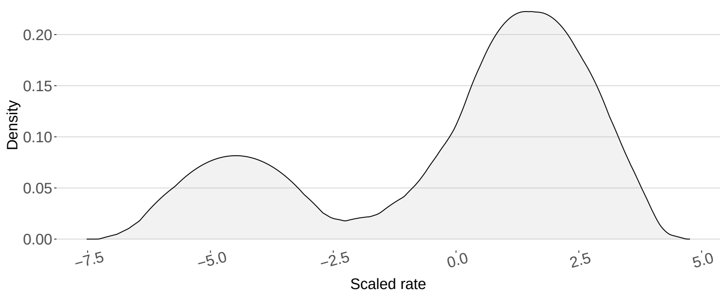
(a) 1994Q4



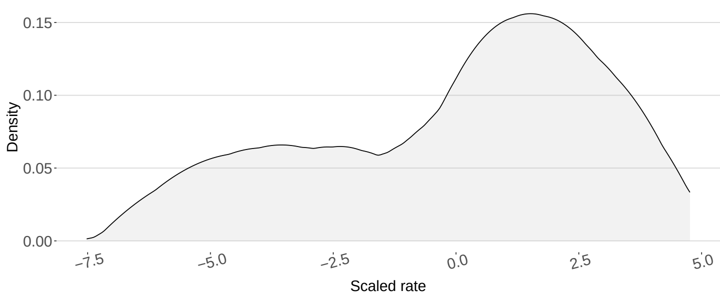
(b) 2007Q3



(c) 2019Q1



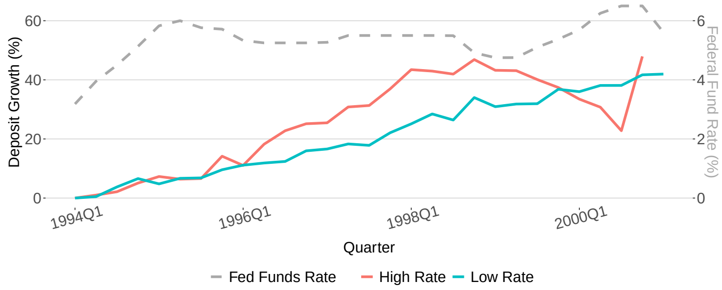
(d) 2022Q2



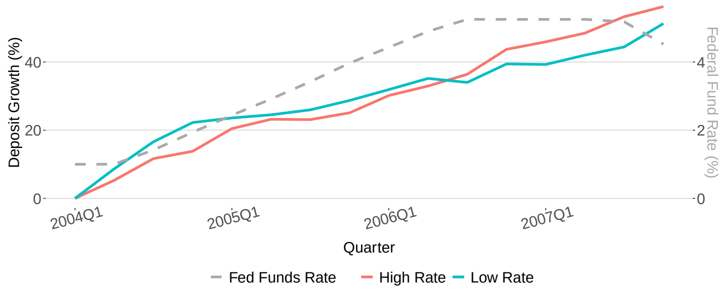
Notes: This figure displays kernel density plots of the demeaned logarithm of branch deposits by the top 25 banks at the peak of each interest rate hiking cycle. Figures a, b, c and d illustrate the kernel density at the following quarters: 1994Q4, 2007Q3, 2019Q1, and 2022Q2 (the last quarter available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

Figure D.7: Deposit Growth (Fixed Top 25 Banks)

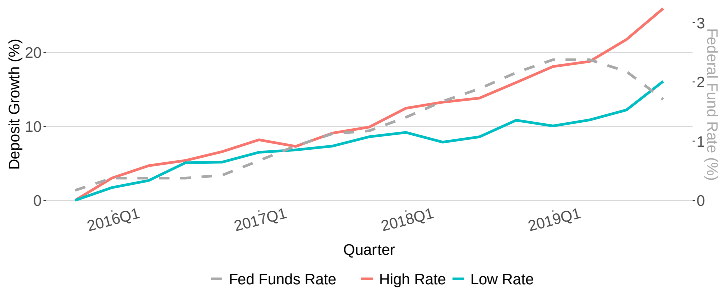
(a) 1993Q4-2001Q1



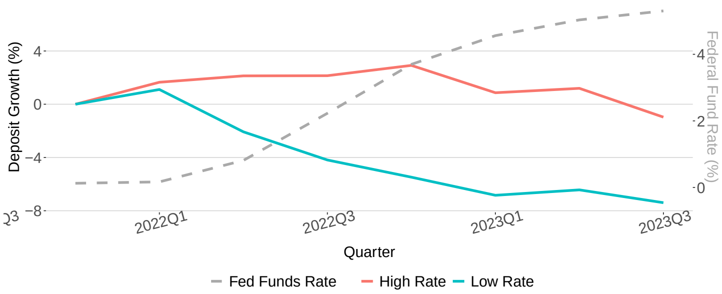
(b) 2004Q1-2007Q4



(c) 2015Q4-2019Q4

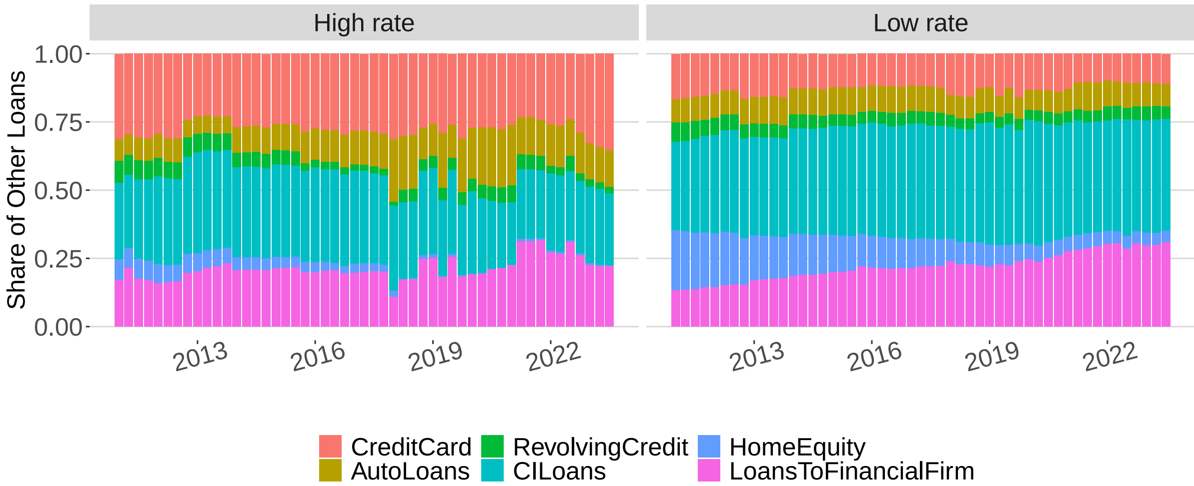


(d) 2021Q4-2023Q2



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 D.7a D.7b, D.7c, and D.7d 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 D.8: Share of Non-Real Estate Loans (Top 25 Banks)

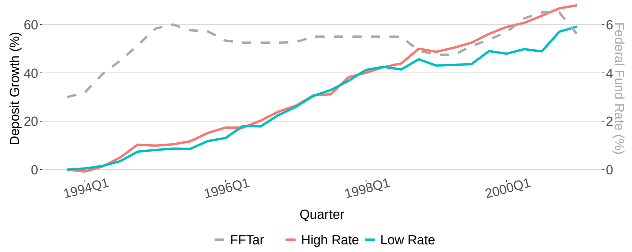


Notes: This figure presents the share of non-real estate loans of high and low rate banks among the top 25 banks from 2001Q1 through 2023Q2. We consider six categories: credit card loans, auto loans, home equity loans, revolving credit to individuals, commercial and industrial loans, and loans to other financial firms. See Appendix Table C.1 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.

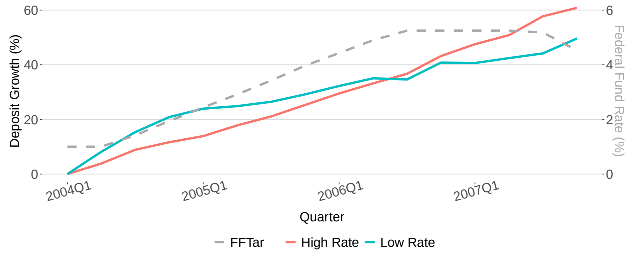
E Robustness Tables Top 100 Banks

Figure E.1: Deposit Growth (Top 100 Banks)

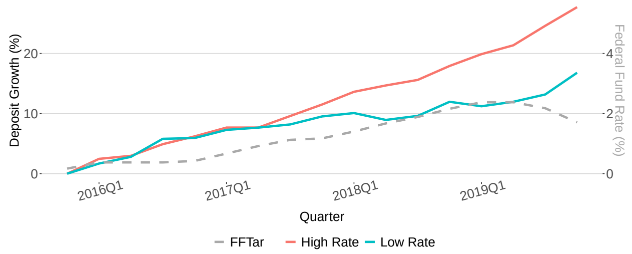
(a) 1993Q4-2001Q1



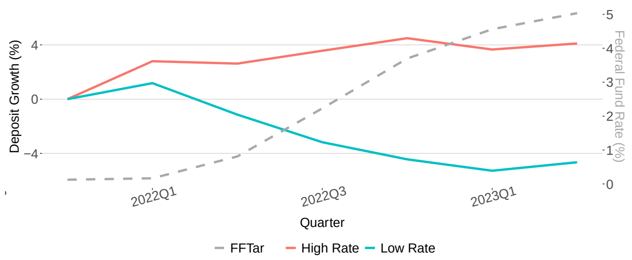
(b) 2004Q1-2007Q4



(c) 2015Q4-2019Q4



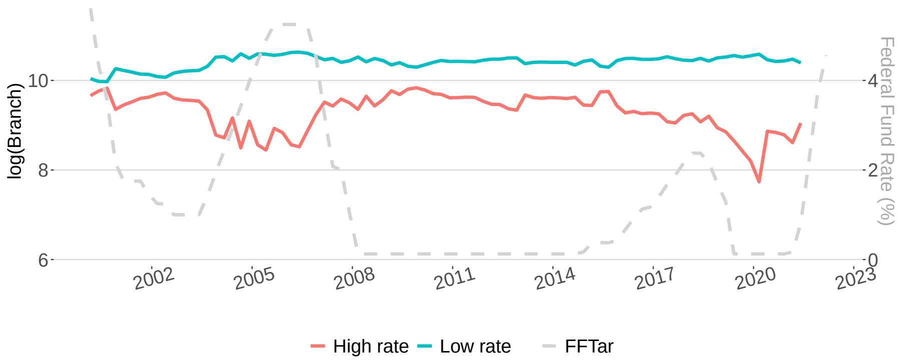
(d) 2021Q4-2023Q2



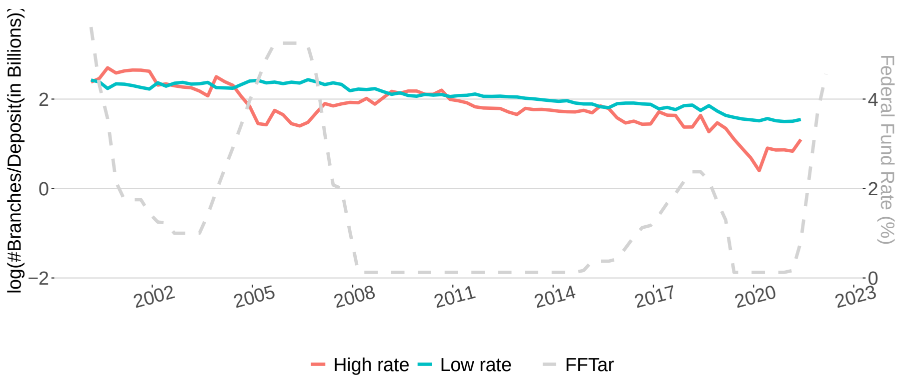
Notes: This figure compares the deposit growth of high and low rate banks among the top 100 banks over the three recent rate hiking cycles. Figures E.1a E.1b, E.1c, and E.1d compare the deposit growth experienced by high-rate banks to that of low-rate banks from 1993Q4 through 2001Q1, from 2004Q1 through 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 E.2: Branches (Top 100 Banks)

(a) Growth of Branches



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

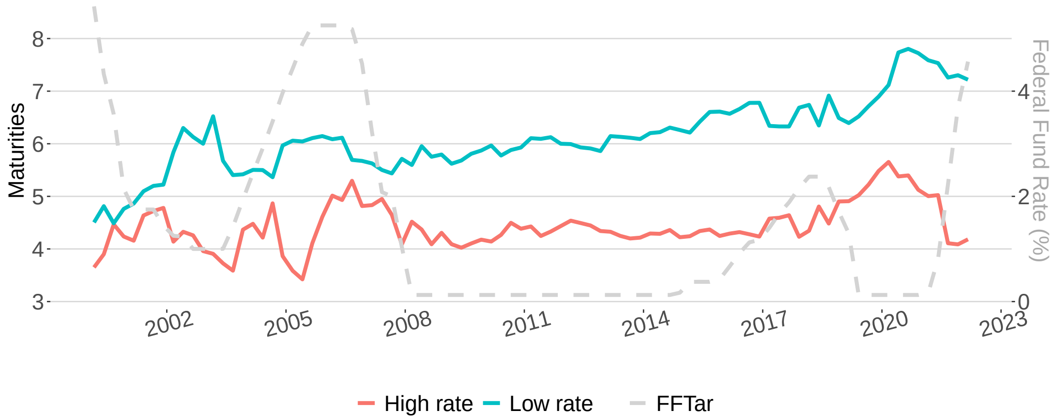


(c) Customer age

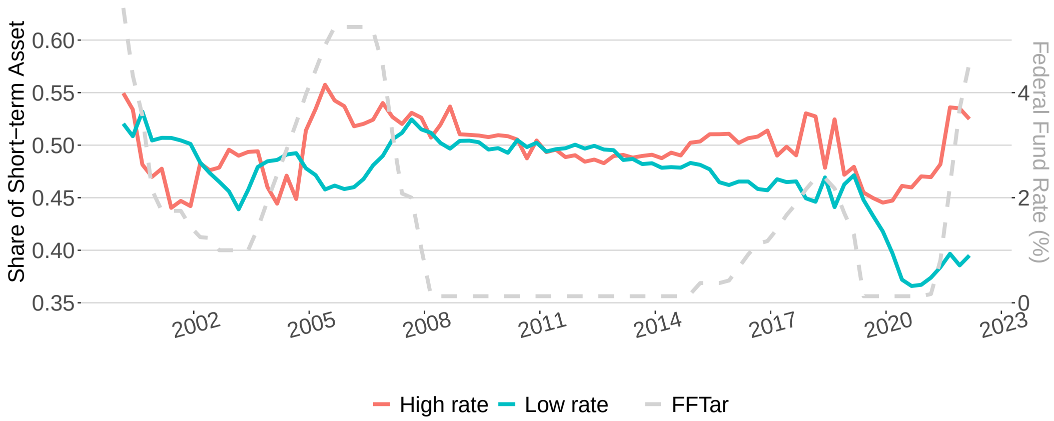
Notes: This figure compares branches operating by high and low rate banks among the top 100 banks from 2001Q1 through 2022Q2, which is the quarter where the most recent SOD data ends. Figure E.2a presents the log-transformed number of branches of high and low rate banks. Figure E.2b presents the log-transformed ratio between branches and deposits (in Billions) of high and low rate banks. Figure E.2c 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 E.3: Duration Risk (Top 100 Banks)

(a) Maturity



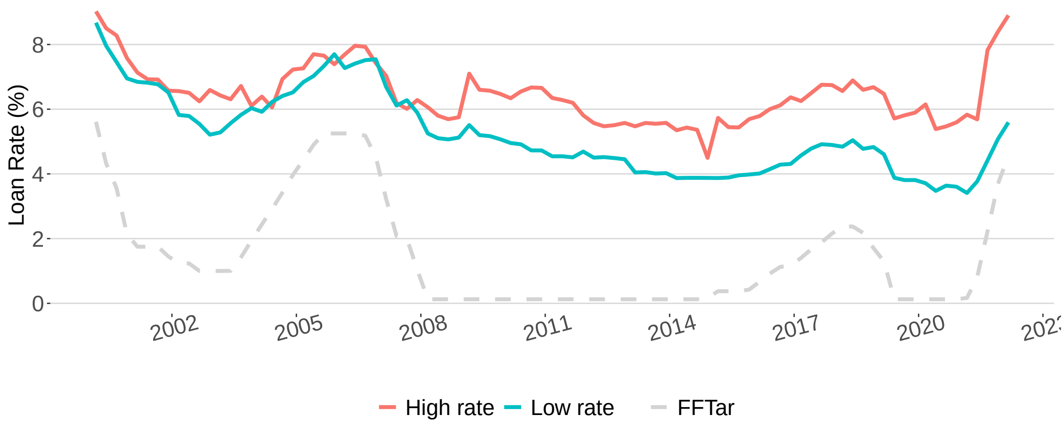
(b) Share of Short-Term Assets



Notes: This figure compares the duration risk of high and low rate banks among the top 100 banks from 2001Q1 through 2023Q2. Figure E.3a presents the maturity (# of years) of high and low rate banks. Figure E.3b 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 E.4: Credit Risk (Top 100 Banks)

(a) Loan rate



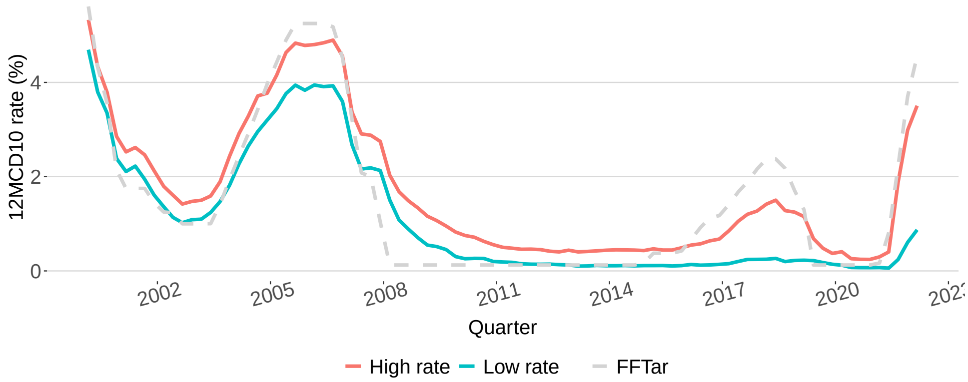
(b) Credit spread

(c) Charge-offs

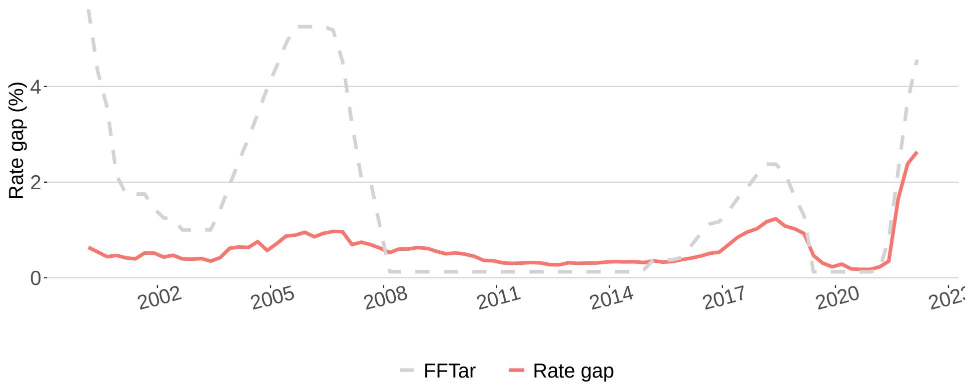
Notes: This figure compares the credit risk of high and low rate banks among the top 100 banks from 2001Q1 through 2023Q2. Figure E.4a presents the loan rate (%) of high and low rate banks. Figure E.4b presents the credit spread (%) of high and low rate banks. The credit spread is computed as the difference between the loan rate and synthetic term rate (average of term treasury yields, weighted by the share of loans with corresponding maturities). Figure E.4c presents the charge-off rate (%) for high and low rate banks. See Appendix Table C.1 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 E.5: Dispersion of Bank Deposit Rates (Top 100 Banks)

(a) Rate



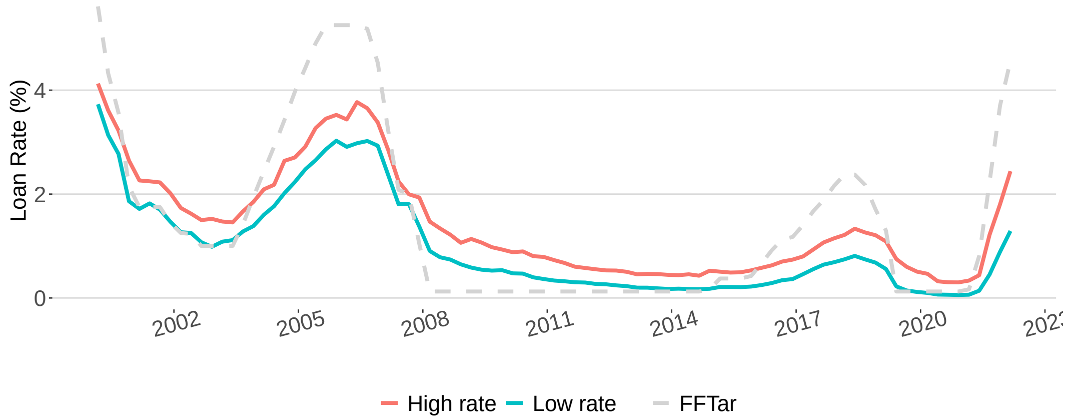
(b) Rate Gap



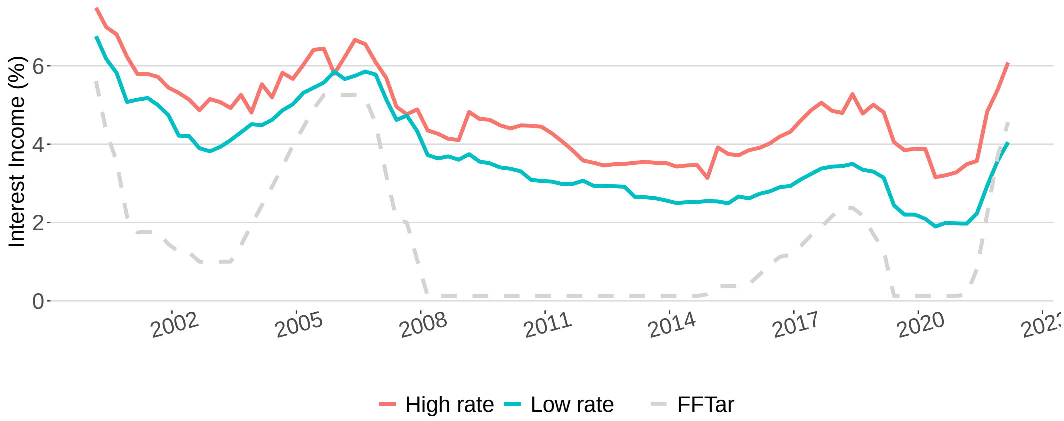
Notes: This figure characterizes the dispersion of deposit rates of high and low rate banks from 2001Q1 through 2023Q2 among the top 100 banks. Figure E.5a presents a time-series plot of the of 12-month certificate of deposit rates of at least $10,000 (12MCD10K) using RateWatch data for *high rate* (blue) and *low rate* (red) banks. Figure E.5b 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 E.6: Net Interest Margin (Top 100 Banks)

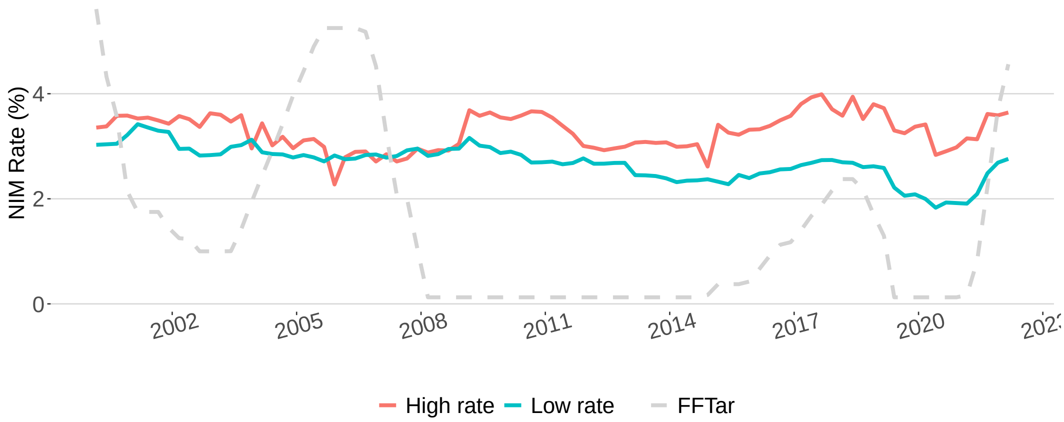
(a) Interest Expense



(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 E.6a presents the interest expense (%) of high and low rate banks. Figure E.6b presents the interest income (%) of high and low rate banks. Figure E.6c presents the net interest margin (NIM) rate (%) for high and low rate banks. See Appendix Table C.1 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 E.1: 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, ΔFFTar_q denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and 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 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 C.1 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 E.2: Deposit Growth and Loans (Top 100 Banks)

	ΔDeposit$_{i,y}$		ΔPersonal Loan$_{i,y}$		ΔC&I Loan$_{i,y}$		ΔReal Estate Loan$_{i,y}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔFFTar$_y$ $\times$ $\mathbb{1}$(High Rate)$\times$Post	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)
ΔFFTar$_y$ $\times$ $\mathbb{1}$(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)
ΔFFTar$_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)
ΔFFTar$_y$ $\times$ $\mathbb{1}$(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:

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

where i and q indicate the bank and quarter-year, respectively, ΔFFTar$_y$ denotes the annual change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post$_q$ denotes the post-crisis period (post-2009), "Crisis" is an indicator for the third and fourth quarters of 2008, and 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, ΔDeposit$_{i,y}$ 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 E.3: 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 E.4: 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 E.5: 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.

F Main Results for Top 100 Banks with Bank FE

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

Table F.1: Deposit Betas

	ΔDep. Rate		ΔInterest Expense		ΔInterest Income		ΔNIM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔFFTar$\times\mathbb{1}$(High Rate)$\times$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$\times\mathbb{1}$(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)$\times$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)
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)
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, ΔFFTar_q denotes the change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High Rate}_i}$ denotes whether bank i is a high rate bank, Post_q denotes the post-crisis period (post-2009), and $\text{ROA}_{i,q-1}$ and $\text{Tier1}_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio, respectively. The dependent variable, $Y_{i,q}$ is the change in the 12MCD10K rate (ΔDep. Rate$_{i,q}$) in column (1), the change in interest expense (ΔInterest Expense$_{i,q}$) in column (2), change in net interest income (ΔInterest Income$_{i,q}$) in column (3), and change in NIM (ΔNIM$_{i,q}$) 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 C.1 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 F.2: Growth in Deposits and Loans

	ΔDeposit$_{i,y}$		ΔPersonal Loan$_{i,y}$		ΔC&I Loan$_{i,y}$		ΔReal Estate Loan$_{i,y}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔFFTar$_y$ $\times$ $\mathbb{1}$(High Rate)$\times$Post	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)
ΔFFTar$_y$ $\times$ $\mathbb{1}$(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)
ΔFFTar$_y$ $\times$ $\mathbb{1}$(High Rate)$\times$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:

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

where i and q indicate the bank and quarter-year, respectively, ΔFFTar$_y$ denotes the one-year change in the Federal Funds Target Rate, $\mathbb{1}_{\text{High rate}_i}$ denotes whether bank i is a high rate bank, Post$_q$ denotes the post-crisis period (post-2009), Crisis is an indicator for the third and fourth quarters of 2008,, and ROA$_{i,q-1}$ and Tier $1_{i,q-1}$ denote the control variables – the return on assets and the tier 1 capital ratio of the previous quarter, respectively. The dependent variable, ΔY$_{i,y}$ 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 F.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)
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)
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 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 F.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 F.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.