Don't Fear the Repo: The Relationship Between Financing Choices and Bank Performance in the Post-crisis World

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Abstract

Using a combination of linear regressions and vector autoregression models, this paper develops a theoretical framework to examine how shifts in banks' exposure to repo markets and the expansion of deposit franchises could influence the financial performance and balance sheet strength across three distinct policy regimes: the pre-Global Financial Crisis (GFC) era (1994–2007), the GFC/Zero Interest Rate Policy (ZIRP) era (2008–2014), and the post-GFC/COVID-19 crisis era (2015–2023). The results reveal a striking contrast in bank behavior: banks highly exposed to repo markets tend to adopt risk-averse lending strategies, dampening financial performance but securing more favorable haircuts in repo transactions through careful balance sheet management and strong operating performance. On the other hand, banks with riskier loan portfolios benefit from increasing their repo exposure — strengthening their balance sheets and improving operational performance over time, despite initially facing higher collateral demands that draw on tier 1 capital. For the average bank, repo reliance and deposit growth historically had opposing effects: repo funding supported balance sheet resilience and stricter lending standards, while deposit growth fueled lending expansion. However, post-crisis dynamics reveal a convergence of these effects, highlighting how the interplay between repo and deposits has evolved from a trade-off to a complementary funding strategy. These findings shed light on the growing complexity of bank financing decisions since the GFC, underscoring both the benefits and risks associated with reliance on repo and deposit funding in a changing monetary landscape.

Keywords: monetary policy, repurchase agreements, deposits, lending, bank capital

1. Introduction

With the central bank at its helm, the banking system underpins economic activity by channeling capital to individuals and businesses. The deposit-taking capabilities of the banks allow them to source capital and extend credit, fueling investment and driving economic growth. However, that also means that the intermediation process can carry profound negative effects, with two recent examples being the Global Financial Crisis (GFC) between 2007 and 2009 and the US regional bank crisis of 2023. During these events, the capital mismanagement (Gorton, 2010) and balance sheet weaknesses coming from some of the deposit financing choices (Drechsler et al., 2024) among the vulnerable banks have been proven detrimental to the broader economy. Some other banks, on the other hand, through a combination of careful capital (Kapan and Minoiu, 2013) and liquidity management, especially within repurchase agreement (repo) markets (Gorton and Metrick, 2012), have avoided severe losses. One of the keys to understanding why some banks weather crises while others succumb to distress lies in exploring how financing strategies — specifically the balance between deposit and repo financing — shape their risk aversion, performance, and resilience to economic shocks. This relationship is even more crucial in the increasingly financialized economy (Davis and Kim, 2015), as bank financing decisions shape everything from household savings to corporate strategies. In a complex and interconnected financial system, these decisions ultimately trace back to how banks fund themselves and allocate the sourced capital. As monetary policy continues to evolve in the 2020s, the landscape of bank funding markets looks vastly different from that of the pre-GFC era, prompting an investigation of these shifting dynamics.

To investigate the evolving relationship between the financing sources and its implications for financial stability, I use detailed bank-level data from 1994 to 2024, segmenting banks by delinquency[1] and repo dependence[2], both serving as approximations for banks' degree of risk

[1] Using a 5% threshold, twice the average delinquency rate for the sample period

[2] Using a 15%, or 97.5^{th} percentile threshold

appetite and aversion, respectively. I then apply linear models and vector autoregressions to quantify the relationship between changes in financing structure and subsequent performance and develop a robust theoretical framework that explains the reasons behind the banks' choices of repo financing levels.

The analysis reveals that banks with higher exposure to repo markets tend to maintain stronger balance sheets, have stronger operating performance, and exhibit more risk aversion in lending, likely to secure more favorable repo haircuts[3]. In turn, those banks see worse loan performance, with significantly lower net interest margins the more dependent on repo they are, underscoring that those banks prioritize maintaining low transaction costs in repo markets instead of their lending activities. In contrast, banks with higher deposit sensitivity and overall riskier loan portfolios tend to see declines in their balance sheet strength and operating performance, while experiencing stronger net interest margins. These dynamics reveal a peculiar pattern that I characterize using the theoretical model - repo can serve as a monitoring mechanism for banks with weaker balance sheets or risky loan portfolios. The haircuts and collateral requirements, while initially high for such banks, reward building stronger balance sheets and reducing the risk of the loan portfolios in the long run.

However, after the Global Financial Crisis (GFC) and the introduction of new monetary policy tools, the balance between these funding sources has shifted, with banks benefiting from a diversified funding mix. This work finds that banks with risky loan portfolios and higher dependency on deposit financing face stricter collateral requirements as their reliance on repo grows, incentivizing balance sheet improvements. At the same time, repo-sensitive banks see major improvements in their net interest margins when they increase the proportion of deposits in their financing structure. Those banks also continue maintaining stronger balance sheets as their deposit reliance grows, likely in an attempt to counter potential haircut increases driven by rising loan portfolio risk. This transformation highlights the importance of understanding funding strategies in the context of monetary policy shifts, as

[3]The difference between the market value of the collateral in repo transactions and the agreed-upon-price paid for the collateral at the inception of the repurchase agreement

these choices have significant implications for financial stability and bank performance. As a result, this paper shows the evolving interplay between repo and deposit funding that has reshaped bank risk profiles and lending strategies, particularly with the GFC policy response playing a crucial role in this transformation.

Section 1.1 provides institutional background to the analysis in this work. Section 2 reviews the theoretical and empirical literature on monetary policy, the bank funding markets, as well as the banks' financial performance during and outside of crises. Section 3 explains the data I used to conduct the analysis, and outlines the hypotheses and models I devised to explain the effects of changes in banks' funding and lending decisions. Sections 4 through 6 outline the results of the analysis. Section 4 explains some of the univariate results, section 5 contains the mainline regression analysis, and section 6 provides further empirical validation of the mainline results. Section 7 discusses the implications and limitations of the analysis and provides possible framework expansion avenues. Section 8 provides an overall conclusion of the study.

1.1. Institutional Background

This work analyzes the changes in the decisions and subsequent performance of the banks over three distinct monetary policy regimes, so it is important to outline the driving forces behind the period selection.

Throughout the past 40 years, there have been several distinct changes in policy direction, overall transparency, and timeliness of policy decisions. One of the first major changes, documented by Bernanke and Kuttner (2005), was the replacement of conference calls with regularly scheduled meetings in 1994, which was also the year when the FOMC changed the communication frequency, releasing policy statements within a day of the meeting rather than several weeks after the policy events and accompanying meetings with minutes releases. As a result, choosing 1994 as the starting point not only allows me to employ almost all of the available FDIC data in analysis, which dates to 1992, to ensure the replicability of the

results of this study but also makes this analysis consistent with the vast majority of the financial and economic literature since the publishing of Bernanke and Kuttner (2005), such as Ozdagli (2017) and Chava and Hsu (2019).

The next era of monetary policy brought one of the most critical changes in the US monetary policy - the introduction of the Zero Interest Rate Policy (ZIRP) and the subsequent adoption of quantitative easing (QE) as a response to the series of major bank failures and the unraveling of the Global Financial Crisis (GFC) in 2008. This era began with the emergency meeting on January 22, 2008, highlighting the efforts to stabilize the economy with a 75-basis point rate cut to bring the federal funds rate to zero percent, with the quantitative easing gathering pace in November of the same year. The QE efforts from the FOMC have ultimately resulted in the ZIRP implementation until the end of 2015, one year after the official end of the third round of quantitative easing, which I consider an appropriate cutoff point for this era of the monetary policy, as the banks' were no longer faced with the lowest possible cost of financing in the four years that followed. Another notable change during this period was the introduction of new policy communications in April of 2011, when the Chair of the Federal Reserve, Ben Bernanke, held the first-ever press conference immediately after the meeting. Thus, using 2008 as the starting point of the new policy era helps capture innovations in monetary policymaking and is also consistent with the cutoffs used in the stock market reaction literature (Chava and Hsu, 2019).

The final monetary policy regime began with the first post-GFC rate hike in December 2015, the FOMC proceeded with gradual increases in the key policy rate until 2019. Shortly after the reversal of the policy direction, several key events occurred: the repo markets experienced a crisis in September of 2019, and, more famously, the COVID-19 crisis forced the FOMC to initiate a large-scale QE program, which was larger than the first three rounds of quantitative easing altogether. The monetary policy communications have also become more transparent, which is only natural given the increase in the complexity of the policy, with Jerome Powell, the Fed Chair, holding press conferences after each FOMC meeting, as

opposed to every other meeting. Some studies, such as De Pooter (2021) and Gorodnichenko et al. (2023) have found that the informational content, as well as the language used in those press conferences, reveals the FOMC's view of the economy and provides insight into the future policy actions, showing that the additional press conferences have mostly fulfilled their purpose of improving information transparency. One of the main reasons I put pre- and post-COVID subsamples together is due to the overall efficiency of the monetary policy in the post-GFC era. The policy response time has shortened drastically, with the liquidity backstops during the 2023 Banking crisis being established in a much shorter time than they were at the height of the GFC. A similar can be said about the 2019 repo run, with the short-term credit facility being established mere days after the crisis. As a result, this era of monetary policy is distinct in its transparency and timeliness of decisions, as well as the overall complexity of the financial system.

Given the events outlined above, I anticipate significant differences between the banks' lending and financing outcomes before the GFC, during the ZIRP period, and the post-GFC (post-ZIRP) periods, based on the monetary policy expectations and based on the monetary policy tools available to the central bankers.

2. Literature Review

I contribute to the discussion on the banks' adaptability to different monetary policy regimes by focusing on how changes in their financing strategies—specifically the choice of repo and deposit financing— can affect their lending strategies and subsequent performance. A rich array of literature explores market reactions to monetary policy decisions, much of which traces back to the seminal work of Bernanke and Kuttner (2005), which was among the first to examine the stock market's reaction to FOMC announcements. Subsequent studies, including Chava and Hsu (2019), which assesses the impact of the FOMC on firms with varying financial health, Ozdagli (2017), which focuses on firms with differing levels of

information frictions, and Bauer and Swanson (2022), which analyzed how high-frequency changes in market interest rates impact the stock market's reaction to monetary policy surprises, extend the groundwork laid by Bernanke and Kuttner (2005).

Much of the recent economics literature, including Li et al. (2023), utilizes GDP growth and deposit market shares in their analysis of the drivers of banks' reactions to policy decisions. Li et al. (2023) find that the deposit market share plays a critical role in shaping banks' responses to monetary policy. I incorporate these insights into my analysis, confirming that the results are robust to changes in GDP and market share. Additionally, I build on some of the methodologies used in interest rate forecasting literature, such as that in Gürkaynak et al. (2007), by applying them to assess how banks' stock prices react to monetary policy decisions.

The lending risk literature incorporates monetary policy in the discussion of the relationship between bank funding types and lending strategy, focusing on funding costs as the primary driver of banks' financing decisions. One of the foundational works in this area, Deshmukh et al. (1982), modeled the impact of monetary policy on banks' lending incentives, incorporating the funding costs. Their model shows that if liability management increases funding costs, banks are likely to adopt a more conservative lending strategy, showing an indirect link between policy decisions and bank lending. This model has been extended by more recent studies, such as Deans and Stewart (2012), which examines the performance of loans in response to changes in funding costs, and Tran (2020), which analyzes how liquidity determines the banks' lending policies. A central tenet in this body of work is that higher funding costs lead to tighter lending standards, although this relationship has evolved since the Global Financial Crisis (GFC).

The impact of monetary policy on bank lending and deposit-taking behavior has also been a topic of recent research. For instance, Afonso et al. (2022) analyzes how monetary policy surprises, in conjunction with bank regulations, affect balance sheet costs. Other works, such as Yu and Wangner (2023) and Greenwald et al. (2023), explore shifts in credit

allocation and deposit-taking behavior in response to changes in monetary policy. Works such as Drechsler et al. (2017) and Dursun-de Neef et al. (2023) further investigate how these shifts manifest themselves in the deposit market, with changes in deposit withdrawals and competition among banks under different interest rate environments. Overall, a great deal of work has been laid out in the analysis of deposits and deposit franchises, which allows me to employ some of the methodologies and provide additional contrast with the repo funding. As a result, this work shows that repo dependency significantly affects the banks' lending strategy, consistent with the prior findings.

Studies such as Bech et al. (2010) and Arrata et al. (2020) explore how repo markets, a significant source of funding for banks, interact with monetary policy. Both of those works examine the disparity in the reactions of repo and federal funds rates during periods of quantitative easing. My analysis builds upon their frameworks by incorporating deposit funding, allowing me to further examine the spectral relationship between different funding sources and banks' lending strategies. My results also provide insights into the less linear aspects of banks' financing choices, such as incentive mechanisms embedded in repo financing.

The growing importance of repo in bank operations is also noted in much of the recent banking literature. Studies such as Gorton (2010), Gorton and Ordoñez (2014), Martin et al. (2014), and Gorton et al. (2020) highlight the role of collateral and portfolio risk in repo transactions. My findings align with this literature, showing that banks with greater exposure to repo markets tend to maintain stronger balance sheets, including higher levels of tier 1 capital. This suggests that the repo market's dynamics are crucial in understanding banks' financial stability and lending behavior, and I describe that further in the model shown in the Appendix.

In addition to lending activities, the banking literature has also examined other aspects of bank performance, such as asset quality and non-performing assets (Byrne and Kelly, 2019), and profitability in specific banking systems, as seen in Camba-Mendez and Mongelli (2021). While much of this research focuses on asset quality, my study explores how changes

in loan portfolio risk and balance sheet strength could affect bank performance, providing additional insights into the drivers of profitability. My findings contribute to this area by offering further robustness to existing conclusions.

In summary, the literature strongly supports the notion that monetary policy and banks' future performance are closely intertwined. A growing body of evidence also highlights the critical role that banks' financing decisions play in shaping their performance. This study adds to the literature by exploring the channels through which changes in banks' financing strategies, particularly repo and deposit funding, can change their lending decisions and subsequent performance. By doing so, it enhances our understanding of the adaptability of banks across different monetary policy regimes and underscores the importance of financing choices in shaping banks' lending behavior and financial outcomes.

3. Data, Hypotheses, and Methodology

3.1. Data

Most of this work utilizes quarterly bank-level financial data from the Federal Deposit Insurance Corporation (FDIC), from 1994 to 2023. In particular, I use items such as net interest margin, scaled by total assets (nimy), net operating margin, also scaled by total assets (noijy), tier 1 capital ratio (idt1rwajr), level of charged-off non-performing assets (ntlnlsr), the average interest rate received (intincy), deposit level (dep), and repo level (frepo). Using these items, I calculate the banks' dependency on repo and deposits as sources of funding, expressed as the ratio of repo (deposits) to the bank's total assets (asset). The majority of the results presented in the subsequent sections are based on the subsample splits that use delinquency rates and repo dependency to identify the banks that are likely engaging in speculative lending and the banks that are somewhat highly dependent on repurchase agreements to sustain their operations. All of the variables used in the analysis were winsorized according to 3 standard deviations and were then standardized to aid interpretability of the

results.

The condensed bank-level data allows for multiple ways to refine the analysis through various control variables. In each bank-level regression, I control for bank size by taking the natural logarithm of banks' total assets. I also verify that the banks' financial performance is not driven solely by the management by including the efficiency ratio (effr), and is not dependent on either the state the bank is chartered or operating in or the period in which the observations were taken by including state-year-quarter fixed effects.

Additionally, I include the deposit Herfindahl–Hirschman index (HHI) (Li et al., 2023), used by much of the recent literature on bank behavior and financial performance and defined on a state level as:

$$HHI_s = \sum_{i=1}^{N(s)} \left(\frac{\text{Bank } i\text{'s Deposits in a State } s}{\text{Total Deposits in a State } s}\right)^2, \tag{1}$$

where $N(s)$ is the total number of distinct banks or bank holding companies in a given state s.

Another way I control for previously-researched drivers of banks' performance is by including the expected and unexpected components of changes in federal funds (Bernanke and Kuttner, 2005) and long-term rates Gürkaynak et al. (2007). To calculate the said components, I use the federal funds and 10-year Treasury rates futures taken from Bloomberg, for both of which I adapt the Bernanke and Kuttner (2005) monthly surprise formula to quarterly data. I do so by taking the average target federal funds rate for the quarter and subtracting the three-month federal funds futures rate on the last day of the previous quarter $(f^1_{t-1,T})$[4], with the identical process repeated for the 10-year Treasury rate futures, in which

[4]For example, the federal funds surprise in the third quarter (July-September) will be calculated as the average target rate in the third quarter of the year minus the three-month federal funds futures contract on June 30

I replace the target federal funds rate with the actual 10-year Treasury rate:

$$\Delta surprise_t = \frac{1}{T}\sum_{i=1}^{T} target - f^1_{t-1,T}, \tag{2}$$

where T is the number of days in a quarter. The expected component of the change in a given rate is calculated by subtracting (2) from the actual changes in the federal funds and 10-year Treasury rate, which were taken from the St. Louis Fed's Federal Reserve Economic Database (FRED). However, there are several issues with measuring monetary policy surprises for long windows, the main being the timing of substantial rate changes that occur at the beginning or inv the middle of the quarter. To combat this problem, I verify the consistency of the results by replacing the quarterly surprises with average monthly surprises in the given quarter. I find no notable changes in the strength or the significance of the mainline results.

In addition, I conduct a series of robustness checks, including the direct replication of table 2 in the analysis of Bernanke and Kuttner (2005), with an addition of 10-year rate surprises. I proceed to calculate unexpected (surprise) change using the daily change in a particular rate futures and scaling it by the ratio of the total number of days in the month and the number of days in the month affected by the change, following Kuttner (2001) and Bernanke and Kuttner (2005):

$$\Delta surprise_d = \frac{D}{D-d}(f^0_{m,d} - f^0_{m,d-1}), \tag{3}$$

where D is the number of days in a month m, d is the number of the day when an event occurred[5], and $f^0_{m,(d,d-1)}$ is a current month's federal funds futures rate on days d and $d-1$, respectively. I also hand-collect the data on the dates and specifics of the FOMC meetings dating to 1989[6], following the same general process as Bernanke and Kuttner (2005), who

[5]e.g., for an event taking place on June 15, scale factor will be $\frac{30}{30-15}$

[6]I thank Dr. Ken Kuttner of Williams College for assistance in clarifying key timing issues related to employment releases and reversals

identify whether a meeting signified a reversal in monetary policy [7], the direction of the change in policy rate, as well as whether a given meeting was an emergency, such as the rate changes in the early 2008, as well as the FOMC's response to the growing threat of the COVID-19 in early-mid March of 2020. Furthermore, since almost every meeting since 2011 was accompanied with a press conference, for the QE/ZIRP subsample (2008-2014), every meeting with a press conference was identified as such in the sample. I then gather data from the Center for Research in Securities Prices (CRSP) on the monthly returns of the banking firms and aggregate them using an asset-weighting scheme, with the book value of assets for each of the banks being taken from the Compustat database.

3.2. Hypotheses

The ideas I test in this work focus on the effects of bank financing choices on their lending strategy and subsequent performance across different types of monetary policy regimes. These effects include the changes in banks' operating income and net interest margins, the quality of capital expressed in the level of tier 1 capital, as well as their exposure to the monetary policy via the repo markets. I investigate those effects using the following models:

$$NIM_{t+1} = \beta_1 DepSen_{i,t} + \beta_2 RepoSen_{i,t} + Controls_{i,t} \tag{4}$$

$$NOI_{t+1} = \beta_1 DepSen_{i,t} + \beta_2 RepoSen_{i,t} + Controls_{i,t} \tag{5}$$

$$T1C_{t+1} = \beta_1 DepSen_{i,t} + \beta_2 RepoSen_{i,t} + Controls_{i,t}, \tag{6}$$

where NOI_{t+1} represents the net operating income-to-assets ratio, NIM_{t+1} is the net interest margin scaled by the total assets, and $T1C_{t+1}$ is the level of tier 1 capital, all in the next fiscal quarter $t+1$ for a specific bank i. The primary regressors in those models are the banks' deposit and repo sensitivities in the current fiscal quarter. I use the deposit

[7] whether the FOMC has initiated a cut after a series of hikes and vice versa, or switches between contractionary and expansionary monetary policy

sensitivity as an empirical approximation of the banks' propensities to expand their lending base, as opposed to building a stronger balance sheet. Although deposit sensitivity is an imperfect representation, the idea that higher deposit levels correspond to higher lending (Friedman and Schwartz (1963), Stiglitz and Weiss (1981)) and generally less liquid capitalization Kapan and Minoiu (2013) is generally well-documented. The repo dependency, on the other hand, is the empirical proxy for the banks' sensitivity to the monetary policy, as repurchase agreements are heavily used by the FOMC and banks in general. Repo sensitivity thus represents an approximation of the incentive to build a stronger balance sheet to secure lower transaction costs in the repo market. A more precise representation of this incentive would be the repo haircuts faced by the banks, but the access to that data, with the existing resources available publicly, is somewhat constrained. The control variables used in the regressions will include the fed funds and 10-year Treasury rate changes with their expected and surprise components, the bank size, measured in the natural logarithm of total assets, deposit market share, GDP growth, and efficiency ratios. The models will also include year-month-state fixed effects.

It is also important to note that the banks' reactions to the changes in monetary policy regimes will not be identical. I single out the banks with abnormally high delinquency rates of over 5% as the subgroup with a very high propensity to expand their lending base as opposed to tapering it or tightening the standards, and the banks with high dependency on the repo funding as the banks with a high propensity to build a stronger balance sheet and, at the same time, have less of a preference to expand the lending base to minimize current delinquency losses.

I thus propose the following set of hypotheses that explain the banks' adaption to different monetary policy regimes through their choice of lending and financing strategies.

Hypothesis 1. *Banks with risky loan portfolios will see significantly worse financial and operating performance from further increasing their propensity to lend*

$H1 : \beta_{1,HighDelinq} < 0$*, in Models (4) and (5)*

The aftermath of the GFC, among many other things, involved a significant overhaul of the credit analysis (He et al. (2011) and He et al. (2012)) and lending standards (Brei and Schclarek, 2013). I hypothesize that banks that have engaged in speculative lending or have risky loan portfolios, defined as banks with a delinquency rate of over 5%[8], on account of their survival, have either tightened their lending standards, by lending less to riskier borrowers or have started seeing lower marginal lending profits from the further expansion of the lending base. The first idea is much harder to test reliably, although I anticipate that those banks will adopt more repo in their structure as a loan quality control mechanism, benefiting in the long run from having safer loan portfolios through achieving lower repo haircuts. The focal point of $H1$, however, is the idea that the banks with risky loan portfolios tend to see weaker financial performance if they continue expanding their lending base or further loosening their lending standards, which is the opposite of the seminal work from Dell'Ariccia and Marquez (2006), suggesting that looser, not stricter lending standards will lead to a decrease in profits. I anticipate, however, that the framework in Dell'Ariccia and Marquez (2006) will hold for banks with a delinquency rate of less than 5%, showing that the banks with risky loan portfolios are an extreme case.

Hypothesis 2. *Banks that are the most exposed to the changes in monetary policy will be more risk-averse in both their lending and financing activities*

$H2A : \beta_{2,HighRepo} < 0$ *in Model (4)*

$H2B : \beta_{2,HighRepo} > 0$ *in Model (6)*

I equate the exposure to the monetary policy to the repo sensitivity, as banks heavily use the repurchase agreements to obtain financing from other banks and the Federal Reserve (Anbil and Senyuz, 2018).

The idea being tested in $H2$ is that the banks most sensitive to the repo market will be more risk-averse in their lending and capital sourcing due to their dependence on the repo market, in which the quality of the collateral is one of the key drivers of counterparty

[8]twice the average delinquency rate of 2.5% over the 1994-2024 period (excluding GFC)

search (Gorton and Metrick, 2012). As a result, to remain attractive to a potential repo counterparty, those banks will choose to maintain high levels of tier 1 capital ratio and engage in less speculative lending, pronounced in lower average interest rates the more repo-sensitive banks will charge. However, since the degree as to which the lending opportunity can be seen as speculative differs ex-ante, repo-sensitive banks could be walking away from a potentially fruitful investment, and will ultimately see lower profitability due to the lower average interest rate they charge to their borrowers and forgoing the ex-post profitable investments that seemed too risky ex-ante. This idea is somewhat related to Camba-Mendez and Mongelli (2021), who used data from European banks to analyze heterogeneity in loan pricing, whose findings match the idea that banks that are most dependent on financing from other banks tend to offer lower interest rates to their customers. Thus, I anticipate that the banks that are most heavily exposed to the repo market[9] not only will have more tier 1 capital on their balance sheet than non-repo-dependent banks but also will refrain from engaging in speculative lending, even if it means forgoing the promising investments, which will result in a negative relationship between higher repo sensitivity and net interest margins for those banks.

3.3. Methodology

To test these ideas, I start by documenting the number of meetings in Table 1, which follows a format similar to the one in table 1 of Bernanke and Kuttner (2005), reporting the number of meetings in each of the policy regime subsamples, the standard deviation of the federal funds rate surprises and the bank stock returns, as well as the propensity of the FOMC to announce changes to monetary policy during the scheduled meetings. Within the same table, I analyze the differences in the banks' financials with a series of two-sample mean difference tests, focusing on the differences between the low- and high-delinquency (over 5% delinquency rate) banks and the differences between repo-insensitive and repo-sensitive (over

[9]Heavy exposure is defined as having over 15% of repo in the financing structure

15% repo dependency) banks. I additionally use some loan risk approximations, such as the average interest rate the bank charges and the bank's market share in commercial real estate lending, to provide further evidence in favor of repo sensitivity as a potential driver of risk aversion in lending.

I then use the FDIC data previously described and analyze the relationship between changes in banks' repo and deposit sensitivities and next-quarter financial and operating performance, representing the bank's lending decisions, and the banks' tier 1 capital levels, which in turn represents the bank's propensity to prioritize the quality of capital over lending. Those relationships are analyzed through a series of linear regressions with state-year-quarter fixed effects and the controls described in the data section. Each of the regressions is additionally run on a smaller subset of data, restricting the banks based on the delinquency rate and repo dependency levels, along with the subsample splits based on the policy regime. In addition to the mainline models, Moreover, to explain some of the results seen in these models, I devise a theoretical framework in the Appendix.

Aside from forecasting the one-period changes, I analyze the impulse response functions using vector autoregression (VAR) models, a process often used in the monetary policy literature to see the long-run implications of the changes in the policy. Within each VAR model, I ensure that the deposit and repo sensitivity are not analyzed in conjunction with one another to isolate the individual effects of the repo and deposit sensitivities, due to some of the results pointing towards the presence of both complementary and substitute-like properties of the two funding sources. VAR also includes the short- and long-term rate surprises, as well as the size of the banks, represented by the weighted-average natural logarithm of the banks' total assets, as well as the bank management quality, approximated using the aggregate efficiency ratios. These additional covariates help ensure that a roughly similar number of controls is employed within the VAR framework. Expected components of rate changes, as well as market share variables, are excluded to avoid potential collinearity issues with the other covariates.

Lastly, I provide some empirical validation and additional robustness checks. I verify the consistency of results by analyzing the drivers of the banks' repo holdings, to supplement the analysis on the tier 1 capital levels, and also investigate the drivers of the banks' delinquency rates and the average interest rates the banks charge their borrowers, to show that the deposit and repo sensitivities are representative of the banks' propensity to alter the lending strategy. In addition, I analyze the effects of the monetary policy surprises on bank stock returns across the monetary policy regimes, using a subset of publicly traded banks. To achieve that, I employ a series of linear regressions to assess the effects of the various components of changes in the short-term (federal funds) and long-term (10-year Treasury) rates on the value-weighted bank returns within each monetary policy regime on a one-day basis, closely following the empirical strategy of the first 3 tables in the appendix of Bernanke and Kuttner (2005).

4. Sample Overview and Univariate Statistics

Panel A of table 1 shows the overview of the monetary policy events in the four key periods, including the number of events, the standard deviation of the value-weighted bank return during and outside of the event days, the volatility of the monetary policy surprise, and the propensity of the FOMC to announce changes to policy rate in a scheduled meeting. In 2008, several rate changes happened during the emergency meetings (January 22 and October 8), which is the main reason the propensity to announce rate changes during meetings is only 5 out of 7 (71.43%) during the QE/ZIRP period. As for the post-GFC period, the federal funds rate changes were seemingly most effectively priced by the futures markets, even with the extreme policy actions undertaken during the early days of the COVID-19 crisis. The major increases in transparency likely explain this phenomenon, as not only did the FOMC start doing press conferences in 2011, but the frequency of the conferences and the media coverage have both increased tremendously. During the pre-crisis and QE/ZIRP periods, the

volatility of the bank stocks during FOMC events was higher than outside of the events. In contrast, the volatility of the bank return during the FOMC events after the GFC became seemingly lower than outside of FOMC events. One explanation could be that just as the futures markets have become more effective at incorporating changes in the key policy rate, the bank stock prices have started incorporating the changes in monetary policy and the stimulus provided to the financial system. However, analyzing returns in isolation may lead to a sample selection problem due to the scarcity of publicly-listed banking firms. Thus, as interesting as these univariate results are, it is important to analyze the individual financial performance of the banking firms.

Panel B shows the summary statistics for the dependent variables and repo sensitivity of the banks in the sample. The average delinquency rates have seemingly decreased after the crisis, with 50% of the banks having less than 0.01% delinquency post-GFC. The average levels of deposit sensitivity have generally stayed consistent across all subsamples. Net interest margin (NIM) generally has stayed at roughly the same 75-percentage point range over the years, but notably becoming less volatile in the post-GFC period than it was before the crisis. Some very volatile variables include net operating margin (NOI) and tier 1 capital ratio. Still, this seemingly high volatility is likely driven by some of the outliers in the sample, such as tiny county banks with low levels of assets. Tier 1 capital, which is the proxy variable for balance sheet strength, seems to be as volatile after the GFC as they were before, which is a somewhat unexpected univariate result.

4.1. Univariate Subsample Comparison

The results in panel C show the subsample averages and mean difference tests for subsamples of banks split based on repo sensitivity. The average delinquency rate difference is somewhat negligible across all subsamples. At the same time, an interesting trend emerged during the crisis, where the repo-insensitive group has a higher average delinquency rate, which is not seen outside of the crisis. The net interest margin tends to be significantly

higher for the more repo-insensitive group, which is consistent with the theoretical model, as repo-dependent banks could be forgoing the lucrative loans due to the need to maintain high levels of tier 1 capital, to help ensure lower haircuts in the future. This is confirmed by the univariate results on tier 1 capital ratios, with the high-dependency group having 1.7-1.8 times the tier 1 capital ratio of the insensitive group. After the crisis, however, the highly sensitive bank group sees a decline in average tier 1 capital ratios, making this difference considerably smaller, albeit still significant. The difference in the net operating margins and average interest rates charged by the banks also shows that the repo-sensitive group tends to charge significantly lower interest rates to its borrowers, which could imply that this group attempts to pursue less risky loans, at least on an ex-ante basis. Furthermore, repo-sensitive banks tend to have a significantly lower percentage of commercial real estate loans in their portfolios, giving more evidence for the idea that repo-sensitive banks are more risk-averse than the average bank. Such loans are widely regarded as some of the riskier loans the banks make (Igan and Pinheiro (2010), Jiang et al. (2023)), and thus serve as another approximation of the banks' risk profile, similar to the yields. Thus, this dynamic underscores the high levels of risk aversion for the repo-dependent banks. This seeming risk aversion costs those banks on the ex-post basis, as shown by both net interest and operating margin differences. Intriguingly, the repo-sensitive banks have also seemingly adapted their balance sheets to include more deposits in their financing structure, with the average growing from 78.65% before the crisis to an average of 83.50% post-GFC, with no statistically significant difference between repo-dependent and non-dependent banks.

Panel D shows the subsample averages and mean difference tests for two subsamples based on the 5% delinquency rate split. Generally, the high-delinquency (HD) banks have significantly higher net interest margins and charge a higher average interest rate, as one would anticipate from the group of banks that engage in riskier lending. Average tier 1 capital generally seems too volatile to adequately compare, even though the mean difference test reveals an interesting dynamic, where outside of crisis, the banks that seem to be

engaging in speculative lending have higher average tier 1 capital levels, which is somewhat expected due to the need to sustain operations. During the GFC, as anticipated, such banks also seemingly suffered from lower operating income as opposed to their seemingly less risky counterparts, even though that gap seems to have somewhat closed post-GFC. High-delinquency banks also tend to have more repo in their funding mix, which shows some support for the theoretical framework in the Appendix and the results covered later in the analysis. While such banks are seemingly assigning more importance to lending activities, they could be attempting to address their "extreme" status within this framework by taking on more repo and, as a result, seeing improvements in their lending and operating income, as well as the balance sheet strength, which in turn could result in lower repo transaction costs. Very unexpectedly, the high-delinquency subgroup is seemingly less reliant on the deposit financing levels, even though the scale of the difference seems to fade during and after the crisis, further suggesting that the high-delinquency banks may have started adjusting their financing behavior to ensure they have a diversified financing structure, incorporating both more deposits and repo in their financing structure. In conjunction with the results in panel C, one may infer that the substitute-like relationship between deposit and repo financing has evolved to make the two financing types more complimentary to one another. Another explanation for this behavior of banks with risky loan portfolios is that they are attempting to exit the subgroup, which is supported by the analysis of the banks' net interest margins and some of the empirical validation later in the analysis. Lastly, the percentage of commercial real estate (CRE) loan market share for the high-delinquency banks is consistently and significantly higher than that for the low-delinquency banks, underscoring the risk appetite of those banks.

Naturally, while the univariate results seem intriguing, it is imperative to conduct a more sophisticated analysis to determine how the banks' lending and financing choices transform their short- and long-run performance and balance sheet health, which will be discussed in detail in the following sections.

5. Effect of the Monetary Policy on Bank-level Performance

This section is dedicated to testing the hypotheses concerning the repo-dependent banks and banks engaging in risky lending, outlined in section 3.2. The analysis employed in this section primarily utilizes linear regressions of the next-quarter levels of net interest and operating margins and banks' tier 1 capital ratios. I also use vector autoregressions (VAR) to understand the long-run implications of shifts in banks' financing choices. The rationale for some of the results in this section is also derived and discussed in the theoretical model in the Appendix.

5.1. Bank-level Financial Performance

First, I test the changes in net interest margins to understand the relationship between propensities to lend or build stronger balance sheets and the success of the banks' loan portfolios.

Table 2 shows the results of regressions of the standardized net interest margin on the banks' repo and deposit sensitivities, split by the percentage of delinquent loans relative to total assets held by the bank (panel B) and the banks' repo dependency (panel A).

Panel A of table 2 shows similar results as Panel A based on the repo dependency splits. For the banks with over 15% repo sensitivity (RS), taking on more repo in the structure generally seems to hurt the net interest margins in the following quarter, with the effect being consistently negative across the board. For such banks taking on more deposits in their financing structure, however, would seemingly translate to better loan performance, as for a 1-standard deviation (10.54%) increase in the deposit sensitivity, the repo-dependent banks would see an average of a 0.1 standard deviations (0.1%) increase in their net interest margins. Increasing the risk tolerance for such banks would also spell higher average net interest margin for repo-sensitive banks. After the crisis, this effect (5-basis point average

increase in net interest margins for a 70-basis point increase in delinquency rate) is about one-third of what it was before the crisis (15-basis point average increase for a 70-basis point increase in delinquency rate). This suggests that with the increasing adoption of repo financing among the banks globally (Morais et al., 2019), those more dependent on repo are seeing fewer incentives to take on more risk, likely due to the repercussions in collateral pricing, which is supported by findings in Bech et al. (2010) and Arrata et al. (2020). The effects of higher deposit sensitivity for the repo-insensitive subsample (RI) are also positive, being roughly of the same magnitude as the RS group before the crisis, and half of the effect seen in the repo-sensitive banks during and after the crisis. The relationship between repo sensitivity and net interest margins is equally intriguing in this subsample, with the repo-insensitive banks seeing an average of 0.78% increase in their net interest margins for a 6% increase in the repo sensitivity before the crisis, all else held constant, with the effect almost fully disappearing during and after the crisis. This implies that the shifts in the monetary policy and the repo market turmoil during the crisis (Gorton, 2010) have reduced the incentive for the repo-insensitive banks to increase their exposure to the repo markets, which may explain why in the univariate statistics, repo sensitivity among all banks has consistently declined over the years. Finally, the effect of the higher delinquency rates on net interest margins for repo-insensitive banks is far stronger than for their repo-dependent counterparts. Before the crisis, the repo-insensitive banks saw a 17-basis point increase (almost 2x the RS group) for a 70-basis point increase in delinquency rates, and over 6x of the effect seen in the repo-sensitive group after the crisis, with the effect during GFC being roughly the same across the two groups, holding other variables constant. This shows that for the banks not dependent on repo, there are noticeable incentives to take on additional risk if they are seeking to improve their average loan performance, which is somewhat expected. This relationship is also cyclical, given that it is the weakest during the crisis period.

Panel B of table 2 shows that for the banks with over 5% in delinquency rate (HD), the higher propensity to increase the loan base by 10.54% results in the average decline of 0.11

standard deviations (0.11%) before, 0.42 (0.42%) during, and 0.24 (0.24%) after the crisis, all else held constant. The relationship between the net interest margin and repo sensitivity, before and during the crisis, mimics the one described above. After the crisis, however, this relationship shifted in a strongly positive direction, with a 1-standard deviation (6%) increase in repo sensitivity corresponding to an average of a half-standard-deviation increase in the bank's net interest margin. Finally, for the high-delinquency banks, the higher delinquency rate, outside of crisis, tends to correspond to a higher net interest margin, likely driven by the higher average interest rates charged by those banks. For the banks with less than a 5% delinquency rate (LD), the relationship between net interest margins and deposit sensitivity is consistent with the previous works of literature, with an average increase of net interest margin by roughly 1% for a 10.5% increase in deposit sensitivity before and during the crisis, falling to 0.6% after the crisis. The effect of repo sensitivity is negative, but economically insignificant, with an average decline in net interest margins close to 0 before, 0.6% during, and 0.5 after the crisis for a 6% increase in repo sensitivity in the previous quarter, keeping other covariates constant. The positive effect of delinquency rates on net interest margins for this subsample is far stronger than it is for the high-delinquency subsample, suggesting that risk-taking among these banks could be a net positive, at least for the overall loan performance.

There are several interesting dynamics in these results. First, the loan portfolios of the banks with high exposure to repo markets tend to benefit from having more deposit financing, while increasing their repo exposure tends to do the opposite. A very likely explanation is that these banks, to continue facing lower haircuts, pay more attention to building a stronger balance sheet by increasing their capital adequacy ratios and ensuring they impose stricter lending standards. This behavior can lead those banks to "leave money on the table" by rejecting the ex-post high-quality borrowers due to their perceived (or modeled) ex-ante risk, consistent with Hypothesis 2. This assertion is also supported by the theoretical framework in the Appendix, where repo-sensitive banks tend to ascribe more importance to reducing

the reputation cost within the utility maximization problem.

Secondly, it seems that in the post-GFC setting, the banks with abnormally high delinquency rates tend to see performance improvements from increased dependency on repo funding, with the reason lying in the utility maximization problem outlined in the Appendix. The utility obtained from the improvements in the first term of the utility maximization problem shown in the Appendix model ($\alpha\pi_L$), through better collections or higher interest rates, outpaces the utility lost with the growth in the second term of the problem ($(1-\alpha)C_R$), especially given that for these banks, α is higher. In other words, repo dependency, due to the high reputation costs faced by these banks, enables them to improve their net interest margins. This ties into the idea that for these banks, higher repo exposure can serve as a monitoring mechanism that rewards the reduction of the overall risk of their balance sheets with favorable collateral pricing in the future.

However, the shifts in the banks' financial performance cannot be fully captured within a 1-period framework, as the bank's financials may exhibit a lagged response to the change in its propensity to make more loans or build a stronger balance sheet.

Figure 1 shows impulse response function (IRF) plots based on a six-variable VAR that includes the net interest margin, banks' repo and deposit sensitivities, size and efficiency ratios, as well as the long and short-term rate surprises, following Bernanke and Kuttner (2005). I include most of the covariates used in the previous model, except for the expected components of rate changes and the market share-related variables, and ensure that within each model, the deposit and repo sensitivities are analyzed separately. Additionally, I aggregate the covariates for each of the subsamples of interest using asset weighting, which could result in some interesting deviations from the results seen in table 2.

Panel A shows the IRF plots for the repo-sensitive (RS) group, depicting the response of the standardized net interest margins to an increase in repo sensitivity. Before the crisis, the banks' net interest margins showed little change in response to changes in repo dependency, while during the GFC, higher repo sensitivity for already repo-dependent banks generally

corresponded to significantly and persistently lower net interest margins, which could be likely caused by the repo runs (Gorton (2010), Gorton and Metrick (2012)), especially at the early stages of GFC/ZIRP period.

Panel B of figure 1 confirms some of the analysis within the high-delinquency (HD) subsample seen in table 2 and offers an interesting insight into the dynamics of those banks' net interest margins. During the GFC, the banks' net interest margin tends to improve significantly after two quarters since the bank increased its repo sensitivity. That performance improvement, however, slows down in the quarters that follow. During the post-GFC period, the HD banks have seen consistently higher net interest margins for up to two years after the increase in their repo sensitivity, a relationship almost inverse of that seen before the crisis.

Figure 2 shows the IRF graphs based on the changes in net interest margins in response to changes in deposit sensitivity for the repo-sensitive banks, providing further insight into the changes in those banks' performance. The higher deposit sensitivity tends to consistently benefit the repo-dependent banks in the long run, especially before and during the crisis. After the crisis, the increase in the banks' net interest margins in response to an increase in deposit sensitivity is relatively short-lived. These positive long-run changes in deposit sensitivity are generally consistent with the expectations outlined earlier in the discussion.

The effect of increasing deposit sensitivity tends to change with the monetary policy regime for the high-delinquency subgroup, as seen on panel B of figure **??**. Before the GFC, the high-delinquency banks' loan performance seemingly suffered after they increased their deposit sensitivity, with the opposite situation during the GFC, and seemingly no long-run changes in net interest margins in the post-crisis period. These shifts are likely caused by the GFC and the subsequent policy response and the general expansion of the monetary policy toolkit. Those banks likely benefitted from the asset buyback programs that the policy response entailed, having a direct line to the Fed to sell distressed securities.

In summary, the analysis of the changes in banks' financial performance through the lens

of changes in net interest margins shows some interesting trends. The more repo-sensitive the banks become, the more they alter their loan portfolios to minimize the risk of their balance sheets (or reputation cost, as modeled in the Appendix), likely to ensure lower repo haircuts. Those banks tend to see improvements in their financial performance once they incorporate more deposits in their funding mix. At the same time, the banks that engage in speculative lending are seeking to improve their future loan performance and financial health, using repo markets as a monitoring mechanism that encourages stricter lending practices. The results also imply that in the post-crisis world, repo and deposit financing are complementary to one another within the banks' financing structure, highlighting the growing complexity of the banks' financing choices. The VAR analysis also reveals some interesting long-run dynamics, such as the persistent benefits from increasing the deposit sensitivity for the repo-dependent banks, albeit weaker in the post-GFC period than previously. Another interesting result shown in IRF plots is the seeming shift in the effects of increasing repo sensitivity on the performance of the high-delinquency banks.

5.2. Bank-level Operating Performance

Naturally, the analysis of the financial performance in isolation may leave some unanswered questions, such as the ability of the banks engaging in speculative lending to stay in business or whether repo dependence corresponds to overall better management decisions despite the previously seen declines in net interest margins, given that the banks need to stay solvent to prevent a run or a crisis (Diamond and Dybvig, 1983). Thus, it is important to see how different banks are managed through the lens of the net operating income of those banks.

Table 3 reports the results of regressions of next-quarter standardized net operating margins on the standardized repo and deposit sensitivities, delinquency rates, and the control variables. Within the world of repo-sensitive (RS) banks, panel A shows that on average, increasing their funding levels in any way seems to correlate to lower net operating income, especially during the financial crisis, with a 1-standard deviation increase in both deposit

and repo sensitivity corresponding to a combined average effect of a 3.6% decline in the net operating margin in the next quarter. The overall situation is somewhat more interesting after the crisis. Firstly, the repo-sensitive banks' net operating income tends to be, on average, unchanged by an increase in the repo sensitivity. Even more intriguingly, taking on additional risk tends to improve their operating performance. This underscores the robustness of the predictions made in Hypothesis 2 and in the theoretical model, showing that repo-dependent banks are highly risk-averse due to their need to receive lower haircuts. On the other hand, if those banks take on some riskier loans, thereby increasing their delinquency rate, their operating performance seems to improve, all else constant. However, the effect of increased risk of the loan portfolio is likely two-sided. Even though a 1-standard deviation (6%) increase in the delinquency rate corresponds to an average increase in the net operating margin by 48 basis points, these banks will likely face repercussions in the repo market in the longer run via higher haircuts, thus making the additional risk-taking in lending sub-optimal within the theoretical framework in the Appendix and according to Hypothesis 2. However, there is no reliable way to test this without the appropriate data, so this idea can only exist as an implication of the results, albeit a strong one and consistent with the literature (Deans and Stewart (2012), Tran (2020)). Within the repo-insensitive (RI) subsample, higher levels of deposit sensitivity generally correspond to lower net operating margins, with the effect growing stronger after the crisis, with a 1-standard deviation increase in deposit sensitivity translating to a 1.3-standard deviation (1.4%) decline in the net operating margin. The delinquency rate seemingly has no major effect on the net operating margins for those banks. Quite unexpectedly, a 6% increase in repo sensitivity translates to a 7-basis point decline in net operating margins in the following quarter for the RI group. The loss of the positive relationship between the repo dependency and the net operating margins provides some more evidence that deposit and repo financing have become more complementary to one another, with their effects on the net operating income becoming more aligned in the post-crisis monetary policy era.

As anticipated by the discussion of the results in table 2, the higher deposit sensitivity (or propensity to prefer lending over building a stronger balance sheet) among the high-delinquency (HD) banks translates to a decline in the net operating income, with this effect growing nearly 13.5 times [10] between the pre- and post-crisis periods. This dynamic provides significant evidence in favor of Hypothesis 1, as the risky banks that are continuing to take on more borrowers, as opposed to strengthening their balance sheet and imposing stricter lending standards, end up with lower overall income, hinting at potential mismanagement. This is further strengthened by the relationship between repo sensitivity and net operating income for those banks. On average, before the crisis, the banks with abnormally high delinquency rates tended to see higher average operating income the more repo-sensitive they became, with an average increase of 0.45 standard deviations (or 0.45-percentage points) in the bank's net operating income should the high-delinquency bank increase its repo sensitivity by 1 standard deviation (6%). After the crisis, this magnitude has grown to 7 times the pre-crisis effect, with the 1-standard deviation (6%) increase in repo sensitivity corresponding to an average increase in the net operating income of almost 3.5%. While this spike could be attributed to the considerably smaller post-GFC sample, it strengthens the assertions made by both the theoretical model and the discussion of the results of the previous table, in which I suggest that the high-delinquency banks could be increasing their exposure to repo markets to reduce the overall risk of their balance sheets using the monitoring function of the haircuts, actively seeking to move themselves out of the high-delinquency category. This also could explain such a drastic decline in the sample size, especially in conjunction with prior evidence on the effect of the GFC on the banks' risk attitudes (Brei and Schclarek, 2013). Finally, as anticipated, the higher delinquency rate corresponds to overall lower operating income, providing further validation for Hypothesis 1, as the banks with riskier loan portfolios that fail to take the delinquency rates under control will suffer from lower operating margins, especially during and after the crisis. The results within the low-delinquency (LD)

[10] An average decline of 38 basis points before the crisis versus an average decline of 5.18% for 1-standard deviation, or 10.5% increase in deposit sensitivity

subsample mimic closely those among the banks of the repo-insensitive (RI) subsample, with the only notable difference being the statistically insignificant negative relationship between the higher repo sensitivity and net operating margin post-GFC, which is significant for the RI subsample.

As for the long-run trends, figure 3 shows the graphs of the net operating margins' response to the increases in the banks' repo sensitivity. For the repo-sensitive subgroup, the results somewhat mimic the findings in figure 1, with the persistently lower profitability following a further increase in repo sensitivity during the crisis, and a short-lived increase in profitability during the post-crisis period. For the high-delinquency subsample, during and after the crisis, higher repo sensitivity spells better overall profitability, as anticipated. However, during the crisis, this effect is more short-lived and, half a year after the change, results in a decline in profitability. 4 shows the results concerning changes in deposit sensitivity, with the only noteworthy differences being the shift in the net operating margins for repo-sensitive banks during the GFC period, with a significant, but short-lived decline in overall profitability following an increase in the banks' deposit sensitivity. This dynamic is likely attributable to the early GFC period of heightened uncertainty in lending and the overall turmoil in the banking system. Another noteworthy difference is the post-GFC long-run performance of the high-delinquency subsample, with those banks suffering a strong, but short-lived decline in the net operating margins following an increase in propensity to increase their lending base, which provides further support to Hypothesis 1.

Overall, the results in table 3 help strengthen some of the assertions made in the discussion of the net interest margin results, with some more support for the idea that the increased repo dependency may serve as a monitoring mechanism for the riskier banks, especially after the crisis. In addition, the negative relationship between deposit sensitivity and operating margins, in conjunction with some of the findings in the VAR analysis, gives more strength to Hypothesis 1, showing that risky banks have been altering their financing behav-

ior to include repo[11], and suffering significant losses if they are not rethinking their lending standards. Another interesting dynamic is that if the bank is highly dependent on repo, there is seemingly no benefit to funding diversification, as those banks' operating margins tend to decline in response to an increase in deposit sensitivity. This is likely explained by the combination of higher interest expenses and deposit servicing costs. Furthermore, more support for Hypothesis 2 and the theoretical model in the Appendix is shown in the results for the repo sensitivity among the repo-dependent banks, as, on average, further increasing the repo sensitivity translates to lower interest and operating margins for those banks, which is also supplemented by the benefit of risk-taking, shown by the positive coefficient on the delinquency rate.

5.3. Bank-level Financing Choice

Finally, I investigate the relationship between repo and deposit sensitivities, along with delinquency rate, on the level of tier 1 capital. I seek to provide evidence for the claims made throughout the previous parts of this section on the banks' propensity to prioritize capital quality and strong balance sheets, as well as provide more support for Hypotheses 2.

Table 4 shows the results for the regressions of the next-quarter standardized tier 1 capital ratios on the standardized repo, deposit sensitivities, and delinquency rates. Panel A of the table provides some strong evidence for Hypothesis 2, with the repo-sensitive (RS) banks increasing their tier 1 capital levels the more repo-sensitive they become. This provides further support for the idea that the risk aversion of repo-dependent banks is being driven by the desire to maintain low haircuts and good standing in the markets, entertained throughout most of this work. These results also proved evidence for the idea that the deposit sensitivity represents the banks' choice to expand the loan portfolio, as opposed to building a stronger balance sheet, with a significantly negative relationship between the RS banks' deposit sensitivity and tier 1 capital ratios, which also holds for the repo-insensitive (RI) portion of the

[11] which in turn allows for a reward system for improving the loan portfolios and helps improve interest and operating margins

sample. An interesting development after the GFC also shows that the higher delinquency rate corresponds to higher levels of tier 1 capital, supporting the idea that an increase in risk appetite will be beneficial to repo-dependent banks. Another explanation could be that those banks wish to engage in more lending or take on additional risk and maintain the haircuts they are currently paying at the same time, which also connects to the discussion of table 3. In other words, RS banks are compensating for the current level of delinquencies by building a stronger balance sheet, ensuring the haircuts they pay in the repo market do not increase to the level where their marginal utility is positive from increasing the balance sheet risk. The only unusual development when it comes to the repo-insensitive (RI) sample is the negative relationship between repo sensitivity and tier 1 capital in the post-crisis period, which could be associated with the seemingly more complex interplay of repo and deposits in the bank financing mix and ultimate lending goals, discussed previously.

There are some interesting differences between the delinquency-split samples. The high-delinquency (HD) subgroup sees some notable changes in the relationship between tier 1 capital and the funding sensitivities after the crisis, with tier 1 capital seemingly not reacting to any changes in the banks' deposit sensitivity. Unexpectedly, those banks see a weak decline in their tier 1 capital ratios (significant only at 10% level) following an increase in their repo sensitivity, with a 6% increase in the repo dependency corresponding to an average decline of 0.155 of a standard deviation (or 2.2%) in tier 1 capital ratios, all else held constant. Finally, during the GFC, the banks with risky loan portfolios tended to have more tier 1 capital the higher their delinquency rate was [12]. Those banks were likely attempting to sell the distressed securities to the central bank, sourcing Treasuries and other high-quality capital, thus being the key beneficiaries of the quantitative easing program, which was the cornerstone policy tool during those 7 years. The low-delinquency (LD) subgroup, saw no difference in the effects of either variable, with a strongly negative relationship between the tier 1 capital ratios and deposit sensitivity and delinquency rates, along with a positive effect

[12] 1% average increase in tier 1 capital ratio for a 70-basis point increase in the banks' delinquency rate

of higher repo sensitivity on the average tier 1 capital ratio, consistent with expectations.

The impulse response analysis is shown in figures 5 and 6. Some interesting mismatches between table 4 and long-run changes arise from these plots. For the repo-sensitive banks, the post-GFC long-run dynamics are consistent with the table. During the GFC era, the repo-dependent banks' tier 1 capital seemed to decrease initially in response to a further increase in repo dependency but continuously improved in the years since that adjustment was made. Panel B shows that the increase in repo sensitivity strongly corresponds to lower tier 1 capital ratios among high-delinquency banks, at least initially. One explanation for that could be the pre-existing balance sheet risk, which forces these banks to present the dealer banks with better collateral to avoid high haircuts. The long-run reversion of this effect to 0 also supports that idea, as the HD banks will keep on improving their balance sheet strength in the subsequent periods, and as a result, normalize their levels of tier 1 capital in the long run. Figure 6 shows that for repo-dependent banks, the effect of an increase in deposit sensitivity on the tier 1 capital ratio during the crisis is similar to that on the net interest and operating margins, with a significant and prolonged decline in the tier 1 capital ratio in the long run. After the crisis, interestingly, the repo-sensitive banks tend to benefit from the higher levels of diversification in the financing mix. This once again shows the promise of the idea that deposit and repo financing are becoming complementary to one another and are bolstering the banks' overall performance and financial health. Panel B of figure **??** shows that outside of the crisis, an increase in deposit sensitivity results in a lower tier 1 capital ratio for the high-delinquency banks in the short run. Once again, the GFC-period performance could be attributed to the asset buyback programs, where the HD banks sell distressed assets and improve their overall capital adequacy.

Overall, the results show additional support for Hypothesis 2, showing that the repo-sensitive banks are continuously strengthening their balance sheets, likely to maintain good standing in the repo market and ensure lower transaction costs. The IRF analysis also shows several interesting trends, with an increase in repo sensitivity potentially hurting the high-

delinquency banks' balance sheets in the short run, likely due to the collateral requirements forcing those riskier banks to present dealers with more high-quality collateral, drawing from their tier 1 capital.

5.4. Summary

Given the findings discussed in the rest of this section, the empirical analysis, one of the critical takeaways is the shift in the bank behavior after the GFC, especially repo-sensitive and high-delinquency banks. A key similarity in those banks' responses to the crisis involves the benefit of diversification of the funding sources for both, resulting in changes in incentives. The high-delinquency banks are benefiting from the expansion of their repo reserves, potentially through the incentives mechanism of lower haircuts they face. At the same time, the repo-sensitive banks are seeing higher lending profits and overall better operations management from increasing the risk of their balance sheets, even though for those banks, this may result in repercussions from the repo market dealers. The IRF analysis also offers some different perspectives on the effects of changes in deposit and repo sensitivities on the long-run performance and balance sheet strength, showing that short-run changes may translate into different long-run trends in tier 1 capital ratios, net interest and operating margins.

6. Empirical Validation

This section offers a separate look at the banks' ex-post lending outcomes to supplement findings on net interest margins and contains an analysis of the key drivers of the repo and deposit sensitivities, in addition to the modification of the Bernanke and Kuttner (2005) table 2. While Bernanke and Kuttner (2005) investigate the effect of the federal funds rate surprises on the broader market returns, I focus this section of the analysis on the subset of the publicly traded banks. To further expand that framework, I add the 10-year rate

surprises.

6.1. The Drivers of Lending Decisions

I start with testing whether the bank's financing mix and monetary policy regimes affect the bank's lending practices through the lenses of changes in next-quarter delinquency rates and interest rates. Panel A of table 5 reports the regression of the 1-standard deviation changes in banks' delinquency rates on 1-standard deviation changes in repo and deposit sensitivities. The higher deposit sensitivity corresponds to a negligible increase in delinquency rates during the crisis. This positive relationship becomes negative after the crisis, with the 1-standard deviation increase in the deposit sensitivity corresponding to, all else constant, an average decrease of 2 percentage points post-crisis, with the same magnitude during the crisis. On average, the more repo-sensitive banks have a significantly higher percentage of non-performing loans. The economic significance of this relationship, however, is debatable, as the 1-standard deviation (6%) increase in repo sensitivity translates to a 0.02-standard deviation (or a 1.5-basis point) increase in the delinquency rate at the before and after the GFC, with a negligible effect during the crisis.

Some more peculiar results can be seen in panel B of the table. On average, more repo-sensitive banks tend to charge significantly lower average yields, as anticipated from the results on the interest income, and as predicted by the model. As banking theory predicts (Ho and Saunders, 1981), the higher delinquency rate, commonly associated with speculative lending, corresponds to a considerably higher average yield charged by the bank. The deposit sensitivity results show a puzzling dynamic, in which before the GFC, the higher deposit sensitivity, and as a result the propensity to expand the lending base as opposed to strengthen the balance sheet, translates to an overall riskier loan portfolio with correspondingly higher average loan rates. This relationship dynamic directly contradicts the findings of the works of theory, which predict that the higher levels of deposits would, either directly (Stiglitz and Weiss, 1981) or on a second-order level (Diamond and Dybvig, 1983), translate to lower

lending rates due to the bank's financial stability (Tobin (1963) and Friedman and Schwartz (1963)) and lending relationships with the depositors (Berlin and Mester, 2015). In contrast, post-GFC, there is a statistically and economically significant negative relationship between the percentage of funding from deposits and the interest rate charged by the banks, with the 1-standard deviation (10.5%) increase in the deposit sensitivity corresponding to a 0.03-standard deviation (18-basis point) decrease in the lending rates. A potential explanation for this relationship could be hinted at by Hypothesis 1 and somewhat pronounced in the analysis in the previous section. Despite the lack of subsample splits in this regression analysis, this shift could be attributed to the high-delinquency group, which after the GFC, is seemingly changing its behavior to adapt to the new monetary policy landscape, choosing to take on and as a result, offload risk off their balance sheet. In turn, their average yields become lower as they forgo riskier loans, which works in conjunction with the complementary relationship the deposit and repo funding seem to attain post-GFC.

These findings warrant further analyses involving splitting the banks into groups that have an abnormal delinquency rate (defined as twice the average 30-year rate of 2.5%, or 5%), and a more or less regular delinquency rate (which is all other banks)l along with the groups based on their repo sensitivity, with the cutoff rate of 15%, as these preliminary results on lending decisions and some of the univariate results in table 1 show that the lending and financing behavior of the banks is likely to differ.

6.2. Reaction of Bank Stock Prices to Changes in Target Rate

Table 8 reports the results of the regressions of the bank returns on the actual, expected, and surprise components of both short-term and long-term rates. Columns (1) and (2) of the table show the results for the full sample analysis, which suggest that on average, the monetary policy surprises generally have no major effect on bank returns. The higher long-term rate changes, however, tend to correspond to lower bank returns, with an average decline of 22 basis points for a 1% increase in the unexpected component of the 10-year rate

change. However, these dynamics are likely driven by the QE/ZIRP (columns (4) and (5)) subsample, with seemingly no notable effect of long-term rate surprises on the banks' returns outside of crisis. The monetary policy surprises are also seemingly not priced into the banks' stocks after the crisis, with an average of 20-basis point decline following the 1% increase in the federal funds rate surprise, which is likely associated with the COVID-19 and Regional Banking crises.

Overall, table 8 shows that generally, unlike the broader stock market reaction to the FOMC events documented by Bernanke and Kuttner (2005),Ozdagli (2017), and Chava and Hsu (2019), the banks tend to react less to the unexpected changes in the rate surprises, outside of crises, regardless of whether it is the market-determined rate or the rate directly affected by the monetary policy decisions.

However, the overall performance of the banking system cannot be adequately captured by the stock prices alone, so it may be hard to estimate the system-wide effects of the monetary policy and market rate shocks reliably. Nonetheless, the results described above provide valuable insight into the market participants' reaction to such shocks and could be advanced further by analyzing longer horizons, mimicking tables 8 and 9 of Bernanke and Kuttner (2005).

6.3. Drivers of the bank's Lending and Financing Preferences

Given that the majority of this study revolves around the banks' choices between engaging in more lending or spending time building a stronger balance sheet, it is important to analyze what could affect those decisions.

Table 6 shows the results for the repo sensitivity, which within the context of this study, is the banks' propensity to prefer building a stronger balance sheet as opposed to increasing their borrower base. Naturally, the future repo sensitivity is highly correlated with its past levels, even though this correlation is not perfect, with some additional effect coming from the deposit sensitivity. The relationship with other variables, however, is not econom-

ically significant. Panel B shows the results without the last-quarter repo sensitivity, and shows that while there is a statistically significant relationship between repo sensitivity and other covariates, that relationship is not economically significant, albeit the findings show some interesting patterns, such as the worse-managed banks having higher repo sensitivity in the future, as evidence by the positive coefficient on the efficiency ratio, which is also supplemented by the findings on the delinquency rate, suggesting that the banks that are not making prudent lending and general management decisions, could be looking to improve the general financial health of the bank by engaging in more repo transactions, which forces the banks to maintain high levels of top-notch financing and reduce the balance sheet risk. Another way to explain these relationships lies within the theoretical framework - the dependency on repo forces banks to forgo the potentially lucrative lending opportunities due to high perceived ex-ante default probability, making the banks seem mismanaged. And due to the seeming stickiness of the repo funding shown in panel A, the banks continue to forgo the riskier loans, receive the lower average yield, and make less money than their less repo-dependent counterparts.

Table 7 shows the analogous analysis for the deposit sensitivity, or the banks' propensity to prioritize lending activities and increase the borrower base as opposed to building a stronger balance sheet. There is an even stronger correlation between the future and current levels of deposit sensitivity, which is not unexpected since the significant deposit outflows generally happen in runs (Drechsler et al., 2024) and in the absence of payment frictions, the deposit franchise does not lose its value (Lu et al., 2024), so it is only natural that a higher level of total deposits in the current quarter is likely to continue increasing. In the absence of the deposit sensitivity, the results show somewhat stronger relationships between the future deposit sensitivity and the other covariates. Before and during the crisis, the better-managed banks tended to have a higher deposit sensitivity in the next quarter, suggesting that the more prudent bank managers are prioritizing the value of the deposit franchise, which is not unexpected. Interestingly, that relationship disappears post-GFC, which could hint at

the effects of the new monetary policy regime. The relationship between delinquencies and deposit sensitivity is also somewhat interesting, as outside of the crisis, the banks with the delinquency rate have a lower propensity to expand their lending activities in the next quarter. Finally, in the post-GFC world, the banks are seemingly more likely to have a diversified financing portfolio, as evidenced by the positive causal relationship between repo and deposit sensitivities, which calls back to the findings in table 6.

In general, the banks tend to sustain or increase their levels of repo and deposits in their funding structure. Since the crisis, the two financing sources have seemingly become complementary, rather than acting as substitutes for one another. Another interesting post-crisis dynamic is the lack of any significant relationships between the bank's current management performance and the changes in lending and financing preferences, which could be driven by the changes in the monetary policy landscape. Overall, the findings are generally consistent with and offer more validation to both the results seen in the previous section of the analysis and the theoretical framework.

7. Discussion

When one considers the balance sheets of individual bank holding companies, the analysis of changes in the banks' financing structures through their choice of deposit and repo financing could affect their financial performance and balance sheet strength across different monetary policy regimes. These effects also allow one to hypothesize about the drivers of such behavior. For example, there are evident benefits of higher deposit sensitivity, or propensity to expand the lending base, for repo-sensitive banks. A likely explanation is that repo-dependent banks are highly risk averse[13] and generally prefer building stronger balance sheets to face lower haircuts in the repo market, so increasing their risk tolerance helps those banks increase their net interest margins. The side effect, however, is that those banks will

[13]As shown by the analysis of CRE loan market share and interest rates the repo-sensitive banks charge their borrowers

likely see lower operating margins and will see a decline in tier 1 capital ratios, as they may start lending to lower-quality borrowers. This, in turn, will almost inevitably increase the transaction costs they are faced with in the repo markets. In addition, banks with high repo sensitivity also saw the worst long-run performance during the GFC/ZIRP period, which is likely attributed to the runs on repo and general turmoil documented by Gorton (2010) and Gorton and Metrick (2012). Conversely, higher repo sensitivity tends to be beneficial to riskier banks, as the haircuts charged by dealer banks promote a market-based monitoring mechanism for such banks, in which those banks will be rewarded for improving their financial strength and altering their lending base. On the other hand, the higher repo dependency for banks with riskier loan portfolios also spells a short-term decline in the balance sheet strength, due to the need for those banks to present more high-quality collateral in repo transactions during the several periods following the increase in repo dependency. These banks also tend to benefit the most during the crisis, as evidenced by the impulse response analyses, likely due to the opportunity to sell distressed assets to the FOMC.

The banks' financial and operating performance analyses also show that on average, the higher levels of repo sensitivity, while seemingly negatively affecting the banks' interest income through decreased lending profits, could generally result in better capital, and overall stronger operating performance. The latter becomes less prominent after the crisis, which is directly implied by Hypothesis 1 outlined earlier in this work and is supported by the theoretical framework.

All in all, there are several different implications for the banks in this analysis. First, for banks highly dependent on repo, increasing their risk tolerance may be positive for the overall financial performance, but may prove detrimental in the repo markets due to the erosion of balance sheet strength. At the same time, riskier banks can increase their repo sensitivity to help motivate safer lending habits but will suffer in the short run due to their preexisting risk level. Finally, the performance of those types of banks tends to vastly differ during times of crisis, with one likely benefiting from buyback programs, while the other

suffering from the runs in funding markets.

This analysis, however, has obvious limitations, such as the lack of loan-level analysis, which would be instrumental to understanding the broader societal implications of the banks' choices of utilizing deposit and wholesale funding. Additionally, while I account for the long-run effects of changes in banks' deposit and repo funding levels, the explanations I provide in the results section are not robust to the banks' dynamic preferences, as the banks may revert their lending base expansion decisions to strengthening their balance sheet, especially during the crisis periods. Furthermore, while the effect of deposit costs is already incorporated into the net interest margins, this analysis does not extrapolate whether the possible effects of the banks' preference changes are a potential result of changing deposit rates or that of an event in the repo market, such as the 2019 repo run. There are also numerous ways to expand this framework. With the loan-level data, one would be able to infer the societal implications of changes in banks' repo and deposit sensitivities, such as the community-level effects, or directly quantify the effects those changes have on riskier borrowers, which was discussed throughout this work. Furthermore, one can build a robust natural experiment framework using the changes in state or local regulations and their effects on the banks' financing choices. Finally, one can use the framework in this analysis and extend it to non-bank lending.

7.1. Model Extensions

The theoretical framework outlined in the Appendix has been instrumental in explaining the trends seen in the bank-level analysis and the majority of the predictions made in the discussion of results tie into the framework. It also correctly predicts the outcomes seen in the analysis of the repo-sensitive banks' net interest margins and tier 1 capital across all periods except the post-GFC, and the robustness of its predictions is verified by the analysis of the delinquency rates and average yields, suggesting that those banks could be prioritizing their reputation in the repo markets.

However, there are clear limitations to this framework. First and foremost, the results seen in the post-GFC analysis suggest that the relationship between and joint effects of repo and deposit financing levels on the banks' performance and balance sheet health may have been transformed by the non-conventional monetary policy tools introduced in response to the GFC, which is not consistent with the predicted utility-maximizing levels of the repo dependency in equation (A.5). The first-order conditions of that equation show that the repo sensitivity is weakly decreasing in the deposit sensitivity levels, a clear sign of a substitute-like relationship. As a result, the theoretical framework, while helpful in illustrating the effects of increasing repo and deposit sensitivities on the bank's financial performance and health, could be refined further to consider the shifts in the banks' preferences.

Furthermore, the model's definition of reputation cost could be furthered by introducing repo haircuts, the decrease in which would correspond to a lower reputation cost and help explain some of the predictions made in the discussions of the high-delinquency and repo-dependent banks' performance and overall health. This modification will also help alleviate the mismatch between the data and the model prediction on the relationship between the banks' delinquency rates (serving as a proxy for value-at-risk, or the reputation cost) and the repo sensitivity. It is impossible to reliably incorporate them, however, without the transaction-level data on repo haircuts. Furthermore, the goal of the model in the Appendix is to explain the relationships seen in the data using the realistic approximations of the value-at-risk, lending profits, and propensities to build stronger balance sheets or expand the lending base, and including variables that cannot be reliably approximated using the FDIC data are intended to be excluded from the model due to their unobservability. Nevertheless, the reputation cost measure could be refined and made more realistic.

8. Concluding Remarks

This analysis underscores the different effects the changes in monetary policy regimes can have on various banks based on their risk profile and exposure to monetary policy decisions. Banks highly dependent on repo financing, which are seemingly risk-averse due to the wish to maintain favorable haircuts in the repo markets, generally choose to restrict their borrower base to only the safest borrowers. As a result, when those banks choose to serve a larger group of borrowers, thus increasing the risk of their balance sheet, are seen as improving their financial performance, although it is highly probable that those banks will, in the long run, be faced with the higher haircuts due to the overall riskier balance sheets.

A behavior quite opposite of that is evident in banks with high delinquency rates. After the GFC, those banks have started seeking ways to improve their balance sheets, particularly through increasing their exposure to repo markets, which not only explains the overall decrease in such banks since the pre-crisis level but also helps explain the declines in average delinquency rates over time. Such banks are also initially faced with stricter collateral requirements than banks without abnormal delinquency rates, which is somewhat clearly seen when one considers the long-run effects of increases in repo sensitivity for an average bank in this group.

For an average bank, the effect of having more deposits and repo in the funding mix has changed quite drastically after the crisis. Before the GFC, higher deposit load, allowing for the expansion of the lending base, generally spelled better financial (albeit not operational) performance, and generally riskier balance sheets, while having more repo in the funding structure typically led to more risk-averse lending decisions, potentially resulting in lower net interest margins but better operational performance and stronger balance sheets. After the crisis, the relationship between the two types of funding has changed from seemingly opposite to complementary, showing that having a healthy mix of both is beneficial for the banks' performance, which is a likely product of the introduction of new monetary policy tools during the crisis.

In summary, the banks' financing choices have evolved over the different monetary policy regimes in several ways. Not only has the relationship between repo and deposit financing evolved with the introduction of the new monetary policy tools, but the overall effects of the banks' choice of financing on the subsequent changes in financial performance and balance sheet health has evolved, especially in the more extreme cases, such as the banks with abnormally high delinquency rates and the banks with the repo dependency in the top 5% of the sample.

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Appendix. Incentives to Alter Lending and Financing Strategies

The following theoretical models show the banks' incentives to change their lending and financing strategy based on the size of the bank's repo and deposit sensitivities.

A.1 Variables

The key variable in this model, repo sensitivity (γ_R), defined as the total amount of repo funding divided by the bank's total assets, is an appropriate proxy for a bank's liquidity dependence in the absence of data on average deposit rates for various reasons. First, this model assumes that banks rely on liquidity to maintain operations, without which the banks would lack the incentive to hold adequate levels of high-quality capital. As a result, they would not need to provide collateral unless they were actively seeking liquidity. Therefore, if a bank is not repo-sensitive, it contradicts the assumption of liquidity dependence central to this model. Second, this study examines how banks' lending and financing decisions adapt to changes in monetary policy, and repo sensitivity not only captures liquidity dependence during both the pre- and post-GFC monetary policy regimes but repo also plays a particularly significant role in the latter, with the Fed's greater involvement in the financial markets through multiple rounds of QE.

Other variables in this model include:

1. *Lending Decision Variables*: the lending income from the loan portfolio (π_L), taken from Tirole (1988):

$$E(\pi_L) = \gamma_D \sum_{i=1}^{N} (r_i L_i - \delta_i L_i), \tag{A.1}$$

where L is the total amount of the loan i, r is the return on the loan i, and δ is loan i's default probability[14]; and the bank's risk aversion (α_L, s.t. $0 \leq \alpha_L \leq 1$), defined

[14]This value is approximated using the bank's operating income given the call report data

as the weight the bank puts on the lending preferences; the bank's deposit sensitivity (γ_D)

2. *Bank's Repo Market Reputation*: (C_L)[15], which is defined as the average delinquency rate

$$C_L = \gamma_R \frac{\sum_{i=1}^{N}(\delta_i L_i)}{N}, \tag{A.2}$$

reputation preference, defined as the weight the bank puts on the importance of repo activities $(1 - \alpha_L)$

A.2 Objective Function

The banks seek to maximize the following individual utility function by choosing optimal levels of repo funding:

$$U_b = \alpha_{L,b}\pi_{L,b} - (1 - \alpha_{L,b})C_{L,b} \tag{A.3}$$

Within this model, the bank's choice of lending is directly influenced by its repo and deposit sensitivities:

$$\alpha_L = \gamma_D - \gamma_R \tag{A.4}$$

A.3 Model Solution

Substituting (A.1) and (A.2) into (A.3), the optimization problem can be rewritten as follows:

$$U = (\gamma_D - \gamma_R)(\gamma_D \sum_{i=1}^{N}(r_i L_i - \delta_i L_i)) - (1 - \gamma_D + \gamma_R)(\gamma_R \frac{\sum_{i=1}^{N}(\delta_i L_i)}{N})$$

Solving the problem with respect to γ_R nets the following solution for the optimal levels

[15]This measure can only be reliably estimated using the delinquency rate, which is observable to all other banks and is reasonably expected to affect the bank's reputation in the repo market

of repo financing, keeping the deposit levels unchanged:

$$\gamma_R^* = \frac{\gamma_D}{2} - \frac{\gamma_D \sum_{i=1}^{N}(r_i L_i - \delta_i L_i)}{2N \sum_{i=1}^{N}(\delta_i L_i)} - 1 \tag{A.5}$$

A.4 Model Implications

The solution (A.5) shows that the banks' propensity to engage in repo transactions typically increases with the delinquency rate, which could suggest that the banks with riskier balance sheets could be imposing market-based monitoring mechanisms for their loan portfolios. The monitoring comes in haircuts, primarily driven by overall creditworthiness and collateral quality (Chebotarev, 2021). In turn, to achieve a better standing in the repo market and get cheaper access to the wholesale markets, the bank will attempt to improve its loan portfolio quality. This idea can be somewhat reliably tested with vector autoregression models, which are shown in figures 1-6.

The repo dependency is also decreasing in the deposit sensitivity, suggesting that the two financing options are substitutes. Another explanation is that in general, if the bank has sufficient low-beta financing in its structure, it will not need to rely on the high-beta wholesale funding markets, which is generally supported by the no-run equilibrium and general discussion in the Drechsler et al. (2024). After the global financial crisis, with the relative ease of attaining repo funding from the lender of last resort, the substituting relationship between the two financing levels may change, however, as the new tools in the monetary policy toolkit reduce the punishment on the banks with high levels of delinquent loans, particularly with the buyback programs employed as part of the quantitative easing (Darmouni and Rodnyansky (2017) and Morais et al. (2019)).

Finally, optimal levels of repo dependency are also decreasing in the lending profit, which, within the context of this study suggests that more repo-dependent banks will tend to trivialize the expansion of their loan portfolios, which is a somewhat mechanical relationship considering the definition of the lending preference outlined in (A.2.4). Due to the need to

maintain high levels of top-notch collateral and ensure that the bank's overall creditworthiness is high to achieve a lower cost of engaging in repo transactions (Chebotarev, 2021), the repo-dependent banks will also likely tighten the lending standards (Gorton, 2010) to reduce the risk of the balance sheet, which entails that the banks will take on safer borrowers than a less repo-dependent bank would, and as a result, change comparatively lower interest rates, the idea that is tested in table 5.

Table 1: Descriptive Statistics

Panel A of this table reports selected descriptive statistics of fed funds rate surprises and bank stock returns and the descriptions of the FOMC events and outside of them. Panel B reports the average, median, standard deviations, 25^{th} and 75^{th} percentiles of the banks' financial characteristics, along with the sample sizes for each period. Panel C reports the two-sample mean difference test for the low-delinquency and high-delinquency (over 5% delinquency rate) banks. Panel D reports the two-sample mean difference test for the repo-insensitive and repo-sensitive (over 15% repo dependency) banks.

Panel A. Monetary Policy Event Analysis

	Pre-GFC	GFC/ZIRP	Post-GFC
Number of FOMC events	115	63	65
SD of Fed Funds surprise, bps	8.22	11.18	4.59
SD of bank returns on event days, %	1.75	3.74	1.77
SD of bank returns on NON-event days, %	1.39	3.02	1.85
% of Rate changes announced in meetings	92.31	71.43	95.83

Panel B. Dependent Variable Summary Statistics

Sample	Variable	N	Mean	SD	25%	Median	75%
Full	Delinquency Rate	969,345	0.25	0.70	0.00	0.05	0.25
	Deposit Sensitivity	969,345	82.80	10.73	80.35	85.43	88.79
	NIM	969,345	4.02	1.03	3.41	3.97	4.56
	NOI	969,345	0.97	1.01	0.59	0.99	1.37
	Repo Sensitivity	969,345	3.16	5.98	0.00	0.79	4.17
	Tier 1 CR	969,345	17.63	13.92	11.47	14.37	19.37
	Yield Received	969,345	6.24	1.88	4.70	6.30	7.73
Pre-GFC	Delinquency Rate	566,137	0.21	0.62	0.00	0.05	0.22
	Deposit Sensitivity	566,137	82.74	11.41	80.44	85.73	89.09
	NIM	566,137	4.27	1.05	3.67	4.23	4.83
	NOI	566,137	1.07	0.94	0.71	1.08	1.43
	Repo Sensitivity	566,137	4.08	6.66	0.00	1.99	5.48
	Tier 1 CR	566,137	18.15	13.91	11.38	14.43	19.85
	Yield Received	566,137	7.35	1.41	6.50	7.49	8.21
GFC/ZIRP	Delinquency Rate	235,368	0.46	0.92	0.00	0.13	0.51
	Deposit Sensitivity	235,368	82.38	9.97	79.60	84.60	88.13
	NIM	235,368	3.73	0.90	3.24	3.71	4.18
	NOI	235,368	0.68	1.20	0.30	0.73	1.16
	Repo Sensitivity	235,368	2.23	5.00	0.00	0.07	2.53
	Tier 1 CR	235,368	17.81	13.55	11.83	14.52	19.09
	Yield Received	235,368	5.04	1.30	4.20	4.94	5.80
Post-GFC	Delinquency Rate	167,840	0.11	0.46	-0.00	0.01	0.10
	Deposit Sensitivity	167,840	83.60	9.30	81.15	85.57	88.60
	NIM	167,840	3.59	0.87	3.11	3.56	4.02
	NOI	167,840	1.03	0.84	0.63	0.98	1.36
	Repo Sensitivity	167,840	1.40	3.84	0.00	0.00	0.82
	Tier 1 CR	167,840	15.63	14.26	11.25	13.97	18.30
	Yield Received	167,840	4.18	1.03	3.61	4.13	4.67

Panel C. Repo-insensitive (RI) versus Repo-sensitive (RS)

		RI		RS		Difference	
Sample	Variable	Mean	SD	Mean	SD	Mean	p-value
Full	CRE Loans	1.67	3.78	1.20	3.95	0.47	(0.0)
	Delinquency Rate	0.26	0.73	0.30	0.99	-0.04	(0.0)
	Deposit Sensitivity	82.94	10.26	79.13	19.02	3.81	(0.0)
	NIM	4.03	1.07	3.93	1.50	0.10	(0.0)
	NOI	0.96	1.10	0.62	2.45	0.34	(0.0)
	Repo Sensitivity	2.33	3.30	25.13	13.80	-22.80	(0.0)
	Tier 1 CR	17.48	16.31	31.89	40.18	-14.41	(0.0)
	Yield Received	6.25	1.91	6.09	2.20	0.16	(0.0)
Pre-GFC	CRE Loans	1.07	3.09	0.89	3.35	0.19	(0.0)
	Delinquency Rate	0.21	0.64	0.29	0.98	-0.08	(0.0)
	Deposit Sensitivity	82.95	10.81	78.65	19.36	4.30	(0.0)
	NIM	4.29	1.08	4.13	1.53	0.16	(0.0)
	NOI	1.07	0.99	0.62	2.47	0.45	(0.0)
	Repo Sensitivity	3.00	3.52	25.41	14.14	-22.41	(0.0)
	Tier 1 CR	17.79	15.49	32.78	40.43	-14.99	(0.0)
	Yield Received	7.39	1.42	6.64	2.07	0.75	(0.0)
GFC/ZIRP	CRE Loans	2.29	4.33	1.89	4.98	0.41	(0.0)
	Delinquency Rate	0.48	0.98	0.42	1.15	0.06	(0.0)
	Deposit Sensitivity	82.45	9.62	79.35	19.32	3.10	(0.0)
	NIM	3.75	0.94	3.29	1.27	0.45	(0.0)
	NOI	0.63	1.34	0.46	2.61	0.17	(0.0)
	Repo Sensitivity	1.68	2.89	24.85	13.67	-23.18	(0.0)
	Tier 1 CR	17.86	16.79	33.60	43.22	-15.74	(0.0)
	Yield Received	5.06	1.33	4.53	1.67	0.53	(0.0)
Post-GFC	CRE Loans	1.22	3.10	1.01	3.23	0.21	(0.203)
	Delinquency Rate	0.11	0.49	0.15	0.69	-0.04	(0.0)
	Deposit Sensitivity	83.60	9.21	83.50	13.70	0.10	(0.578)
	NIM	3.60	0.93	3.30	1.06	0.30	(0.0)
	NOI	1.04	0.97	0.92	1.79	0.12	(0.0)
	Repo Sensitivity	1.04	2.39	22.88	9.82	-21.83	(0.0)
	Tier 1 CR	15.95	18.08	19.39	26.82	-3.44	(0.0)
	Yield Received	4.19	1.08	3.77	1.15	0.42	(0.0)

Panel D. Low-delinquency (LD) versus High-delinquency (HD)

		LD		HD		Difference	
Sample	Variable	Mean	SD	Mean	SD	Mean	p-value
Full	CRE Loans	1.62	3.72	5.41	7.85	-3.79	(0.0)
	Delinquency Rate	0.22	0.58	6.24	0.61	-6.02	(0.0)
	Deposit Sensitivity	82.86	10.54	73.18	26.75	9.68	(0.0)
	NIM	4.02	1.05	5.58	3.32	-1.56	(0.0)
	NOI	0.95	1.13	0.14	4.58	0.81	(0.0)
	Repo Sensitivity	3.16	5.96	4.39	8.67	-1.23	(0.0)
	Tier 1 CR	18.00	17.86	20.13	31.13	-2.14	(0.0)
	Yield Received	6.23	1.90	8.12	4.00	-1.89	(0.0)
Pre-GFC	CRE Loans	1.06	3.08	2.18	5.98	-1.12	(0.0)
	Delinquency Rate	0.18	0.52	6.27	0.60	-6.08	(0.0)
	Deposit Sensitivity	82.82	11.15	65.56	33.02	17.25	(0.0)
	NIM	4.27	1.07	6.89	3.31	-2.62	(0.0)
	NOI	1.05	1.08	1.38	4.13	-0.33	(0.0)
	Repo Sensitivity	4.07	6.63	6.54	10.88	-2.48	(0.0)
	Tier 1 CR	18.49	17.69	23.36	35.17	-4.87	(0.0)
	Yield Received	7.34	1.43	10.29	3.56	-2.95	(0.0)
GFC/ZIRP	CRE Loans	2.23	4.26	6.72	8.06	-4.49	(0.0)
	Delinquency Rate	0.41	0.77	6.21	0.62	-5.80	(0.0)
	Deposit Sensitivity	82.41	9.84	79.89	17.86	2.52	(0.0)
	NIM	3.73	0.92	4.12	2.57	-0.39	(0.0)
	NOI	0.65	1.28	-1.27	4.65	1.93	(0.0)
	Repo Sensitivity	2.22	4.99	2.68	5.89	-0.46	(0.0)
	Tier 1 CR	18.25	17.92	16.78	26.12	1.47	(0.0)
	Yield Received	5.03	1.31	5.96	2.97	-0.93	(0.0)
Post-GFC	CRE Loans	1.21	3.07	4.50	9.15	-3.30	(0.0)
	Delinquency Rate	0.10	0.39	6.25	0.61	-6.15	(0.0)
	Deposit Sensitivity	83.62	9.27	76.97	17.13	6.65	(0.0)
	NIM	3.59	0.89	6.97	3.74	-3.39	(0.0)
	NOI	1.04	0.97	1.57	4.13	-0.53	(0.0)
	Repo Sensitivity	1.39	3.84	2.09	4.06	-0.70	(0.0)
	Tier 1 CR	15.99	18.21	21.84	31.99	-5.85	(0.0)
	Yield Received	4.17	1.03	8.61	4.90	-4.44	(0.0)

Table 2: Impact of bank characteristics and rate changes on net interest margin
This table reports the results of linear regressions of the 1-standard deviation change in banks' net interest margin in the next fiscal quarter on 1-standard deviation changes in repo and deposit sensitivities, defined as the amounts of repo and deposits relative to total funding, and the delinquency rate. The regressions include state-year-month fixed effects and include the following controls: bank size, represented as the natural logarithm of the bank's total outstanding loan amount, efficiency ratio, the quarter-on-quarter GDP Growth, bank's market share in a given state, as well as the expected and surprise quarterly changes of Fed Funds and 10-year Treasury rates, and the interactions of those expected and surprise changes with the bank state market shares. Panel A reports the regression results for the subsamples split based on the repo sensitivity relative to 15% threshold, with columns (1)-(4) reporting results for the banks with over 15% repo sensitivity and columns (5)-(8) reporting the results for the banks with a repo sensitivity of less than 5%. Panel B reports the regression results for the subsamples split based on the delinquency rate relative to 5% threshold, with columns (1)-(4) reporting results for the banks with over 5% delinquency rate, and columns (5)-(8) reporting the results for the banks with a delinquency rate of less than 5%. Within each panel, columns (1) and (5) utilize the full sample, columns (2) and (6) use the 1994-2007 (pre-GFC) subsample, columns (3) and (7) use the 2008-2014 (GFC/ZIRP) subsample and (4) and (8) use the 2015-2023 (post-GFC) subsample.

Panel A. Repo-sensitive (RS) and Repo-insensitive (RI) Banks

Sample:	(1) Full RS	(2) Pre-GFC RS	(3) GFC/ZIRP RS	(4) Post-GFC RS	(5) Full RI	(6) Pre-GFC RI	(7) GFC/ZIRP RI	(8) Post-GFC RI
Deposit Sensitivity	0.096***	0.090***	0.108***	0.111***	0.075***	0.101***	0.044***	0.053***
	(0.004)	(0.005)	(0.010)	(0.020)	(0.001)	(0.001)	(0.002)	(0.003)
Repo Sensitivity	-0.161***	-0.162***	-0.183***	-0.123***	0.073***	0.078***	-0.005*	-0.007*
	(0.004)	(0.005)	(0.010)	(0.014)	(0.002)	(0.002)	(0.003)	(0.004)
% of Delinq. Loans	0.125***	0.149***	0.050***	0.051***	0.173***	0.264***	0.064***	0.317***
	(0.004)	(0.005)	(0.009)	(0.018)	(0.001)	(0.001)	(0.001)	(0.003)
Observations	34,479	26,452	5,355	2,668	928,986	536,580	228,439	163,967
Adjusted R^2	0.36	0.34	0.32	0.26	0.28	0.26	0.17	0.25

Panel B. High-delinquency (HD) and Low-delinquency (LD) Banks

Sample:	(1) Full HD	(2) Pre-GFC HD	(3) GFC/ZIRP HD	(4) Post-GFC HD	(5) Full LD	(6) Pre-GFC LD	(7) GFC/ZIRP LD	(8) Post-GFC LD
Deposit Sensitivity	-0.228***	-0.105***	-0.419***	-0.239**	0.112***	0.134***	0.085***	0.061***
	(0.014)	(0.018)	(0.024)	(0.101)	(0.001)	(0.001)	(0.002)	(0.003)
Repo Sensitivity	-0.128***	-0.193***	-0.097***	0.520***	-0.008***	-0.007***	-0.062***	-0.051***
	(0.021)	(0.027)	(0.034)	(0.136)	(0.001)	(0.001)	(0.002)	(0.003)
% of Delinq. Loans	0.180***	0.245***	0.034	0.356***	0.172***	0.253***	0.057***	0.314***
	(0.032)	(0.051)	(0.040)	(0.111)	(0.001)	(0.002)	(0.002)	(0.003)
Observations	5,636	2,545	2,642	442	957,823	560,480	206,072	191,271
Adjusted R^2	0.60	0.56	0.50	0.79	0.27	0.24	0.18	0.22

Table 3: Impact of bank characteristics and rate changes on net operating margin
This table reports the results of linear regressions of the 1-standard deviation change in banks' net operating margin in the next fiscal quarter on 1-standard deviation changes in repo and deposit sensitivities, defined as the amounts of repo and deposits relative to total funding, and the delinquency rate. The regressions include state-year-month fixed effects and include the following controls: bank size, represented as the natural logarithm of the bank's total outstanding loan amount, efficiency ratio, the quarter-on-quarter GDP Growth, bank's market share in a given state, as well as the expected and surprise quarterly changes of Fed Funds and 10-year Treasury rates, and the interactions of those expected and surprise changes with the bank state market shares. Panel A reports the regression results for the subsamples split based on the repo sensitivity relative to 15% threshold, with columns (1)-(4) reporting results for the banks with over 15% repo sensitivity and columns (5)-(8) reporting the results for the banks with a repo sensitivity of less than 5%. Panel B reports the regression results for the subsamples split based on the delinquency rate relative to 5% threshold, with columns (1)-(4) reporting results for the banks with over 5% delinquency rate, and columns (5)-(8) reporting the results for the banks with a delinquency rate of less than 5%. Within each panel, columns (1) and (5) utilize the full sample, columns (2) and (6) use the 1994-2007 (pre-GFC) subsample, columns (3) and (7) use the 2008-2014 (GFC/ZIRP) subsample and (4) and (8) use the 2015-2023 (post-GFC) subsample.

Panel A. Repo-sensitive (RS) and Repo-insensitive (RI) Banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	Full RS	Pre-GFC RS	GFC/ZIRP RS	Post-GFC RS	Full RI	Pre-GFC RI	GFC/ZIRP RI	Post-GFC RI
Deposit Sensitivity	-0.705***	-0.094***	-3.139***	-3.318***	-0.298***	-0.105***	-0.259***	-1.322***
	(0.026)	(0.014)	(0.135)	(0.181)	(0.003)	(0.002)	(0.005)	(0.020)
Repo Sensitivity	-0.087***	0.036***	-0.472***	-0.104	0.037***	0.028***	0.005	-0.067**
	(0.026)	(0.014)	(0.135)	(0.124)	(0.005)	(0.002)	(0.007)	(0.029)
% of Delinq. Loans	-0.014	-0.025*	0.189	0.480***	-0.165***	-0.072***	-0.291***	0.001
	(0.027)	(0.014)	(0.118)	(0.162)	(0.003)	(0.002)	(0.003)	(0.020)
Observations	34,479	26,452	5,355	2,668	928,986	536,580	228,439	163,967
Adjusted R^2	0.18	0.40	0.26	0.25	0.13	0.37	0.32	0.06

Panel B. High-delinquency (HD) and Low-delinquency (LD) Banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	Full HD	Pre-GFC HD	GFC/ZIRP HD	Post-GFC HD	Full LD	Pre-GFC LD	GFC/ZIRP LD	Post-GFC LD
Deposit Sensitivity	-0.719***	-0.383***	-1.359***	-5.176***	-0.301***	-0.075***	-0.445***	-1.331***
	(0.054)	(0.048)	(0.111)	(0.635)	(0.003)	(0.002)	(0.007)	(0.019)
Repo Sensitivity	0.584***	0.451***	0.507***	3.489***	0.029***	0.017***	0.133***	-0.027
	(0.080)	(0.070)	(0.157)	(0.861)	(0.003)	(0.002)	(0.007)	(0.019)
% of Delinq. Loans	-0.806***	-0.577***	-1.329***	-1.293*	-0.128***	-0.065***	-0.217***	0.042*
	(0.123)	(0.134)	(0.182)	(0.700)	(0.004)	(0.002)	(0.006)	(0.025)
Observations	5,636	2,545	2,679	406	957,823	560,480	231,115	166,228
Adjusted R^2	0.30	0.41	0.24	0.61	0.13	0.39	0.17	0.06

Table 4: Impact of bank characteristics and rate changes on tier 1 capital ratio
This table reports the results of linear regressions of the 1-standard deviation change in banks' tier 1 capital ratios in the next fiscal quarter on 1-standard deviation changes in repo and deposit sensitivities, defined as the amounts of repo and deposits relative to total funding, and the delinquency rate. The regressions include state-year-month fixed effects and include the following controls: bank size, represented as the natural logarithm of the bank's total outstanding loan amount, efficiency ratio, the quarter-on-quarter GDP Growth, bank's market share in a given state, as well as the expected and surprise quarterly changes of Fed Funds and 10-year Treasury rates, and the interactions of those expected and surprise changes with the bank state market shares. Panel A reports the regression results for the subsamples split based on the repo sensitivity relative to 15% threshold, with columns (1)-(4) reporting results for the banks with over 15% repo sensitivity and columns (5)-(8) reporting the results for the banks with a repo sensitivity of less than 5%. Panel B reports the regression results for the subsamples split based on the delinquency rate relative to 5% threshold, with columns (1)-(4) reporting results for the banks with over 5% delinquency rate, and columns (5)-(8) reporting the results for the banks with a delinquency rate of less than 5%. Within each panel, columns (1) and (5) utilize the full sample, columns (2) and (6) use the 1994-2007 (pre-GFC) subsample, columns (3) and (7) use the 2008-2014 (GFC/ZIRP) subsample and (4) and (8) use the 2015-2023 (post-GFC) subsample.

Panel A. Repo-sensitive (RS) and Repo-insensitive (RI) Banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	Full RS	Pre-GFC RS	GFC/ZIRP RS	Post-GFC RS	Full RI	Pre-GFC RI	GFC/ZIRP RI	Post-GFC RI
Deposit Sensitivity	-0.623***	-0.605***	-0.710***	-0.503***	-0.296***	-0.293***	-0.365***	-0.285***
	(0.005)	(0.005)	(0.011)	(0.022)	(0.001)	(0.001)	(0.002)	(0.002)
Repo Sensitivity	0.097***	0.088***	0.130***	0.080***	0.032***	0.045***	0.021***	-0.025***
	(0.005)	(0.005)	(0.011)	(0.015)	(0.001)	(0.001)	(0.002)	(0.003)
% of Delinq. Loans	-0.015***	-0.013**	-0.023**	0.065***	-0.028***	-0.035***	-0.022***	-0.002
	(0.005)	(0.006)	(0.010)	(0.020)	(0.001)	(0.001)	(0.001)	(0.002)
Observations	34,479	26,452	5,355	2,668	928,986	536,580	228,439	163,967
Adjusted R^2	0.56	0.56	0.68	0.44	0.28	0.30	0.33	0.23

Panel B. High-delinquency (HD) and Low-delinquency (LD) Banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	Full HD	Pre-GFC HD	GFC/ZIRP HD	Post-GFC HD	Full LD	Pre-GFC LD	GFC/ZIRP LD	Post-GFC LD
Deposit Sensitivity	-0.372***	-0.339***	-0.514***	-0.061	-0.346***	-0.349***	-0.405***	-0.300***
	(0.009)	(0.011)	(0.014)	(0.066)	(0.001)	(0.001)	(0.002)	(0.002)
Repo Sensitivity	0.083***	0.093***	-0.002	-0.155*	0.080***	0.088***	0.077***	0.008***
	(0.013)	(0.016)	(0.020)	(0.089)	(0.001)	(0.001)	(0.001)	(0.002)
% of Delinq. Loans	0.068***	0.043	0.080***	-0.093	-0.047***	-0.059***	-0.037***	-0.006**
	(0.020)	(0.032)	(0.024)	(0.073)	(0.001)	(0.001)	(0.001)	(0.003)
Observations	5,636	2,545	2,679	406	957,823	560,480	231,115	166,228
Adjusted R^2	0.42	0.50	0.47	0.66	0.32	0.35	0.36	0.24

Table 5: Impact of bank characteristics and rate changes on delinquency rate and average interest rate charged by the bank

This table reports the results of linear regressions of the 1-standard deviation change in banks' next-quarter delinquency rate (Panel A) and the average yield (Panel B) on 1-standard deviation changes in repo and deposit sensitivities, defined as the amounts of repo and deposits relative to total funding, and the delinquency rate. The regressions include state-year-month fixed effects and include the following controls: bank size, represented as the natural logarithm of the bank's total outstanding loan amount, efficiency ratio, the quarter-on-quarter GDP Growth, bank's market share in a given state, as well as the expected and surprise quarterly changes of Fed Funds and 10-year Treasury rates, and the interactions of those expected and surprise changes with the bank state market shares. Within each panel, column (1) utilizes the full sample, column (2) uses the 1994-2007 (pre-GFC) subsample, column (3) uses the 2008-2014 (GFC/ZIRP) subsample and (4) uses the 2015-2023 (post-GFC) subsample.

Panel A. Delinquency Rate

	(1)	(2)	(3)	(4)
Sample:	Full	Pre-GFC	GFC/ZIRP	Post-GFC
Deposit Sensitivity	-0.052***	-0.087***	0.020***	-0.028***
	(0.001)	(0.001)	(0.003)	(0.002)
Repo Sensitivity	0.012***	0.020***	0.007**	0.021***
	(0.001)	(0.001)	(0.003)	(0.002)
Observations	963,465	563,033	233,794	166,638
Adjusted R^2	0.11	0.06	0.17	0.08

Panel B. Average Interest Rate Charged

	(1)	(2)	(3)	(4)
Sample:	Full	Pre-GFC	GFC/ZIRP	Post-GFC
Deposit Sensitivity	0.047***	0.077***	0.020***	-0.032***
	(0.001)	(0.001)	(0.001)	(0.002)
Repo Sensitivity	-0.069***	-0.078***	-0.078***	-0.024***
	(0.001)	(0.001)	(0.001)	(0.002)
% of Delinq. Loans	0.122***	0.171***	0.057***	0.218***
	(0.001)	(0.001)	(0.001)	(0.002)
Observations	963,465	563,033	233,794	166,638
Adjusted R^2	0.74	0.54	0.51	0.31

Table 6: Impact of bank characteristics and rate changes on repo sensitivity

This table reports the results of linear regressions of the 1-standard deviation change in banks' repo sensitivity in the next fiscal quarter on 1-standard deviation changes in repo and deposit sensitivities, defined as the amounts of repo and deposits relative to total funding, and the delinquency rate. The regressions include state-year-month fixed effects and include the following controls: bank size, represented as the natural logarithm of the bank's total outstanding loan amount, efficiency ratio, the quarter-on-quarter GDP Growth, bank's market share in a given state, as well as the expected and surprise quarterly changes of Fed Funds and 10-year Treasury rates, and the interactions of those expected and surprise changes with the bank state market shares. Panel A reports the regression results including the previous-quarter repo sensitivity. Panel B reports the results without the previous-quarter repo sensitivity. Within each panel, column (1) utilizes the full sample, column (2) uses the 1994-2007 (pre-GFC) subsample, column (3) uses the 2008-2014 (GFC/ZIRP) subsample and (4) uses the 2015-2023 (post-GFC) subsample.

Panel A. Including Previous-Quarter Repo Sensitivity

	(1)	(2)	(3)	(4)
Sample:	Full	Pre-GFC	GFC/ZIRP	Post-GFC
Log(Total Loans)	-0.000***	-0.000***	-0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Deposit Sensitivity	-0.002***	-0.002***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Repo Sensitivity	0.057***	0.057***	0.056***	0.055***
	(0.000)	(0.000)	(0.000)	(0.000)
Eff. Ratio	0.000***	0.000***	-0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
% of Delinq. Loans	-0.000***	-0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	963,465	563,033	233,794	166,638
Adjusted R^2	0.97	0.97	0.97	0.99

Panel B. Excluding Previous-Quarter Repo Sensitivity

	(1)	(2)	(3)	(4)
Sample:	Full	Pre-GFC	GFC/ZIRP	Post-GFC
Log(Total Loans)	-0.014***	-0.017***	-0.012***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
Deposit Sensitivity	-0.003***	-0.004***	-0.002***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Eff. Ratio	0.007***	0.010***	0.003***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
% of Delinq. Loans	0.001***	0.001***	0.000***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	963,465	563,033	233,794	166,638
Adjusted R^2	0.15	0.16	0.11	0.08

Table 7: Impact of bank characteristics and rate changes on deposit sensitivity
This table reports the results of linear regressions of the 1-standard deviation change in banks' deposit sensitivity in the next fiscal quarter on 1-standard deviation changes in repo and deposit sensitivities, defined as the amounts of repo and deposits relative to total funding, and the delinquency rate. The regressions include state-year-month fixed effects and include the following controls: bank size, represented as the natural logarithm of the bank's total outstanding loan amount, efficiency ratio, the quarter-on-quarter GDP Growth, bank's market share in a given state, as well as the expected and surprise quarterly changes of Fed Funds and 10-year Treasury rates, and the interactions of those expected and surprise changes with the bank state market shares. Panel A reports the regression results including the previous-quarter deposit sensitivity. Panel B reports the results without the previous-quarter deposit sensitivity. Within each panel, column (1) utilizes the full sample, column (2) uses the 1994-2007 (pre-GFC) subsample, column (3) uses the 2008-2014 (GFC/ZIRP) subsample and (4) uses the 2015-2023 (post-GFC) subsample.

Panel A. Including Previous-Quarter Deposit Sensitivity

	(1)	(2)	(3)	(4)
Sample:	Full	Pre-GFC	GFC/ZIRP	Post-GFC
Log(Total Loans)	-0.000	-0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Deposit Sensitivity	1.000***	1.000***	1.000***	1.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Repo Sensitivity	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Eff. Ratio	-0.000***	-0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
% of Delinq. Loans	0.000***	-0.000***	0.000*	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	963,465	563,033	233,794	166,638
Adjusted R^2	1.00	1.00	1.00	1.00

Panel B. Excluding Previous-Quarter Deposit Sensitivity

	(1)	(2)	(3)	(4)
Sample:	Full	Pre-GFC	GFC/ZIRP	Post-GFC
Log(Total Loans)	-0.188***	-0.255***	-0.143***	-0.059***
	(0.001)	(0.001)	(0.002)	(0.002)
Repo Sensitivity	-0.017***	-0.023***	-0.011***	0.006**
	(0.001)	(0.001)	(0.002)	(0.002)
Eff. Ratio	-0.047***	-0.087***	0.004**	-0.002
	(0.001)	(0.001)	(0.002)	(0.002)
% of Delinq. Loans	-0.043***	-0.096***	0.006***	-0.034***
	(0.001)	(0.001)	(0.001)	(0.002)
Exp. FF Rate Ch.	-0.008***	-0.016***	0.008*	-0.007
	(0.001)	(0.002)	(0.004)	(0.004)
Observations	963,465	563,033	233,794	166,638
Adjusted R^2	0.14	0.16	0.13	0.11

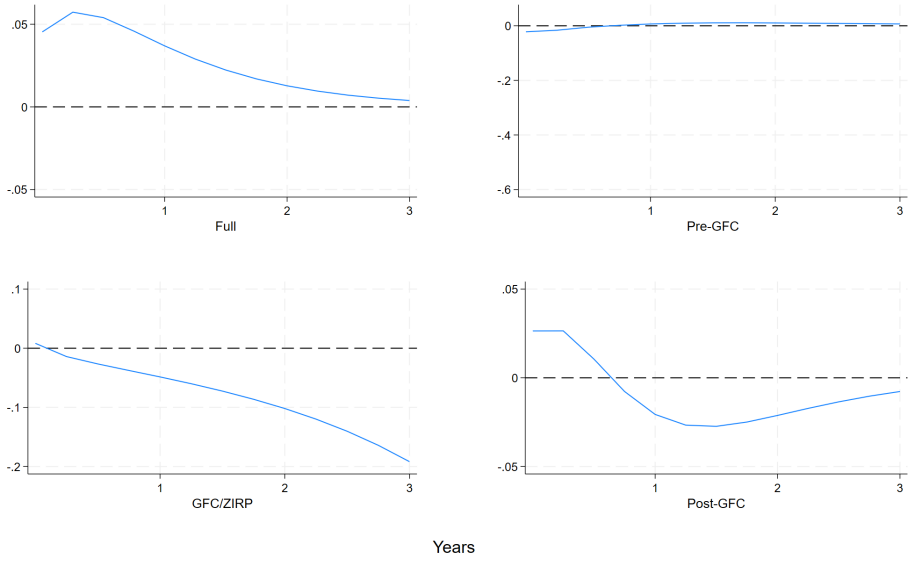
Table 8: Response of Bank Returns to Fed Funds Rate Changes

This table reports the baseline regression results, with the 1-day value-weighted bank return as the dependent variable. Columns (1), (4), and (7) use the Actual, or raw changes in the Fed Funds and 10-year Treasury rates as independent variables, while columns (2), (5), and (8) expected and unexpected components of the changes in said rates. All of the regressions do not use the emergency meetings of 2008 and 2020 that serve as outliers. The parentheses contain heteroskedasticity-consistent standard errors.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Full	Full	Pre-GFC	Pre-GFC	GFC/ZIRP	GFC/ZIRP	Post-GFC	Post-GFC
Raw FF Rate Ch.	-0.005		0.002		0.010		-0.007	
	(0.006)		(0.007)		(0.031)		(0.008)	
Raw 10-year Rate Ch.	-0.021		0.021		-0.077*		0.054	
	(0.020)		(0.023)		(0.041)		(0.045)	
Exp. FF Rate Ch.		-0.009		-0.005		-0.007		-0.005
		(0.007)		(0.007)		(0.040)		(0.008)
Unexp. FF Rate Ch.		0.015		0.029*		0.021		-0.200***
		(0.017)		(0.018)		(0.038)		(0.074)
Exp. 10-year Rate Ch.		-0.069***		0.031		-0.157***		0.016
		(0.025)		(0.030)		(0.050)		(0.051)
Unexp. 10-year Rate Ch.		-0.222***		0.117		-0.417***		-0.085
		(0.071)		(0.091)		(0.140)		(0.155)
Intercept	0.004***	0.004***	0.003*	0.003**	0.011**	0.008*	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.002)	(0.002)
Observations	237	237	112	112	62	62	63	63
Adjusted R^2	-0.00	0.03	-0.01	0.01	0.03	0.10	0.02	0.10

Fig. 1. **Dynamic Response of net interest margins to banks' repo sensitivity.** The figure below shows four panels, each showing an impulse response of net interest margins to a one-standard increase in the banks' repo sensitivity, for repo-sensitive (Panel A) and high-delinquency (Panel B) banks. Impulse responses were obtained via a four-variable VAR(1) model results, using quarterly data on the Fed Funds surprises, banks' asset-weighted average balance sheet size and efficiency ratios, and deposit and repo sensitivities. The Y-axis shows the variable response, X-axis shows the number of years since the given observation date. The graphs are presented for the full, pre-GFC, GFC/ZIRP, and post-GFC samples.

Panel A. Repo-Sensitive Banks



Panel B. High-Delinquency Banks

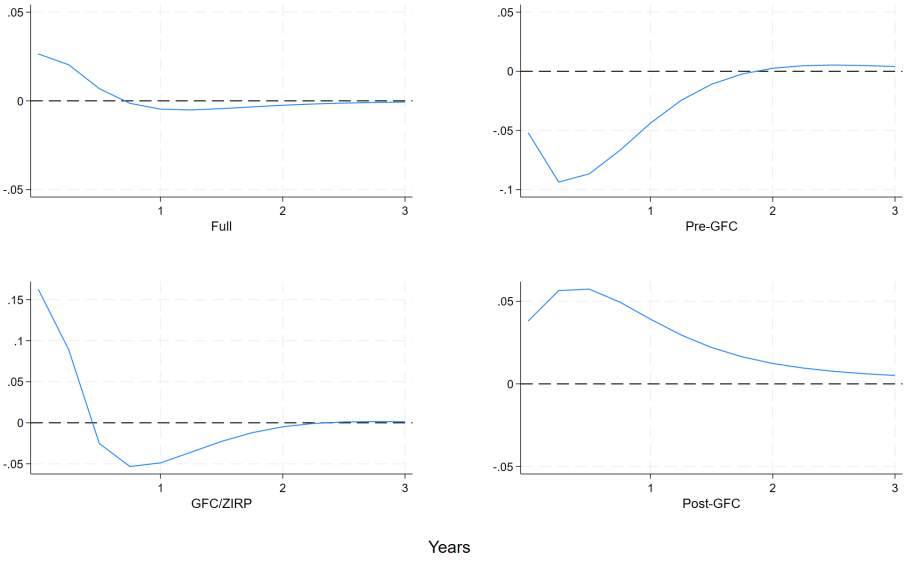
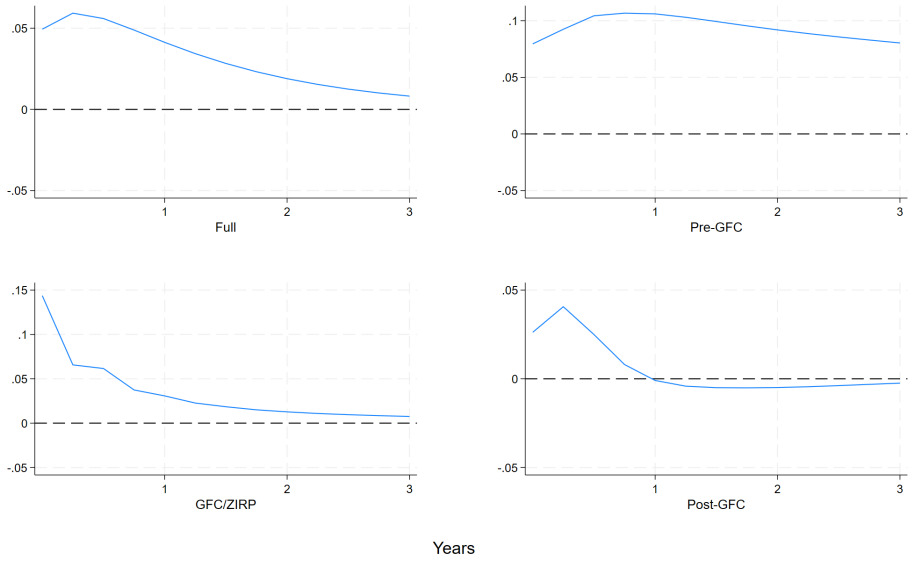


Fig. 2. **Dynamic Response of net interest margins to banks' deposit sensitivity.** The figure below shows four panels, each showing an impulse response of net interest margins to a one-standard increase in the banks' deposit sensitivity, for repo-sensitive (Panel A) and high-delinquency (Panel B) banks. Impulse responses were obtained via a four-variable VAR(1) model results, using quarterly data on the Fed Funds surprises, banks' asset-weighted average balance sheet size and efficiency ratios, and deposit and repo sensitivities. The Y-axis shows the variable response, X-axis shows the number of years since the given observation date. The graphs are presented for the full, pre-GFC, GFC/ZIRP, and post-GFC samples.

Panel A. Repo-Sensitive Banks



Panel B. High-Delinquency Banks

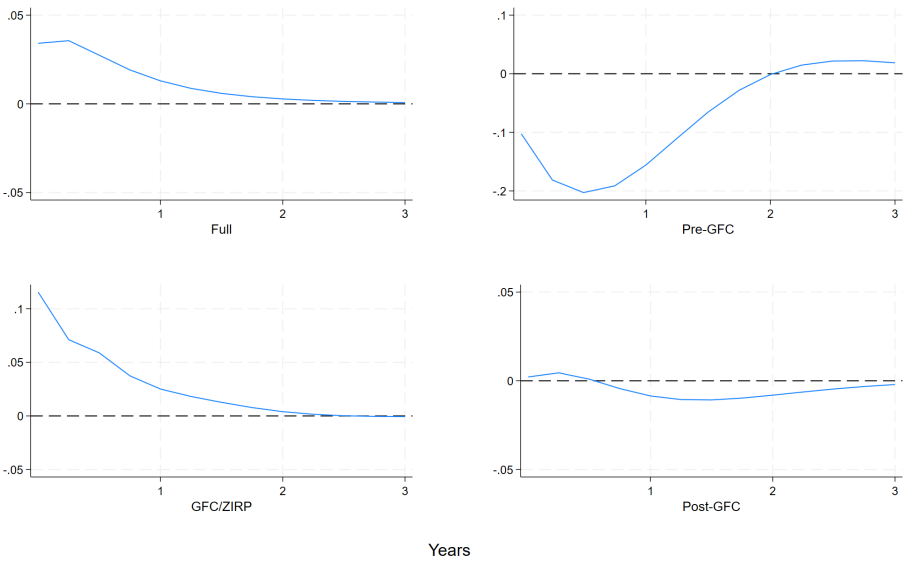
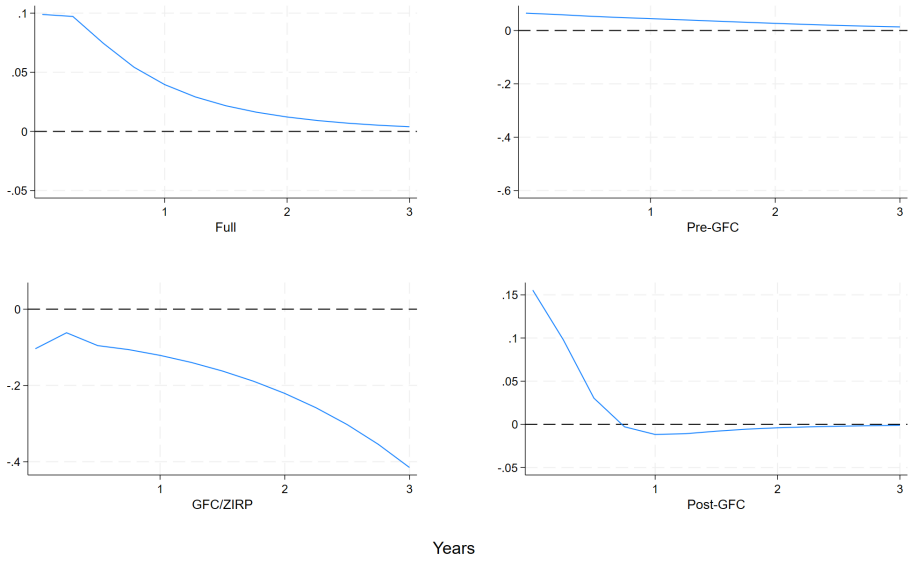


Fig. 3. **Dynamic Response of net operating margins to banks' repo sensitivity.** The figure below shows four panels, each showing an impulse response of net operating margins to a one-standard increase in the banks' repo sensitivity, for repo-sensitive (Panel A) and high-delinquency (Panel B) banks. Impulse responses were obtained via a four-variable VAR(1) model results, using quarterly data on the Fed Funds surprises, banks' asset-weighted average balance sheet size and efficiency ratios, and deposit and repo sensitivities. The Y-axis shows the variable response, X-axis shows the number of years since the given observation date. The graphs are presented for the full, pre-GFC, GFC/ZIRP, and post-GFC samples.

Panel A. Repo-Sensitive Banks



Panel B. High-Delinquency Banks

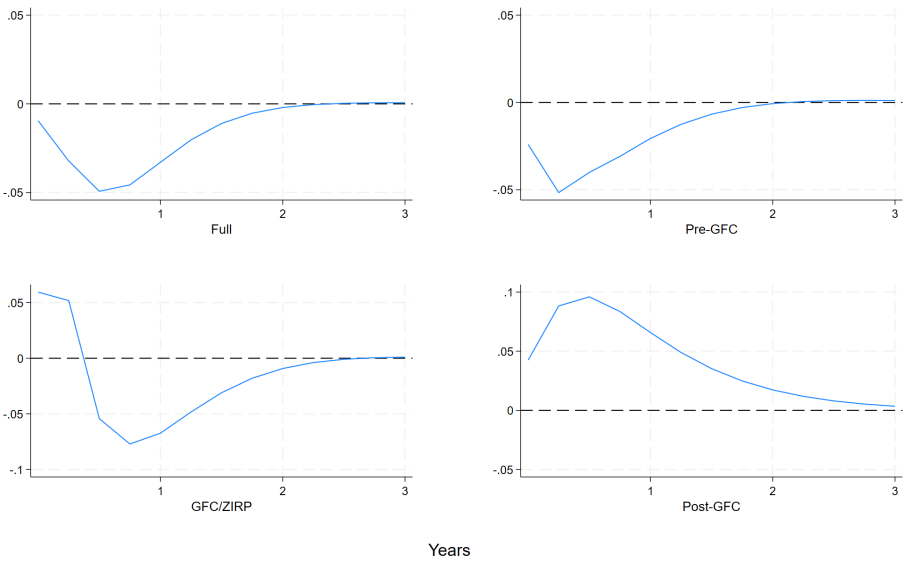
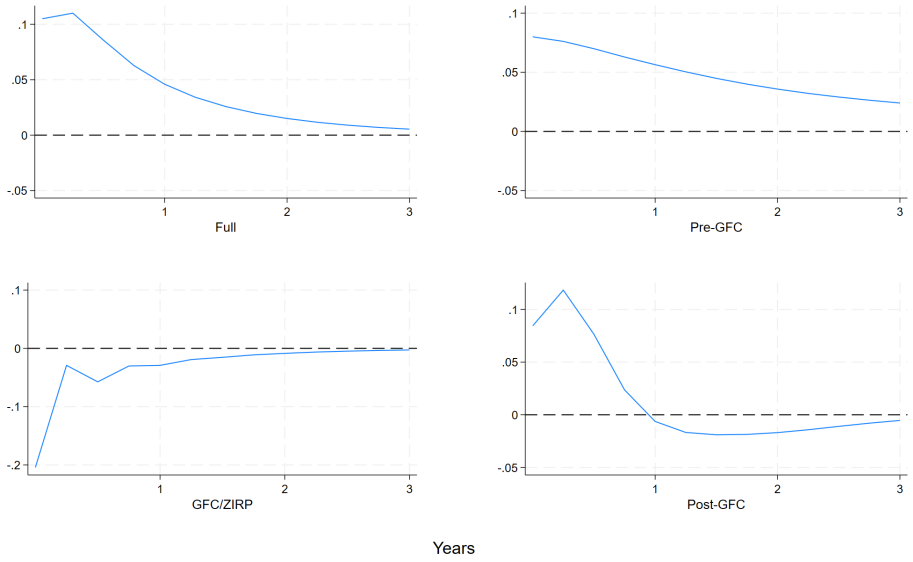


Fig. 4. **Dynamic Response of net operating margins to banks' deposit sensitivity.** The figure below shows four panels, each showing an impulse response of net operating margins to a one-standard increase in the banks' deposit sensitivity, for repo-sensitive (Panel A) and high-delinquency (Panel B) banks. Impulse responses were obtained via a four-variable VAR(1) model results, using quarterly data on the Fed Funds surprises, banks' asset-weighted average balance sheet size and efficiency ratios, and deposit and repo sensitivities. The Y-axis shows the variable response, X-axis shows the number of years since the given observation date. The graphs are presented for the full, pre-GFC, GFC/ZIRP, and post-GFC samples.

Panel A. Repo-Sensitive Banks



Panel B. High-Delinquency Banks

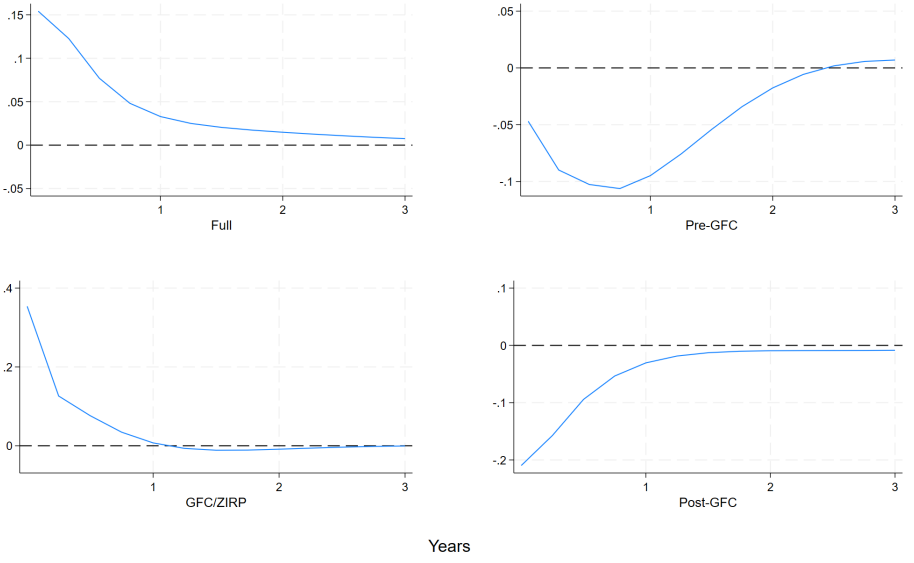
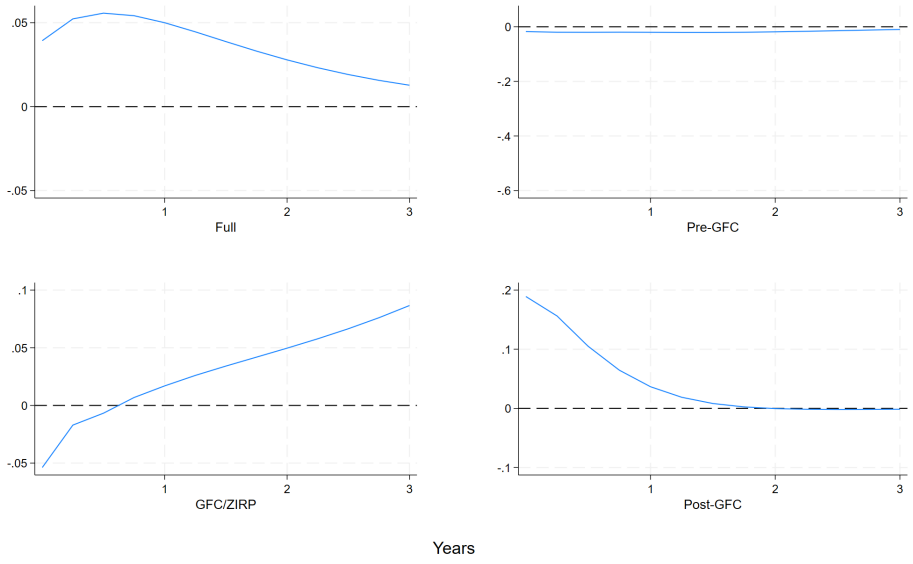


Fig. 5. **Dynamic Response of tier 1 capital level to banks' repo sensitivity.** The figure below shows four panels, each showing an impulse response of net operating margins to a one-standard increase in the banks' repo sensitivity, for repo-sensitive (Panel A) and high-delinquency (Panel B) banks. Impulse responses were obtained via a four-variable VAR(1) model results, using quarterly data on the Fed Funds surprises, banks' asset-weighted average balance sheet size and efficiency ratios, and deposit and repo sensitivities. The Y-axis shows the variable response, X-axis shows the number of years since the given observation date. The graphs are presented for the full, pre-GFC, GFC/ZIRP, and post-GFC samples.

Panel A. Repo-Sensitive Banks



Panel B. High-Delinquency Banks

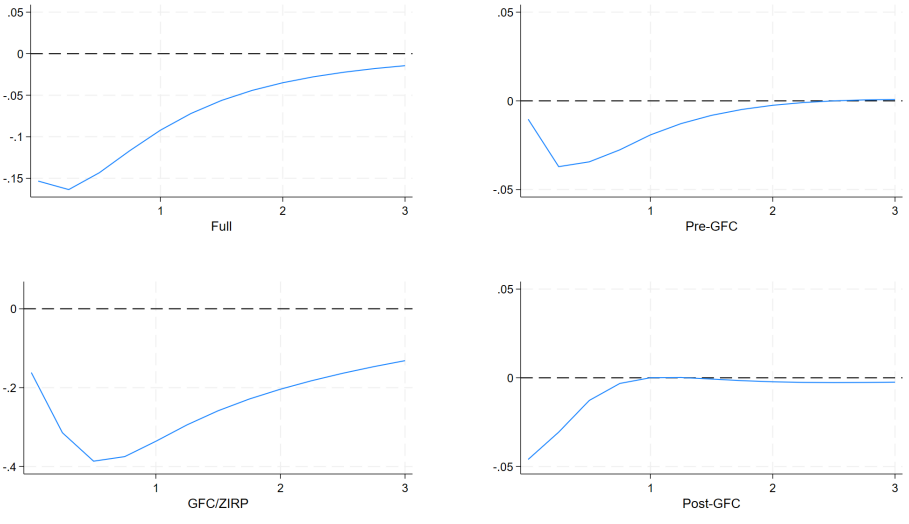
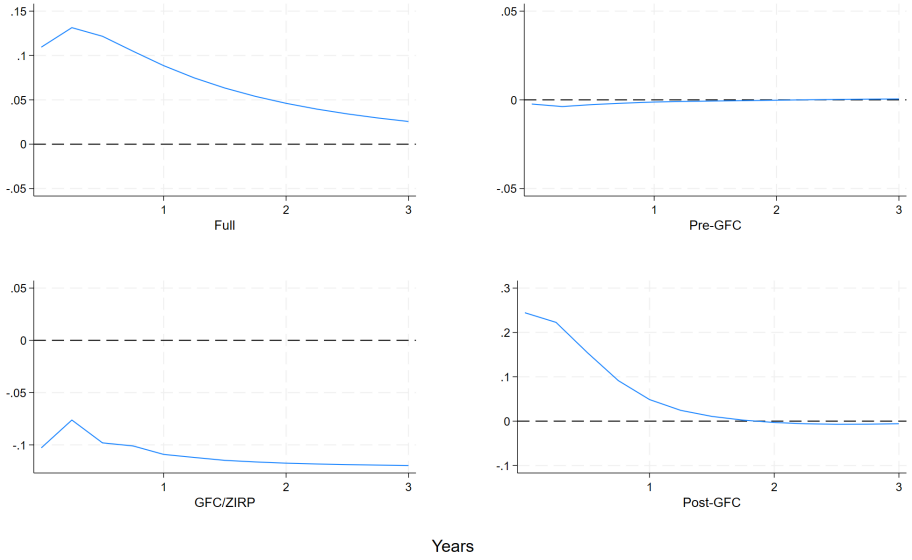


Fig. 6. **Dynamic Response of tier 1 capital level to banks' deposit sensitivity.** The figure below shows four panels, each showing an impulse response of net operating margins to a one-standard increase in the banks' repo sensitivity, for repo-sensitive (Panel A) and high-delinquency (Panel B) banks. Impulse responses were obtained via four-variable VAR(1) model results, using quarterly data on the Fed Funds surprises, banks' asset-weighted average balance sheet size and efficiency ratios, and deposit and repo sensitivities. The Y-axis shows the variable response, X-axis shows the number of years since the given observation date. The graphs are presented for the full, pre-GFC, GFC/ZIRP, and post-GFC samples.

Panel A. Repo-Sensitive Banks



Panel B. High-Delinquency Banks

