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Monetary Policy and Bank Funding Costs: Patterns and Predictability in the Transmission of the Policy Rate to U.S. Banks' Funding Costs*

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August 7, 2025

Abstract

This paper shows that U.S. commercial banks' funding betas rise predictably with the length, magnitude, and direction of each monetary policy cycle: longer cycles and those with larger changes in the policy rate yield stronger pass-through in both tightening and loosening cycles, with modest asymmetry favoring slightly greater transmission during loosening cycles. Nondeposit liabilities consistently adjust more than deposits. Crucially, at the aggregate banking-system level and across banks grouped by size, this cycle-dependent relationship has remained remarkably stable over three decades, highlighting the durability and predictability of interest-rate transmission to banks' funding costs.

JEL Codes: C22, E44, G21

Keywords: Bank funding betas; Deposit vs. nondeposit funding costs; Monetary policy cycles; Interest-rate transmission

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1 Introduction

Banks fund their assets through a combination of equity and debt, with debt funding split into deposits and nondeposit liabilities.[1] As banks compete with other financial institutions for these funding sources, they must carefully manage the rates paid on deposits and nondeposit liabilities to remain attractive to creditors and investors while maintaining profitability. A key determinant of these rates is the central bank's policy rate, which directly and indirectly influences the cost of various forms of bank funding. When the Federal Reserve adjusts its policy rate, banks must recalibrate their funding costs, particularly deposit rates, to retain depositors while mitigating the effect on interest expenses and profitability. Understanding whether the pass-through of policy rate changes to funding costs is stable and predictable has important implications for financial stability. If banks' funding costs rise too quickly relative to asset yields, net interest margins may compress, eroding profitability and potentially incentivizing greater risk-taking. At the same time, lower profitability can reduce banks' resilience to shocks, increasing financial fragility. These dynamics can amplify financial stress, particularly in environments with rapidly changing policy rates, underscoring the importance of understanding how predictably funding costs adjust to monetary policy shifts.

In this paper, we examine the transmission of policy rate changes to U.S. banks' funding rates using aggregated data constructed from individual bank observations. We analyze both overall trends and differences across bank-size categories over multiple monetary policy cycles since the mid-1980s. We then assess whether these relationships are stable and predictable across cycles.

This paper contributes to the existing literature on the transmission of monetary policy through banks, which has been widely explored in studies such as Bernanke and Blinder (1992), Kashyap and Stein (2000), Jiménez et al. (2012), and Drechsler, Savov, and Schnabl (2017). These papers examine how changes in monetary policy affect banks' lending behavior

[1] Examples of nondeposit liabilities include short-term wholesale funding in the form of repurchase agreement transactions or Federal Home Loan Bank advances as well as more stable long-term debt.

and aggregate financial conditions through the bank lending and deposit channels. Our contribution lies in documenting patterns of the transmission of policy rates to banks' funding rates, helping to assess the stability of the relationship between monetary policy and total bank funding costs.

Recent research focusing on the United States—including Kang-Landsberg and Plosser (2022) and Kang-Landsberg, Luck, and Plosser (2023); Kleymenova, Leu, and Vojtech (2024); and the Federal Reserve Bank of Kansas City (2024)—has used similar data to document the increasing sensitivity of deposit rates to policy rate changes. These studies primarily examine deposit betas, defined as the ratio of the change in banks' average deposit rates to the change in the policy rate. While they document and analyze deposit rate responsiveness to changes in the policy rate, they do not examine overall debt funding costs, leaving a gap of understanding around nondeposit liabilities. Other recent work, such as Beyer et al. (2024) and Messer and Niepmann (2023), explores structural factors affecting monetary policy pass-through to deposit rates in the euro area and across European banking systems. Our analysis extends this literature by providing a comprehensive examination of both deposit and nondeposit funding rates in the U.S. banking system, offering new insights into the stability of total funding costs over multiple monetary policy cycles.

Our findings indicate that the transmission of policy rates to banks' funding costs varies significantly across monetary policy cycles, but these differences are systematically linked to policy cycle characteristics. Specifically, we find that (1) the transmission of policy rate changes appears to be just slightly asymmetric across tightening and loosening cycles, with loosening cycles having somewhat higher funding betas than tightening cycles; (2) larger changes in the policy rate are associated with stronger pass-through (higher betas); and (3) longer cycles exhibit greater transmission of policy rate changes to funding rates. Finally, we demonstrate that a simple econometric model, which links banks' funding rates to previous funding rates and both the previous and current policy rate, provides highly accurate forecasts of total funding rates. These patterns hold both at the systemwide level and across different bank-size categories.

The remainder of this paper is structured as follows. Section 2 describes the data and methodology used to quantify policy rate transmission across monetary policy cycles and bank-size categories. Section 3 presents results for the U.S. banking system as a whole. Section 4 breaks down the findings by bank-size category, distinguishing between the top 10 largest banks in a cycle (by total assets), the next 90 largest banks (midsize), and all other banks (small). Section 5 introduces a simple econometric model to evaluate the predictability of funding rates during the most recent monetary policy tightening. The concluding section discusses the policy implications of our findings.

2 Data and Methodology

2.1 Data

To calculate funding rates in the aggregate and by bank-size category, we use data from the Consolidated Reports of Conditions and Income report (hereafter, Call Report) from the first quarter of 1987 to the second quarter of 2024. These data have information on the banks' end-of-quarter liabilities (including deposits), the average over-the-quarter level for some of the banks' liabilities, and the interest expenses incurred by banks related to these liabilities. Because we are interested in analyzing the effects of U.S. monetary policy on U.S. banks' funding rates, we would like to only use liabilities and respective interest expenses that are booked in domestic offices. However, the data do not separate either nondeposit liabilities or interest expenses between domestic and foreign. Given that deposits are the main source of funding for most U.S. banks, we decide to use domestic deposits and respective interest expenses and then use both domestic and foreign nondeposit liabilities and respective interest expenses. For internal consistency purposes, we then construct total liabilities as the sum of domestic deposits and domestic and foreign nondeposit liabilities. This measure of total liabilities will include domestic deposits and domestic nondeposit liabilities, which is what we are interested in, but it will also contain some small amount of nondeposit foreign liabilities. Although foreign nondeposit liabilities are included in our measure of total liabilities, they represent only a small fraction of total funding—on average, less than 2.7 percent. The small share of foreign nondeposit liabilities in total liabilities ensures that our results primarily reflect domestic funding cost dynamics rather than global funding market conditions.

In the analysis, we show results for the aggregate U.S. banking system and for three bank-size categories based on rankings of total assets at the beginning of each monetary policy cycle. We roll up all data to the bank holding company level where one exists. The three bank-size categories are as follows: the top 10 largest banks, the next 90 largest banks (midsize), and all other banks (small). The top 10 group's share of total assets in the banking system has grown considerably since 1987:Q1 when it was 28 percent to over 59 percent in 2024:Q2, while that of the next 90 (midsize) group has decreased since the beginning of the sample from 38 percent to just 27 percent in 2024:Q2.

In addition to the bank income statement and balance sheet data from the Call Reports, we use data on the federal funds rate (FFR) published daily by the Board of Governors of the Federal Reserve System.[2] We use these data to first identify the timing of U.S. monetary policy cycles from 1987:Q1 until now and then construct estimates of banks' funding betas.

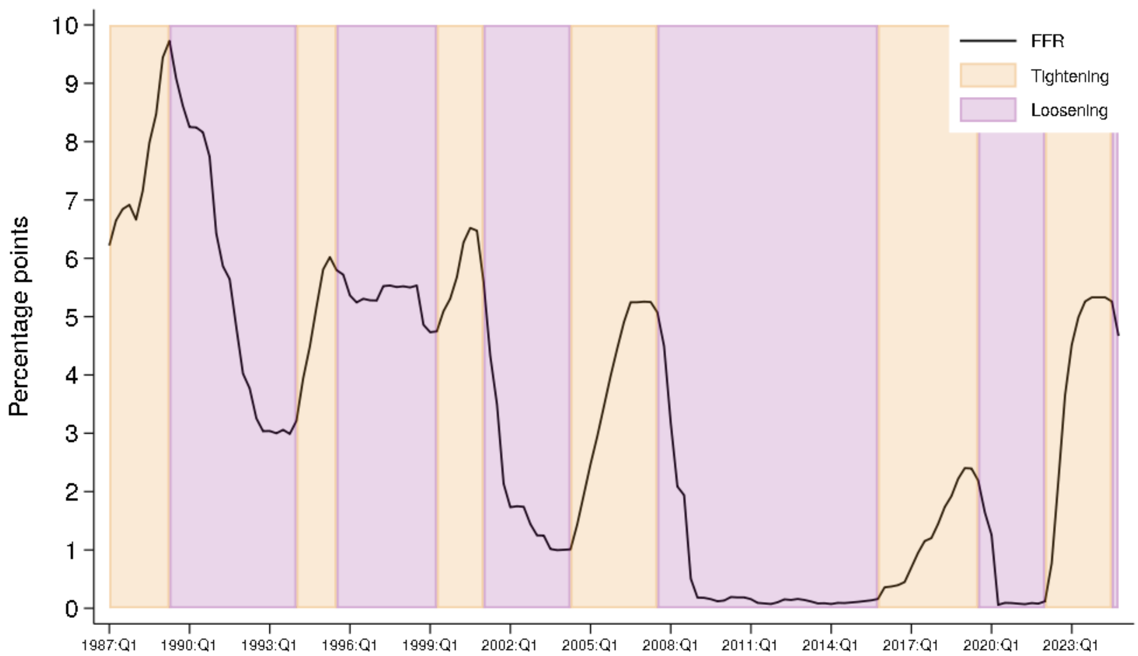
2.2 Methodology

Dating of U.S. Monetary Policy Cycles To identify U.S. monetary policy cycles from 1987:Q1 to 2024:Q4, we apply a simple rule: A shift from a tightening to a loosening cycle (or vice versa) occurs when the policy rate begins to decrease (increase) for the first time after the previous cycle started. The only exception to this rule is the 1995:Q3–1999:Q1 cycle, during which policy adjustments were interpreted as recalibrations rather than a distinct cycle. Figure 1 presents the resulting monetary policy cycles over the period of analysis. Our sample includes six tightening cycles and six loosening cycles, each varying in length

[2]Federal funds rate data are available here: https://www.federalreserve.gov/releases/h15.

and total change in the policy rate. However, we exclude the most recent loosening cycle, which began in September 2024, as it includes only two quarters of data.

Figure 1: U.S. Monetary Policy Cycles, 1987–2024



Note: FFR is federal funds rate. The key identifies shaded areas in order from left to right.

Source: St. Louis Federal Reserve Bank FRED database and authors' calculations.

Banks' Funding Betas To calculate bank funding rates (FR) using balance sheet data, we divide a bank's interest expenses in a given quarter by the average level of liabilities during the quarter and multiply by 400 to annualize and express it as a percentage:[3]

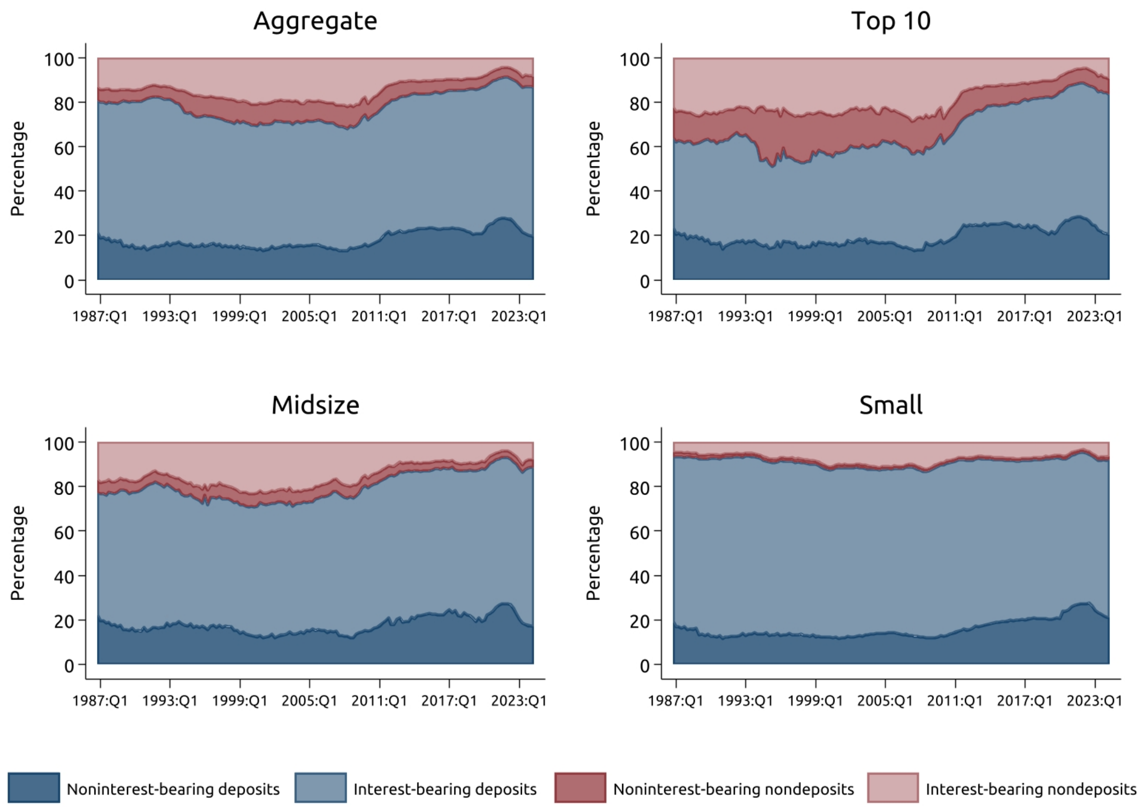
$$FR_t = \frac{\text{Interest expenses}_t}{\text{Liabilities}_t} \cdot 400 \tag{1}$$

[3]For the cases where banks' report the average over the period (schedule K), we use that amount as the measure of liabilities (savings deposits, time deposits, federal funds purchased and securities sold under agreements to repurchase, and other borrowed money). For the cases where these are unavailable, we compute the average between periods t and t-1 to get an estimate of the average of that variable during the quarter (transaction deposits, trading liabilities, subordinated notes and debentures, and other liabilities).

In our analysis, we consider three funding rates: total, deposit, and nondeposit. The total funding rate is the weighted average of the deposit and nondeposit funding rates. The deposit funding rate represents the annualized rate banks pay on deposits, while the nondeposit funding rate corresponds to the annualized rate paid on nondeposit liabilities. Each of these funding rates is calculated with both the interest-bearing and noninterest-bearing related liabilities in the denominator. We make this choice, rather than dividing only by the interest-bearing liabilities, to reflect the full picture of banks' funding costs. Neglecting to consider the noninterest-bearing liabilities does not allow for a complete analysis of how changes in the policy rate affect banks' funding costs and financial stability more broadly.

Figure 2 shows the decomposition of total bank liabilities through time into deposits and nondeposits, both interest bearing and noninterest bearing, for the aggregate banking system and the three bank-size categories. Deposits, specifically those that are interest bearing, make up the largest share of bank liabilities for all three groups over the full horizon. The top 10 group holds the most nondeposit liabilities, followed by the midsize category and then the small category. All three groups saw a retraction from nondeposit liabilities from 2008 to early 2022, which is in part due to regulatory changes with respect to nonstable funding such as short-term wholesale funding. Within nondeposit liabilities, the top 10 group holds the most noninterest-bearing nondeposits, which includes accounts payable and deferred tax liabilities. Banks in the small category are almost entirely funded by deposits, with most of them being interest bearing.

Figure 2: Decomposition of Bank Liabilities in the Aggregate and by Bank-Size Category



Note: The key identifies shaded areas in order from bottom to top.
Source: Call Report and authors' calculations.

To compute the funding betas (total funding, deposit, and nondeposit), we follow the literature and define the beta (β_{FR}) as the ratio of the change in the funding rate to the change in the policy rate (FFR) over a monetary policy cycle:

$$\beta_{FR} = \frac{FR_{end} - FR_{start-1}}{FFR_{end} - FFR_{start-1}} \tag{2}$$

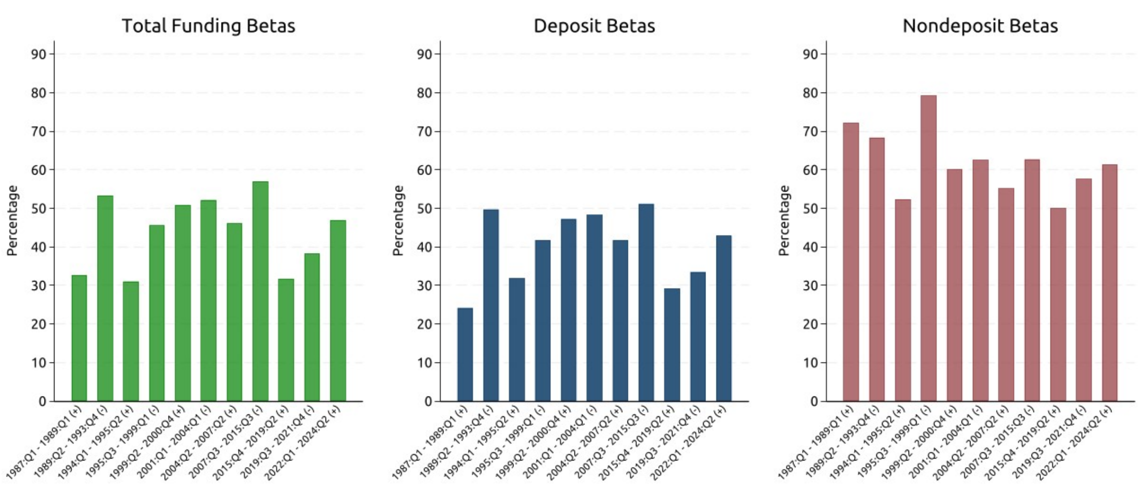
To account for potential changes in funding costs or the policy rate at the beginning or end of a quarter, we measure changes in both the numerator and denominator from the quarter before the start of the monetary policy cycle (start-1) to the final quarter (end) of the cycle. Both FR and FFR are averaged over each quarter. To ensure comparability at the start and end of each cycle, we use a balanced sample across all identified monetary policy cycles.

3 Banking Systemwide Results

Using the data and methodology described in the previous section, we first compute total funding, deposit, and nondeposit betas for each identified monetary policy cycle at the banking system level. We then examine how deposit and nondeposit betas vary and assess how key characteristics of the monetary policy cycle—direction, magnitude of the policy rate change, and cycle length—influence the estimated betas.

Funding Betas across Cycles Figure 3 presents the estimated total funding, deposit, and nondeposit betas for the 11 monetary policy cycles included in the sample at the banking system level.

Figure 3: Total Funding, Deposit, and Nondeposit Betas, 1987:Q1–2024:Q2

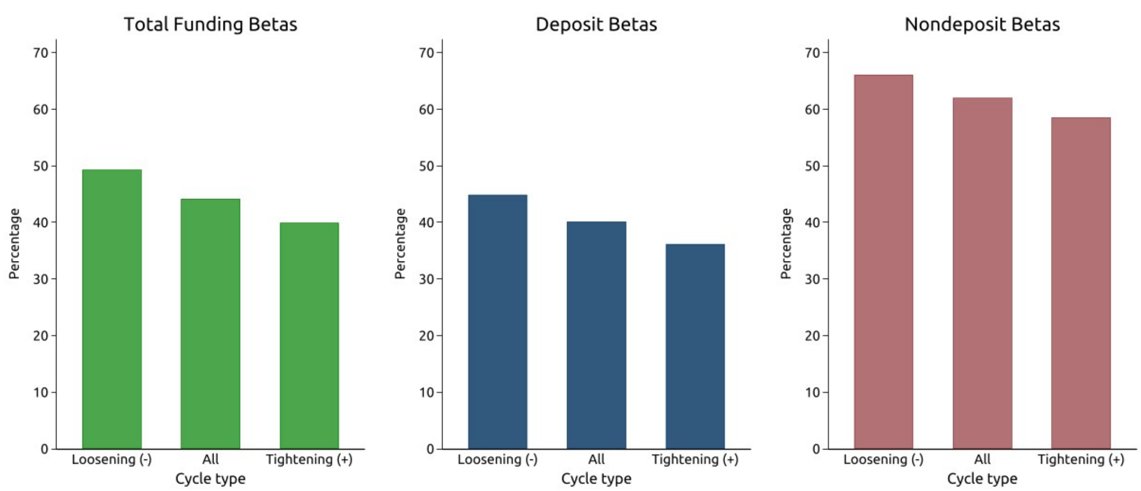


Source: Call Report and authors' calculations.

As shown in Figure 3, while funding betas vary across cycles and by type, several patterns emerge at the banking system level. First, deposit betas are consistently lower than nondeposit betas, suggesting a systematically higher pass-through of policy rate changes to nondeposit liabilities. Second, deposit betas remain at or below around 50 percent across the 11 cycles, indicating that banks maintain a substantial spread on deposits, supported by strong demand that allows them to command a markup over the policy rate. Third, total funding betas are closer in value to deposit betas, reflecting that deposits make up the largest share of bank liabilities on average.

Bank Funding Betas in Loosening and Tightening Monetary Policy Cycles Figure 4 highlights substantial variation in funding betas across cycles. One potential factor driving this heterogeneity is whether monetary policy is in a tightening or loosening phase. Figure 3 plots the average total funding, deposit, and nondeposit betas across all cycles, as well as separately for tightening and loosening cycles.

Figure 4: Average Funding Betas, by Type of Monetary Policy Cycle

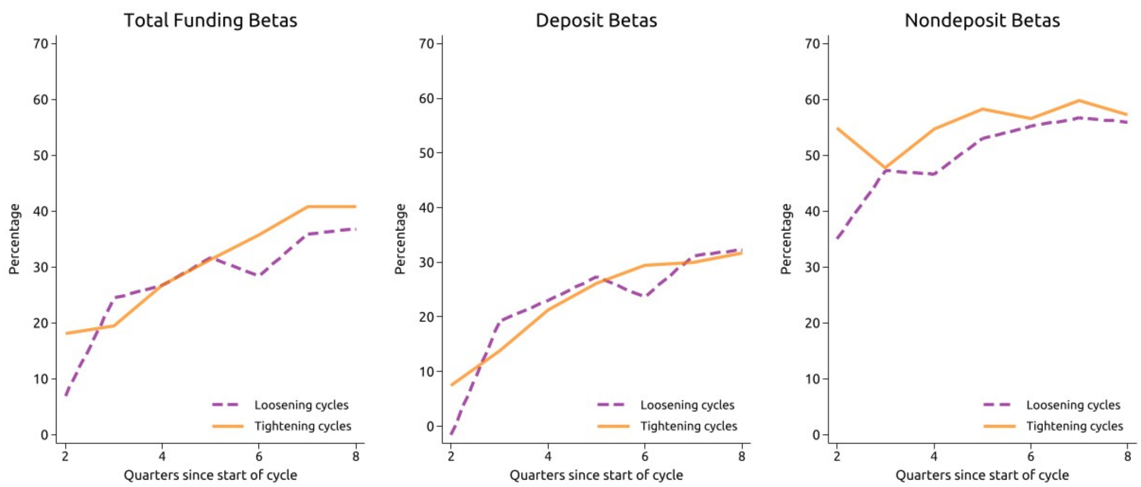


Note: Data included range from 1987:Q1 to 2024:Q2.

Source: Call Report and authors' calculations.

As shown in Figure 4, funding betas tend to be slightly higher in loosening cycles than in tightening cycles. This pattern holds for both deposit and nondeposit betas. However, these differences are no longer statistically significant when controlling for other aspects of a monetary policy cycle, including the magnitude of the policy rate change and length of the cycle. These results reflect betas over the entire monetary policy cycle, which may obscure important differences in how betas evolve over time. For example, banks may adjust deposit rates more quickly at the start of loosening cycles, but this dynamic is not captured when looking only at average betas for the full cycle. To explore this possibility, Figure 5 examines total funding, deposit, and nondeposit betas across tightening and loosening cycles for quarters 2 through 8 of the monetary policy cycle, allowing us to assess whether short-term asymmetries emerge that are not apparent in the aggregate results of Figure 4.[4]

Figure 5: Median Funding Betas, by Monetary Policy Cycle Direction



Source: Call Report and authors' calculations.

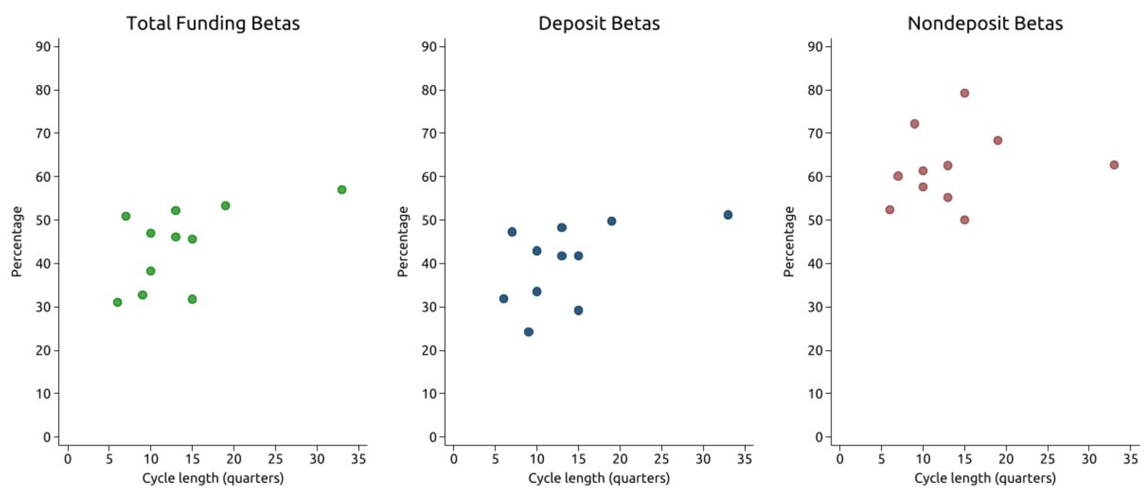
Figure 5 shows that while betas tend to increase over the course of a monetary policy cycle, there are no systematic differences between loosening and tightening cycles. Overall, the results in Figures 4 and 5 suggest that while cycle type does play a role in determining funding betas, that role may be less important than that of other monetary policy cycle

[4]We restrict the analysis shown in Figure 5 to quarters 2 through 8 of the cycle because first-quarter results are highly noisy and not representative. Additionally, extending beyond eight quarters would have progressively reduced the sample size, as fewer cycles last that long, making estimates less reliable. Note that two tightening cycles are shorter than eight quarters. The 1994:Q1–1995:Q2 cycle lasts six quarters, and the 1999:Q2–2000:Q4 cycle lasts seven quarters. Also, we choose to show the median across cycles instead of the average because the median is more robust to noise in small samples.

characteristics.

Bank Funding Betas and the Length of the Monetary Policy Cycle The length of a monetary policy cycle is another dimension that may influence estimated bank funding betas. Because the transmission of policy rate changes to banks' funding costs is not immediate, betas are expected to increase over time. Figure 4 already illustrates the gradual pass-through of policy rate changes to funding rates, but it only captures the first eight quarters of each cycle. In this section, we examine the relationship between total cycle length and estimated betas. Figure 6 plots total funding, deposit, and nondeposit betas against the length of each monetary policy cycle.

Figure 6: Bank Funding Betas, by Length of the Monetary Policy Cycle



Source: Call Report and authors' calculations.

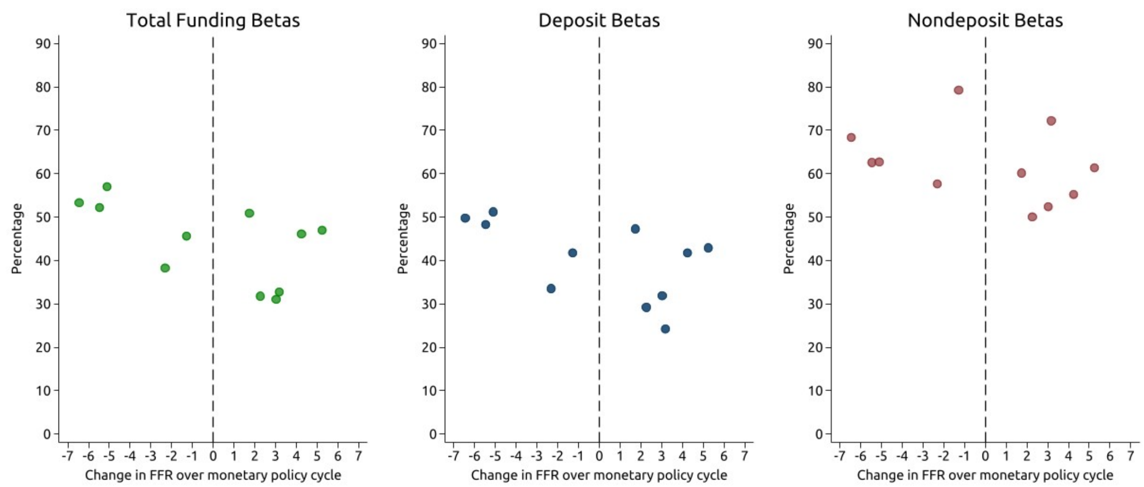
Focusing first on deposit betas (the middle panel), Figure 6 suggests that betas tend to increase with cycle duration, though the relationship is not strictly monotonic and may be bounded from above. For nondeposit betas (the right panel), the pattern also suggests a positive relationship between betas and cycle length, though, again, with an upper bound.[5]

[5]In practice, betas can reach 1 or even exceed it, depending on market conditions. The idea of an upper bound is based purely on empirical observation rather than a theoretical constraint.

Finally, for total funding betas (the left panel), which represent a weighted average of deposit and nondeposit betas, we observe a similar pattern. Betas tend to rise as the cycle lengthens, but the increase appears limited beyond a certain point.

Bank Funding Betas and the Total Change in the Policy Rate The third and final characteristic of the monetary policy cycles we examine is the total change in the policy rate from the start to the end of each cycle. Figure 7 plots total funding, deposit, and nondeposit betas against the total change in the policy rate for each identified monetary policy cycle.

Figure 7: Bank Funding Betas and the Total Change in the Policy Rate



Note: FFR is federal funds rate.

Source: Call Report and authors' calculations.

The results in Figure 7 suggest that bank funding betas tend to increase with the magnitude of the policy rate change, with a similar effect for both rate hikes and cuts.

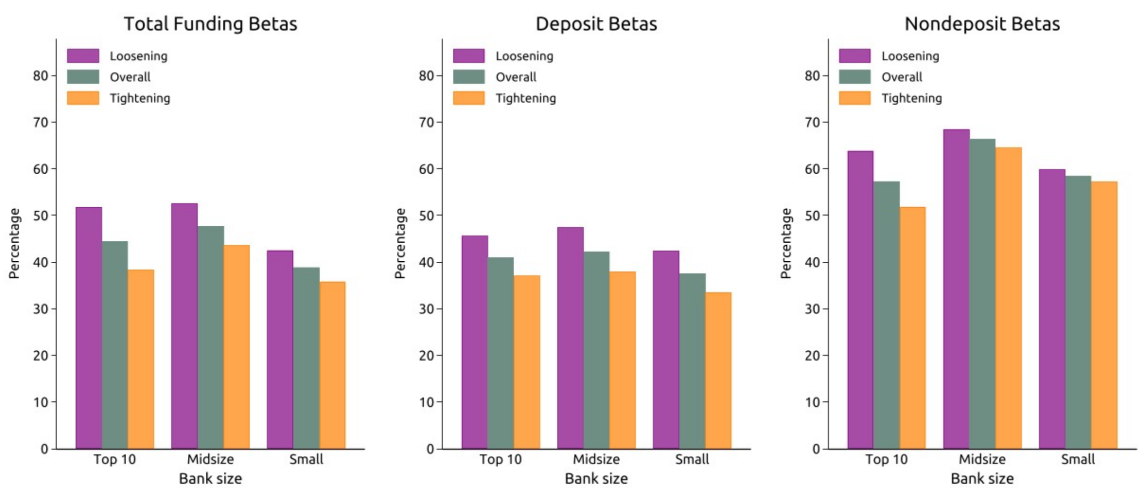
Altogether, the results linking funding betas to cycle direction, length, and magnitude of policy rate changes indicate that the pass-through of policy rates to banks' funding costs follows consistent and predictable patterns. This discovery suggests that a relatively simple model—allowing for delayed and proportional transmission of policy rate changes—could effectively predict bank funding cost adjustments.

4 Results by Bank-Size Categories: Top 10, Midsize, and Small

In this section, we extend our analysis by examining whether the patterns observed at the banking system level hold across broad bank-size categories, largely defined by total assets. Following the approach in the previous section, we assess how monetary policy cycle characteristics—direction, length, and magnitude of policy rate changes—affect funding betas across the top 10 largest, midsize, and small banks.

Bank Funding Betas in Loosening and Tightening Monetary Policy Cycles, by Bank-Size Category We first examine how the direction of policy rate changes affects the pass-through to funding costs across different bank-size categories. The results of this analysis are shown in Figure 8.

Figure 8: Funding Betas, by Direction of Monetary Policy Cycle and Bank-Size Category

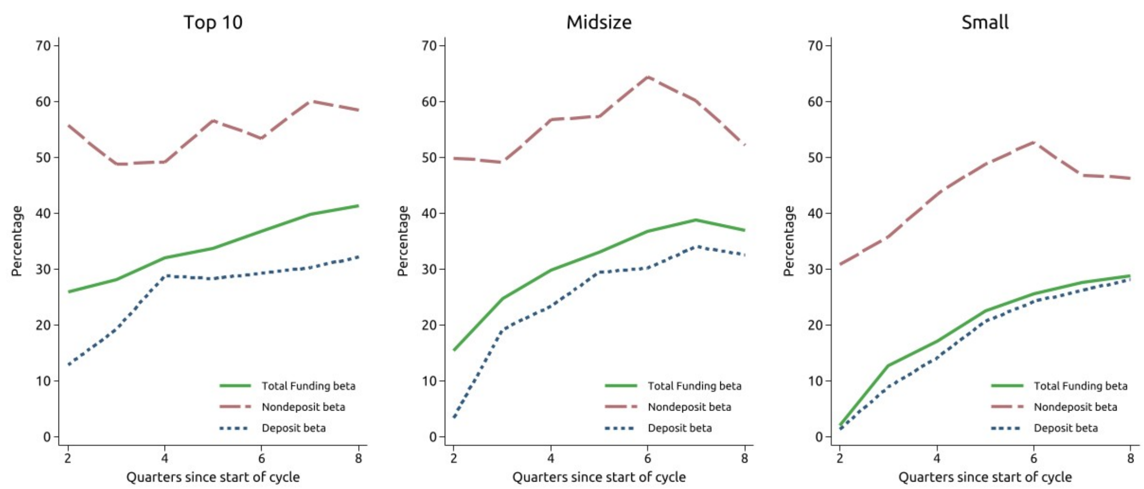


Note: Data included range from 1987:Q1 to 2024:Q2. The key identifies bars in order from left to right.
Source: Call Report and authors' calculations.

Consistent with the banking system–level results, Figure 8 shows that loosening cycles tend to be associated with higher total funding and deposit betas across all bank-size categories. However, these differences are only statistically significant for the total funding betas and deposit betas for the top 10 and midsize groups.

Bank Funding Betas over Cycles, by Bank-Size Category Next, Figure 9 examines median total funding betas over the course of the monetary policy cycle across bank-size categories to identify potential differences in how betas evolve over time. This section considers all monetary policy cycles together (loosening and tightening) rather than analyzing them separately, as in the banking system–level results.

Figure 9: Median Funding Betas over the Monetary Policy Cycle, by Bank-Size Category

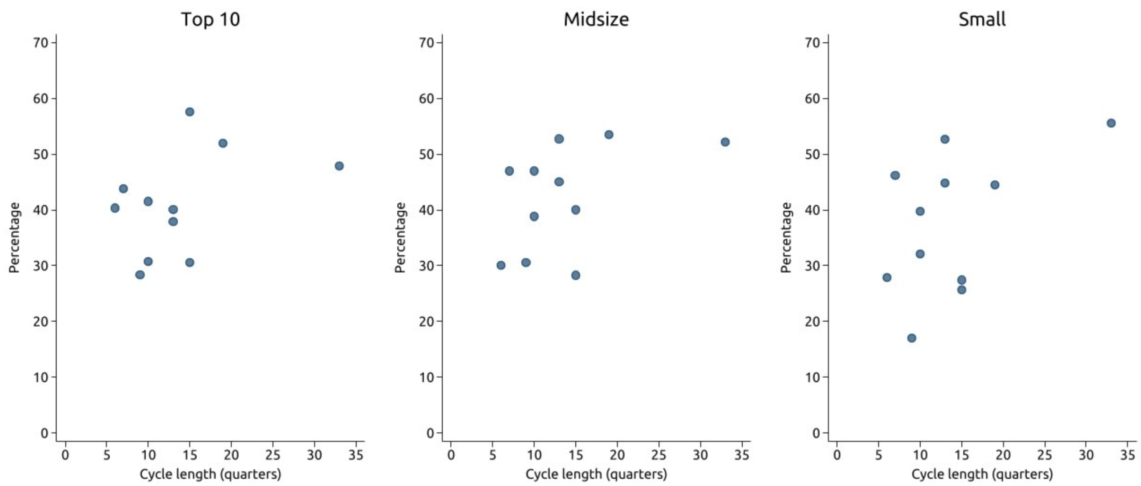


Source: Call Report and authors' calculations.

Consistent with the banking system–level results, Figure 9 shows that funding betas tend to increase as the monetary policy cycle progresses. Across all bank-size categories, nondeposit betas remain systematically higher than deposit betas. Additionally, the gap between total funding betas and deposit betas is largest for the top 10 group, followed by midsize banks, with small banks showing the smallest difference. These differences largely reflect the fact that the top 10 group relies more on nondeposit funding than smaller banks throughout the monetary policy cycle.

Bank Funding Betas and the Length of the Monetary Policy Cycle, by Bank-Size Category Next, we broaden the analysis from within-cycle betas to examine how total cycle length affects funding betas across the three bank-size categories. Figures 10, 11, and 12 display deposit, nondeposit, and total funding betas, respectively, by cycle length and bank size.

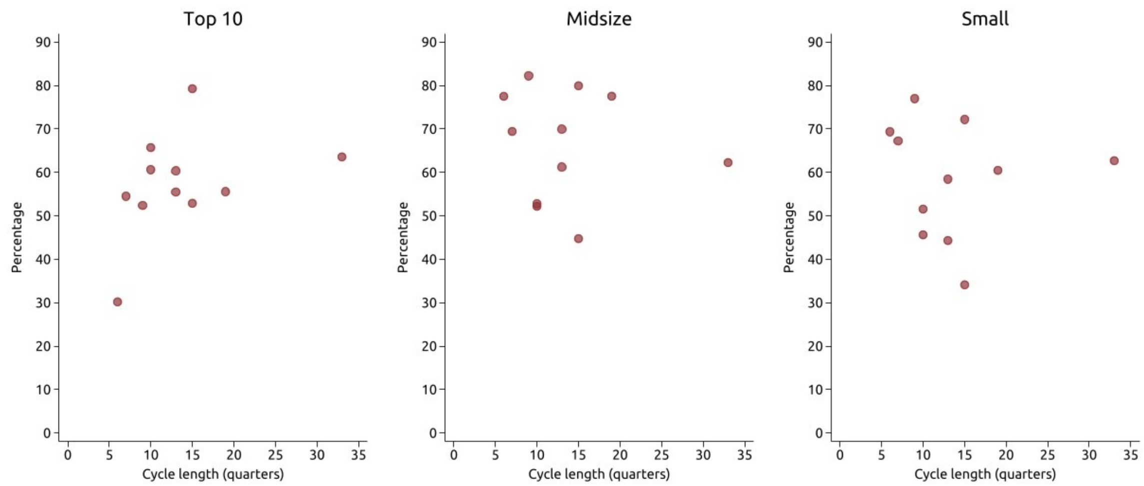
Figure 10: Deposit Betas, by Cycle Length and Bank-Size Category



Source: Call Report and authors' calculations.

The results in Figure 10 indicate a positive relationship between cycle length and deposit betas for small and intermediate-sized banks, while the relationship is weaker for the top 10 group. Similar to the banking system–level results, deposit betas tend to increase as cycle length extends, though the relationship appears bounded. This result suggests that longer cycles lead to greater, albeit limited, pass-through of policy rate changes to deposit funding.

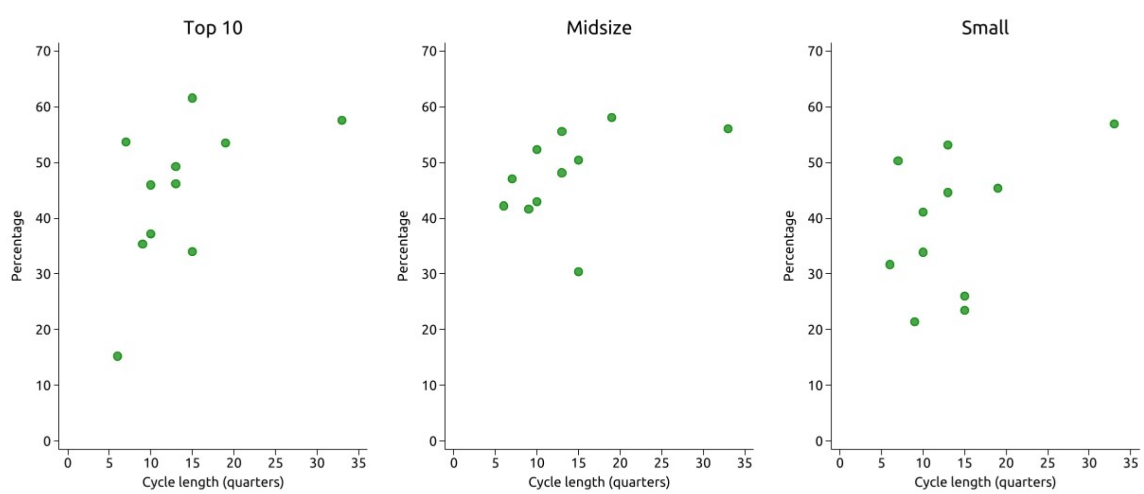
Figure 11: Nondeposit Betas, by Cycle Length and Bank-Size Category



Source: Call Report and authors' calculations.

By contrast, Figure 11 shows no significant relationship between cycle duration and nondeposit betas for any bank-size category. This finding could reflect the fact that policy rate pass-through to nondeposit funding occurs more quickly than for deposit funding, limiting the effect of longer cycles.

Figure 12: Total Funding Betas, by Cycle Length and Bank-Size Category

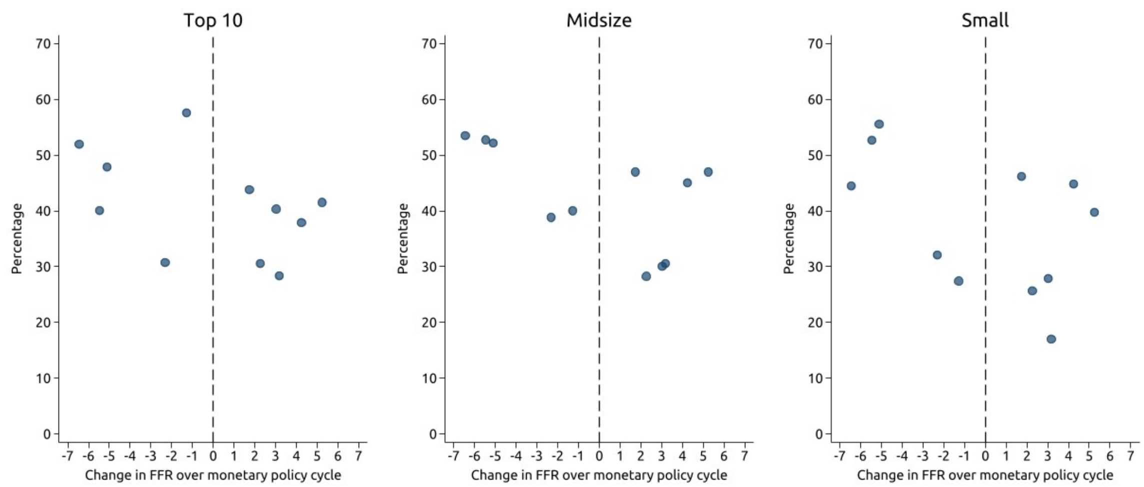


Source: Call Report and authors' calculations.

Finally, Figure 12 shows that all bank-size categories exhibit a positive relationship between cycle length and total funding betas. This relationship is driven by the primary reliance on deposits for bank funding for all bank-size categories.

Bank Funding Betas and the Total Change in the Policy Rate, by Bank-Size Category Lastly, we examine how the total change in the policy rate from the start to the end of a cycle affects funding betas across bank-size categories. The results of this analysis are shown in Figure 13.

Figure 13: Deposit Betas and the Total Change in the Policy Rate, by Bank-Size Category

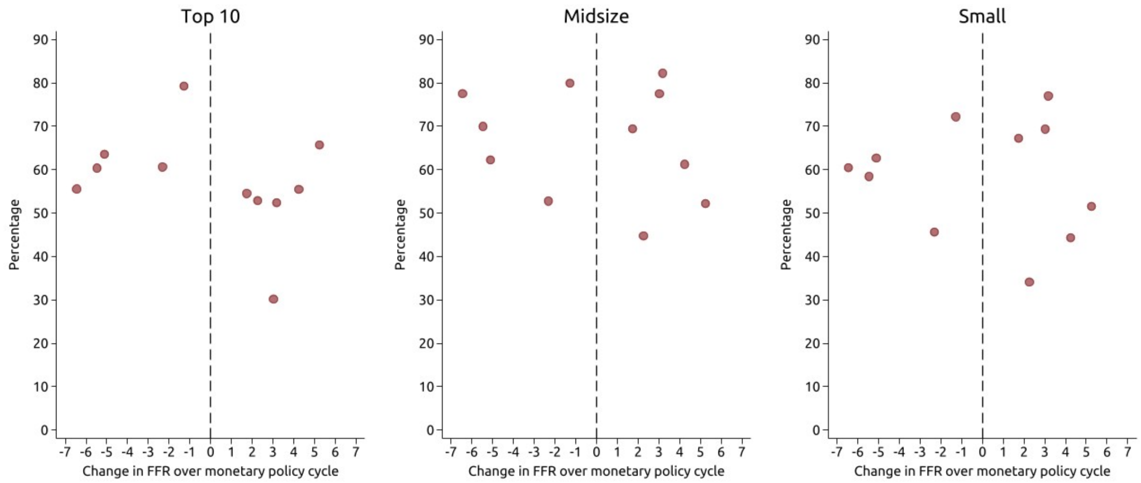


Note: FFR is federal funds rate.

Source: Call Report and authors' calculations.

The results in Figure 13 indicate that all bank-size categories experience larger deposit betas when the policy rate change is more pronounced, whether increasing or decreasing, like the pattern observed at the banking system level.

Figure 14: Nondeposit Betas and the Total Change in the Policy Rate, by Bank-Size Category

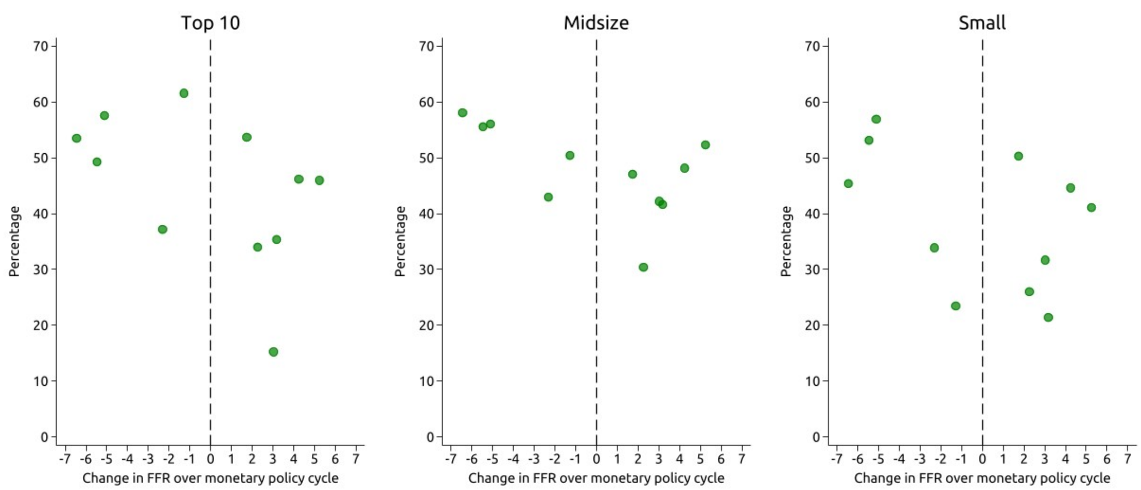


Note: FFR is federal funds rate.

Source: Call Report and authors' calculations.

In contrast to deposit betas, Figure 14 shows no clear relationship between nondeposit betas and the magnitude of the policy rate change for any bank-size category.

Figure 15: Funding Betas and Total Change in the Policy Rate, by Bank-Size Category



Note: FFR is federal funds rate.

Source: Call Report and authors' calculations.

Figure 15 shows that total funding betas are strongly positively correlated with the magnitude of policy rate changes for midsize and small banks. The relationship is less clear for the top 10 group, likely because the banks in this group have more nondeposit liabilities, which do not have a strong correlation with the change in the policy rate. Figures 13 and 14 indicate that this relationship is driven by deposit funding for midsize and small banks.

5 Simple Model of Funding Rates and Policy Rates

The results in Sections 3 and 4 suggest that banks' funding rates evolve in relatively predictable ways in response to changes in the policy rate. In this section, we introduce a simple econometric model to test this hypothesis. The model is specified as follows:

$$FR_t^{i,j} = \alpha + \rho FR_{t-1}^{i,j} + \beta FFR_t + \varphi FFR_{t-1} + \varepsilon_t^{i,j} \tag{3}$$

This model postulates that the current funding rate (FR_t) depends on both the previous period's funding rate (FR_{t-1}) and level of the policy rate (FFR_{t-1}), as well as the current level of the policy rate (FFR_t); this model is commonly known as an error-correction model. We will analyze estimates of the long-run funding betas, which we can obtain from this model. Long-run funding betas are the estimate of the pass-through of changes in the federal funds rate assuming that no other shocks hit the economy or banks during an extended period. The long-run beta can be estimated with the following calculation utilizing the regression coefficients:[6]

$$\beta_{long-run} = \frac{\beta + \varphi}{1 - \rho} \tag{5}$$

[6]If we write the econometric model in its error-correction form, the long-run beta corresponds to the coefficient relating the level of the federal funds rate and the funding rate:

$$\Delta FR_t = \alpha + \beta \Delta FFR_t + (\rho - 1)\left[FR_{t-1} - \frac{\beta + \varphi}{1 - \rho} FFR_{t-1}\right] + \varepsilon_t \tag{4}$$

For this analysis, we consider four cases, represented by the superscript i, which denotes total funding rates for the full banking system, the top 10 group, midsize banks, and small banks. Additionally, we distinguish between three funding rate types, denoted by the superscript j: total funding, deposit, and nondeposit funding rates.

Table 1: Estimation Results

	Aggregate	Top 10	Midsize	Small
Funding Rate				
Funding Rate$_{t-1}$	0.88***	0.87***	0.85***	0.88***
	(0.015)	(0.034)	(0.017)	(0.018)
FFR$_t$	0.33***	0.35***	0.33***	0.24***
	(0.019)	(0.030)	(0.023)	(0.018)
FFR$_{t-1}$	-0.24***	-0.26***	-0.23***	-0.15***
	(0.023)	(0.044)	(0.022)	(0.015)
Constant	-0.01	-0.02	0.01	0.01
	(0.015)	(0.019)	(0.018)	(0.020)
Observations	149	149	149	149
R-Squared	0.998	0.989	0.998	0.998
Long-Run Beta	0.73***	0.72***	0.71***	0.74***
	(0.035)	(0.059)	(0.030)	(0.029)
Deposit Rate				
Deposit Rate$_{t-1}$	0.71***	0.51***	0.63***	0.89***
	(0.036)	(0.042)	(0.042)	(0.012)
FFR$_t$	0.27***	0.24***	0.23***	0.21***
	(0.032)	(0.049)	(0.045)	(0.017)
FFR$_{t-1}$	-0.09***	-0.01	-0.02	-0.13***
	(0.033)	(0.053)	(0.052)	(0.014)
Constant	-0.25***	-0.27***	-0.14**	-0.09***
	(0.057)	(0.067)	(0.058)	(0.018)
Observations	149	149	149	149
R-Squared	0.993	0.982	0.991	0.998
Long-Run Beta	0.62***	0.48***	0.59***	0.75***
	(0.065)	(0.043)	(0.053)	(0.056)
Nondeposit Rate				
Nondeposit Rate$_{t-1}$	0.45***	0.54***	0.34***	0.62***
	(0.035)	(0.095)	(0.095)	(0.133)
FFR$_t$	0.65***	0.73***	0.59***	0.53***
	(0.094)	(0.198)	(0.039)	(0.059)
FFR$_{t-1}$	-0.20**	-0.29	-0.13**	-0.29***
	(0.091)	(0.193)	(0.061)	(0.104)
Constant	0.49***	0.19	0.91***	1.02***
	(0.081)	(0.170)	(0.083)	(0.156)
Observations	149	149	149	149
R-Squared	0.984	0.945	0.981	0.962
Long-Run Beta	0.81***	0.95***	0.71***	0.63***
	(0.064)	(0.194)	(0.027)	(0.072)

Note: Heteroskedasticity and serial correlation standard errors are shown in parentheses. Estimation sample is from 1987:Q1 to 2024:Q2. ***, **, and * denote statistical significance at 1 percent, 5 percent, and 10 percent, respectively. FFR is federal funds rate.

Source: St. Louis Federal Reserve Bank FRED database, Call Report, and authors' calculations.

The first takeaway from the results in Table 1 is that the policy rate and previous policy and funding rates together explain nearly all the variance in funding rates, as indicated by the very high R2 values across all models. This finding is consistent with the discussions in previous sections, which suggest that bank funding rates evolve in predictable ways with respect to the changes of the policy rate but also that there is some time to adjustment, as reflected by positive and statistically significant coefficients on the lagged value of the dependent variable. Now we turn to the discussion of long-run betas, first for the banking system as a whole and next by bank-size category.

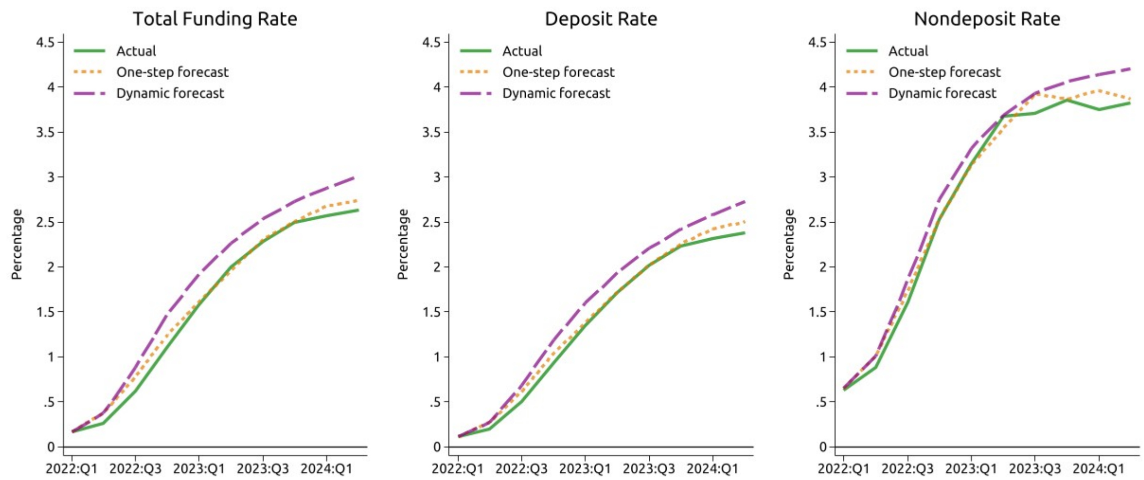
Banking System-Level Model Results Examining the estimates of long-run betas by funding type provides further insight into the pass-through of the policy rate to funding costs. These estimates are different from what we observe in practice because it is never the case that there is a very long period between changes in policy rates with no other shocks hitting banks or the economy. However, this exercise allows for a better comparison of the full pass-through of policy rates to banks' funding costs.

The leftmost column of Table 1 shows that the long-run beta is highest for nondeposit liabilities (0.81) and lowest for deposit liabilities (0.62), with the total funding long-run beta being in between the two (0.73). This result suggests that nondeposit funding costs are more responsive to current conditions and, therefore, less dependent on past values (i.e., less persistent) than deposit funding costs.

Model Results by Bank-Size Category Next, we estimate the model separately for each bank-size category. The results show that small banks have the highest long-run betas for total funding and deposits, whereas they have the lowest long-run beta for nondeposit funding. The smaller banks rely more on deposits for funding and therefore may need to pass through changes in the policy rate more than the larger banks. Also, this group of banks has the lowest long-run beta for nondeposit funding, suggesting that their nondeposit funding is less responsive to changes in monetary policy. The lower long-run nondeposit funding beta for small banks is paired with the largest constant, a result that is consistent with the reduced sensitivity to monetary policy of nondeposit funding costs. The top 10 group has the lowest long-run beta for deposit funding (0.48), indicating that these banks are more likely to let deposits run off and replace them with nondeposit funding, which they can access more easily. The top 10 group has the highest long-run beta for nondeposit funding (0.95), meaning that changes in the policy rate pass almost entirely to these banks' nondeposit funding costs. The long-run betas for the midsize group are in between those of the top 10 group and small banks for both deposit and nondeposit funding.

Forecasting Bank Funding Rates Using the estimated model, we assess its ability to forecast the evolution of funding rates during the most recent monetary policy cycle (2022:Q1–2024:Q2) by comparing observed funding rates with the model's predictions based on the observed policy rate and the previous period's funding rate. For this exercise, we re-estimated the model using data only through the end of 2021:Q4, just before the most recent monetary policy cycle started. For brevity, we focus on the aggregate banking system funding rate, considering total, deposit, and nondeposit funding rates. Figure 16 presents the results of this analysis.

Figure 16: Funding Rate Model Forecasts



Source: St. Louis Federal Reserve Bank FRED database, Call Report, and authors' calculations.

As shown in Figure 16, the model performs exceptionally well in forecasting actual funding rates throughout the most recent monetary policy cycle for both a one-step-ahead forecast and a fully dynamic forecast. Discrepancies emerge only toward the end of the forecast period for the one-step forecast, but these differences remain relatively small.[7] In line with the results in Sections 3 and 4, the results from this forecasting exercise show once again that, conditional on the path of interest rates, aggregate funding rates are quite predictable (or at least their predictability has held in the historical sample considered).

6 Concluding Remarks

In this paper, we documented patterns of policy rate pass-through in the U.S. banking system for total, deposit, and nondeposit funding over 11 monetary policy cycles since 1987, analyzing these effects for the banking system as a whole and across three bank-size categories—the top 10 largest banks, the next 90 largest banks (midsize), and small banks. We also assessed the degree of predictability in funding rates in response to policy rate changes.

[7]Similar results are observed when we do the same analysis by bank-size category.

Our findings indicate that estimated funding betas vary significantly across monetary policy cycles but that this variation is highly correlated with key characteristics of the policy cycle. Specifically, we find that both cycle length and the magnitude of the policy rate change exhibit a strong positive relationship with total funding betas at the aggregate banking system level. Moreover, the transmission of policy rate changes to funding rates is slightly more pronounced for loosening cycles compared with tightening cycles. In the final section of this paper, we introduced a simple econometric model that relates the current funding rate to both the current policy rate and the previous policy rate and funding rate to better understand the transmission of policy rates to bank funding costs. The results show that this model provides an exceptionally strong fit to the data and performs remarkably well in forecasting bank funding rates.

Overall, the findings in this paper suggest that banks' funding rates are relatively predictable at both the aggregate level and across broadly defined bank-size categories. Furthermore, our analysis highlights that monetary policy cycle characteristics play an important role in explaining observed differences in funding betas across cycles.

It is important to note, however, that these results are based on aggregate statistics, which limits the ability to draw direct implications for individual banks. Bank-specific factors likely play a significant role in determining individual banks' funding responses, meaning that results at the bank level may differ substantially from the aggregate trends identified in this paper. Analyzing funding rate dynamics at the individual bank level remains an important question but is beyond the scope of this work.

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