Why Do Net Interest Margins Behave Differently across Banks as Interest Rates Rise? Evidence from the Recent Tightening Cycle

By Brendan Laliberte and Rajdeep Sengupta

The Federal Reserve began raising the federal funds rate to reduce persistent inflation in March 2022. Rising interest rates can influence bank profitability both positively (by increasing payments from those with floating-rate debt) or negatively (by forcing banks to offer higher returns to their depositors). Which of these effects dominates depends on both the speed with which loan and deposit rates adjust to rate hikes and on banks' business models.

Although most banks became more profitable during the 2022–23 tightening cycle, a smaller group of banks saw consistent decreases in their net interest margins (NIMs). Understanding why these banks' NIMs declined may provide useful insight to policymakers. With the spring 2023 banking turmoil revealing significant vulnerabilities on some bank balance sheets, banks experiencing persistently decreasing margins could be more susceptible to further rate hikes or shocks that could affect the quality of their assets.

In this article, we explore the differences in bank NIMs and their drivers over the 2022–23 tightening cycle. We find that the distribution of bank NIMs widened over this period, largely due to differences in banks' business models. Specifically we find that "margin-decreasing" banks were more involved in capital markets, with higher shares of

Brendan Laliberte is a research associate at the Federal Reserve Bank of Kansas City. Rajdeep Sengupta is a senior economist at the bank..

trading assets and non-deposit funding even prior to the rate hike cycle. Declines in NIMs at these banks were driven mainly by increases in yields on their non-deposit funding, rather than changes in their shares of deposit versus non-deposit funding. In addition, margin-decreasing banks are not only vulnerable because of lower profitability; since the pandemic they have increased their exposure to commercial real estate (CRE) and are now relatively more exposed to CRE concentration risk. If policy persists on a higher rate path and CRE property prices continue to fall, the balance sheets of margin-decreasing banks could experience significant stress.

Section I shows how rising rates in the 2022–23 tightening cycle have changed bank margins over six quarters of monetary policy tightening. Section II analyzes the drivers of bank performance over the rate hiking cycle. Section III considers vulnerabilities for banks going forward and implications for regulators.

I. Bank NIMs during Rate Hiking Cycles

Changes in the federal funds rate can influence bank NIMs through three main channels.[1] First, over short horizons, bank NIMs may vary with the *level* of interest rates, with higher policy rates associated with higher NIMs. This association is driven by how changes in short-term policy rates pass through to yields on assets and liabilities. Bank assets, such as loans, tend to be floating-rate contracts, benchmarked to reference rates that typically reprice with policy rates (Gerlach, Mora, and Uysal 2018; Paul and Zhu 2022). In contrast, payouts on bank liabilities, such as deposits, are largely at the discretion of the bank and typically adjust to policy rates at a slower pace.[2] Thus, bank NIMs tend to rise with rate hikes but fall with rate cuts. Indeed, a major concern for policymakers after rates hit the zero lower bound at the onset of the pandemic was sustaining bank profitability in a low-rate environment (IMF 2020; Hinton and Paulson 2021).

Second, over longer horizons, bank NIMs have been shown to depend on the *difference* between long-term and short-term rates, or the slope of the yield curve. Typically, banks finance their longer-term, higher-yielding assets with relatively shorter-term, lower-yielding liabilities. Because interest margins are the difference between interest

income on bank assets and the interest expense on their liabilities, these margins can depend on the term premium, or the additional compensation investors expect for longer-term versus shorter-term lending. All else equal, an increase in the term premium (that is, a steepening of the yield curve) tends to raise bank NIMs, while a lower term premium (a flattening or inversion of the yield curve) tends to lower NIMs. Indeed, some evidence suggests that the slow, consistent decline in term premiums since the early 1980s has been associated with lower bank NIMs (Paul and Zhu 2020; Paul 2023).

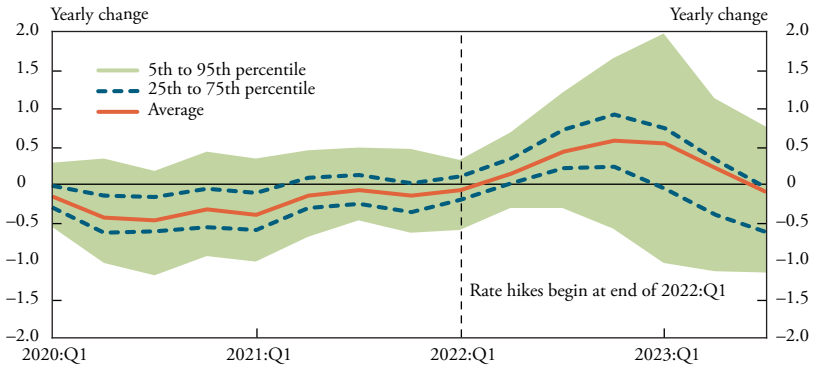
Third, policy rate changes can influence bank NIMs through changes in the *composition* of banks' liabilities and assets. During a rate hike cycle, if banks are too slow to adjust deposit rates, depositors may migrate to higher-yielding money market alternatives. Deposit outflows force banks to switch to other, costlier funding sources, which can increase bank funding costs and compress NIMs.[3] Some observers have argued that deposit outflows in the face of rising rates create an important channel for monetary policy transmission.[4] Banks can also change the composition of their assets to benefit more from higher rates. For example, banks might switch away from relatively riskier loans to fixed income securities with higher coupon yields. In this way, rising interest rates can bring about changes in the composition of banks' balance sheets that affect bank profitability.

Together, these channels suggest that the relationship between monetary policy changes and bank NIMs is not always clear-cut and may vary by bank. Studies have found that bank NIMs increased on average with policy tightening during the previous tightening episode from 2015 to 2019, and this increase was higher relative to the previous three tightening episodes (Berry and others 2019). However, rate hiking cycles have not always increased margins and sometimes have even shrunk them (Ennis, Fessenden, and Walter 2016). Moreover, the relationship between interest rates and bank margins has also varied by bank size (Covas, Rezende, and Vojtech 2015; Sengupta and Xue 2022).

Chart 1 shows that NIMs initially increased on average during the recent tightening cycle, but the rate of increase has since slowed considerably. Although lower policy rates lowered NIMs on average (orange line) during the pandemic in 2020, NIMs increased as the Fed began raising rates in March 2022.[5] This initial increase is not surprising, as

Chart 1

Initial NIM Increases Have Slowed Considerably with Successive Rate Hikes



Note: Chart shows distribution of annual changes in NIMs for each quarter beginning in 2020.
Sources: Board of Governors of the Federal Reserve System and authors' calculations.

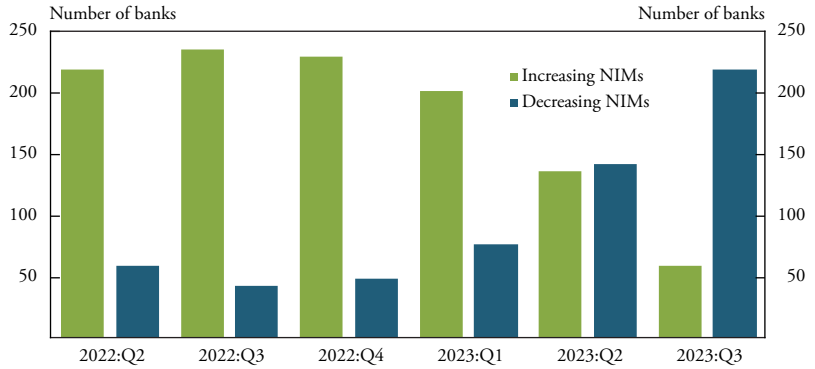
loan rates increased while banks were successful in reducing the pass-through from rate hikes to interest expenses on deposits at the initial stages of the tightening cycle. However, the rate of increase slowed considerably since late 2022 with successive rate hikes. Chart 1 also shows that during the 2022–23 hiking cycle, the dispersion in NIM changes increased considerably—the interquartile range (blue dashed lines) and 5th–95th percentile range (green shaded area) widen with successive rate hikes.

Although NIMs at most banks increased for a year after rate hikes started, the number of banks with declining NIMs also increased steadily throughout this rate hike cycle. Chart 2 shows that NIMs increased for over 200 banks from the start of rate hikes until the end of 2022 (green bars), while the number of banks with declining NIMs (blue bars) increased from 46 in 2022:Q3 to 224 in 2023:Q3.

The decline in NIMs has been more persistent for some banks regardless of size. Since rate hikes started in March 2022, 52 banks have seen declining NIMs in at least four quarters. Not surprisingly, banks with more quarters of declining NIMs have lower NIMs on average. The group of banks with at least four quarters of declining NIMs includes banks of all sizes: around 26 percent of community banking organizations (CBOs), 19 percent of regional banking organizations (RBOs), and 19 percent of large banking organizations (LBOs) belong

Chart 2

Number of Banks with Declining NIMs Has Increased



Sources: Board of Governors of the Federal Reserve System and authors' calculations.

to this group.[6] Table 1 suggests that variations in size cannot uniquely account for why some banks have seen more persistent NIMs declines.

II. Margin-Increasing and Margin-Decreasing Banks

To better understand why some banks have seen NIMs compress as interest rates have risen, we compare banks with a persistent decline in NIMs to those with a persistent increase in NIMs during this hiking cycle.[7] We define banks with a persistent decline in NIMs during a rate hike cycle as "margin-decreasing banks." Margin-decreasing banks satisfy two criteria. First, they have declining NIMs in at least four of the six quarters since rate hikes started. Second, any *hikes* in NIMs in any of the six quarters must be small—that is, smaller than half a standard deviation of the long-term NIMs distribution.[8] Chart 3 shows that over the past six quarters, the entire distribution of year-over-year NIM changes widened and shifted left. For margin-decreasing banks, we require that changes in NIMs be less than 0.25 (shown as the dashed vertical line on the right) in all six quarters and less than zero for at least four of the six quarters.

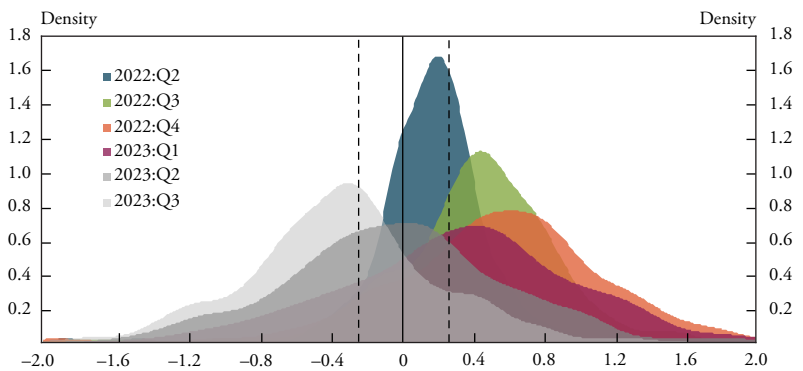
In contrast, we define banks with a persistent increase in NIMs under a rate hike cycle as "margin-increasing banks." Margin-increasing banks also satisfy two criteria. First, they have increasing NIMs in at least four of the six quarters since rate hikes started. Second, any *decreases* in NIMs in any of the six quarters must be small—that is,

Table 1
Persistence in NIMs Decline

	Number of banks	Number of CBOs	Number of RBOs	Number of LBOs	NIM values (over six quarters)		
					Mean	Max	Min
Banks with declining NIMs	230	128	81	21	3.25	10.46	–1.39
in all six quarters	16	10	5	1	2.46	4.67	–1.39
in five out of six quarters	17	12	3	2	2.74	4.64	0.22
in four out of six quarters	19	11	7	1	3.02	8.49	1.36
in three out of six quarters	41	29	9	3	3.25	7.71	0.58
in two out of six quarters	62	39	22	1	3.30	8.71	0.64
in one out of six quarters	75	27	35	13	3.56	10.46	1.30
Banks with increasing NIMs	45	17	18	10	3.64	6.96	0.51

Sources: Board of Governors of the Federal Reserve System and authors' calculations.

Chart 3
Distribution of NIM Changes Has Widened and Shifted Left



Note: The area under each curve is equal to one.
Sources: Board of Governors of the Federal Reserve System and authors' calculations.

smaller (in absolute value) than one-half of a standard deviation of the long-term NIMs distribution. In terms of Chart 3, we require that changes in NIMs do not drop below –0.25 in all six quarters (shown as the dashed vertical line on the left) and are greater than zero for at least four of the six quarters.

Comparing margin-decreasing and margin-increasing banks

We compare characteristics of margin-decreasing banks with margin-increasing banks to help explain why margin-decreasing banks are relatively more vulnerable to rate hikes.[9] Table 2 shows the

Table 2
Margin-Increasing and Margin-Decreasing Banks by Size

	Number of banks				Total assets (billions)**	NIMs**		
Sample	Total	LBOs	RBOs	CBOs	Mean	Mean	Max	Min
Full sample	275	31	99	145	$87.58	3.32	10.46	–1.39
Margin-increasing banks	104	19	42	43	$168.08	3.61	10.46	0.51
Margin-decreasing banks	34	3	11	20	$95.78	2.59	4.67	–1.39

**Data as of 2023:Q3
Sources: Board of Governors of the Federal Reserve System and authors' calculations.

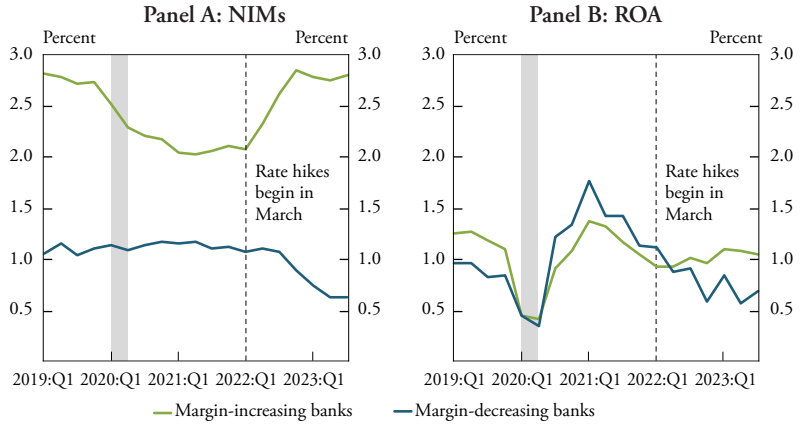
characteristics of margin-decreasing banks and margin-increasing banks. For the rate hike cycle that started in March 2022, we find that 34 banks (out of a total of 275 banks) are margin-decreasing banks, and 104 banks are margin-increasing banks. Both margin-increasing and margin-decreasing groups include banks from all size groups. However, margin-decreasing banks are smaller on average than margin-increasing banks, holding roughly $96 billion in assets compared with roughly $168 billion.

Chart 4 plots differences in the level of NIMs (Panel A) and returns on assets (ROA) (Panel B) for margin-increasing banks and margin-decreasing banks. While margin-increasing banks have higher NIMs than margin-decreasing banks, their ROA are comparable.[10] Margin-increasing banks have a relatively higher net interest income, but their net noninterest income (noninterest income less noninterest expense) is relatively lower than margin-decreasing banks, resulting in a comparable ROA (see appendix Chart A-1). Noninterest income has been a relatively more important source of overall profitability for margin-decreasing banks than for margin-increasing banks. That said, the recent widening of ROA between margin-decreasing banks and margin-increasing banks can be attributed to the widening gap between their NIMs during the tightening cycle. As a result, differences in interest margins have translated to differences in overall profitability between the two groups.

Comparing the composition of assets and liabilities for margin-increasing banks and margin-decreasing banks prior to the rate hiking cycle reveals structural differences. Table 3 shows composite balance sheets at the end of 2021:Q4, just prior to the start of the rate hike

Chart 4

NIM and ROA Levels for Margin-Increasing and Margin-Decreasing Banks



Note: Gray bar denotes National Bureau of Economic Research (NBER)-defined recession.
Sources: Board of Governors of the Federal Reserve System, NBER, and authors' calculations.

cycle. For each group, balance sheet entries are normalized to show the share of each item as a percentage of the group's total assets. On average, margin-decreasing banks have a relatively smaller share of assets in loans and securities but a relatively larger share in trading assets and repurchase agreements. As the last column shows, these differences are substantial and statistically significant.[11] These results speak to differences in the business models of margin-increasing and margin-decreasing banks: on average, margin-decreasing banks have a relatively greater capital market footprint and positive net noninterest income, contributing to their overall profitability (see appendix Chart A-1).

Liability-side differences between margin-decreasing banks and margin-increasing banks can also be attributed to differences in their business models. Margin-increasing banks rely primarily on deposit funding, with interest and noninterest-bearing deposits comprising close to 70 percent of their funding. In contrast, deposit funding makes up around 32 percent of funding at margin-decreasing banks, which rely relatively more on non-deposit sources of funding, including repurchase agreements, other borrowed money, and other liabilities.[12]

Drivers of differences in NIM behavior

The most notable difference between the interest-insensitive components of margin-decreasing banks and margin-increasing banks is

Table 3
Bank Balance Sheets at the End of 2021 (Share of Total Assets)

Margin-decreasing banks		Margin-increasing banks		Difference
Assets		Assets		
Cash and balances due	12.9	Cash and balances due	14.1	–1.2
Securities	9.7	Securities	23.9	–14.1***
Repurchase agreements	21.4	Repurchase agreements	7.9	13.5***
Loans	25.1	Loans	39.4	–14.2***
Trading assets	22.2	Trading assets	7.6	14.6***
Other	2.8	Other	3.5	–0.7**
Total	94.0	Total	96.0	
Liabilities and equity		Liabilities and equity		
Deposits	31.5	Deposits	68.6	–37.1***
Noninterest-bearing	2.5	Noninterest-bearing	21.2	–18.7***
Interest-bearing	29.0	Interest-bearing	47.4	–18.4***
Repurchase agreements	10.3	Repurchase agreements	4.6	5.8***
Trading liabilities	10.3	Trading liabilities	3.2	7.1***
Other borrowed money	19.2	Other borrowed money	8.4	10.8***
Other liabilities	19.8	Other liabilities	5.9	14.0***
Equity	8.9	Equity	9.4	–0.5
Total	100.0	Total	100.0	
Number of bank holding companies	34		104	

* Significant at the 10 percent level
** Significant at the 5 percent level
*** Significant at the 1 percent level

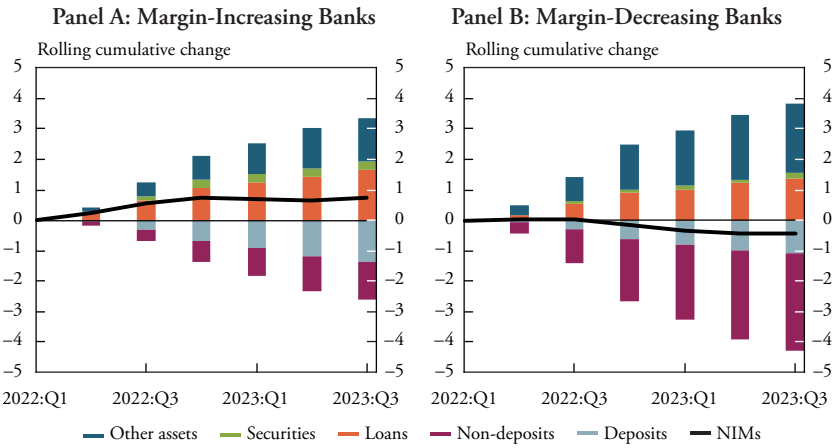
Sources: Board of Governors of the Federal Reserve System and authors' calculations.

noninterest-bearing deposits. While noninterest-bearing deposits comprise around 21 percent of bank assets for margin-increasing banks in 2021:Q4, they make up only 2.5 percent of margin-decreasing banks' assets (see Table 3).[13] Although this difference shrinks if we consider only non-LBOs and has reduced somewhat with the outflow of deposits during the tightening cycle, it is still an important reason for the differences in bank NIMs. Banks that can successfully retain much of their noninterest-bearing deposits during the rate hiking cycle not only pay less on their existing deposits but are also less dependent on more expensive non-deposit funding sources.

Next, we adopt the methodology in Covas, Rezende, and Vojtech (2015) to examine how interest-sensitive components of the bank balance sheet contribute to NIMs. Chart 5 shows the cumulative changes in contributions to bank NIMs from loans, securities, and other interest-bearing assets on the asset side and from interest-bearing deposits and non-deposits on the liability side. As interest rates increased starting in March 2022, changes in contributions from asset-side

Chart 5

Change in NIM Components for Margin-Increasing and Margin-Decreasing Banks



Note: Changes are cumulative relative to the base period 2022:Q1.
Sources: Board of Governors of the Federal Reserve System and authors' calculations.

components were positive, while changes from liability-side components were negative.

Chart 5 shows that changes in the contribution of non-deposits (maroon bars) have made the largest difference in the behavior of NIMs between margin-increasing banks (Panel A) and margin-decreasing banks (Panel B). Increases in contributions from loans and securities (orange and green bars, respectively) are relatively higher at margin-increasing banks, whereas the increases in contributions from other assets (dark blue bars) are relatively higher at margin-decreasing banks. In fact, we find that the positive asset-side contributions are surprisingly higher in aggregate at margin-decreasing banks. Perhaps more surprising is that increases in deposit funding costs (light blue bars) are moderately more minimal for margin-decreasing banks. If not for the strong negative contributions from non-deposits, NIMs of margin-decreasing banks would be increasing.[14]

Overall, the positive and negative changes in contributions for the current rate hike cycle have been qualitatively similar for margin-decreasing banks and margin-increasing banks. Quantitatively, the substantial differences in the negative contribution from non-deposit

funding to margin-decreasing banks and margin-increasing banks have been the crucial factor driving the overall differences in NIMs. Although most studies on this rate hike cycle have focused on deposit funding costs, we find that non-deposit funding is the critical determinant of differences between increasing and decreasing margins.[15]

Changes in yields and shares

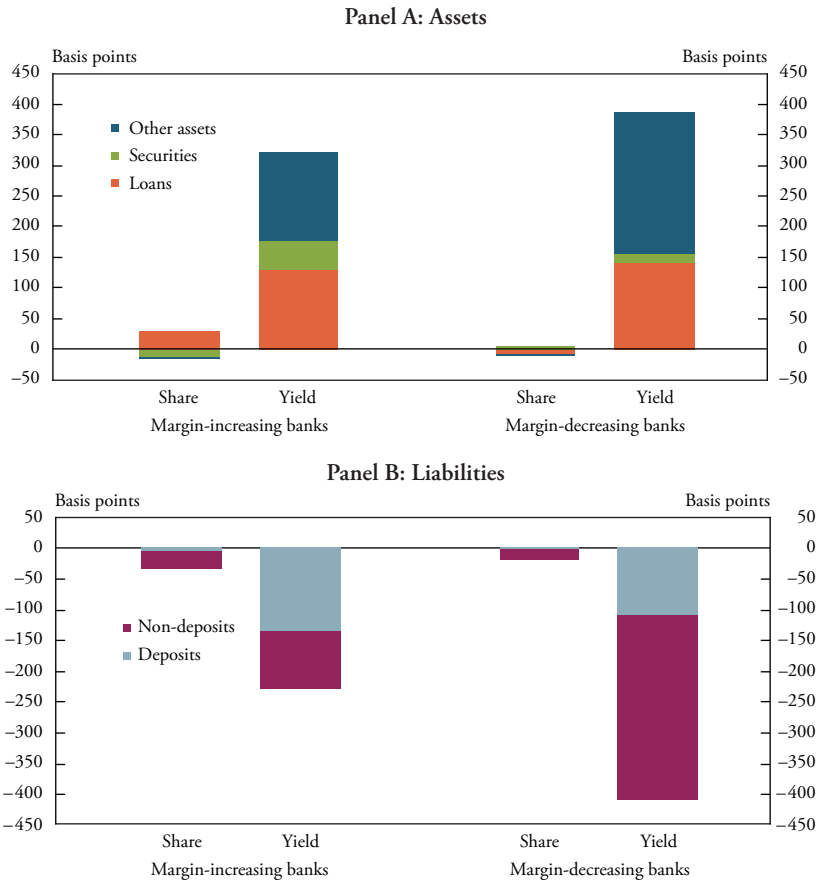
The changes in how components on banks' balance sheets contribute to NIMs after interest rates hikes can be further decomposed into changes in yields (prices) and changes in shares (volumes). For example, rising interest rates contribute to lower NIMs by increasing yields on deposit and non-deposit funding. At the same time, rising rates can also lead to deposit outflows, which raise a bank's share of non-deposit funding. To the extent that changes in non-deposit funding yields from rising rates are higher than changes in deposit funding yields, the switch away from deposit funding can raise bank funding costs—and this contribution to changes in NIMs is captured by the changes in shares in the decomposition process.

Chart 6 decomposes contributions to changes in NIMs during the 2022–23 rate hike cycle in terms of yields and shares. Since the beginning of the rate hike cycle, the target policy rate interval has increased by over 500 basis points. As a result, the bulk of the contributions to changes in NIMs during the rate hike cycle has been driven by changes in yields; changes in shares are observable, but significantly smaller in magnitude.[16] Panel A shows that on the asset side, the contribution from changes in loan yields (orange bars) is comparable across the two groups, but the contribution from changes in yields on securities (green bars) is relatively lower, while the contribution from changes in yields on other assets (blue bars) is relatively higher at margin-decreasing banks. Unlike margin-decreasing banks, margin-increasing banks also record a small but positive contribution to their NIMs from an increase in their loan shares.

Panel B shows that on the liability side, the bulk of the contributions from deposits (light blue bars) and non-deposits (maroon bars) are driven by changes in yields. Nonetheless, both bank groups record a small but negative contribution to their NIMs from an increase in their non-deposit funding shares; as a proportion of the total (negative)

Chart 6

Shares and Yields at Margin-Increasing and Margin-Decreasing Banks



Note: Changes are relative to the base period 2022:Q1.
Sources: Board of Governors of the Federal Reserve System and authors' calculations.

contribution from non-deposits, the contribution from changes in shares is around 6 percent for margin-decreasing banks and about 25 percent for margin-increasing banks. Our results suggest that the switch from deposit to non-deposit funding appears to have contributed more to changes in NIMs at margin-increasing banks relative to margin-decreasing banks. These differences could be attributed to the fact that non-deposit shares at margin-decreasing banks were already high prior to rate hikes, largely due to their business models.

Overall, our results suggest that differences in banks' business models drove differences in their NIMs during this rate hike cycle. Margin-decreasing banks tend to be more active in capital markets, which generates a clear disadvantage for them by increasing their non-deposit funding costs.[17] Non-deposit funding yields tend to respond to changes in policy rates faster than deposit funding. Moreover, rate increases tend to increase non-deposit funding shares, though this channel was more relevant for margin-increasing banks. In the end, the choice to maintain a relatively larger share of non-deposit funding was probably driven by the high operating expense of maintaining a deposit franchise in the low-rate environment prior to the recent rate hikes.

III. Implications of Declining NIMs for Financial Stability

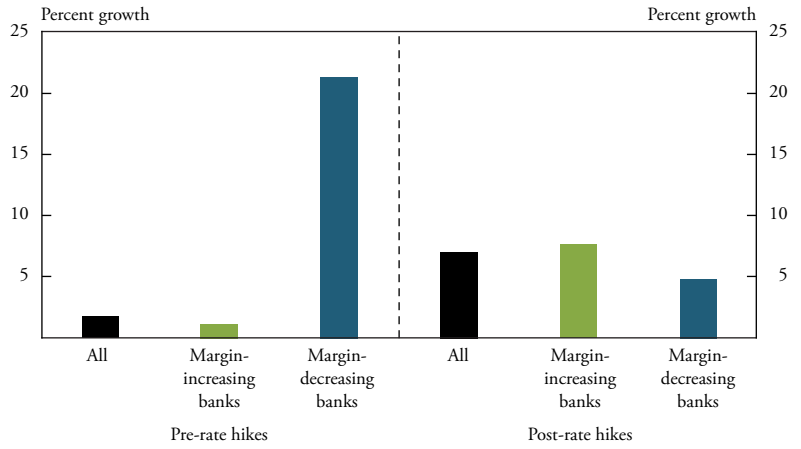
The higher profits at margin-increasing banks can help them build more capital over time, which increases their resilience against shocks. If policy rates remain elevated, low and declining profitability could adversely affect margin-decreasing banks in two ways. First, it could reduce retained earnings and capital growth over time, which in turn tend to affect banks' lending strategies. Second, it could increase banks' vulnerability to shocks. The spring 2023 banking turmoil revealed significant vulnerabilities on some bank balance sheets. These range from asset-side credit risk on their CRE loans and interest rate risk on their securities to liability-side funding risk on their uninsured deposits. Low profitability can interact with any of these balance sheet vulnerabilities and create strains for margin-decreasing banks.

Loan growth at margin-decreasing banks

We examine the financial stability implications of NIM compression by examining lending patterns at margin-decreasing banks. Profitability challenges such as NIM compression can make banks adopt lending strategies at either extreme. Distressed banks can adopt more aggressive lending strategies and even gamble for resurrection (taking on greater risk in hope of reviving a failing bank), or become more sedate and reduce lending.[18] Chart 7 compares loan growth for margin-decreasing banks and margin-increasing banks in the six quarters preceding and following 2021:Q4, just prior to the start of the rate hike cycle. We find that margin-decreasing banks (blue bars) have significantly higher

Chart 7

Total Loan Growth, Pre- and Post-Rate Hikes



Notes: Percent growth is over six quarters before and after rate hikes.
Sources: Board of Governors of the Federal Reserve System and authors' calculations.

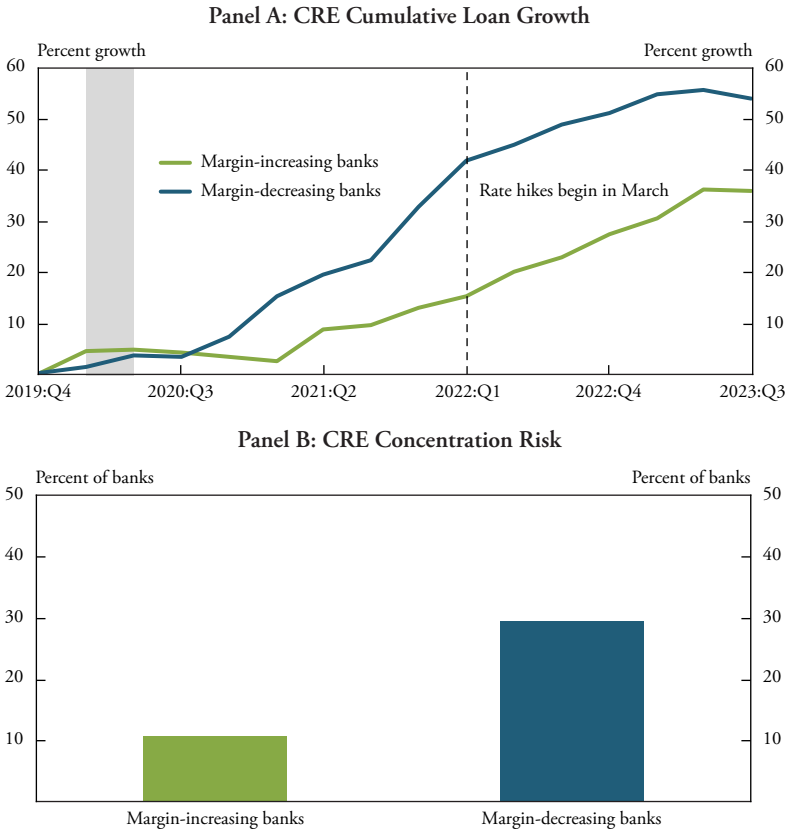
loan growth rates than margin-increasing banks (green bars) prior to the rate hike cycle but somewhat lower growth rates during the rate hike cycle. This finding suggests that margin-decreasing banks were relatively more aggressive in lending when rates were at the zero lower bound but became relatively more conservative after their NIMs began to decline during the rate hike cycle.

Balance sheet vulnerabilities and margin-decreasing banks

Next, we examine whether NIM compression at margin-decreasing banks has been accompanied by any of three balance sheet vulnerabilities that could exacerbate policymakers' concerns about financial stability: CRE exposure, unrealized losses, and uninsured deposits.

Panel A of Chart 8 shows that CRE loan growth was relatively higher at margin-decreasing banks both before and during the rate hike cycle. Rapid growth of CRE lending is often viewed as a cause for concern by regulators because it makes banks vulnerable to a sharp downturn in CRE values. For example, interagency guidelines laid out criteria for concentration risks based on CRE exposure relative to banks'

Chart 8
CRE Loan Growth and Concentration Risk

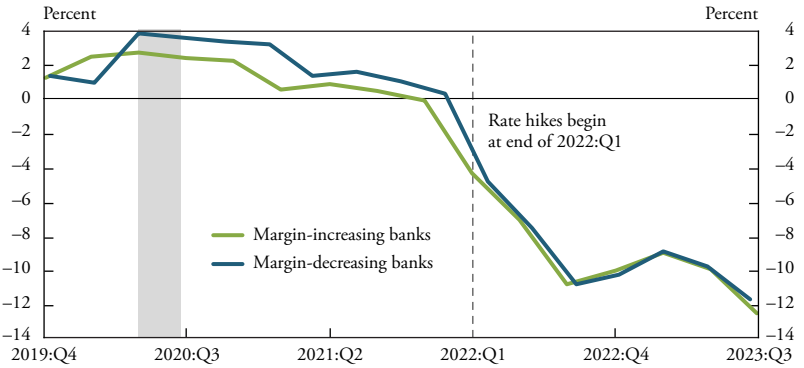


Notes: Growth in Panel A is relative to base period 2019:Q4. Gray bar denotes NBER-defined recession. Panel B displays the percentage of banks in each group that violates at least one of the interagency CRE risk guidelines.
Sources: Board of Governors of the Federal Reserve System, NBER, and authors' calculations.

total capital (Office of the Federal Register 2006). Panel B of Chart 8 shows the share of banks in each group that fail at least one of the two concentration risk criteria laid out by the regulatory agencies. We find that around 10 of the 34 margin-decreasing banks (29 percent) and 11 of the 104 margin-increasing banks (11 percent) are exposed to significant CRE concentration risk.[19] While more research is needed to determine details of this exposure, the data suggest that margin-decreasing banks are more vulnerable than margin-increasing banks in terms of their CRE concentrations.[20] Relative to margin-increasing banks, the

Chart 9

Unrealized Losses for Margin-Increasing and Margin-Decreasing Banks



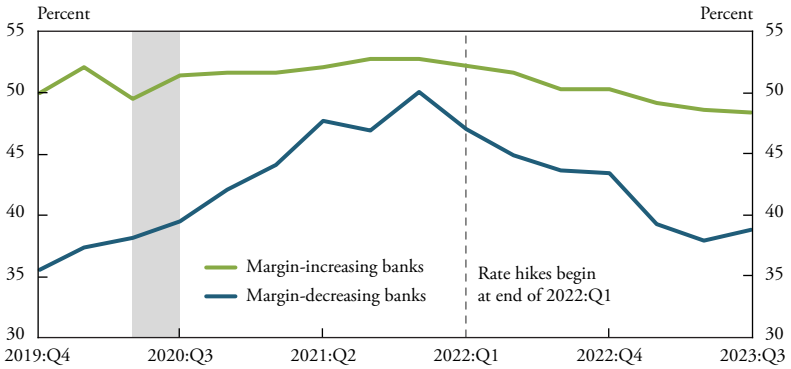
Notes: Plot shows unrealized losses as a share of total securities held on portfolio. Gray bar denotes NBER-defined recession.
Sources: Board of Governors of the Federal Reserve System, NBER, and authors' calculations.

interaction of higher CRE concentration risk and low and declining profitability at margin-decreasing banks is a notable vulnerability.

Chart 9 shows that unrealized losses as a share of securities for margin-decreasing banks and margin-increasing banks have been similar since the beginning of the rate hike cycle. These include marked-to-market losses on securities that are held to maturity and available for sale. Although the losses themselves are unrealized and do not affect bank margins directly, they can affect margins indirectly. For example, unrealized losses can prevent banks from repositioning their balance sheets toward more profitable opportunities if banks are unwilling to realize those losses. Moreover, some forms of non-deposit funding, such as advances from the Federal Home Loan Bank, are contingent on banks maintaining adequate capital to account for some unrealized losses (see Marsh and Laliberte 2023 for details). Chart 9 shows that the share of unrealized losses at margin-decreasing banks are not significantly different from margin-increasing banks to make them more vulnerable to shocks.

On the liability side, Chart 10 shows that uninsured deposits as a share of total deposits have been significantly higher at margin-increasing banks than margin-decreasing banks since 2019:Q1. Notably,

Chart 10
Uninsured Deposits at Margin-Increasing and Margin-Decreasing Banks



Notes: Plot shows uninsured deposits as a share of total deposits. Gray bar denotes NBER-defined recession.
Sources: Federal Financial Institutions Examination Council, NBER, and authors' calculations.

the increase in the share of uninsured deposits prior to the rate hike cycle—and the decline in the share during the rate hike cycle—is sharper for margin-decreasing banks than margin-increasing banks.[21] However, funding risks from sharp withdrawals of uninsured deposits are likely not greater at margin-decreasing banks relative to margin-increasing banks.

Conclusion

The monetary policy tightening cycle that began in March 2022 raised questions about how higher interest rates would affect bank profitability. Although most banks initially saw NIMs increase, as rate hikes continued, a small group of banks began to see NIMs decline, making them potentially vulnerable to further shocks.

We find that these margin-decreasing banks appear to follow a different business model than margin-increasing banks, with a relatively larger capital market footprint. The relatively higher reliance on nondeposit funding at margin-decreasing banks predates the rate hike cycle and has driven the overall decline in their NIMs. Additionally, we find that margin-decreasing banks have a higher share of CRE lending and are more vulnerable in their CRE concentration than margin-increasing banks.

Based on the vulnerabilities we observe in margin-decreasing banks, an overall deceleration of margin growth for all banks, and the potential for a higher-for-longer rate environment, banks may want to incorporate more measures of interest rate risk from rate hikes into their stress-testing framework. Such a stress-testing framework is being explored in 2024, in addition to the existing framework that is aimed at avoiding a business cycle contraction by testing for sudden decreases in economic activity accompanied by rate cuts (Board of Governors of the Federal Reserve System 2024). A sustained period of rate hikes may dampen loan demand, increase loan delinquencies, increase interest expenses through deposit outflows to higher interest-paying alternatives, and similarly erode capital through realized and unrealized losses in the securities portfolio (IMF 2023). Because the effects of a higher-for-longer environment on bank profitability vary considerably, the confluence of balance sheet vulnerabilities with NIM compression underscores the need for stress-testing to sharpen risk assessment and increase capital held against interest rate risks.

References

Afonso, Gara, Marco Cipriani, Catherine Huang, Abduelwahab Hussein, and Gabriele La Spada. 2023. "Monetary Policy Transmission and the Size of the Money Market Fund Industry: An Update." Federal Reserve Bank of New York, *Liberty Street Economics*, April 3. Available at https://doi.org/10.24148/wp2023-34

Ben-David, Itzhak, Ajay Palvia, and René Stulz. 2019. "Do Distressed Banks Really Gamble for Resurrection?" National Bureau of Economic Research, working paper no. 25794, May. Available at https://doi.org/10.3386/w25794

Benediktsdóttir, Sigríður, Gauti BergÞóruson Eggertsson, and Eggert Þórarinsson. 2017. "The Rise, Fall, and Resurrection of Iceland: A Postmortem Analysis of the 2008 Financial Crisis." *Brookings Papers on Economic Activity*, no. 2, pp. 191–308. Available at https://doi.org/10.1353/eca.2017.0014

Berry, Jared, Felicia Ionescu, Robert Kurtzman, and Rebecca Zarutskie. 2019. "Changes in Monetary Policy and Banks' Net Interest Margins: A Comparison across Four Tightening Episodes." Board of Governors of the Federal Reserve System, *FEDS Notes*, April 19. Available at https://doi.org/10.17016/2380-7172.2352

Board of Governors of the Federal Reserve System. 2024. "Exploratory Analysis of Risks to the Banking System: Summary of Analysis Parameters." February.

———. 2023. "Instructions for Preparation of Consolidated Financial Statements for Holding Companies: Reporting Form FR Y-9C." March.

Castro, Andrew, Michele Cavallo, and Rebecca Zarutskie. 2022. "Understanding Bank Deposit Growth during the COVID-19 Pandemic." Board of Governors of the Federal Reserve System, *FEDS Notes*, June 3. Available at https://doi.org/10.17016/2380-7172.3133

Covas, Francisco, Marcelo Rezende, and Cindy M. Vojtech. 2015. "Why Are Net Interest Margins of Large Banks So Compressed?" Board of Governors of the Federal Reserve System, *FEDS Notes*, October 5. Available at https://doi.org/10.17016/2380-7172.1612

Debbaut, Peter, and Huberto M. Ennis. 2014. "Large U.S. Bank Holding Companies During the 2007–09 Financial Crisis: An Overview of the Data." Federal Reserve Bank of Richmond, *Economic Quarterly*, vol. 100, no. 2, pp. 113–157.

Drechsler, Itamar, Alexi Savov, and Philipp Schnabl. 2017. "The Deposits Channel of Monetary Policy." *Quarterly Journal of Economics*, vol. 132, no. 4, pp. 1819–1876. Available at https://doi.org/10.1093/qje/qjx019

Driscoll, John C., and Ruth A. Judson. 2013. "Sticky Deposit Rates." Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series no. 2013-80. Available at https://doi.org/10.17016/FEDS.2013.80

Ennis, Huberto M., Helen Fessenden, and John R. Walter. 2013. "Do Net Interest Margins and Interest Rates Move Together?" Federal Reserve Bank of Richmond, *Economic Brief,* no. 16-05, May.

Gerlach, Jeffrey R., Nada Mora, and Pinar Uysal. 2018. "Bank Funding Costs in a Rising Interest Rate Environment." *Journal of Banking & Finance*, vol. 87, pp. 164–186. Available at https://doi.org/10.1016/j.jbankfin.2017.09.011

Hinton, Angela, and Chester Polson. 2021. "The Historic Relationship between Bank Net Interest Margins and Short-Term Interest Rates." *FDIC Quarterly*, vol. 15, no. 2, pp. 31–41.

IMF (International Monetary Fund). 2023. "A New Look at Global Banking Vulnerabilities." *Global Financial Stability Report*, Chapter 2.

———. 2020. "Banking Sector: Low Rates, Low Profits?" *Global Financial Stability Report: Markets in the Time of COVID-19*, Chapter 4.

Marsh, W. Blake, and Brendan Laliberte. 2023. "The Implications of Unrealized Losses for Banks." Federal Reserve Bank of Kansas City, *Economic Review*, vol. 108, no. 2, pp. 5–24. Available at https://doi.org/10.18651/ER/v108n2MarshLaliberte

Office of the Federal Register, National Archives and Records Administration. 2006. "Federal Register." Vol. 71, no. 238, December 12.

Paul, Pascal. 2023. "Banks, Maturity Transformation, and Monetary Policy." *Journal of Financial Intermediation*, vol. 53. Available at https://doi.org/10.1016/j.jfi.2022.101011

———. 2022. "When the Fed Raises Rates, Are Banks Less Profitable?" Federal Reserve Bank of San Francisco, *Economic Letter*, no. 2022-35, December 20.

Paul, Pascal, and Simon Zhu. 2020. "Are Banks Exposed to Interest Rate Risk?" Federal Reserve Bank of San Francisco, *Economic Letter*, no. 2020-16, June 22.

Repullo, Rafael. 2020. "The Deposits Channel of Monetary Policy: A Critical Review." Center for Economic Policy Research, Discussion Paper no. DP15553, December.

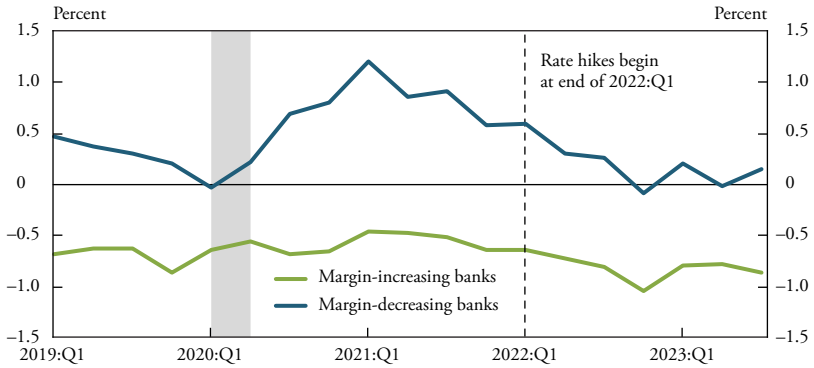
Sengupta, Rajdeep, and Fei Xue. 2022. "Do Net Interest Margins for Small and Large Banks Vary Differently with Interest Rates?" Federal Reserve Bank of Kansas City, *Economic Review*, vol. 107, no. 1, pp. 45–64. Available at https://doi.org/10.18651/ER/v107n1SenguptaXue

Appendix

Supplementary Chart

Chart A-1

Net Noninterest Income to Total Assets



Notes: Plot shows unrealized losses as a share of total securities held on portfolio. Gray bar denotes NBER-defined recession.
Sources: Board of Governors of the Federal Reserve System, NBER, and authors' calculations.

Endnotes

[1]A bank's NIM equals interest income less interest expenses as a fraction of total interest-earning assets and is a measure of the profitability of interest-earning assets.

[2]Bank deposits tend to be downward-flexible and upward-sticky depending on, among other factors, the deposit mix (interest-bearing or noninterest-bearing, for example) and the composition of depositors (retail or institutional, for example) (Driscoll and Judson 2013).

[3]A bank can respond to deposit outflows in three ways. First, it can replace deposit funding with non-deposit funding. Second, it can raise deposit rates in a bid to arrest the outflow and to attract deposits from other depository institutions. Lastly, it can shrink its balance sheet by shedding assets (selling loans and securities, for example) which lessens the need to replace lost funding. In practice, a bank may use all three options, but data limitations do not allow us to distinguish between them.

[4]Drechsler, Savov, and Schnabl (2017) find that this deposit channel of monetary policy transmission is stronger for counties with less bank competition (higher concentration of deposits), but Repullo (2020) questions the importance of this result.

[5]We use a sample of 275 bank holding companies that filed FR Y-9C reports *in all quarters* between 2021:Q4 and 2023:Q3. In this article, we use the terms "banks" and "bank holding companies" interchangeably. Using a balanced panel helps with the exposition but introduces survivorship bias. However, the larger sample of 318 banks that filed *at any point* during this period yields similar results.

[6]We define bank holding companies with assets fewer than $10 billion as CBOs, assets between $10 and 100 billion as RBOs, and assets greater than $100 billion as LBOs.

[7]Using a simpler definition of margin-decreasing banks and margin-increasing banks in terms of positive and negative changes in NIMs as shown in Chart 2 yields qualitatively similar results. Although the results are similar, the simpler definition does not account for the persistence in NIMs' decline and can be influenced by outliers. In a tightening cycle wherein policy rates increase incrementally every quarter, persistent changes suggest that NIMs' behavior is less likely to be influenced by factors other than changes in policy rates.

[8]The second criterion rules out sharp, idiosyncratic increases that are unlikely to be driven by policy rate changes. The standard deviation of the long-term series for annual changes in bank NIMs since 2013 for banks in our sample is 0.5. By this measure, the second criterion for persistent decline (increase) requires that NIMs be lower (higher) than 0.25 (–0.25) in all six quarters.

[9]This exercise is more descriptive than predictive or even causal. Our goal is to uncover what has driven the differences in NIM performance during this rate hike cycle.

[10]Chart 4 also shows that divergence in NIMs during the current rate hike cycle is not merely historical mean reversion in the aftermath of the extraordinary policy measures undertaken during the pandemic. Instead, the decline in NIMs for margin-decreasing banks suggests a divergence from medium-term trends.

[11]We use a statistical t-test to reject our null hypothesis that there is no difference between the two groups.

[12]The "other borrowed money" category includes commercial paper, term repo funding, and Federal Home Loan Bank advances, among other funding sources (Debbaut and Ennis 2014). The category "other liabilities" includes accounts payable, deferred compensation liabilities, and dividends declared but not yet payable, among others. For a full list of these other liabilities, see Board of Governors of the Federal Reserve System (2023).

[13]Of course, a higher share of noninterest-bearing deposits is the result of building the deposit franchise (branches, marketing, employee salaries), which is reflected in the relatively higher noninterest expenses and lower (negative) net noninterest income of margin-increasing banks (see chart in the appendix).

[14]If the contribution of the non-deposit component at margin-decreasing banks were the same as at margin-increasing banks, the overall NIMs contribution (shown by the solid lines in Chart 5) would be positive instead of negative. Conversely, if the contribution of the non-deposit component at margin-increasing banks were the same as at margin-decreasing banks, the overall NIMs contribution would be negative instead of positive.

[15]The relatively lower change in deposit yields is largely driven by the composition of deposits. While the changes in yields on non-deposit funding have a relatively greater contribution, this does not imply that it is costlier for the bank to fund the marginal (additional) dollar with non-deposit funding.

[16]The relatively smaller contribution from changes in shares also follows mathematically from the large balance sheets of the two groups of banks, whereby even sizeable changes in volumes are small compared with shares of aggregate assets of the margin-decreasing ($3.1 trillion) and margin-increasing ($17.1 trillion) groups.

[17]Typically, such differences in business models are attributed to larger banks having a greater footprint than smaller banks. However, in results not shown here, we find that the differences in Table 3 are not driven by data from LBOs or outliers.

[18]Benediktsdóttir, Eggertsson, and Þórarinsson (2017) argue that Icelandic banks gambled for resurrection prior to the global financial crisis. However, Ben-David, Palvia, and Stulz (2019) find that distressed banks in the United States took actions to reduce leverage and risk, such as reducing asset and loan growth, largely due to regulatory pressure.

[19] In accordance with interagency guidelines, we exclude owner-occupied non-farm non-residential loans from total CRE. If we include these loans, 14 out of 34 margin-decreasing banks (41 percent) and 21 of the 104 margin-increasing banks (20 percent) are exposed to significant CRE concentration risk. In other words, the concentration risk at margin-decreasing banks is significant whether we include or exclude owner-occupied, non-farm, non-residential loans.

[20] For example, credit risk on CRE properties is currently higher for office, retail, and multifamily sectors. However, data limitations prevent us from determining bank credit exposures to these individual sectors.

[21] Many factors have driven the rise and fall in the share of uninsured deposits at banks, including asset purchases by the Federal Reserve and the subsequent balance sheet runoff (Castro, Cavallo, and Zarutskie 2022). One potential explanation for the sharper trajectory at margin-decreasing banks is their larger capital market footprint. Nonbanks active in the sale and purchase of System Open Market Account (SOMA)-eligible assets on the Fed balance sheet are more likely to be clients of margin-decreasing banks.