Delay and Pray:

Strategic Forbearance via Commercial Real Estate Loan Modifications

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Abstract:

This study examines how U.S. banks have responded to growing commercial real estate (CRE) stress following the sharp monetary tightening cycle that began in 2022. We focus on the prevalence of "delay and pray" strategies, in which lenders extend favorable refinancing terms to existing borrowers to defer the recognition of nonperforming loans and provisions for credit losses. We explore how these strategies vary across banks of different sizes, risk profiles, and funding structures. By focusing on loan modifications rather than new originations and refinancings, our analysis sheds light on whether financially or structurally vulnerable institutions are more likely to mask underlying loan deterioration. The findings aim to advance understanding of risk transmission in CRE credit markets and inform regulatory debates surrounding bank supervision and financial stability.

JEL Classifications: G21, G28, R33

Key Words: bank lending, banking supervision, CECL, commercial mortgage, commercial real estate, credit losses, mortgage refinancing, nonperforming loans, provisions for credit losses, restructured loans

1. Introduction

Recent developments in commercial real estate (CRE) markets have renewed attention to structural vulnerabilities within the banking sector, particularly among regional and community banks with relatively high exposure to CRE mortgage lending. Following the historic monetary tightening cycle initiated by the Federal Reserve's Federal Open Market Committee (FOMC) in March 2022, mortgage lenders have faced increasing pressure to manage loan performance in a higher interest rate environment while navigating loan classification and credit loss provisioning requirements. The banking stress events of 2023 further heightened supervisory and market scrutiny of balance sheet risk, contributing to a period of elevated vigilance across the banking sector. At the same time, weakening real estate fundamentals, interacting with the highly leveraged structures typical of CRE financing, have intensified concerns about financial stability linked to commercial mortgage assets and have shown to crowd out new credit provision (Crosignani and Prazad, 2024). Against this backdrop, our paper examines the strategic use of loan refinancing and modification practices, often described as "delay and pray," and documents systematic differences across bank size, consistent with regulatory forbearance and delayed recognition of credit risk.

Commercial banks are widely recognized as key participants in commercial real estate (CRE) finance and constitute the primary originators and holders of commercial mortgage debt in the United States. As a result, developments in CRE markets transmit directly to bank balance sheets, making the scale and maturity profile of bank-held CRE loans particularly relevant for financial stability assessments. Community and regional banks, in particular, play a dominant role in CRE lending, holding a disproportionate share of CRE loans relative to their share of total banking assets, especially in income-producing property markets (Federal Reserve Bank of Kansas City, 2024; Aldana, 2024).

The prolonged post-pandemic low-interest-rate environment preceding the Federal Reserve's monetary tightening cycle contributed to a substantial accumulation of commercial real estate (CRE) exposures on U.S bank balance sheets. At the onset of rate increases in early 2022, banks held approximately $2.57 trillion[1] in CRE loans, representing 7.6% of total bank assets, reflecting an 11.7% increase relative to December 2019, when CRE loan balances totaled $2.3 trillion[2].

Between 2023 and 2024, approximately $1.65 trillion of U.S CRE mortgages were estimated to have matured with another $998 billion set to mature in 2025[3], of which at least half were originated by commercial banks. These mortgages were originated 5 – 10 years ago at rates of 3% - 4%, whereas current market rates are 6% – 8 %. If refinanced at current rates, most of these CRE properties would be cash-flow negative. As shown in Figure 1, regional and community banks are particularly exposed:[4] although they hold fewer than 40% of total loans, they account for nearly 70% of CRE loans. Regional banks such as Bank OZK (56.7% of assets in CRE), Valley National Bank (42.4%), and Flagstar Bank N.A. (39.3%) illustrate the concentration of risk among mid-sized lenders.

The post-COVID CRE environment has been shaped by both transitory and structural pressures. On the transitory side, as discussed earlier, the FOMC increased its target federal funds rate from near zero in early 2022 to over 5% by August 2023--the most aggressive tightening cycle in the history of the FOMC. This interest-rate shock dramatically reduced CRE valuations,

[1] *The Fed - Assets and Liabilities of Commercial banks in the United States - H.8 – March 30, 2024*. (n.d.). https://www.federalreserve.gov/releases/h8/20220429/
[2] *The Fed - Assets and Liabilities of Commercial banks in the United States - H.8 - January 31, 2020*. (n.d.). https://www.federalreserve.gov/releases/h8/20200131/
[3] S&P Global *"Commercial Real Estate Maturity Wall $950B in 204, peaks in 2027"* by Thomas Mason
[4] Regulators typically classify banks into community banks as those with less than $10 billion in assets, regional bank as those with $10 billion to $100 billion in assets, and national banks as those with more than $100 billion in assets.

constrained liquidity, and increased refinancing risk.[5] Structurally, the persistence of remote work and changing demand for physical office and retail space have resulted in enduring vacancies, functional obsolescence, and projected valuation declines of up to 39% in some asset classes (Gupta, Mittal, & Van Nieuwerburgh, 2022).

These developments have incentivized banks to engage in extend-and-pretend strategies to defer recognition of loan losses. In such cases, a bank simply extends a maturing loan without materially altering other terms, including the interest rate, allowing the bank to avoiding classification of the loan as impaired (the "extend" or "delay."). This practice allows the bank to avoid having to provision for credit losses, which mitigates pressure on the bank's capital adequacy ratios, albeit at the cost of transparency and long-run credit discipline. The hope is that interest rates will fall during the near term, bringing the loan rate closer to current market rate (the "pretend" or "pray").

The objective of this study is to investigate whether banks have strategically modified CRE loans in response to tightening financial conditions and to identify which institutional characteristics predict such behavior. First, we test whether loan modifications increased following the interest rate shock that began in Mar. 2022. Second, we test whether these patterns vary by bank size, capital adequacy, and funding structure (as proxied by reliance on uninsured deposits and/or brokered deposits). In doing so, we aim to identify whether weaker or more exposed institutions are more likely to engage in strategic forbearance.

By analyzing bank regulatory bank disclosures of CRE loan modifications, this study provides insights into how financial institutions respond to real estate distress under tightening

[5] The interest-rate shock also caused massive unrealized losses in banks' portfolios of investment securities, which reached $620 billion as of Q3 2023. See Cole et al. (2025).

credit conditions—something that has not happened during the past 50 years.[6] The findings will contribute to policy debates on regulatory oversight, capital transparency, and the procyclicality of bank lending.

2. Background and Literature

2.1 Background

The commercial real estate (CRE) sector occupies a central role in the U.S. financial system, with over $3 trillion in outstanding loans held by depository institutions as of late 2024. These exposures are disproportionately concentrated in regional and community banks, many allocating substantial shares of total assets to CRE lending. Despite this structural dependence, the post-pandemic period has significantly altered the risk profile of CRE markets, exposing lenders to unprecedented cyclical and structural challenges.

At the cyclical level, the Federal Reserve initiated the most aggressive monetary tightening campaign in modern history beginning in March 2022. In less than eighteen months, the target federal funds rate increased by over 500 basis points. This rapid change in the cost of capital not only curtailed new CRE investment activity but also triggered a repricing of existing assets. Many property owners have faced deteriorating debt-service coverage ratios and diminished refinancing capacity, especially as loan maturities converge in a higher-rate environment. For banks, this has translated into mounting pressure on collateral valuations, risk weights, and loan performance metrics.

[6] As measured by the benchmark NCREIF National Property Index, CRE property values have fallen year-over-year only three times since 1978—during the 1991-1993 "credit crunch; during the Global Financial Crisis of 2008-2010; and during and after the interest-rate shock of 2022-2023. Only during this last period did interest rates rise at the same time CRE property values were falling.

Structurally, the CRE sector has undergone a fundamental transformation. The COVID-19 pandemic accelerated long-standing shifts in demand for office and retail space, with remote work and e-commerce adoption reducing foot traffic and leasing stability in key urban centers. Once-prized office towers in cities such as San Francisco, New York, and Chicago now face double-digit vacancy rates, long lease-up periods, and persistent uncertainty around long-term usage. Industry forecasts suggest that certain office asset classes may face secular price declines of up to 30 to 40 percent (Gupta, Mittal, & Van Nieuwerburgh, 2022), raising serious concerns about recovery values and loss given default.

In this environment, banks face incentives to manage credit risk without immediately recognizing losses. Given the backward-looking nature of accounting standards and the procyclical effects of provisioning, some banks may pursue refinancing strategies that temporarily mask the true risk of their CRE portfolios. This behavior, referred to colloquially as "delay and pray" involves extending loan maturities or modifying terms in ways that avoid triggering troubled debt classifications. By doing so, banks can defer charge-offs, preserve regulatory capital ratios, and potentially delay scrutiny from supervisors. However, such practices may lead to misallocation of credit, underpricing of risk, and reduced transparency in the banking system.

Despite widespread concern among regulators and market participants, little empirical research has quantified the extent to which banks rely on these strategies, nor which types of institutions are most likely to engage in them. This research aims to fill that gap by examining strategic refinancing behavior through the lens of monetary policy shocks, bank risk characteristics, and real estate collateral conditions. The study provides an empirical foundation for understanding how financial institutions adapt to evolving CRE risk and contributes to broader discussions on credit market resilience and regulatory oversight.

2.2 Literature Review

A large body of research explores how banks manage credit risk and delay loss recognition during periods of economic stress. Foundational studies by Berger and Udell (1995) and Degryse and Ongena (2005) emphasize the role of relationship lending in influencing loan terms, monitoring intensity, and renegotiation outcomes. These studies suggest that banks with longer borrower histories may be more inclined to restructure or refinance loans under distress to preserve ongoing relationships.

The practice of regulatory forbearance, where institutions delay recognizing asset impairments, has been widely documented. Caballero, Hoshi, and Kashyap (2008) detail how Japanese banks perpetuated zombie lending by rolling over loans to insolvent borrowers, contributing to prolonged stagnation. Similarly, Huizinga and Laeven (2012) show that European banks used accounting discretion to delay expected loss recognition during the global financial crisis, raising concerns about transparency and credit misallocation.

In the U.S. context, Beatty and Liao (2011) provide empirical evidence that delayed provisioning affects future risk-taking, particularly during recessions. Ivashina and Scharfstein (2010) show that banks responded to the 2008 liquidity crisis by tightening lending selectively, especially for riskier or opaque borrowers. These behaviors are reinforced by Acharya and Mora (2015), who demonstrate that liquidity-constrained banks prioritize short-term survival by altering internal asset composition rather than issuing new credit.

More recently, Crosignani and Prazad (2024) investigate the commercial real estate refinancing market and document extend-and-pretend behavior in the wake of tightening financial conditions. Their findings suggest that some banks refinance maturing CRE loans at below-market spreads to avoid recognizing losses, particularly when they are undercapitalized. Aldana (2023)

finds that smaller banks may exhibit greater flexibility in restructuring loans due to superior knowledge of local markets and borrower-specific information.

The effects of monetary policy on credit markets are also well understood. Dell'Ariccia, Laeven, and Suarez (2017) show that interest rate increases reduce risk appetite and curtail credit availability. Jiménez et al. (2014) use loan-level data to show that tightening policy disproportionately affects weaker borrowers, as banks become more selective and risk-averse. These dynamics are amplified in capital-intensive sectors such as commercial real estate (Garmaise & Moskowitz, 2008), where even modest rate changes significantly affect refinancing feasibility.

A parallel stream of literature addresses how regulatory capital requirements and supervisory structures influence bank behavior. Barth, Caprio, and Levine (2013) show that institutional features of regulation affect risk-taking and provisioning incentives. Repullo and Suarez (2013) argue that capital regulation is inherently procyclical, potentially discouraging timely recognition of losses when asset values fall. Santos (2011) finds that following the subprime crisis, banks adjusted loan pricing to reflect both borrower risk and regulatory constraints, indicating that internal capital needs drive credit allocation.

Despite these insights, few studies combine property-level refinancing data with matched bank characteristics to identify strategic behavior in real time. This project addresses that gap by using the 2022 monetary tightening cycle as a plausibly exogenous shock and focusing on observable variation in refinancing behavior across institutions. By doing so, it contributes to a growing literature on real estate risk transmission, regulatory forbearance, and the intersection of monetary policy and bank decision-making.

3. Data

We obtain our data from one primary source: the FFIEC Call Reports (Forms 051, 041, and 031), from which we obtain semi-annual bank-level information on CRE loans and loan modifications, as well as balance sheet and income statement information for all U.S. commercial banks.[7] The Call Reports provide five categories of CRE loans: residential construction, nonresidential construction, multifamily, and two types of nonfarm nonresidential (NFNR) mortgages, which include office, retail, industrial and other property types of commercial real estate. The two types are owner-occupied and non-owner-occupied.[8] We aggregate these five categories into our aggregate measure of total CRE loans.

The Call Reports provide information separately on CRE loans that were modified and are in compliance with their modified terms, as well as CRE loans that were modified and are now past due (nonperforming). We combine these two sets of variables to come up with our measure of *total modified CRE loans*. Figure 2 shows the aggregate amount of modified loans (both in compliance/performing and past due/nonperforming) over our sample period. These amounts are relatively stable from 2019-Q4 through 2023-Q2 at $8 billion to $10 billion, but then rise rapidly during each subsequent semi-annual period, almost quadrupling to a high of $31 billion as of 2025-Q2. About three quarters of the $22 billion increase is accounted for by performing modifications, which is consistent with the hypothesized "delay and pray" strategy.

Using this variable, we create an indicator variable *modified CRE* that is equal to one if a bank reports non-zero total modified CRE loans and zero otherwise. We calculate a *CRE modification ratio* defined as total modified CRE loans divided by total CRE loans. Finally, we calculate a *modified CRE nonperforming loan ratio* defined as CRE modifications past due divided by total modified CRE loans. These are our four dependent variables. The Call Reports only collect information on modified loans from

[7] Community banks only report loan modifications on their June and December Call Reports, whereas large banks report quarterly. This limits us to semi-annual data for our analysis.
[8] The Call Reports do not provide disaggregated information on NFNR property types, which is a major shortcoming of these data.

Form 51 reporters (banks with less than $5 billion in assets) during June and December. Hence, we collect semi-annual information from 2019 Q4 through 2025 Q4.

Data from these reports also enable us to construct measures of bank size, CRE exposure, capital adequacy, and funding structure to assess heterogeneity in refinancing behavior across institutions.

We follow regulatory guidance in classifying banks into three size groups: community banks (assets less than $10 billion); regional banks (assets between $10 billion and $100 billion); and national banks (assets greater than $100 billion).

Table 1 presents definitions for each of our analysis variables—dependent, focal explanatory and controls. Table 2 presents descriptive statistics for our analysis variables—dependent, focal explanatory and controls. Among our dependent variable, the mean modification incidence is 0.322, indicating that only about 32 percent of bank-period observations had positive values of the amount of modifications. The mean for the natural logarithm of the amount of modifications is 0.305 and is highly skewed, with a maximum of 8.23. The mean for the share of CRE loan modifications is 0.005, indicating that the average share of modification was 0.5%. The mean for CRE modification NPLs is 0.335, indicating that the average percentage of CRE modifications that were nonperforming was 33.5%. In other words, one third of all CRE modifications were nonperforming. (We note that the sample size for this variable drops by almost two thirds, as a bank cannot report a CRE modification NPL if it reports a zero amount of CRE modifications.) Overall, we have about 52,000 bank-period observations but only about 17,000 for the CRE modification NPL ratio.

Among our focal explanatory variables, we see that regional banks account for only 2.6 percent of the observations and national banks only 0.7 percent of the observations. Just over half of the observations are post March 2022.

Among our control variables, the average equity to asset ratio is 12.1 percent; the average NPL ratio is 0.9 percent; the average ROA is 110 basis points; the average liquidity ratio is 33.4 percent; and the average CRE exposure ratio is 231 percent.

4. Methodology

We present descriptive information about loan modifications in both a univariate and multivariate setting. First, we present univariate descriptive statistics and charts for each of our four dependent variables:

- the incidence of CRE loan modifications (*CRE Modification Incidence*),
- the natural logarithm of amount of modifications (*ln(CRE modifications*),
- the percentage of modifications (*CRE Modification Ratio*), and
- the nonperforming CRE modification ratio (*CRE Mod NPL Ratio*).

Second, we present multivariate evidence on how modifications changed during and after the runup of interest rates. Our primary empirical strategy is built around identifying whether different groups of U.S. banks engaged in strategic refinancing behavior, colloquially known as "delay and pray," to conceal credit risk and defer loss recognition on commercial real estate (CRE) loans during the post-pandemic period after the monetary tightening. We exploit the rapid increase in interest rates initiated by the Federal Reserve in March 2022 as an exogenous shock that strained CRE market fundamentals and created incentives for banks to modify, rather than classify, underperforming loans.

We assess whether regional and national banks offered more loan modification and suffered higher modification NPL ratios than community banks. We estimate the following panel specification:

$$Modified_{i,t} = \beta_0 + \beta_1\left(Regional_{i,t}\right) \quad + \beta_2\left(National_{i,t}\right)$$

$$+\beta_3\left(Regional_{i,t} \times Post_t\right) \quad + \beta_4\left(National_{i,t} \times Post_t\right) + \gamma X_{i,t} + \Theta t + \varepsilon_{i,t}$$

(1)

Where:

$CRE\ Modified_{i,t}$ = is one of our four CRE loan modification variables for bank *i* at time *t*;

CRE Modification Incidence $_{i,t}$ = an indicator if the amount of CRE loan modifications is greater than zero for bank *i* at time *t*;

Ln(CRE Modifications $_{i,t}$ *)* = natural logarithm of the amount of CRE loan modifications for bank *i* at time *t*;

CRE Mod Ratio $_{i,t}$ = the percentage of CRE loans that are modified for bank *i* at time *t*; or

CRE Mod NPL Ratio $_{i,t}$ = the percentage of modified CRE loans that are non-current for bank *i* at time *t*;

$Post_t$= an indicator variable that is equal to one for periods after March 2022 and zero otherwise,

Regional $_{i,t}$ = indicator variable that is equal to one for regional banks and zero otherwise;

National $_{i,t}$ = indicator variable that is equal to one for national banks and zero otherwise;

$X_{i,t}$= a vector of controls for bank *i* at time *(t – 1)*; and

Θ_t = a vector of time fixed effects for each semi-annual period; and

$\varepsilon_{i,t}$ = an i.i.d error term.

Our control variables include:

Equity Ratio $_{i,t}$ = total equity capital divided by total assets for bank *i* at time *t*;

NPL Ratio $_{i,t}$ = nonperforming loans (past due 30-89 days, past due 90+ days, nonaccrual) plus foreclosed assets divided by total assets for bank *i* at time *t*;

ROA $_{i,t}$ = return on assets (net income divided by total assets for bank *i* at time *t*;

Liquidity Ratio $_{i,t}$ = liquid assets (cash plus investment securities) divided by total assets for bank *i* at time *t*;

CRE Exposure $_{i,t}$ = the total amount of CRE loans divided by total assets for bank *i* at time *t*;

Here, our focal coefficients are the interaction terms β_3,and β_4, which measure the difference in our modification dependent variable at regional and national banks, respectively, relative to the omitted category of community banks for periods after Mar. 2022. We expect to find that β_3,and β_4, are positive

and statistically significant, indicating that modifications are greater at regional and national banks, respectively, which would provide evidence of greater "delay and pray" behavior among the larger banks. The vector of time fixed effects controls for all macroeconomic variables that are common across all loans at time *t*.(and eliminate the need to The time fixed effects also absorb the indicator $Post_t$ so that we do not include it in the model to avoid collinearity.

5. Results.

5.1 Univariate Results

We begin with a series of charts showing our four dependent variables plotted over time by bank size (community, regional and national). In Figure 3, we plot the incidence of CRE modifications over time by bank size from Q4 2019 through Q4 2025. In general, we see a slow decline in the incidence of modification from Q4 2019 through Q4 2021 for each of the three groups of banks, but a more pronounced decline for regional and small banks. For community banks, the incidence continues to decline slowly through Q2 2024 before increasing slightly through Q4 2025. For national banks, the incidence rises from Q2 2023 through Q2 2025 but then falls slightly during Q4 2025. For regional banks, the incidence continues to decline through Q2 2023 and then rises sharply each period through Q4 2025. This evidence suggests that national banks and regional banks responded to rising interest rates by turning to modifications of their CRE loans, which would have difficulty refinancing at much higher rates.

In Figure 4, we plot the natural logarithm of the amount of CRE modifications over time and by bank size. We plot the natural logarithm of the amount rather than the amount so that we can compare trends among the three banks. Here, vertical distances measure percentage changes rather than amounts. Here, we see that the amount of CRE modifications by community banks is flat among community banks throughout the sample period. For regional banks, the amount of

modifications declines from Q4 2020 though Q2 2023 and then trends upwards sharply through Q2 2025. For national banks, the amount of CRE modification is relatively flat from Q2 2022 through Q4 2022 and then rises sharply through Q2 2025. For regional and national banks, this structural break corresponds to the time when interest rates began to rise sharply in response to inflationary pressures and, like Figure 3, suggests that national banks and regional banks responded to rising interest rates by turning to modifications of their CRE loans, which would have difficulty refinancing at much higher rates.

In Figure 5, we plot the CRE modification ratio over time and by bank size. Here, we see that the modification ratio for community banks declined slowly over the entire sample period. For regional banks, the modification ratio slowly declines from Q4 2019 through Q2 2023 and then trends sharply upwards through Q2 2025. For national bank, the modification ratio slowly declines from Q4 2019 only through Q2 2022, and then trends sharply upwards through Q2 2025, more sharply than regional banks. Interestingly, the modification ratios for both regional and national banks declined from Q2 2025 through Q4 2025. As with Figures 3 and 4, the structural break for regional and national banks corresponds to the time when interest rates began to rise sharply in response to inflationary pressures and suggests that national banks and regional banks responded to rising interest rates by turning to modifications of their CRE loans, which would have difficulty refinancing at much higher rates.

In Figure 6, we plot the CRE Modification NPL ratio over time and by bank size. Here, we see that the NPL ratio for community banks is relatively flat over the entire sample period at about 35%. The NPL ratio for regional banks rises from 38% in Q4 2019 to 48% in Q2 2022, then declines to around 30% at the end of the sample period. This appears to be driven by the rise in performing modifications following the runup in interest rates rather than by a decline in

nonperforming modifications; in fact, nonperforming modifications rose significantly but not as fast as performing modifications. The NPL ratio for national banks rises from 51% in Q4 2019 to 70% in Q4 2020 and then declines to less than 30 in Q2 2023, after which it rebounds slightly up to around 40% in Q2 2024.

5.2 Multivariate Results

Next, we present multivariate results from our regression models discussed in section 4 above, where we sequentially analyze each of our four dependent variables. We utilize a differences-in-differences framework, where we consider the runup in interest rates as an exogenous shock to our three size groupings of banks. The charts we presented in section 5.1 provide support for the parallel-trends assumption, as they show similar trends among community, regional and national banks during the period 2019 Q4 through 2021 Q4 prior to the Fed's first rate hike in Mar. 2022. We classify community banks as our control group and classify regional and national banks as two different treatment groups. Our regression models then enable us to test whether the modification behavior of regional and community banks diverge from that of community banks following the rate shock.

5.2.1 Incidence of CRE Modifications

In Table 3, we present the results from estimating eq. (1) via logistic regression where our dependent variable *modification incidence* is an indicator for a bank that reported a positive value for the amount of CRE loan modifications during that semi-annual period. First, we estimate the model without bank-level control variables (shown in panel 1) and then we estimate the model with bank-level control variables (shown in panel 2). For ease of interpretation, we present odds

ratios rather than coefficients. Because the results from the two estimations are qualitatively similar, we only discuss the results shown in panel 2.

The indicators for both regional and national banks are positive and highly significant and indicate that regional (national) banks were almost six (eight) times more likely to modify CRE loans than the omitted category of community banks during the period prior to Q1 2022. Our two focal explanatory variable are the interaction terms of the indicator *Post* and the indicators *Regional* and *National*, which show how modification incidence changed after the Fed began raising interest rates in March 2022. Both interaction terms are positive and highly significant. The odds ratios indicate that, during the post period, regional banks were 35 percent more likely to report modified CRE loans, while national banks were 150 percent more likely to report modified CRE loans, than were community banks.

Turning to our bank-level control variables, four of the five are statistically significant. Banks with higher equity ratios and higher liquidity ratio are significantly less likely to report modified CRE loans. Banks with higher NPL ratios and higher CRE exposure ratios are significantly more likely to report modified CRE loans. ROA lacks statistical significance

5.2.2 Amount of CRE Modifications

In Table 4, we present the results from estimating eq. (1) via OLS regression where our dependent variable is the natural logarithm of the amount of CRE loan modifications during that semi-annual period. First, we estimate the model without bank-level control variables (shown in panel 1) and then we estimate the model with bank-level control variables (shown in panel 2).

Because the results from the two estimations are qualitatively similar, we only discuss the results shown in panel 2.

The indicators for both regional and national banks are positive and highly significant and indicate that regional (national) banks reported modification amounts that were 140 percent (280 percent) larger than the omitted category of community banks during the period prior to Q1 2022. Our two focal explanatory variable are the interaction terms of the indicator Post and the indicators Regional and National, which show how reported amounts of modifications changed after the Fed began raising interest rates in March 2022. Both interaction terms are positive and highly significant. During the post period, regional (national) banks reported modification amounts that were 49 percent (122 percent) higher than they reported during the control period.

Turning to our bank-level control variables, all five are statistically significant. Banks with higher equity ratios, higher NPL ratios and higher CRE exposure ratios report significantly larger modification amounts. Banks with higher profitability and liquidity ratios report significantly lower modification amounts.

5.2.3. CRE Modification Share

In Table 5, we present the results from estimating eq. (1) via OLS regression where our dependent variable is the CRE loan modification ratio during that semi-annual period. First, we estimate the model without bank-level control variables (shown in panel 1) and then we estimate the model with bank-level control variables (shown in panel 2). Because the results from the two estimations are qualitatively similar, we only discuss the results shown in panel 2.

The indicator for national banks is not statistically significant but the indicator for regional banks are negative and highly significant and indicate that regional banks reported significantly lower modification ratios than the omitted category of community banks during the period prior to Q1 2022. Our two focal explanatory variable are the interaction terms of the indicator *Post* and the indicators *Regional* and *National*, which show how modification ratios changed after the Fed began raising interest rates in March 2022. Both interaction terms are positive and highly significant. During the post period, regional (national) banks reported modification ratios that were higher by 0.3 percent (0.1 percent) than they reported during the control period. The average modification ratio is 0.5 percent, so these are economically significant changes.

Turning to our bank-level control variables, only three of the five are statistically significant. Banks with higher NPL ratios and higher liquidity report significantly higher modification ratios. Banks with CRE exposure ratios report significantly lower modification ratios. The equity to asset ratio and ROA lack statistical significance.

5.2.4. Nonperforming CRE Modification Ratio

In Table 6, we present the results from estimating eq. (1) via OLS regression where our dependent variable is the CRE modification NPL ratio during that semi-annual period. First, we estimate the model without bank-level control variables (shown in panel 1) and then we estimate the model with bank-level control variables (shown in panel 2). Because the results from the two estimations are qualitatively similar, we only discuss the results shown in panel 2.

The indicators for both regional and national banks are positive and statistically significant and indicate that regional (national) banks reported CRE modification NPL ratios that were 12

(27) percentage points higher than at the omitted category of community banks during the period prior to Q1 2022. Our two focal explanatory variable are the interaction terms of the indicator *Post* and the indicators *Regional* and *National*, which show how modification ratios changed after the Fed began raising interest rates in March 2022. Both interaction terms are negative and highly significant. During the post period, regional (national) banks reported CRE modification NPL ratios that were lower by 13 (25) percent points than during the control period. The average CRE modification NPL ratio is 33 percent, so these are economically significant changes.

Turning to our bank-level control variables, only three of the five are statistically significant. Banks with higher equity ratios, higher liquidity ratios and higher NPL ratios report significantly higher CRE modification NPL ratios. ROA and the CRE exposure ratio lack statistical significance.

5.3 Discussion

We analyze four different measures of CRE loan modifications using both univariate and multivariate analysis. On the extensive margin, we analyze the incidence of modifications—does or does not a bank report using modifications as a tool for dealing with distressed CRE loans. On the intensive margin, we analyze (the natural logarithm of) the amount of CRE loan modifications and the percentage of CRE loans that are modified. Among banks that use CRE loan modifications as a tool, we analyze the percentage of modified CRE loans that are classified as nonperforming.

On the extensive margin, we find that regional and national banks increased, while community banks decreased, the use of modifications as a tool for addressing distressed CRE loans, especially in the period after Fed tightening. On the intensive margin, we find a sharp

increase in the amount of CRE loan modifications at regional and large banks, but not at community banks, following the Fed tightening. Similarly, we find a sharp increase in the percentage of CRE loans that were modified by regional and national banks, but not by community banks, following the Fed tightening. Finally, we find that the percentage of modified CRE loans classified as nonperforming declined at regional and national banks, but not at community banks, following the Fed tightening.

In general, these finding support the hypothesized "delay and pray" behavior by regional and national banks in dealing with the growing distress in the CRE loan market. Much of this distress was attributable to the need to refinance at much higher rates maturing CRE loans that were originated during the zero-interest-rate period prior to 2022. The modifications "delay" the day of reckoning while the banks and borrowers "pray" for the Fed to lower interest rates, as it has done since Sept. 2024. However, long-term rates such as the yield on the 10-year Treasury Bond remain stubbornly high as do alternative measures of consumer inflation. During 2026, markets should begin to provide clarity whether this strategy has been successful or just delayed a wave of new CRE loan delinquencies.

6. Summary and Conclusions

In this study, we analyze commercial real estate loan modifications reported by commercial banks of different sizes before and after the 2022 – 2023 interest-rate shock. More specifically, we investigate whether banks have strategically modified CRE loans in response to tightening financial conditions and to identify which institutional characteristics predict such behavior. On the extensive margin, we find that regional and national banks are much more likely to use

modifications as a tool for dealing with distressed CRE loans. On the intensive margin, we find that regional and national banks sharply increased the volume of CRE loan modifications when the Fed began to raise interest rates in early 2022. We also find that the percent of CRE loans that were modified rose sharply after rates began to rise. In contrast, we find that the percentage of modified CRE loans that were classified as nonperforming declined at regional and national banks as rates began to rise. These findings are consistent with the hypothesized "delay and pray" strategy for dealing with the growing volume of distressed CRE loans by modifying, rather than classifying these loans and foreclosing upon underlying collateral.

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Figure 1: Bank Exposure to Commercial Real Estate by Bank Size

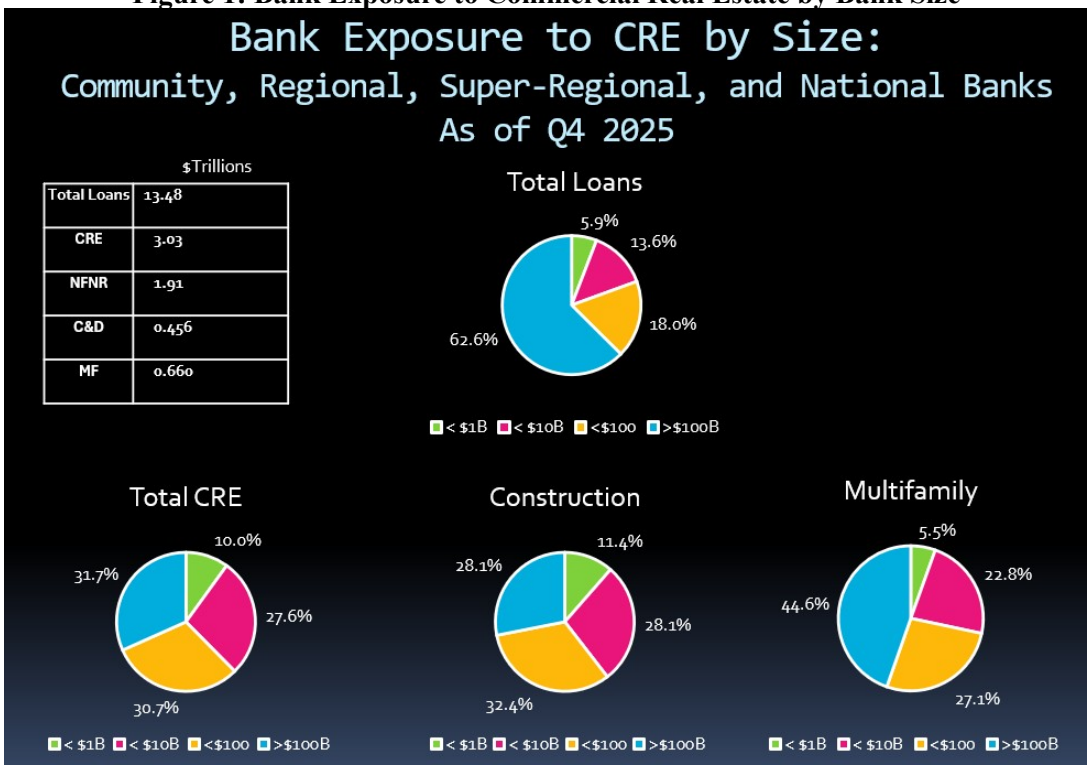

Figure 2: Amount of CRE Loan Modifications, by Quarter

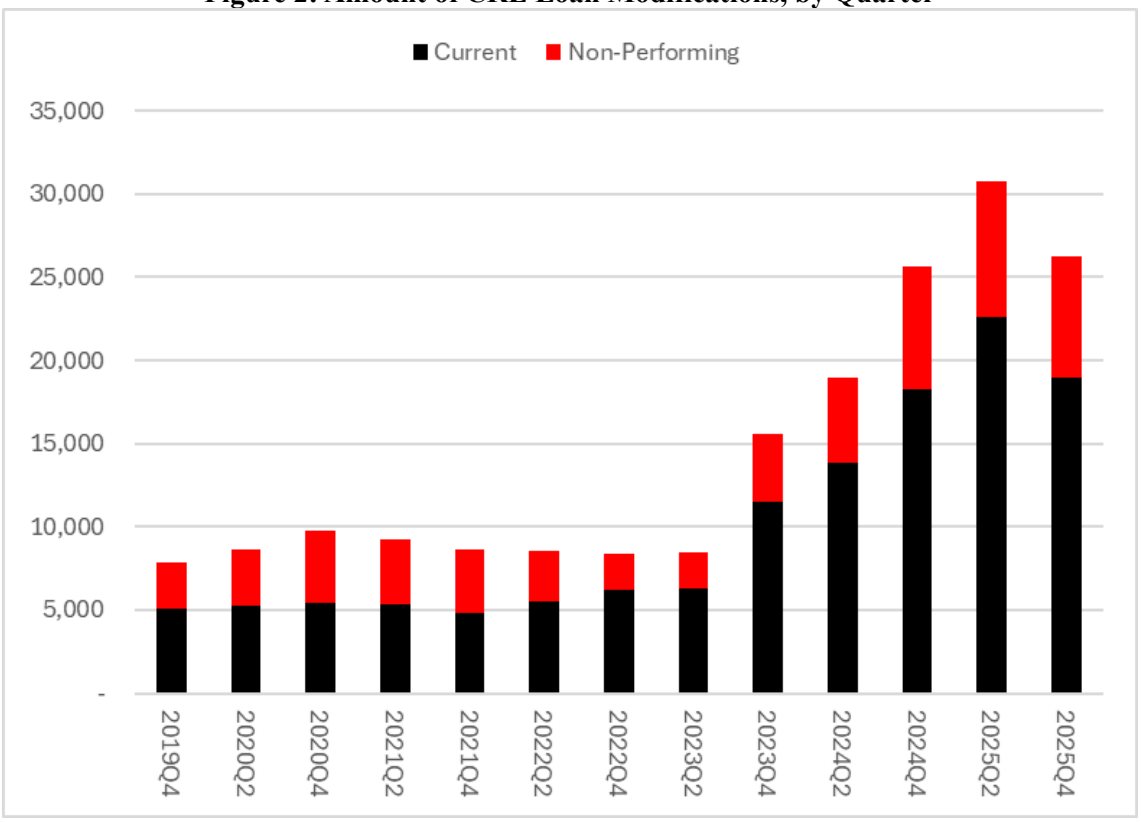

Figure 3: Percentage of Banks Reporting CRE Loan Modifications, by Bank Size and Quarter

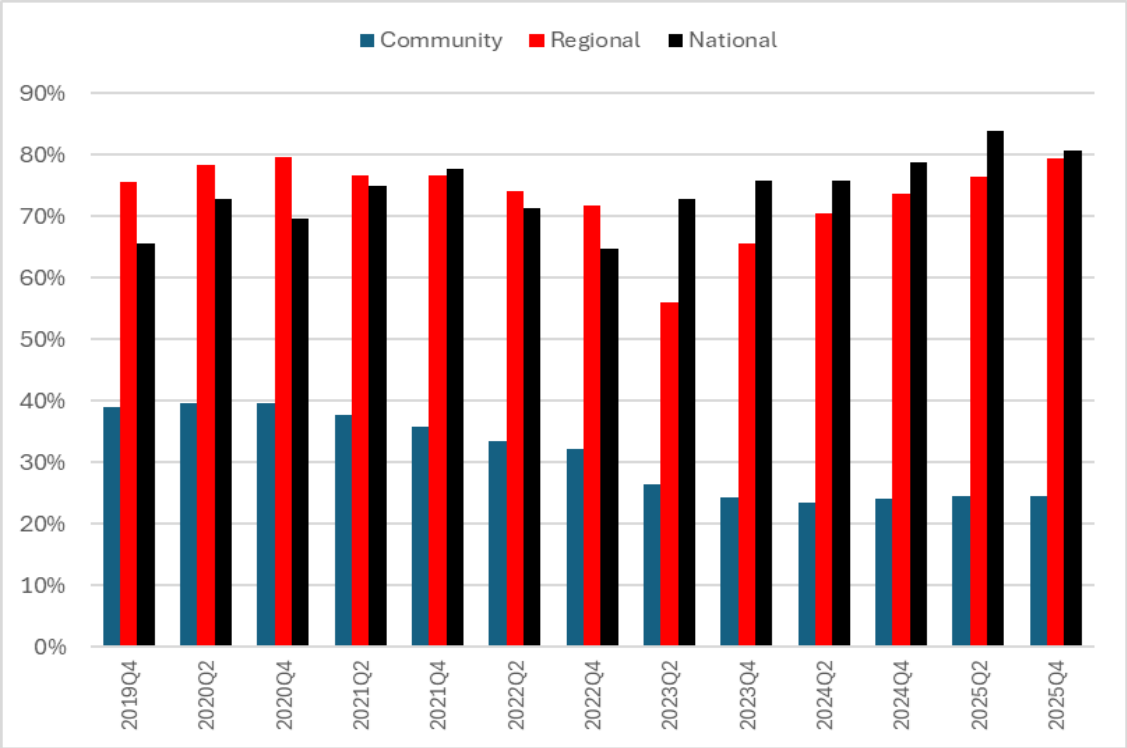

Figure 4: Growth in CRE Loan Modification Activity Across Bank Size and Quarter

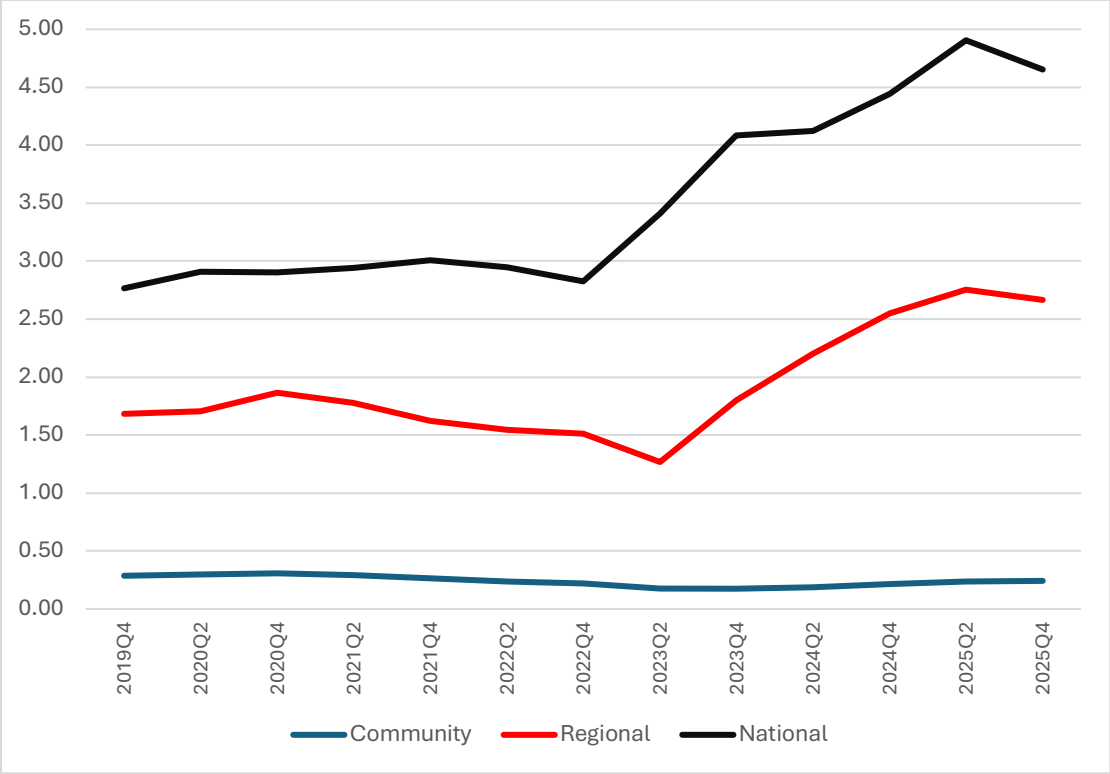

Figure 5: Commercial Real Estate Loan Modification Ratios by Bank Size

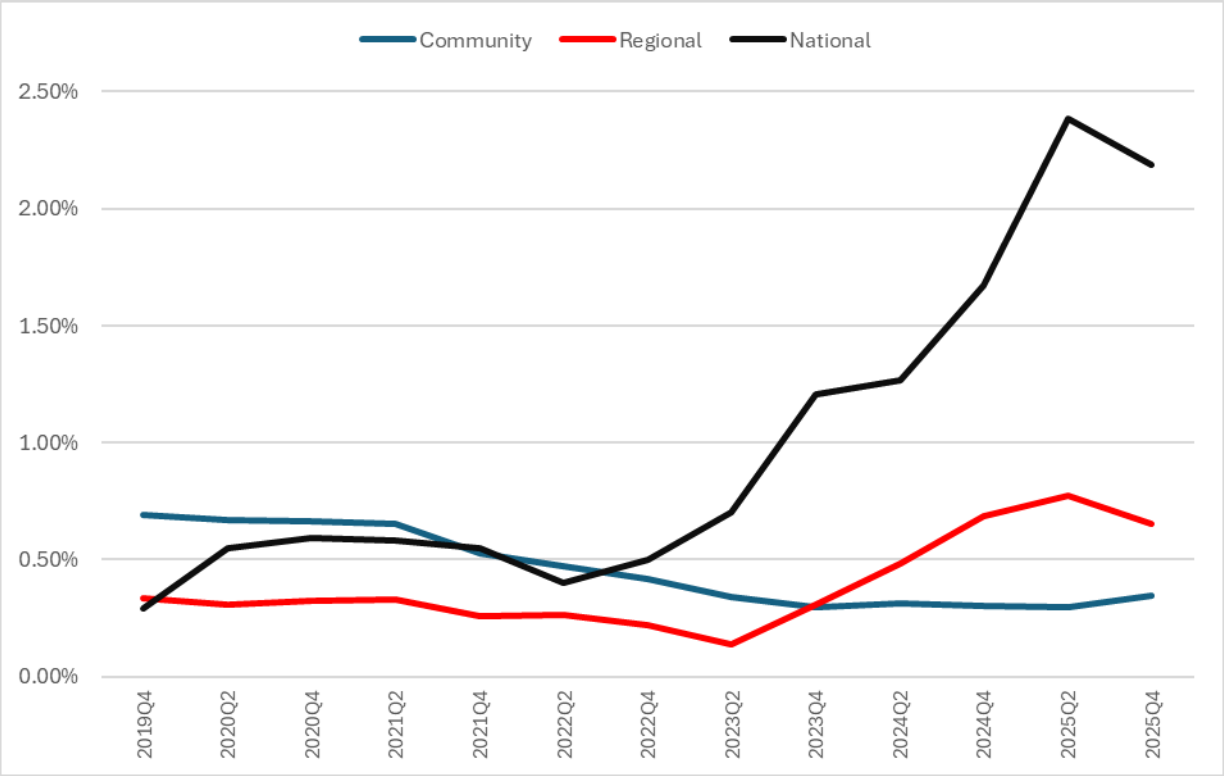

Figure 6: NPL Ratios of Modified Commercial Real Estate Loans

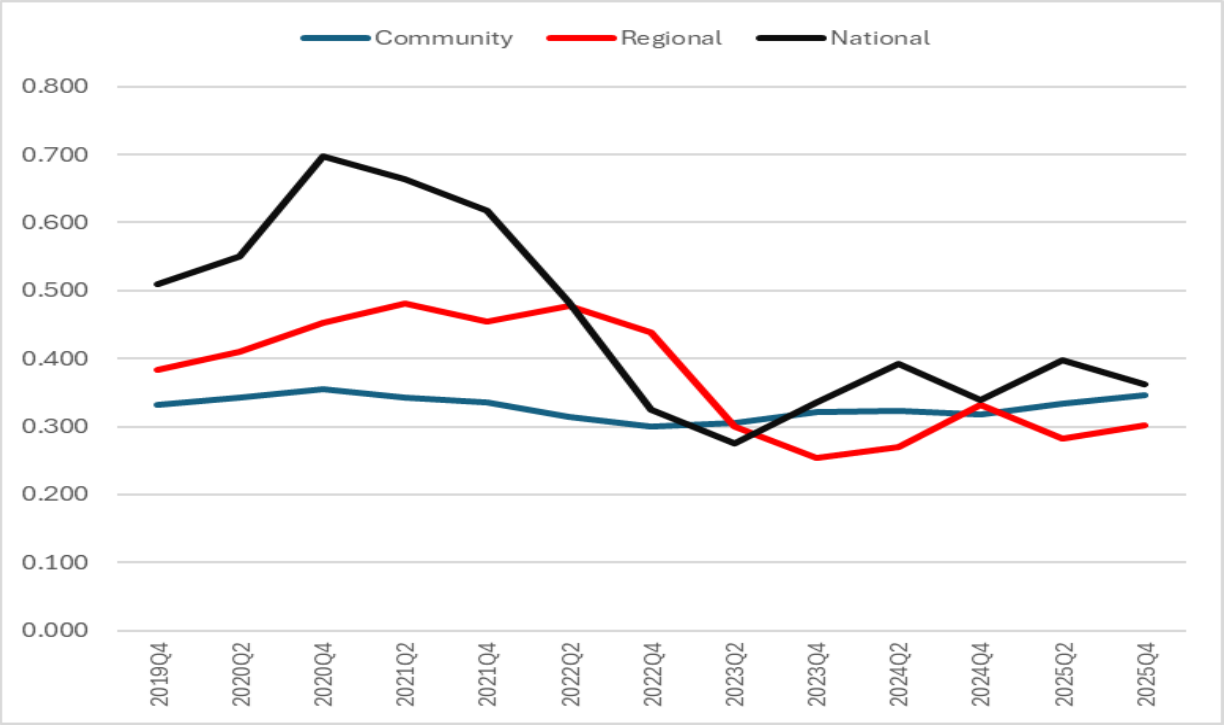

Table 1

Variable Definitions

This table defines variables used to analyze commercial real estate loan modifications. Total CRE loans include owner occupied nonfarm nonresidential mortgages, other nonfarm nonresidential mortgages, multifamily mortgages, residential construction loans and commercial real estate construction loans.

Variable	Definition
Dependent Variables	
Modification incidence	=1 if the amount of CRE modifications is greater than zero and =0 otherwise
Ln(CRE Modifications)	Natural logarithm of the amount of CRE modifications.
Modification Ratio	Amount of CRE modifications to the amount of CRE loans
CRE Modification NPL Ratio	Amount of nonperforming CRE modifications.
Focal Explanatory Variables	
Community	Indicator for community banks (assets < $10B)
Regional	Indicator for regional banks ($10B < assets < $100B)
National	Indicator for national banks (> $100B in assets)
Control Variables	
Equity Ratio	Total equity divided by total assets
NPL to Asset Ratio	Sum of nonperforming loans and foreclosed real estate divided by total assets.
ROA	Net income divided by total assets
Liquid Asset Ratio	Liquid assets (cash & securities) divided by total assets
CRE Exposure Ratio	Total CRE loans divided by total Equity

Table 2
Summary Statistics

This table presents descriptive statistics for variables used to analyze commercial real estate loan modifications. The sample period spans 2019Q4 through 2025Q4. Variables are defined in Table 1.

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent Variables					
mod	56,958	0.322	0.467	0	1
lntcremod	56,957	0.305	0.758	0	8.229
cremodshr	55,272	0.005	0.023	0	1
cremodnpl	18,320	0.335	0.421	0	1
Focal Explanatory Variables					
regional	56,958	0.026	0.159	0	1
national	56,958	0.007	0.083	0	1
post	56,958	0.563	0.496	0	1
pregional	56,958	0.015	0.122	0	1
pnational	56,958	0.004	0.063	0	1
Control Variables					
Equity to Asset Ratio	56,888	0.121	0.106	-0.056	1
NPL to Asset Ratio	56,888	0.009	0.012	0	0.330
ROA	56,888	0.011	0.012	-0.02	0.1
Liquid Asset Ratio	56,888	0.334	0.181	0	1.135
CRE Exposure Ratio	56,755	230.8	172.2	0	2,347

Table 3

Incidence of Commercial Real Estate Loan Modifications

This table reports difference-in-differences estimates of the incidence of commercial real estate (CRE) loan modification around the post-shock period. The dependent variable *modification incidence* is an indicator that is equal to one for a bank reporting a positive value for the amount of CRE loan modification and zero otherwise (extensive margin) and is estimated using a logistic regression model. $Post_t$ is an indicator variable that is equal to one for periods after March 2022 and zero otherwise. $Regional_{i,t}$ is an indicator variable that is equal to one for regional banks (assets $10 billion - $100 billion) and zero otherwise; $National_{i,t}$ is an indicator variable that is equal to one for national banks (assets > $100 billion) and zero otherwise. Community banks (assets < $10 billion) are the omitted size category. *Equity Ratio* is the ratio of total equity to total assets. *NPL Ratio* is the ratio of nonperforming loans to total assets. ROA is the ratio of net income to total assets. *Liquidity Ratio* is the ratio of liquid assets (cash plus investment securities) to total assets. *CRE Exposure Ratio* is the ratio of CRE loans and commitment to total equity. The table presents odds ratios rather than coefficients for ease of interpretation. Column (1) excludes our five bank control variables while Column 2 includes them. Community banks are the omitted category.
Standard errors are heteroskedasticity-robust. *** p<0.01, ** p<0.05, * p<0.10.

	(1)		(2)	
Regional	5.680***	(0.553)	5.832***	(0.578)
National	4.674***	(0.817)	7.704***	(1.358)
Post*Regional	1.227*	(0.151)	1.350**	(0.170)
Post*National	1.965***	(0.460)	2.467***	(0.581)
2020Q4	1.004	(0.041)	1.037	(0.044)
2021Q4	0.928*	(0.038)	0.977	(0.042)
2021Q4	0.857***	(0.036)	0.932	(0.041)
2022Q2	0.770***	(0.032)	0.827***	(0.037)
2022Q4	0.718***	(0.031)	0.633***	(0.029)
2023Q2	0.538***	(0.024)	0.429***	(0.020)
2023Q4	0.491***	(0.022)	0.393***	(0.019)
2024Q2	0.470***	(0.021)	0.382***	(0.018)
2024Q4	0.490***	(0.022)	0.392***	(0.019)
2025Q2	0.504***	(0.023)	0.405***	(0.019)
2025Q4	0.504***	(0.023)	0.413***	(0.020)
Equity to Asset Ratio			0.143***	(0.028)
NPL to Asset Ratio			1.015***	(0.001)
ROA			0.239	(0.285)
Liquid Asset Ratio			0.705***	(0.046)
CRE Exposure Ratio			1.003***	(0.000)
Obs.	56,950		56,751	
Pseudo-R2	0.034		0.097	

Table 4
Amounts of Commercial Real Estate Loan Modifications

This table reports difference-in-differences estimates of the natural logarithm of the amount of commercial real estate (CRE) loan modifications around the post-shock period. The dependent variable *ln(CRE Modifications)* is the natural logarithm of the amount (in millions) of CRE loan modification reported by each bank in each period and is estimated using an OLS regression model. $Post_t$ is an indicator variable that is equal to one for periods after March 2022 and zero otherwise. *Regional* $_{i,t}$ is an indicator variable that is equal to one for regional banks (assets $10 billion - $100 billion) and zero otherwise; *National* $_{i,t}$ is an indicator variable that is equal to one for national banks (assets > $100 billion) and zero otherwise. Community banks (assets < $10 billion) are the omitted size category. *Equity Ratio* is the ratio of total equity to total assets. *NPL Ratio* is the ratio of nonperforming loans to total assets. ROA is the ratio of net income to total assets. *Liquidity Ratio* is the ratio of liquid assets (cash plus investment securities) to total assets. *CRE Exposure Ratio* is the ratio of CRE loans and commitment to total equity. For each explanatory variable, the Table presents coefficients and standard errors. Column (1) excludes our five bank control variables while Column 2 includes them. Community banks are the omitted category.

Standard errors are heteroskedasticity-robust. *** p<0.01, ** p<0.05, * p<0.10.

	(1)		(2)	
Regional	1.422***	(0.027)	1.403***	(0.026)
National	2.664***	(0.050)	2.810***	(0.049)
Post*Regional	0.478***	(0.035)	0.490***	(0.034)
Post*National	1.177***	(0.066)	1.220***	(0.064)
2020Q4	0.0143	(0.013)	0.0277**	(0.012)
2021Q4	-0.00481	(0.013)	0.0157	(0.013)
2021Q4	-0.0314**	(0.013)	0.00234	(0.013)
2022Q2	-0.0614***	(0.013)	-0.0286**	(0.013)
2022Q4	-0.0998***	(0.013)	-0.109***	(0.013)
2023Q2	-0.146***	(0.013)	-0.173***	(0.013)
2023Q4	-0.129***	(0.013)	-0.155***	(0.013)
2024Q2	-0.108***	(0.013)	-0.131***	(0.013)
2024Q4	-0.0696***	(0.013)	-0.0990***	(0.013)
2025Q2	-0.0404***	(0.013)	-0.0707***	(0.013)
2025Q4	-0.0366***	(0.013)	-0.0633***	(0.013)
Equity to Asset Ratio			0.235***	(0.031)
NPL to Asset Ratio			3.842***	(0.219)
ROA			-1.058***	(0.261)
Liquid Asset Ratio			-0.0998***	(0.017)
CRE Exposure Ratio			0.000941***	(0.000)
Constant	0.296***	(0.009)	0.0655***	(0.013)
Obs.	56,949		56,750	
Adjusted R2	0.267		0.315	

Table 5
Commercial Real Estate Loan Modification Ratio

This table reports difference-in-differences estimates of the commercial real estate (CRE) loan modifications around the post-shock period. The dependent variable *modification ratio* is the amount (in millions) of CRE loan modifications divided by the amount (in millions) of total CRE loans reported by each bank in each period and is estimated using an OLS regression model. $Post_t$ is an indicator variable that is equal to one for periods after March 2022 and zero otherwise. $Regional_{i,t}$ is an indicator variable that is equal to one for regional banks (assets $10 billion - $100 billion) and zero otherwise; $National_{i,t}$ is an indicator variable that is equal to one for national banks (assets > $100 billion) and zero otherwise. Community banks (assets < $10 billion) are the omitted size category. *Equity Ratio* is the ratio of total equity to total assets. *NPL Ratio* is the ratio of nonperforming loans to total assets. ROA is the ratio of net income to total assets. *Liquidity Ratio* is the ratio of liquid assets (cash plus investment securities) to total assets. *CRE Exposure Ratio* is the ratio of CRE loans and commitment to total equity. For each explanatory variable, the Table presents coefficients and standard errors. Column (1) excludes our five bank control variables while Column 2 includes them. Community banks are the omitted category.

Standard errors are heteroskedasticity-robust. *** p<0.01, ** p<0.05, * p<0.10.

	(1)		(2)	
Regional	-0.00299***	(0.001)	-0.00275***	(0.001)
National	-0.000615	(0.002)	-0.000881	(0.002)
Post*Regional	0.00434***	(0.001)	0.00436***	(0.001)
Post*National	0.0113***	(0.002)	0.0107***	(0.002)
2020Q4	-0.0000472	(0.000)	0.000264	(0.000)
2021Q4	-0.000145	(0.000)	0.000239	(0.000)
2021Q4	-0.00141***	(0.000)	-0.000719	(0.000)
2022Q2	-0.00194***	(0.000)	-0.00114**	(0.000)
2022Q4	-0.00267***	(0.000)	-0.00165***	(0.000)
2023Q2	-0.00343***	(0.000)	-0.00235***	(0.000)
2023Q4	-0.00374***	(0.000)	-0.00261***	(0.000)
2024Q2	-0.00357***	(0.000)	-0.00262***	(0.000)
2024Q4	-0.00357***	(0.000)	-0.00281***	(0.000)
2025Q2	-0.00358***	(0.000)	-0.00296***	(0.000)
2025Q4	-0.00315***	(0.000)	-0.00264***	(0.000)
Equity to Asset Ratio			0.000234	(0.002)
NPL to Asset Ratio			0.188***	(0.008)
ROA			-0.00549	(0.013)
Liquid Asset Ratio			0.00335***	(0.001)
CRE Exposure Ratio			-0.00000235***	(0.000)
Constant	0.00669***	(0.000)	0.00379***	(0.001)
N	55,264		55,103	
adj. R-sq	0.004		0.015	

Table 6
Commercial Real Estate Loan Modification Nonperforming Loan (NPL) Ratio

This table reports difference-in-differences estimates of the natural logarithm of the amount of commercial real estate (CRE) loan modifications around the post-shock period. The dependent variable *CRE Mod NPL Ratio* is the amount (in millions) of nonperforming CRE loan modifications divided by the amount (in millions) of total CRE loan modifications reported by each bank in each period and is estimated using an OLS regression model. $Post_t$ is an indicator variable that is equal to one for periods after March 2022 and zero otherwise. *Regional* $_{i,t}$ is an indicator variable that is equal to one for regional banks (assets $10 billion - $100 billion) and zero otherwise; *National* $_{i,t}$ is an indicator variable that is equal to one for national banks (assets > $100 billion) and zero otherwise. Community banks (assets < $10 billion) are the omitted size category. *Equity Ratio* is the ratio of total equity to total assets. *NPL Ratio* is the ratio of nonperforming loans to total assets. ROA is the ratio of net income to total assets. *Liquidity Ratio* is the ratio of liquid assets (cash plus investment securities) to total assets. *CRE Exposure Ratio* is the ratio of CRE loans and commitment to total equity. For each explanatory variable, the Table presents coefficients and standard errors. Column (1) excludes our five bank control variables while Column 2 includes them. Community banks are the omitted category. Standard errors are heteroskedasticity-robust. *** p<0.01, ** p<0.05, * p<0.10.

	(1)		(2)	
Regional	0.117***	(0.020)	0.119***	(0.020)
National	0.263***	(0.038)	0.272***	(0.038)
Post*Regional	-0.127***	(0.027)	-0.128***	(0.026)
Post*National	-0.237***	(0.050)	-0.247***	(0.050)
2020Q4	0.0149	(0.013)	0.0247*	(0.013)
2021Q4	0.00431	(0.013)	0.0139	(0.013)
2021Q4	-0.00279	(0.013)	0.0130	(0.014)
2022Q2	-0.0236*	(0.014)	-0.00353	(0.014)
2022Q4	-0.0305**	(0.014)	-0.00403	(0.014)
2023Q2	-0.0345**	(0.015)	-0.00970	(0.015)
2023Q4	-0.0229	(0.015)	0.00336	(0.016)
2024Q2	-0.0178	(0.016)	0.00409	(0.016)
2024Q4	-0.0192	(0.015)	0.000195	(0.016)
2025Q2	-0.00733	(0.015)	0.00663	(0.015)
2025Q4	0.00376	(0.016)	0.0123	(0.016)
Equity to Asset Ratio			0.266**	(0.107)
NPL to Asset Ratio			3.716***	(0.249)
ROA			0.632	(0.487)
Liquid Asset Ratio			0.0476*	(0.024)
CRE Exposure Ratio			0.00000856	(0.000)
Constant	0.339***	(0.009)	0.235***	(0.022)
Obs.	18,319		18,299	
adj. R-sq	0.006		0.019	