Regulatory Leniency and Depositor Discipline*

Michael Iselin
Carlson School of Management
University of Minnesota

Allison Nicoletti†
The Wharton School
University of Pennsylvania

Jacob Ott
Carlson School of Management
University of Minnesota

Haiwen (Helen) Zhang
Carlson School of Management
University of Minnesota

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†Corresponding author, Mailing address: 3620 Locust Walk, Philadelphia PA, 19104, Email address: *anico@wharton.upenn.edu*

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Abstract

We examine whether uninsured depositors exhibit price discipline in the presence of lenient bank regulators. We exploit the unexpected shale booms to identify a shock to information asymmetry between depositors and managers, which increases the importance of regulatory monitoring. We find the change in uninsured deposit rates at state banks exposed to shale booms positively associates with the leniency of their state regulators. This result is stronger for riskier banks and for branches with more sophisticated depositors. These findings further our understanding of the interaction between two of the three pillars of the Basel Accords: regulatory supervision and market discipline.

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1. Introduction

An agency conflict between depositors and bank managers is one of the main reasons for bank regulation. In their efforts to mitigate this agency conflict, regulators conduct on-site examinations, monitor bank performance through regulatory reports, assign regulatory ratings which determine a bank's ability to continue its operations, and issue corrective actions to remediate any areas of concern. Prior literature finds that bank regulators' ability and incentives to monitor bank activities vary both across time and across regulators (Kroszner & Strahan, 1996; Barth, Caprio Jr., & Levine, 2004; White, 2011; Morrison & White, 2013; Bischof, Daske, Elfers, & Hail, 2020). Even within the United States, Agarwal, Lucca, Seru, & Trebbi (2014) document variation in the leniency of different state regulators relative to their federal counterparts and find that more lenient state regulators are associated with costly future outcomes, such as higher problem bank rates and bank failure rates. In this paper, we examine whether the deposit market understands this association between bank outcomes and regulatory leniency and investigate whether uninsured depositors exhibit price discipline in the presence of more lenient regulators.[1] By investigating this question we further our understanding of the interplay between market discipline and regulatory supervision in the banking industry.

We follow Agarwal et al. (2014) and define a regulator as more lenient if they are more likely to delay intervention for a given level of bank risk. We argue that regulatory leniency can affect uninsured deposit pricing through two channels. First, delayed intervention can have a direct effect on deposit rates if it allows problems to build up, which could both increase the likelihood of bank failure and exacerbate depositor losses in the event of bank failure. Second, delayed intervention can have an indirect effect on deposit rates if it allows banks with lenient regulators to invest in riskier assets in the future without increasing the likelihood of regulatory intervention. If depositors understand these potential consequences of more lenient regulators, we predict a positive association between deposit interest rates and regulatory

[1] Consistent with prior studies, we use the term "discipline" to refer to higher interest rates (or lower deposit growth) in the presence of greater bank risk (Park & Peristiani, 1998; Martinez Peria & Schmukler, 2001).

leniency. Importantly, this prediction differs from the findings in prior literature that primarily document an association between observable realized risk outcomes and deposit interest rates (Park & Peristiani, 1998; Martinez Peria & Schmukler, 2001). Instead, regulatory leniency is an ex-ante construct associated with potential *future* negative outcomes, including delayed intervention when the bank is experiencing problems or greater future risk-taking, that are not yet reflected in observable realized risk measures.

We focus on depositor discipline because deposits are the most important source of funding for banks (Jayaratne & Morgan, 2000), can affect bank stability (Diamond & Dybvig, 1983), and are at the focal point of banking theory explaining the need for bank regulation (Dewatripont & Tirole, 1994). Uninsured depositors have strong incentives to monitor bank performance and risk-taking because, unlike insured depositors who are protected by deposit insurance, they are at risk of loss in the case of bank failure (Demirgüç-Kunt & Detragiache, 2002; Demirgüç-Kunt & Huizinga, 2004). In support of this, prior studies document that uninsured deposit growth and interest rates are sensitive to bank risk and performance measures (Park & Peristiani, 1998; Martinez Peria & Schmukler, 2001). These findings suggest that uninsured depositors are able to both acquire and understand relevant, publicly-available financial information. There is also evidence that uninsured depositors are able to obtain and act on non-public information (Iyer, Puri, & Ryan, 2016). Collectively, the evidence in prior research suggests that uninsured depositors are relatively sophisticated entities and have both the ability and incentives to obtain information relevant to monitoring and disciplining bank risk-taking.

Although prior literature provides evidence that uninsured depositors are sensitive to bank risk and performance measures, there are a few reasons why uninsured depositors may not engage in price discipline with respect to regulatory leniency. First, learning about and understanding regulatory leniency requires larger information acquisition costs compared to calculating realized financial statement ratios from publicly available financial reports. Public information regarding bank supervisory activities and outcomes is more limited, and uninsured depositors may determine that the costs of acquiring this information outweigh the benefits. Second, prior research documents that depositors value several factors when choosing a bank, and even with the rise of internet banking, one of the most important factors is still the bank's branch network (Jordan, 2000; DeYoung et al., 2007), not bank risk. Thus, even if depositors are aware of regulatory leniency, it may not be an important enough factor to affect interest rates.

We use the rate on large time deposits from the bank's Call report to measure uninsured deposit rates. Specifically, we follow Chen, Goldstein, Huang, & Vashishtha (2019) and divide the total interest expense on these deposits by the average total level of these deposits. Regulatory leniency is a more difficult construct to measure empirically. We rely on the Agarwal et al. (2014) regulatory index to measure this construct. Agarwal et al. (2014) use access to confidential regulatory examination data and the alternating examination schedule of state and federal regulators at state-chartered banks to compare regulatory ratings issued by a bank's federal regulator (i.e., the Federal Deposit Insurance Corporation (FDIC) or the Federal Reserve) to ratings for the same bank issued by the state regulator. The authors provide a time-invariant, state-level regulatory index based on their analysis, which captures the average difference in regulatory (CAMELS) ratings assigned by the state regulator relative to the federal regulator in each state. Larger values of this index correspond to relatively more lenient state regulators. Although there are several potential sources that contribute to the relative leniency of state regulators compared to federal regulators in each state, Agarwal et al. (2014) document that some of the variation in the leniency index is driven by state regulator concerns regarding the local economy and budgetary concerns.

The regulatory leniency index is a state-level, time-invariant measure, thus any association between this index and banks' uninsured deposit rates is particularly susceptible to bank-level or state-level correlated omitted variable concerns. The lack of variation in the leniency index also leaves us unable to identify an exogenous shock or change to leniency within a bank. Instead, we identify a setting where there is a change in the importance of regulatory leniency. We argue that an increase in information asymmetry between depositors and bank managers leaves depositors more reliant on bank regulators to monitor bank risk-taking and thus, increases the weight that depositors place on regulatory leniency. The specific setting that we investigate is the unexpected development of "fracking" technology that led to oil and gas shale booms from 2003 - 2010 in specific local communities. Gilje, Loutskina, & Strahan (2016) document that banks operating in counties exposed to these booms significantly expanded their lending portfolio.

Morgan (2002) provides evidence that as the size of a bank's loan portfolio increases, so too does bank opacity. Based on this finding, we argue that the increased lending during the boom period exacerbates the information asymmetry problem between managers and depositors. This increase in information asymmetry increases the extent to which depositors must rely on bank regulators to monitor risk taking. However, depositors may be less willing to rely on a more lenient regulator and instead may exhibit greater price discipline. A second effect of these shale booms is an inflow of new deposits stemming from both lease payments to local land owners and increased business activity in the local community (Gilje, 2019). Although this inflow of deposits likely has a negative effect on the average level of deposit interest rates, we do not expect an incremental association between these new deposits flows and regulatory leniency.[2] Importantly, we expect the increase in information asymmetry to be relevant to both these potential new depositors as well as existing depositors (i.e., those present before the boom) who have similar incentives to monitor bank risk.

Our use of the shale boom setting allows us to include both bank fixed effects and state by quarter fixed effects in an effort to mitigate concerns regarding correlated omitted variables. More specifically, we are able to include bank fixed effects due to the within-bank variation in exposure to the boom, which allows us to account for innate bank characteristics that are associated with both leniency and deposit interest rates. In addition, because the shale booms vary across counties within a particular state and different states experience the shale boom during different time periods, our research design can accommodate state by

[2] If regulatory leniency is a priced risk, then deposit rates will already reflect any differential effect of leniency and depositors should be indifferent between banks with lenient and strict regulators. If regulatory leniency is not a priced risk, then there is no reason for depositors to allocate their newfound wealth differentially between a more lenient bank and a less lenient bank. Consistent with these arguments, in untabulated analysis, we do not find an incremental effect of regulatory leniency on the association between exposure to the boom and uninsured deposit growth.

quarter fixed effects to control for economic conditions at the state-quarter level. Importantly, we also control for multiple measures of bank risk to strengthen the argument that we are not simply capturing differences in observable bank risk associated with regulatory leniency. However, we are careful to point out that despite our stringent fixed effects structure, we cannot completely eliminate endogeneity concerns.

Our primary analysis examines whether uninsured deposit rates are more sensitive to regulatory leniency after a shale boom. As a baseline, we find no association between boom exposure and uninsured deposit interest rates, which is consistent with the countervailing effects of an increase in supply reducing uninsured deposit rates and an increase in information asymmetry increasing uninsured deposit rates.[3] We next document that regulatory leniency is positively associated with the boom exposure/interest rate relation. This finding is consistent with our argument that the increase in information asymmetry is more relevant for banks with more lenient regulators. The economic magnitude of this association suggests that a one standard deviation increase in regulatory leniency is associated with a 6.9 - 9.9 basis point increase in uninsured deposit rates during the 5-year boom period for a bank that operates entirely within a boom county. The economic magnitude is in line with prior studies in the shale boom setting (Gilje et al., 2016) and is reasonable given that regulatory leniency is only one factor that determines deposit interest rates. This finding suggests that uninsured depositors understand the increased importance of regulatory monitoring after the shale boom and exhibit greater price discipline in the presence of a more lenient regulator.

Next, we examine whether the positive association between regulatory leniency and interest rates after a shale boom is stronger for riskier banks. Uninsured depositors may be more concerned about bank failure when a bank's asset composition reflects higher risk, when a bank is closer to default, and when a bank is subject to greater liquidity risk (Hannan & Hanweck, 1988; Imbierowicz & Rauch, 2014). These situations represent cases where the

[3] In contrast, in Section 4.2, we document a negative baseline association between boom exposure and *insured* deposit rates. Given that insured deposits are fully protected in the case of bank failure, we expect the effect of an increase in information asymmetry on insured deposit rates to be minimal. These findings also suggest that the negative association between *total* deposit interest rates and boom exposure documented in Gilje et al. (2016) is driven by insured deposits.

potential for depositor losses is high, and thus, depositors may be more sensitive to variation in regulatory leniency. To capture these dimensions of risk, we use the ratio of risk-weighted assets to total assets, which captures the bank's balance sheet risk, the z-score, which captures the bank's default risk, and the ratio of loans to deposits, which captures the bank's liquidity risk. We document that the positive association between regulatory leniency and deposit rates after a shale boom is stronger for banks with higher balance sheet risk, banks with higher default risk (i.e., lower z-scores), and banks with higher liquidity risk. These findings strengthen our interpretation that uninsured depositors engage in price discipline associated with regulatory leniency.

A concern with our interpretation and the use of the state-level regulatory leniency measure is that a different state-level factor that is correlated with the leniency measure could be driving the results. Importantly, in addition to being correlated with leniency, any potential correlated omitted variable would need to be staggered across time and across state and correlated with the timing of the shale booms. It would also need to have a larger effect on banks with more of their deposits located in boom counties. Nonetheless, in an effort to further mitigate concerns regarding an alternative explanation, we perform a falsification test using nationally-chartered banks. These banks are also subject to the shale boom but they are solely supervised by the Office of the Comptroller of the Currency (OCC). Thus, if the effect we document is due to regulatory leniency at state-chartered banks, we would not expect to observe similar results for national banks based on the leniency of the state regulator where the bank is headquartered. Moreover, this test helps mitigate concerns that we are simply capturing interest rate adjustments to the boom stemming from changes in the competitive landscape that are also correlated with leniency. We find no evidence of an effect of regulatory leniency on the shale boom/interest rate relation for national banks and further find that the magnitude is significantly smaller compared to that documented for state banks. These findings strengthen our interpretation that variation in regulatory leniency is driving the results.

We next examine the relation between regulatory leniency and insured deposit rates.

Papers document evidence consistent with price discipline by insured depositors, but the magnitude is generally smaller relative to uninsured depositors (Demirgüç-Kunt & Huizinga, 2004; Berger & Turk-Ariss, 2015). Examining insured deposit rates also helps to further address the concern that state banks with lenient regulators have a competitive advantage and simply raise rates to attract more deposits. If that were the case we would expect banks to raise deposit rates on relatively cheaper insured deposits by at least as much if not more than the amount that they raise rates on more expensive uninsured deposits. We find no evidence of an association between leniency and insured deposit rates. This test further corroborates the interpretation that we are capturing the effects of regulatory leniency.

There are multiple potential sources of information that depositors can use to understand leniency, including conversations with management, disclosure of corrective actions issued to local banks, or news of local bank failures. Unfortunately, it is unclear how and when depositors would use these mechanisms to develop an expectation of regulatory leniency, making it difficult to document empirically. However, understanding leniency through any of these channels requires a certain level of sophistication. Thus, if our main results are indeed associated with regulatory leniency we would expect them to be driven by relatively more sophisticated groups of uninsured depositors. To test this, we follow Chen et al. (2019) and use the percentage of individuals within a particular county that holds a college degree to measure sophistication. Because this sophistication measure is at the county level, we conduct this analysis at the branch level.[4] After partitioning the sample into branches located in high education and low education counties, we find that the main result is primarily driven by branches located in high-education counties. This finding corroborates our main result, suggesting that a certain level of sophistication is required for depositors to understand and price regulatory leniency.

As a final test, to determine whether our results generalize beyond the shale boom setting, we examine the association between regulatory leniency and uninsured deposit rates at state banks using a broader panel of banks across the country in a matched sample

[4] Consistent with the idea that branches have some autonomy in setting deposit rates, prior research documents within bank variation in offered deposit rates (Drechsler et al., 2017; Dlugosz et al., 2019).

design. Specifically, we match each state bank to the most similarly-sized national bank headquartered in the same county. We further include state-quarter fixed effects, which control for fluctuating local economic conditions to the extent that state and national banks operating in the same state are similarly affected by these fluctuations. Results from this analysis show that leniency is positively associated with deposit rates at state banks relative to the national bank control group. Finding a consistent result in this broader setting mitigates concerns that our results only hold in the shale boom setting and corroborates the interpretation that depositors engage in price discipline with respect to regulatory leniency.

This paper contributes to the literature along two primary dimensions. First, we contribute to the broad literature that examines the effects of regulation and regulatory requirements on bank-level outcomes, such as risk-taking and investment decisions (e.g., Gonzalez, 2005; Laeven & Levine, 2009; Ongena, Popov, & Udell, 2013; Barth, Lin, Ma, Seade, & Song, 2013). The most closely related papers are those examining the consequences of regulatory leniency. These papers document that stricter regulators are associated with lower problem bank rates and failure rates (Agarwal et al., 2014), more transparent financial statements (Costello, Granja, & Weber, 2019) and greater small business lending (Granja & Leuz, 2018). However, it is unclear whether depositors understand these future potential implications of more lenient regulators and as a result, exhibit price discipline on an ex-ante basis. Adding to this uncertainty, prior research argues that effective bank regulation is important because depositors often hold diverse claims and lack the ability or information to monitor bank managers, leading to the failure of the usual market mechanisms (Dewatripont & Tirole, 1994; Flannery, 2014). Our findings also help further our understanding of the links between two of the three pillars of the Basel Accords.[5] However, we note that our paper does not speak to other consequences of lenient regulators, such as implications for the deposit insurance fund, the local economy, or other stakeholders, such as equity holders.

Second, we contribute to the literature on market discipline and depositor monitoring.

[5] The Basel Committee on Banking and Supervision designates three pillars of a sound financial architecture in the second Basel Accord (Basel II). These three pillars are minimum capital requirements, supervisory reviews, and market discipline.

Billett, Garfinkel, & O'Neal (1998) find that regulation potentially undermines market discipline by offering insurance on a subset of deposits. We show that uninsured depositors provide at least some market discipline in the presence of lenient regulators. Other papers document evidence consistent with depositor discipline of bank risk-taking by showing that deposit growth and deposit interest rates are sensitive to bank fundamentals (Park & Peristiani, 1998; Martinez Peria & Schmukler, 2001) and that depositors withdraw funds ahead of bank failure (Goldberg & Hudgins, 2002). These papers illustrate that depositors discipline banks surrounding poor performance, which is generally the ex-post realized outcome of greater risk-taking. Our study contributes to this literature by documenting that depositors are also able to understand and price an ex-ante risk factor that is more difficult to observe and assess, namely regulatory leniency.

2. Data and Research Design

2.1. Variable Measurement

To test the primary research question of whether uninsured depositors exert price discipline on banks subject to more lenient regulators, we calculate a proxy for uninsured deposit rates using information on large deposits (i.e., those with balances greater than $100,000).[6] Specifically, similar to Chen et al. (2019), we divide the quarterly interest expense on large deposits by the average quarterly balance of large deposits. We then annualize this amount to arrive at the final measure, $Unins\_Rate$. This measure captures the average annual interest rate for all large deposits held by the bank at the end of the fiscal period and is the dependent variable in all of our main analyses.

Regulatory leniency depends on the specific agency responsible for bank oversight, which includes conducting on-site safety and soundness examinations. National banks are

[6] The threshold for deposit insurance increased from $100,000 to $250,000 in October 2008. The initial increase was a temporary measure but was made permanent as part of the Dodd-Frank Act, which was enacted in July 2010. The threshold for reporting large time deposits in the Call report did not increase until the third quarter of 2009. Although this may create measurement error in our proxy for uninsured deposit rates, our research design should reduce this concern to the extent that our treatment and control observations are similarly affected.

supervised solely by the Office of the Comptroller of the Currency (OCC). State banks are supervised by their respective state regulator as well as their federal regulator, which is the Federal Reserve for state banks that are members of the Federal Reserve system and the Federal Deposit Insurance Corporation (FDIC) for non-member state banks. State banks with total assets below $250 million are supervised on an alternating basis by either their federal regulator or their state regulator. The examinations for state banks with total assets greater than $250 million are usually jointly conducted by the federal and state regulators, although the agencies alternate serving as the lead (Agarwal et al., 2014). Unfortunately, the agency that is conducting or serving as the lead on the examination is strictly confidential.

Given this data availability constraint, we rely on the measure developed by Agarwal et al. (2014), which leverages access to confidential regulatory examination data. Specifically, Agarwal et al. (2014) use the rotation between state and federal regulators for state-chartered banks and examine the average CAMELS rating assigned by the two regulators for the same bank to assess the strictness of the state regulator relative to the federal regulator. The paper documents that state regulators assign "better" CAMELS ratings relative to their federal counterparts and interpret this as evidence that state regulators are more lenient, on average.[7] They further validate this interpretation by showing that more lenient state regulators are associated with higher bank failure rates, higher problem bank rates, larger asset sale discounts, and lower Troubled Asset Relief Program (TARP) repayments even after controlling for CAMELS ratings, suggesting that delayed supervisory corrections under lenient regulators lead to costly outcomes. Agarwal et al. (2014) also develop a state-level time-invariant leniency index, which captures the relative leniency of state regulators compared to federal regulators in each state. This index is publicly-available and provides variation in regulatory leniency for our study. A larger value of this index corresponds to relatively more

[7] At the conclusion of the examination, bank regulators assign CAMELS ratings. The CAMELS rating is comprised of a rating for each of the following dimensions along with an overall rating: capital adequacy (C), asset quality (A), management quality (M), earnings (E), liquidity (L), and sensitivity to market risk (S). The examination findings and CAMELS ratings are shared only with bank management and are not publicly available. Receipt of a poor CAMELS rating can prevent banks from engaging in acquisitions or opening new branches, restrict payout policies, affect lending decisions, and in the extreme, result in closure of the bank.

lenient state regulators.[8] For interpretation purposes, we normalize the raw leniency variable by subtracting the mean within our sample and dividing by the standard deviation and use this transformed variable (*Leniency*) as the primary independent variable of interest.

2.2. Research Design

The regulatory leniency measure is a state-level, time-invariant measure. Thus, any association between leniency and deposit interest rates is subject to concerns of omitted correlated variables. To address this, we rely on an empirical setting that increases the importance of regulatory monitoring from the depositor perspective. We argue that greater information asymmetry between depositors and managers increases the reliance that depositors place on regulators to perform monitoring and as a result, the weight placed on leniency in the depositor pricing function. To obtain variation in this information asymmetry problem, we examine the effects of shale booms staggered across several states between 2003 and 2010.

The unexpected advances in hydraulic fracturing ("fracking") technology, a combination of horizontal drilling and hydraulic fracturing, expanded the number of wells with potential for oil and gas drilling and greatly decreased the likelihood that a well would be unproductive. As a result, oil and gas firms negotiated with land owners to use their property for fracking. The contracts typically involve (i) an upfront payment to landowners that is paid regardless of whether the well is productive and (ii) a royalty percentage based on well productivity. In addition to the direct inflows from royalty payments these shale booms also resulted in significant job creation in local economies and increased wages across many different industries. Feyrer et al. (2017) find that for each million dollars of new oil and gas production the local county experienced an $80,000 growth in wages and a $132,000 growth in royalty

[8] Variation in leniency can arise if regulators have access to different information sources or have different incentives that affect their decisions. For example, holding bank performance constant, one regulatory group may exhibit forbearance in the hopes that bank performance will improve while another may choose to intervene immediately. Another source of leniency is differences in resource allocation or budgetary constraints. Agarwal et al. (2014) examine the potential sources of leniency in their setting and document that the state leniency index is larger when state regulators have incentives to place greater weight on the local economy and when state budgets are tighter. This evidence suggests that there are a number of sources that contribute to observed leniency.

and business income.[9] Prior literature finds that the royalty payments made to landowners as a result of the shale boom as well as the corresponding economic growth of the local economy led to large deposit inflows at local banks and to expanded mortgage lending as it alleviated financial constraints (Gilje et al., 2016). We refer to the period following a "shale boom" (i.e., extraction of additional oil and natural gas from a well using the new fracking technology) as the "boom period."

Given prior findings that banks exposed to these shale booms expanded lending, we contend that this setting represents an economic event that increases information asymmetry between depositors and managers. Specifically, Morgan (2002) finds that bank opacity is increasing in the size of the loan portfolio. Greater information asymmetry increases the importance of regulatory monitoring to depositors, because regulators have the ability to obtain private information and closely monitor bank risk-taking. This importance of regulatory monitoring is relevant for both the bank's existing depositors and any new depositors stemming from the shale boom since both groups have incentives to be informed regarding bank failure risk. Therefore, all else equal, we would expect an increase in uninsured deposit rates if depositors exhibit greater price discipline when information asymmetry increases. An additional effect of the boom is the inflow of new deposits, which should lead to a reduction in deposit interest rates, on average. We argue that this supply effect does not vary with regulatory leniency. Specifically, if leniency is priced, then depositors are indifferent between banks with lenient and strict regulators. If leniency is not priced, then there should be no effect of leniency on deposit flows. Consistent with this argument, in untabulated analysis, we find no evidence of an incremental effect of leniency on the association between boom exposure and uninsured deposit growth.

Thus, our main identification strategy examines changes in the association between regulatory leniency and deposit interest rates after the shale boom. A key advantage of this setting is that the nature of the variation allows us to control for economic trends affecting all

[9] It is difficult to obtain an estimate of the overall increase in production as a result of fracking advances but Feyrer et al. (2017) report that from 2005 - 2014 the oil and gas industry extracted $393 billion of new production.

banks in the same state in the same quarter by including state-quarter fixed effects as well as any time-invariant unobservable bank characteristics by including bank fixed effects. Given this design, an alternative explanation would require an omitted factor that is correlated with both regulatory leniency and bank exposure to the boom. To further mitigate concerns regarding this possibility, we conduct a falsification analysis using nationally-chartered banks in Section 4.1.

Our main test investigates the association between uninsured deposit rates and *Boom_Exposure* and allows that association to vary with regulatory leniency. We test this association by estimating the following ordinary least squares regression, where the unit of observation is the bank-quarter and i indexes the bank, q indexes the quarter, and s indexes the state location of the bank headquarters:

$$\begin{aligned}
Unins_Rate_{i,q} = {} & \beta_1 Boom_Exposure_{i,q} + \boldsymbol{\beta_2 Leniency_s * Boom_Exposure_{i,q}} \\
& + \beta_3 County_Exposure_{i,q} + \beta_4 Size_{i,q-1} + \beta_5 Tier1_{i,q-1} + \beta_6 NPL_{i,q-1} \\
& + \beta_7 ROA_{i,q-1} + \beta_8 Loans\text{-}to\text{-}Deposits_{i,q-1} + \beta_9 RealEstateLoans_{i,q-1} \\
& + \beta_{10} C\&ILoans_{i,q-1} + \beta_{11} LoanRate_{i,q-1} + \beta_{12} Z\text{-}Score_{i,q-1} + \beta_{13} RWA_{i,q-1} \\
& + \phi_i + \lambda_{s,q} + \epsilon_{i,q}
\end{aligned} \tag{1}$$

The sample includes observations from all state-chartered banks that are headquartered in one of the states subject to a shale boom during our sample period that meet the other sample restriction requirements discussed below in 2.3. *Boom_Exposure* is the percentage of a bank's deposits that are located in a county experiencing a boom in the current year or any of the previous four years. Similar to Gilje et al. (2016), we use deposits to measure bank exposure to the boom given that the booms occurred at the county-level and branch-level information on banks' total lending is unavailable. We identify the length of the boom period by examining the length of time following the initial boom during which banks continue to experience consistent uninsured deposit inflows.

The coefficient estimate on *Boom_Exposure*, β_1, represents the average change in the uninsured deposit rate in response to the shale boom exposure for a bank subject to the mean level of regulatory leniency.[10] We do not have a prediction for the direction of β_1 given

[10] *Leniency* is a normalized variable, so its mean is zero allowing for this interpretation of the coefficient

that an increase in information asymmetry would result in an increase in uninsured deposit rates while an increase in the supply of uninsured deposits would result in a decrease in uninsured deposit rates. Therefore, the sign of the coefficient is determined by the net of these two effects. The main coefficient of interest is β_2, which represents the effect of a one standard deviation change in *Leniency* on the interest rate adjustment driven by the boom exposure. If depositors understand the increased importance of regulatory monitoring after a shale boom, we would expect a positive β_2.

To mitigate concerns that there is something fundamentally different about boom counties, we also control for the percentage of a bank's deposits located in counties that ever boom ($County\_Exposure$). The specification also includes several controls for bank characteristics. Specifically, we control for bank size by including the log of total assets ($Size$) and for bank risk and performance by including: the Tier 1 capital ratio ($Tier1$), the ratio of non-performing loans to total loans (NPL), the ratio of annualized income before taxes and extraordinary items to total assets (ROA), the ratio of annualized loan income scaled by total loans (*LoanRate*), the ratio of loans to deposits (*Loans-to-Deposits*), the natural log of the Z-Score calculated using the standard deviation of return on assets over the prior three years (*Z-Score*), and risk weighted assets scaled by total assets (RWA). Finally, we control for the bank's loan portfolio characteristics by including real estate loans scaled by total loans ($RealEstateLoans$) and commercial and industrial loans scaled by total loans ($C\&ILoans$). All financial control variables are measured at the end of the previous quarter ($q-1$). The inclusion of multiple measures of observable bank risk strengthens the argument that we are capturing the potential future implications of leniency beyond observable current performance and risk characteristics. Detailed variable definitions are provided in Appendix A, and standard errors are clustered by bank.

This setting provides variation across two dimensions that we leverage in the research design. First, there is variation across time in when the shale booms happen in different states as well as multiple booms for a few of the states. Second, there is variation in a

estimate on $Boom\_Exposure$.

bank's exposure to the counties affected by the shale booms which allows us to measure *Boom_Exposure* as a continuous variable. Using this variation, we first include quarter fixed effects to control for any changes contemporaneous with the shale booms that might affect deposit rates. In the second specification we are able to further include state by quarter fixed effects which remove characteristics common to all banks in a given quarter in a given state. As such, the design compares banks located in the same state-quarter with the primary difference being that some banks are exposed (or more exposed) to shale booms while others are not. Finally, we include bank fixed effects to control for time-invariant unobservable bank characteristics.

2.3. Sample Selection

Our sample includes all state-chartered banks that are headquartered in a state that was subject to a shale boom. We identify nine states with shale booms over the period 2003-2010 (Plosser, 2014; Wu, 2018). Specifically, Arkansas, Kansas, Louisiana, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, and West Virginia all have at least one county that we identify as being subject to a shale boom. There are 122 counties within these states that are exposed to a boom, and many counties that are not exposed to a boom. The counties affected by the booms and the years of the booms are presented in Appendix B. We use the FDIC's Summary of Deposits (SOD) data to identify the location of bank deposits at the county-level. In order to have a pre- and post-period for each of the shale booms, we begin the sample period in 2000 and end the sample period in 2012.

We obtain the other data used in this study from several sources. First, deposit information and control variables are constructed using the FDIC's Statistics on Depository Institutions (SDI), Summary of Deposits (SOD), and Call report data. Second, the leniency index is obtained from Amit Seru's website.[11] In order to mitigate the effect of mergers and acquisitions, we omit bank-quarters with asset growth greater than 10%. We also implement several filters such that the leniency index from Agarwal et al. (2014) is applicable

[11] https://aseru.people.stanford.edu/data-and-discussions

by excluding: banks with greater than $10 billion in assets, new banks (less than five years old), and banks that have recently switched charters (in the past two years). We winsorize all continuous variables at the top and bottom one percentile to mitigate the influence of outliers. Our final sample consists of 65,795 bank-quarter observations representing 1,807 state-chartered banks located in nine states.

3. Results

3.1. Descriptive Statistics

We begin by presenting descriptive statistics both for the full sample and then separately for bank-quarters exposed to shale booms and bank-quarters not exposed to shale booms. Table 1, Panel A presents the full set of descriptives and shows that the average annual interest rate on uninsured deposits (*Unins_Rate*) in our sample is 3.3%. The average bank-quarter in our sample has 12% of its deposits in counties that experience a shale boom at some point in time (*County_Exposure*), but the variable is skewed as more than half of the observations have no exposure to these counties. The average bank-quarter has total assets of approximately $232 million. In addition, the average Tier 1 capital ratio is 17%, which is well above the regulatory minimum to be considered well-capitalized, and the average annual ROA is approximately 1.3%. Finally, we standardize the variable *Leniency* resulting in a mean of zero and a standard deviation of one.

[Insert Table 1]

Table 1, Panel B presents means and standard deviations separately for each control variable for bank-quarters with and without exposure to counties that have a shale boom during the current quarter (e.g., *Boom_Exposure* > 0 vs *Boom_Exposure* $= 0$). It then also reports both raw differences in the means and normalized differences across those two groups. We examine normalized differences to evaluate covariate differences, because Imbens & Wooldridge (2009) show that normalized differences are independent of sample size and can be preferable to the standard t-test. They also state that normalized differences greater than 0.25 can indicate specification sensitivity. The table shows that all differences with the exception of *County_Exposure* and *Size* are below the recommended threshold. The large difference in *County_Exposure* across the two groups is by construction as banks that have activities in counties while they are exposed to a shale boom also almost certainly have exposure to those same counties outside of boom periods. There is also a slight difference across the two groups in *Size*. This difference is unsurprising because larger banks have a more disperse network of branches and are more likely to have at least one branch in a county that has a shale boom relative to smaller banks.

3.2. Main Results

Table 2 reports the results of estimating equation (1). Column (1) reports results including bank fixed effects and quarter fixed effects. Column (2) further controls for local economic shocks by replacing quarter fixed effects with state-quarter fixed effects. Across both columns, the coefficient on *Boom_Exposure* is insignificant, consistent with the net effect of an increase in uninsured deposit supply resulting in lower deposit rates and an increase in information asymmetry resulting in higher deposit rates for banks subject to the mean level of leniency.[12] We next document a positive and significant coefficient estimate on the interaction term *LeniencyXBoom_Exposure*, consistent with our prediction. The magnitude of this coefficient suggests that a one standard deviation increase in regulatory leniency is associated with a 9.9 basis point (or 6.9 in Column (2)) increase in uninsured deposit rates during the 5-year boom period for a bank that operates entirely within boom counties. This magnitude is consistent with prior studies that examine the pricing effect of the shale boom (Gilje et al., 2016) and is reasonable given that regulatory leniency is only one consideration for depositors in determining their required interest rate. This finding suggests that uninsured depositors engage in ex-ante price discipline with respect to regulatory leniency.

[Insert Table 2]

[12] As shown in Section 4.2, we document a negative association between boom exposure and *insured* deposit rates, on average. This finding is consistent with the supply effect dominating the information asymmetry effect.

3.3. Cross-Sectional Variation in Risk

We next assess whether the association documented in the previous section is stronger for high risk banks. High risk banks are relatively closer to failure and the ability of regulators to intervene promptly is more important relative to lower risk banks. We specifically examine three dimensions of bank risk: balance sheet risk, default risk, and liquidity risk (Hannan & Hanweck, 1988; Imbierowicz & Rauch, 2014). Banks with greater balance sheet risk or lower distance to default may be viewed as more likely to fail and as such, depositors may require an incrementally higher interest rate in the face of more lenient regulators as delayed intervention is particularly salient for these banks. Banks with greater liquidity risk may be less able to repay depositor funds in the event of a failure, which might also lead depositors to place additional value on timely regulatory intervention.

To capture balance sheet risk, we define RWA as the ratio of risk-weighted assets to total assets. Larger values of RWA correspond to greater risk. Second, to capture default risk, we use the z-score, which is a measure of distance to default (Roy, 1952; Laeven & Levine, 2009). Specifically, we define *Z-score* as the sum of ROA and the capital ratio scaled by the standard deviation of ROA measured over the prior 12 quarters. Larger values of *Z-score* correspond to higher distance to default and as such, lower default risk. Third, we capture liquidity risk using the ratio of loans to deposits (DiSalvo & Johnston, 2017). This ratio captures the extent to which banks have longer-term maturity loans financed with shorter-term deposits such that larger values correspond to higher liquidity risk.

We first partition the sample based on RWA at the end of the prior quarter. The results are presented in Table 3. Column (1) presents the results for the sample of banks with above median risk-weighted assets (greater risk), and column (2) for the sample of banks with below median risk-weighted assets (lower risk). The positive effect of regulatory leniency on the association between boom exposure and deposit rates exists in both subsamples, but the magnitude is significantly larger in the high risk subsample relative to the low risk subsample (p-value = 0.008). Specifically, the economic magnitude of a one standard deviation increase in *Leniency* is 11.4 basis points larger in column (1) compared to column (2). We provide a similar analysis in columns (3) and (4) after further including state-quarter fixed effects. Again, the difference in coefficients on the interaction term is significantly different across the two columns (p-value = 0.003) and the economic magnitude of the difference corresponds to a 13.2 basis point increase for a one standard deviation increase in leniency. These findings suggest that depositors exhibit greater price discipline with respect to regulatory leniency for banks with greater balance sheet risk.

[Insert Table 3]

Table 4 reports the results of these cross-sectional analyses when we partition the sample based on default risk (*Z-Score*) at the end of the prior quarter. The table shows that the positive effect of *Leniency* on the association between *Boom_Exposure* and deposit rates is present in both low risk (high z-score) banks (Columns 1 and 3) and high risk (low z-score) banks (Columns 2 and 4). However, the effect of a one standard deviation change in regulatory leniency on the relation between *Boom_Exposure* and uninsured deposit rates in the low z-score subsample is 6.5 (7.3) basis points larger than the effect in the high z-score subsample when we include quarter (state-quarter) fixed effects. This difference is only statistically significant at conventional levels when including state-quarter fixed effects (p-values of 0.129 and 0.083, respectively). Thus, Table 4 indicates that greater default risk is associated with stronger leniency price discipline.

[Insert Table 4]

Table 5 reveals a similar picture when we partition based on liquidity risk at the end of the prior quarter. Higher loans-to-deposits represents higher risk, so Columns (1) and (3) present the high risk subsample and Columns (2) and (4) present the low risk subsample. Similar to the previous results, we report that the effect of a one standard deviation change in regulatory leniency on the relation between *Boom_Exposure* and uninsured deposit rates in the high risk subsample is 8.6 (8.3) basis points larger than the effect in the low risk subsample when we include quarter (state-quarter) fixed effects. These differences are both statistically significant at conventional levels (p-values of 0.090 and 0.086 respectively). This result indicates that liquidity risk is relevant to depositor price discipline surrounding regulatory leniency.

[Insert Table 5]

Taken together the results in these three tables provide evidence that depositors exhibit greater price discipline with respect to regulatory leniency for banks that, based on realized risk outcomes, appear to put depositors at greater risk of losing their funds. This is consistent with the notion that depositors are particularly sensitive to downside risk and withdraw funds ahead of bank failure (Goldberg & Hudgins, 2002).

4. Additional Analyses

4.1. National Bank Falsification Test

One concern with our research design is that, by construction, banks with boom exposures and banks without boom exposures are either located in different parts of the state or in a different time period holding location constant. We include bank fixed effects to account for time-invariant factors associated with bank location. However, if there is a county-level, time-varying risk factor that is correlated with boom exposure and regulatory leniency, this may confound our inferences. In an effort to mitigate this concern, we perform a falsification test using nationally-chartered banks. The advantage of this test is that national banks located in boom counties have similar shale boom exposures, but given that these banks are regulated by the *national* bank regulator (the Office of the Comptroller of the Currency), price discipline should not be systematically associated with leniency of *state* regulators. Thus, if the associations we observe are the result of regulatory leniency, we should not find any differential effect of the state leniency measure on price discipline during the boom period for a sample of national banks. However, if the results are driven by geographic factors correlated with boom exposure and leniency, such as a change in the competitive landscape during the boom period, we would expect to document similar results for national banks to those documented for our state bank main sample.

To implement this test, we replicate our main analysis using a sample of national banks. Specifically, we assign the regulatory leniency measure to each national bank based on the headquarters location of that bank. We present the results of estimating equation (1) for national banks in Table 6. Column (1) presents the results with bank and quarter fixed effects, and Column (2) presents the results with bank and state-quarter fixed effects. Across both columns, we find an insignificant coefficient estimate on the interaction term, $LeniencyXBoom\_Exposure$. Additionally, the coefficient estimates reported in Table 6 are significantly different from the estimates reported for the state banks in Table 2 (*p*-value of 0.043 (0.047) for Column 1 (2)). These results provide further support for our conclusion that the effects we document in our main analysis are indeed associated with differences in regulatory leniency as opposed to other unobservable factors that are correlated with bank location.

[Insert Table 6]

4.2. Insured Deposit Rates

We next run the our main specification examining the association between regulatory leniency and the boom exposure/deposit rate relation but focus on *insured* rates instead of *uninsured* rates. While some prior papers document evidence consistent with price discipline by insured depositors, the magnitude is generally smaller relative to uninsured depositors (Demirgüç-Kunt & Huizinga, 2004; Berger & Turk-Ariss, 2015). Therefore, this test allows us to assess the plausibility of our interpretation. This analysis also helps to rule out the alternative explanation that the shale booms result in changes to bank competition that is correlated with regulatory leniency. If our main results are driven by banks with more lenient regulators competing more fiercely for deposits after the boom, then we would expect these effects to also be present when examining insured rates. Moreover, we would expect a potentially stronger effect on insured rates relative to uninsured rates since insured deposits represent a cheaper source of funding for banks.

Table 7 presents the results of estimating equation (1) but replacing the dependent variable with insured deposit rates (Ins_Rate). Column (1) presents the results with bank and quarter fixed effects, while column (2) replaces the quarter fixed effects with state-quarter fixed effects. Across both columns, we find a negative association between boom exposure and insured deposit rates for banks subject to the mean level of leniency as evidenced by the negative coefficient on $Boom\_Exposure$. This finding is consistent with the supply shock effect dominating the information asymmetry effect for insured depositors who are fully protected in the case of bank failure.[13] We next find no evidence of an association between regulatory leniency and boom period insured deposit rates. This result corroborates the evidence in prior research documenting more limited effects of price discipline by insured depositors compared to uninsured depositors. In addition, this test also helps us mitigate concerns regarding the alternative explanation that banks in states with lenient regulators face higher deposit competition and simply raise deposit rates to attract more funding without depositors realizing the risks associated with lenient regulators. Collectively, these results provide further corroboration of our main finding and interpretation.

[Insert Table 7]

4.3. Depositor Sophistication

Uninsured depositors likely obtain information regarding regulatory leniency from a number of different sources, including public information on regulatory enforcement actions or failures and private information obtained from bank management. However, it is difficult to empirically assess the extent to which depositors rely on each information source and the period during which they obtain this information. Regardless, we argue that more sophisticated depositors have a greater ability to acquire this information and if our results are driven by leniency, we would expect the results to be stronger when depositor sophistication is relatively higher. Similar to Chen et al. (2019), we measure depositor sophistication as the

[13] Gilje et al. (2016) do not separately examine insured and uninsured deposit rates, but find a negative association between total deposit rates and boom exposure. Our result for insured deposit rates is consistent with their findings.

percentage of residents in a county that hold a college degree.[14] Given that this information is taken from the Census and only available every ten years, we use the percentages from the year 2000 to capture sophistication. Because sophistication information is available at the county-level, we use branch-level analyses to construct more powerful tests. In addition, aggregating sophistication information to the bank-level is challenging, because it is unclear what summarization metric (e.g., the average sophistication, maximum level of sophistication) should be used to capture bank-level depositor sophistication. To capture sophistication, we create an indicator variable *Education* that is equal to one if the percentage of county residents with college degrees in 2000 is greater than the sample median and zero otherwise. By construction, *Education* is fixed during our sample period.

To capture branch-level interest rates, we obtain data from a third party data provider called RateWatch. RateWatch conducts weekly surveys of over 100,000 branches and collects advertised deposit rates and annual percentage yields on new accounts for many different products. We focus on rates quoted on certificate of deposit (CD) accounts, because they are one of the most frequently quoted products. Specifically, we define $Unins\_Rate\_Branch$ as the annual rate offered on CDs with balances of at least \$100,000 from 2000 - 2010 and with balances of at least \$250,000 from 2011 - 2012 to maintain the largest sample size. RateWatch began surveying at \$250,000 in 2011, because the deposit insurance limit permanently increased from \$100,000 to \$250,000 during 2010. Thus, the chosen rates should largely capture deposit accounts above the FDIC's insurance limit.

We use a similar research design to our main, bank-level analyses by estimating the following regression, where the unit of observation is the branch-quarter and b indexes the branch, i indexes the bank, q indexes the quarter, c indexes the county location of the branch,

[14] The United States Department of Agriculture Economic Research service reports this data at https://data.ers.usda.gov/reports.aspx?ID=17829.

and s indexes the state location of the bank headquarters.[15]

$$
\begin{aligned}
Unins\_Rate\_Branch_{b,q} = {} & \beta_1 Boom\_Exposure_{i,q} + \boldsymbol{\beta_2 Leniency_s * Boom\_Exposure_{i,q}} \\
& + \beta_3 Size_{i,q-1} + \beta_4 Tier1_{i,q-1} + \beta_5 NPL_{i,q-1} + \beta_6 ROA_{i,q-1} + \beta_7 Loans\text{-}to\text{-}Deposits_{i,q-1} \\
& + \beta_8 RealEstateLoans_{i,q-1} + \beta_9 C\&ILoans_{i,q-1} + \beta_{10} LoanRate_{i,q-1} + \beta_{11} Z\text{-}Score_{i,q-1} \\
& + \beta_{12} RWA_{i,q-1} + \lambda_{c,q} + \epsilon_{b,q} \qquad (2)
\end{aligned}
$$

We estimate the above regression separately for branches in counties with relatively more sophisticated depositors ($Education = 1$) and those in counties with relatively less sophisticated depositors ($Education = 0$). Importantly, both subsamples have variation in both $Boom\_Exposure$ as well as *Leniency*, which allows us to determine whether our main result is driven by branches in counties with more sophisticated depositors.

The dependent variable is measured at the branch-level while all independent variables are measured at the bank-level. We include county by quarter fixed effects to account for time-varying unobservable characteristics that are common to all branches operating in the same county in a given quarter. Therefore, the variation that we exploit is within county-quarter variation in *bank*-level exposure to the boom. We continue to control for bank-level characteristics to mitigate concerns regarding observable characteristics driving the results.[16] We would expect the positive β_2 to be concentrated in the higher sophistication subsample if depositors understand and exhibit discipline over regulatory leniency.

The results of estimating equation (2) are presented in Table 8. Column (1) first presents results for the full sample of branch-quarter observations and shows that our main result documented in Table 2 holds at the branch-level. Specifically, we document a positive and significant coefficient on $LeniencyXBoom\_Exposure$. A one standard deviation increase in leniency corresponds to an increase in branch-level uninsured deposit rates of 4.8 basis points for a bank that operates entirely within boom counties relative to banks that operate entirely outside of boom counties. We next partition the sample based on depositor sophistication

[15] The sample size in the branch-level analysis does not increase substantially, because RateWatch does not cover every bank in our sample, and RateWatch coverage is more limited in the early part of our sample period.

[16] We do not include branch fixed effects, because there is limited variation in the rate variable for some branches due to RateWatch surveying frequency. However, inferences are qualitatively similar if we do include branch fixed effects.

with the below median *Education* subsample tabulated in column (2) and the above median subsample tabulated in column (3).[17] In column (2), we find no evidence of an effect of leniency on the association between boom exposure and uninsured deposit rates. However, in column (3), we document a positive and significant coefficient on the interaction term, suggesting that depositors in counties with above median depositor sophistication understand and engage in price discipline surrounding leniency. Additionally, the coefficient estimates on the interaction term are significantly different across the two columns (p-value = 0.082). This finding provides further support that the associations we document are consistent with depositors understanding leniency rather than other observable characteristics.

[Insert Table 8]

5. External Validity

In this section, we provide evidence regarding whether our main finding holds outside of the shale boom setting. As previously discussed, the primary advantage of the shale boom setting is that it allows us to mitigate concerns regarding bank-level and state-level correlated omitted variables associated with the time-invariant, state-level leniency measure. One concern with this setting is that the results may be specific to banks located in boom states and not reflective of deposit rates outside of boom states or during non-boom periods. In an effort to mitigate this concern, we perform a matched sample analysis using a broader panel of banks. Specifically, we examine the association between regulatory leniency and deposit rates at state-chartered banks across all states and use national banks headquartered in the same county as a control group to account for local economic conditions.

The sample for this specification includes observations meeting all of our sample selection criteria described in Section 2.3 except that we remove banks that switch their charters at any time during the sample period, and we do not require the bank to be headquartered in a boom state. To increase the comparability between national and state

[17] The sample size in column (1) is slightly larger than the total sample size across columns (2) and (3) because there are some counties for which we do not have education data.

banks in the sample, we perform a one-to-one match with replacement by matching each state bank-quarter observation to a national bank-quarter observation located in the same county that is closest in asset size. Using this sample, we estimate the following regression:

$$\begin{aligned} Unins\_Rate_{i,q} = {} & \beta_1 State\_Charter_{i,q} + \boldsymbol{\beta_2 State\_Charter_{i,q} * Leniency_s} \\ & + \beta_3 Size_{i,q-1} + \beta_4 Tier1_{i,q-1} + \beta_5 NPL_{i,q-1} + \beta_6 ROA_{i,q-1} \\ & + \beta_7 Loans\text{-}to\text{-}Deposits_{i,q-1} + \beta_8 RealEstateLoans_{i,q-1} + \beta_9 C\&ILoans_{i,q-1} \\ & + \beta_{10} LoanRate_{i,q-1} + \beta_{11} Z\text{-}Score_{i,q-1} + \beta_{12} RWA_{i,q-1} + \alpha_q * \lambda_s + \epsilon_{i,q} \end{aligned} \quad (3)$$

State_Charter is an indicator variable equal to one if the bank is chartered by the state and zero for nationally-chartered banks. All other variables are as previously defined. In contrast to our previous specification, we do not include bank fixed effects since both *Leniency* and *State_Charter* are fixed within a bank. However, because of the national bank control group, we are able to include state-quarter fixed effects to account for fluctuating state-level economic conditions under the assumption that national and state banks operating in the same state face similar conditions. The coefficient estimate on *State_Charter*, β_1, captures the average difference in deposit rates for state relative to national banks located in states with mean level regulatory leniency of the state regulator. β_2 represents the effect of a one standard deviation change in *Leniency* on deposit rates at state banks and is expected to be positive.

We first present descriptive statistics for the full sample of 213,816 bank-quarter observations in Panel A of Table 9. The mean interest rate on uninsured deposits is approximately 3.4%, which is similar to the average magnitude in the shale boom setting. The average bank size is $342 million in total assets, average Tier 1 capital ratio is 15.6% and average annual ROA is 1.2%. These statistics are in line with those documented in the shale boom setting, although the average bank size is larger because banks in boom states tend to be smaller than the average bank in the country. To assess the comparability of the state and national banks in our sample, we next present descriptive statistics separately for each group of banks in Panel B of Table 9. We again calculate normalized differences for each covariate between the two groups and note that all differences are below the 0.25 recommended by

Imbens & Wooldridge (2009). Overall, these descriptive statistics suggest that our treatment and control observations are relatively similar on observable dimensions.

[Insert Table 9]

The results of estimating equation (3) are provided in Table 10. Column (1) provides the results including state and quarter fixed effects, while column (2) includes state-quarter fixed effects. We document a positive coefficient on $State\_CharterXLeniency$ across both columns, indicating that leniency has a positive incremental effect on deposit rates for state-chartered banks relative to similarly-sized national banks operating in the same county. This finding corroborates the results from our main analyses and suggests that our results can be generalized beyond the shale boom setting.

[Insert Table 10]

6. Conclusion

In this paper, we ask whether depositors engage in price discipline of regulatory leniency using the setting of shale booms stemming from fracking technology (Gilje et al., 2016; Gilje, 2019). This setting represents an increase in the information asymmetry problem between depositors and managers and makes regulatory monitoring more important to uninsured depositors. Our main finding is that regulatory leniency is associated with higher interest rates paid on uninsured deposits following a shale boom. This result is consistent with depositors engaging in price discipline for banks with more lenient regulators.

We perform several additional analyses in the shale boom setting to corroborate our interpretation. First, we show that the results are stronger for riskier banks, consistent with depositor price discipline being stronger when the depositors are already at a higher risk of loss. Second, to mitigate concerns regarding other risk factors that are correlated with shale booms and regulatory leniency, we perform a falsification test using national banks and find no effect of state-level regulatory leniency on price discipline for these banks. Third, we find no evidence of an effect of regulatory leniency on the association between boom exposure and insured deposit rates, suggesting that there is not a geographic factor correlated with leniency and the boom that explains our results. Fourth, branch-level analyses suggest that our results are driven by depositors in counties with a relatively more sophisticated population, which provides support for our interpretation that uninsured depositors understand regulatory leniency.

As a final test, we assess external validity of our results and provide evidence that they generalize beyond the shale boom setting. Specifically, we show that regulatory leniency is positively associated with uninsured deposit rates at state banks relative to matched national banks similar in size and located in the same county. We argue that while each of our findings are subject to certain drawbacks, the combination of tests provides consistent evidence that uninsured depositors exhibit price discipline when banks have more lenient regulators. However, we are careful to note that because we do not examine exogenous variation in regulatory leniency, we are unable to definitively rule out endogeneity concerns.

These findings contribute to the literature in two ways. First, our results suggest that depositors appear to understand the potential future costly outcomes of leniency and provide price discipline on an ex-ante basis. Importantly, our conclusion speaks only to market discipline by depositors and does not address other stakeholders (e.g., equity holders) or externalities of lenient regulators beyond individual banks. Second, prior research documents evidence consistent with depositor discipline of ex-post, poor performance or greater realized risk-taking. We show that depositors also appear to price ex-ante indicators of potential future negative outcomes.

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Appendix A: Variable Definitions

This table provides variable definitions for all variables. Variable names correspond to the respective database.

Variable name	**Variable definition**	**Calculation**	**Source**
Boom_Exposure	Share of a bank's deposits that are located within counties that are currently booming scaled by the bank's total deposits. Counties are defined to be booming during the initial year of a shale boom and the subsequent four years.	$\frac{\sum_{n=0}^{j} deposits_j}{deposits_i}$ where j indexes branches of bank i that are in counties which are *currently* booming.	SOD
C&I Loans	Commercial and industrial loans divided by net loans and leases.	$\frac{lnci}{lnlsnet}$	SDI
County_Exposure	Share of a bank's deposits that are located within counties that ever boom scaled by the bank's total deposits.	$\frac{\sum_{n=0}^{k} deposits_k}{deposits_i}$ where k indexes branches of bank i that are in counties that *ever* boom.	SOD
Education	Percentage of adults within a county who completed college as of the year 2000.		United States Department of Agriculture Economic Research service
Ins_Rate	Annualized interest rate on deposits other than large time deposits (expressed as a percent).		Call Report & SDI
Leniency	Standardized regulatory leniency index, which captures the average difference in CAMELS ratings assigned by state regulators relative to federal regulators in each state.		Amit Seru's website
Loans-to-Deposits	Net loans and leases divided by total deposits.	$\frac{lnlsnet}{dep}$	SDI
Loan Rate	Annualized quarterly interest rate on loans (expressed as a percent)	$\frac{ilndom_q}{lnlsnet_{q-1}} * 400$ $ilndom$ is adjusted to the quarterly amount (reported year-to-date)	SDI
NPL	Loans and leases 90 days past due and non-accrual loans and leases divided by net loans and leases.	$\frac{nclnls}{lnlsnet}$	SDI
Real Estate Loans	Real estate loans divided by net loans and leases.	$\frac{lnre}{lnlsnet}$	SDI
ROA	Annualized pre-tax net income divided by average total assets.	$roaptx$	SDI

Continued on following page

Appendix A: Variable Definitions (cont'd)

This table provides variable definitions for all variables. Variable names correspond to the respective database.

Variable name	**Variable definition**	**Calculation**	**Source**
RWA	Risk-weighted assets scaled by total assets.	$\frac{rwajt}{asset}$	SDI
Size	Natural log of total assets.	log(asset)	SDI
State_Charter	Indicator variable equal to one if the bank is state-chartered and zero if the bank is nationally-chartered		Call report
Tier1	Tier 1 (core) capital divided by risk-weighted assets.	$\frac{rbc1rwaj}{100}$	SDI
Unins_Rate	Annualized quarterly interest rate on large time deposits (expressed as a percent).	$\frac{riada517_q}{rcona514_q} * 400$ $riada517$ is adjusted to the quarterly amount (reported year-to-date)	Call Report
Unins_Rate_Branch	Annual interest rate offered on certificate of deposits (CDs) of \$100,000 until 2010 and of \$250,000 after 2010 (expressed as a percent).		RateWatch
Z-Score	Bank z-score measured as the natural log of the sum of ROA and capital scaled by the standard deviation of ROA over the past 12 quarters.	$\text{Log}(\frac{ROA + \frac{eq}{asset}}{\sigma ROA_{t,t-11}})$	SDI

Appendix B: Shale Boom Counties

This table provides a list of the states and counties that experienced a shale boom during our sample and the initial year of the boom.

State	County	Initial Boom Year	State	County	Initial Boom Year	State	County	Initial Boom Year
AR	Cleburne	2004	OK	Coal	2005	TX	Tarrant	2003
AR	Conway	2004	OK	Hughes	2005	TX	Wheeler	2003
AR	Faulkner	2004	OK	Johnston	2005	TX	Wise	2003
AR	Independence	2004	OK	Marshall	2005	TX	Andrews	2004
AR	Pope	2004	OK	Pittsburg	2005	TX	Crockett	2004
AR	Van Buren	2004	OK	Blaine	2007	TX	Ector	2004
AR	White	2004	OK	Canadian	2007	TX	Glasscock	2004
KS	Barber	2010	OK	Dewey	2007	TX	Harrison	2004
KS	Comanche	2010	OK	Alfalfa	2008	TX	Howard	2004
KS	Harper	2010	OK	Grant	2008	TX	Irion	2004
LA	Bienville	2007	OK	Harper	2008	TX	Martin	2004
LA	Bossier	2007	OK	Kay	2008	TX	Midland	2004
LA	Caddo	2007	OK	Pawnee	2008	TX	Nacogdoches	2004
LA	De Soto	2007	OK	Woods	2008	TX	Panola	2004
LA	Red River	2007	PA	Bradford	2007	TX	Reagan	2004
LA	Sabine	2007	PA	Clearfield	2007	TX	Rusk	2004
ND	Billings	2004	PA	Clinton	2007	TX	San Augustine	2004
ND	Burke	2004	PA	Fayette	2007	TX	Shelby	2004
ND	Dunn	2004	PA	Greene	2007	TX	Upton	2004
ND	Golden Valley	2004	PA	Lycoming	2007	TX	Culberson	2005
ND	Mckenzie	2004	PA	Susquehanna	2007	TX	Pecos	2005
ND	Mclean	2004	PA	Tioga	2007	TX	Reeves	2005
ND	Mountrail	2004	PA	Washington	2007	TX	Ward	2005
ND	Stark	2004	PA	Westmoreland	2007	TX	Atascosa	2008
ND	Williams	2004	PA	Wyoming	2007	TX	De witt	2008
OH	Belmont	2009	TX	Cooke	2003	TX	Dimmit	2008
OH	Carroll	2009	TX	Denton	2003	TX	Frio	2008
OH	Columbiana	2009	TX	Ellis	2003	TX	Gonzales	2008
OH	Guernsey	2009	TX	Erath	2003	TX	Karnes	2008
OH	Harrison	2009	TX	HempHill	2003	TX	La Salle	2008
OH	Jefferson	2009	TX	Hill	2003	TX	Live Oak	2008
OH	Monroe	2009	TX	Hood	2003	TX	Mcmullen	2008
OH	Noble	2009	TX	Jack	2003	TX	Webb	2008
OK	Beckham	2004	TX	Johnson	2003	TX	Wilson	2008
OK	Ellis	2004	TX	Lipscomb	2003	TX	Zavala	2008
OK	Lincoln	2004	TX	Montague	2003	WV	Doddridge	2007
OK	Roger Mills	2004	TX	Ochiltree	2003	WV	Harrison	2007
OK	Seminole	2004	TX	Palo Pinto	2003	WV	Marshall	2007
OK	Washita	2004	TX	Parker	2003	WV	Upshur	2007
OK	Atoka	2005	TX	Roberts	2003	WV	Wetzel	2007
OK	Carter	2005	TX	Somervell	2003			

Table 1: Descriptive statistics

This table presents descriptive statistics of the variables used in the main analysis. Panel A presents statistics for the pooled sample of bank-quarter level observations for state-chartered banks used in the main analysis. Panel B presents means and standard deviations separately for banks with *Boom_Exposure* > 0 and *Boom_Exposure* $= 0$. The final two columns present the difference in means across these two subsamples and the normalized differences. Normalized differences are calculated as: $\frac{\bar{X}_a - \bar{X}_b}{\sqrt{{s_a}^2 + {s_b}^2}}$ where $\bar{X}$ and s^2 are the subsample mean and subsample variance, respectively. Continuous variables are winsorized at the 1st and 99th percentiles.

Panel A: Distributional statistics for the pooled sample

	Mean	StDev	P 10	Median	P 90
Unins_Rate	3.281	1.541	1.323	3.119	5.494
Boom_Exposure	0.047	0.195	0.000	0.000	0.000
Leniency	0.000	1.000	-0.624	-0.279	2.522
County_Exposure	0.123	0.303	0.000	0.000	0.786
Size	11.491	1.158	10.079	11.415	13.027
Tier1	0.170	0.082	0.101	0.146	0.269
NPL	0.014	0.018	0.000	0.008	0.034
ROA	0.013	0.009	0.004	0.013	0.022
Loans-to-Deposits	0.709	0.207	0.429	0.72	0.962
Real Estate Loans	0.617	0.202	0.339	0.634	0.872
C&I Loans	0.154	0.098	0.045	0.139	0.282
Loan Rate	7.718	1.425	5.984	7.563	9.673
Z-Score	3.656	0.805	2.642	3.738	4.587
RWA	0.639	0.129	0.468	0.644	0.800

Panel B: Normalized differences of *Boom_Exposure* $>$ 0 vs *Boom_Exposure* $=$ 0

	Boom_Share > 0		Boom_Share = 0			Normalized
	Mean	StDev	Mean	StDev	Difference	Difference
Observations	4,862		60,933			
County_Exposure	0.645	0.373	0.081	0.255	0.564	1.248
Size	12.015	1.356	11.449	1.130	0.566	0.321
Tier1	0.158	0.077	0.171	0.082	-0.013	0.116
NPL	0.013	0.016	0.014	0.018	-0.001	0.042
ROA	0.014	0.008	0.013	0.009	0.001	0.083
Loans-to-Deposits	0.696	0.205	0.710	0.207	-0.014	0.048
Real Estate Loans	0.616	0.188	0.617	0.203	-0.001	0.004
C&I Loans	0.172	0.099	0.153	0.098	0.019	0.136
Loan Rate	7.471	1.213	7.738	1.439	-0.267	0.142
Z-Score	3.722	0.713	3.650	0.812	0.072	0.067
RWA	0.650	0.133	0.638	0.129	0.012	0.065

Table 2: The effect of regulatory leniency on uninsured deposit interest rates for state banks

This table presents the results of OLS regressions where the dependent variable is the average interest rate on uninsured deposits (*Unins_Rate*) for state-chartered banks. The main independent variables of interest are *Boom_Exposure* and *LeniencyXBoom_Exposure*. *Boom_Exposure* is the percentage of a bank's deposits located within a county that experienced a shale boom in the current year or any of the prior four years and zero for all other observations. *LeniencyXBoom_Exposure* is the interaction between *Boom_Exposure* and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of *Leniency* is subsumed by the bank fixed effects. Control variables are defined in Appendix A. Column (1) includes bank and quarter fixed effects and Column (2) includes bank and state-quarter fixed effects. Numbers below the coefficient estimates in parentheses are t-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Unins_Rate	(2) Unins_Rate
Boom_Exposure	-0.036	-0.029
	(-1.06)	(-0.86)
Leniency X Boom_Exposure	0.099***	0.069***
	(3.95)	(2.79)
County_Exposure	-0.055	-0.035
	(-0.53)	(-0.34)
Size	0.083***	0.077***
	(3.17)	(2.96)
Tier1	-1.107***	-0.990***
	(-5.15)	(-4.64)
NPL	-0.263	-0.299
	(-0.79)	(-0.91)
ROA	-4.751***	-5.216***
	(-6.01)	(-6.55)
Loans-to-Deposits	0.306***	0.430***
	(3.90)	(5.49)
Real Estate Loans	0.087	0.049
	(0.84)	(0.46)
C&I Loans	0.282**	0.230*
	(2.10)	(1.69)
Loan Rate	0.090***	0.069***
	(11.05)	(8.94)
Z-Score	0.008	0.006
	(0.90)	(0.68)
RWA	-0.262**	-0.335***
	(-2.07)	(-2.71)
Constant	1.711***	1.932***
	(4.86)	(5.62)
Observations	65,795	65,795
Adj R-Squared	0.854	0.859
Bank FE	Yes	Yes
Quarter FE	Yes	No
State-Quarter FE	No	Yes

Table 3: The cross-sectional effect of balance sheet risk on the association between regulatory leniency and uninsured deposit rates

This table presents the results of OLS regressions where the dependent variable is the average interest rate on uninsured deposits (*Unins_Rate*) for state-chartered banks. The main independent variables of interest are *Boom_Exposure* and *LeniencyXBoom_Exposure*. *Boom_Exposure* is the percentage of a bank's deposits located within a county that experienced a shale boom in the current year or any of the prior four years and zero for all other observations. *LeniencyXBoom_Exposure* is the interaction between *Boom_Exposure* and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of *Leniency* is subsumed by the bank fixed effects. Control variables are defined in Appendix A. The full sample of bank quarters is split between those with above median versus below median values of RWA (at the end of the prior quarter), which is the ratio of risk-weighted assets to total assets. Columns (1) and (3) present results for bank quarters with above median values for RWA and Columns (2) and (4) present results for bank quarters with below median values for RWA. Columns (1) and (2) include bank and quarter fixed effects and Columns (3) and (4) include bank and state-quarter fixed effects. Numbers below the coefficient estimates in parentheses represent *t*-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	High RWA	Low RWA	High RWA	Low RWA
	(1) Unins_Rate	(2) Unins_Rate	(3) Unins_Rate	(4) Unins_Rate
Boom_Exposure	-0.029	-0.052	-0.051	-0.034
	(-0.61)	(-1.28)	(-1.09)	(-0.78)
Leniency X Boom_Exposure	0.170***	0.056*	0.146***	0.014
	(5.48)	(1.76)	(4.65)	(0.43)
Difference in Coeff	0.114***		0.132***	
p-Value	0.008		0.003	
Observations	32,857	32,835	32,857	32,835
Adj R-Squared	0.865	0.853	0.869	0.859
Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	No	No
State-Quarter FE	No	No	Yes	Yes

Table 4: The cross-sectional effect of default risk on the association between regulatory leniency and uninsured deposit rates

This table presents the results of OLS regressions where the dependent variable is the average interest rate on uninsured deposits ($Unins\_Rate$) for state-chartered banks. The main independent variables of interest are $Boom\_Exposure$ and $LeniencyXBoom\_Exposure$. $Boom\_Exposure$ is the percentage of a bank's deposits located within a county that experienced a shale boom in the current year or any of the prior four years and zero for all other observations. $LeniencyXBoom\_Exposure$ is the interaction between $Boom\_Exposure$ and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of $Leniency$ is subsumed by the bank fixed effects. Control variables are defined in Appendix A. The full sample of bank quarters is split between those with above median versus below median values of $ZScore$ (at the end of the prior quarter), which is the z-score of the bank calculated over the prior 12 quarters. Columns (1) and (3) present results for bank quarters with above median values for $ZScore$ and Columns (2) and (4) present results for bank quarters with below median values for $ZScore$. Columns (1) and (2) include bank and quarter fixed effects and Columns (3) and (4) include bank and state-quarter fixed effects. Numbers below the coefficient estimates in parentheses represent t-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	High ZScore	Low ZScore	High ZScore	Low ZScore
	(1) Unins_Rate	(2) Unins_Rate	(3) Unins_Rate	(4) Unins_Rate
Boom_Exposure	-0.037	-0.021	-0.023	-0.027
	(-0.75)	(-0.53)	(-0.49)	(-0.66)
Leniency X Boom_Exposure	0.075**	0.140***	0.038	0.111***
	(2.39)	(3.99)	(1.29)	(3.14)
Difference in Coeff	0.065		0.073*	
p-Value	0.129		0.083	
Observations	32,840	32,864	32,840	32,864
Adj R-Squared	0.867	0.852	0.873	0.855
Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	No	No
State-Quarter FE	No	No	Yes	Yes

Table 5: The cross-sectional effect of liquidity risk on the association between regulatory leniency and uninsured deposit rates

This table presents the results of OLS regressions where the dependent variable is the average interest rate on uninsured deposits (*Unins_Rate*) for state-chartered banks. The main independent variables of interest are *Boom_Exposure* and *LeniencyXBoom_Exposure*. *Boom_Exposure* is the percentage of a bank's deposits located within a county that experienced a shale boom in the current year or any of the prior four years and zero for all other observations. *LeniencyXBoom_Exposure* is the interaction between *Boom_Exposure* and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of *Leniency* is subsumed by the bank fixed effects. Control variables are defined in Appendix A. The full sample of bank quarters is split between those with above median versus below median values of *Loans-to-Deposits* (at the end of the prior quarter), which is the ratio of loans to deposits. Columns (1) and (3) present results for bank quarters with above median values for *Loans-to-Deposits* and Columns (2) and (4) present results for bank quarters with below median values for *Loans-to-Deposits.* Columns (1) and (2) include bank and quarter fixed effects and Columns (3) and (4) include bank and state-quarter fixed effects. Numbers below the coefficient estimates in parentheses represent *t*-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	High LTD	Low LTD	High LTD	Low LTD
	(1) Unins_Rate	(2) Unins_Rate	(3) Unins_Rate	(4) Unins_Rate
Boom_Exposure	0.068	-0.080*	0.049	-0.056
	(1.38)	(-1.89)	(0.97)	(-1.37)
Leniency X Boom_Exposure	0.156***	0.066**	0.119***	0.034
	(4.67)	(2.09)	(3.55)	(1.06)
Difference in Coeff	0.090**		0.086*	
p-Value	0.050		0.060	
Observations	32,869	32,832	32,869	32,832
Adj R-Squared	0.853	0.861	0.858	0.865
Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	No	No
State-Quarter FE	No	No	Yes	Yes

Table 6: The effect of regulatory leniency on uninsured deposit interest rates for national banks

This table presents the results of OLS regressions where the dependent variable is the average interest rate on uninsured deposits (*Unins_Rate*) for nationally-chartered banks. The main independent variables of interest are *Boom_Exposure* and *LeniencyXBoom_Exposure*. *Boom_Exposure* is the percentage of a bank's deposits located within a county that experienced a shale boom in the current year or any of the prior four years and zero for all other observations. *LeniencyXBoom_Exposure* is the interaction between *Boom_Exposure* and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of *Leniency* is subsumed by the bank fixed effects. Control variables are defined in Appendix A. Column (1) includes bank and quarter fixed effects and Column (2) includes bank and state-quarter fixed effects. Numbers below the coefficient estimates in parentheses represent *t*-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Unins_Rate	(2) Unins_Rate
Boom_Exposure	0.037	0.045
	(0.98)	(1.15)
Leniency X Boom_Exposure	0.016	-0.014
	(0.48)	(-0.40)
Observations	31,273	31,273
Adj R-Squared	0.892	0.896
Controls	Yes	Yes
Bank FE	Yes	Yes
Quarter FE	Yes	No
State-Quarter FE	No	Yes

Table 7: The effect of regulatory leniency on insured deposit interest rates for state banks

This table presents the results of OLS regressions where the dependent variable is the average interest rate on insured deposits (*Ins_Rate*) for state-chartered banks. The main independent variables of interest are *Boom_Exposure* and *LeniencyXBoom_Exposure*. *Boom_Exposure* is the percentage of a bank's deposits located within a county that experienced a shale boom in the current year or any of the prior four years and zero for all other observations. *LeniencyXBoom_Exposure* is the interaction between *Boom_Exposure* and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of *Leniency* is subsumed by the bank fixed effects. Control variables are defined in Appendix A. Column (1) includes bank and quarter fixed effects and Column (2) includes bank and state-quarter fixed effects. Numbers below the coefficient estimates in parentheses are t-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Ins_Rate	(2) Ins_Rate
Boom_Exposure	-0.070**	-0.077**
	(-2.10)	(-2.27)
Leniency X Boom_Exposure	0.050	0.039
	(1.62)	(1.32)
Observations	65,795	65,795
Adj R-Squared	0.908	0.913
Controls	Yes	Yes
Bank FE	Yes	Yes
Quarter FE	Yes	No
State-Quarter FE	No	Yes

Table 8: The cross-sectional effect of depositor sophistication on the association between regulatory leniency and uninsured deposit rates

This table presents the results of OLS regressions where the dependent variable is the branch-level interest rate on uninsured deposits (*Unins_Rate_Branch*) for state-chartered banks. The main independent variables of interest are *Boom_Exposure* and *LeniencyXBoom_Exposure*. *Boom_Exposure* is the percentage of a bank's deposits located within a county that experienced a shale boom in the current year or any of the prior four years and zero for all other observations. *LeniencyXBoom_Exposure* is the interaction between *Boom_Exposure* and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of *Leniency* is subsumed by the fixed effects. Control variables are defined in Appendix A. Column (1) presents the regression with the full sample of branch-quarters. The sample is then split between those with above median versus below median values of *Education*, which is the percentage of adults within a county who completed college as of the year 2000. Column (2) presents results for branch-quarters with below median values for *Education* and Column (3) presents results for branch-quarters with above median values for *Education*. All columns include county-quarter fixed effects. Numbers below the coefficient estimates in parentheses represent *t*-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	Full Sample	Low Education	High Education
	(1) Unins_Rate_Branch	(2) Unins_Rate_Branch	(3) Unins_Rate_Branch
Boom_Exposure	-0.054*	-0.037	-0.064
	(-1.87)	(-0.84)	(-1.54)
Leniency X Boom_Exposure	0.049**	-0.012	0.070**
	(2.18)	(-0.34)	(2.24)
Difference in Coeff		0.082*	
p-Value		0.084	
Observations	72,040	32,220	31,950
Adj R-Squared	0.959	0.963	0.960
Controls	Yes	Yes	Yes
County-Quarter FE	Yes	Yes	Yes

Table 9: Matched sample descriptive statistics

This table presents descriptive statistics of the variables used in the matched sample analysis. Panel A presents statistics for the pooled sample of bank-quarter level observations. Panel B presents means and standard deviations separately for state-chartered banks and matched nationally-chartered banks. The final two columns present the difference in means across these two subsamples and the normalized differences. Normalized differences are calculated as: $\frac{\bar{X}_a - \bar{X}_b}{\sqrt{{s_a}^2 + {s_b}^2}}$ where $\bar{X}$ and s^2 are the subsample mean and subsample variance, respectively. Continuous variables are winsorized at the 1st and 99th percentiles.

Panel A: Distributional statistics for the pooled sample

	Mean	Std. Dev	P10	Median	P90
Uninsured_Rate	3.414	1.561	1.401	3.270	5.634
Leniency	0.000	1.000	-1.032	0.009	0.916
Size	11.850	1.184	10.404	11.763	13.381
Tier1	0.156	0.074	0.096	0.134	0.242
NPL	0.015	0.021	0.000	0.008	0.040
ROA	0.012	0.011	0.001	0.013	0.023
Loans-to-Deposits	0.751	0.201	0.489	0.763	0.995
Real Estate Loans	0.679	0.196	0.413	0.703	0.917
C&I Loans	0.154	0.103	0.040	0.137	0.287
Loan Rate	7.452	1.494	5.697	7.263	9.427
Z-Score	3.592	0.902	2.409	3.713	4.614
RWA	0.674	0.133	0.493	0.683	0.840

Panel B: Normalized differences of state versus national banks

	State		National			Normalized
	Mean	Std. Dev	Mean	Std. Dev	Difference	Difference
Observations	106,908		106,908			
Size	11.729	1.223	11.971	1.130	-0.242	-0.15
Tier1	0.157	0.077	0.155	0.071	0.002	0.02
NPL	0.015	0.021	0.016	0.022	-0.001	-0.03
ROA	0.012	0.01	0.012	0.011	0.000	0.00
Loans-to-Deposits	0.759	0.202	0.744	0.199	0.015	0.05
Real Estate Loans	0.681	0.202	0.676	0.190	0.005	0.02
C&I Loans	0.151	0.105	0.158	0.101	-0.007	-0.05
Loan Rate	7.518	1.484	7.387	1.502	0.131	0.06
Z-Score	3.580	0.88	3.605	0.923	-0.025	-0.02
RWA	0.677	0.134	0.671	0.132	0.006	0.03

Table 10: The association between regulatory leniency and uninsured deposit rates for state banks relative to national banks

This table presents the results of OLS regressions from the matched sample research design. The dependent variable is the average interest rate on uninsured deposits (*Unins_Rate*). *State_Charter* is an indicator variable equal to one for state-chartered banks and equal to zero for nationally-chartered banks. The main independent variable of interest is *State_CharterXLeniency*, which is the interaction between *State_Charter* and the regulatory leniency measure from Agarwal et al. (2014) based on the bank's state of headquarters and normalized by subtracting its mean and dividing by its standard deviation. The main effect of *Leniency* is subsumed by the state fixed effects. Control variables are defined in Appendix A. Column (1) includes state and quarter fixed effects and Column (2) includes state-quarter fixed effects. Numbers below the coefficient estimates in parentheses represent *t*-statistics. Standard errors are clustered by bank. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Unins_Rate	(2) Unins_Rate
State_Charter	0.035**	0.036**
	(2.30)	(2.37)
State_Charter X Leniency	0.024*	0.024**
	(1.92)	(1.97)
Size	0.039***	0.037***
	(4.44)	(4.34)
Tier1	-0.383***	-0.363**
	(-2.68)	(-2.57)
NPL	-0.042	0.014
	(-0.12)	(0.04)
ROA	-6.477***	-7.124***
	(-7.60)	(-8.59)
Loans-to-Deposits	0.322***	0.339***
	(5.77)	(6.13)
Real Estate Loans	0.233***	0.225***
	(3.36)	(3.42)
C&I Loans	-0.062	-0.095
	(-0.62)	(-1.00)
Loan Rate	0.089***	0.080***
	(8.91)	(8.30)
Z-Score	0.013	0.014
	(1.47)	(1.57)
RWA	0.021	0.034
	(0.23)	(0.36)
Constant	1.959***	2.038***
	(12.92)	(13.65)
Observations	213,816	213,816
Adj R-Squared	0.811	0.817
Bank FE	Yes	Yes
Quarter FE	Yes	No
State-Quarter FE	No	Yes