The Procyclicality of FDIC Deposit Insurance Premiums

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A broad awareness exists about the potential procyclical effects of FDIC deposit insurance premium pricing. Despite the importance of the topic, however, empirical study on the link between procyclical insurance premiums and bank performance has been limited due to identification challenges. In this paper, we examine empirically the procyclical effect of FDIC insurance premiums by exploiting unique changes to premium rate schedules set by regulatory agencies during the financial crisis. Using internal FDIC data on bank risk to remove the effect of premium changes driven by bank endogenous factors, we examine the effect of changes in deposit insurance premiums that are plausibly exogenous to the performance of an individual bank. Using credit unions as a control group, which are not subject to the same deposit insurance premium regulations as banks, we estimate the effect of deposit insurance premiums on bank lending. We document empirically a procyclical effect of deposit insurance premium on bank lending during the crisis and show that community banks are disproportionately affected by this mechanism. Our study provides some of the first, large-scale evidence on the procyclical effects of deposit insurance premiums while also highlighting the importance of countercyclical deposit insurance policy.

Keywords: FDIC; deposit insurance; procyclicality

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1. Introduction

The Global Financial Crisis highlighted the importance of bank credit in facilitating real economic growth. Cingano, et al. (2016) documents a reduction in firm investment for the four years following a drop in bank credit growth, and Bottero, et al. (2020) highlights the importance of banks' securities portfolios in the propagation of financial shocks across countries. These studies show that procyclical lending can significantly affect real economic growth "as a large number of negative net present value (NPV) loans are extended during an expansion and positive NPV loans are denied during a downturn" (Berger and Udell 2004). Consequently, academics and regulators have debated the unintended consequences of deposit insurance regulations that may intensify the procyclicality of bank lending. In a policy document outlining potential improvements to the deposit insurance system, the Federal Deposit Insurance Corporation (FDIC) noted that increasing premiums on banks during economic downturns may confront banks with "steep deposit insurance payments [while] earnings are already depressed… [which], in turn, could cause a further cutback in credit, resulting in a further slowdown of economic activity at precisely the wrong time in the business cycle" (FDIC 2001).[1]

Despite interest in the issue, empirical research on the link between procyclical deposit insurance premium regulations and bank lending has been limited due to identification challenges. Historically, most changes in bank assessment rates are driven by changes in bank fundamentals, and "exogenous variation in insurance premiums, which is necessary to establish a causal effect, is scarce," (Kim and Rezende 2019). Even when plausibly exogenous variation exists, it is difficult to distinguish its effect from that of endogenous variation caused by changes in bank performance. As a result, the effect of procyclical insurance premiums on bank credit remains mostly uninvestigated empirically. Thus, in managing the Deposit Insurance Fund (DIF), policymakers face the challenge of balancing decisions related to premium changes with the potential effect of such premium changes on the banking industry.

[1] In the document, the FDIC made five policy recommendations to "address the existing weaknesses in the deposit insurance system," some of which were adopted as part of the Federal Deposit Insurance Reform Act of 2005 and the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010. We discuss each of these in Section 2.

In this paper, we exploit changes to FDIC deposit insurance premium schedules, necessitated by the financial crisis, to empirically document a procyclical effect of FDIC deposit insurance premiums on bank lending. Individual bank assessment rates, which are set based on bank fundamentals, are bounded by rate schedules set by the FDIC Board of Directors in accordance with the Federal Deposit Insurance Act (FDI Act).[2] Therefore, changes to the rate schedule set by the Board are plausibly exogenous to any specific bank's performance. Further, we use the FDIC internal risk rating data to isolate the effect of this exogenous change in deposit insurance premiums from the effect of contemporaneous endogenous changes in individual bank performance during the crisis.

We estimate the causal, procyclical effect of deposit insurance premium changes using rate changes in FDIC insurance premium assessment schedule around the global financial crisis. Specifically, we find the bank lending growth rate drops 1.6 percent in the quarter following a seven basis-point (bp) increase in deposit insurance premiums and rises 0.3 percent in the quarter following a five to ten basis-point decrease. This is consistent with the procyclicality argument, as it documents a significant drop in bank lending growth following a relative increase to bank premiums and a significant rise in lending growth following a relative decrease.[3] Our finding suggests that deposit insurance premiums, which have been relatively overlooked in the procyclicality discussion, can be a significant driver of bank credit procyclicality. It also shows that changes in deposit insurance premiums can influence the real economy through the bank lending channel and suggests there may be costs to raising deposit insurance premiums that should be considered, particularly during a crisis.[4][5]

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[2] The FDIC Board of Directors sets assessment rates, considering the following statutory factors: (1) operating expenses of the Deposit Insurance Fund (DIF), (2) estimated failed bank resolution income and expenses, (3) projected effects of the payment of assessments on the capital and earnings of depository institutions, and (4) risk factors and other factors considered under the risk-based assessment system. See 12 U.S.C. 1817(b)(2)(A).

[3] The decrease in lending after a premium increase may indicate a decline in borrower credit or selective lending to protect the bank's portfolio. The increase in lending after a premium reduction may indicate the bank lowering its credit standards. We discuss how our research design address borrower effects in Section 5.

[4] The FDIC Board has adopted several changes to FDIC premiums since the crisis to reduce the risk of future major assessment-rate increases during economic downturns.

[5] We note that some U.S. deposit insurance policies are a direct response to statutory changes. For example, the FDIC made rate schedule revisions in 2011 in response to the Dodd-Frank Act, altering the assessment base from insured deposit to average consolidated total assets minus average tangible equity.

In additional analysis, we document small, community banks are particularly impacted as they rely more on deposits as a primary source of funding. Small banks—those with less than $100 million in assets—suffered a two percent drop in loan growth rates in the quarter following a seven basis-point increase in the assessment rate, which is substantially higher than the industry average of 1.6 percent. On the other hand, deposit insurance premium increases have an insignificant effect on large banks with assets greater than $10 billion. This finding shows the deposit insurance premium increase during the crisis had a particularly strong unintentional contractionary effect on small bank lending. Our findings suggest that a one-size-fits-all change in deposit insurance premium rates might be suboptimal, and that applying differential rate changes, based on financial institution size, can help deposit insurers minimize this procyclical effect.

We also examine alternate channels through which deposit insurance premiums could affect bank performance. We find deposit insurance premium changes do not consistently predict changes to either deposit growth or to the interest rates banks pay on deposits. Rather, in our sample, the effect is concentrated in changes to bank lending—a finding which highlights banks did not find alternative funding sources to deposits or pass on the costs to customers during the crisis. Thus, increases in deposit insurance premiums appear to directly affect the supply of loans by increasing the cost of funds for banks.[6] We acknowledge this finding is limited to our sample period and look forward to future work on procyclicality during non-crisis times.

For our empirical analysis, we use a difference-in-difference approach to isolate the effect of exogenous assessment rate changes. For the first difference, we use the timing of the deposit insurance premium rate changes necessitated by changes in the DIF funding status, while controlling for variation in deposit insurance rates caused by changes in bank risk ratings during the period of analysis. We define the funding status of the DIF as the difference between the current level of funds and the level targeted by the

[6] There is extensive empirical evidence demonstrating that an increase in cost of capital leads to a decrease in bank lending. Kovner and Van Tassel (2020) use survey data to show that when banks' CAPM cost of capital increases, bank managers tighten loan standards and increase loan spreads. Similarly, C´el´erier, et al. (2017) show that a decrease in the cost of equity leads banks to expand their balance sheet by increasing their supply of credit.

Board. For the second difference, we remove the influence of other contemporaneous macroeconomic events by comparing the experiences of banks to those of credit unions that face similar macroeconomic conditions but not subject to deposit insurance premium changes at the same time. Through these comparisons, we isolate the effect of the deposit insurance rate changes from exogenous factors.

We use credit unions as a control group throughout our analyses for multiple reasons. Due to the operational similarity of banks, credit unions provide control for demand-side shocks, as macroeconomic developments during the crisis likely had a similar effect on both bank and credit union borrowers. Credit unions also serve as a control for exogenous legislative changes that may have affected lending, as credit unions and banks were both subject to the same legislative changes in many cases (e.g., Dodd-Frank Act).

Despite the similarity to banks, credit unions are regulated by a separate government agency: the National Credit Union Association (NCUA). In our empirical design, we exploit the fact the NCUA operates its own deposit insurance fund called the National Credit Union Share Insurance Fund (NCUSIF) and sets the deposit insurance premiums for credit unions independently from the FDIC. Thus, by using credit unions as a control, we are able to plausibly triangulate the effect of premium changes as distinct from other regulatory and macroeconomic events and credibly estimate the effect of the FDIC premium change on the supply of credit by banks. We discuss contemporaneous regulatory changes and notable differences between banks and credit unions in Sections 2 and 4.

Despite similarities in the financial sector, banks and credit unions can differ significantly in size and loan portfolio composition. Unlike banks, credit unions are non-profit organizations and, thus, tend to be smaller with a greater focus on consumer finance. Although our difference-in-difference design and control variables should address systematic differences between these two groups, it remains possible that endogenous factors other than deposit insurance premiums are affecting our findings.

To address this concern, we run additional robustness tests. We restrict the sample of banks and credit unions to those with assets of less than $100 million to reduce systematic differences between the two types of institutions. Tests using this size-constrained sample corroborates our main results that changes in premiums cause procyclical lending behavior. We also repeat the difference-in-difference

analysis using an entropy-balanced sample, in which the weights on particular institutions are determined by asset, leverage, and other portfolio characteristics for more precise matching between banks and credit unions. Once again, this robustness check affirms our finding that deposit insurance premiums amplify changes in bank lending.

A broad literature explores options for regulators to address procyclicality (Borio and Lowe 2001; Repullo and Suarez 2013; Behn, et al. 2016), but most studies on the procyclicality of bank regulation are concerned with risk-based capital and loan-loss reserves, and little discussion evolves around deposit insurance premiums. In their thorough review of bank cyclicality, Athanasoglou, et al. (2014) conclude that concerns over bank regulation amplifying cyclicality are well founded but that more research is required to bridge the gap between theoretical and empirical research. Our study seeks to help bridge this gap by providing the first estimates of the effect of procyclical deposit insurance premiums on the credit supply using a large sample of U.S. banks.

Our paper is also related to literature on the credit channel of monetary policy transmission. The bank lending channel theory suggests that monetary policy affects banks' cost of funds, which affects their overall supply of credit (Black, et al. 2010). In this paper, we show that increases in FDIC deposit insurance assessments have an effect similar to contractionary monetary policy on the supply of bank credit. Increases in the deposit assessment rate essentially increase the funding cost for banks, which leads to a tightening of bank credit supply.

To the best of our knowledge, this paper is the first to document a procyclical effect of deposit premium regulation using a large sample of U.S. banks. Our findings indicate that concerns over deposit insurance premiums "resulting in a further slowdown of economic activity at precisely the wrong time in the business cycle" (FDIC 2001) are well founded and that efforts to smooth deposit insurance premiums throughout the business cycle could help address this problem. In 2001, the FDIC proposed eliminating the sharp premium swings resulting from the change in premium requirements by adopting a policy of more gradual rate increases when the fund falls below the target and gradual rebates when the fund grows above. During the crisis, however, the fund's rapid depletion made a rapid increase in deposit insurance

premiums unavoidable. In our paper, we show that deposit insurers may be able to mitigate the procyclical effect of deposit insurance premium increases during a crisis by differentiating the magnitude of the premium jump across bank sizes when a gradual rate increase is not feasible.

The findings also have an important implication for FDIC DIF management. Our findings suggest that a counter-cyclical deposit insurance premium policy, which strives to time any necessary increases in insurance rates to periods of economic growth, would help dampen the procyclicality of bank credit and may provide the capacity for the FDIC to lower insurance premiums during a downturn. Further, by raising rates in periods of excess liquidity, the FDIC may be able to help reduce the misallocation problem that comes from the "large number of negative net present value (NPV) loans extended during an expansion and positive NPV loans denied during a downturn" (Berger and Udell 2004). Thus, our findings suggest that when the FDIC Board adopts a restoration plan to return the DIF to above the statutory level, if possible, it should strive to enact rate increases during periods of economic expansion.

The paper proceeds in the following order. In section 2, we discuss the historical and institutional background of the FDIC and the NCUA as well as related literature. Section 3 establishes our hypotheses. Section 4 provides an overview of FDIC deposit insurance premium data and NCUA financial data. Section 5 presents the results of the difference-in-difference analysis across banks and credit unions as well as an out-of-sample analysis to further scrutinize our main findings. Section 6 concludes.

2. Background and Related Literature

2.1 Background on the Deposit Insurance of Banks and Credit Unions

Congress created the FDIC as an independent agency under the Banking Act of 1933 in response to the collapse of more than 4,000 savings and loan associations (S&Ls) and banks during the Great Depression. The FDIC's mission is to "maintain stability and public confidence in the nation's financial system," which it pursues by (1) insuring deposits, (2) examining and supervising financial institutions for safety and soundness and consumer protection, (3) making large and complex financial institutions

resolvable, and (4) managing receiverships. To date, the FDIC has succeeded in its mission to instill stability and confidence, and no depositor has lost a dollar of FDIC-insured funds.

The methods by which the FDIC assesses deposit insurance premiums has changed as the economy has changed and the FDIC's understanding of banks' structural incentives has evolved. When the FDIC was established, insured banks paid a flat-rate assessment of one-twelfth of one percent, or 8.3 cents per $100 of insured deposits (8.3 basis points). Banks were charged a statutory rate for deposit insurance until the Federal Deposit Insurance Corporation Improvement Act was enacted in 1991, which sought to address the problem of moral-hazard in deposit insurance by instituting risk-related deposit insurance premiums.[7]

In January 1993, the FDIC adopted a schedule of premium rate ranges based on a bank's risk profile. Since then, assessment rate schedules have ranged between zero and 77.5 basis points, with the current schedule's assessment rates ranging from 1.5 to 40 basis points. See Appendix A for a timeline of the FDIC deposit insurance rate premiums. More detailed information on the FDIC assessment schedule history can be found in Garnett, et al. (2020), which reviews the history of risk-based premiums at the FDIC.

The deposit insurance rate schedules are determined by the FDIC Board of Directors, and the funds held in the DIF are used to insure deposits and resolve failed banks.[8] In setting assessment rates, the FDIC Board of Directors is required by statute to consider, among other things, the projected effects of payment of assessments on the capital and earnings of insured depository institutions, risk factors taken in account under the risk-based pricing system, and estimated expenses and income of the Deposit Insurance Fund (73 FR 78155).[9] The FDIC Board also sets a Designated Reserve Ratio (DRR), which is the level of

[7] Banks were charged the 8.3 basis points statutory rate until 1950 when the FDIC enacted a rebate system that lowered the effective assessment. Rebates ended in the 1980s, and Congress enacted a minimum reserve ratio of 1.25 percent as part of the Financial Institutions Reform, Recovery, and Enforcement Act of 1989.
[8] On February 8, 2006, the President signed The Federal Deposit Insurance Reform Act of 2005. The act merged the Bank Insurance Fund (BIF) and the Savings Association Insurance Fund (SAIF) into a new fund, the Deposit Insurance Fund (DIF), effective March 31, 2006.
[9] 12 U.S.C. 1817(b)(2). The full list of statutory requirements for setting assessment rates can be found at https://www.fdic.gov/regulations/laws/rules/1000-800.html#fdic1000sec.7.

funds the FDIC seeks to maintain in the DIF relative to the level of insured deposits, on an annual basis. This level is set within a statutory boundary considering factors that include the risk of losses to the DIF, economic conditions generally affecting insured depository institutions, and the prevention of sharp swings in assessment rates for insured depository institutions. During the crisis, the DRR rate was set to 1.25 percent in accordance with the FDIC Reform Act of 2005, which directs the institution to set the rate between 1.15 percent and 1.5 percent. Requirements around setting the DRR were later revised by the Dodd-Frank Act in 2010, and the target ratio now stands at 2.00 percent. This means the FDIC aims to maintain a DIF balance of $2.00 for every $100 of insured deposits. The FDIC views the DRR as a long-term, minimum target that will allow the fund to grow sufficiently large during times of favorable banking conditions to increase the likelihood of the DIF remaining positive throughout periods of significant losses due to bank failures, consistent with the FDIC's comprehensive fund management plan.

The FDIC Reform Act allowed the FDIC to manage the pace at which the DRR varies within the designated range, but if the ratio fell below 1.15 percent—or was expected to within six months—the FDIC was required to enact a plan to restore the DIF to 1.15 percent, generally within five years. If the reserve ratio exceeded 1.5 percent, the FDIC was required to generally dividend to the DIF members all amounts above that necessary to maintain the DIF at 1.5 percent.[10] Figure 1 details the quarterly balance and funding status of the DIF between 2003 and 2018. The figure highlights a major drop in the reserve ratio in mid-2008, which prompted the FDIC to announce an assessment-rate increase starting in 2009.

The FDIC must provide notice and opportunity for comment before revising or modifying the assessment system (12 U.S.C. 1817(b)(1)(F)). For example, before the assessment rate change in 2009 Q1, the FDIC published a notice of proposed rulemaking (NPR) and request for comments on a proposed uniform seven basis-point assessment-rate increase on October 16, 2008. NPRs are generally followed by

[10] The Dodd-Frank Act allows the FDIC's Board to issue dividends from the DIF if the reserve ratio exceeds 1.5 percent. The Board has suspended dividends indefinitely under the comprehensive plan to increase the probability that the reserve ratio will reach a level sufficient to withstand a future crisis. In lieu of dividends, the Board has adopted a set of assessment rates that progressively decrease when the reserve ratio exceeds 2.0 percent and 2.5 percent. (https://www.fdic.gov/resources/deposit-insurance/deposit-insurance-fund/dif-fund-management.html)

a comment period ranging between 30 and 60 days. After reviewing and addressing comments, the FDIC Board of Directors published a final rule on December 22, 2008, with the seven basis-point assessment-rate increase, effective as of January 1, 2009.[11]

Not all regulated depository institutions are insured by the FDIC. The NCUA is an independent federal agency created by the Congress in 1970 to regulate and insure the deposits of credit unions. The NCUA employs an alternative deposit insurance system to that of the FDIC. Like the FDIC, the NCUA insures deposits up to $250,000 with backing by the U.S. federal government. The NCUA requires credit unions to deposit and maintain 1.00 percent of insured deposits in the National Credit Union Share Insurance Fund (NCUSIF).

The NCUSIF insures deposits in credit unions, and the fund's earnings are used to support the NCUA's operation. The NCUA does not charge deposit insurance premiums unless the NCUSIF's equity ratio falls below 1.30 percent and may not charge a premium greater than the amount necessary to restore the equity ratio to 1.30 percent. The assessment of deposit insurance premiums is exceptionally rare and has only occurred in four years since 1985 (1991 to 1992 and 2009 to 2010). In 2009 and 2010, the NCUA received $727 million and $930 million from premiums. See Appendix B for a timeline of the NCUA deposit insurance rate premiums.

Although credit unions are monitored and insured by the NCUA, they are still subject to most legislation that affects banks. For example, the Dodd-Frank Act Wall Street Reform and Consumer Protection Act applies to both banks and credit unions, and it increased the insured amount from $100,000 to $250,000 for both types of institutions.[12] In 2015, the U.S. Government Accountability

[11] In setting assessment rates, the FDIC is also required by law to consider the projected effects of the payment of assessments on the capital and earnings of insured institutions. For example, when the FDIC charged a special assessment in 2009, it projected that charging a special assessment in 2009 would result in an equity capital decrease of about 0.2 percent (74 Fed. Reg. at 25642 (May 29, 2009)).

[12] As stated in American Banker, the Consumer Financial Protection Bureau (CFPB), which was created under the Dodd-Frank Act, had the authority to exempt smaller institutions like credit unions from its rules but has been reluctant to use this authority

Office (GAO) published a report on the effects of the Dodd-Frank Act. The report found the law was "expected to have impacts on community banks and credit unions" and that "representatives from community banks, credit unions, and industry associations [the] GAO interviewed cited an increase in compliance burden associated with these rules," [13] highlighting the similarity between macroeconomic and legislative pressures faced by banks and credit unions.

2.2 Related Literature

The literature on deposit insurance has evolved alongside banking crises and changes in deposit insurance regulation. The savings and loan crisis, which led to a series of bank and S&L institution failures in the 1980s and early 1990s, renewed interest in deposit insurance and government guarantees. Following the seminal paper Merton (1977), an extensive literature developed around deposit insurance pricing and the net value of government insurance. Notable works include Marcus and Shaked (1984), which compared the FDIC rates to the fair value derived from Black-Scholes option-pricing model, and Ronn and Verma (1986), which used the isomorphic relationship between equity and call options to empirically estimate the value of deposit premiums.

Leading up to and following the passage of the Federal Deposit Insurance Corporation Improvement Act (FDICIA) in 1991 and the introduction of risk-based premiums in 1993, the literature on deposit insurance shifted focus to how risk-based premiums could mitigate the moral-hazard problem inherent in deposit insurance (Freixis and Rochet 2008). Keeley (1990) discusses how the increase in bank competition in the 1980s caused banks to increase default risk, putting the flat-rate deposit premium system under stress. Berlin, et al. (1991) reviews the empirical evidence that moral hazard led to the 1990s savings and loans crisis. Flannery (1991) shows that risk-measurement errors can cause FDIC deposit insurance to be mispriced and suggests the effect of such error can be minimized with risk-based capital standards and risk-based insurance premia.

[13] The report, titled "Dodd-Frank Regulations: Impacts on Community Banks, Credit Unions and Systemically Important Institutions," is available online at https://www.gao.gov/products/gao-16-169.

However, despite an extensive literature on deposit insurance premiums and risk, deposit insurance premiums have largely been excluded from recent studies on regulatory procyclicality. A few notable exceptions include Pennacchi (1999) and Pennacchi (2005). Pennacchi (1999) uses a sample of 68 U.S. banks to estimate the cyclicality of deposit insurance premiums under a deposit insurance fund reserve targeting policy and shows that a targeting policy can prove superior to a flat rate in reducing moral hazard, assuming a fair pricing policy is infeasible. The paper suggests, however, that a targeting policy can significantly bias rates downward relative to the fair premium in a growth economy—an argument supported by the fact that, at the time, more than 90 percent of U.S. banks were paying a zero-deposit insurance rate to the FDIC. With the introduction of risk-based capital requirements from Basel II, Pennacchi (2005) develops a model to compare the procyclical effects of risk-based deposit insurance premiums to those of risk-based capital requirements. Using archival data on 42 commercial public banks, the author shows that deposit insurance premiums generate smaller procyclical effects than capital requirements.

In contrast to the lack of literature on deposit insurance premiums and procyclicality, an extensive literature on the procyclicality of capital requirements has developed since the global financial crisis and introduction of Basel II. Repullo and Suarez (2013) use a dynamic equilibrium model to examine the capital buffers required by Basel II and conclude that Basel II is theoretically more procyclical than Basel I but reduces banks' probability of failure during recessions. Kashyap and Stein (2004) use simulation models and suggest that the capital requirement "[has] the potential to create an amount of additional cyclicality."

Several studies use an international setting to examine the effects of banking regulations put forth by the Basel Committee. For example, Ayuso, Pérez, and Saurina (2004) use panel data on Spanish commercial and savings banks to examine the relationship between capital requirements and the business cycle. In agreement with theoretical work on the Basel II capital buffers, the authors find a negative relationship between the business cycle and capital buffers. Saurina and Trucharte (2007) examine the probability of default on mortgage loans using data from the Spanish Credit Register. They compare the

capital requirements of different Basel II approaches and determine the procyclical effect is very sensitive to risk-measurement methodology. These studies are useful to better understand the effects of international banking regulation but are limited in their applicability to the United States, which has a unique set of banking regulations.

This gap in the development of procyclicality literature between capital requirements and deposit insurance premiums is due in part to a lack of data. As mentioned in Kim and Rezende (2019), most deposit insurance premium changes over time and across banks are driven by factors endogenous to the bank, which makes it hard to isolate the effect of a deposit insurance premium change on a bank's performance. This paper attempts to bridge the gap between theoretical and empirical studies noted in the literature (Athanasoglou et al. 2014) by exploiting unique developments in the deposit insurance premium schedule during the financial crisis. We construct our model using a large cross-sectional panel of data to better estimate the effect of deposit insurance premiums on the financial performance of depository institutions and use the extensive theoretical literature on bank regulation and cyclicality to motivate our empirical predictions.

3. Hypothesis Development

We build off prior theoretical literature to develop our predictions on the procyclical effect of deposit insurance premiums. In the subsequent section, we test our hypothesis using large-scale, confidential FDIC data.

Setting deposit insurance premiums to maintain the adequacy of the DIF may exacerbate swings in the business cycle by reducing credit precisely when it is needed the most. During economic upturns, the DIF is likely to be well funded, and during downturns, the DIF is likely to be depleted as bank failures mount.

We posit that a bank has multiple channels of response when faced with an increase in deposit insurance premiums. First, a bank can respond by passing on the cost to depositors in the form of reduced interest rates on deposits. Flannery and James (1984) show that "demand, savings, and retail time deposit balances are 'sticky' or imperfectly responsive to changes in market rate." This means that retail

depositors are generally unlikely to respond to small changes in deposit interest rates by changing banks. Therefore, this can be a relatively inexpensive way for banks to respond to a premium increase. Second, prior to the enactment of the Dodd-Frank Act, a bank could reduce its assessment base by switching from deposits to external borrowing for funding. From 1935 to 2010, the assessment base of a bank was roughly equivalent to its domestic deposits, so a bank could have resorted to other short-term borrowing to reduce premiums paid to the FDIC.[14]

However, both strategies face a major challenge during a financial crisis. When credit markets are tight and liquidity is scarce, it becomes more difficult to find external funding to replace deposits. Thus, banks are unlikely to risk losing a potential customer by reducing the deposit rate in response to an assessment rate change as deposits tend to be a more secure source of funding.

When banks cannot reduce the burden of increased assessment rates by reducing deposits or passing on the cost to customers, assessment-rate increases result in higher cost of capital for banks. When the cost of capital increases, banks have been shown to withhold lending from projects they would otherwise have engaged.[15] We predict, therefore, during a crisis period, banks will respond to a deposit insurance rate increase by raising the interest rates attached to loans, which in turn will reduce total bank lending.[16] This is likely a costly option for banks and the most undesirable outcome for financial regulators, but it may be the only option available to banks during a financial crisis.

The economic significance of the deposit insurance premiums assessed suggests they have the potential to meaningfully affect the performance and lending ability of financial institutions. We

[14] In April 2011, as part of the Dodd-Frank Act of 2010, the FDIC expanded the assessment base to be average consolidated total assets minus average tangible equity, so this channel has not been available to banks since 2011.
[15] Multiple empirical studies support this relationship between bank lending and the cost of capital. Kovner and Van Tassel (2020) show, using survey data, that bank managers tighten loan standards and increase loan spreads when their bank's CAPM cost of capital increases. Similarly, Célérier, et al. (2016), show that a decline in the cost of equity leads banks to expand their balance sheets by increasing the amount of credit supplied.
[16] This is essentially the prediction of Berger and Udell (2004), which suggests that procyclical lending "could significantly misallocate resources as a large number of negative net present value (NPV) loans are extended during an expansion and positive NPV loans are denied during a downturn."

demonstrate the significance of premiums on a bank's lending ability by providing an illustrative example of both a single institution and the average industry effect.

Zions Bancorporation (Zions) is a large regional financial holding company that discloses aggregate FDIC premiums paid by its insured depository institution (IDI) subsidiaries in its annual financial statements.[17] Table 1 presents a summary of the finances of Zions Bancorporation from 2007 through 2014. For the five years in our sample window, in which Zions reported positive income (2007 and 2011 to 2014), it paid an average of $37 million in FDIC premiums on an average of $366.9 million of income per year. Deposit insurance premiums represent a significant expense to the holding company at 10.03 percent of net income. However, the figure is more striking when we examine the years in which the holding company reported a net loss. For the three years in which Zions reported a loss (2008 to 2010), it paid an average of $74 million in the FDIC premiums on an average of $596.5 million of losses per year. In fact, deposit insurance premiums paid during loss years are on average more than double those paid during profitable years and account for 12.43 percent of the total loss. This example highlights both the economic significance of deposit insurance premiums and the potential for premiums to exacerbate any procyclicality of bank performance and lending ability.

Next, we show the significance of deposit insurance premiums across financial institutions using aggregate data. In Figure 2, we separately present the deposit insurance premiums paid by both banks and credit unions for the years 2005 to 2015. Figure 2A plots the average deposit insurance premiums paid as a percentage of net income, and the results support the inferences drawn from the single-bank example. Deposit insurance premiums represented less than five percent of bank net income until the start of the financial crisis. They then surged to nearly fourteen percent during the crisis years before settling down to around eight percent in the following years. Credit unions, which are charged for deposit insurance by

[17] Premium amounts disclosed in the 10-K are at the holding-company level and apply to multiple FDIC-insured banks. Individual banks may not disclose assessment rates, as these can be used to back out confidential supervisory ratings.

NCUA only on rare occasions when the NCUSIF's equity ratio falls below 1.30 percent, are shown to have been assessed a premium in 2009 and 2010.

Figure 2B presents the unscaled, average deposit insurance premiums paid by banks and credit unions between 2005 and 2015, and it shows the increase observed in Figure 2A isn't driven entirely by a decrease in income. Banks experienced multiple deposit insurance premium changes during the period, but the changes around the financial crisis were particularly steep. These changes were driven by the FDIC's increase in deposit insurance premium rates, following the rapid depletion of the DIF. In 2009, even banks in the lowest risk category experienced an increase in deposit insurance premium as the rate more than doubled from 5-7 basis points to 12-14 basis points. This provides further evidence that depository institutions historically have faced higher (lower) deposit insurance premiums during economic downturns (upturns).

Overall, the evidence suggests that deposit insurance premiums represent a significant expense to insured banks, particularly during years in which the institution is least situated to adapt to any increased cost. We use the findings of the prior theoretical literature on banking deposit insurance, the FDIC's statement on cyclicality, and our initial, time-series analysis on the premiums paid to guide our analyses.

4. Data

4.1 Data and Sample Period

For our main analysis, we use public financial and market data alongside a confidential banking dataset maintained by the FDIC. We develop a sample of 8,151 FDIC-insured banks containing 91,329 bank-quarter observations between 2009 and 2011. The FDIC dataset contains detailed information on banks including financial statement data, the confidential FDIC premium charged, and confidential deposit insurance risk ratings. We use these data to identify changes to the deposit insurance premiums unrelated to individual bank performance and to control for other factors that could potentially influence a bank's risk rating and lending ability.

Our control sample consists of 5,534 NCUA-affiliated credit unions containing 62,262 firm-quarter observations between 2009 and 2011. As with our insured bank sample, we use financial

data gathered from SNL Financial Institution and the NCUA to control for factors that could affect a credit union's lending ability. As discussed in Section 2, although there were significant regulatory and economic changes during this period, they affected banks and credit unions alike. In additional analyses, we examine the period prior to the passage of the Dodd-Frank Act to examine whether contemporaneous changes implemented in response to the financial crisis affect our results.

We identify changes to deposit insurance premium rates using data from multiple sources. We gather deposit insurance premium data for banks from the FDIC's online historical timeline and assessment rate schedules and for credit unions from the NCUA's annual reports to Congress.

For our difference-in-difference analysis, we analyze four changes to assessment rates during the financial crisis, of which two applied to banks alone.[18] The other two events are assessment rate changes by the NCUA to replenish NCUSIF, which applied to credit unions. We include credit union assessment rate changes in our analysis for three reasons. First, this allows us to partially empirically test whether credit unions are indeed a suitable control group for banks, which we have theoretical reasons to expect. That is, if credit unions behave in a manner much different from banks in response to premium increases, then this assumption is called into doubt. Second, their inclusion increases the number of deposit insurance rate changes from two to four, which helps us obtain more robust understanding on the effect of procyclical deposit insurance premiums. Third, it shows and makes more salient that potentially procyclical deposit insurance premiums affect not only banks but also a wider array of depository institutions.

The following list provides details of the deposit insurance premium changes by the FDIC and the NCUA around the crisis period.

[18] There was another revision in 2009 Q2, but this was excluded from the analysis for two reasons. First, the change in assessment rate was much less significant than the 2009 Q1 revision. For instance, the 2009 Q1 revision increased rates for Risk Category I banks from 5-7 basis points to 12-14 basis points; whereas, the 2009 Q2 change merely widened the band of permissible rates to 12-16 basis points for the same banks. Second, it was pre-announced along with 2009 Q1 revision. In the 2009 Q1 final rule for assessment increase, the FDIC stated its plan to "issue another final rule early in 2009, to take effect on April 1, 2009, to change the way the FDIC's assessment system differentiates for risk." A special assessment of five basis points in 2009 Q3 was also not considered for the same reason. Its announcement through the FDIC Interim Rule happened in 2009 Q1, along with assessment changes.

1) In 2009 Q1, the FDIC implemented a unilateral seven basis-point increase in bank assessment rates across all risk categories to restore the DIF reserve ratio to its target minimum of 1.15 percent. This was a considerable jump, as even the banks considered least risky were charged 5-7 basis points at the time. Assessment rates were held at this elevated level until 2011 Q2.
2) In 2011 Q2, the FDIC revised its assessment system and implemented a long-term, comprehensive fund management plan, which included a new set of assessment rate schedules and a higher long-term DRR goal. As a result of these changes, assessment rates were revised down by between seven and ten basis points, with the precise amount determined by a bank's risk rating.[19]
3) In 2009 Q4, the NCUA raised $727 million in revenue from credit unions to restore the NCUSIF's equity ratio to 1.30 percent. The NCUA does not charge deposit insurance premiums unless the equity ratio of the NCUSIF falls below 1.30 percent.
4) In 2010 Q4, the NCUA raised $930 million in revenue to restore the deposit insurance fund, as the NCUSIF's equity ratio once again fell below 1.3 percent.

4.2 Descriptive Statistics and Correlations

Table 2, Panel A presents summary statistics for FDIC-insured banks. We find that gross loans and leases constitute on average 64.2 percent of a bank's assets, and consist primarily of real estate loans, which compose 72.5 percent of total loans. Net interest income represents approximately 0.9 percent of assets on average. We also control for off-balance-sheet unused commitments to ensure the results observed in the data are not driven by the commitments made in the pre-crisis period. Unused commitments for banks represent 18.4 percent of assets during the period, and 17.5 percent of that amount is related to home equity lines of credit. The table documents a slight rightward skew in the distribution of bank size, suggesting that our empirical results may be primarily driven by large banks. We address this concern by limiting the size of institutions in an additional analysis.

[19] In 2011 Q2, the FDIC amended its regulations to implement revisions to the FDI Act, which modified the definition of an institution's deposit insurance assessment base. We repeat the 2011 Q2 analysis using the modified base but find the change did not have a material effect on the analysis, especially for small banks that are less impacted by the regulation.

Table 2, Panel B presents summary statistics for the NCUA-insured credit unions. Relative to banks, the average credit union holds more cash and fewer loans and leases. Credit unions' cash holdings average 11.9 percent of assets, and gross loans and leases average 56.7 percent. Credit unions also have less unused commitments outstanding relative to banks. Unused commitments for credit unions represent 10.8 percent of assets, 24.7 percent of which are related to home equity lines of credit. Because credit unions, on average, are smaller, we perform subsequent robustness analyses by restricting the sample to institutions with assets below $100 million. This restriction allows us to better match the treatment and control samples.

Table 3, presents the correlation table for insured banks in Panel A and for insured credit unions in Panel B. The correlations indicate only weak associations between control variables, reducing concerns of multicollinearity. Institution size is generally negatively correlated with cash holdings and net interest income. Bank size is negatively correlated with deposits, but positively correlated for credit unions. Overall, the correlations among our variables for credit unions are generally consistent with banks; however, we refrain from drawing inferences here due to the univariate nature of the statistics.

5. Empirical design and results

5.1 Empirical Model

In this section, we empirically examine bank responses to a change in the assessment rate. Specifically, we test the three propositions presented in Section 3 and examine the effect of procyclical deposit insurance with the following difference-in-difference model:

$$y_{iq} = \beta_0 + \beta_1 P_q + \beta_2 x_i + \beta_3 P_q x_i + \gamma Z_{iq} + \varepsilon_{iq}$$

P_q is an indicator equal to one for the quarter immediately following a change in the deposit insurance premium rate and zero otherwise. To isolate and best identify the effect of a rate change, we restrict the window of analysis to two quarters—the quarter immediately before and immediately after a rate change. This restriction is necessary due to a large number of legislative changes and Federal Reserve programs that were implemented during the crisis period. x_i is an indicator equal to one if the institution is an

FDIC-insured bank and zero otherwise. We interact P_q and x_i to create our variable of interest, and thus β_3 captures the change in behavior caused by the change in deposit insurance premiums independent of other macroeconomic changes. Our dependent variable, y_{iq}, is one of the three measures of bank response discussed in Section 3, which are change in deposits (%Δ Deposits), interest expense scaled by total deposits (Interest Exp) and change in gross loans and leases (%Δ Loans).

We also include a broad vector of control variables (Z_{iq}) to account for other plausible determinants of lending behavior, including the natural log of total assets ($LN(ASSET)$) as a measure of firm size, cash holdings ($CASH$), total deposits ($TOTAL\ DEPOSITS$), and gross loans and leases ($LOANS\ AND\ LEASES$), all scaled by assets. Similarly, we control for liabilities and bank performance by including debt obligations ($LEVERAGE$), unused commitments ($UNUSED\ COMMIT$), loan and lease charge-offs ($CHARGE-OFFS$) and net interest ($NET\ INTEREST\ INC$), all scaled by assets. We also control for the composition of assets and liabilities by controlling for the portion of real estate loan ($RE\ LOANS$) and home equity lines of credit ($HOME\ EQUITY\ COMMIT$). See Appendix C for our list of variable definitions.

Between 2007 and 2016, a bank's assessment rate was determined by its assigned risk category, which corresponded to its bank capitalization and supervisor rating and was kept confidential by the FDIC. Risk category 1 contained well capitalized banks with CAMELS rating 1or 2, and risk category 4 containing all undercapitalized institutions with CAMELS rating 4 and 5.[20] Shifts in the risk category were driven by endogenous changes to the bank, such as changes in capitalization. To limit potential change driven by bank-endogenous factors, we exclude from our analysis banks that changed risk category during the analysis period.

5.2 Main Analysis

[20] A CAMELS composite rating is a weighted average of a bank's sub-rating for Capital, Asset quality, Management, Earnings, Liquidity, and Sensitivity to market risk. Examiners assign ratings on a scale of one to five. A rating of one indicates the strongest performance and risk-management practices, and a five indicates the weakest performance and risk-management practices.

We first examine whether the assessment-rate increase during the financial crisis led to a change in bank portfolios as hypothesized in section 3. In our initial analysis, we use the FDIC's assessment-rate increase in 2009 Q1 and the NCUA's assessment increase in 2009 Q04 as they were the first change in deposit insurance premiums during the crisis for the respective institutions. Following the FDIC's assessment-rate increase in 2009 Q1, we expect banks to either switch from deposits to external sources of funding, decrease interest on deposits, or decrease lending relative to credit unions. Following the NCUA's assessment increase in 2009 Q4, we expect credit unions to do the same, leading to relative increases in deposits, interest rates, or lending for banks.

We begin by examining whether changes in the assessment rate during the financial crisis led to changes in the type of funding used by banks. The dependent variable is percentage change in total deposits, and the coefficient of interest, β_3, captures the effect of an assessment rate change on an insured bank's deposits. If banks switched their funding source from deposits to external sources following the assessment-rate increase as posited, then the coefficient will be negative and statistically significant following the FDIC's assessment-rate increase in 2009 Q1. Correspondingly, our theory also predicts that β_3 will be positive following the assessment-rate increase for credit unions in 2009 Q4, as credit unions seek alternative funding source.

We present our findings in Table 4, columns 1 and 2. The coefficient β_3 in column 1 and 2 is negative and statistically significant ($p < 0.01$), indicating that banks decreased deposits relative to the prior quarters. This decrease is likely driven by a run on uninsured deposits in large banks. The drop in uninsured deposits accounts for more than 80 percent of the drop in the average deposit during this period. This seems to be driven by large banks, as 75 percent of small banks saw an increase in deposits during the period. Thus, differences between banks and credit unions due to deposits can be addressed by constraining our sample to small and mid-size banks, which we do in later tests.

Next, we examine whether banks responded to the assessment rate change by adjusting their deposit rates. "Sticky" deposit rates are well documented in the empirical banking literature, and three

months may not be enough time to fully assess the effect of the rate increase.[21] Driscoll and Judson (2013) document CD rates respond very quickly to a change in the federal funds rate despite banks' sluggishness in adjusting the aggregate deposit rate.[22] Because CDs tend to be a substantial portion of banks' interest-bearing deposits,[23] we expect a quick CD rate change to affect the interest expenses of financial firms—assuming that CD rates respond to deposit insurance rate changes as they do to federal funds rate changes.

To test the interest rate pass-through proposition, we run the difference-in-difference model on interest expense-to-deposit ratio, controlling for institution-specific factors. Our theory suggests that an increase in the FDIC assessment rate will precipitate a decline in CD rates, which will in turn cause interest expenses to decrease relative to total deposits. We present our findings in columns 3 and 4 of Table 4. We find the coefficient on our variable of interest is positive but statistically insignificant in both cases, which suggests no clear interest rate pass-through immediately following the rate changes.

Last, we use a generalized difference-in-difference design to examine the effect of deposit insurance premiums on bank lending, independent of other factors. The dependent variable is the percentage change in gross loans and leases over the prior quarter ($\%\Delta Loans$). Our theory suggests that an increase (decrease) in the FDIC assessment rate will cause banks to reduce (increase) lending due to the increased (decreased) costs. We present our findings in columns 5 and 6 of Table 4. We find the coefficient on our variable of interest is negative and statistically significant at the one percent level following the assessment-rate increase in 2009 Q1, suggesting that banks indeed decreased their lending in response to a premium increase. We also find the coefficient is positive and statistically significant at the one percent level following an increase in deposit insurance premiums for credit unions in 2009 Q4. This suggests banks increased lending following a decrease in premiums relative to credit unions.

[21] See Rosen (2002), Driscoll and Judson (2013), and Yankov (2018).
[22] The paper finds the median duration between a Fed rate change and the corresponding bank CD rate change ranged between six to seven weeks. The distribution across banks of time taken to change CD rates was tight, with very few taking more than 15 weeks to respond.
[23] Large denomination CDs (CDs over the deposit insurance limit) with a remaining maturity less than a year accounted for roughly 23 percent of banks' total deposits in 2008 Q4 across banks on average.

Table 4 shows the primary method by which banks and credit unions initially responded to the deposit premium increase was through contraction in lending, as we posited in Section 3. We now turn our focus to bank lending and investigate whether the effect of the assessment rate changes observed in 2009 is also observed in other years around the financial crisis. For this purpose, we examine the rate changes enacted by the FDIC in 2009 Q1 and 2011 Q2 and those enacted by the NCUA in 2009 Q4 and 2010 Q4. Including the initial period of recovery from the financial crisis in the analysis allows us to investigate the effect of an assessment rate decrease and check whether the effect of assessment rate change is symmetric for both increases and decreases.

We present the results for our main analysis in Table 5. Each column corresponds to a quarter in which there was a rate change. The quarters are presented chronologically with 2009 Q1 in column 1 and 2011 Q2 in column 4. We indicate whether there was a premium rate increase or decrease as well as the magnitude of the change in basis points, which range from a decrease of about seven basis points to an increase of about ten basis points.

Our findings, presented in Table 5, are largely consistent with our central hypotheses and previous results. Specifically, in column 1, we find that an increase in deposit insurance premiums of about seven basis points causes roughly a 1.6 percent decrease in bank lending growth rates relative to the prior quarter, compared to that of credit unions. Correspondingly, in column 4, we find that a decrease in deposit insurance premiums of approximately seven basis points causes an approximate 0.3 percent increase in bank lending growth rates relative to the prior quarter, compared to that of credit unions. This drop in the magnitude of change in 2011 Q2 relative to 2009 Q1 likely can be explained by expectations; unlike the 2009 increase, the 2011 rate decrease was largely anticipated as the deposit insurance fund had reached its target level.

Our findings are consistent for increases to NCUA premiums. In columns 2 and 3, we find that credit union lending growth decreases by approximately 1.4 percent and 0.5 percent relative to banks after the NCUA raised its deposit insurance premiums. These results are consistent with our basic framework

and hypothesis that an increase (decrease) to deposit insurance premiums causes a decrease (increase) in lending.

Our findings provide empirical ground on which policymakers can stand when responding to future financial crises. In 2009, FDIC's Board of Directors voted in favor of a special assessment on banks to replenish the DIF. The vote was not unanimous, and the key concern of the dissenter was the effect of an assessment increase on lending. Camden R. Fine, president of the Independent Community Bankers of America at the time, also stated in his interview with New York Times that the assessment-rate increase "would translate into higher banking fees, fewer loans or lower savings account interest rates" (New York Times, Feb. 27, 2009)[24] Until now, however, no empirical exercise has examined whether these concerns were valid, and, if so, to what degree. The findings of this paper provide insight on how the assessment increase affected bank lending and savings' rates during the crisis period, and how assessment rates can intensify procyclicality of bank credit during a crisis.

Robustness Tests

As previously discussed, although banks and credit unions face similar macroeconomic pressures, banks are generally larger than credit unions. This size difference could be affecting our results, as larger institutions may be better able to withstand changes to deposit insurance premiums or better able to smooth lending over time. To account for this potential issue, here we limit our sample to credit unions and banks with assets less than $100 million.[25] By comparing similar sets of institutions, we can better determine whether our primary results are, at least in part, a statistical artifact of these different size distributions.

Table 6 presents the results from our size-limited sample, and the results are consistent with our main analysis. In column 1, we find an increase in deposit insurance premiums of about seven basis points causes about a two percent decrease in lending growth rate relative to credit unions. In columns 2

[24] F. D. I. C. Increases Fees to Insure Bank Deposits (https://www.nytimes.com/2009/02/28/business/28banks.html)
[25] The $100 million threshold for small banks is set to match the size distribution of credit unions, as more than 80 percent of credit unions have less than $100 million in assets.

and 3, we find that a ten-point increase to credit unions' premiums results in their decreasing lending growth rate by 1.2 percent, and a two-basis point increase leads to a decrease of 0.5 percent. Correspondingly, in column 4, we find a decrease in deposit insurance premiums of approximately seven basis points causes approximately a 1.2 percent increase in bank lending growth rates relative to credit unions. This suggests that small banks make relatively steeper changes to lending compared to larger ones following a rate change. Taken together, the results support the findings of our main analysis that increases (decreases) to deposit insurance premiums cause decreased (increased) bank lending.

We further test the robustness of our main results by entropy balancing the size-limited sample. Banks and credit unions differ significantly not just in size but also in asset portfolio composition. Because they are nonprofit institutions, credit unions tend to hold fewer risky assets and post lower net incomes relative to banks. This difference is documented in Table 7, panel A. The summary statistics of pre-entropy-balanced, size-limited sample show that credit unions' average percent cash holding is more than double that of banks', and their portion of real estate loans in the loan portfolio is roughly half that of banks. To better match banks and credit unions, therefore, we entropy balance credit unions and banks at the first moments for eight quarters before the analysis period (2007 Q1 to 2008 Q4) for all covariates used in the main analysis. The results presented in Table 7, panel A show the resulting weighted samples of credit unions and banks closely align in asset composition and other firm characteristics.

Panel B of Table 7 shows the results of regressions run, using the entropy-balanced sample. The results are largely consistent with those of the main analysis, with three of four coefficients remaining significant and with a consistent sign. In column 1, we find that an increase in FDIC deposit insurance premiums of about seven basis points causes banks to decrease lending by about two percent relative to credit unions. Likewise, in column 2, again we find that credit union lending decreases by about 0.9 percent relative to banks when only the former face an increase in deposit insurance premiums. Statistical insignificance in column 3 may be explained by anticipation and the smaller rate increase. Finally, in column 4, we find a decrease in bank deposit insurance premiums of seven basis points causes approximately a 2.5 percent increase in bank lending growth relative to credit unions.

We further analyze heterogeneity in bank lending practice by repeating the main analysis for large and small banks separately. We define large banks as institutions with assets greater than $10 billion and small banks as institutions with assets less than $100 million.[26] This analysis allows us to observe heterogeneity in bank responses to deposit insurance premium increases. Our findings, presented in Table 8, confirm the most acute response to deposit insurance rate changes comes from these small community banks. In column 1, we find that an increase in deposit insurance premiums of seven basis points does not cause a significant reduction in large banks' lending growth. We do find, however, that small banks decrease their lending by over two percent relative to the prior quarter compared to credit unions. In columns 3 through 6, we find that credit unions reduce their lending relative to both large and small banks in response to deposit insurance premium increases. In column 7, we find again that a decrease in deposit insurance premiums of about seven basis points does not affect large banks' relative lending behavior. However, we find that even with forecasting, small bank lending growth rate jumps 1.4 percent following a deposit insurance premium reduction. These findings suggest that small banks are particularly strongly affected by changes to bank deposit insurance premiums, implying that small bank borrowers—generally small businesses or individuals without other sources of credit—are more likely to suffer the consequences of procyclicality.

In Table 9, we analyze the effect of deposit insurance premium increases by loan type. In column 1, we find that an increase in deposit insurance premiums of approximately seven basis points causes an approximate 0.9 percent drop in the real-estate loan growth rate relative to credit unions. The relative increase in bank credit-card loans following the 2009 Q1 rate increase in column 2 is likely due to a drawdown on the credit-card line of credit. When new loans are hard to obtain, people tend to resort to established lines of credit, such as credit cards, for liquidity. Correspondingly, Commercial & Industrial (C&I) loans declined sharply in 2009 Q1. These loans tend to be particularly risky for banks and, thus, are likely be first in line for removal when banks contract their credit. Credit union premium increases in

[26] $10 billion is a commonly used threshold for "large banks" in regulatory discussions, research, and policy implementation (e.g., Volcker Rule cut-off for banks).

2009 Q4 and 2010 Q4 have statistically significant effects on real-estate loans but insignificant effects on C&I loans. This may be due to differences in loan composition; C&I and agricultural loans are negligible components of a credit union's portfolio, and constitute only about two percent of total loans at the time of the deposit insurance premium changes. The bank deposit insurance premium drop in 2011 Q2 has a positive and significant effect on real-estate, and agricultural loans, but negative effect on credit-card and C&I loans

5.3 Out-of-Sample Analysis

Identification is a major challenge facing empirical analysis of the financial crisis. Between 2008 and 2010, numerous new laws (e.g., Emergency Stabilization Act, Housing Economic Recovery Act, American Recovery and Reinvestment Act, Dodd-Frank Act, etc.), regulatory changes, and programs implemented by the Federal Reserve had a near-simultaneous effect on banks and other financial institutions. While our identification strategy is designed to limit the confounding influence of events other than the deposit insurance premium changes specified, perfect identification remains difficult in this setting. Therefore, in this section, we use an alternative sample of insured banks from the 1990s to verify the robustness our results.

Between the mid-1980s to mid-1990s, the United States saw the failure of 1,043 out of the 3,234 S&Ls. This episode, known as the "S&L crisis" led to two major legislative changes. First, the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA), which abolished the Federal Savings and Loans Insurance Corporation (FSLIC), which previously insured S&Ls and established a new deposit insurance fund called the Savings Association Insurance Fund (SAIF) to operate as part of the FDIC. The legislation also created the Bank Insurance Fund (BIF), which replaced the Federal Deposit Insurance Fund previously operated by the FDIC. Following the FIRREA's passage, the FDIC managed both funds, which were "maintained separately and not commingled" (12 U.S. Code § 1821a).[27]

[27] The BIF and the SAIF were merged to form the DIF on March 31, 2006.

Second, the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) introduced a risk-based premium structure to both deposit insurance funds. Beginning in 1993, institutions were to be charged rates that reflected different levels of risk and likelihoods of failure as measured by their capitalization and supervisory group. The law also required that assessment rates remain high until the deposit insurance funds were fully capitalized.

While the assessment-rate increase was simultaneous for both the BIF and the SAIF, downward revisions were not. Banks' profitability improved more quickly than the S&Ls', and the BIF was fully recapitalized by mid-1995. This recapitalization of BIF was faster than lawmakers had anticipated and prompted the FDIC to reduce the deposit insurance rate for banks while keeping the rate for S&Ls unchanged.[28] This disparity continued until Congress passed The Deposit Insurance Funds Act of 1996, which recapitalized the SAIF through a one-time special assessment. New, lower rates for S&Ls took effect on January 1, 1997.

In this section, we exploit this timing difference between the SAIF and BIF rate changes to test the validity of the results presented in the previous section. We use the following equation for our analysis:

$$y_{iq} = \beta_0 + \beta_1 P_q + \beta_2 \tau_i + \beta_3 P_q \cdot \tau_i + \gamma Z_{iq} + \varepsilon_{iq}$$

τ_i is an indicator which takes a value of 1 if an institution is insured by BIF and 0 if it is insured by SAIF. y_{iq} is a dependent variable, which is the loan growth rate, deposit growth rate, or interest expense-to-deposit ratio as in the previous section. We run our analysis on an entropy-balanced sample due to a non-negligible difference in asset composition and characteristics between banks and S&Ls during the analysis period. We also drop home-equity lines of credit ($HOME\ EQUITY\ COMMIT$) as the data is poorly populated pre-2000s.

As in Section 3, we posit that, for periods immediately following the BIF-assessment rate drop in 1995 Q3, the BIF-insured banks will respond to this change by increasing deposits relative to other

[28] See Shoukry (2021).

funding sources (i.e., deposit growth rate increases) through their increasing interest payments to attract depositors (i.e., interest expense-to-deposit ratio increases). We also expect banks to increase their lending relative to S&Ls, as banks now enjoy a lower cost of capital.

In the period following the SAIF's assessment rate drop in 1997 Q1, we expect the same effects for SAIF firms. That is, we expect SAIF firms' deposit growth rate to increase, interest expense-to-deposit ratio to increase and lending to increase in response. However, the drop in 1997 Q1 was largely anticipated as the legislative change that dictated the drop was passed in 1996 Q2. As we observed in 2011 Q2, such projections tend to mute the immediate effect of a premium rise or drop as banks reallocate resources pre-implementation.

Table 10, columns 1, 3, and 5 present the effect of the BIF assessment rate drop in 1995 Q3, and columns 2, 4, and 6 display the effect of SAIF assessment rate drop in 1997 Q1. Column 1 of Table 10 shows that β_3 is weakly significant, which suggests that the change in assessment rate may not have had a significant effect on funding sources immediately following the rate increase.

Column 3 further reveals the interest on deposits did not change for BIF firms relative to SAIF firms following the assessment rate drop. In column 5, we see the assessment rate drop seems to have had an immediate effect on bank lending. A statistically significant increase in the lending growth by BIF-insured banks relative to S&Ls follows the assessment rate change, which is consistent with our main findings.

We find similar results after the SAIF assessment rate change in 1997. Column 2 indicates a weak decrease in deposits relative to other funding sources, and column 4 again suggests no significant effect on interest expense. However, contrary to our hypothesis, column 6 shows that SAIF institutions didn't significantly increase lending relative to BIF firms following the assessment rate drop. This is likely driven by the anticipation effect described earlier. Unlike the change in 1995 Q3, which was the result of the faster-than-anticipated recovery of banks, the change in 1997 Q1 was the result of legislative change in 1996 Q2. Further, the legislative change was also anticipated by the industry as premium disparity between S&Ls and banks was considered undesirable by regulators.

6. Conclusion

There is a broad awareness that increasing (decreasing) deposit insurance premiums when the banking industry is facing economic stress (good conditions) could amplify fluctuations in bank performance and lending ability, worsening procyclicality of bank credit. We tested this hypothesis by exploiting plausibly exogenous changes to the FDIC deposit insurance premium schedules during the financial crisis. We use confidential FDIC bank regulatory ratings to control for individual bank risk and use credit unions, which are not subject to the same deposit insurance premiums, as a control group.

We find that bank lending decreases (increases) in response to a premium increase (decrease), which is consistent with our hypotheses. These findings remain robust in size-constrained and entropy-balanced samples, which suggests that the result is not driven by systematic differences between banks and credit unions. Our study provides some of the first large-scale empirical evidence on the potential procyclical effects of deposit insurance.

Over its long history, the FDIC has adapted its approach to setting deposit insurance premiums in response to an evolving banking system and to effectively monitor, evaluate, and insure banks. Recent changes have addressed some procyclicality concerns. For example, in 2011 the FDIC introduced scorecards for large banks to determine assessment rates derived from new data, including information about how they fared during the crisis. In addition, in 2016, the FDIC updated its pricing structure for established small banks. Additionally, the Board has indefinitely suspended dividends under the comprehensive DIF management plan to increase the probability that the reserve ratio will reach a level sufficient to withstand a future crisis. These efforts will likely reduce the risk of major assessment-rate increases during future economic downturns.

Overall, this study improves our understanding of how and whether FDIC deposit insurance premium regulations affect bank credit and the macroeconomy. Our findings indicate that concerns over deposit insurance premiums "resulting in a further slowdown of economic activity at precisely the wrong time in the business cycle" (FDIC 2001) are well founded and suggest that efforts to smooth deposit insurance rates throughout business cycles can help reduce the procyclicality of bank credit. These results

may be of interest to academics and regulators alike as they seek to understand and regulate financial institutions and to avoid unintended or procyclical consequences of deposit insurance premium changes.

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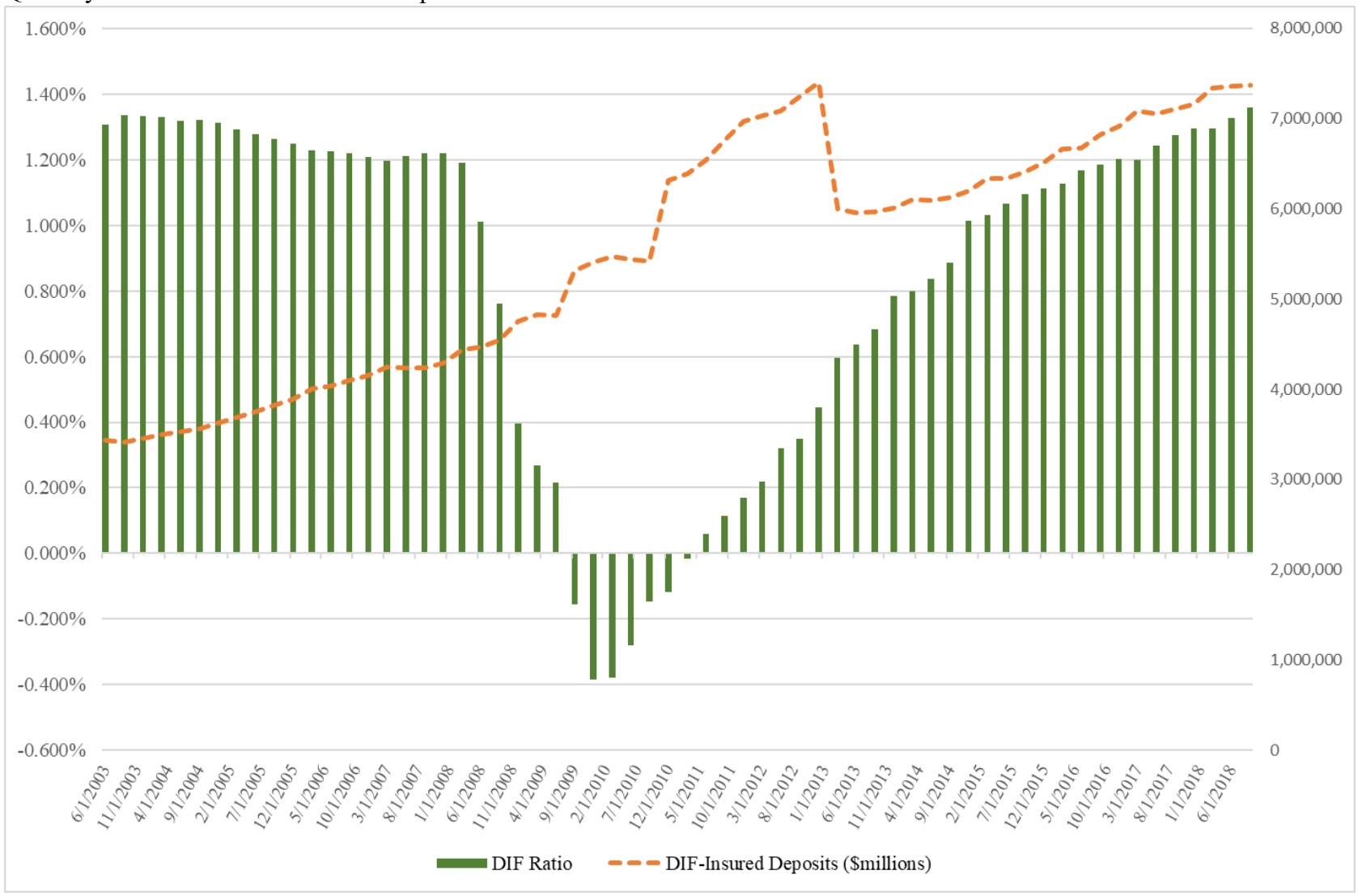
Figure 1
Quarterly Reserve Ratio and Insured Deposits



This figure presents the quarterly balance of the Deposit Insurance Fund and insured deposits. The figure also presents the reserve ratio, which is the ratio of the fund balance to insured deposits. Data are available from the FDIC Quarterly Banking Profile (https://www.fdic.gov/bank/analytical/qbp/qbpmenu.html.)

Figure 2

Figure 2A: Deposit insurance premiums paid as a percentage of net income by banks and credit unions

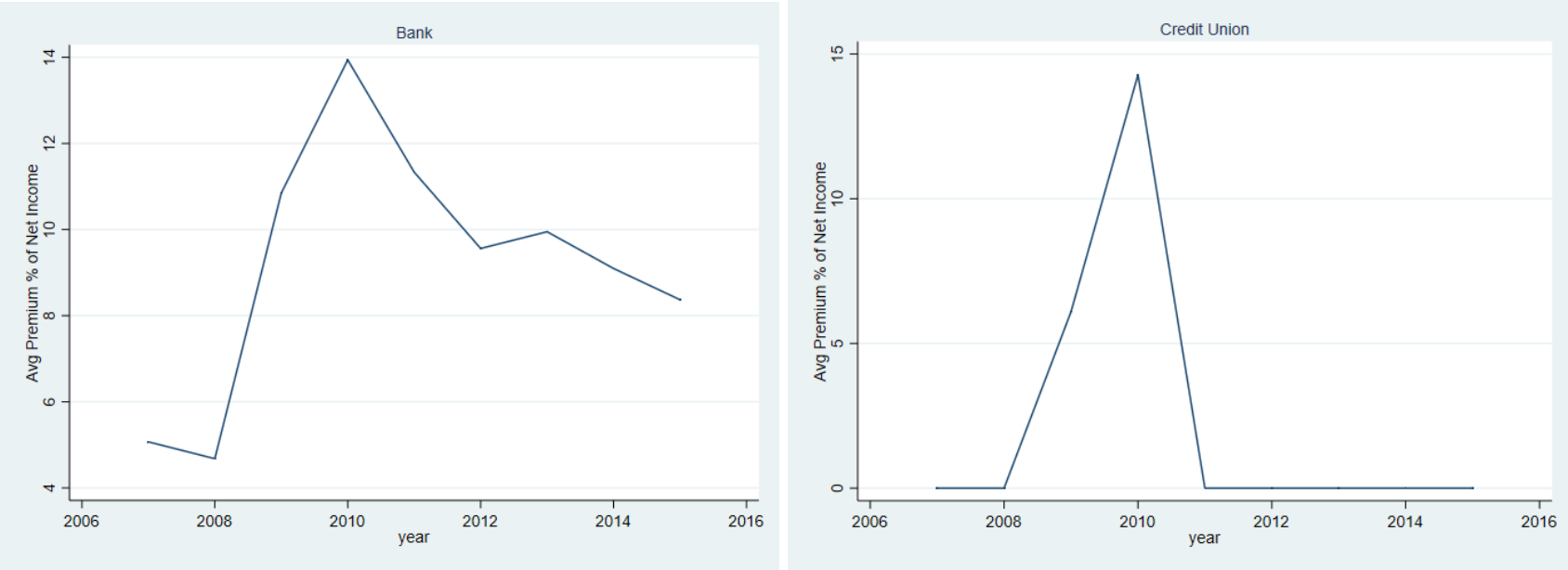
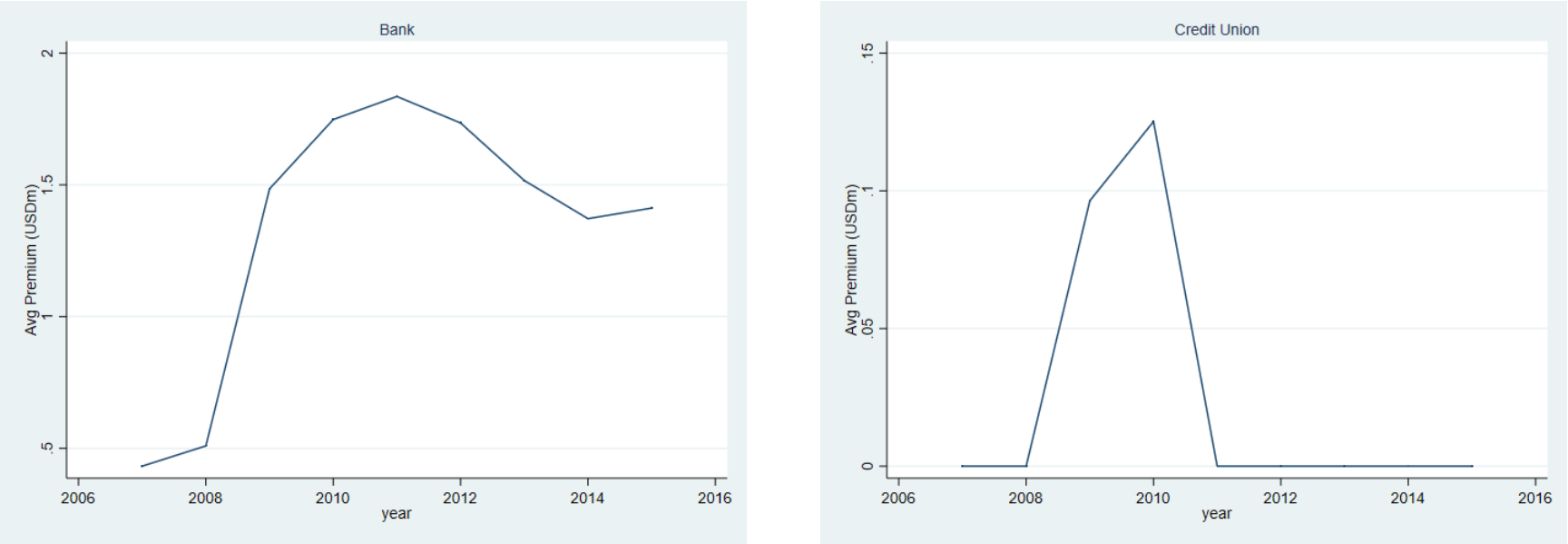


Figure 2B: Average deposit insurance premiums paid by insured banks and credit unions (unscaled).



Source: FDIC confidential data, NCUA Annual Reports

Table 1: Summary financial data for Zions Bancorporation ($ millions)

Zions Bancorporation	2007	2008	2009	2010	2011	2012	2013	2014
Revenue	2,294,300	2,162,300	2,701,600	2,167,900	2,254,400	2,151,800	2,033,700	2,188,600
Net Income	501,700	(271,400)	(1,221,700)	(296,300)	322,700	348,200	263,500	398,500
FDIC Premiums	6,500	19,900	100,500	102,000	63,900	43,400	38,000	32,200
% Revenue	0.28%	0.92%	3.72%	4.71%	2.83%	2.02%	1.87%	1.47%
% Net Income	1.30%	-7.33%	-8.23%	-34.42%	19.80%	12.46%	14.42%	8.08%

This table presents summary financial data for Zions Bancorporation. Zions Bancorporation is a regional financial holding company headquartered in Utah. All data are drawn from the company's annual reports filed with the U.S. Securities and Exchange Commission.

Table 2
Summary statistics
Panel A: FDIC insured banks

	Mean	Median	S.D.	Min	P25	P75	Max
LN(ASSET)	12.1050	11.9570	1.3306	8.0453	11.2495	12.7619	21.3256
CASH	0.0836	0.0583	0.0800	0.0000	0.0298	0.1102	0.9640
LOANS AND LEASES	0.6415	0.6648	0.1539	0.0000	0.5525	0.7525	1.0610
CHARGE-OFFS	0.0018	0.0005	0.0040	-0.0240	0.0001	0.0018	0.1752
LEVERAGE	0.8907	0.8995	0.0455	0.0076	0.8784	0.9133	1.1213
TOTAL DEPOSITS	0.8278	0.8449	0.0832	0.0000	0.7961	0.8813	1.1196
NET INTEREST INC	0.0087	0.0086	0.0025	-0.1110	0.0076	0.0097	0.0648
RE LOANS	0.7247	0.7619	0.1933	0.0000	0.6216	0.8666	1.0441
UNUSED COMMIT	0.1838	0.0750	3.9577	0.0000	0.0434	0.1168	315.8623
HOME EQUITY COMMIT	0.1751	0.0960	0.2106	0.0000	0.0000	0.2836	1.0000
Observations	91,329						

Panel B: NCUA insured credit unions

	Mean	Median	S.D.	Min	P25	P75	Max
LN(ASSET)	10.6587	10.5009	1.5306	5.3327	9.5588	11.6131	17.6641
CASH	0.1190	0.0980	0.0846	-0.1130	0.0612	0.1533	0.9783
LOANS AND LEASES	0.5668	0.5747	0.1590	0.0142	0.4573	0.6834	1.1340
CHARGE-OFFS	0.0015	0.0009	0.0031	0.0000	0.0003	0.0018	0.3612
LEVERAGE	0.8838	0.8938	0.0459	0.3975	0.8642	0.9137	1.9710
TOTAL DEPOSITS	0.8687	0.8799	0.0517	0.3880	0.8471	0.9029	1.8887
NET INTEREST INC	0.0088	0.0086	0.0054	-0.1465	0.0074	0.0101	1.1897
RE LOANS	0.3832	0.3879	0.2352	0.0000	0.2022	0.5590	0.9914
UNUSED COMMIT	0.1079	0.0891	0.1221	0.0000	0.0440	0.1475	15.0985
HOME EQUITY COMMIT	0.2474	0.1511	0.2850	0.0000	0.0000	0.3849	1.0000
Observations	62,262						

Panel A: Sample consists of 84,326 bank-quarter observations from 2009 to 2011 with sufficient data for estimation. Variable definitions and sources are included in Appendix C.

Panel B: Sample consists of 90,735 credit union-quarter observations from 2009 to 2011 with sufficient data for estimation. Variable definitions and sources are included in Appendix C.

Table 3
Correlation table
Panel A: FDIC insured banks

		1	2	3	4	5	6	7	8	9	10
1	LN(ASSET)	1.000									
2	CASH	-0.180	1.000								
3	LOANS AND LEASES	0.161	-0.300	1.000							
4	CHARGE-OFFS	0.138	0.002	0.162	1.000						
5	LEVERAGE	0.130	-0.145	0.232	0.132	1.000					
6	TOTAL DEPOSITS	-0.263	0.065	0.016	0.006	0.492	1.000				
7	NET INTEREST INC	-0.060	-0.170	0.274	0.024	-0.064	-0.029	1.000			
8	RE LOANS	0.200	-0.107	0.247	0.068	0.180	0.041	-0.197	1.000		
9	UNUSED COMMIT	0.012	-0.014	-0.040	0.008	-0.090	-0.093	0.011	-0.084	1.000	
10	HOME EQUITY COMMIT	0.214	-0.091	0.162	0.068	0.129	-0.047	-0.132	0.467	-0.018	1.000

Panel B: NCUA insured credit unions

		1	2	3	4	5	6	7	8	9	10
1	LN(ASSET)	1.000									
2	CASH	-0.311	1.000								
3	LOANS AND LEASES	0.214	-0.200	1.000							
4	CHARGE-OFFS	0.040	-0.002	0.174	1.000						
5	LEVERAGE	0.272	-0.099	0.300	0.152	1.000					
6	TOTAL DEPOSITS	0.054	0.003	0.182	0.103	0.808	1.000				
7	NET INTEREST INC	-0.103	-0.023	0.225	0.096	0.026	0.036	1.000			
8	RE LOANS	0.512	-0.264	0.196	-0.039	0.192	0.054	-0.112	1.000		
9	UNUSED COMMIT	0.199	-0.084	0.140	0.043	0.131	0.082	0.012	0.152	1.000	
10	HOME EQUITY COMMIT	0.105	-0.113	0.050	-0.042	0.032	-0.012	-0.074	0.383	0.029	1.000

Panel A: This table presents univariate correlations for our sample of insured bank-quarters with sufficient data for estimation. Correlations are presented for all independent variables used in the main regression analysis. Our sample period covers 2009 to 2011.

Panel B: This table presents univariate correlations for our sample of insured credit union-quarters with sufficient data for estimation. Correlations are presented for all independent variables used in the main regression analysis. Our sample period covers 2009 to 2011.

Table 4
The effect of deposit insurance premiums on bank performance

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	%Δ Deposits	%Δ Deposits	Interest Exp	Interest Exp	%ΔLoans	%ΔLoans
Bank premiums (bps)	Increase (7)	No Change (0)	Increase (7)	No Change (0)	Increase (7)	No Change (0)
Credit union premiums (bps)	No Change (0)	Increase (10)	No Change (0)	Increase (10)	No Change (0)	Increase (10)
Quarter of Premium Change	2009Q1	2009Q4	2009Q1	2009Q4	2009Q1	2009Q4
POST	0.0487***	0.0161***	-0.0151	0.00416	-0.00588***	-0.0192***
	(0.00140)	(0.000852)	(0.0127)	(0.00297)	(0.000814)	(0.000701)
INSURED BANK	0.0304***	0.0187***	-0.101	-0.0496	0.0174***	-0.00229*
	(0.00335)	(0.00184)	(0.0757)	(0.0343)	(0.00181)	(0.00127)
POST*INSURED BANK	-0.0529***	-0.00932***	0.0305	0.00346	-0.0158***	0.0144***
	(0.00216)	(0.00177)	(0.0228)	(0.00260)	(0.00133)	(0.00111)
LN(ASSET)	0.00571***	0.00537***	-0.00766	-0.00718	0.00304***	-0.000417
	(0.000777)	(0.000762)	(0.00621)	(0.00488)	(0.000580)	(0.000430)
CASH	0.108***	0.0892***	0.482	0.166	-0.0197	-0.0210*
	(0.0181)	(0.0162)	(0.373)	(0.123)	(0.0127)	(0.0114)
LOANS AND LEASES	0.00915	-0.00725	0.0287	0.0733	0.0605***	0.0311***
	(0.00805)	(0.00691)	(0.0269)	(0.0500)	(0.00480)	(0.00368)
CHARGE-OFFS	-0.667***	-1.200***	-3.791	-2.315	-2.561***	-2.978***
	(0.248)	(0.263)	(3.441)	(1.739)	(0.225)	(0.205)
LEVERAGE	-0.316***	-0.214***	2.992	1.913	-0.390***	-0.183***
	(0.0567)	(0.0533)	(2.252)	(1.300)	(0.0319)	(0.0249)
TOTAL DEPOSITS	0.0543**	0.0481**	-3.281	-2.053	0.0112	0.0183**
	(0.0259)	(0.0229)	(2.400)	(1.387)	(0.0103)	(0.00914)
NET INTEREST INC	-3.793***	-0.213**	10.65	0.720	-2.122***	-0.142
	(1.289)	(0.106)	(7.295)	(0.819)	(0.492)	(0.0875)
RE LOANS	0.00340	-0.00490	-0.0615	-0.0453	0.00764*	-0.00458
	(0.00752)	(0.00620)	(0.0455)	(0.0315)	(0.00395)	(0.00299)
UNUSED COMMIT	-0.000319**	-0.000813	-0.00275	-0.00220	0.000552	-0.000461***
	(0.000145)	(0.000672)	(0.00255)	(0.00175)	(0.000598)	(7.69e-05)
HOME EQUITY COMMIT	-0.00353	-0.00404*	0.196	0.0942	-0.0110***	-0.00959***
	(0.00293)	(0.00229)	(0.147)	(0.0661)	(0.00211)	(0.00169)
Observations	26,398	25,548	26,410	25,550	26,395	25,544
R-squared	0.061	0.035	0.021	0.030	0.122	0.080

This table presents the tests of the association between FDIC deposit insurance premiums and bank response. See Appendix C for all variable definitions. Robust standard errors are clustered at the institution level. *, **, and *** indicate statistical significance at the two-tailed 10%, 5%, and 1% level.

Table 5
The effect of deposit insurance premiums on bank lending

	(1)	(2)	(3)	(4)
Dependent Variable	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans
Bank premiums (bps)	Increase (7)	No Change (0)	No Change (0)	Decrease (7)
Credit union premiums (bps)	No Change (0)	Increase (10)	Increase (2)	No Change (0)
Quarter of Premium Change	2009Q1	2009Q4	2010Q4	2011Q2
POST	-0.00588***	-0.0192***	-0.00877***	0.0233***
	(0.000814)	(0.000701)	(0.000631)	(0.000699)
INSURED BANK	0.0174***	-0.00229*	0.00169	-0.00101
	(0.00181)	(0.00127)	(0.00112)	(0.00106)
POST*INSURED BANK	-0.0158***	0.0144***	0.00470***	0.00266**
	(0.00133)	(0.00111)	(0.00105)	(0.00108)
LN(ASSET)	0.00304***	-0.000417	0.00174***	0.00231***
	(0.000580)	(0.000430)	(0.000339)	(0.000304)
CASH	-0.0197	-0.0210*	-0.0333***	-0.0382***
	(0.0127)	(0.0114)	(0.00661)	(0.00543)
LOANS AND LEASES	0.0605***	0.0311***	0.0460***	0.0509***
	(0.00480)	(0.00368)	(0.00387)	(0.00329)
CHARGE-OFFS	-2.561***	-2.978***	-3.933***	-4.342***
	(0.225)	(0.205)	(0.125)	(0.265)
LEVERAGE	-0.390***	-0.183***	-0.0825***	-0.0928***
	(0.0319)	(0.0249)	(0.0185)	(0.0151)
TOTAL DEPOSITS	0.0112	0.0183**	0.00389	0.0144*
	(0.0103)	(0.00914)	(0.00954)	(0.00862)
NET INTEREST INC	-2.122***	-0.142	-0.427	-0.193
	(0.492)	(0.0875)	(0.346)	(0.291)
RE LOANS	0.00764*	-0.00458	-0.0215***	-0.0204***
	(0.00395)	(0.00299)	(0.00239)	(0.00212)
UNUSED COMMIT	0.000552	-0.000461***	0.000399	-0.000151
	(0.000598)	(7.69e-05)	(0.000246)	(0.000219)
HOME EQUITY COMMIT	-0.0110***	-0.00959***	-0.00918***	-0.00276**
	(0.00211)	(0.00169)	(0.00147)	(0.00139)
Observations	26,395	25,544	24,865	24,706
R-squared	0.122	0.080	0.086	0.132

This table presents the OLS estimates of Equation 1, which tests the association between FDIC deposit insurance premiums and bank lending. See Appendix C for all variable definitions. Robust standard errors are clustered at the institution level. *, **, and *** indicate statistical significance at the two-tailed 10%, 5%, and 1% level.

Table 6
The effect of deposit insurance premiums on bank lending, size constrained

	(1)	(2)	(3)	(4)
Dependent Variable	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans
Bank Premiums (bps)	Increase (7)	No Change (0)	No Change (0)	Decrease (7)
Credit Union Premiums (bps)	No Change (0)	Increase (10)	Increase (2)	No Change (0)
Quarter of Premium Change	2009Q1	2009Q4	2010Q4	2011Q2
POST	-0.00485***	-0.0207***	-0.00971***	0.0261***
	(0.00101)	(0.000877)	(0.000773)	(0.000876)
INSURED BANK	0.0187***	0.00104	0.00256	-0.00528***
	(0.00249)	(0.00181)	(0.00166)	(0.00163)
POST*INSURED BANK	-0.0198***	0.0119***	0.00534***	0.0119***
	(0.00226)	(0.00185)	(0.00180)	(0.00196)
LN(ASSET)	0.00654***	0.00201**	0.000792	0.00322***
	(0.00118)	(0.000929)	(0.000782)	(0.000727)
CASH	-0.00953	-0.00134	-0.0404***	-0.0301***
	(0.0143)	(0.0154)	(0.00784)	(0.00664)
LOANS AND LEASES	0.0799***	0.0444***	0.0550***	0.0694***
	(0.00720)	(0.00462)	(0.00594)	(0.00586)
CHARGE-OFFS	-2.031***	-2.527***	-3.947***	-4.444***
	(0.301)	(0.319)	(0.182)	(0.317)
LEVERAGE	-0.407***	-0.187***	-0.103***	-0.0714**
	(0.0432)	(0.0331)	(0.0274)	(0.0325)
TOTAL DEPOSITS	-0.0228	0.0120	0.0157	-0.00346
	(0.0254)	(0.0177)	(0.0201)	(0.0282)
NET INTEREST INC	-3.056***	-0.142	-0.649	-0.959*
	(0.955)	(0.0950)	(0.533)	(0.497)
RE LOANS	0.0133***	5.95e-05	-0.0181***	-0.0211***
	(0.00448)	(0.00375)	(0.00319)	(0.00296)
UNUSED COMMIT	-0.000913	-0.00263	-0.0134***	-3.70e-05
	(0.00100)	(0.00222)	(0.00273)	(0.000327)
HOME EQUITY COMMIT	-0.00801***	-0.00377*	-0.00577***	0.00171
	(0.00256)	(0.00209)	(0.00180)	(0.00181)
Observations	13,599	12,890	12,297	12,116
R-squared	0.174	0.083	0.083	0.149

This table presents the OLS estimates of Equation 1, which tests the association between FDIC deposit insurance premiums and bank lending. In this table, we limit the sample to financial institutions with assets less than $100 million to better match the treatment and control group. See Appendix C for all variable definitions. Robust standard errors are clustered at the institution level. *, **, and *** indicate statistical significance at the two-tailed 10%, 5%, and 1% level.

Table 7
Panel A: Summary statistics pre and post entropy balancing

	Pre entropy balancing			Post entropy balancing		
	Bank	Credit Union	Difference	Bank	Credit Union	Difference
LN(ASSET)	10.780	9.837	0.943	10.780	10.780	0.000
CASH	0.059	0.121	-0.061	0.059	0.059	0.000
LOANS AND LEASES	0.626	0.611	0.015	0.626	0.626	0.000
CHARGE-OFFS	0.001	0.001	-0.001	0.001	0.001	0.000
LEVERAGE	0.861	0.863	-0.001	0.861	0.861	0.000
TOTAL DEPOSITS	0.815	0.852	-0.038	0.815	0.815	0.000
NET INTEREST INC	0.009	0.010	-0.001	0.009	0.009	0.000
RE LOANS	0.641	0.312	0.329	0.641	0.641	0.000
UNUSED COMMIT	0.130	0.109	0.021	0.130	0.130	0.000
HOME EQUITY COMMIT	0.105	0.244	-0.139	0.105	0.105	0.000

Table 7, continued

Panel B: The effect of deposit insurance premiums on bank lending, entropy balanced

	(1)	(2)	(3)	(4)
Dependent Variable	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans
Bank premiums (bps)	Increase (7)	No Change (0)	No Change (0)	Decrease (7)
Credit union premiums (bps)	No Change (0)	Increase (10)	Increase (2)	No Change (0)
Quarter of Premium Change	2009Q1	2009Q4	2010Q4	2011Q2
POST	-0.00624	-0.0171***	-0.00349	0.0134***
	(0.00495)	(0.00505)	(0.00472)	(0.00430)
INSURED BANK	0.0298***	0.00348	0.00665**	-0.0106***
	(0.00385)	(0.00458)	(0.00298)	(0.00252)
POST*INSURED BANK	-0.0195***	0.00896*	-0.00153	0.0245***
	(0.00558)	(0.00542)	(0.00504)	(0.00469)
LN(ASSET)	0.00485**	0.00203	0.00443**	-0.00277
	(0.00228)	(0.00189)	(0.00202)	(0.00228)
CASH	-0.0487**	-0.000210	-0.0357***	-0.0257**
	(0.0216)	(0.0162)	(0.0125)	(0.0124)
LOANS AND LEASES	0.0676***	0.0650***	0.0446***	0.0608***
	(0.0115)	(0.0104)	(0.0135)	(0.00954)
CHARGE-OFFS	-3.606***	-3.288***	-3.386***	-4.259***
	(0.458)	(0.378)	(0.288)	(0.666)
LEVERAGE	-0.451***	-0.121***	-0.111***	-0.0686**
	(0.0466)	(0.0394)	(0.0342)	(0.0340)
TOTAL DEPOSITS	-0.0150	-0.0343*	-0.00260	-0.00846
	(0.0317)	(0.0205)	(0.0223)	(0.0218)
NET INTEREST INC	-4.014***	-4.131***	-0.873	-0.206
	(0.867)	(0.755)	(0.889)	(0.871)
RE LOANS	0.00368	-0.0303***	-0.0276***	-0.0160**
	(0.00829)	(0.00772)	(0.00775)	(0.00692)
UNUSED COMMIT	-0.00107	-0.00354**	-0.0190***	2.33e-05
	(0.00165)	(0.00161)	(0.00606)	(0.000641)
HOME EQUITY COMMIT	-0.00975	-0.0124**	-0.0161***	-0.00682
	(0.00766)	(0.00603)	(0.00597)	(0.00461)
Observations	13,574	12,750	12,092	11,886
R-squared	0.180	0.098	0.102	0.169

Panel A: This table presents the summary statistics pre and post entropy balancing. See Appendix C for all variable definitions.

Panel B: This table presents the OLS estimates of Equation 1, which tests the association between FDIC deposit insurance premiums and bank lending. In this table, we limit the sample to financial institutions with assets less than $100 million and entropy balance on all other control variables to better match the treatment and control group. See Appendix C for all variable definitions. Robust standard errors are clustered at the institution level. *, **, and *** indicate statistical significance at the two-tailed 10%, 5%, and 1% level.

Table 8
The effect of deposit insurance premiums on bank lending by financial institution size

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans
Bank premiums (bps)	Increase (7)	Increase (7)	No Change (0)	No Change (0)	No Change (0)	No Change (0)	Decrease (7)	No Change (7)
Credit union premiums (bps)	No Change (0)	No Change (0)	Increase (10)	Increase (10)	Increase (2)	Increase (2)	No Change (0)	Increase (0)
Quarter of Premium Change	2009Q1	2009Q1	2009Q4	2009Q4	2010Q4	2010Q4	2011Q2	2011Q2
Institution size	Large	Small	Large	Small	Large	Small	Large	Small
POST	-0.00884***	-0.00540***	-0.0195***	-0.0193***	-0.00861***	-0.00871***	0.0232***	0.0233***
	(0.000736)	(0.000846)	(0.000696)	(0.000710)	(0.000629)	(0.000630)	(0.000695)	(0.000697)
INSURED BANK	-0.00853	0.0219***	-0.0129	0.00434***	0.00326	0.00271*	0.00691	-0.00523***
	(0.0157)	(0.00230)	(0.0103)	(0.00166)	(0.00733)	(0.00154)	(0.00601)	(0.00151)
POST*INSURED BANK	-0.0115	-0.0204***	0.0391**	0.00901***	0.0114	0.00351**	0.00258	0.0139***
	(0.0150)	(0.00219)	(0.0155)	(0.00179)	(0.00895)	(0.00174)	(0.00750)	(0.00187)
LN(ASSET)	0.00367***	0.00513***	-0.000592	0.00112**	0.000480	0.00150***	0.00187***	0.00212***
	(0.000595)	(0.000726)	(0.000433)	(0.000497)	(0.000431)	(0.000445)	(0.000427)	(0.000398)
CASH	-0.0555***	-0.0149	-0.0474***	-0.00822	-0.0487***	-0.0403***	-0.0534***	-0.0361***
	(0.00696)	(0.0133)	(0.0113)	(0.0142)	(0.00737)	(0.00718)	(0.00601)	(0.00606)
LOANS AND LEASES	0.0299***	0.0748***	0.0396***	0.0420***	0.0482***	0.0541***	0.0635***	0.0657***
	(0.00587)	(0.00634)	(0.00366)	(0.00406)	(0.00383)	(0.00535)	(0.00585)	(0.00511)
CHARGE-OFFS	-2.126***	-2.136***	-2.470***	-2.702***	-3.933***	-4.092***	-3.954***	-4.158***
	(0.261)	(0.286)	(0.363)	(0.324)	(0.243)	(0.175)	(0.528)	(0.391)
LEVERAGE	0.0398	-0.402***	-0.0130	-0.184***	0.0255	-0.0967***	-0.0535**	-0.0802***
	(0.0272)	(0.0390)	(0.0214)	(0.0298)	(0.0345)	(0.0257)	(0.0219)	(0.0280)
TOTAL DEPOSITS	-0.0182	-0.0124	-0.00498	0.00752	-0.0411	0.00400	0.0350*	0.00555
	(0.0267)	(0.0202)	(0.0156)	(0.0147)	(0.0318)	(0.0178)	(0.0185)	(0.0232)
NET INTEREST INC	0.754*	-2.559***	-0.0509***	-0.148	-0.431	-0.635	-0.959*	-0.898**
	(0.412)	(0.813)	(0.0159)	(0.0984)	(0.263)	(0.504)	(0.539)	(0.455)
RE LOANS	-0.00340	0.0115***	-0.00562**	-0.00215	-0.0178***	-0.0178***	-0.0205***	-0.0193***
	(0.00311)	(0.00390)	(0.00285)	(0.00324)	(0.00238)	(0.00280)	(0.00254)	(0.00253)
UNUSED COMMIT	0.00332	-0.00124	-0.000456	-0.00197	0.00861***	-0.0138***	-0.00365	-5.58e-05
	(0.00294)	(0.000920)	(0.00276)	(0.00208)	(0.00295)	(0.00277)	(0.00301)	(0.000336)
HOME EQUITY COMMIT	-0.00198	-0.00870***	-0.00145	-0.00430**	-0.00253	-0.00603***	0.00344*	0.00129
	(0.00178)	(0.00229)	(0.00169)	(0.00187)	(0.00172)	(0.00165)	(0.00179)	(0.00164)
Observations	10,953	16,465	10,640	15,770	10,462	15,181	10,414	15,021
R-squared	0.097	0.165	0.110	0.090	0.095	0.088	0.165	0.146

This table presents the OLS estimates of Equation 1, which tests the association between FDIC deposit insurance premiums and bank lending. We split the sample into large (over $10 billion in assets) and small (under $100 million in assets). See Appendix C for all variable definitions. Robust standard errors are clustered at the institution level. *, **, and *** indicate statistical significance at the two-tailed 10%, 5%, and 1% level.

Table 9
The effect of deposit insurance premiums on bank lending by loan type

	(1)	(2)	(3)	(4)
Financial Instrument	Real Estate	Credit Card	C&I	Agricultural
Dependent Variable	%ΔLoans	%ΔLoans	%ΔLoans	%ΔLoans
Controls Included	Yes	Yes	Yes	Yes
2009Q1				
POST*INSURED BANK	-0.00861***	0.0257***	-0.0300***	-0.0422
	(0.00166)	(0.00840)	(0.00865)	(0.0299)
2009Q4				
POST*INSURED BANK	0.0101***	0.00133	0.0113	-0.0176
	(0.00155)	(0.00877)	(0.00815)	(0.0386)
2010Q4				
POST*INSURED BANK	0.00502***	-0.0156**	0.00563	-0.0577*
	(0.00151)	(0.00732)	(0.00789)	(0.0330)
2011Q2				
POST*INSURED BANK	0.00776***	-0.0144*	-0.0144*	0.179***
	(0.00140)	(0.00869)	(0.00871)	(0.0551)

This table presents the OLS estimates of Equation 1, which tests the association between FDIC deposit insurance premiums and bank lending. We analyze the sample by financial instrument type as indicated in the table. See Appendix C for all variable definitions. Robust standard errors are clustered at the institution level. *, **, and *** indicate statistical significance at the two-tailed 10%, 5%, and 1% level

Table 10
The effect of deposit insurance premiums on bank lending, evidence from BIF and SAIF

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	%ΔDeposits	%ΔDeposits	Interest Exp	Interest Exp	%ΔLoans	%ΔLoans
BIF (bps)	Decrease (19)	No Change (0)	Decrease (19)	No Change (0)	Decrease (19)	No Change (0)
SAIF (bps)	No Change (0)	Decrease (23)	No Change (0)	Decrease (23)	No Change (0)	Decrease (23)
Quarter of Premium Change	1995Q3	1997Q1	1995Q3	1997Q1	1995Q3	1997Q1
POST	-0.0721*	0.0640	0.00992	-0.00253	-0.255***	-0.00688
	(0.0395)	(0.0487)	(0.0693)	(0.0202)	(0.0658)	(0.0338)
BIF	-0.0964***	0.0273	0.0859	0.0642*	-0.260***	-0.0141
	(0.0297)	(0.0268)	(0.0731)	(0.0344)	(0.0484)	(0.0221)
POST*BIF	0.0698*	-0.0868*	-0.0109	-0.000296	0.242***	-0.00520
	(0.0393)	(0.0492)	(0.0704)	(0.0290)	(0.0655)	(0.0341)
LN(ASSET)	0.00923	0.0203*	-0.0175	-0.0232**	-0.0206	0.0134
	(0.00700)	(0.0123)	(0.0208)	(0.00958)	(0.0136)	(0.0120)
CASH	-0.181	-0.0226	0.327	0.109	-1.105***	0.516***
	(0.130)	(0.221)	(0.355)	(0.138)	(0.253)	(0.166)
LOANS AND LEASES	-0.155***	0.0501	-0.00800	0.00956	-0.302***	0.0507
	(0.0370)	(0.0540)	(0.0824)	(0.0479)	(0.0438)	(0.0966)
CHARGE-OFFS	3.331	1.092	0.822	8.144	-2.184	-6.070
	(6.192)	(1.600)	(4.054)	(7.691)	(3.917)	(4.953)
LEVERAGE	0.280	0.108	1.793	1.085*	1.050***	0.0794
	(0.251)	(0.228)	(1.104)	(0.563)	(0.343)	(0.198)
TOTAL DEPOSITS	-0.0694	0.157	-1.787*	-1.069**	-0.798***	-0.0353
	(0.144)	(0.200)	(1.057)	(0.477)	(0.266)	(0.175)
NET INTEREST INC	1.534	-9.240**	-1.541	5.224	8.772**	-0.632
	(3.510)	(3.887)	(7.534)	(3.572)	(4.328)	(3.286)
RE LOANS	-0.108***	-0.0198	-0.175**	-0.0605	-0.113**	-0.0344
	(0.0312)	(0.0482)	(0.0857)	(0.0563)	(0.0543)	(0.0472)
UNUSED COMMIT	-0.00159	0.000518	0.000755	0.00798***	-0.00552**	0.000731
	(0.00114)	(0.000427)	(0.00260)	(0.00164)	(0.00234)	(0.000776)
Observations	21,160	21,734	21,182	21,736	21,156	21,737
R-squared	0.458	0.136	0.005	0.014	0.649	0.186

This table presents the OLS estimates of our main analysis using a sample of banks from the 1990s, which tests the association between FDIC deposit insurance premiums and bank response. See Appendix C for all variable definitions. Robust standard errors are clustered at the institution level. *, **, and *** indicate statistical significance at the two-tailed 10%, 5%, and 1% level.

Appendix A

Summary Timeline of FDIC Deposit Insurance Rate Premiums

Years	Assessment rate range in basis points
1934 – 1989	8.3
1990	12
January 1991 – June 1991	19.5
July 1991 – 1992	23
1993 – June 1995 (Risk-based introduced)	23 to 31
July 1995 – December 1995	4 to 31
1996 – 2006	0 to 27
2007 – 2008	5 to 43
January 2009 – March 2009	12 to 50
April 2009 – March 2011	7 to 77.5
April 2011 – June 2016*	2.5 to 45
July 2016 – present	1.5 to 40

This table presents a summarized history of the deposit insurance premium rates charged to banks by the FDIC. The rates for the BIF are presented prior to the DIF formation in 2006. Information is gathered from the following FDIC web sources: https://www.fdic.gov/deposit/insurance/historical.html#20090101; https://www.fdic.gov/bank/historical/brief/brhist.pdf; and https://www.fdic.gov/about/history/timeline/index.html.

*In 2011, the assessment base against which rates are applied was revised from domestic deposits to total consolidated assets less tangible equity.

Appendix B

Summary Timeline of NCUA Deposit Insurance Rate Premiums

Years	NCUSIF rate schedule in basis points
1971 to 1981	8.3
1982	13.9
1983	16.7
1984	8.3
1985 to 1990	0
1991 to 1992	8.3
1993 to 2008	0
2009	10.3
2010	12.4
2011 to present	0

This table presents a summarized history of the deposit insurance premium rates charged to credit unions by the NCUA. Information is gathered from the NCUA Annual Reports (https://www.ncua.gov/news/annual-reports?page=0)

NCUA assessment base "Insured shares means the total amount of a credit union's share, share draft and share certificate accounts, or their equivalent under state law (which may include deposit accounts), authorized to be issued to members, other credit unions, public units, or nonmembers (where permitted under the Act or equivalent state law)." Federal Register, Vol. 60, No. 148.

Appendix C
Variable definitions

%ΔDEPOSITS	Total current quarter deposits less prior period deposits divided by prior period deposits.
%ΔLOANS	Total current quarter loans less prior period loans divided by prior period loans.
INSURED BANK	Indicator equal to one if the institution is an FDIC insured bank and zero if it is an NCUA insured credit union.
BIF	Indicator equal to one if the institution is an FDIC bank insured by the Bank Insurance Fund (BIF) and zero if it is insured by the Savings Association Insurance Fund (SAIF). Applies to period before DIF was created by the Federal Deposit Insurance Reform Act of 2005.
POST	Indicator equal to one for the quarter immediately following a change to assessed deposit insurance premiums and zero otherwise.
CASH	Total cash due from depository institution divided by total assets.
CHARGE-OFFS	Total loan and lease charge-offs divided by total assets
HOME EQUITY COMMIT	Total home equity line commitments divided by total unused commitments.
INTEREST EXP	Total interest expense divided by total deposits.
NET INTEREST INC	Total net interest income divided by total assets.

LEVERAGE	Total debt divided by total assets.
LN(ASSET)	Natural log of total assets.
LOANS AND LEASES	Total gross loans and leases divided by total assets.
RE LOANS	Total real estate loans divided by total loans and leases
TOTAL DEPOSITS	Total deposits divided by total assets.
UNUSED COMMIT	Total unused commitments divided by total loans and leases