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Do loan loss reserves behave like capital? Evidence from recent bank failures

Jeffrey Ng · Sugata Roychowdhury

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Abstract Regulatory capital guidelines allow for loan loss reserves to be added back as capital. Our evidence suggests that the influence of loan loss reserves added back as regulatory capital (hereafter referred to as "add-backs") on bank risk cannot be explained by either economic principles underlying the notion of capital or accounting principles underlying the recording of reserves. Specifically, we observe that, in sharp contrast to the economic notion of capital as a buffer against bank failure risk, add-backs are positively associated with the risk of bank failure during the recent economic crisis. Furthermore, the positive association of add-backs with bank failure risk is concentrated among cases in which the add-backs are highly likely to increase a bank's total regulatory capital. The evidence cannot thus be fully explained by accounting principles either, since the role of loan loss reserves according to those principles does not depend on whether the reserves generate a regulatory capital increase. Additional analysis suggests that the observed influence of loan loss reserves on bank failure risk may be an unintended consequence of their regulatory treatment as capital.

Keywords Bank failure · Bank risk · Regulatory capital · Capital adequacy · Loan loss reserves · Loan loss provisions

JEL Classification G21 · G28 · G32 · G38 · M41

J. Ng
School of Accountancy, Singapore Management University, 60 Stamford Road, Singapore 178900, Singapore
e-mail: jeffreyng@smu.edu.sg

S. Roychowdhury (✉)
Boston College, 140 Commonwealth Avenue, Fulton 520A, Chestnut Hill, MA 02142, USA
e-mail: sugata.roychowdhury@bc.edu

1 Introduction

Under current regulations, US commercial banks can include cumulative accrued losses on their loan portfolio as a component of regulatory capital. The regulatory provision that permits loan loss reserves to be added back to capital (up to a certain limit) has received considerable attention in the wake of the economic crisis. In speaking at the American Bankers Association meeting on March 17, 2010, Comptroller of the Currency John Dugan argued for the relaxation of limits on the inclusion of loan loss reserves as capital, to encourage banks to report adequate and timely reserves. On the following day at that same meeting, Federal Deposit Insurance Corp. (FDIC) Chairperson Sheila Bair contested this view, arguing that "letting more reserves count [toward capital] could dramatically, in our view, dilute the quality of capital."

Commercial banks add a substantial amount of loan loss reserves back as regulatory capital.[1] The issue of whether loan loss reserves should be added back is a controversial one from an accounting and economic perspective (Wall and Koch 2000). According to basic accounting principles, loan loss reserves reflect anticipated future cash-flow losses in the loan portfolio. To that extent, one might expect higher loan loss reserves to be associated with greater risk of bank failure during an economic downturn. On the other hand, as Berger et al. (1995) point out, a key desirable feature of capital is its ability to act as a buffer against financial distress during negative shocks to the bank's economic environment. The economic crisis spanning 2008–2010 provides a rich setting in which to examine various aspects of the association between components of capital and the risk of bank failure during a significant negative shock to the economy. Our study exploits this setting to investigate whether the add-back of loan loss reserves does indeed influence the quality of capital (that is, its ability to serve as a buffer against failure risk) and the conditions under which the influence is more pronounced.

We analyze several aspects of the regulatory treatment of loan loss reserves. First, an increase in loan loss reserves via loan loss provisions directly decreases the Tier 1 capital reported by banks by reducing shareholders' equity. Second, the full influence of this decline in Tier 1 capital on *total* capital is mitigated by the add-back of loan loss reserves as Tier 2 capital. Third, there are specific aspects of the regulatory provisions under which add-backs can *increase* a bank's total regulatory capital. We are specifically interested in this third aspect. Indeed, the question we address is the following: does the influence of loan loss reserves added back as capital on bank failure risk depend on whether the add-backs generate increases in total capital? To examine this issue, we test for the influence of loan loss reserves added back to capital on the risk of bank failure and, importantly, allow for the relation to vary with whether the add-backs increase regulatory capital. Since regulators presumably consider both Tier 1 and total regulatory capital when assessing bank health, all our tests include Tier 1 capital as an important control variable.

[1] For example, at the end of 2007, about 86.2 % of total loan loss reserves were added back to regulatory capital and constituted about 6.5 % of total capital.

Our empirical results indicate that, as expected, Tier 1 capital is negatively associated with the risk of bank failure. After controlling for Tier 1 capital and other CAMELS-type variables used by the FDIC to evaluate bank health, we observe that the incremental influence of add-backs on bank failure risk depends on whether the add-backs increase total regulatory capital. Loan loss reserves added back as Tier 2 capital but unlikely to increase total regulatory capital exhibit a weak/insignificant association with bank failure risk. However, add-backs highly likely to increase total regulatory capital are positively associated with bank failure risk even after imposing all other appropriate controls. These results are robust to using alternative definitions of bank failure. On the one hand, the results are clearly inconsistent with conventional economic notions of capital as a buffer against failure risk. On the other hand, they cannot be fully explained by accounting principles either, since the role of loan loss reserves according to those principles does not depend on whether the reserves generate a regulatory capital increase.

To examine the inconsistency of the observed influence of loan loss reserve add-backs with what would be expected under either accounting or economic principles, we perform additional analyses focusing on banks that survive in 2008. Focusing on this set of banks allows us to examine the relation between add-backs and other aspects of the banks' future activities. Requiring that banks survive in 2008 results in very few observations lost due to banks failing, since most failures occurred in 2009 and 2010 (120 and 139 in 2009 and 2010, respectively, versus only 20 in 2008). The most interesting insight from this analysis is that banks appear less likely to restrict lending in response to higher loan loss reserves if the reserves added back to capital are responsible for a regulatory capital increase. Additionally, when add-backs generate a regulatory capital increase, they are more negatively associated with future operating performance. The results cumulatively suggest that banks experiencing a regulatory capital increase from add-backs are less restrictive in lending at a time that their loan quality is deteriorating, which potentially contributes to increased failure risk.

We conduct additional analyses and robustness tests that yield interesting insights into the influence of add-backs to capital. We observe that the incremental positive association between add-backs that increase capital and failure risk is particularly pronounced among banks with low total capital. Furthermore, even among firms that survive the crisis, add-backs that generate capital increases in 2007 are more positively associated with the frequency of annual losses between 2008 and 2010. Finally, our results are robust to controlling for whether the commercial banks in our sample received TARP funding.

The primary contribution of our paper is in considering the role of regulatory capital in shaping the association between loan loss reserves and a real outcome, bank failure. We find evidence consistent with the presence of a possibly unintended consequence when regulatory accounting departs from conventional accounting and economic principles by allowing loan loss reserves to count towards bank capital. The literature recognizes that higher capital can induce bank managers to invest in more risky assets (see, for example, Shrieves and Dahl 1992). There certainly exists abundant anecdotal evidence suggesting that bankers consider loan loss reserve add-backs as additional capital against which they would extend more loans, even during

a crisis. For example, in arguing against regulatory restrictions placed on the add-back of loan reserves as capital, Joe Brennan, President and CEO of the Georgia Bankers Association, stated in 2009 that "76 % of all Georgia banks were adversely affected by the restriction" and "that billions in capital among Georgia banks would be freed up to support more lending if the limit were suspended." Echoing the sentiment expressed by Brennan, a number of banks have intensively lobbied in favor of a higher limit on loan loss reserve add-backs to capital. In its comment letter to the Federal Reserve Board on October 15, 2009, Discover Financial Services argues for the elimination of the current cap on loan loss reserves eligible to qualify as Tier 2 capital.[2]

From a regulatory perspective, allowing add-backs as capital is potentially desirable in that it encourages timelier provisions for reserves that anticipate future loan losses. Our results indicate a potential cost of allowing loan loss reserves as capital. Banks for which the add-backs increase regulatory capital (approximately 25 % of our sample) are encouraged to maintain lending at a time that the quality of their loan portfolio is progressively deteriorating, even when their loan loss provisions are not necessarily any timelier relative to other banks. In not restricting lending, bank managers possibly underestimate the risk of extending loans, the severity of the crisis, or both. Alternatively, they are aware of the impending problems but view less restricted lending (facilitated by the regulatory capital boost from add-backs) as the appropriate response since they have little to lose and are seeking low-probability risky payoffs (see discussion in Sect. 4.3). Our results thus point to the possibility that less restricted lending at a time when credit quality is deteriorating can have an adverse effect, compromising banks' ability to survive.

Our study contributes to the literature examining banks' loan loss provisioning choices in recent times (see, for example, Beatty and Liao 2011; Bushman and Williams 2012; Beck and Narayanamoorthy 2012). Our paper is also related to literature examining determinants of bank performance and failure (Meyer and Pifer 1970; Thomson 1991; Wheelock and Wilson 2000; Arena 2008; Akins et al. 2013). In the context of the most recent economic crisis in the US, Jin et al. (2011) report a strong positive association between loan loss reserve increases and the probability of bank failure during 2007–2010. Cole and White (2012) report that, in their tests, loan loss reserves appear to be negatively associated with the risk of bank failure during the recent crisis. In the light of these potentially conflicting findings, our paper contributes by providing evidence that the association between loan loss reserves and bank failure risk depends on the regulatory treatment of the reserves.

The rest of the paper is organized as follows. Section 2 discusses our setting and hypothesis. Section 3 describes our sample construction and data. Section 4 presents our results, and Sect. 5 concludes.

[2] Joe Brennan was delivering a statement to the Domestic Policy Subcommittee of the U.S. House Oversight and Government Reform Committee on November 2, 2009. Discover's comment letter was on bank regulators' proposed rule-making on risk-based capital guidelines and related issues (Federal Reserve Board 2009).

2 Setting, related literature, and hypotheses

2.1 Add-back of loan loss reserves as regulatory capital

The capital adequacy ratio, or the ratio of regulatory capital to risk-weighted assets, is the metric most widely relied on by regulators to monitor bank solvency (Estrella et al. 2000). There are two main sources of regulatory capital: Tier 1 and Tier 2. Tier 1 capital is core capital; it includes shareholders' equity (the primary component) and disclosed reserves. Tier 2 capital is secondary capital; it includes general loss reserves, undisclosed reserves, and subordinated term debt. In practice, for US commercial banks, Tier 2 capital consists primarily of loan loss reserves.[3] The International Basel Committee requirements specify a minimum limit of 4 % for Tier 1 capital and 8 % for total capital.

Changes in loan loss reserves affect regulatory capital in a two-step process. First, any growth in loan loss reserves via loan loss provisions lowers Tier 1 capital because it reduces shareholders' equity. Second, regulatory capital guidelines allow loan loss reserves to be added back as capital up to a limit of 1.25 % of gross risk-weighted assets (GRWA).[4] Thus, if loan loss reserves prior to the provision already exceed 1.25 % of GRWA, there is no effect beyond the decline in Tier 1 capital. However, if loan loss reserves are below the 1.25 % limit, the increase in the reserves via the loan loss provision is added back to regulatory capital as a component of Tier 2 capital. The add-back can generate a situation where total capital does not decline and may even increase when there is an increase in loan loss reserves. The simple numerical example below illustrates the role of loan loss reserve increases in influencing regulatory capital.[5]

Assume a bank increases its loan loss reserves by reporting a loan loss provision of $100 and that the statutory tax rate is 40 %. This transaction, ceteris paribus, has two effects on regulatory capital: (i) a Tier 1 effect and (ii) a Tier 2 effect. The loan loss provision reduces after-tax income by $100*(1 − tax rate), or $60, which in turn reduces shareholders' equity and hence Tier 1 capital by $60. Since banking capital regulations allow loan loss reserves to be considered as Tier 2 capital, Tier 2 capital increases by the provision amount of $100. Total regulatory capital (the sum of Tier 1 and Tier 2) increases by $ (−60 + 100) or $40 as a result of the loan loss provision, that is, the tax rate times the provision amount. If loan loss reserves prior to the provision were already equal to or greater than 1.25 % of GRWA, the $100 provision in the example would not increase Tier 2 capital. If loan loss reserves were below the 1.25 % limit but significantly close to it, it is possible that only a

[3] For example, in our sample, loan loss reserves on average account for 95 % of Tier 2 capital.

[4] Gross risk-weighted assets equal risk-weighted assets used in the computation of the capital ratios plus excess allowance for loan and lease losses plus the allocated transfer risk reserve. The limit of 1.25 % of gross risk-weighted assets on the amount of the loan loss reserves that a bank may include in Tier 2 capital is a standard included in the first capital accord of the Basel Committee on Banking Supervision (Basel Accord). See the Basel Committee on Banking Supervision, International Convergence of Capital Measurement and Capital Standards (1988), paragraph 21.

[5] We thank the FDIC for confirming that our example correctly represents the effect of the regulations.

portion of the $100 loan loss provision would count towards Tier 2 capital, not the entire amount.[6]

The example highlights that an increase in loan loss reserves can increase regulatory capital. Furthermore, the effect of loan loss changes on regulatory capital depends on the size of total available Tier 2 capital relative to the maximum limit allowable under current regulations.

2.2 Identification of banks in which add-backs generate a regulatory capital increase

This subsection describes the procedure we follow to identify banks that likely reported higher total regulatory capital in 2007 because of increases in loan loss reserves. The primary condition that banks need to satisfy to experience a capital increase from loan loss reserve is that loan loss reserves do not already exceed 1.25 % of GRWA. Therefore we require that the stock of loan loss reserves at the beginning of 2007 be below the 1.25 % limit on the add-back of these reserves as capital. In addition, we focus on banks that exhibit positive loan loss provisions in 2007. Banks with negative loan loss provisions are reversing provisions from prior years that are deemed excessive; in addition, such banks would not have experienced any increase in regulatory capital in 2007 as a result of their loan loss reserve decisions. Finally, we identify banks that are not registered as S corporations. Beginning in 1997, commercial banks can elect S corporation as their preferred tax status (instead of the more conventional C corporation status) if they meet certain conditions (Mehran and Suher 2009).[7] S corporations are essentially pass-through entities, meaning that they are exempt from federal income tax themselves, and their entire income is taxed at the shareholder level based on the percentage of shares owned (see Goldstein 1997; Levy et al. 1997; Kummer 2004). Thus they differ from regular C corporation banks.[8]

[6] Note that loan charge-offs have a slightly different effect relative to loan loss provisions. A charge-off occurs when a bank identifies a specific account in default and reduces both the loan outstanding and the loan loss reserve by the same amount. Thus a charge-off of $100 would reduce loan loss reserves by $100, ceteris paribus. Since charge-offs do not affect the shareholders' equity account, the sole effect of a $100 increase in charge-offs would be to *decrease* Tier 2 capital, and hence total regulatory capital, by $100 (to the extent that loan loss reserves were within the maximum allowable limit).

[7] A commercial bank can either elect to be either an "S corporation" or a "qualifying subchapter S subsidiary." To be an S corporation, the bank must have filed a valid election with the Internal Revenue Service and obtained the consent of all of its shareholders. An election for a bank to be a qualifying subchapter S subsidiary must have been made by a bank's parent holding company, which must also have made a valid election to be an S corporation. In addition, the bank (and its parent holding company) must meet specific criteria, including, for example, having no more than 100 qualifying shareholders and having only one class of stock outstanding.

[8] With a large percentage of S corporations reporting zero taxes on their call reports, and in general with their book taxes reflecting permanent differences with their tax statements, these banks would not typically experience the tax-effect-driven increase in regulatory capital from add-backs normal for C corporations.

2.3 Bank failure

Since our primary hypothesis rests on predicting the probability of bank failure, it is instructive to consider the process involved in declaring a failure. Bank failures involve the chartering authority or the FDIC closing banks[9]—that is, shutting down its operations, re-distributing its assets and liabilities and, if necessary, paying off insured depositors. Generally, a bank is closed when the regulator determines that it is "critically undercapitalized" and deems it unable to meet its obligations to depositors and other creditors. The key attribute determining undercapitalization is insolvency, which occurs when the bank's assets are worth less than its liabilities according to either book or market values. The Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 requires regulators to close banks before they reach book-value insolvency, since the market values of bank assets are uncertain and, for troubled banks, typically below their book values. Another reason for bank closure is illiquidity, which occurs when a bank cannot meet its current obligations as they come due. For example, when depositors are concerned that a bank is failing, they may withdraw their deposits and precipitate a liquidity crisis at the bank (i.e., bank runs). Illiquidity appears to drive bank failures more commonly in the European Union. Because of deposit insurance and the US Federal Reserve's capacity to provide liquidity, banks in the United States typically fail because they are insolvent as opposed to illiquid (Bennett 2002).

In the event of a failure, the FDIC acts as a receiver and is in charge of failure resolution. FDICIA mandates the use of the least-cost resolution method for bank failures, the objective of which is to minimize the present value of the net losses incurred by the FDIC. There are two primary types of failure resolution methods: (1) purchase-and-assumption transactions and (2) deposit pay-offs. In a purchase-and-assumption transaction, a healthy bank acquires the failed bank by purchasing "some or all" of the assets and assuming "some or all" of the liabilities. The FDIC often provides assistance to the acquiring bank, e.g., in the form of loan-loss sharing agreements, and then liquidates the remaining assets and liabilities, internalizing the cost of doing so. The acquiring bank usually compensates the FDIC for the franchise value from the failed bank's established customer relationships, which helps reduce the insurer's resolution cost. In a deposit-payoff transaction, the FDIC pays the failed bank's depositors the full amount of their insured deposits. Typically deposit payoffs are observed when no other bank is interested in assuming the assets and liabilities of the failed bank.

Variations of the two primary methods exist. For example, in a deposit transfer transaction, the FDIC transfers the insured deposits to a healthy bank that is willing to be an agent of the FDIC. The depositors can either withdraw their deposits or let them remain in the new bank. In a bridge transaction, the FDIC itself temporarily acquires the failed bank's assets and liabilities and takes over its operations while

[9] The chartering authority for state-chartered banks is usually the state banking department; for national banks, the Office of the Comptroller of the Currency (OCC); and for federal savings institutions, the Office of Thrift Supervision (OTS). While it is much more common for the chartering authoring to close a bank, the FDIC has the authority, under the FDIC Improvement Act of 1991, to close any bank that it considers to be critically undercapitalized and that does not have a plan to restore capital to an adequate level.

deciding on the least-cost resolution method. In a more significant departure, the FDIC can engage in an open-bank transaction, in which it provides financial assistance to the bank while it continues operations.

We classify all bank closures as failures, except for open-bank transactions that are implemented when banks' liquidity or solvency issues are perceived as temporary. We also test robustness in our empirical analyses to an alternative definition of failure that is noisier but also more inclusive: the set of all banks that disappear from the sample between 2008 and 2010.

2.4 Related literature and hypothesis

Prior literature has examined the association of loan loss reserves (and changes therein) with the financial health and performance of banks and the evidence is mixed. For example, a number of academic studies indicate the possibility that banks report larger loan loss provisions, thus increasing their loan loss reserves, when they are financially stronger and expect better future performance. Hence, these papers argue, banks with greater loan loss reserve increases signal financial strength, as evidenced by their positive association with changes in market value of equity (Elliott et al. 1991; Wahlen 1994; Beaver and Engel 1996; Liu et al. 1997). In a recent study, Beatty and Liao (2011) suggest that more conservative loan loss provisioning practices benefit banks in that they reduce the sensitivity of lending to the regulatory capital ratio during recessions. In the context of the recent economic crisis, Cole and White (2012) report a negative association between loan loss reserves in 2007 and the probability of bank failure during 2009. These studies appear to be consistent with regulators' rationale for the inclusion of loan loss reserves as capital: reserves provide a buffer against future deteriorations in banks' financial condition.

In contrast, some studies question whether loan loss reserve increases are associated with financial strength. Ahmed et al. (1999) document that loan loss provisions are associated with negative announcement returns. Similarly, using an international sample of banks in East Asia and Latin America, Arena (2008) finds that greater loan loss reserve increases (via provisions) appear to be associated with greater risk of bank failure. Bushman and Williams (2012) find that discretionary provisioning choices that are less forward-looking with respect to future nonperforming loans are associated with lower discipline with respect to risk-taking. Using data from the most recent economic crisis in the US, Jin et al. (2011) report a strong positive association between loan loss reserve increases and the probability of bank failure during 2007–2010. These results are consistent with accruals reflecting contemporaneous economic events that have implications for future cash flows (Dechow 1994). For banks, loan loss reserves reflect accrued losses in their loan portfolios and thus the reserves are expected to be positively associated with future deteriorations in banks' financial condition.

To our knowledge, no study has examined the influence on future bank performance of allowing loan loss reserves to count toward regulatory capital. The literature examining the inclusion of loan loss reserves in regulatory capital is largely restricted to testing whether managers exercise their accounting discretion to overstate loan loss provisions in an attempt to report higher capital (Moyer 1990;

Beatty et al. 1995; Ahmed et al. 1999). Our goal, on the other hand, is to provide evidence on the incremental influence of loan loss reserves on failure risk when such reserves count towards regulatory capital. This analysis is crucial given recent remarks by bankers indicating that, in making their lending decisions, they regard loan loss reserve add-backs as a legitimate component of capital against which they would extend future loans (for example, the remarks from the Georgia Bankers' Association mentioned in the introduction).

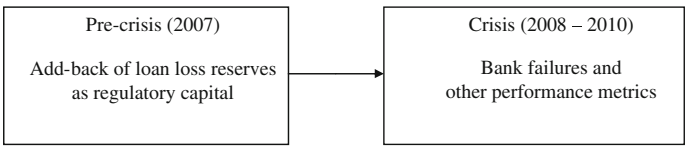
Systematic evidence also indicates that banks tend to assume more risk when they have a higher cushion against declines in their financial condition in the form of capital (Shrieves and Dahl 1992). Thus, it is conceivable that banks with higher regulatory capital as a result of larger loan loss reserves indeed extend more loans than they would otherwise. The resulting credit exposure can, however, have an unintended consequence: if economic conditions turn unexpectedly severe and loan quality deteriorates, the banks can incur further losses and experience a greater likelihood of failure. Given this potentially adverse consequence of allowing loan loss reserves to count towards regulatory capital, we test the following hypothesis (stated in null form):

> Loan loss reserves added back to regulatory capital are not incrementally associated with the probability of bank failure when they generate higher regulatory capital for the bank.

We focus on the probability of bank failure, given that it captures the risk of an unambiguously negative outcome and is consistent with the focus in a substantial literature on bank risk.[10] Boyd and De Nicoló (2005) point out that a major drawback of the bank risk literature is the inability of proxies for riskiness to directly capture bank failure probability. Our study benefits from the relatively large sample of bank failures during the recent economic crisis. However, for a subset of firms that survive the crisis, we test whether greater loan loss reserve add-backs that increase capital are associated with a less extreme but nevertheless negative consequence, that is, a higher frequency of annual losses between 2008 and 2010.

3 Sample construction

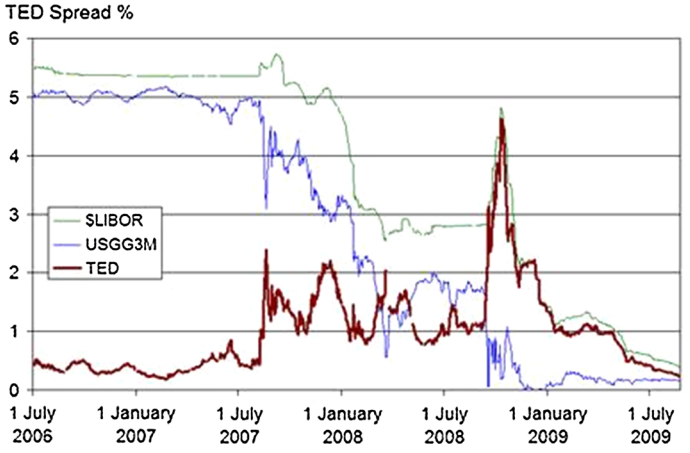
The timeline in our research design is shown below:



[10] See for example, Meyer and Pifer (1970), Koehn and Santomero (1980), Thomson (1991), Wheelock and Wilson (2000), Boyd and De Nicoló (2005), Arena (2008), and Jin et al. (2011), among others. Some studies (e.g., Laeven and Levine 2009) use a continuous measure of bank risk, such as the z-score, which attempts to capture the probability of failure via insolvency.

Our identification of the crisis period as beginning in 2008 is based on a number of linked considerations. First, consider the nature of crisis. The housing market peaked in 2006; by 2007, falling housing prices were already giving rise to concerns about the economy, with fears about a looming subprime crisis (Ryan 2008). The initial clear and public indications of what is now referred to as the financial crisis surfaced in the middle of 2007, with the failure of Bear Stearns' subprime mortgage funds. The full-fledged economic crisis that affected a much larger section of the economy, and was officially termed a recession, hit primarily in 2008, with the total collapse of Bear Stearns in March 2008 and the Lehman Brothers bankruptcy in September 2008. The NBER classifies the recession as having begun in December of 2007.

Second, rising TED spreads (i.e., the spread between the 3-month LIBOR and the 3-month T-bill rates), a commonly accepted sign of economic gloom, point to the crisis fully precipitating in 2008. In August of 2007, the TED spread did climb to very high, but not unprecedented, levels (around 200 basis points). But in September/October of 2008, it rose to over double that level, peaking at 464 basis points (see figure below), the highest in its history (inclusive of the 1987 stock market crash, when it rose to 300 basis points).



Finally, the commercial banks we study were hurt more by the *economic* crisis that directly influenced their borrowers than by the underlying *financial* crisis, which affected most immediately the large investment banks. Data on commercial bank failure (Table 1 in the paper) supports this—there were only two commercial bank failures in 2007. By comparison, in 2008, there were 20. We would thus introduce significant noise into the measurement of bank failure occurrence if we expanded the crisis period to include 2007, given that the failure spurt began in 2008, even though the financial crisis arguably originated in 2007. Hence our empirical analysis focuses on the effect of the add-back of loan loss reserves in 2007 on bank failures and other performance metrics during the subsequent 3 years.

Table 1 Distribution of bank failures from 2001 to 2010

Year	Failures	Total assets ($m)	Total deposits ($m)	Bank failures with FDIC cost info	Total cost ($m)
Panel A: Failure of commercial banks					
2001	3	58.6	51.6	3	4.6
2002	10	2,656.4	2,291.6	4	361.9
2003	3	961.2	903.2	2	135.6
2004	3	150.8	140.1	3	14.1
2005	0	0.0	0.0	–	–
2006	0	0.0	0.0	–	–
2007	2	102.5	89.2	1	3.0
2008	20	17,963.8	14,898.6	19	4,580.5
2009	120	119,175.1	97,596.8	120	24,100.9
2010	139	84,811.4	71,956.4	139	20,243.7
Panel B: Failure of thrifts					
2001	1	2,300.0	1,600.0	0	–
2002	1	52.0	40.0	0	–
2003	0	0.0	0.0	–	–
2004	1	12.3	9.8	0	–
2005	0	0.0	0.0	–	–
2006	0	0.0	0.0	0	0.0
2007	1	2,500.0	2,300.0	1	110.0
2008	5	401,694.6	224,332.1	5	12,842.0
2009	19	51,709.1	39,844.6	18	12,174.8
2010	18	11,494.6	8,837.4	18	1,909.5

This table provides information on bank and thrift failures by calendar year from 2001 to 2010. Panel A (B) shows the failure of commercial banks (thrifts)

3.1 Data on bank failures

We obtain data on bank failures from the FDIC website.[11] The FDIC, which is appointed as the receiver in the event of a bank failure, publishes a press release that provides details about the bank at the time of failure, including the actions being taken to deal with it. The press releases (available on the FDIC website) provide pertinent information, including the name of the failed bank, the bank's estimated assets and deposits at the time of the failure, and the failure's cost to the FDIC. As an example, the press release for the failure of Corus Bank is provided in Appendix A. Corus Bank's failure date was September 11, 2009. Its estimated assets and deposits at the time of failure were both approximately $7 billion. The cost of the failure to the FDIC was assessed at $1.7 billion.

Table 1 provides descriptive information about the failure of commercial banks and thrifts (which includes savings and loans associations and savings banks) from

[11] http://www.fdic.gov.

2001 to 2010. While, for the reasons discussed below, the focus of this paper is the failure of commercial banks, we also provide information about the failure of thrifts to provide a broader overview of failures and to highlight the enormity of the problems facing the banking industry. Failures of commercial banks and thrifts, which were relatively infrequent prior to the recent financial crisis, increased dramatically afterward as a result of the economic recession. A total of 21 commercial banks and four thrifts failed from 2001 through 2007, compared to a total of 279 commercial banks and 42 thrifts in 2008, 2009, and 2010. Consistent with theories on regulatory capital (e.g., Diamond and Rajan 2000) and bank regulatory guidelines, we expect that it is during periods like 2008–2010 when regulatory capital would matter most in ensuring banks' survival. Data on direct costs of failures indicates that the bank failures resulted in huge costs to the FDIC insurance fund. For example, the total cost to the fund on account of failed commercial banks was $4.58 billion in 2008, $24.1 billion in 2009, and $20.2 billion in 2010. In fact, failure costs were significant enough to deplete the FDIC insurance fund to the point of insolvency during 2009.

We focus on commercial banks because (i) commercial banks and thrifts file different regulatory reports, (ii) detailed regulatory report data for individual commercial banks, both private and public, are publicly available in a machine-readable form but not so for thrifts, and (iii) the number of failed commercial banks is significantly larger than the number of thrifts, facilitating wide-sample empirical analyses. For brevity, we henceforth use the term "banks" to refer to the commercial banks in our sample.

Figure 1 provides further description of bank failures between 2001 and 2010. For each year, it shows the banks that failed during the year as a percentage of banks

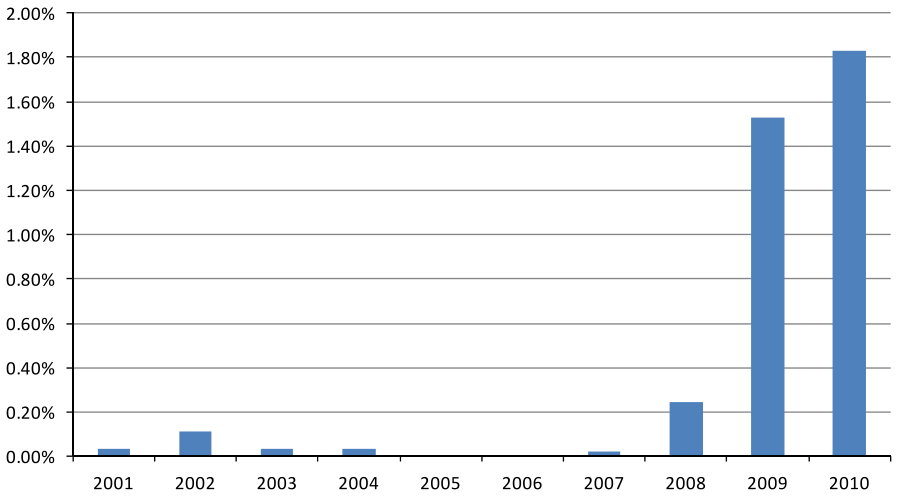


Fig. 1 Percentage of bank failures from 2001 to 2010. The figure below presents the percentage of banks that failed in each year as a percentage of banks at the beginning of the year. The number of banks at the beginning of the year is the number of banks that filed call reports and had positive total assets

that existed at the beginning of the year.[12] As Fig. 1 demonstrates, the percentage of bank failures increased sharply in the years 2008–2010.

3.2 Data from call reports

We obtain data on loan loss reserves, as well as other accounting variables, from the call reports filed by banks with the Federal Reserve, the FDIC, or the Office of the Comptroller of the Currency. In their call reports, banks and their subsidiaries must present their financial condition and results of operations on a consolidated basis in accordance with US generally accepted accounting principles (GAAP). However, the reports are not required to be audited by an independent external auditor in accordance with generally accepted auditing standards. Each call report essentially consists of an income statement, a balance sheet, and a series of schedules linked to either the income statement or balance sheet. Because most of the banks in our sample are private banks, the call reports are the only source of financial information about these banks. Hence, except for the hand-collected data on bank failure, our analyses are limited to variables that can be constructed with these reports. The data is available in machine-readable form at the Chicago Federal Reserve website.[13]

We begin with the 8,076 call reports filed by banks in the 50 states and Washington D.C. for the fiscal year ending December 2007. To be included in our sample, the bank must have positive total assets and total loans for the fiscal years ending December 2006 and December 2007; we require data from both 2006 and 2007 to construct variables that measure changes from 2006 to 2007. The computation of loan loss timeliness also requires data for 12 quarters ending December of 2007. The data requirements for the primary and control variables reduce the sample to 6,382 banks. To merge the bank failure data with the call report data, we obtain the RSSD ID of the banks in the bank failure dataset. The RSSD ID is the unique identifying number assigned by the Federal Reserve for all financial institutions, main offices, and branches. Of the 6,382 banks in our sample, 221 banks failed between 2008 and 2010. Thus, after imposing the data availability constraints, our sample captures 221 of the 279 failures during this period.

Table 2 presents the distribution of the 6,382 banks across the different states and regions of the United States. The states with the most number of bank failures are Georgia, Illinois, and Florida, with 37, 35, and 24 failures, respectively. Nevada has the highest failure rate (the percentage of all banks that failed), at 34.8 %. From a regional perspective, while there were more bank failures in the South, the failure rate is higher in the West, at 9.20 %. The uneven distribution of bank failures across different states and regions is consistent with the fact there was significant variation in the impact of the economic crisis across the United States.

[12] The number of banks at the beginning of the year is the number of banks that filed call reports and had positive total assets.

[13] http://www.chicagofed.org/webpages/banking/financial_institution_reports/commercial_bank_data.cfm.

Table 2 Within-sample distribution of commercial bank failures across the United States

Northeast: 6/563 = 1.07 %		
New England		Middle Atlantic
Connecticut (0/36)		New Jersey (2/66)
Maine (0/22)		New York (1/110)
Massachusetts (1/138)		Pennsylvania (2/161)
New Hampshire (0/14)		
Rhode Island (0/6)		
Vermont (0/10)		
Midwest: 73/2,809 = 2.60 %		
East North Central	West North Central	
Indiana (1/113)	Iowa (0/313)	Nebraska (1/195)
Illinois (35/541)	Kansas (6/282)	North Dakota (0/84)
Michigan (7/131)	Minnesota (13/373)	South Dakota (1/66)
Ohio (1/170)	Missouri (6/289)	
Wisconsin (2/252)		
South: 81/2,347 = 3.45 %		
South Atlantic	East South Central	West South Central
Delaware (0/21)	Alabama (3/126)	Arkansas (1/131)
District of Columbia (0/4)	Kentucky (0/173)	Louisiana (0/127)
Florida (24/187)	Mississippi (1/86)	Oklahoma (2/233)
Georgia (37/258)	Tennessee (0/153)	Texas (6/541)
Maryland (2/41)		
North Carolina (2/66)		
South Carlina (3/54)		
Virginia (0/86)		
West Virginia (0/60)		
West: 61/663 = 9.20 %		
Mountain		Pacific
Arizona (4/31)	Montana (0/63)	Alaska (0/5)
Colorado (3/120)	Utah (4/42)	California (20/182)
Idaho (0/12)	Nevada (8/23)	Hawaii (0/4)
New Mexico (1/46)	Wyoming (1/37)	Oregon (6/27)
Washington (14/71)		
All regions: 221/6,382 = 3.46 %		

This table shows the distribution of 221 commercial bank failures in 2008, 2009, and 2010 within our sample of 6,382 commercial banks. The sample is the number of commercial banks in existence at the end of 2007 that have the data needed to compute the variables used in our analysis (see Table 4). Within each pair of parentheses, the number of bank failures is indicated on the left; the total number of banks is indicated on the right

Table 3 provides the distribution of the 6,382 banks in our sample based on the criteria for identifying whether they experienced an increase in regulatory capital as a result of the add-back of loan loss reserves (*ADDBACK*), represented by the indicator variable *CAPINC*. For example, during 2007, 32.8 % of banks elected to be taxed as S corporations; we focus on the remaining 67.2 % as more likely to have experienced regulatory capital increases as a consequence of tax effects. Most banks (84.1 %) reported positive loan loss provisions during 2007. Finally, 64.3 % of the banks had not reached the 1.25 % limit on the add-back of loan loss reserves as capital at the beginning of 2007 (i.e., according to the call report for the period ending December 2006). The intersection of these criteria generates a subsample of 2,440 banks, constituting 38.2 % of the sample, that are highly likely to have experienced an increase in total regulatory capital due to loan loss reserve increases via provisions in 2007; *CAPINC* assumes a value of one for these banks and zero for all other banks.

Table 4 provides some descriptive information about the add-back of loan loss reserves (*ADDBACK*) as a component of total loan loss reserves (*LLR*) and also as a component of total regulatory capital (*TOTAL CAPITAL*). Panel A presents the summary statistics of the breakdown of loan loss reserves and total regulatory capital. The add-back of loan loss reserves is 86.1 % of total loan loss reserves and 6.5 % of total regulatory capital, suggesting that that the add-back of loan loss reserves is economically significant.

Panel B presents the univariate comparisons between banks that failed and those that did not. Banks that failed had, as expected, significantly higher loan loss reserves as a percentage of total risk-weighted assets; 1.563 versus 1.194 %. Both the add-back component and the non-add-back component of loan loss reserves are significantly higher for banks that failed. In particular, for the banks that failed (did not fail), the add-back component of loan loss reserves is 1.129 % (1.037 %). In contrast, compared to banks that failed, banks that did not fail have higher total regulatory capital and higher Tier 1 capital; this is consistent with the economic notion of capital as a buffer against bank failure.

Finally, Panel C of Table 4 presents univariate comparisons between banks that experienced increases in regulatory capital from add-backs ($CAPINC = 1$) and those did not ($CAPINC = 0$). Even though the add-backs are lower for banks with $CAPINC = 1$, they represent 96 % their loan loss reserves, while for banks with $CAPINC = 0$, add-backs represent a relatively lower 81.5 % of their loan loss reserves. As a percentage of total capital, add-backs are more comparable across the two groups: 65.3 % for $CAPINC = 1$ and 64.4 % as $CAPINC = 0$.[14]

[14] Add-backs as a percentage of total capital for $CAPINC = 0$ banks are comparable in magnitude to those of $CAPINC = 1$ banks probably because the former have already reported a high enough level of loan loss reserves in prior periods to exhaust the possibility of further regulatory capital increases from add-backs.

Table 3 Banks likely to experience a capital increase from add-back of loan loss reserves

	Number	Percentage
S Corporation in 2007		
No	4,289	67.20
Yes	2,093	32.80
Positive loan loss provisions in 2007		
No	1,014	15.89
Yes	5,368	84.11
Reached 1.25 % limit on add-backs at the beginning of 2007		
No	4,102	64.27
Yes	2,280	35.73
CAPINC		
Capital increase from tax benefit due to loan loss provisions in 2007		
No	3,942	61.77
Yes	2,440	38.23

This table presents the distribution of 6,382 banks within each criterion that we used to construct *CAPINC*, which is an indicator variable equaling one if a bank is likely to experience a capital increase from the add-back of loan loss reserves in 2007 and zero otherwise. Specifically, *CAPINC* equals one if the bank (i) is not an S Corporation, (ii) has positive loan loss provisions, and (iii) has not reached the 1.25 % limit on add-back of loan loss reserves as capital in the previous year

4 Research design, related data, and results

4.1 Research design and related data

To examine how bank failure risk is associated with the add-back of loan loss reserves as capital, we begin by examining the relation between bank failure and total regulatory capital ratio using the following logistic regression model:

$$FAIL = \beta_0 + \beta_1 TOTAL\,CAPITAL + \sum_{\mathrm{i}} \beta_i CONTROL_{\mathrm{i}} + \varepsilon, \qquad (1)$$

where *FAIL* is an indicator variable equaling one if the bank that existed at the end of 2007 failed during the period from 2008 to 2010; *TOTAL CAPITAL* is the total regulatory capital ratio (i.e., total regulatory capital scaled by risk weighted assets); and *CONTROL* is a set of control variables added to mitigate omitted correlated variable bias: *NPL*, *CH-_NPL*, *TIMELY*, *ROA*, *REAL ESTATE LOAN*, *LOAN CONCENTRATION*, *UNINSURED DEPOSIT*, *LIQUIDITY, OVERHEAD*, *INSIDER LOAN*, *TOTAL_ASSETS*, as well various regional dummies (*MIDWEST*, *SOUTH*, *WEST*) and regulator dummies (*FED*, *OCC*) as fixed effects. All the independent variables are measured at the end of 2007, i.e., before the occurrence of the bank failures between 2008 and 2010.

If regulatory capital is indeed acting as a buffer against bank failure, we expect the coefficients on *TOTAL CAPITAL* to be positive. *NPL* is nonperforming loans as a percentage of total loans, and *CH_NPL* is change in nonperforming loans as a

Table 4 Bank failures, loan loss reserves, and regulatory capital

Panel A: Summary statistics for all banks

Variable	Mean	Std	P25	Median	P75
LLR	1.207	0.639	0.893	1.096	1.357
ADDBACK	1.040	0.238	0.897	1.101	1.251
OTHER LLR	0.167	0.524	0.000	0.000	0.111
TOTAL CAPITAL	16.078	9.969	11.540	13.720	17.660
TIER1	14.976	9.984	10.430	12.655	16.620
ADDBACK	1.040	0.238	0.897	1.101	1.251
OTHER TIER2	0.064	0.407	0.000	0.000	0.000
Less: *DEDUCTION*	0.001	0.034	0.000	0.000	0.000

Panel B: Univariate comparison of nonfailed banks and failed banks

	FAIL = 0	*FAIL* = 1	Difference
Number of banks	6,161	221	
LLR	1.194	1.563	0.369***
ADDBACK	1.037	1.129	0.093***
OTHER LLR	0.158	0.434	0.276***
TOTAL CAPITAL	16.230	11.851	−4.379***
TIER1	15.132	10.617	−4.515***
ADDBACK	1.037	1.129	0.093***
OTHER TIER2	0.063	0.105	0.042
Less: *DEDUCTION*	0.001	0.000	−0.001

Table 4 continued

Panel C: Univariate comparison of banks with *CAPINC* = 0 *and CAPINC* = 1

	CAPINC = 0	*CAPINC* = 1	Difference
Number of banks	3,942	2,440	
LLR	1.334	1.002	−0.332***
ADDBACK	1.088	0.963	−0.125***
OTHER LLR	0.246	0.040	−0.207***
TOTAL CAPITAL	16.900	14.751	−2.149***
TIER1	15.783	13.671	−2.113***
ADDBACK	1.088	0.963	−0.125***
OTHER TIER2	0.029	0.120	0.091***
Less: *DEDUCTION*	0.000	0.003	0.002*

This table provides univariate analyses of the differences between banks that failed in 2008–2010 and those that did not. The sample consists of 6,382 commercial banks; the loan loss reserves and capital ratios are based on the numbers reported in their call reports for 2007. Panel A presents some descriptive statistics related to loan loss reserves and regulatory capital. Panel B compares the differences in loan loss reserves and regulatory capital between banks that failed and those that did not. Panel C compares the differences in loan loss reserves and regulatory capital between banks likely to experience a capital increase from add-back of loan loss reserves (*CAPINC* = 1) in 2007 and those not likely to (*CAPINC* = 0). *LLR* is loan loss reserves. *ADDBACK* is loan loss reserves that are added back to total capital. *OTHER LLR* is loan loss reserves that are not added back to total capital because of the 1.25 % limit on add-back. *TOTAL CAPITAL* is total capital. *TIER1* is tier 1 capital. *OTHER TIER2* capital is tier 2 capital less *ADDBACK*. *DEDUCTION* is deduction from total capital. For comparability, all the variables are scaled by risk-weighted assets. Significance levels are based on two-tailed tests. ***, **, and * denote significance at the 1, 5, and 10 % levels, respectively

percentage of nonperforming loans from 2006 to 2007. We expect banks with relatively greater *NPL* and *CH_NPL* to exhibit greater failure risk.

In addition to reporting the provisions themselves, we measure the timeliness of loan loss provisions reported by banks, denoted *TIMELY*. Following Beatty and Liao (2011), *TIMELY* is obtained from the following two regressions:

$$LLP_t = \alpha_0 + \alpha_1 CH\_NPL_{t-2} + \alpha_2 CH\_NPL_{t-1} + \alpha_3 TIER1_t + \alpha_4 EBP_t + \varepsilon_t$$

$$LLP_t = \alpha_0 + \alpha_1 CH\_NPL_{t-2} + \alpha_2 CH\_NPL_{t-1} + \alpha_3 TIER1_t + \alpha_4 EBP_t + \alpha_1 CH\_NPL_t + \alpha_2 CH\_NPL_{t+1} + \varepsilon_t.$$

In the above regressions, *LLP* denotes loan loss provisions divided by lagged total loans. *TIER1* is tier 1 risk-adjusted capital ratio at the beginning of the quarter. *EBP* is earnings before loan loss provisions scaled by lagged total loans. And *CH_NPL* is the change in nonperforming loans scaled by lagged total assets over the quarter. The adjusted R^2 of the second equation is expected to exceed that of the first equation by a greater extent when loan loss provisions are timelier in capturing future changes in nonperforming loans. Accordingly, *TIMELY* is measured as adjusted R^2 of the second equation minus that of the first equation from the above two regressions, estimated over the 12 quarters for every bank, between the quarter ending March 2005 and the quarter ending December 2007.

Turning to the remaining control variables in regression (1), *ROA* is net income as a percentage of average beginning and ending total assets. We expect more profitable banks to be less likely to fail. *REAL ESTATE LOAN* is loans and leases as a percentage of total assets, which we include as a control for composition of the loan portfolio. Exposure to real estate loans was a key factor behind the financial difficulties that many banks faced during the crisis. We expect banks with relatively more real estate loans to be at a greater risk of failure. *LOAN CONCENTRATION* is the Herfindahl index of the distribution of real estate loans, commercial and industrial loans, loans to depository institutions, agricultural loans, loans to individuals, and loans to foreign governments. We expect banks with more concentrated loan portfolios to be more likely to fail.

UNINSURED DEPOSIT is uninsured assessable deposits as a percentage of total assessable deposits. We expect banks with more uninsured deposits to be at a greater risk of failure during times of crisis due to the greater possibility of deposit runs by uninsured depositors. *LIQUIDITY* is the cash and balances due from depository institutions and securities as a percentage of total deposits. Cash and balances due from depository institutions provide liquidity during deposit withdrawals, which tend to be higher during economic crises. Hence a bank with higher *LIQUIDITY* is likely to face fewer difficulties in meeting withdrawal requests and is less likely to fail.

OVERHEAD is non-interest expense (e.g., salaries and employee benefits, expenses of premises and fixed assets) as a percentage of total assets. Higher overhead expenses are an indicator of lower efficiency, greater agency problems, or both. *INSIDER LOAN* is loans to executive officers, directors, principal shareholders, and their related interests as a percentage of total assets. More insider loans could indicate greater agency problems. Hence we expect banks with higher

overhead expenses and more insider loans to fail. *TOTAL_ASSETS* is the total assets of the bank in billions, a proxy for bank size. From casual observation of the failed banks, it becomes apparent that both small and large banks failed during the recent crisis. However, we control for size because it is an important consideration when closing a bank, particularly in light of the possibility of governmental support if the bank is "too big to fail."

Next, we include region dummies to mitigate concerns that the empirical results are driven by heterogeneous regional characteristics; as Table 2 indicates, there is significant variation in bank failures across regions. Examples of such heterogeneity include differences in the expansion of the property sector and unemployment differences.[15] *MIDWEST* is an indicator variable equaling one if a bank is in the Midwest region and zero otherwise; *SOUTH* and *WEST* are defined analogously for the southern and western regions, respectively. By construction, the Northeast (*NORTHEAST*) serves as the benchmark region. We also control for regulator types using indicator variables. *FED* and *OCC* are indicator variables equaling one if bank is supervised by the Federal Reserve Board (FED) or the Office of the Comptroller of the Currency (OCC) respectively. By construction, the FDIC (*FDIC*) serves as the benchmark regulator.

The main objective of this study is to examine the incremental association between bank failure and the add-back of loan loss reserves as capital, after controlling for the other components of total regulatory capital and including the appropriate control variables. Hence we break down *TOTAL CAPITAL* into its major components, *ADDBACK*, *TIER1*, and *OTHER TIER2* (see Table 3). We then run the following logistic regression model, which is essentially an extension of Eq. (1):

$$FAIL = \beta_0 + \beta_1 ADDBACK + \beta_2 TIER1 + \beta_3 OTHER\,TIER2 + \beta_4 OTHER\,LLR + \sum_{i} \beta_i CONTROL_i + \varepsilon, \quad (2)$$

where *ADDBACK* is the add-back of loan loss reserves; *TIER1* is Tier 1 capital; *OTHER TIER2* capital is Tier 2 capital less loan loss reserves added back; and *OTHER LLR* is loan loss reserves not added back to regulatory capital due to the 1.25 % limit. For comparability, these variables are scaled by risk-weighted assets. The other variables are defined in Eq. (1).

If each of the components of total regulatory capital acts as a buffer against bank failure, we expect *FAIL* to be negatively associated with *TIER1*, *ADDBACK*, and *OTHER TIER2*. If, on the other hand, each of the components of loan loss reserves acts in accordance with accrual principles and captures future cash flow losses in the loan portfolio, we expect *FAIL* to be positively associated with both *ADDBACK* and *OTHER LLR*.

Next, to identify whether add-backs have a differential effect when they generate a capital increase for the bank, we examine whether the association between bank

[15] We cannot include state dummies because there are several states with no bank failures. Hence it is not possible to examine how within-state variation in loan loss reserve accounting is associated with within-state variation in the risk of bank failure.

failure and add-back of loan loss reserves as capital varies cross-sectionally with *CAPINC*. To that end, we extend Eq. (2) by running the following logistic regression model:

$$\begin{aligned} FAIL = {} & \beta_0 + \beta_1 ADDBACK\text{x}CAPINC + \beta_2 ADDBACK + \beta_3 CAPINC \\ & + \beta_4 TIER1 + \beta_5 OTHER\,TIER2 + \beta_6 OTHER\,LLR, \\ & + \sum_{\text{i}} \beta_i CONTROL_{\text{i}} + \varepsilon. \end{aligned} \tag{3}$$

Finally, it is possible that systematic differences exist in various properties of loan loss reserves and related bank characteristics like nonperforming loans across banks with $CAPINC = 1$ and $CAPINC = 0$. To the extent that this can imply differential relations between these variables with failure risk, we also impose controls for the interaction of CAPINC with the following: loan loss reserves not added back to capital, nonperforming loans and changes therein, as well as the timeliness of loan loss reserves. To that end, we estimate the following logistic regression model:

$$\begin{aligned} FAIL = {} & \beta_0 + \beta_1 ADDBACK \times CAPINC + \beta_1 OTHER\,LLR \times CAPINC + \beta_1 NPL \\ & \times CAPINC + \beta_1 CH\_NPL \times CAPINC + \beta_1 TIMELY \times CAPINC \\ & + \beta_2 ADDBACK + \beta_3 CAPINC + \beta_4 TIER1 + \beta_5 OTHER\,TIER2 \\ & + \beta_6 OTHER\,LLR, + \sum_{\text{i}} \beta_i CONTROL_{\text{i}} + \varepsilon. \end{aligned} \tag{4}$$

Since our study examines the failure risk of banks, a natural alternative to using logistic regression models is hazard models. Hazard models incorporate information about the time that elapses before an event (in our case, a bank failure) occurs. These models have been used in numerous research contexts, especially when the hazardous event of interest is rare (e.g., Lee and Urrutia 1996; Shumway 2001; Carpenter and Lewis 2004). For example, Shumway (2001) demonstrates that hazard models outperform static models such as logistic models in predicting bankruptcy. However, a limitation of hazard models is the need to make additional assumptions of the functional model. We rely on the widely used Cox proportional hazard model (Cox 1972; Cox and Oakes 1984), which has the following form: $h(t) = h_0(t)exp(X_i\beta_i)$, where $h(t)$, the hazard rate, is the risk of failure at a certain point in time, conditional on survival until that point in time; X_i is a vector of explanatory variables; and β_i is a vector of coefficients. The explanatory variables are the same as those in Eqs. (1) through (3). $h_0(t)$ represents the baseline hazard rate that is exclusively a function of time. In the Cox model, the coefficient on the explanatory variable represents the proportional change in the hazard rate for a one-unit change in the explanatory variable.

Finally, to further examine the effects of the add-back of loan loss reserves, we also examine the influence of add-backs on alternative outcomes for a smaller sample of banks that survive in 2008 (6,191 as opposed to the 6,382 in the full sample). In particular, we rely on *LOAN GROWTH 2008*, *NPL 2008*, and *ROA 2008*. *LOAN GROWTH 2008* is the percentage increase in loans from 2007 to 2008; *NPL 2008* is the nonperforming loans in 2008; and *ROA 2008* is the return on assets

Table 5 Descriptive statistics

Variable	Mean	SD	P25	Median	P75
FAIL	0.035	0.183	0.000	0.000	0.000
NPL	2.652	2.897	0.883	1.906	3.432
CH_NPL	0.760	2.663	−0.193	0.335	1.297
TIMELY	0.107	0.123	0.020	0.063	0.149
ROA	1.233	1.359	0.762	1.239	1.680
REAL ESTATE LOAN	68.804	19.633	57.907	72.186	82.588
LOAN CONCENTRATION	55.100	19.570	39.909	54.447	69.178
UNINSURED DEPOSIT	39.867	15.081	29.478	37.808	47.868
LIQUIDITY	19.286	749.100	2.869	3.932	5.749
OVERHEAD	3.120	4.317	2.376	2.862	3.410
INSIDER LOAN	1.339	1.503	0.254	0.848	1.930
TOTAL ASSETS	1.692	30.683	0.071	0.149	0.332
NORTHEAST	0.088	0.284	0.000	0.000	0.000
MIDWEST	0.440	0.496	0.000	0.000	1.000
SOUTH	0.368	0.482	0.000	0.000	1.000
WEST	0.104	0.305	0.000	0.000	0.000
FDIC	0.657	0.475	0.000	1.000	1.000
FED	0.127	0.333	0.000	0.000	0.000
OCC	0.216	0.411	0.000	0.000	0.000
LOAN GROWTH 2008	0.098	0.487	0.000	0.062	0.133
NPL 2008	3.714	4.040	1.268	2.624	4.747
ROA 2008	0.515	1.987	0.225	0.901	1.397

This table provides some descriptive statistics of the variables (other than *ADDBACK*, *OTHER LLR*, *TOTAL CAPITAL*, *TIER1*, and *OTHER TIER2*, whose descriptive statistics are in Table 3 Panel A) that are used in the analysis of bank failure. The sample consists of 6,382 commercial banks. *FAIL* is an indicator variable equaling one if the bank failed in 2008, 2009, or 2010 and zero otherwise. All the remaining variables are measured in 2007, unless indicated otherwise. *NPL* is nonperforming loans (i.e., loans past due 30, 90 days, and non-interest-accruing) as a percentage of total loans. *CH_NPL* is the change in the percentage of nonperforming loans from 2006 to 2007. *ROA* is the return on assets. *REAL ESTATE LOAN* is estate loans as a percentage of total loans. *LOAN CONCENTRATION* is the Herfindhal index of the distribution of real estate loans, commercial and industrial loans, loans to depository institutions, agricultural loans, loans to individuals, and loans to foreign governments. *UNINSURED DEPOSIT* is uninsured assessable deposits as a percentage of total assessable deposits. *LIQUIDITY* is the cash and balances due from depository institutions and securities as a percentage of total deposits. *OVERHEAD* is non-interest expense (e.g., salaries and employee benefits, expenses of premises, and fixed assets) as a percentage of total assets. *INSIDER LOAN* is loans to executive officers, directors, principal shareholders, and their related interests as a percentage of total assets. *TOTAL ASSETS* is total assets in billions. *NORTHWEST*, *MIDWEST*, *SOUTH*, and *WEST* are indicator variables equaling one if the bank is located within the Northwest, Midwest, South, and West regions, respectively, and zero otherwise. *FDIC*, *FED*, and *OCC* are indicator variables equaling one if bank is supervised by FDIC, the Federal Reserve or OCC, respectively. *LOAN GROWTH 2008* is the percentage increase in loans from 2007 to 2008, *NPL 2008* is the nonperforming loans in 2008, and *ROA 2008* is the return on assets in 2008; the number of observations for variables measured in 2008 is 6,191

in 2008. An important caveat with considering these outcomes is that the sample size is smaller because of the data requirements to compute the 2008 numbers. The loss of firms is not random because the reduction in sample size is likely to reflect banks that disappear due to negative performance outcomes in 2008, including failures. This survivorship bias is particularly pertinent for the analysis with nonperforming loans and ROA as dependent variables, since they are more directly associated with bank performance. The regression specifications to examine these outcomes are similar to Eqs. (2), (3), and (4); the two differences are i) the 2008 outcome variables replace *FAIL* as the dependent variable, and ii) the regression specification is ordinary least squares, as opposed to logistic.

Table 5 presents the descriptive statistics for the dependent variable and all control variables in the above equations. The mean value of *FAIL* indicates that 3.5 % of the banks in our sample failed in 2008, 2009, or 2010. The descriptive statistics for the remaining variables are based on the call reports for 2007. Nonperforming loans constitute, on average, 2.65 % of total loans. The change in nonperforming loans as a percentage of total assets was 0.76 %. At the end of 2007, the banks are generally profitable, with a mean return-on-assets of 1.23 %. On average, 68.80 % of the total loans made by the banks are real estate loans. Uninsured deposits as a percentage of total assessable deposits are around 40 %. The average cash-to-deposit percentage is 19.29 %. Average overhead and insider loans, as a percentage of total assets, are 3.12 and 1.34 %, respectively. The mean and median total assets of the banks are $1.69 billion and $0.15 billion. The percentage of banks in the Northeast, Midwest, South, and West are 8.8, 44.0, 36.8, and 10.4 %, respectively. The percentage of banks that are regulated by the FDIC, the Federal Reserve, and the OCC are 65.7, 12.7, and 21.6 %, respectively.

4.2 Results

4.2.1 Bank failure analyses

Table 6 presents the analyses that examine the relation between bank failures and the add-back of loan loss reserves as regulatory capital. The objective is to examine how pre-crisis (i.e., 2007) add-back of loan loss reserves is associated with bank failures during the crisis (i.e., 2008–2010). In the first column of Panel A, the coefficient on *LLR* is positive and statistically significant at the 10 % level, consistent with loan loss reserves being positively associated with bank failure risk. The coefficient on *TOTAL CAPITAL* is negative and statistically significant at the 1 % level, suggesting that a higher level of total capital is associated with a lower failure risk. This result is consistent with capital serving as a buffer against bank failure. The statistically significant coefficients on control variables have the expected signs. Banks with higher levels of nonperforming loans are more likely to fail. Banks with more concentrated loan portfolios are more likely to fail, a result that highlights the advantages of a diversified loan portfolio. Banks with more uninsured deposits and lower liquidity are more likely to fail, as expected given their greater susceptibility to deposit runs. In terms of regions, banks located in the

regions other than the Northeast region are more likely to fail, consistent with the earlier evidence in Table 2.

In the second column, total capital is split into various components—*ADDBACK*, *TIER1*, and *OTHER TIER2*. Since *ADDBACK* is a component of *LLR*, the remaining component *OTHER LLR* is included as a control variable. The coefficient on *ADDBACK* is positive and statistically significant at the 1 % level, suggesting that a higher level of *ADDBACK* is associated with a higher likelihood of bank failure. In sharp contrast, the coefficient on *TIER1* is negative and statistically significant at the 1 % level, suggesting that a higher level of Tier 1 capital is associated with a lower likelihood of bank failure. The coefficients imply that a single-standard-deviation increase in Tier 1 capital is associated with a 93.3 % *reduction* in bank failure risk, while a single-standard-deviation increase in loan loss reserves added back as capital is associated with a 24.2 % *increase* in bank failure risk. The coefficients on *OTHER TIER2* and *OTHER LLR* are statistically insignificant. These results suggest

Table 6 Bank failures and add-back of loan loss reserves as regulatory capital

Panel A: Logistic regression

	Probability of failure			
Column	(1)	(2)	(3)	(4)
ADDBACK × *CAPINC*			2.171**	2.283**
			(2.54)	(2.51)
OTHER LLR × *CAPINC*				−0.011
				(−0.03)
NPL × *CAPINC*				0.007
				(0.10)
CH_NPL × *CAPINC*				−0.030
				(−0.35)
TIMELY × *CAPINC*				−0.005
				(−0.00)
LLR	0.184*			
	(1.93)			
TOTAL CAPITAL	−0.272***			
	(−7.29)			
CAPINC			−2.313**	−2.394**
			(−2.42)	(−2.37)
ADDBACK		0.911**	−0.056	−0.096
		(2.07)	(−0.10)	(−0.17)
OTHER LLR		0.069	0.096	0.103
		(0.58)	(0.82)	(0.82)
TIER1		−0.271***	−0.267***	−0.268***
		(−7.28)	(−7.12)	(−7.14)

Table 6 continued

Panel A: Logistic regression				
	Probability of failure			
Column	(1)	(2)	(3)	(4)
OTHER TIER2		−0.215	−0.217	−0.221
		(−1.17)	(−1.17)	(−1.18)
NPL	0.202***	0.206***	0.209***	0.207***
	(5.55)	(5.57)	(5.65)	(4.83)
CH_NPL	0.002	−0.008	−0.014	−0.004
	(0.05)	(−0.20)	(−0.36)	(−0.08)
TIMELY	0.628	0.695	0.736	0.719
	(1.04)	(1.14)	(1.21)	(0.91)
ROA	−0.016	−0.017	−0.007	−0.009
	(−0.27)	(−0.29)	(−0.12)	(−0.14)
REAL ESTATE LOAN	0.008	0.007	0.007	0.007
	(1.39)	(1.26)	(1.27)	(1.30)
LOAN CONCENTRATION	0.025***	0.026***	0.026***	0.026***
	(3.89)	(4.05)	(4.05)	(4.02)
UNINSURED DEPOSIT	0.022***	0.021***	0.021***	0.021***
	(3.97)	(3.84)	(3.73)	(3.71)
LIQUIDITY	−0.131***	−0.133***	−0.131***	−0.130***
	(−3.33)	(−3.36)	(−3.31)	(−3.29)
OVERHEAD	−0.019	−0.017	−0.017	−0.017
	(−0.33)	(−0.29)	(−0.31)	(−0.30)
INSIDER LOAN	0.028	0.023	0.023	0.022
	(0.53)	(0.45)	(0.44)	(0.42)
TOTAL ASSETS	0.087	0.082	0.083	0.080
	(1.32)	(1.17)	(1.15)	(1.11)
MIDWEST	1.542***	1.462***	1.426***	1.420***
	(3.27)	(3.12)	(3.05)	(3.01)
SOUTH	1.245***	1.160**	1.113**	1.112**
	(2.66)	(2.50)	(2.40)	(2.38)
WEST	2.246***	2.176***	2.137***	2.132***
	(4.70)	(4.58)	(4.50)	(4.45)
FED	0.076	0.081	0.068	0.077
	(0.33)	(0.35)	(0.29)	(0.33)
OCC	0.350*	0.356*	0.355*	0.357*
	(1.78)	(1.81)	(1.80)	(1.81)
Intercept	−4.795***	−5.744***	−4.692***	−4.657***
	(−5.68)	(−6.10)	(−4.56)	(−4.50)
Pseudo R-squared	28.66 %	28.97 %	29.32 %	29.34 %

Table 6 continued

Panel B: Hazard regressions

	Failure Hazard rate			
Column	(1)	(2)	(3)	(4)
ADDBACK × CAPINC			2.370***	2.271***
			(2.99)	(2.66)
OTHER LLR × CAPINC				0.121
				(0.63)
NPL × CAPINC				−0.011
				(−0.19)
CH_NPL × CAPINC				0.002
				(0.03)
TIMELY × CAPINC				−0.273
				(−0.24)
LLR	0.113			
	(1.52)			
TOTAL CAPITAL	−0.246***			
	(−7.20)			
CAPINC			−2.561***	−2.403**
			(−2.85)	(−2.53)
ADDBACK		1.032**	−0.064	−0.032
		(2.47)	(−0.12)	(−0.06)
OTHER LLR		0.008	0.042	−0.002
		(0.08)	(0.45)	(−0.01)
TIER1		−0.250***	−0.247***	−0.246***
		(−7.25)	(−7.19)	(−7.15)
OTHER TIER2		−0.191	−0.216	−0.214
		(−1.18)	(−1.32)	(−1.30)
NPL	0.149***	0.152***	0.162***	0.170***
	(5.10)	(5.09)	(5.64)	(4.71)
CH_NPL	0.002	−0.005	−0.017	−0.021
	(0.05)	(−0.15)	(−0.55)	(−0.52)
TIMELY	0.356	0.355	0.437	0.543
	(0.65)	(0.64)	(0.79)	(0.78)
ROA	0.034	0.026	0.040	0.042
	(0.84)	(0.64)	(1.00)	(1.03)
REAL ESTATE LOAN	0.008**	0.008**	0.008**	0.008**
	(2.34)	(2.23)	(2.25)	(2.12)
LOAN CONCENTRATION	0.024***	0.024***	0.023***	0.024***
	(4.58)	(4.53)	(4.43)	(4.44)
UNINSURED DEPOSIT	0.015***	0.014***	0.014***	0.014***
	(3.12)	(2.97)	(2.89)	(2.86)

Table 6 continued

Panel B: Hazard regressions				
	Failure Hazard rate			
Column	(1)	(2)	(3)	(4)
LIQUIDITY	−0.128***	−0.130***	−0.125***	−0.128***
	(−3.46)	(−3.48)	(−3.38)	(−3.42)
OVERHEAD	0.004	0.002	−0.002	−0.002
	(0.10)	(0.04)	(−0.05)	(−0.05)
INSIDER LOAN	0.029	0.023	0.020	0.021
	(0.61)	(0.47)	(0.42)	(0.44)
TOTAL ASSETS	0.111*	0.104	0.112*	0.113*
	(1.87)	(1.64)	(1.72)	(1.73)
MIDWEST	1.559***	1.438***	1.387***	1.367***
	(3.35)	(3.15)	(3.06)	(3.02)
SOUTH	1.339***	1.197***	1.118**	1.099**
	(2.93)	(2.66)	(2.50)	(2.46)
WEST	2.273***	2.162***	2.087***	2.064***
	(4.85)	(4.69)	(4.57)	(4.52)
FED	−0.079	−0.067	−0.101	−0.092
	(−0.38)	(−0.32)	(−0.49)	(−0.44)
OCC	0.352**	0.354**	0.353**	0.354**
	(1.99)	(2.00)	(2.00)	(2.00)
Pseudo R-square	28.66 %	28.97 %	29.32 %	29.34 %

This table presents the regressions that analyze the relation between bank failures and the add-back of loan loss reserves as regulatory capital. Panel A (B) shows the results of logistic (hazard) regressions. The sample consists of 6,382 commercial banks. The definitions of the variables can be found in Tables 4 and 5. The t-statistic of each coefficient is provided in brackets below the coefficient. ***, **, and * denote significance at the 1, 5, and 10 % levels, respectively

that, while add-back of loan loss reserves is part of total capital, Tier 2 capital, and total loan loss reserves, the add-back has distinctly different associations with bank failure risk. The evidence indicates that loan loss reserves added back as capital do not possess the characteristics of capital as a buffer against bank failure. Loan loss reserves excluded from capital also are not significantly associated with bank failure risk.

In the third column, we examine whether the association between bank failure risk and add-back of loan loss reserves depends on whether the latter generate a regulatory capital (*CAPINC*) increase for the bank. We observe that banks with $CAPINC = 0$ are on average more likely to fail. Banks with $CAPINC = 0$ have relatively higher loan loss reserves by construction—their reserves even at the beginning of 2007 exceeded the permissible limit as add-backs to capital; higher loan loss reserves are expected to be associated with poorer future bank health. Our key interest however is on the influence of loan loss reserves added back to capital

on bank failure. The coefficient on the primary explanatory term *ADDBACK* × *CAPINC* is positive and statistically significant at the 5 % level. This suggests that the positive association between bank failure risk and add-backs is even stronger when increases in add-backs are associated with a regulatory capital increase. Further, the statistically insignificant coefficient on *ADDBACK* indicates that, for banks that do not experience the capital increase from the add-back of loan loss reserves, there is no evidence of an association between bank failure and the add-backs. We find (in untabulated analyses) that the sum of the coefficients on *ADDBACK* × *CAPINC* and *ADDBACK* (i.e., 2.171 − 0.056) is statistically significant at the 1 % level. The results in in the third column thus indicate that the significant positive association between bank failure probability and add-back of loan loss reserves is concentrated among banks more likely to experience capital increases from add-backs.

The fourth and final column of Panel A controls for the possibility that influence of *OTHER_LLR*, *NPL*, *CH_-NPL*, and *TIMELY* vary across banks with *CAPINC* = 1 and *CAPINC* = 0. Results reveal that the influence of the above controls does not appear to depend on *CAPINC*. Other key results remain similar to those observed in the third column of Panel A, including the differentially positive influence of *ADDBACK* when *CAPINC* = 1.

Panel B presents results using the proportional-hazards model with the dependent variable as the time to failure and provide essentially the same inferences. Specifically, (i) total capital is negatively associated with bank failure risk, (ii) add-backs of loan loss reserves are positively associated with bank failure risk, after controlling for other components of total capital, and (iii) the positive association between add-backs and failure risk is much more pronounced among banks in which growth in add-backs generate a regulatory capital increase.

Finally, in untabulated analyses, we identify the subset of all banks that disappear from the sample between 2008 and 2010 as failed banks. This research design choice reduces our ability to detect true failures, but it allows for the possibility that the disappearances reflect pre-emptive takeovers of banks near failure. The results with this expanded definition of failure confirm that add-backs are incrementally associated with bank failure risk when they generate a capital increase in 2007.

4.2.2 Analyses of bank actions in 2008

In this section, we examine how the add-back of loan loss reserves in 2007 is associated with bank actions in 2008; these actions are identified and measured using the call reports that the banks file in 2008. A key objective of these analyses is to illuminate how the add-back could be associated with other outcomes, particularly those that possibly contribute to a higher risk of bank failure. A key limitation of the analyses is potential survivorship biases because the analyses require the banks to have survived through 2008 and filed their call reports in 2008. Ex ante, we expect the survivorship biases to work against finding that add-backs are associated with potentially negative outcomes, because the most negative outcomes in 2008, failures, are excluded from our sample by construction.

Table 7 presents the results of examining the relation between add-backs and three outcome variables in 2008: loan growth, nonperforming loans, and return on

Table 7 Performance indicators in 2008 and add-back of loan loss reserves as regulatory capital in 2007

	Loan growth 2008			NPL 2008			ROA 2008		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ADDBACK × *CAPINC*		0.146**	0.138**		1.326***	0.533		−0.787***	−0.337*
		(2.35)	(2.16)		(3.77)	(1.47)		(−4.02)	(−1.67)
OTHER LLR × *CAPINC*			0.087			1.553***			−1.444***
			(0.60)			(4.70)			(−7.86)
NPL × *CAPINC*			−0.004			0.130***			0.004
			(−0.53)			(2.76)			(0.16)
CH_NPL × *CAPINC*			0.001			0.052			−0.031
			(0.13)			(0.99)			(−1.06)
TIMELY × *CAPINC*			−0.092			−0.750			0.631*
			(−0.77)			(−1.15)			(1.74)
CAPINC		−0.151**	−0.126*		−0.970***	−0.546		0.537***	0.106
		(−2.43)	(−1.88)		(−2.67)	(−1.42)		(2.66)	(0.50)
ADDBACK	−0.112***	−0.155***	−0.155***	0.550***	0.191	0.397*	−0.270***	−0.074	−0.188
	(−4.06)	(−4.73)	(−4.71)	(3.15)	(0.85)	(1.77)	(−2.78)	(−0.59)	(−1.50)
OTHER LLR	−0.003	0.001	−0.001	0.176**	0.256***	0.172*	−0.202***	−0.254***	−0.155***
	(−0.19)	(0.06)	(−0.06)	(2.05)	(2.95)	(1.91)	(−4.23)	(−5.25)	(−3.09)
TIER1	0.009***	0.009***	0.009***	−0.014***	−0.013***	−0.016***	−0.001	−0.002	−0.000
	(10.82)	(10.85)	(10.78)	(−2.69)	(−2.58)	(−3.18)	(−0.42)	(−0.55)	(−0.02)
OTHER TIER2	−0.037**	−0.037**	−0.037**	0.102	0.099	0.105	−0.063	−0.060	−0.068
	(−2.34)	(−2.37)	(−2.35)	(1.03)	(1.00)	(1.07)	(−1.14)	(−1.09)	(−1.25)
NPL	−0.016***	−0.016***	−0.015***	0.875***	0.876***	0.834***	−0.107***	−0.108***	−0.105***
	(−4.88)	(−4.87)	(−4.28)	(42.09)	(42.22)	(35.89)	(−9.29)	(−9.37)	(−8.10)

Table 7 continued

	Loan growth 2008			NPL 2008			ROA 2008		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CH_NPL	0.008**	0.008**	0.008**	−0.013	−0.019	−0.054**	−0.100***	−0.096***	−0.078***
	(2.34)	(2.31)	(2.10)	(−0.60)	(−0.87)	(−2.18)	(−8.05)	(−7.75)	(−5.64)
TIMELY	0.186***	0.186***	0.207***	−0.316	−0.268	−0.009	−0.199	−0.232	−0.445**
	(3.75)	(3.74)	(3.66)	(−1.01)	(−0.86)	(−0.02)	(−1.14)	(−1.33)	(−2.08)
ROA	−0.009*	−0.009*	−0.009*	0.000	0.016	0.044	0.587***	0.576***	0.554***
	(−1.75)	(−1.71)	(−1.67)	(0.00)	(0.48)	(1.28)	(31.21)	(30.56)	(29.33)
REAL ESTATE LOAN	0.000	0.000	0.000	0.013***	0.013***	0.013***	−0.012***	−0.012***	−0.011***
	(0.80)	(0.84)	(0.82)	(3.50)	(3.42)	(3.37)	(−5.70)	(−5.62)	(−5.41)
LOAN CONCENTRATION	−0.001**	−0.001**	−0.001**	0.028***	0.028***	0.028***	−0.000	−0.000	−0.000
	(−2.23)	(−2.20)	(−2.19)	(7.43)	(7.32)	(7.40)	(−0.23)	(−0.07)	(−0.24)
UNINSURED DEPOSIT	−0.000	−0.001	−0.001	0.015***	0.015***	0.014***	−0.012***	−0.012***	−0.012***
	(−1.02)	(−1.14)	(−1.16)	(5.14)	(4.97)	(4.87)	(−7.49)	(−7.32)	(−7.07)
LIQUIDITY	−0.000	−0.000	−0.000	−0.000*	−0.000	−0.000	0.000***	0.000**	0.000***
	(−1.10)	(−1.21)	(−1.20)	(−1.67)	(−1.29)	(−1.45)	(2.94)	(2.52)	(2.71)
OVERHEAD	0.001	0.001	0.001	−0.015	−0.017	−0.017	0.013*	0.015*	0.016**
	(0.31)	(0.25)	(0.23)	(−1.03)	(−1.24)	(−1.21)	(1.71)	(1.94)	(2.08)
INSIDER LOAN	0.006	0.006	0.006	−0.009	−0.019	−0.015	−0.015	−0.009	−0.011
	(1.49)	(1.45)	(1.44)	(−0.35)	(−0.71)	(−0.57)	(−1.03)	(−0.59)	(−0.73)
TOTAL ASSETS	0.039***	0.039***	0.039***	0.111***	0.081**	0.083**	−0.102***	−0.081***	−0.081***
	(6.58)	(6.42)	(6.41)	(2.94)	(2.13)	(2.18)	(−4.84)	(−3.82)	(−3.81)
MIDWEST	−0.051**	−0.052**	−0.053**	1.188***	1.201***	1.139***	−0.123	−0.135	−0.103
	(−2.07)	(−2.12)	(−2.13)	(7.64)	(7.71)	(7.35)	(−1.42)	(−1.56)	(−1.20)

Table 7 continued

	Loan growth 2008			NPL 2008			ROA 2008		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SOUTH	−0.020	−0.020	−0.021	1.202***	1.197***	1.157***	−0.038	−0.038	−0.018
	(−0.81)	(−0.83)	(−0.84)	(7.75)	(7.72)	(7.50)	(−0.44)	(−0.44)	(−0.21)
WEST	−0.014	−0.015	−0.015	2.176***	2.147***	2.112***	−0.664***	−0.647***	−0.624***
	(−0.48)	(−0.51)	(−0.51)	(11.60)	(11.45)	(11.33)	(−6.36)	(−6.21)	(−6.02)
FED	−0.013	−0.014	−0.013	−0.188	−0.189	−0.203*	−0.021	−0.021	−0.018
	(−0.68)	(−0.72)	(−0.71)	(−1.58)	(−1.59)	(−1.72)	(−0.32)	(−0.32)	(−0.27)
OCC	0.004	0.003	0.003	−0.040	−0.042	−0.036	0.006	0.007	0.005
	(0.26)	(0.19)	(0.18)	(−0.41)	(−0.44)	(−0.38)	(0.11)	(0.12)	(0.09)
Intercept	0.268***	0.315***	0.312***	−2.888***	−2.641***	−2.657***	1.768***	1.659***	1.709***
	(5.02)	(5.55)	(5.46)	(−8.59)	(−6.94)	(−6.99)	(9.45)	(7.84)	(8.09)
R-squared	3.85 %	3.94 %	3.96 %	44.48 %	44.76 %	45.44 %	28.85 %	29.35 %	30.29 %

This table presents regression results using the sample of 6,191 commercial banks that survive in 2008. The definitions of the variables can be found in Tables 4 and 5. The t-statistic of each coefficient is provided in brackets below the coefficient. ***, **, and * denote significance at the 1, 5, and 10 % levels, respectively

assets. In the first two columns of Table 7, the dependent variable is loan growth from 2007 to 2008. The coefficient of −0.112 (t-stat = −4.06) on *ADDBACK* in the first column suggests that higher add-backs are generally associated with a reduction in loan growth from 2007 to 2008. Since the add-backs are typically higher when loan loss reserves are higher, this result suggests that banks experiencing trouble with their loan portfolios restrict their lending activities. As the second column indicates, the coefficient on *ADDBACK* × *CAPINC* is significantly positive (0.146, t-stat = 2.35) implying that, ceteris paribus, higher add-backs banks in 2007 are less likely to restrict bank lending when they generate a regulatory capital increase. The coefficient implies that a single standard deviation increase in *ADDBACK* is incrementally associated with an increase in loan growth of 3.4 percentage points among banks with *CAPINC* = 1.[16] This result is robust to controlling for variation in the influence on failure of other characteristics such as loan loss reserves not included in capital, NPL, etc. with *CAPINC*. The finding is consistent with claims by organizations such as the Georgia Bankers' Association and Discover that higher capital as a result of add-backs would encourage banks to lend more.

In the next three columns, the dependent variable is the nonperforming loans in 2008. The coefficient of 0.550 (t-stat = 3.15) on *ADDBACK* in column 4 indicates that higher add-backs are associated with a higher level of nonperforming loans in 2008, after controlling for the level of nonperforming loans in 2007 and other variables. The significantly positive coefficient on *ADDBACK* × *CAPINC* in the fourth column (along with the insignificant one of *ADDBACK*) suggests that this association is concentrated among banks experiencing a capital increase as a result of loan loss reserve growth (via provisions) in 2007. This result is, however, not robust to controlling for variation in *CAPINC* interacted with *NPL* and *OTHER LLR*; each of these interactions demonstrates an incrementally positive association with *NPL* in 2008.

Finally, in the last three columns, we find that higher add-backs are associated with weaker financial performance. The coefficient of −0.270 (t-stat = −2.78) on *ADDBACK* in column 7 indicates that the return on assets in 2008 is lower for banks with higher add-backs in 2007, after controlling for return on assets in 2007 and other variables. The incremental coefficient of −0.787 (t-stat = −4.02) on *ADDBACK* × *CAPINC* in column (8) indicates that this weaker performance is much more pronounced for banks in which the add-backs generated a capital increase in 2007. Column (9), which imposes more controls for the variation in the influence of other bank characteristics related to loan and loan-reserve quality, produces mixed results. We still observe that *ADDBACK* is incrementally associated with lower *ROA* in 2008 for banks with *CAPINC* = 1. This result survives the various controls imposed in column (9). Interestingly, however, *OTHER_LLR* also demonstrates an incrementally negative influence on ROA in 2008. Importantly, the incrementally higher likelihood bank failure in 2008 in response to *ADDBACK* documented in Table 6 suggests that the ROA results in Table 7 do not capture fully the negative effect of *ADDBACKS* on performance for banks with *CAPINC* = 1.

In summary, our results indicate that add-backs generating a regulatory capital increase in 2007 encouraged banks to lend more in 2008. Since add-backs are a component of loan loss reserves, this implies that banks were motivated to lend

[16] This seems economically significant given that the magnitude of mean loan growth is 9.8 %.

more because of capital increases even though those increases resulted from poorer-quality loan portfolios. Indeed, the finding suggests that bank managers regard an increase in regulatory capital resulting from higher loan loss reserves as a buffer against which they can extend more loans, much in the same way as an increase in retained earnings. The net consequence manifests in a higher risk of bank failure between 2008 and 2010. The results with add-backs cannot be attributed to general variation in the influence of loan loss reserves, since reserves not added back to capital do not exhibit the same empirical relations as add-backs.

4.3 Robustness tests and additional analysis

We check the robustness of our results to a variety of alternative specifications. First, as we discuss in Sect. 3, we focus on the economic crisis that is widely thought to have afflicted the US commencing 2008. However, the financial crisis underlying the economic downturn began in 2007. In robustness tests, we define the crisis period as stretching from 2007 through 2010. In other words, we repeat our analysis with all explanatory variables measured in 2006, and the dependent variable defined as bank failures from 2007 through 2010. Our results are very similar in all our specifications to those reported.

Second, our identification of banks that experience a capital increase from add-backs relies on three requirements: (1) existing loan loss reserves at the beginning of 2007 are below the 1.25 % limit on the add-back of these reserves as capital, (2) loan loss provisions in 2007 are positive, and (3) banks are not registered as S corporations. We perform two robustness analyses with respect to these requirements. A part of the rationale for requirement (2) is that only banks with positive loan loss provisions could have experienced increases in regulatory capital in 2007 as a result of their loan loss reserve decisions. Strictly speaking, the banks also need to be profitable on the books; however, over 90 % of banks in our sample were profitable in 2007. Requiring that banks were profitable in 2007 does not materially influence any of our results. To the extent that S corporations tend to be inherently different, we also tested the robustness of our results to the exclusion of S corporations from our sample of commercial banks. Sample size drops from 6,382 to 4,289 commercial banks, but our primary results on the relation bank failure probability and add-backs remain qualitatively similar (and are indeed statistically stronger) with the exclusion.

Our third additional analysis incorporates the possibility that Tier 2 capital is not equally crucial for all banks. Recall that add-backs to Tier 2 are limited to 1.25 % of gross risk-weighted assets, and most banks do not have any other significant components of Tier 2 capital. Consequently, the influence of add-backs on bank outcomes is likely limited on average but more crucial when total capital is low. Table 8 reports the results we obtain on bank failure probability upon partitioning the 6,382 banks in our sample based on whether their total capital was below or above median. Mean total capital among banks classified as having low versus high capital is 11.62 and 20.55 % of risk-weighted assets, respectively. Mean add-backs of loan loss reserves amount to 8.86 and 5.11 % of total capital, respectively, among banks classified as having low versus high capital. The results reveal that the incremental sensitivity of bank failure risk to add-backs when add-backs are likely

Table 8 Bank failures and add-back of loan loss reserves as regulatory capital

	Probability of failure	
Total capital Column	Low (1)	High (2)
ADDBACK × *CAPINC*	2.952***	−3.705
	(2.87)	(−1.27)
OTHER LLR × *CAPINC*	−0.263	1.338
	(−0.59)	(1.12)
NPL × *CAPINC*	−0.051	0.486**
	(−0.55)	(2.46)
CH_NPL × *CAPINC*	0.034	−0.612***
	(0.32)	(−2.66)
TIMELY × *CAPINC*	0.427	−16.911
	(0.30)	(−1.35)
CAPINC	−2.972***	3.778
	(−2.63)	(1.15)
ADDBACK	−0.732	4.288**
	(−1.12)	(2.27)
OTHER LLR	0.158	0.112
	(0.53)	(0.65)
TIER1	−0.434***	−0.106*
	(−5.34)	(−1.86)
OTHER TIER2	−0.511**	0.423
	(−2.23)	(1.02)
NPL	0.232***	−0.064
	(3.89)	(−0.57)
CH_NPL	0.024	0.216*
	(0.36)	(1.75)
TIMELY	0.392	1.764
	(0.39)	(1.17)
ROA	−0.127	0.004
	(−1.36)	(0.05)
REAL ESTATE LOAN	0.050*	0.010
	(1.94)	(0.92)
LOAN CONCENTRATION	−0.000	0.014
	(−0.00)	(1.00)
UNINSURED DEPOSIT	0.016**	0.024*
	(2.42)	(1.73)
LIQUIDITY	−0.089**	−0.352***
	(−2.03)	(−2.67)
OVERHEAD	−0.249**	0.113*
	(−2.13)	(1.72)

Table 8 continued

	Probability of failure	
Total capital	Low	High
Column	(1)	(2)
INSIDER LOAN	0.030	0.076
	(0.51)	(0.55)
TOTAL ASSETS	0.063	0.215
	(0.74)	(1.02)
MIDWEST	1.462***	1.019
	(2.80)	(0.87)
SOUTH	1.117**	1.328
	(2.15)	(1.16)
WEST	2.300***	2.066*
	(4.29)	(1.75)
FED	0.284	−0.210
	(1.13)	(−0.23)
OCC	0.399*	1.000**
	(1.69)	(2.09)
Intercept	−3.418**	−10.966***
	(−2.22)	(−3.53)
Pseudo R-squared	28.66 %	28.97 %

This table presents regression results using the sample of 6,382 commercial banks. It analyzes the difference between banks close to and far away from the total regulatory capital requirement, with the median total regulatory capital being used to partition the sample. The definitions of the variables can be found in Tables 4 and 5. The t-statistic of each coefficient is provided in brackets below the coefficient. ***, **, and * denote significance at the 1, 5, and 10 % levels, respectively

to increase regulatory capital is most pronounced among banks with low total capital. This result is consistent with the intuition that add-backs have a more significant influence on bank outcomes when they are a more significant component of total capital.

In our fourth additional analysis, we examine a sample of banks that survived the crisis between 2008 and 2010 and the influence of add-backs in this sample on a measure of poor financial performance that is less extreme and less dichotomous than failure. Specifically, we measure the number of times a surviving bank reports annual losses between 2008 and 2010; this variable can therefore take the value of 0, 1, 2, or 3. In Table 9, we report results of estimating a regression using the same explanatory variables as in Table 6, but with the frequency of annual losses as the dependent variable for the sample of 5,703 commercial banks that file call reports in all the 3 years between 2008 and 2010. The results in Table 9 indicate that add-backs exhibit a positive association with the frequency of annual losses in general, but incrementally even more so when such add-backs lead to regulatory capital

Table 9 Frequency of annual losses between 2008 and 2010 and add-back of loan loss reserves as capital

	Frequency of losses			
Intercept	−0.533***	−0.703***	−0.746***	−0.722***
	(−5.93)	(−7.07)	(−6.66)	(−6.42)
ADDBACK × CAPINC			0.315***	0.207*
			(3.00)	(1.92)
OTHER LLR × CAPINC				0.126
				(0.98)
NPL × CAPINC				−0.008
				(−0.54)
CH_NPL × CAPINC				0.070***
				(4.24)
TIMELY × CAPINC				−0.162
				(−0.83)
LLR	0.038*			
	(1.87)			
TOTAL CAPITAL	−0.002			
	(−1.06)			
CAPINC			−0.128	−0.041
			(−1.19)	(−0.36)
ADDBACK		0.206***	0.168**	0.189***
		(3.99)	(2.53)	(2.84)
OTHER LLR		−0.019	0.012	0.005
		(−0.74)	(0.46)	(0.20)
TIER1		−0.002	−0.001	−0.002
		(−1.05)	(−0.93)	(−1.58)
OTHER TIER2		0.064**	0.060**	0.061**
		(2.17)	(2.05)	(2.08)
NPL	0.069***	0.069***	0.068***	0.067***
	(10.88)	(10.88)	(10.93)	(9.42)
CH_NPL	0.027***	0.027***	0.025***	0.011
	(4.03)	(4.03)	(3.77)	(1.53)
TIMELY	0.227**	0.240**	0.268***	0.326***
	(2.43)	(2.57)	(2.88)	(2.88)
ROA	−0.184***	−0.186***	−0.179***	−0.176***
	(−18.36)	(−18.49)	(−17.84)	(−17.45)
REAL ESTATE LOAN	0.004***	0.003***	0.003***	0.003***
	(3.24)	(2.91)	(2.77)	(2.69)
LOAN CONCENTRATION	0.006***	0.006***	0.006***	0.006***
	(5.21)	(5.43)	(5.27)	(5.26)
UNINSURED DEPOSIT	0.007***	0.007***	0.007***	0.007***
	(8.11)	(8.13)	(8.06)	(7.60)

Table 9 continued

	Frequency of losses			
LIQUIDITY	−0.000***	−0.000***	−0.000**	−0.000**
	(−3.08)	(−2.79)	(−2.44)	(−2.54)
OVERHEAD	0.027***	0.028***	0.027***	0.026***
	(9.21)	(9.46)	(9.18)	(9.09)
INSIDER LOAN	0.025***	0.025***	0.021***	0.020**
	(3.20)	(3.14)	(2.61)	(2.53)
TOTAL ASSETS	0.050***	0.044***	0.029**	0.028**
	(4.59)	(3.86)	(2.56)	(2.41)
MIDWEST	0.258***	0.252***	0.267***	0.256***
	(5.61)	(5.46)	(5.81)	(5.57)
SOUTH	0.274***	0.271***	0.279***	0.272***
	(5.95)	(5.89)	(6.07)	(5.93)
WEST	0.623***	0.612***	0.610***	0.601***
	(10.93)	(10.74)	(10.74)	(10.59)
FED	−0.004	−0.006	−0.005	−0.007
	(−0.11)	(−0.17)	(−0.14)	(−0.19)
OCC	−0.054*	−0.058**	−0.057**	−0.052*
	(−1.85)	(−1.98)	(−1.97)	(−1.79)
Adjusted R-squared	19.96 %	20.20 %	21.03 %	21.48 %

This table presents regression results of analyzing the relation between the frequency of annual losses between 2008 and 2010 and the add-back of loan loss reserves as regulatory capital. The sample consists of 5,703 commercial banks that filed call reports for all the 3 years 2008–2010. The definitions of the variables can be found in Tables 4 and 5. The t-statistic of each coefficient is provided in brackets below the coefficient. ***, **, and * denote significance at the 1, 5, and 10 % levels, respectively

increases. The results are thus consistent with those reported in Table 6 with bank failure probability as the dependent variable.

Our final additional analysis incorporates the role of capital infusions into banks by the US government under the Capital Purchase Program (CPP). CPP was a prominent component of the Troubled Assets Relief Program (TARP). The capital infusions under CPP, often loosely referred to as "TARP funding," helped commercial banks withstand the liquidity shocks that characterized the financial crisis and hence likely influenced their probability of failure. TARP funding is not included in our primary tests in Table 6 as a control variable because, unlike all other explanatory variables, it does not immediately precede the crisis. Rather TARP funding is concurrent with the crisis, having been disbursed between October 2008 and December 2009. Academic evidence suggests that TARP funds were provided to banks with lower regulatory capital that nevertheless were assessed by regulators as being fundamentally strong enough, in terms of asset quality, to survive the crisis (Bayazitova and Shivdasani 2011; Ng et al. 2013). We obtain data on CPP participation from the US Treasury financial stability reports, which can be

Table 10 The role of TARP

	Probability of failure				Probability of TARP funding			
Intercept	−4.264***	−5.274***	−4.434***	−4.399***	−2.206***	−2.759***	−4.343***	−4.417***
	(−5.03)	(−5.58)	(−4.29)	(−4.23)	(−5.58)	(−6.20)	(−7.39)	(−7.49)
ADDBACK × CAPINC			1.923**	1.929**			−1.380***	−1.378***
			(2.25)	(2.12)			(−2.87)c	(−2.78)
OTHER LLR × CAPINC				0.182				−0.148
				(0.55)				(−0.40)
NPL × CAPINC				−0.029				−0.077
				(−0.37)				(−1.07)
CH_NPL × CAPINC				−0.001				0.101
				(−0.01)				(1.27)
TIMELY × CAPINC				−0.106				−1.043
				(−0.08)				(−1.43)
LLR	0.193**				0.243***			
	(2.02)				(3.12)			
TOTAL CAPITAL	−0.287***				−0.083***			
	(−7.55)				(−5.87)			
CAPINC			−1.946**	−1.852*			2.050***	2.240***
			(−2.03)	(−1.83)			(3.88)	(4.07)
ADDBACK		0.932**	0.113	0.094		0.711***	1.841***	1.825***
		(2.11)	(0.20)	(0.16)		(3.17)	(4.75)	(4.68)
TARP	−3.252***	−3.275***	−3.306***	−3.312***				
	(−5.24)	(−5.30)	(−5.31)	(−5.32)				
OTHER LLR		0.079	0.108	0.083		0.064	0.101	0.105
		(0.67)	(0.94)	(0.64)		(0.49)	(0.83)	(0.83)

Table 10 continued

	Probability of failure				Probability of TARP funding			
TIER1		−0.287***	−0.282***	−0.283***		−0.082***	−0.082***	−0.083***
		(−7.54)	(−7.38)	(−7.41)		(−5.78)	(−5.70)	(−5.72)
OTHER TIER2		−0.079	−0.073	−0.081		0.082	0.059	0.053
		(−0.42)	(−0.38)	(−0.42)		(0.85)	(0.60)	(0.54)
NPL	0.187***	0.192***	0.198***	0.208***	−0.166***	−0.161***	−0.158***	−0.126***
	(5.09)	(5.14)	(5.28)	(4.79)	(−4.55)	(−4.38)	(−4.27)	(−2.72)
CH_NPL	0.007	−0.005	−0.013	−0.013	0.033	0.027	0.021	−0.022
	(0.17)	(−0.12)	(−0.33)	(−0.27)	(0.84)	(0.68)	(0.53)	(−0.42)
TIMELY	0.734	0.842	0.885	0.903	0.294	0.349	0.437	0.986*
	(1.18)	(1.35)	(1.42)	(1.10)	(0.81)	(0.96)	(1.19)	(1.92)
ROA	−0.029	−0.023	−0.011	−0.007	−0.058	−0.066	−0.040	−0.041
	(−0.49)	(−0.40)	(−0.19)	(−0.12)	(−1.29)	(−1.43)	(−0.86)	(−0.88)
REAL ESTATE LOAN	0.008	0.007	0.007	0.007	0.014***	0.012***	0.012***	0.012***
	(1.47)	(1.34)	(1.35)	(1.34)	(3.01)	(2.70)	(2.61)	(2.68)
LOAN CONCENTRATION	0.023***	0.024***	0.024***	0.024***	0.000	0.001	0.000	0.000
	(3.51)	(3.72)	(3.67)	(3.68)	(0.05)	(0.26)	(0.07)	(0.06)
UNINSURED DEPOSIT	0.023***	0.022***	0.022***	0.022***	0.011***	0.011***	0.011***	0.011***
	(4.12)	(4.00)	(3.92)	(3.84)	(3.35)	(3.33)	(3.32)	(3.22)
LIQUIDITY	−0.136***	−0.139***	−0.136***	−0.136***	0.001	0.001	0.001	0.001
	(−3.46)	(−3.53)	(−3.46)	(−3.45)	(0.98)	(0.78)	(0.91)	(0.90)
OVERHEAD	−0.004	−0.004	−0.006	−0.006	0.028**	0.031***	0.032***	0.032***
	(−0.09)	(−0.07)	(−0.12)	(−0.12)	(2.46)	(2.61)	(2.73)	(2.72)
INSIDER LOAN	0.055	0.051	0.049	0.050	0.181***	0.179***	0.172***	0.173***
	(1.03)	(0.96)	(0.90)	(0.92)	(6.79)	(6.72)	(6.36)	(6.39)

Table 10 continued

	Probability of failure				Probability of TARP funding			
TOTAL ASSETS	0.228***	0.206***	0.198***	0.200***	0.642***	0.623***	0.578***	0.581***
	(3.31)	(2.81)	(2.64)	(2.65)	(16.45)	(15.15)	(13.81)	(13.84)
MIDWEST	1.575***	1.484***	1.465***	1.427***	0.330*	0.300*	0.364**	0.370**
	(3.32)	(3.15)	(3.10)	(3.03)	(1.93)	(1.75)	(2.12)	(2.15)
SOUTH	1.331***	1.239***	1.206**	1.176**	0.495***	0.470***	0.503***	0.502***
	(2.82)	(2.65)	(2.58)	(2.52)	(3.03)	(2.87)	(3.07)	(3.06)
m	2.263***	2.193***	2.173***	2.138***	0.261	0.219	0.233	0.232
	(4.69)	(4.59)	(4.53)	(4.47)	(1.34)	(1.12)	(1.19)	(1.19)
FED	0.090	0.075	0.042	0.055	0.264**	0.263**	0.277**	0.281**
	(0.38)	(0.32)	(0.18)	(0.23)	(2.16)	(2.14)	(2.24)	(2.27)
OCC	0.324	0.329	0.328	0.327	−0.070	−0.080	−0.077	−0.075
	(1.62)	(1.64)	(1.63)	(1.62)	(−0.62)	(−0.71)	(−0.68)	(−0.66)
Pseudo R-squared	32.50 %	32.87 %	33.19 %	33.22 %	20.13 %	20.36 %	21.38 %	21.47 %

The first four columns re-examine the results in Table 6 Panel A by introducing TARP as an additional control variable. The last four columns present results with TARP as the dependent variable. TARP is an indicator variable equaling one if the bank received capital infusion under TARP and zero otherwise. The definitions of the other variables can be found in Tables 3 and 5. The sample includes 6,382 commercial banks. The t-statistic of each coefficient is provided in brackets below the coefficient. ***, **, and * denote significance at the 1, 5, and 10 % levels, respectively

found at http://www.treasury.gov/initiatives/financial-stability/Pages/default.aspx. We note that the main recipients of the capital infusion were bank holding companies. We define an indicator variable *TARP*, which is set equal to one if the commercial bank or its bank holding company received a capital infusion under TARP and zero otherwise.[17]

The first four columns in Table 10 re-examine the results in Table 6 Panel A with *TARP* as an additional control variable. Importantly, the incremental positive association between add-backs and bank failure probability when add-backs generate regulatory capital increases is robust to the inclusion of *TARP* as a control variable. As expected, *TARP* is associated negatively with failure probability. This is at least partially because the liquidity provided by TARP funding during 2008 and 2009 enabled banks to withstand the effects of crisis between 2008 and 2010. One the other hand, this may reflect the possibility that TARP funding was provided to banks that were unlikely to fail.

The last four columns in Table 10 analyze how bank variables in 2007 are associated with the probability of receiving TARP funding during 2008 and 2009. Our results reveal that banks receiving TARP funding had lower Tier 1 capital in 2007; they also had higher real estate loans and higher uninsured deposits and tended to be larger. On the other hand, they also had lower nonperforming loans (*NPL*) in 2007, consistent with the possibility that the US government was not keen to provide funding to banks with weak asset quality. Interestingly, the probability of TARP funding was higher for banks with larger add-backs (as demonstrated by the significantly positive coefficient on *ADDBACK*), but this relation was weaker when add-backs generated regulatory capital increases (as demonstrated by the significantly negative coefficient on $ADDBACK \times CAPINC$). The results suggest that TARP funding was more forthcoming for banks with higher loan loss reserves and hence higher add-backs, conditional on the level of nonperforming loans. However, TARP funding was less likely when bank capital was higher as a consequence of these add-backs, that is, bank capital was of poorer quality. An important caveat in this regard is the preliminary and descriptive nature of our analysis of TARP funding; a thorough analysis of the determinants of TARP funding is beyond the scope of this paper, and thus our results should be interpreted with caution.

5 Conclusion

We rely on the recent economic crisis to test the influence of loan loss reserves on the risk of financial instability for banks. The specific link we explore arises from guidelines that allow for loan loss reserves to be added back to regulatory capital up to a certain limit. This add-back of loan loss reserves (or simply "add-backs") has recently been the subject of extensive regulatory debate and bank lobbying. Some regulators and banks have called for an increase in the limit, while other regulators

[17] A bank holding company can own a number of commercial banks. As information about how a bank holding company distributed the capital infusion among its commercial banks is not available, we assume that all the commercial banks within the holding company received capital support when the parent is a CPP participant.

have cautioned that such an action would reduce the quality of capital as a buffer against financial instability. The regulatory rationale for allowing loan loss reserves to be added back to capital appears to rely on the add-backs providing banks incentives to record loss reserves in a timely manner.

The regulatory treatment generates effects that cannot be explained by either economic principles underlying the notion of capital or accounting principles underlying the recording of reserves. We observe that, in sharp contrast to the notion of capital as a buffer against bank failure risk, loan loss reserves added back as regulatory capital are *positively* associated with the risk of bank failure during the recent economic crisis. We subsequently construct an indicator variable based on specific regulations to capture whether increases in add-backs are highly likely to increase a bank's total regulatory capital. We document that, in contrast to accounting principles underlying the recording of reserves, the positive association of add-backs and future failure risk is concentrated only among banks that experience a capital increase from growth in add-backs.

Two caveats are warranted. First, we have attempted to include all control variables that may have a bearing on our analysis and are observable, but we acknowledge that certain factors that are not observable to us also might influence bank failure risk. For example, because of data availability constraints, we control for exposure to real estate loans but not specifically for exposure to subprime, Alt A, hybrid, and home equity loans that were most affected by the crisis. A second caveat applies to the positive influence of add-backs on bank failure risk when they generate regulatory capital increases. We do not analyze possibly beneficial consequences of add-backs, such as encouraging banks to be more pro-active in provisioning for loan losses, especially in normal (that is, noncrisis) financial conditions. To that extent, our analysis is partial. Importantly, however, our analysis points to a cost that may arise during economic crises from allowing loan loss reserves to be added back to capital.

Further analyses reveal some insights into the possible reasons for add-backs positive association with failure risk. Banks are more prone to maintain lending during the crisis in response to add-backs that generate additional regulatory capital. In not restricting lending, bank managers may underestimate the severity of the ensuing credit crunch. Alternatively, they comprehend the credit problems during times of worsening economic conditions but attempt to capitalize on any opportunity to grow their business as much as their regulatory capital would allow. In other words, even when bank managers are aware of the impending crisis and their deepening loan problems, they can still have incentives to assume risks via their lending in the hope of positive payoffs if they anticipate that they have little to lose. In the words of Downs and Rocke (1994): "*One can easily imagine circumstances where an executive, competent or incompetent, who has the misfortune to be caught in a poor economy will be tempted to gamble for resurrection by implementing high-payoff, low-probability policies.*" As our results demonstrate, the outcome on average is negative, with the consequence that add-backs that increase regulatory capital ultimately heighten bank failure risk.

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Appendix 1: Example of an FDIC press release on bank failure

MB Financial Bank, National Association, Chicago, Illinois, Assumes All of the Deposits of Corus Bank, National Association, Chicago, Illinois

FOR IMMEDIATE RELEASE	Media Contact:
September 11, 2009	LaJuan Williams-Dickerson
	Office (202) 898-3876
	Email: lwilliams-dickerson@fdic.gov

Corus Bank, National Association, Chicago, Illinois, was closed today by the Office of the Comptroller of the Currency, which appointed the Federal Deposit Insurance Corporation (FDIC) as receiver. To protect the depositors, the FDIC entered into a purchase and assumption agreement with MB Financial Bank, National Association, Chicago, Illinois, to assume all of the deposits of Corus Bank, N.A.

The eleven branches of Corus Bank will reopen on their next normally scheduled business day as branches of MB Financial Bank. Depositors of Corus Bank will automatically become depositors of MB Financial Bank. Deposits will continue to be insured by the FDIC, so there is no need for customers to change their banking relationship to retain their deposit insurance coverage. Customers should continue to use their existing branches until MB Financial Bank can fully integrate the deposit records of Corus Bank.

This evening and over the weekend, depositors of Corus Bank can access their money by writing checks or using ATM or debit cards. Checks drawn on the bank will continue to be processed. Loan customers should continue to make their payments as usual.

As of June 30, 2009, Corus Bank had total assets of $7 billion and total deposits of approximately $7 billion. MB Financial Bank will pay the FDIC a premium of 0.2 percent to assume all of the deposits of Corus Bank. In addition to assuming all of the deposits of the failed bank, MB Financial Bank agreed to purchase approximately $3 billion of the assets, comprised mainly of cash and marketable securities. The FDIC will retain the remaining assets for later disposition. The FDIC plans to sell substantially all of the remaining assets of Corus Bank in the next 30 days in a private placement transaction.

Customers who have questions about today's transaction can call the FDIC toll-free at 1-800-823-5017. The phone number will be operational this evening until 9:00 p.m., Central Daylight Time (CDT); on Saturday from 9:00 a.m. to 6:00 p.m., CDT; on Sunday from noon to 6:00 p.m., CDT; and thereafter from 8:00 a.m. to 8:00 p.m., CDT. Interested parties can also visit the FDIC's Web site at http://www.fdic.gov/bank/individual/failed/corus.html.

The FDIC estimates that the cost to the Deposit Insurance Fund (DIF) will be $1.7 billion. MB Financial Bank's acquisition of all the deposits was the "least costly" resolution for the FDIC's DIF compared to alternatives. Corus Bank is the 90th FDIC-insured institution to fail in the nation this year, and the sixteenth in Illinois. The last FDIC-insured institution closed in the state was Platinum Community Bank, Rolling Meadows, on September 4, 2009.

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Congress created the Federal Deposit Insurance Corporation in 1933 to restore public confidence in the nation's banking system. The FDIC insures deposits at the nation's 8,195 banks and savings associations and it promotes the safety and soundness of these institutions by identifying, monitoring and addressing risks to which they are exposed. The FDIC receives no federal tax dollars—insured financial institutions fund its operations.

FDIC press releases and other information are available on the Internet at www.fdic.gov, by subscription electronically (go to www.fdic.gov/about/subscriptions/index.html) and may also be obtained through the FDIC's Public Information Center (877-275-3342 or 703-562-2200). PR-168-2009.

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