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When time is not on our side: The costs of regulatory forbearance in the closure of insolvent banks[☆]

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ABSTRACT

In this paper, we empirically estimate the costs of delay in the FDIC's closures of 433 commercial banks between 2007 and 2014 based upon a counterfactual closure regime. We find that the costs of delay could have been as high as $18.5 billion, or 37% of the FDIC's estimated costs of closure of $49.8 billion. We think that these findings call for a more aggressive stance by bank regulators with respect to the provisions for loan losses and write-downs of banks' non-performing assets. More aggressive (and earlier) provisions and write-downs, or adoption of a capital ratio that penalizes nonperforming loans, would allow the concept of "prompt corrective action" (PCA) to play the role that it was meant to play in reducing FDIC losses from insolvent banks.

"If you snooze, you lose." – a popular saying

1. Introduction

During the years 2007–2014, 433 commercial banks and 77 savings institutions ("thrifts") were closed by U.S. bank regulators (see Fig. 1). These closures (almost always due to insolvency) were costly to the Federal Deposit Insurance Corporation (FDIC), which was the deposit insurer for these 510 institutions: The FDIC has estimated that its closure costs totaled $77.5 billion: $49.8 billion for closing the commercial banks, and $27.7 billion for closing the thrifts.

These closures received considerably less public attention during the financial crisis of 2008–2009 than did the financial problems of very large bank and non-bank financial institutions, such as Wachovia and AIG. Nevertheless, these closures were clearly costly to the FDIC and were considered substantial: As of 2009, the FDIC projected that its closure costs would bring its reserves close to zero and would require a special levy by the FDIC on its insured institutions, as well as an increase in their regular deposit insurance premiums.

In this study, we argue that bank regulators acted too slowly to close financially troubled banks – in essence, it was granting forbearance – and that earlier/more timely closures would have significantly reduced the FDIC's closure costs for these banks. To this end, we: a) propose alternative accounting benchmarks that would provide earlier "tripwires" for the closure of troubled banks; b) establish a methodology for estimating the (reduced) costs to the FDIC of those earlier (counterfactual) bank closures; and c) compare those reduced costs of earlier closures with the FDIC's estimates of its costs at the time of its (later) actual closures. *We be-*

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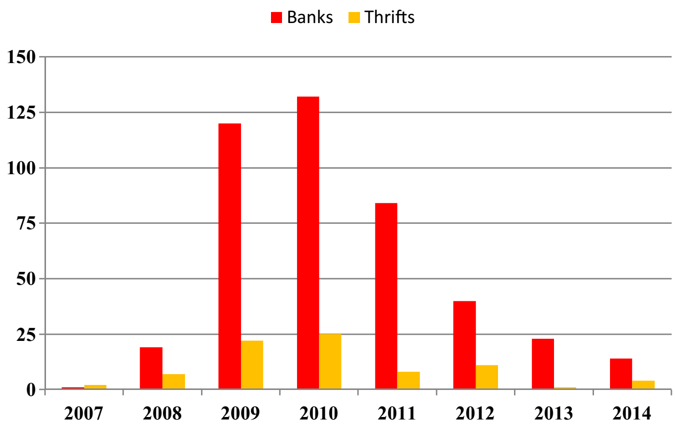

Fig. 1. U.S. bank and thrift failures 2007–2014.
This figure shows the number of U.S. commercial banks and thrift institutions that were closed by their chartering authorities during the period of 2007–2014 at a cost of about $77 billion in current-year dollars.
Source: FDIC website www.fdic.gov.

lieve that we are the first to provide specific estimates of the costs of delay – of regulatory forbearance – in the closure of failing banks.

The determinants of bank closures and of the costs to the FDIC of closures have received extensive attention, but, as we discuss below, the costs of delay in closures have not received sufficient attention. There have been more than 100 studies of the determinants of bank closures, or to use the more popular term "failures", that date back to Meyer and Pifer (1970). We will not attempt to provide such a review here; instead, we refer interested readers to extensive reviews in Torna (2010) and Demyanyk and Hasan (2009). In general, the consensus in this literature is that proxies for the CAMELS components – specifically, measures of Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity to risk – are consistently important determinants of bank failures across both time and countries. (CAMELS is a ratings system used by bank regulators to assess the financial condition of depository institutions.) In addition, asset concentrations – especially concentrations in commercial real estate mortgages and construction lending – have been found to play an important role (see, e.g., Cole and White, 2012).

The literature on the determinants of the costs of closure is much more limited. Bovenzi and Murton (1988), James (1991), Osterberg and Thomson (1995), Shaeck (2008), and Bennett and Unal (2014) analyze bank failure costs for various periods from the 1980s through the 2000s. Barth, Bartholomew, and Bradley (1991), Blalock and Elmer (1991), Cole et al. (1995), and Cole and Eisenbeis (1996) analyze the failure costs of thrift institutions that were closed during the 1980s savings & loan (S&L) crisis. As a general pattern, these studies model failure costs as a function of proxies for the CAMELS components – in particular, capital, asset quality, earnings, and liquidity – and generally find that these four components are statistically significant in explaining failure costs with the expected signs: positive (i.e., smaller failure costs) for higher capital, superior asset quality, better earnings, and more liquidity. Some also find a role for fraud as proxied by insider loans.

Other than ours, there are only two studies of which we are aware that examine the failure costs of the banks that were closed during and after the 2008–2009 financial crisis: Balla et al. (2015) focus on the effectiveness of PCA and compare losses during the post-PCA period 2007–2013 with losses during the pre-PCA S&L crisis period 1986–1992, and find that losses as a percentage of bank assets counterintuitively increased, rather than decreased, after the adoption of PCA in 1991. Granja et al. (2014) focus on the capitalization of potential acquirers and find that banks located in markets with better-capitalized potential acquirers had significantly lower failure costs. In our study, we use a failure-cost model that is similar to the model in Balla et al. (2015).

As compared with these studies of the causes and costs of bank failures, *the issue of whether bank regulators have recently been too slow to close troubled banks – and whether more timely closures would have reduced the FDIC's costs – has received far less recent attention.*

By contrast, in the 1980s and early 1990s, the topics of closure delays and the costs of those delays to government deposit insurers – which were often characterized as the costs of "regulatory forbearance" – were an important part of the discussion of the need to reform bank prudential regulation, especially in the context of the S&L debacle of that era. This discussion led to the concept of "prompt corrective action" (PCA). An embodiment of that concept – a mandate for the FDIC to close banks before they become insolvent in order to reduce the FDIC's costs of closure – became an important component of the Federal Deposit Insurance Corporation Improvement Act of 1991. This law, commonly known as FDICIA, established a system of "prompt corrective action" that requires the chartering authority of an insured depository institution to place it into conservatorship or receivership within 90 days of its classification as "critically undercapitalized," which was (and remains) defined as having a ratio of tangible capital to assets that is less than two percent.

The banking literature has extended these concepts: Boot and Thakor (1993) develop a model where the regulator seeks a reputation as a capable monitor, and this can lead to distortions in closure policies that increase failure costs. Mitchell (2001) and Acharya and Yorulmazer (2007) develop models where the high social costs of bank failures make closures less likely when many banks are discovered to be in financial difficulties at the same time. Brown and Dinc (2011) provide empirical support for this "too-many-to-fail" hypothesis.

Kane (1989a, b, c, 1990) argues that reputational concerns and the ability to conceal losses lead regulators to delay closing troubled firms in hopes of putting off recognition of systemic problems until the regulators can leave office and leave the problems to their successors, even when such delays increase the ultimate costs of resolution. Consistent with this, Brown and Dinc (2005) and Lui and Ngo (2014) find that regulators are less likely to close banks immediately prior to elections.

White (1991) argues that – at least with respect to the S&L crisis – standard regulatory procedures by 1986 had included tighter regulatory restrictions on declining institutions. But Kane and Yu (1996) argue that the S&L closure losses continued to increase through 1988; and Degennaro and Thomson (1996) show that forbearance with respect to insolvent thrifts as of year-end 1979 was a costly bet for regulators. Cole (1993) analyzes the determinants of insolvency and of closure for thrift institutions that failed during the S&L crisis, and finds that agency conflicts between regulators and taxpayers are important in explaining why some thrifts were closed while others were not.

In an international context, Laeven and Valencia (2008, p. 22) write that "regulatory forbearance is a common feature of crisis management" in the 42 cross-country crisis episodes that they analyze and that prolonged forbearance occurs in about two-thirds of these episodes. And Choi and Sohn (2014) analyze the effect of forbearance in Korea: When regulators postpone PCA for insolvent savings banks, the strength of depositor market discipline decreases not only at the insolvent bank but also at other banks that are operating in the same market.

Loveland (2016) uses share price data for publicly traded banks that eventually failed during 2008–2010 to show that, for two years prior to closure, these banks were systematically under-provisioning with respect to their impaired loans, and thus overstating their capital. Because the provisioning process is overseen by prudential regulators, Loveland characterizes this as "regulatory forbearance".

Thus, there has been a continuing awareness in the literature of the dangers of regulatory forbearance. However, after the wave of U.S. bank and thrift closures during the 1980s and early 1990s, the health of the banking and thrift sectors revived substantially, and the numbers of financial institution failures fell precipitously through the 1990s and the mid 2000s: From 1994–2006, the FDIC closed only 70 banks in total: an average of less than six per year. No banks were closed during 2005 or 2006. With few weak institutions and fewer closures that imposed only relatively small costs to the FDIC (the 70 bank failures that occurred during 1994–2006 cost the FDIC a total of $1.99 billion), the policy discussion of and attention to the PCA concept that was embedded in FDICIA back in 1991 to forestall regulatory forbearance receded.

Nevertheless, the evidence of the past decade – the large losses to the FDIC that were noted at the beginning – indicates that the PCA concept has not worked as intended.

In this study, as in Cole and White (2012), we focus our analysis on commercial banks. We establish more stringent accounting benchmarks for (earlier) closures of troubled banks, and we provide estimates – based on our empirical modeling of the FDIC's costs of closing troubled banks – of the cost savings that would have accrued to the FDIC if it had (counterfactually) adhered to our more stringent benchmarks instead of the more lenient accounting measure that bank regulators actually used (and still use). We find that the FDIC could have saved as much as 37% of its estimated closure costs – or about $18.5 billion – by earlier closures of banks that were failing.

This paper proceeds as follows: Section 2 provides some arguments as to why forbearance and delay could increase the costs of closure. Section 3 revisits the current PCA closure criterion (a ratio of tangible capital to assets of less than 2%) and proposes two alternative (more stringent) accounting benchmarks that would call for earlier resolutions of failing banks. Section 4 describes our methodology for modeling the FDIC's costs of closing insolvent banks and for applying our model's results to a counterfactual scenario of the earlier bank closures that our proposed benchmarks would have required. Section 5 discusses the data for this study: our data sources, and the descriptive statistics for our analysis. Section 6 presents the main results of our analysis and offers some extensions, as well as addressing the issue of the possibility of premature closures ("false positives"). And Section 7 provides a summary and conclusions.

2. Forbearance and the costs of closure

Why might delay in the closing of an insolvent bank increase the eventual real costs of closure?[1] Standard finance theory would predict that the owners of an insolvent bank, if unrestrained by prudential regulators, should be willing to undertake any available risky investments – even those with negative expected values – since the owners (in a legal system of limited liability) would not bear any of the additional losses (since the bank is already insolvent) and would enjoy the gain if the risky investments yielded sufficiently favorable outcomes such that the bank regained solvency. Prudential regulators, of course, would retort that their examiners and supervisors do place tight restrictions on the risk-taking of thinly capitalized banks, exactly for this reason (see White (1991)).

Nevertheless, there are reasons to believe that delay in closure is likely to increase the costs of closure: First, despite the regulatory restraints, bank executives may be able to "sneak" some risky negative-expected-value investments past the regulators. Second, as the bank approaches insolvency and likely closure, the best employees are likely to depart, since their continued employment at the bank after it is taken over by an acquirer will be (at best) uncertain. Their departure is likely to decrease the stock of institutional knowledge with respect to loans and other investments, which could increase delinquencies and the costs of those delinquencies. Third, the maintenance of difficult-to-manage assets – such as real estate that has been foreclosed-upon and is in the possession of the bank – may deteriorate; this could happen because of the departure of employees who are familiar with the assets, or simply because the bank's management sees little gain in the effort to maintain these assets. Fourth, market conditions could deteriorate, which would reduce the liquidation values of bank assets such as mortgages and foreclosed real estate.

In sum, there are sensible reasons to believe that the FDIC's closure costs could well increase with delay.

3. Reassessing the 2% PCA criterion

The Federal Deposit Insurance Corporation Improvements Act of 1991 (FDICIA) includes a provision that requires regulators of all depository institutions to take "prompt corrective action" (PCA) with respect to depository institutions whose capital ratios are declining below adequate levels.[2] Included in the list of required actions is the following: If an institution is "critically undercapitalized" (which means that it has a ratio of tangible capital to assets that is less than 2%), the bank regulators are supposed to place the bank into conservatorship or receivership or "take such other action ... [that] would better serve the purpose of" that section of the FDICIA.

Balla et al. (2015) report that, for the 403 banks in their sample that failed during the 2007–2013 period, the average book value of capital at the end of the quarter prior to closure was + 1.5% of assets. It thus appears that the FDIC has been adhering reasonably closely to the PCA requirements.

However, the FDIC's estimates (at the time of closure) of the average costs of closure for those 403 banks – in essence, their *negative* net worth, estimated less than one quarter later – was an astounding 23.8% of assets! This finding raises an immediate suspicion as to the usefulness of the standard (i.e., GAAP) accounting measures for measuring the value of banks' assets – especially for those banks that are in financial difficulties (see also Loveland, 2016). The finding also draws into question the usefulness of the PCA mandate, at least when GAAP accounting measures are the ones that are used to determine when a bank's capital falls below the level of 2% of its assets.[3] After all, the average (GAAP) capital levels for these soon-to-fail banks were above 2% at the end of the second quarter before closure – when the real losses for these failed banks would have still been substantial.

In that spirit, the remainder of this section will propose two alternative (more stringent) accounting benchmarks for earlier closures of failing banks.

[1] By posing the question in terms of real costs, we recognize that the standard accounting system (GAAP) is often slow in recognizing the embedded losses on assets. Thus, the pure passage of time will generate apparent losses in assets (when measured by GAAP), when, in truth, the losses happened earlier and GAAP is simply slow in recognizing them. We will return to this point below when we address the question of the usefulness of the 2% PCA criterion.

[2] A summary of the PCA provisions of the FDICIA can be found in Jones and King

3.1. The NACR1 benchmark

In an earlier work on bank closures, Cole and White (2012) define a "technical failure" as the point where the sum of a bank's equity plus loan loss reserves was less than 50% of its nonperforming assets (NPA), where NPA is defined as the sum of loans past due 30–89 days and still accruing interest; loans past due 90 or more days and still accruing interest; nonaccrual loans; and foreclosed real estate:

$$(\text{Equity} + \text{Reserves} - 0.5 \times \text{NPA}) < 0. \tag{1}$$

Thus, our "technical failure" is the equivalence of book-value insolvency when a bank is forced to write-off half of the value of its bad loans. In essence, the logic of using "technical failure" as a criterion for failure is that GAAP accounting for loan-loss provisions and loan-loss reserves allows a bank to over-state the value of its assets and thus to overstate its capital. This same logic will inform our analysis below.

For the purposes of the current study, we retain the spirit of our earlier "technical failure" formula, but follow Chernykh and Cole (2015) in modifying it to offer two alternative measures that provide benchmarks focusing on the 2% PCA closure criterion:[4]

For our first measure, we begin by dividing NPA into its components: loans past due 30–89 days and still accruing interest (*PD30*); loans past due 90 or more days and still accruing interest (*PD90*); nonaccrual loans (*NONACCRUAL*); and foreclosed real estate (*OREO*).[5] We next apply the standard supervisory loan-loss provisioning requirements that are used by U.S. (and many other nations') banking regulators as the write-down "haircuts" for these four categories: 20% to *PD30*; 50% to *PD90*; and 100% to *Nonaccrual* and to *OREO*. We then define our initial version of the "nonperforming asset coverage ratio" (NACR) as:

$$\begin{aligned} NACR1 \equiv {} & (\text{Equity} + \text{Reserves} - 0.2 \times \text{PD30} - \\ & 0.5 \times \text{PD90} - \text{Nonaccrual} - \text{OREO}) \div \text{Assets}. \end{aligned} \tag{2}$$

And we define as our first benchmark of "NACR-based PCA failure" the point in time when a bank's *NACR1* falls below 2%; or:

$$\begin{aligned} & (\text{Equity} + \text{Reserves} - 0.2 \times \text{PD30} - \\ & 0.5 \times \text{PD90} - \text{Nonaccrual} - \text{OREO}) \div \text{Assets} < 2\%. \end{aligned} \tag{3}$$

We thus engage in a counterfactual exercise: For each of the banks that the FDIC closed during 2007–2014, we assume that the FDIC – in the spirit of PCA – instead would have closed the bank (i.e., declared a receivership) at an earlier point in time: immediately following the quarter in which the bank first reported financial data that indicated that it had dropped below this benchmark of "NACR-based PCA failure". We then simulate (following the methodology that we describe below) what the FDIC's closure cost for that bank would have been at this earlier (counterfactual) point in time, and compare this counterfactual cost estimate with the FDIC's cost estimate at the (later) time of the actual closure of the same bank.

3.2. The NACR2 benchmark

As a second, alternative measure of NACR-based PCA failure, we employ a somewhat less stringent (but simpler) method for writing down NPA: a uniform 50% write-down "haircut" that is applied to all categories of NPA. This uniform 50% loan-loss provisioning rate is the "haircut" that is assumed by the International Monetary Fund in many of its Financial Sector Assessment Programs (FSAP) for countries where more detailed provisioning data are not available (and it is the measure that we used in our earlier paper). Thus, *NACR2* is defined as:

$$NACR2 \equiv (\text{Equity} + \text{Reserves} - 0.5 \times \text{NPA}) \div \text{Assets}. \tag{4}$$

And accordingly our second benchmark of "NACR-based PCA failure" is the point in time when a bank's *NACR2* falls below 2%; or:

$$(\text{Equity} + \text{Reserves} - 0.5 \times \text{NPA}) \div \text{Assets} < 2\%. \tag{5}$$

Again, we provide a counterfactual scenario: For each of the banks that the FDIC closed during 2007–2014, we again assume that the FDIC would have closed the bank earlier (at the time when the bank first fell below the $NACR2 = 2\%$ criterion) and then simulate what the FDIC's cost of closure of that bank would have been at this (alternative) earlier time of closure and again compare it to the FDIC's estimate of its costs at the (later) time of the actual closure of that bank.

It is important to note that we do not claim that either of our NACR-based benchmarks for earlier closures of banks would be ones that would minimize the closure costs to the FDIC. Indeed, we recognize below (in Section 6) that even these more aggressive (counterfactual) closure would have reduced the FDIC's failure cost by no more than 40%.

4. The model for the FDIC's resolution costs

Since our goal is to demonstrate the potential savings that could accrue to the FDIC from closing earlier the eventually-to-fail banks, we need to calculate the costs of these (counterfactual) earlier closures on a comparable basis to how the FDIC estimates its costs of closure at the time when it actually closed banks. Unfortunately, the FDIC only reports the cost estimates themselves; the FDIC does not provide the basis (or "formula") from which it computes those cost estimates. Consequently, we first must develop a reasonable model for replicating – or at least approximating – the FDIC's basis for its cost estimates, so that we can then use the same model to measure the costs of closing these banks earlier.

We start with a standard accounting identity for any company:

$$\text{Net Worth} \equiv \text{Assets} - \text{Liabilities}. \tag{6}$$

As our data (discussed in Section 5) show, the average book-value net worth for all banks that were closed during 2007–2014, as of the end of the quarter immediately prior to their closure, was +1.5% of assets. Yet the FDIC's estimate of the closure costs (i.e., the negative net worth) at the time of closure was 26.0% of assets. (These figures for book value equity and FDIC loss estimates are quite close to those that are reported by Balla et al., 2015, for bank closures 2007–2013.) Since the FDIC's loss estimates were made less than a quarter after the reported net worth figures, it is unlikely that there was much change in the underlying assets or liabilities during this interval. Instead, the FDIC's loss estimates must have been based on its belief that the assets were worth less than the bank had reported on its most-recent pre-closure balance sheet – that "haircuts" were needed – and/or that the liabilities were greater than had been reported.

Since the FDIC does not report the basis for its estimates, our immediate task is to try to recreate or approximate the basis for the FDIC's loss estimates: i.e., recreate its specific "haircuts" on assets and/or any augmentation of liabilities. If the FDIC were to estimate "haircuts" by major asset and liability categories, one possible route would be to start with the identity (6) above and estimate an

[4] Chernykh and Cole (2015) first proposed the use of the non-performing asset coverage ratio (NACR) as an alternative trigger for prompt corrective action. Their study compares the accuracy of NACR with that of existing bank regulatory capital ratios in predicting bank failures during the recent crisis and find that NACR was a considerably more accurate predictor of failure.

[5] Foreclosed real estate is often described by bank regulators and those in the banking industry as "other real estate owned": hence, the acronym OREO.

OLS regression that would have the FDIC's loss estimate (as a % of assets) as the dependent variable and the major categories of the book-value assets and liabilities (also as a % of assets) that were on the bank's closest pre-closure balance sheet as the independent variables (along with any suitable control variables).[6] However, our initial efforts in this direction did not prove fruitful.[7]

Instead, suppose that the FDIC's loss estimation process takes a more "condensed" approach and focuses on the reported equity and reserves of the about-to-fail bank and its reported levels of its nonperforming assets (i.e., *PD30*; *PD90*; *NONACCRUAL*; and *OREO*). In this case, we can estimate an OLS regression for the sample of failed banks as follows:

$$\begin{aligned} \text{FDIC Est. Loss}_{i,t} = a &+ b_1 \times \text{Equity}_{i,t-1} + b_2 \times \text{Reserves}_{i,t-1} \\ &+ b_3 \times \text{PD30}_{i,t-1} + b_4 \times \text{PD90}_{i,t-1} \\ &+ b_5 \times \text{NONACCRUAL}_{i,t-1} + b_6 \times \text{OREO}_{i,t-1} \\ &+ \Sigma\left(b_j \times \text{CtrlVars}_{j,i,t-1}\right) + e_{i,t}, \end{aligned} \tag{7}$$

where:

- *FDIC Est. Loss*$_{i,t}$ is either the FDIC's estimated closure costs (expressed as a positive number) as a percentage of total bank assets at the quarter t that bank i is closed, or the natural logarithm of this number;
- *Equity*$_{i,t-1}$ is the reported ("book") value of equity for closed-bank i at the end of the quarter $t-1$, i.e., the quarter immediately preceding the closure of bank i, and the other right-hand-side variables are similarly represented;
- *Reserves*$_{i,t-1}$ is the reported value of loan-loss reserves for closed-bank i at the end of the quarter $t_{-}1$;
- *PD30*$_{i,t-1}$ is the reported value of loans past due 30–89 days and still accruing interest for closed-bank i at the end of the quarter $t-1$;
- *PD90*$_{i,t-1}$ is the reported value of loans past due 90 or more days and still accruing interest for closed-bank i at the end of the quarter $t-1$;
- *Nonaccrual*$_{i,t-1}$ is the reported value of nonaccrual loans for closed-bank i at the end of the quarter $t-1$;
- *OREO*$_{i,t-1}$ is the reported value of foreclosed real estate for closed-bank i at the end of the quarter $t-1$;
- *CtrlVars*$_{j,i,t-1}$ is a vector of other j control variables that may be appropriate in estimating the loss that is applicable to bank i, and includes a set of indicator variables for the year of closure;
- b_j are the coefficients that represent the OLS estimates of the values that the FDIC placed on the j right-hand-side variables; and
- $e_{i,t}$ is the estimated error term for bank i and quarter t.

All balance sheet variables, as well as the FDIC's estimated loss, are scaled by the total assets ("/TA") of bank i at the end of the quarter that immediately preceded the closure of the bank. Table 1 presents acronyms and definitions of our variables.

Our expectations are that coefficients b_1 and b_2 should be negative: More reported net worth (even though we know that it is an imperfect measure) and more loan-loss reserves should mean smaller estimated net losses. Similarly, our expectations are that coefficients b_3 through b_6 should be positive (but less than 1.0):[8] This would reflect the FDIC's fears/suspicions/expectations that the write-downs and provisions that had already been taken for these troubled asset categories would be insufficient to cover the actual eventual losses.

We believe that straightforward OLS is an appropriate estimation method for our sample. Since the dependent variable and the appropriate RHS variables are all deflated by the bank's total assets, heteroscedasticity seems unlikely to be a problem; and there are no obvious endogeneity issues among the RHS variables.

In the next step, we engage in a counterfactual exercise: As our factual, we use the FDIC's estimated closure cost at the actual time of a bank's closure. As our counterfactual, we estimate the FDIC's closure cost if it had closed that bank at the earlier time of a "NACR-based PCA failure" . We do this by multiplying the b_j coefficients estimated from Eq. (7) with the same set of explanatory variables that are used in the regression to form the estimates of these coefficients; but these variables are measured/reported by the bank *at an earlier point in time*: at the end of the quarter in which the eventually-to-fail bank reached the point of "NACR-based PCA failure" that we developed in the previous section: either *NACR1* or *NACR2* for the bank is less than 2%. Thus, we calculate:

$$\text{FDIC Est. Loss}_{i,PCA} = \Sigma\, b_j \times \text{Explanatory Variables}_{j,i,PCA}, \tag{8}$$

where subscript *PCA* represents the end of the quarter during which bank i breached the "NACR-based PCA failure" point for *NACR1* or, alternatively, for *NACR2*.

Finally, we calculate the "cost of delay" for failed bank i:

$$\text{Cost of Delay}_i = \text{FDIC Est. Loss}_{i,t} - \text{FDIC Est. Loss}_{i,PCA}, \tag{9}$$

and sum these costs of delay for the 433 banks in our sample.

5. The data

5.1. Sources

Our data come from three basic sources: The first is the FDIC's Historical Statistics on Banking. Each time that the FDIC closes a bank, it issues a press release that identifies the bank and (among other things) provides an estimate of the FDIC's resolution costs (i.e., costs of closure). Information from these accumulated press releases are catalogued by the FDIC and recorded in its Historical Statistics on Banking. We identify bank failures and failure costs from information that is available from the FDIC's Historical Statistics on Banking as of June 1, 2015.[9]

Our second source is the Consolidated Report of Condition and Income. This report is filed by each FDIC-insured bank with the U.S. Federal Financial Institutions Examination Council (FFIEC) on behalf of the three primary U.S. bank regulators. These reports, known informally in the industry as the "Call Reports," provide detailed quarterly data on each FDIC-insured bank's balance sheet and income statement. For periods prior to 2011, we obtain these data from the website of the Federal Reserve Bank of Chicago.[10] For periods after 2010, we obtain these data from the Central Data Repository (CDR) website of the FFIEC,[11] and supplement them with bank structure information that is available from the Chicago Fed website.

Our third source is the FDIC's Directory of Institutions, which we use to track the outcomes of banks that fell below our NACR-based PCA failure thresholds. This directory identified whether a

[6] Balla et al. (2015) attempt a Heckman procedure (to take into account the potential interconnection between the FDIC's decision to close a bank and the loss estimate) that is basically along these lines.

[7] We interpret the coefficients in Balla et al. (2015) as also not being especially helpful in understanding the FDIC's loss estimations.

[8] A coefficient of 1.0 would indicate that the FDIC believed that the reported value for this category of asset would have to be wholly written off.

[9] These data are available for download from the FDIC's website at: https://www2.fdic.gov/hsob/SelectRpt.asp?EntryTyp=30. The FDIC updates these loss estimates for its internal purposes; but these updates are not made available to the public.

[10] Quarterly data files are available at: https://www.chicagofed.org/banking/financial-institution-reports/commercial-bank-data.

[11] Quarterly FFIEC data files are available at: https://cdr.ffiec.gov/public/. Structure files are available at: https://www.chicagofed.org/banking/financial-institution-reports/commercial-bank-structure-data.

Table 1
Variable definitions.
This table provides the definitions of the variables that appear in the table of sample statistics (Table 3). All of the accounting variables for a bank apply to the quarter immediately prior to the closure of that bank.

Variable	Definition
LOSS/TA	FDIC's estimated loss at the time of closing a bank ÷ Total Assets
SIZE	Total assets ($ Millions) of a closed bank
EQ/TA	Total equity ÷ Total assets of a closed bank
ALL/TA	Allowance for loan losses ÷ Total assets of a closed bank
PD30/TA	Loans past due 30–89 days ÷ Total assets of a closed bank
PD90/TA	Loans past due 90 or more days ÷ Total assets of a closed bank
NONACCRUAL/TA	Nonaccrual loans ÷ Total assets of a closed bank
OREO/TA	Foreclosed real estate ÷ Total assets of a closed bank
NACR1	Nonperforming asset coverage ratio 1: (Equity + Reserves – 0.2 × PD30 – 0.5 × PD90 – NONACCRUAL – OREO) ÷ Total Assets
NACR2	Nonperforming asset coverage ratio 2: (Equity + Reserves – 0.5 × NPA) ÷ Total Assets
DELAY1	Days of delay from the end of the quarter when an eventually-to-be-closed bank's NACR1 first falls below 2% of assets until the bank is closed
DELAY2	Days of delay from the end of the quarter when an eventually-to-be-closed bank's NACR2 first falls below 2% of assets until the bank is closed
OCC	Indicator variable if the Office of the Comptroller of the Currency (OCC) was the failed bank's primary federal regulator
FED	Indicator variable if the federal reserve was the failed bank's primary federal regulator

Table 2
Annual bank closures, reported assets, and estimated closure costs, 2007–2014.
This table presents annual data for 2007–2014 for the U.S. commercial banks that were closed by their chartering authorities during each year. The first column shows the year of closure. The second column shows the number of banks that were closed in each year. The third column shows the aggregate assets of the closed banks at their respective times of closure. The fourth column shows the average asset size of the banks that were closed each year. The fifth column shows the aggregate of the FDIC's estimated closure costs for the banks that were closed during that year. The sixth column shows the aggregate estimated annual closure costs expressed as a percentage of the aggregate assets of the banks that were closed during the same year.

Year	Number of banks closed	Aggregate assets at time of closure ($ Millions)	Average assets at time of closure ($ Millions)	FDIC's estimated closure cost ($ Millions)	FDIC's estimated closure costs (% of Assets)
2007	1	$125	$125	$29	23.20%
2008	19	$12,537	$660	$4701	37.50%
2009	120	$117,863	$982	$19,332	16.40%
2010	132	$77,669	$588	$15,690	20.20%
2011	84	$27,213	$324	$6214	22.80%
2012	40	$9196	$230	$2086	22.70%
2013	23	$5959	$259	$1324	22.20%
2014	14	$2588	$185	$408	15.80%
Total	**433**	**$253,151**	**$585**	**$49,784**	**19.70%**

Sources: FDIC annual reports; FDIC Historical Statistics on Banking.

bank was operating as of the effective date of the directory, or whether it had failed or been acquired prior to that date.[12] We use the directory with an effective date of May 21, 2015.

5.2. Descriptive statistics

We start by documenting the annual patterns of bank closures and their costs for the years 2007–2014. These data can be found in Table 2. As can be seen, there were 433 closed banks, which reported $253 billion in assets on the last Call Reports filed before their closure. The FDIC's estimated closure costs for these banks aggregates to slightly less than $50 billion. The (weighted by assets) average cost to the FDIC was 19.7% of assets. (As will be demonstrated below, the closure costs per dollar of assets were smaller for larger banks than for smaller banks.) The largest number of bank closures (132) occurred during 2010; the largest volume of assets for closed banks ($118 billion) occurred during 2009; and the largest (weighted) closure cost per dollar of assets (37.5%) occurred during 2008. (It is worth remembering that 2008 – during the height of the financial crisis – was probably not a good year for finding acquirers for failed commercial banks, which would have exacerbated the FDIC's estimated losses.) Finally, the closed banks were, on average, relatively small: In no year did the average size of the closed banks exceed $1 billion (although it came close in 2009). By contrast, as of year-end 2007, there were 7282 commercial banks that were operating in the U.S., with aggregate assets of $11.2 trillion; thus, average bank size in the U.S. was $1.5 billion.

Next, Panel A of Table 3 provides the descriptive statistics for our sample of 433 closed banks based upon the financial data that were reported by each bank for the quarter that immediately preceded its closure. It is immediately worth noticing that the (equal-weighted) mean value for *LOSS/TA* is 26.0%, which is substantially larger than the 19.7% (asset-weighted) mean that is reported in Table 2. The direct implication, of course, is that the FDIC's costs of closure per dollar of assets of failed banks were smaller for larger banks than for smaller banks; this result will also emerge from the regression results that we report below.

Also worth noticing is that the average length of *DELAY1* was slightly less than six quarters – but the maximum was almost seven years! – and the average length of *DELAY2* was almost exactly a year (with a maximum that was greater than four years). Further worth noticing is that our average *NACR1* and *NACR2* measures (−0.129 and −0.055, respectively) at the end of the quarter just prior to the actual closure of the banks – though embodying more aggressive write-downs for troubled assets than was required by the banks' regulators – are still considerably smaller than the FDIC's estimated losses per dollar of assets (−0.26, on an equal-weighted basis) at the time of actual closure.

Finally, we note that the average value of nonperforming assets as a percentage of assets was 20.7% (11.5% non-accrual loans, 5.3% foreclosed real estate, and 3.9% past due loans) as compared with the average value of equity as a percentage of assets equal to only

[12] The FDIC Directory of Institutions is available at: https://www5.fdic.gov/idasp/advSearch_warp_download_all.asp?intTab=1.

Table 3
Panel A: Descriptive statistics for 433 closed banks, 2007–2014.
The values in this table apply to the 433 failed banks in our sample. The accounting-based measures were reported by the bank at the end of the quarter immediately before its closure; for the definitions of these and the other variables, see Table 1. *DELAY1* and *DELAY2* do not appear in the regressions that follow in Tables 4, 6, and 7; they are provided here to show the extent of the time between when a bank first falls below the 2% *NACR1* or *NACR2* benchmark and when the bank is actually closed by the FDIC. The *NACR1* and *NACR2* measures also do not appear in the regressions but are provided here to show their divergence from the reported net worth (EQ/TA) at the end of the quarter that immediately precedes a bank's closure.

Variable	Mean	S.E.	Min	Median	Max
LOSS/TA	0.260	0.006	0.004	0.254	0.758
SIZE ($ Millions)	575.7	77.8	15.7	210.8	25,455
EQ/TA	0.015	0.001	-0.135	0.014	0.150
ALL/TA	0.034	0.001	0.003	0.031	0.183
PD30/TA	0.033	0.001	0	0.027	0.194
PD90/TA	0.006	0.001	0	0	0.101
NONACCRUAL/TA	0.115	0.003	0	0.101	0.478
OREO/TA	0.053	0.002	0	0.04	0.306
NACR1	−0.129	0.005	−0.541	−0.117	0.142
NACR2	−0.055	0.003	−0.320	−0.050	0.132
DELAY1	519.5	18.4	10	440	2513
DELAY2	364.7	14.7	2	290	1583

Panel B: Sample statistics for 433 closed banks, 2007–2014

Variable	Closure		NACR2 insolvency				NACR1 insolvency			
	Mean	S.E.	Mean	S.E.	Difference	t-statistic	Mean	S.E.	Difference	t-statistic
LOSS/TA	0.260	0.006								
SIZE ($ Millions)	575.7	77.8	659.0	85.3	83.3	0.72	676.0	177.8	100.300	0.52
EQ/TA	0.015	0.001	0.056	0.001	0.041	26.54***	0.071	0.001	0.056	35.56***
ALL/TA	0.034	0.001	0.027	0.001	−0.007	−6.02***	0.022	0.001	−0.012	−9.34***
PD30/TA	0.033	0.001	0.038	0.001	0.005	3.28***	0.031	0.001	−0.002	−1.40
PD90/TA	0.006	0.001	0.006	0.001	0.000	−0.17	0.005	0.001	−0.001	−0.48
NONACCRUAL/TA	0.115	0.003	0.083	0.002	−0.032	−8.55***	0.069	0.002	−0.046	−13.22***
OREO/TA	0.053	0.002	0.027	0.001	−0.026	−11.12***	0.018	0.001	−0.035	−16.04***

Sources: See text
The values in this table apply to the 433 failed banks in our sample. The accounting-based measures were reported by the bank at the end of the quarter immediately before its closure and at the end of the quarters within which its "NACR-based PCA failure" (based upon the *NACR2* and *NACR1* criteria, respectively) occurred; for the definitions of these and the other variables, see Table 1. Difference is the difference in means between the quarter just prior to closure and the quarter in which the NACR-based PCA failure (as measured by *NACR2* or *NACR1*) occurred. t-statistic presents the test statistic from a *t*-test for statistically significant differences in means.
***, **, and * indicate significance levels at the 1%, 5%, and 10% levels, respectively.

1.5% and the average value of loan-loss reserves as a percentage of assets of only 3.4%; clearly, regulators were not requiring these failing banks to provision adequately for, or write off, their bad loans.

Panel B of Table 3 provides the descriptive statistics for our sample of 433 closed banks based upon the financial data that were reported by each bank for the quarter that immediately preceded its closure, and also based upon the financial data that were reported by each bank at the end of the first quarter within which it breached each of our two measures of NACR-based PCA failure. We also test for significant differences in means of the closure and (earlier) NACR-based PCA failure data. When NACR-based PCA failure is based upon *NACR2*, we find that the 0.056 ratio of reported equity to assets at the time of NACR-based PCA failure is significantly larger than the 0.015 ratio at the time of actual closure. We also see that the ratios of loan loss reserves, past-due loans, nonaccrual loans, and foreclosed real estate to assets are significantly smaller at the time of NACR-based PCA failure than at the time of closure. When NACR-based PCA failure is based upon *NACR1*, we find similar results except that both the differences in means and associated t-statistics are even larger.

Since the issue of the inaccuracy of GAAP accounting as a representation of the closure costs of the FDIC is an important one, in Fig. 2 we offer a graphical representation of the average values of *EQ/TA*, *NACR1*, and *NACR2* for the 433 closed banks in our sample for the 16 quarters prior to their closures. As can be seen, average *EQ/TA* remains positive through all 16 quarters and only falls below the 2% PCA level for critical undercapitalization between the next-to-last and the last quarters before closure. By contrast, average *NACR2* for these same (eventually closed) banks falls below the 2% PCA level around the fourth quarter before closure (consistent with the mean of *DELAY2*), and average *NACR1* falls below the 2% PCA level around the sixth quarter before closure (consistent with the mean of *DELAY1*).

Table 4 presents descriptive statistics for *EQ/TA*, *NACR2*, and *NACR1* for each of the 16 quarters prior to closure, along with *t*-tests for significant differences in the means of *EQ/TA* and the two nonperforming asset coverage ratios: *NACR2* and *NACR1*. The difference in the means of *EQ/TA* and *NACR2* reaches 1.0 percentage points and statistical significance 13 quarters prior to closure, and this difference increases in magnitude and statistical significance during each subsequent quarter and reaches a maximum of 6.9 percentage points during the last quarter prior to closure. The difference in the means of *EQ/TA* and *NACR1* reaches 1.1 percentage points and statistical significance 15 quarters prior to closure, and this difference increases in magnitude and statistical significance during each subsequent quarter and reaches a maximum of 14.3 percentage points during the last quarter prior to closure.

6. Empirical results

6.1. OLS estimates of the FDIC cost estimations

As was discussed above, the first stage of our effort is to estimate Eq. (7) with OLS where our dependent variable is either the ratio of closure cost to total assets or the natural logarithm of the ratio of closure costs to total assets. Panels A and B of Table 5 provide those regression results for each respective dependent variable. As can be seen, the results for the two regressions are quite

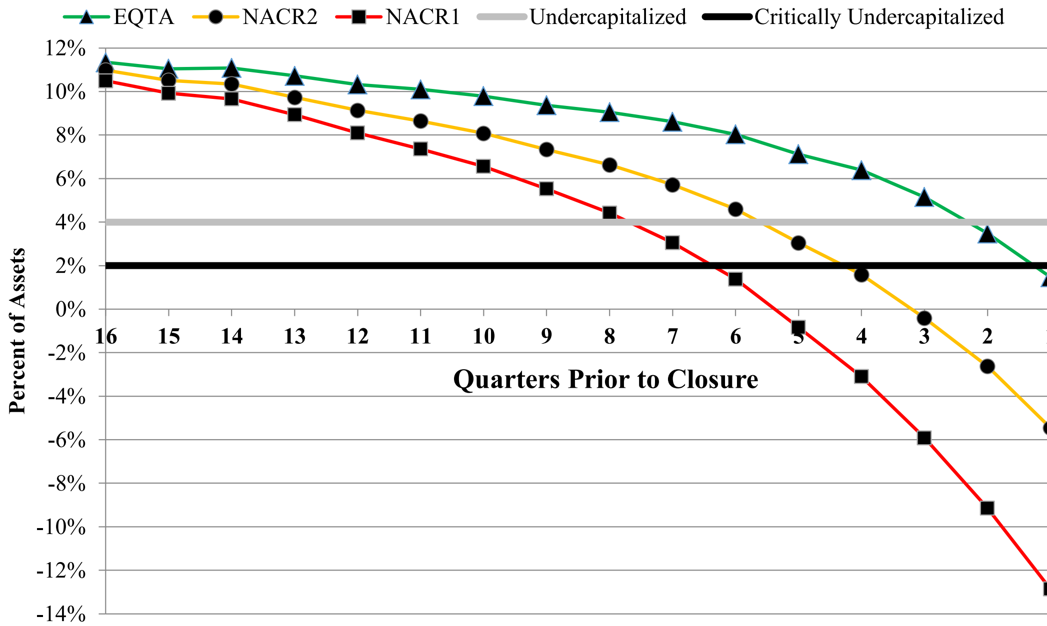

Fig. 2. Time trends of EQ/TA, NACR1, and NACR2 for the 16 quarters prior to closure for banks closed during 2007–2014.
This figure presents the average values of the ratio of equity to assets (*EQ/TA*), Non-performing Asset Coverage Ratio 2 (*NACR2*), and non-performing asset coverage ratio 1 (*NACR1*) during the nine quarters prior to closure for a sample of the 433 U.S. commercial banks that were closed by their chartering authorities during 2007–2014. *NACR2* and *NACR1* are defined in Table 1.

Table 4
Descriptive statistics by quarter.
The values in this table apply to the 433 failed banks in our sample. The accounting-based measures *EQ/TA*, *NACR2*, and *NACR1* were reported by the bank at the end of each of the 16 quarters before its closure; for the definitions of these and the other variables, see Table 1. *Diff* is the difference in means between *EQ/TA* and either *NACR2* or *NACR1*. t-Diff presents the test statistic from a *t*-test for statistically significant differences in means.
***, **, and * indicate significance levels at the 1%, 5%, and 10% levels, respectively.

Quarter	EQ/TA		NACR2				NACR1			
	Mean	S.E.	Mean	S.E.	Diff	t-Diff	Mean	S.E.	Diff	t-Diff
16	0.113	0.004	0.110	0.004	0.004	0.68	0.105	0.004	0.008	1.56
15	0.110	0.003	0.105	0.003	0.005	1.25	0.099	0.003	0.011	2.54**
14	0.111	0.003	0.103	0.004	0.007	1.53	0.097	0.004	0.014	2.81***
13	0.107	0.003	0.097	0.003	0.010	2.30**	0.089	0.004	0.018	3.86***
12	0.103	0.002	0.091	0.003	0.012	3.22***	0.081	0.003	0.022	5.42***
11	0.101	0.002	0.086	0.003	0.015	4.03***	0.074	0.003	0.027	6.65***
10	0.098	0.002	0.081	0.003	0.017	4.81***	0.066	0.003	0.032	7.83***
9	0.094	0.002	0.073	0.002	0.020	6.59***	0.055	0.003	0.038	10.08***
8	0.090	0.002	0.066	0.002	0.024	7.92***	0.044	0.003	0.046	11.88***
7	0.086	0.002	0.057	0.002	0.029	9.77***	0.031	0.004	0.056	14.17***
6	0.080	0.002	0.046	0.002	0.034	11.94***	0.014	0.004	0.067	16.95***
5	0.071	0.001	0.030	0.002	0.041	15.10***	−0.008	0.004	0.080	20.39***
4	0.064	0.001	0.016	0.002	0.048	17.75***	−0.031	0.004	0.095	23.36***
3	0.051	0.001	−0.004	0.002	0.056	20.54***	−0.059	0.004	0.111	26.50***
2	0.035	0.001	−0.026	0.002	0.061	22.14***	−0.091	0.004	0.126	28.94***
1	0.015	0.001	−0.055	0.003	0.069	21.99***	−0.129	0.005	0.143	29.59***

similar; consequently, in discussing these results we will generally refer to those that use the ratio of closure cost to total assets – although we will return to the logarithmic results when we discuss our estimates of the cost savings that could have accrued to the FDIC from earlier closures.

The signs on the main categories of variables are as expected, and four of the six variables are significant at the 10% level or better. The coefficients can be interpreted as follows: The −0.453 coefficient on *EQ/TA* means that the FDIC's estimate of its loss (*LOSS/TA*) on a closed bank was $0.45 smaller for every additional dollar of reported equity; similarly, the +0.802 coefficient on *OREO/TA* means that the FDIC's estimate of its loss was $0.80 larger for every dollar of OREO that was reported on the closed bank's most-recent pre-closure balance sheet.

Perhaps the most surprising result is the +1.683 coefficient on *PD30/TA*; this coefficient is not only significantly greater than 0.0 but is also significantly greater than 1.0. If interpreted literally, this coefficient would imply that the FDIC was estimating that it would lose $1.68 for every dollar of loans that were reported to be 30–89 days overdue at the time of closure. It seems unlikely that mere overdue loans would be that "toxic" . Instead, what is more likely the case is that this relatively large coefficient represents the FDIC's expectation that more overdue loans – with concomitant losses – are likely to appear after closure; i.e., that the reported PD30 loans are just "the tip of the iceberg".

Another important result in the regression is the −0.027 coefficient on Ln *SIZE*. This coefficient shows that – controlling for other influences – larger failed banks were less costly (per dollar of assets) to resolve than were smaller failed banks. This confirms that

Table 5
Regressions explaining the FDIC's bank closure costs for banks that were closed during 2007–2014.
This table presents the results from ordinary-least-squares (OLS) regressions. In Panel A, the dependent variable is the FDIC's estimate of its loss (i.e., cost of closure) at the time that it closes a bank, divided by the total assets of the bank as reported at the end of the quarter that immediately preceded the closure; and, in Panel B, the dependent variable is the natural logarithm of the estimated loss divided by total assets. All variables are defined in Table 1. The regression model also includes a set of indicator variables for the year of closure.
***, **, and * indicate significance levels at the 1%, 5%, and 10% levels, respectively.

Panel A: Loss / Assets

Variable	Estimate	S.E.	t-statistic
Intercept	0.377	0.104	3.64***
Ln SIZE	−0.027	0.004	−6.97***
EQ/TA	−0.453	0.181	−2.51**
ALL/TA	−0.336	0.273	−1.23
PD30/TA	1.683	0.179	9.40***
PD90/TA	0.628	0.382	1.65
NONACCRUAL/TA	0.453	0.075	6.06***
OREO/TA	0.802	0.095	8.43***
Failure Year Indicators		YES***	
Adjusted R^2		0.495	
F-Statistic		31.22***	
Number of Obs.		433	

Panel B: ln (Loss / Assets)

Variable	Estimate	S.E.	t-statistic
Intercept	−0.112	0.661	−0.17
Ln SIZE	−0.182	0.025	−7.25***
EQ/TA	−2.411	1.152	−2.09**
ALL/TA	−1.145	1.742	−0.66
PD30/TA	7.425	1.141	6.51***
PD90/TA	3.187	2.431	1.31
NONACCRUAL/TA	2.086	0.476	4.38***
OREO/TA	3.867	0.606	6.38***
Failure Year Indicators		YES***	
Adjusted R^2		0.367	
F-Statistic		18.89***	
Number of Obs.		433	

the smaller asset-weighted mean percentage loss that is shown in Table 2, as compared to the equal-weighted mean percentage loss that is shown in Table 3, still holds after correcting for other influences.

It is important to remember, however, the limitation on the word "larger" in the context of the closed banks in our sample: As can be seen in Table 3, the largest commercial bank that failed between 2007 and 2014 had only $25.5 billion in assets at the time of closure. This may seem surprising, given all of the attention that was focused on the very large banks and their financial difficulties during the financial crisis of 2008. But much of the difficulties of those very large banks were actually experienced at the level of their holding companies and not at the level of the depositary institution subsidiary of the holding company. And, in any event, none of those large banks were ever declared to be insolvent by their primary regulator and thus none of them formally failed;[13] hence, they are not in our sample.

6.2. The estimated decrease in FDIC losses from earlier closures

The next step in our analysis is to conduct the counterfactual exercise: First, as our factual, we use the FDIC's closure cost estimate that it reported at the time that it closed each bank and the total assets that were reported by that bank at the end of the quarter that immediately preceded closure to calculate the ratio of closure cost to total assets. These closure costs (as a percentage of bank assets) appear in Column 2 of Table 6. The asset-weighted average is 19.7%, or $0.197 per dollar of assets.

Second, we (counterfactually) assume that each of the 433 failed banks had been closed at the (earlier) quarter when it first reported financial data that indicated that it had breached the benchmark where *NACR1* $<$2.0% (or, alternatively, where *NACR2* $<$2.0%), and use Eq. (8) to calculate the predicted cost of closure by multiplying the coefficients (in Table 5) that we estimated from Eq. (7) with the values of the explanatory variables that were reported by the NACR-based PCA-failing banks at these earlier times. These alternative closure costs (as a percentage of bank assets) are our counterfactuals.

Panels A and B of Table 6 present our findings based upon the regression in Table 5 that uses the ratio of closure cost to total assets as the dependent variable (i.e., Panel A in Table 5) and alternatively upon the regression that uses the natural logarithm of this ratio as the dependent variable (i.e., Panel B in Table 5), respectively. As can be seen in Panel A, our asset-weighted point estimates based upon the ratio of closure cost to assets as the dependent variable indicate that the losses would have been only 12.5%, or $0.125 per dollar of assets, if the criterion *NACR1* $<$2.0% had been used and would have been only 15.1%, or $0.151 per dollar of assets, if the *NACR2* $<$2.0% criterion had been used. For each point estimate, we also present a 95% confidence interval based upon the standard error of the predicted point estimate.

To calculate the estimated dollar value in savings, we multiply these point estimates by the appropriate value of bank assets at the time of NACR-based PCA failure (for column 3), sum across banks, and then subtract the aggregate reported closure cost of $49.8 billion (shown in column 2). Based upon the *NACR1* (*NACR2*) criteria, we calculate that the savings would have been $13.21 billion ($6.61 billion) or 26.5% (13.3%) of the FDIC's aggregate closure costs of $49.8 billion.

We repeat the procedure but instead use the coefficients that were estimated using the natural logarithm of the ratio of closure costs to total assets rather than the ratio itself as the dependent variable. As shown in Panel B of Table 6, our asset-weighted estimates that are based upon the logarithm of the ratio indicate that the losses would have been only 10.7%, or $0.107 per dollar of assets, if the criterion *NACR1* $<$2.0% had been used and would have been only 12.4% or $0.124 per dollar of assets if the *NACR2* $<$2.0% criterion had been used. To calculate the estimated dollar value in savings, we again multiply these percentages by the appropriate value of bank assets at the time of NACR-based PCA failure (for column 3), sum across banks at each point in time, and then subtract the aggregate reported closure cost of $49.8 billion (shown in column 2). Based upon the *NACR1* (*NACR2*) criteria, we calculate that the savings would have been $18.47 billion ($14.46 billion) or 37.1% (29.0%) of the FDIC's aggregate closure costs of $49.8 billion.

Thus, the savings to the FDIC from earlier closures of banks (based on our NACR1 criterion) that were eventually closed anyway could have been as large as $18.5 billion or over a third of the FDIC's eventual costs.

6.3. Extensions

6.3.1. Separate periods

It is possible that the FDIC's cost estimation methodology – or at least the coefficients that it applied to its categories – could have changed during the period that we have studied. Perhaps, as the years progressed, the FDIC learned from its experiences and refined its costs estimates.

[13] Even Wachovia, which had $783 billion in assets (including its holding company) at the end of 2007 and which was in clear financial difficulties by the third quarter of 2008, was absorbed by Wells Fargo in October 2008 without any assistance from the FDIC and thus was technically not a failed bank.

Table 6
Estimated reduction in FDIC's bank closure costs from earlier closure.
This table presents our estimates of the reduction in the FDIC's bank closure costs had bank regulators closed banks based upon our counterfactual scenarios rather than at the actual times of closure for the 433 banks in our sample that were closed during 2007–2014. Panel A shows the results when our dependent variable is the ratio of closure costs to total assets; Panel B shows the results when our dependent variable is the natural logarithm of the ratio of closure costs to total assets. The first column shows the counterfactual criterion for earlier closure: either *NACR1* < 2% (as defined in Eq. (3)), or *NACR2* < 2% (as defined in Eq. (5)). The second and third columns show the FDIC's reported costs in $ billions and as a percentage of bank assets, respectively, at the actual times of closure. The fourth through sixth columns show a point estimate and 95% confidence interval for our counterfactual closure costs based upon earlier closures indicated by our counterfactual criteria, using the coefficients from Table 5 and the values of explanatory variables measured at the time a bank breached the counterfactual criteria; and then aggregating over all failed banks and dividing by the aggregated assets of the failed banks at the earlier time of closure. The seventh through ninth columns show a point estimate and 95% confidence interval for the cost savings as a percentage of the reported closure costs shown in column 2 that could have accrued to the FDIC from earlier closures. The tenth through twelfth columns show a point estimate and 95% confidence interval for the cost savings in billions of dollars.

Closure Criterion	FDIC's reported closure costs		Counterfactual closure costs			Estimated cost savings from earlier closure			Estimated cost savings from earlier closure		
	($ Billions)	(% of Assets)	(% of Assets) Point est.	95% Conf. interval		(% of FDIC's reported closure costs) Point est.	95% Conf. interval		$ Billions Point est.	95% Conf. interval	
Panel A: Estimates from (Loss/Assets)											
NACR1 < 2%	49.8	19.7%	12.5%	15.9%	9.1%	26.5%	6.6%	46.5%	13.21	3.29	23.14
NACR2 < 2%	49.8	19.7%	15.1%	18.4%	11.9%	13.3%	−5.6%	32.1%	6.61	−2.77	15.98
Panel B: Estimates from ln(Loss/Assets)											
NACR1 < 2%	49.8	19.7%	10.7%	13.4%	8.6%	37.1%	21.4%	49.4%	18.47	10.66	24.61
NACR2 < 2%	49.8	19.7%	12.4%	15.4%	10.0%	29.0%	11.9%	42.6%	14.46	5.92	21.21

Table 7
Regressions explaining the FDIC's bank closure costs for banks that were closed during 2007–2010 and during 2011–2014.
This table presents the results from ordinary-least-squares (OLS) regressions. In Panel A, the dependent variable is the FDIC's estimate of its loss (i.e., cost of closure) at the time that it closes a bank, divided by the total assets of the bank as reported at the end of the quarter that immediately preceded the closure; and, in Panel B, the dependent variable is the natural logarithm of the estimated loss divided by total assets. All variables are defined in Table 1. The results shown in both panels also include a set of indicator variables for the year in which the sample bank was closed.
***, **, and * indicate significance levels at the 1%, 5%, and 10% levels, respectively.

Panel A: Loss / Assets						
Variable	2007–2010 Failures			2011–2014 Failures		
	Estimate	S.E.	t-statistic	Estimate	S.E.	t-statistic
Intercept	0.351	0.109	3.22***	0.561	0.093	6.00***
Ln SIZE	−0.023	0.005	−4.93***	−0.035	0.007	−4.62***
EQ/TA	−0.640	0.218	−2.94***	0.005	0.328	0.02
ALL/TA	−0.242	0.354	−0.68	−0.793	0.429	−1.85**
PD30/TA	1.351	0.214	6.31***	2.350	0.331	7.09***
PD90/TA	0.729	0.484	1.51	0.202	0.597	0.34
NONACCRUAL/TA	0.486	0.095	5.13***	0.439	0.119	3.69***
OREO/TA	1.025	0.129	7.96***	0.493	0.139	3.55***
Year Indicators		YES***			YES***	
Adjusted R^2		0.545			0.431	
F-Statistic		33.45***			13.12***	
Number of Obs.		272			161	

Panel B: ln (Loss / Assets)						
Variable	2007–2010 Failures			2011–2014 Failures		
	Estimate	S.E.	t-statistic	Estimate	S.E.	t-statistic
Intercept	−0.120	0.769	−0.16	0.072	0.471	0.15
Ln SIZE	−0.174	0.033	−5.35***	−0.173	0.038	−4.58***
EQ/TA	−3.371	1.542	−2.19**	0.167	1.655	0.10
ALL/TA	−1.229	2.504	−0.49	−2.886	2.160	−1.34
PD30/TA	6.906	1.515	4.56***	8.657	1.670	5.18***
PD90/TA	4.274	3.422	1.25	0.629	3.007	0.21
NONACCRUAL/TA	1.871	0.670	2.79***	2.488	0.599	4.15***
OREO/TA	4.784	0.910	5.25***	2.673	0.701	3.81***
Year Indicators		YES***			YES***	
Adjusted R^2		0.366			0.384	
F-Statistic		16.61***			10.99***	
Number of Obs.		272			161	

To explore this possibility, we re-estimate Eq. (7) separately using data for the 272 closures during 2007–2010 and then using data for the 161 closures during 2011–2014. As before, we present the results (in Table 7) that are based on the ratio of closure costs to total assets as the dependent variable (Panel A) and on the natural logarithm of that ratio as the dependent variable (Panel B). And, again, since the results are fundamentally similar, we primarily discuss the results that are based on the former ratio.

As can be seen from our results in Table 7, there are some important differences between the two time periods. First, the coefficient on *EQ/TA* is highly significant and much larger (in absolute value) in the first period but is not significantly different from zero

Table 8
Regressions explaining the FDIC's bank closure costs for banks that were closed during 2007–2014.
This table presents the results from ordinary-least-squares regressions (OLS). In Panel A, the dependent variable is the FDIC's estimate of its loss (i.e., cost of closure) at the time that it closes a bank, divided by the total assets of the bank as reported at the end of the quarter that immediately preceded the closure; and, in Panel B, the dependent variable is the natural logarithm of the estimated loss divided by total assets. All variables are defined in Table 2. The regression model also includes a set of indicator variables for the year of closure.
***, **, and * indicate significance levels at the 1%, 5%, and 10% levels, respectively.

Panel A: Loss / Assets

Variable	Estimate	Std. Error	t-statistic
Intercept	0.384	0.101	3.81***
Ln SIZE	−0.027	0.004	−7.02***
EQ/TA	−0.427	0.176	−2.43**
ALL/TA	−0.457	0.277	−1.65*
PD30/TA	1.584	0.175	9.03***
PD90/TA	0.525	0.371	1.42
NONACCRUAL/TA	0.471	0.074	6.39***
OREO/TA	0.799	0.092	8.65***
OCC	−0.060	0.012	−5.09***
FED	0.010	0.014	0.71
Failure Year Indicators		YES***	
Adjusted R^2		0.525	
F-Statistic		30.85***	
Number of Obs.		433	

Panel B: ln(Loss/Assets)

Variable	Estimate	Std. Error	t-statistic
Intercept	−0.096	0.647	−0.15
Ln SIZE	−0.178	0.025	−7.19***
EQ/TA	−2.224	1.126	−1.97**
ALL/TA	−1.586	1.773	−0.89
PD30/TA	6.803	1.124	6.05***
PD90/TA	2.574	2.375	1.08
NONACCRUAL/TA	2.145	0.472	4.54***
OREO/TA	3.832	0.592	6.47
OCC	−0.354	0.075	−4.72***
FED	0.010	0.092	0.10
Failure Year Indicators		YES***	
Adjusted R^2		0.367	
F-Statistic		18.89***	
Number of Obs.		433	

in the second period. Second, the coefficient on *PD30/TA* is appreciably larger in the second period than in the first, which may indicate that the FDIC believed that *PD30/TA* was a stronger leading indicator of "more bad things to come" in the second period. Third, the coefficient on *OREO/TA* is appreciably smaller in the second period, which may indicate that the FDIC believed that the real estate market was healing in the second period and/or the mark-downs on foreclosed real estate were more realistic.

6.3.2. Different primary regulators

It is possible that there could be differences in FDIC loss experiences depending on the identity of the bank's primary regulator. To explore this possibility, we re-estimate Eq. (7), adding indicator variables for whether the Office of the Comptroller of the Currency (*OCC*) or the Federal Reserve (*FED*) was the primary regulator; the excluded category is state-chartered banks that are not members of the Federal Reserve and thus their primary federal regulator is the FDIC. These results (only for the pooled years) are shown in Panels A and B of Table 8, where the dependent variable is the ratio of closure costs to total assets and the natural logarithm of the ratio of closure costs to total assets, respectively.

As can be seen, the coefficient of *OCC* is negative and highly significant in both models, which indicates that failed banks that were regulated by the OCC were less costly for the FDIC to resolve than were failed banks that were regulated by the Fed or the FDIC. It is also true that the OCC-regulated banks tended to be larger than the banks that were regulated by the Fed and FDIC.[14] Although bank size continues to be included as a RHS variable and continues to have a (negative) coefficient that is close to the coefficient in Table 5, it is possible that this size variable does not fully account for the effects of size and that the *OCC* variable is (at least partially) capturing a size effect as well.

6.4. What about banks for which NACR1 (or NACR2) fell below 2% but then recovered?

Our use of the *NACR1* (or *NACR2*) criterion leads naturally to a question about "false positives" or Type II errors in our counterfactual exercises: What about banks that historically may have declined below the 2% *NACR1* (or *NACR2*) benchmark – and thereby would have been closed under a PCA policy that was based on our counterfactual NACR rule – but then subsequently recovered financially, so that closure by the FDIC would have been (ex post) a mistake?

But would all such banks actually have been closed under a NACR rule? It is important to distinguish among three possible

[14] For example, as of the end of the third quarter of 2010 (before the OCC assumed responsibility for regulating thrift institutions, which tend to be smaller), the OCC was the primary regulator for 1,487 national banks, which had $8.5 trillion in assets; state-chartered commercial banks in the U.S. numbered 5,186 and had $3.4 trillion in assets. The average (OCC-regulated) national bank was thus approximately eight times larger than the average of the other commercial banks in the U.S. See OCC (2011, p. 2).

Table 9
Panel A: Outcomes of banks that became NACR-based PCA failures according to the NACR1 Criterion.
This table shows the outcomes of banks that fell below the *NACR1* = 2% criterion between 2006 and 2014. See the text for sources.

Group	Frequency	Percent	Code	Outcome
1	410	36.8	211	Absorption - Assisted
1	1	0.1	215	Partial Purchase & Assumption - Assisted
1	1	0.1	216	Bridge Bank Merger
1	10	0.9	230	Financial Difficulty - Payoff
	422	**37.9**		
2	149	13.4	223	Merger - Without Assistance
2	16	1.4	240	Other Liquidations and Closings
2	30	2.7	810	Absorption/Consolidation/Merger
2	21	1.9	221	Absorption - Without Assistance
2	8	0.7	712	Office Purchased
2	9	0.8	811	FDIC Assisted Absorption/Consolidation/Merger
2	7	0.6	820	Participated in Reorganization
	240	**21.6**		
3	145	12.9	0	No Event
3	124	11.1	412	Merge BIF and SAIF Funds into DIF
3	46	4.1	525	Undefined
3	44	4.0	520	Change in Location
3	35	3.1	999	Corrections
3	29	2.6	510	Name Change
3	18	1.6	660	Change in Geographic Region/Area/Territory/Field Office
3	4	0.4	550	Undefined
3	4	0.4	610	Change in Trust Powers
3	2	0.2	470	Change in Primary Regulatory Agency
3	1	0.1	310	Becomes a Member of Federal Reserve System
	452	**40.5**		
	1114	**100.0**		

Panel B: Outcomes of banks that became NACR-based PCA failures according to the NACR1 Criterion

Number	Percent	Classification
1114	100.0%	**NACR1 < 2.0%**
422	37.9%	Failures
240	21.5%	Mergers
452	40.6%	Operating as of Q4 2014
		Operating as of Q4 2014
101	9.1%	NACR1 < 2% as of Q4 2014
255	22.9%	Capital Injections > 1% Q4 2014 assets
96	8.6%	Other Recoveries
		Other Recoveries
56	5.0%	Accumulated Net Income > 1% Q4 2014 assets
6	0.5%	Accumulated Other Comprehensive Income > 1% Q4 2014 assets
11	1.0%	2% < NACR1 < 4%
23	2.1%	NACR1 > 4%

This table initially shows consolidated categories for the outcomes of banks that fell below the *NACR1* = 2% criterion between 2006 and 2014 that were presented in Panel A. More detail is provided for banks that were still operating as stand-alone entities as of the end of the fourth quarter of 2014. See the text for sources.

routes whereby a bank that declined below 2% NACR would subsequently be able to recover financially: a) The bank owners were able to raise additional capital (because the owners were able to convince themselves and/or other investors that the bank's long-run prospects for viability were sufficiently good); as a variant on this route, the bank owners could find an acquirer – merging with another bank (without any assistance from the FDIC) – that would serve the same purpose; b) The bank owners had a reasoned plan for regaining financial health that did not require the raising of additional capital, and this plan did actually succeed; or c) The bank's fortunes simply reversed; arguably, the bank "got lucky".

For the first group, the use of a (counterfactual) 2% NACR closure rule would likely have caused these owners to have raised their additional capital sooner, so as to avoid being placed into FDIC receivership as mandated by PCA. Thus, *these banks likely would not have been closed* in our counterfactual scenario.

For the second group, the use of a 2% NACR closure rule also would likely have caused these bank owners to seek additional capital – albeit more reluctantly than the first group, since their reasoned plan for recovery did not include a need for additional capital. To the extent that these owners could have convinced themselves and/or outside investors that the reasoned plan would succeed and thus that investing additional capital was worthwhile, *these banks too would likely not have been closed.*[15]

Only for the last group might the 2% NACR rule have involved a true Type II error. But it is far from clear that the prudential regulation of banks should be forbearing from such closures on the basis of a policy of "let's hope that they get lucky".

To shed light on this issue, we look not only at the banks that were actually (eventually) closed by the FDIC but also at all of the other banks that would have failed a (counterfactual) 2% NACR closure rule, and we track their actual subsequent outcomes with the use of information from the FDIC's Directory of Institutions.[16] Overall, there were 1114 banks that would have failed the

[15] If investors couldn't be convinced of the future viability of the bank, then the argument for regulatory forbearance would be similarly unconvincing.

[16] This directory is available in the form of an Excel workbook that is available for download from the FDIC's website at: https://www2.fdic.gov/idasp/warp_download_all.asp. The directory provides a wide array of information on each financial institution that ever has been insured by the FDIC. In particular, it includes a classification

Table 10
Panel A: Outcomes of Banks That Became NACR-Based PCA Failures According to the NACR2 Criterion.
This table shows the outcomes of banks that fell below the *NACR2* = 2% criterion between 2006 and 2014. See the text for sources.

Group	Frequency	Percent	Code	Outcome
1	399	55.9	211	Absorption - Assisted
1	1	0.1	216	Bridge Bank Merger
1	10	1.4	230	Financial Difficulty - Payoff
	410	**57.4**		
2	11	1.5	221	Absorption - Without Assistance
2	60	8.4	223	Consolidated - Without Assistance
2	12	1.7	240	Other Liquidations and Closings
2	3	0.4	712	Office Purchased
2	8	1.1	810	Absorption/Consolidation/Merger
2	2	0.3	811	FDIC Assisted Absorption/Consolidation/Merger
2	3	0.4	820	Participated in Reorganization
	99	**13.9**		
3	71	9.9	0	No Event
3	1	0.1	310	Becomes a Member of Federal Reserve System
3	46	6.4	412	Merge BIF and SAIF Funds into DIF
3	17	2.4	510	Name Change
3	22	3.1	520	Change in Location
3	22	3.1	525	Undefined
3	2	0.3	550	Undefined
3	3	0.4	610	Change in Trust Powers
3	9	1.3	660	Change in Geographic Region/Area/Territory/Field Office
3	12	1.7	999	Corrections
	205	**28.7**		
	714	**100.0**		

Panel B: Outcomes of Banks That Became NACR-Based PCA Failures According to the NACR2 Criterion

Number	Percent	Classification
714	100.0%	**NACR2 < 2.0%**
410	57.4%	Failures
99	13.9%	Mergers
205	28.7%	Operating as of Q4 2014
		Operating as of Q4 2014
49	6.9%	NACR2 < 2% as of Q4 2014
131	18.3%	Capital Injections > 1% Q4 2014 assets
25	3.5%	Other Recoveries
		Other Recoveries
8	1.1%	Accumulated Net Income > 1% Q4 2014 assets
6	0.8%	Accumulated Other Comprehensive Income > 1% Q4 2014 assets
7	1.0%	2% < NACR2 < 4%
4	0.6%	NACR2 > 4%

This table initially shows consolidated categories for the outcomes of banks that fell below the *NACR2* = 2% criterion between 2006 and 2014 that were presented in Panel A. More detail is provided for banks that were still operating as stand-alone entities as of the end of the fourth quarter of 2014. See the text for sources.

2% *NACR1* rule during 2006–2014 (see Table 9) and 714 banks that would have failed the 2% *NACR2* rule during these same years (see Table 10).

Of the 1114 banks that would have failed the 2% *NACR1* rule, 422 were eventually closed by the FDIC, 240 were merged with other institutions or otherwise liquidated, and 452 remained in operation as of year-end 2014; details are provided in Panel A of Table 9. Next, we use Call Report information to provide additional information on the status of the 452 banks that were still operating as of year-end 2014 because these banks might be considered to be the potential "Type II error" candidates; details are provided in Panel B of Table 9.

First, we calculate their *NACR1* as of Q4 2014 (the end of our sample period), and find that 101 banks remained below the NACR-based PCA failure level (i.e., still below *NACR1* = 2%), so these banks ought not to be considered in the category of Type II errors. The remaining 351 banks had risen above the 2% *NACR1* level and might be considered potential candidates to be Type II errors. We then use information from Schedule RI-A, which shows changes in bank capital. We cumulate each item in Schedule RI-A for the period from initial *NACR1*-based PCA failure until year-end 2014, and express these items as a percentage of Q4 2014 total assets.

In particular, we are interested in the issuance of new capital and in investment by parent holding companies, which, together, we refer to as shareholder capital injections.[17] We find that 255 banks (72.6% of the 351 banks that had risen above 2% *NACR1* benchmark) received capital injections that were greater than 1% of assets, with the median injection equal to 7.2% of assets. Again, it seems likely that these banks would not have been closed by a 2% *NACR1* closure rule – they simply would have sought their fresh capital a little earlier – and thus ought not to be considered to be Type II errors.

Finally, we analyze the remaining 96 (= 351 – 255) banks to shed light on their recoveries. We find that 62 (5.5% of the total) "earned" their way to recovery, which we define as accumulating earnings that were greater than 1% of Q4 2014 assets, and the me-

code to signify a structural event that is related to an institution, such as closure or merger.

[17] Item RIADB509 provides information on proceeds from the sale of capital stock, while item RIAD4415 provides information on transactions from the bank's parent holding company. Item RIAD4310 provides information on net income, and Item RIADB511 provides information on other comprehensive income.

dian earnings were equal to 3.8% of assets. Of the remaining 24 banks, 11 reported that their *NACR1* was greater than 2% but less than 4%, and 23 reported that their *NACR1* was greater than 4%.

In sum, only 96 (8.6%) of the 1114 *NACR1*-based PCA failure banks were able to recover without assistance from regulators, merger partners, or shareholder capital injections. Unfortunately, it is impossible to know how many of these 96 banks had a reasoned and viable plan that could have attracted fresh capital if they had been pressed to do so by a *NACR1* $< 2\%$ closure rule (and thus would have been unlikely to have been closed in any event) and how many simply “got lucky”. In any event, the number of true Type II errors would likely be modest; and, again, the wisdom of a prudential regulatory policy that forbears on the basis of “let’s hope that they get lucky” is far from clear.

In Table 10, we present the results from a similar analysis of the 714 banks that would have failed the 2% NACR2 rule. As can be seen in Panel B of Table 10, only 25 (3.5%) remaining banks are candidates for Type II errors.

In summary, *NACR2* appears to be a somewhat sharper tool than *NACR1* in terms of fewer potential false positives (3.5% vs. 8.6%), but both perform remarkably well. Even so, an important point needs to be emphasized: For the purposes of “back-casting” the effects of a PCA rule that would have been based on something like a 2% NACR rule, the counterfactual behavioral changes that the credible enforcement of the rule would likely have induced – in this case, the earlier injections of fresh capital by shareholders (or by merger partners) into banks that the capital markets believed could be resuscitated – need to be taken into account.

7. Conclusion

The concept of “prompt corrective action” (PCA) was proposed in the 1980s and placed into law in the U.S. in 1991 as a way to reduce forbearance by bank regulators with respect to the closure of insolvent banks and thrifts. The hope/goal was that PCA would mean fewer insolvent banks and lower losses for the FDIC in its closure/resolution of insolvent institutions.

The data in this paper – which examine bank closures for the years 2007–2014 and which support earlier findings by Balla et al. (2015) – show that PCA has not worked as expected: Although bank regulators have been resolving banks shortly after the banks fall below the nominal (i.e., GAAP-based) 2% capital-to-asset ratio that triggers PCA, these banks are – on average – in fact deeply insolvent and costly to the FDIC.

In this paper, we offer potential criteria for triggering earlier bank closures – that could mean appreciable savings to the FDIC in future bank failures.

We begin by proposing benchmarks for (counterfactual) earlier closures that are based on the concept of the “nonperforming asset coverage ratio” (NACR), which employs standardized write-down “haircuts” for a bank’s nonperforming assets. In order to provide comparability to the FDIC’s closure rule, we keep the 2% capital-to-assets closure criterion – but measure the bank’s capital on the basis of our more stringent NACR write-downs. We find that the 433 banks closed by regulators during 2008–2014 breached our NACR1 and NACR2 2% thresholds, on average, 365 days and 520 days, respectively, earlier than the actual closure date.

In order to estimate the (reduced) costs to the FDIC of the earlier closures that our NACR-based criteria would yield (and to do so in a way that is comparable to the FDIC’s cost calculations), we next estimate (with OLS) an empirical model that relates the FDIC’s costs of closure to the major components of those costs for the 433 banks that the FDIC closed between 2007 and 2014. The coefficients from these regressions are then applied to the relevant variables for these 433 to-be-closed banks at the earlier point in time when our NACR criteria would have required that the FDIC close these banks; we thus obtain the estimated costs to the FDIC in the event that it had closed the banks earlier. By subtracting the estimated costs at the time of the (counterfactual) earlier closures from the FDIC’s estimates of its costs at the time of its actual (later) closure, we obtain our estimates of the savings to the FDIC from our proposed earlier closures. Our empirical analysis indicates that the savings could have been as great as 37%, or about $18.5 billion, for the 433 bank closures that occurred during 2007–2014.

Finally, we address the issue of false positives: closing a bank that would have recovered. Our analysis indicates that only about 8.6%/3.5% of the banks failing the NACR1/NACR2 thresholds likely would have recovered without assistance. The remaining banks flagged by NACR either failed, were acquired, were recapitalized, or remained below the 2% threshold as of Q4 2014.

These results also point in an important policy direction: The triggering of PCA’s 2% capital-to-assets ratio under current (GAAP) accounting/regulatory standards is clearly not achieving the goal that PCA was designed to achieve. Instead, bank regulators need to be more aggressive in their insistence on earlier and larger write-downs of troubled assets. In an important sense, the current reluctance to be aggressive in forcing earlier and larger write-downs of these troubled assets is a form of regulatory forbearance. Our paper offers a potential set of targets for more aggressive write-downs.

Alternatively, legislators should consider revising the law governing PCA to mandate the use of an alternative trigger for PCA. Our analysis offers two potential alternatives: *NACR1* and *NACR2*.[18] We hope that such changes are put into place: Our analysis indicates that they would mean substantially smaller losses for the FDIC from future bank failures.

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[18] Indeed, the discussion draft of the Financial Choice Act of 2016 proposes the use of what we define in this paper as *NACR1* as the new trigger for Prompt Corrective Action. At the time that this manuscript was prepared, this discussion draft was available at: http://financialservices.house.gov/uploadedfiles/choice_act-_discussion_draft.pdf .

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