Skin in the Game: Liability Insurance, Extended Liability, and Financial Stability

December 2015

Tyler Beck Goodspeed*

Abstract

Before the National Bank Act of 1863, U.S. bank regulation was a virtual laboratory of alternative treatments at the state level. In this paper, I therefore exploit historical border discontinuities in the provision of bank liability insurance, extended bank shareholder liability, and branch banking laws to analyze the effectiveness of alternative policy approaches to attenuating financial instability. I find that whereas branching and double liability significantly lowered the probability of bank failure during both crisis and non-crisis years, insurance fund coverage had the opposite effect, while the results of mutual insurance were mixed. Banks in counties with branch banking or double liability furthermore experienced smaller declines in lending and banknote circulation during financial crises, while banks covered by liability insurance funds experienced larger declines. I also find that liability insurance and extended liability significantly affected bank risk-taking, with banks covered by liability insurance relying more on shorter-term liabilities and greater leverage, while banks with double shareholder liability were less levered, less reliant on interbank lending, and less exposed to real estate assets. Results therefore strongly suggest that extending shareholder liability and allowing greater geographic diversification are more effective approaches to attenuating financial instability than insurance, explicit or implicit, of bank liabilities.

Keywords: banking, regulation, financial crises, liability, history

* Department of Economics, University of Oxford (tyler.goodspeed@economics.ox.ac.uk). I thank John Turner and George Selgin for detailed comments and suggestions. I also thank the History Project and the Institute for New Economic Thinking for generously funding this research.

1 Introduction

A central theme to discussions of the financial crisis of 2008 has been the probable contributory role of excessive leverage on the part of financial institutions, exacerbated by implicit guarantees of bank liabilities. Yet independent of debates concerning the repeal of Glass-Steagall, explicit guarantees of the liabilities of financial institutions by public deposit insurance programs have been largely absent from these discussions, or even praised, despite the fact that numerous studies have found that poorly designed or imperfectly priced liability insurance can generate similarly perverse financial incentives through the introduction of moral hazard. Moreover, while considerable attention has been paid to the potential for contingent capital to facilitate resolution of distressed institutions without risking public capital or systemic collapse, its effects on bank risk-taking antecedent to moments of acute financial stress has received relatively less consideration.

In contrast, bank liability insurance and equity bail-ins through extended liability have been the subjects of considerable interest in more historical contexts. Calomiris (1989, 1990), Wheelock and Wilson (1995), and Weber (2011) find that U.S. states with government imposed and sponsored liability insurance schemes prior to the establishment of the Federal Deposit Insurance Corporation exhibited excessive risk-taking and were less successful at protecting the payments system in the event of adverse shocks. Calomiris and Schweikart (1991) and Carlson and Mitchener (2006, 2009) additionally demonstrate that the permission of branch banking was generally a more effective means of protecting the payments system than state insurance of bank liabilities. Meanwhile, Grossman (2001) and Mitchener and Richardson (2013) find that banks in states with extended shareholder liability—specifically, liability regimes in which shareholders in failed banks were liable for up to twice their equity

investment—had lower leverage ratios, higher liquidity ratios, and lower failure rates than banks in states with limited liability, though Macey and Miller (1992) and Bodenhorn (2014) observe higher measured leverage ratios among banks with double liability. Macey and Miller (1992) furthermore find that double liability regimes in U.S. banking history constituted an effective regulatory system and resulted in substantial recovery rates for depositors and other creditors.

The problem with existing studies on the topic, however, is that variation in bank liability rules across states was likely highly non-random, correlating with differences in economic specialization and fundamentals, as well as underlying social and cultural views toward bank regulation. Given the limits of historical data, such unobservable correlates could result in significant omitted variable bias. To address this threat to identification in the literature, here I employ a regression discontinuity approach, exploiting historical border discontinuities in the provision of bank liability insurance, extended bank shareholder liability, and branch banking laws in the pre-Civil War United States to analyze the effectiveness of alternative policy approaches to attenuating financial instability. Using a panel data set covering the years 1807 through 1863, I estimate average differences in bank failure rates and balance sheet metrics for banks in U.S. counties covered by liability insurance, double liability, and/or unit banking laws, versus failure rates and balance sheet metrics for banks in paired contiguous border counties not covered.

I find that relative to banks in contiguous border counties with limited liability and unit banking, banks in counties with double liability and branch banking faced significantly lower probabilities of failure during both crisis and non-crisis years. Banks in double liability counties furthermore experienced faster recoveries in interbank lending in the wake of financial crises, while branch banking counties

experienced smaller declines in overall lending and banknote circulation. Moreover, relative to banks in contiguous border counties with single liability, banks in counties with double liability were less levered, less reliant on short-term interbank lending, and less exposed to real estate investments, while banks in counties with branch banking were less exposed to spatially correlated state and local government debt.

In contrast, relative to banks in contiguous border counties without state sponsored liability insurance, banks in counties with state sponsored liability insurance funds faced significantly higher probabilities of failure during both crisis and non-crisis years, and experienced larger declines in overall lending and banknote circulation. I also find that bank coverage by state liability insurance funds was associated with higher leverage, greater reliance on short-term funding, and greater exposure to spatially correlated state and local government debt. Moreover, not only did insurance fund coverage fail to mitigate balance sheet retrenchment during banking crises, banks in counties covered by a liability insurance fund actually contracted lending and note circulation during financial crises to a greater extent than banks in contiguous counties not covered.

The effects of mutual liability insurance schemes with state sponsored insurance funds as backup, meanwhile, were mixed. While banks covered by a mutual insurance system in a given year were no more or less likely to fail, the longer the mutual insurance system had been in effect, the lower the probability of bank failure during non-crisis, but not crisis, years. Though banks in counties covered by a mutual guarantee scheme were more levered and relied more heavily on short-term funding than banks in contiguous border counties not covered, they were also less exposed to state and local government debt, and experienced smaller contractions in lending and note circulation during financial crises.

The results of this paper therefore strongly suggest that more contemporary approaches to mitigating banking sector instability through socialization of losses in the form of explicit state guarantees of bank liabilities is generally sub-optimal and in some instances actually counterproductive. In contrast, allowing banks greater flexibility to diversify geographically and extending bank shareholder liability for institutional losses beyond their equity investment were historically highly effective means of attenuating the risk of bank failure and, in the latter instance, moderating bank risk-taking.

The organization of the remainder of this paper is thus as follows. Section 2 provides a review of the extant literature on the economic history of liability insurance, extended liability, and branch banking, particularly in U.S. contexts. Section 3 provides historical background on the implementation and tenure of alternative bank liability regimes in the antebellum U.S. Section 4 details the data sources used for the analysis, while Section 5 describes the empirical approach. Section 6 presents results and Section 7 concludes.

2 Literature Review

The theoretical case for bank liability insurance is that banks are uniquely vulnerable to panics because they issue short-term, demandable claims backed by longer-term assets whose value is not readily observable or ascertainable by creditors, particularly depositors and noteholders. Thus, adverse shocks that elevate the probability of insolvency among some tranche of bank borrowers can therefore provoke preemptive withdrawals from all banks as asymmetrically informed creditors, able to detect that a shock has occurred but unable to ascertain its incidence, seek to avoid being last in line in a first-come, first-served process of

redemption (Diamond and Dybvig 1983). Such fears can become self-fulfilling as financial institutions facing reserve drains are compelled to engage in forced asset sales at fire-sale prices, and can furthermore result in widespread credit disintermediation as banks contract lending and even defensively suspend convertibility (Calomiris 1989). Liability insurance mitigates the incentive for such runs, and in the event of suspension of payments can furthermore mitigate the incentive of insiders to unload bad bank claims onto unknowledgeable creditors (Diamond and Dybvig 1986).

The extant theoretical and empirical literature on bank liability insurance, however, has highlighted that bank liability insurance, like any insurance, also has the potential to introduce substantial moral hazard if the insurance is imperfectly or not fairly priced. With privatized gains and socialized losses, banks are encouraged to substitute debt for equity and to hold higher risk-return portfolios, while depositors and other creditors have a diminished incentive to monitor bank risk through withdrawal of funds from high-risk banks.

Calomiris (1990), Wheelock and Wilson (1995), and Weber (2011) accordingly find that pre-FDIC state-level experiments with bank deposit and insurance were generally failures, suffering from considerable moral hazard and adverse selection. State-sponsored insurance funds encouraged excessive leverage and asset growth and multiplication of banks, and furthermore failed to protect the payments system in the event of adverse financial shocks. Insured banks were both more likely to fail, and to suffer greater declines in asset values. Calomiris (1990) and Weber (2011) also find, however, that privately administered mutual insurance schemes with mutual monitoring were generally more effective at mitigating the problem of moral

hazard, lowering bank failure rates, and protecting the payments system during banking crises.

Calomiris (1990), Calomiris and Schweikart (1991), and Carlson and Mitchener (2006, 2009) further find that unit banking laws (prohibitions of branch banking) amplified the effects of adverse shocks to the payments system and were associated with lower failure rates during banking crises.[1] While this observation was initially attributed to the stabilizing effects of greater portfolio diversification and coordination among branch banks, Carlson (2001) and Calomiris and Mason (2003) find evidence that branching banks exploited the diversification of sectoral risk in loan portfolios to pursue strategies to increase leverage and reduce reserves, rendering them more vulnerable to macroeconomic shocks. Carlson and Mitchener (2006, 2009) instead argue that branching generated greater competition among banks, thereby raising efficiency and profitability, and consequently survivability.

In contrast to the moral hazard-elevating effects of public liability insurance, the extant theoretical and historical literature suggests that double liability for bank shareholders was introduced to attenuate moral hazard, and was largely effective in doing so. With depositors at an informational disadvantage relative to shareholders and owner-managers, limited liability incentivizes the latter to pursue higher risk-return portfolios, in effect keeping them on the linear portion of their payoff matrix over a greater range of outcomes (Esty 1998).

Moreover, efficient contract design holds that, ceteris paribus, in the presence of asymmetric information liability should be assigned, first, to the contract party facing the lowest cost of acquiring information and, second, to the contract party that is least risk averse. Limited liability may thus be particularly inefficient in

[1] Calomiris (1990) further observes that all of the states adopting insurance funds were unit banking states.

banking if knowledge of the true values of a bank's assets and liabilities is asymmetric—owners know more than noteholders, depositors, and other creditors—and if bank creditors are more risk averse than bank owners. Given that the banking business model is predicated on funding long-term lending through the issuance of short-term, liquid liabilities, these conditions are likely generally satisfied (Esty 1998; Hickson and Turner 2003).[2]

Consistent with the theoretical literature on extended liability, the extant empirical evidence strongly suggests that U.S. state-level double liability regimes mitigated the problem of moral hazard and thereby restrained excessive bank risk-taking and lowered bank failure rates and creditor losses in the event failure. Macey and Miller (1992) find that recovery rates from failed banks with double liability exceeded recovery rates from failed banks with limited (single) liability, with final losses amounting to smaller percentages of total liabilities. Grossman (2001) demonstrates that banks in states with extended liability had lower failure rates, higher capital ratios, and higher liquidity ratios than banks in states with limited liability.

Utilizing panel data, Mitchener and Richardson (2013) similarly find that extended liability reduced leverage ratios and was associated with banks maintaining a larger share of retained earnings as a percentage of loans, rendering banks with extended shareholder liability better positioned to sustain significant declines in the value of their asset portfolios. On the other hand, Bodenhorn (2014) and, relying on cross-sectional data, Macey and Miller (1992) find that double liability was actually associated with higher (measured) bank leverage, a result which could reflect the

[2] For more comprehensive discussions of the potential drawbacks of extended liability, particularly concerning share transferability, see Acheson and Turner (2006), Hickson and Turner (2003), and Hickson, Turner, and McCann (2005).

fact that extended liability provided an implicit, off-balance-sheet increase in bank capital.

In contrast to the present study, however, all of the aforementioned existing empirical literature relies on cross-sectional data, state-by-state case studies, or else national-level panel studies using cross-state variation in liability insurance, extended liability, and branch banking. All three approaches likely fail to control for spatial heterogeneity in unobservable local economic characteristics which may have correlated both with adoption of different liability and branch banking regimes and with differential changes in bank balance sheets and failure rates. The present study therefore improves upon this literature, first, by including a more comprehensive set of county-level covariates which may have varied systematically across the discontinuity thresholds and correlated with differential bank outcomes and, second, by assigning banks to contiguous border county pairs by location. Because border counties share relatively similar economic, geographic, and cultural characteristics, the regression discontinuity approach employed here attenuates potential omitted variable bias owing to unobservable county characteristics.

3 Historical Background

In 1829, the state of New York became the first U.S. state to establish a bank liability insurance scheme, consisting of an insurance fund, into which all banks chartered after the passage of the Safety Fund law had to pay an assessment, a board of commissioners with bank examination powers; and a specified list of investments for bank capital (FDIC 1998).[3] Between 1831 and 1858, five additional

[3] Banks chartered prior to 1829 were not required to join, though 16 of the 40 existing banks elected to be re-chartered and join the system. Under the Vermont system, banks chartered after 1831 were initially required to join the fund, from 1841 newly chartered and re-chartering banks could choose whether or not to join.

states—Vermont, Indiana, Michigan, Ohio, and Iowa—then followed suit. While Vermont and Michigan adopted the New York approach of establishing insurance funds, Indiana instead implemented a mutual insurance system requiring chartered banks to mutually guarantee the liabilities of a failed bank. The liability insurance programs adopted by Ohio and Iowa, meanwhile, incorporated elements of both approaches; though member banks were mutually bound, an insurance fund able to levy special assessments was additionally available to reimburse the banks in the event mutual assurance was insufficient to fully satisfy creditors of failed banks. The insurance fund was then replenished through liquidation proceeds.

Though the Vermont, Indiana, Michigan, and New York (pre 1842) schemes insured all bank debts, the Ohio, Indiana and New York (post 1842) schemes insured only circulating bank notes. The New York-style insurance fund systems were funded by annual assessments of 0.50% of capital stock (0.75% in the case of Vermont), with a maximum annual levy of 3.00% (4.50% in the case of Vermont). The Ohio and Iowa funds were instead funded by a single 10% levy on note issues, while the Indiana mutual insurance system levied special assessments as necessary.[4]

Supervision varied from state to state. In states operating insurance funds, bank commissioners—of which there were only three—were employees of the state. Though commissioners were granted full access to bank records, their actual powers were limited; banks could only be shut down if they were insolvent or had been acting in violation of the law establishing the state sponsored safety fund (FDIC 1998; Weber 2011). In contrast, under the mutual guaranty programs in Indiana,

[4] Whereas the Ohioan and Iowan schemes provided for immediate payment of insured liabilities, creditors in New York, Vermont and Michigan were only paid after final liquidation of failed institutions, while Indiana's program provided that creditors were paid within one year after an institutional failure if liquidation proceeds and shareholder contributions were insufficient to cover realized losses (FDIC 1998).

Ohio, and Iowa, supervisory officials were predominantly selected by and accountable to member banks. Commissioners were furthermore granted considerable latitude to monitor and check unsound banking practices, as the participating banks appointing examiners were aware that they were jointly liable for the costs of lax supervision (FDIC 1998; Weber 2011).

Two factors in particular contributed to the demise of these antebellum experiments with liability insurance. The first was the emergence of the "free banking" movement in the 1830s, which developed in response to the closing of the Second Bank of the United States in 1836. To fill the resulting credit void, many states enacted laws intended to ease barriers to entry into banking. Rather than mandating that chartered banks participate in a liability insurance schemes, these laws permitted banks to post bonds and mortgages with state officials in amounts equal to their outstanding notes issues. Participation in state insurance programs therefore declined as more banks elected to become "free banks," undermining the original insurance system designs to include all banks. Similarly, second, when the federal government in 1865 levied a 10% tax on state-chartered bank note issues to induce more state-chartered banks to convert to national charters under the National Bank Act of 1863, membership in the state insurance systems declined to the point that they ceased to exist effectively (FDIC 1998; Weber 2011).

In addition to liability insurance, antebellum bank regulation also varied by the extent of shareholder liability for losses incurred by management. In 1808, Pennsylvania became the first state to impose double liability, though returned to limited liability two years later. In 1811, however, Massachusetts imposed double liability, followed by Rhode Island in 1818, New York in 1827 (rescinded in 1829, reinstated in 1850, Maine in 1831, New Hampshire and Ohio in 1842, Maryland and

Indiana in 1851, and Wisconsin in 1852 (Bodenhorn 2014). Mitchener and Jaremski (2015) find that double liability was implemented in these early adopter states as a cheaper alternative to the establishment of formal regulatory or supervisory institutions.

While Bodenhorn (2014) finds no evidence that the states which adopted double liability for bank shareholders in the first half of the nineteenth century differed systematically in other characteristics which may have been relevant to differential bank outcomes, Grossman (2007) finds that for the early twentieth century, more commercially developed states and states in which the costs of bank failures were expected to be relatively large were more likely to impose double liability. However, from 1863 to 1933, limited liability was the exception rather than the rule. The National Bank Act of 1863 imposed double liability on shareholders in national banks, and by 1930 only four states (Alabama, Idaho, Louisiana, and Missouri) had single liability for state-chartered banks, with few substantial differences in wording between different state laws, and between state and federal law (Macey and Miller 1992; Grossman 2007).[5]

The demise of double liability in banking came during the 1930s. Amendments to the federal National Bank Act and Federal Reserve Act in 1933 and 1935 eliminated double liability for shares in national banks (Grossman 2007). Macey and Miller (1992) furthermore identify three factors in the demise of double liability at the state level. First, the personal bankruptcy of many shareholders who had had little role in the day-to-day management of failed banks generated political pressure on states to repeal extended liability laws. Second, the substantial waves of bank failures during the Great Depression seemed to suggest that double liability

[5] Two exceptions were California, which imposed unlimited liability, and Colorado, which imposed triple liability (Macey and Miller 1992).

had not fulfilled its purpose. Third, the establishment of the FDIC in 1933 was seen to have rendered double liability redundant. Thus, by 1944, thirty-one states had repealed double bank shareholder liability, and it soon thereafter became "a dead letter everywhere" (Macey and Miller 1992).

4 Data

I examine the impact of bank liability insurance, extended shareholder liability, and unit banking laws on U.S. financial stability between 1807 and 1863 by testing whether these regulatory regimes affected balance sheet size and composition and the probability of bank failure. Dates of bank entry and closure, as well as individual bank balance sheet data, are from Weber (2008). Because the Weber database only includes bank location at the municipality level, I assign banks to counties using the American National Standards Institute (ANSI) codes for U.S. places.

I obtain dates for coverage by a state insurance fund or mutual insurance from FDIC (1998), dates for coverage by double liability from Mitchener and Jaremski (2015), and dates for permission of branch banking from Chapman and Westerfield (1942). The entire contiguous border county sample, coded by liability insurance coverage, is presented in Figure 1. Figures 2, 3, and 4 display mutual insurance or insurance fund coverage, double liability, and branch banking status for states included in the contiguous border county sample.

County latitude, longitude, and surface area are from the 2010 U.S. Census Bureau. Historical county-level population data for the most proximate decennial census year, including both total population and the number of municipalities with more than 2,500 inhabitants, is from the 1850 and 1860 censuses.[6] Farm and

[6] I do not use population statistics from the 1830 and 1840 censuses as many counties have incomplete data.

manufacturing output by value per capita are from the 1860 census. Summary statistics are reported in Table 1.

5 Empirical Framework

The empirical approach is based on estimating average differences in bank failure rates and balance sheet metrics for banks in counties covered by liability insurance (an insurance fund or mutual insurance), double liability, and/or unit banking laws, versus failure rates and balance sheet metrics for banks in contiguous border counties not covered. I define bank failure, F_{icsbt}, for bank i, in county c, in state s, along border segment b, in year t as a binary variable assuming a value of 1 if bank i extended loans in year $t-1$, but not in year t, and 0 otherwise.[7]

I therefore estimate the following equations:

$$\begin{aligned} F_{icsbt} = {} & \beta_{0t} + \beta_{1t}Mutual_{st} + \beta_{2t}Fund_{st} + \beta_{3t}Double_{st} + \beta_{4t}Branch_{st} \\ & + \gamma_{1t}Mutual_{st} \times Notes_{st} + \gamma_{2t}Fund_{st} \times Notes_{st} + \gamma_{3t}Mutual_{st} \times State_{st} \\ & + \boldsymbol{X}_{ct}'\delta + \alpha_c + \lambda_b + \phi_{st} + \varepsilon_{icsbt} \end{aligned} \tag{1}$$

and

$$\begin{aligned} Y_{icsbt} = {} & \beta_{0t} + \beta_{1t}Mutual_{st} + \beta_{2t}Fund_{st} + \beta_{3t}Double_{st} + \beta_{4t}Branch_{st} \\ & + \gamma_{1t}Mutual_{st} \times Notes_{st} + \gamma_{2t}Fund_{st} \times Notes_{st} + \gamma_{3t}Mutual_{st} \times State_{st} \\ & + \boldsymbol{X}_{ct}'\delta + \alpha_c + \lambda_b + \phi_{st} + \varepsilon_{icsbt} \end{aligned} \tag{2}$$

---

[7] The linear probability model employed here permits an easier interpretation of estimated coefficients than in alternative nonlinear specifications, including hazard models. In addition, coefficients in a linear model directly measure marginal effects for the probability that an outcome occurs. However, since F is a binary discrete variable, the variance is not homoscedastic, but varies with the values of the independent variables. Formally, if ρ_i is the probability of failure and $\boldsymbol{X}_i$ a vector of independent variables ($\rho_i = \Pr(F_i = 1 \mid \boldsymbol{X}_i)$), then the LPM is $\rho_i(\boldsymbol{X}) = \beta\boldsymbol{X}_i + \varepsilon_i$. As F_i is a binary discrete variable, ε_i can only take two values, $\varepsilon_i = (1 - \beta\boldsymbol{X}_i) \mid F_i = 1$, and $\varepsilon_i = -\beta\boldsymbol{X}_i \mid F_i = 0$. By definition, since $E(\varepsilon_i) \mid \boldsymbol{X}_i = 0$, we have $\sigma_i^2 = E[(\varepsilon_i - E(\varepsilon_i))^2 \mid \boldsymbol{X}_i] = E(\varepsilon_i^2) = \rho_i(1 - \beta\boldsymbol{X}_i)^2 + (1 - \rho_i)(-\beta\boldsymbol{X}_i)^2 = \beta\boldsymbol{X}_i(1 - \beta\boldsymbol{X}_i)^2$, which varies with i, thus establishing the heteroscedasticity of the residuals ε_i. To correct for this consequent heteroscedasticity, I compute robust standard errors (see Section 5, below).

where Y_{icbst} is the outcome variable of interest for bank i, in county c, in state s, along border segment b, in year t. $Mutual_{st}$, $Fund_{st}$, $Double_{st}$, and $Branch_{st}$ are indicator variables equal to 1 if state s in year t mandated or allowed mutual liability insurance, a liability insurance fund, double liability, or branch banking, respectively, and equal to 0 otherwise; $\boldsymbol{X}_{ct}$ is a vector of county-level covariates that includes geographic center latitude and longitude, population density and the number of municipalities with more than 2,500 inhabitants in the most proximate decennial census year, and farm and manufacturing output per capita in 1860; α_c is a set of county fixed effects and λ_b a set of contiguous county pair-specific fixed effects; ϕ_{st} is a set of state-by-year time fixed effects; and ε_{icsbt} is an error term encompassing all other omitted factors.

Because some state insurance schemes applied only to bank note issues, I interact mutual insurance and insurance fund coverage with a binary variable, $Notes_{st}$, which assumes the value of 1 if the liability insurance scheme in state s in year t applied only to notes, and 0 otherwise. Similarly, because some mutual insurance programs were additionally backed by a state sponsored insurance fund, I also interact mutual insurance coverage with a binary variable, $State_{st}$, which assumes the value of 1 if the mutual liability insurance scheme in state s in year t was additionally backed by a state fund, and 0 otherwise. As an alternative specification, I also estimate Eqs. 1 and 2 with $Mutual_{st}$, $Fund_{st}$, $Double_{st}$, and $Branch_{st}$ as continuous variables denoting the number of years preceding and including year t during which state s mandated or allowed mutual liability insurance, a liability insurance fund or double liability.[8]

[8] I retain $Branch_{st}$ as a binary variable because the three branch banking states in the sample—Indiana, Ohio, and Virginia (including West Virginia)—all permitted branch banking for all years in the sample.

In addition, to evaluate whether banks in counties covered by liability insurance, double liability, and/or unit banking laws experienced systematically different balance sheet changes during and in the immediate aftermath of financial crises, compared to banks in contiguous border counties not covered, I also estimate average differences in balance sheet changes at the discontinuity thresholds from pre-1857 to post-1857:

$$\begin{aligned} Y_{icsb1857,\,1858} - Y_{icsb1856} = {} & \beta_{0t} + \beta_{1t}Mutual_{st} + \beta_{2t}Fund_{st} + \beta_{3t}Double_{st} + \beta_{4t}Branch_{st} \\ & + \gamma_{1t}Mutual_{st} \times Notes_{st} + \gamma_{2t}Fund_{st} \times Notes_{st} \\ & + \gamma_{3t}Mutual_{st} \times State_{st} \\ & + \boldsymbol{X}_{ct}'\delta + \alpha_c + \lambda_b + \phi_{st} + \varepsilon_{icsbt} \end{aligned} \tag{3}$$

The identification assumption throughout is that $E(\varepsilon_{icsbt}) = 0$, that is, that assignment to coverage by public liability insurance, double liability, and unit banking laws within each contiguously adjacent county pair is uncorrelated with differences in outcome residuals in either county. The primary potential threat to identification is that county assignment to the respective treatment groups of liability insurance, double liability, or branch banking is in fact correlated with other, unobservable variables that are in turn correlated with differential bank outcomes. I address this threat in four ways. First, because border counties share relatively similar economic, geographic, and cultural characteristics, the regression discontinuity approach employed here—exploiting sharp policy discontinuities at each contiguous county border—attenuates potential omitted variable bias owing to unobservable county characteristics that may have been correlated both with differential bank policy treatment and subsequent differences in observed outcomes.

Second, I control directly for key county-level characteristics—namely, latitude and longitude, population density and the number of municipalities with more than

2,500 inhabitants, and farm and manufacturing output per capita—that may have varied systematically across the discontinuity thresholds and correlated with differential bank outcomes. Third, by including county fixed effects I control for unobservable variables that vary across counties but are constant over time. Finally, fourth, by including state-by-year time fixed effects I control for unobservable variables, such as year-specific shocks, that vary over time but are constant across states.

Two additional estimation details are worth noting. First, because my analysis is concerned with average differences at each contiguous county border, I consider all contiguous county pairs, meaning an individual bank will have n replicates in my data set if it is located in a county belonging to n distinct cross-state county pairs. This potentially introduces mechanical correlation across county pairs as the residuals are not independent if the counties are within the same higher-order border segment. Formally, for contiguous county pairs b, b' along shared border $\boldsymbol{B}$, $E(\varepsilon_{icsbt}, \varepsilon_{icsb't}) \neq 0$ if b, $b' \in \boldsymbol{B}$. Second, there is a positive serial correlation in within-bank balance sheet metrics over time. To correct for these potential sources of bias and possible heteroscedasticity, robust standard errors are clustered at the bank, state, and border pair levels separately (Cameron, Gelbach, and Miller 2006).

6 Results

6.1 Effects on probability of bank failure

Results of estimating Eq. 1 for average differences in the probability of bank failure by public liability insurance fund, mutual insurance, double liability, and unit banking law coverage are presented in Table 2. Panel A reports estimated coefficients on binary variables for coverage by an insurance fund, mutual insurance,

double liability, or branch banking in year t, while panel B reports estimated coefficients on a binary variable for branch banking and continuous variables for the number of years covered by an insurance fund, mutual insurance, or double liability in year t.

Estimated coefficients reported in panel A, column 1 of Table 2 indicate that banks in counties covered by a liability insurance fund in a given year were 16.7-percentage points more likely to fail between 1807 and 1863 than banks in contiguous counties not covered. Estimated coefficients reported in columns 3 and 4, meanwhile, reveal that not only were banks in counties covered by an insurance fund more likely to fail in non-crisis years, they were also more likely to fail during the financial crisis of 1857.[9] While banks in counties covered by a liability insurance fund in a given non-crisis year were 17.7-percentage points more likely to fail between 1807 and 1863 than banks in contiguous counties not covered, they were also 18.4-percentage points more likely to fail during the crisis of 1857. However, estimated coefficients reported in panel B, columns 1-4 of Table 2 reveal that though a longer period of insurance fund coverage was not associated with a higher or lower probability of institutional failure during non-crisis years, longer insurance fund duration was associated with a higher probability of failure during the financial crisis of 1857. During the crisis of 1857, an additional year of liability insurance fund coverage was associated with a 0.60-percentage point higher probability of bank failure.

In contrast, while banks in counties covered by a mutual insurance system in a given year were no more or less likely to fail than banks in contiguous counties not covered, the length of operation of mutual insurance was associated with a lower

[9] I define the crisis years for the Panics of 1837 and 1857 as 1837 and 1838 and 1857 and 1858, respectively.

probability of bank failure during non-crisis years. Estimated coefficients reported in panel B, columns 1 and 4 of Table 2 indicate that for the entire 1807-1863 period, an additional year of mutual insurance coverage was associated with a 2.0-percentage point lower probability of bank failure, and a 1.9-percentage point lower probability of failure during non-crisis years. Estimated coefficients reported in panel B, columns 2 and 3 reveal that an additional year of mutual insurance coverage was not associated with a higher or lower probability of institutional failure during the crises of 1837 and 1857.

Double liability and branch banking, however, were strongly associated with lower probabilities of bank failure during both crisis and non-crisis years. Estimated coefficients reported in panel A, column 1 of Table 2 indicate that banks in counties covered by double liability or branch banking in a given year were 35.4- and 12.6-percentage points less likely to fail between 1807 and 1863 than banks in contiguous counties not covered, respectively. Estimated coefficients reported in columns 3 and 4, meanwhile, reveal that not only were banks in counties covered by double liability or branch banking less likely to fail in non-crisis years, they were also less likely to fail during the financial crisis of 1857. Specifically, while banks in counties covered by double liability or branch banking in a given non-crisis year were, respectively, 35.5- and 13.0-percentage points less likely to fail between 1807 and 1863 than banks in contiguous counties not covered, they were also 6.0- and 21.9-percentage points less likely to fail during the crisis of 1857.

Estimated coefficients reported in panel B reveal that a longer period of coverage by double liability was also associated with a lower probability of bank failure. Estimated coefficients reported in panel B, columns 1 and 4 of Table 2 indicate that for the entire 1807-1863 period, an additional year of coverage by double liability

was associated with a 2.1-percentage point lower probability of bank failure, and a 2.2-percentage point lower probability of failure during non-crisis years. Estimated coefficients reported in panel B, columns 2 and 3, however, reveal that an additional year of coverage by double liability was not associated with a higher or lower probability of institutional failure during the crises of 1837 and 1857.

Results presented in Table 2 therefore suggest that liability insurance fund schemes had a significant, adverse effect on banking sector stability during the entire 1807 to 1863 period, increasing the probability of bank failure during both crisis and non-crisis years, and that this effect during crisis years was amplified the longer the insurance fund scheme had been in effect. In contrast, double liability and branch banking had significant, positive effects on banking sector stability during the entire period, decreasing the probability of bank failure during both crisis and non-crisis years, with the former's effect generally uncorrelated with the length of time for which double liability had been in effect. The effects of mutual insurance schemes were mixed. While banks covered by a mutual insurance system in a given year were no more or less likely to fail, the longer the mutual insurance system had been in effect, the lower the probability of bank failure during non-crisis, but not crisis, years.

6.2 Effects on bank balance sheets

To explore potential channels through which liability insurance, double liability, and branch banking impacted the probability of bank failure, I also estimate Eq. 2 for differences in average balance sheet metrics. Estimated coefficients for branch banking and years covered by a liability insurance fund, mutual insurance, and double liability are reported in Table 3.

Estimated coefficients reported in column 1 of Table 3 indicate that coverage by mutual insurance, insurance funds, and double liability had significant effects on differences in average leverage ratios. Banks in counties covered by mutual insurance or an insurance fund for an additional year were 2.3- and 5.1-percentage points more levered than banks in contiguous border counties without, respectively. In contrast, banks in counties covered by double liability for an additional year were 0.8-percentage points less levered than banks in contiguous border counties without. Branching does not appear to have had an effect on bank leverage ratios.

Estimated coefficients reported in columns 2-4 of Table 3 indicate that mutual insurance, insurance funds, and double liability also had significant effects on the composition of bank funding. The ratio of deposits to total liabilities at banks in counties covered by mutual insurance or an insurance fund for an additional year was 0.6- and 0.4-percentage points higher than the deposit ratio at banks in contiguous border counties without. However, while banks in counties covered by mutual insurance for an additional year were less likely to rely on notes issues and more likely to rely on interbank borrowing for funding, relative to banks in contiguous counties without, the opposite was true of banks in counties covered by an insurance fund for an additional year.

Specifically, an additional year of mutual insurance coverage was associated with 0.6-percentage point lower ratio of notes to total liabilities and a 0.1-percentage point higher ratio of interbank borrowing, whereas an additional year of insurance fund coverage was associated with 0.3-percentage point higher ratio of notes to total liabilities and a 0.1-percentage point lower ratio of interbank borrowing. While double liability tenure was not associated with differences in reliance on deposits or notes issues for funding, the ratio of interbank borrowing to total liabilities was 0.1-

percentage points lower at banks in counties covered by double liability for an additional year, versus banks in contiguous border counties without. Branching, meanwhile, does not appear to have had an effect on banks' methods of funding.

Estimated coefficients reported in columns 5 and 6 of Table 3 indicate that mutual insurance, insurance funds, double liability and branch banking all had significant effects on the composition of bank lending portfolios. The ratio of real estate lending to total assets was 0.1-percentage points lower at banks in counties covered by double liability for an additional year, versus banks in contiguous border counties without. While the ratio of state and local bonds to total assets was 10.6- and 0.2-percentage points lower at banks in counties covered by branching, and banks in counties covered for an additional year by mutual insurance, respectively, versus banks in contiguous border counties not covered, the state and local bond ratio was 1.2-percentage points higher at banks in counties covered for an additional year by an insurance fund, versus banks in contiguous border counties not covered.

Results presented in Table 3 therefore reveal that mutual insurance, insurance funds, double liability and branch banking significantly affected bank lending portfolios and methods of funding, with consequent effects on balance sheet risk. Double liability was strongly associated with more conservative bank borrowing and lending; not only were banks affected by double liability less levered, they were also less reliant on interbank borrowing for funding and had lower exposure to real estate loans as a percentage of total assets. In contrast, banks affected by mutual insurance or an insurance fund were more highly levered and more reliant on short-term funding from interbank borrowing and notes issues, respectively. In addition, whereas branch banking and mutual insurance were associated with lower exposure to state and local bonds as a percentage of total assets, the opposite was true of

banks covered by an insurance fund. As state and local bond yields are correlated with local economic conditions, this may have elevated covariate risk for banks affected by liability insurance fund protection.

Finally, because a common argument in favor of bank liability insurance is that disruptive reserve drains owing to bank runs can result in balance sheet contraction and consequent credit disintermediation, thereby transmitting financial shocks to the real economy, I also estimate Eq. 3 for average percentage changes in deposits, interbank lending, total lending, and note circulation during the financial crisis of 1857, with results presented in Table 4. Estimated coefficients reported in columns 1 and 5 of Table 4 indicate that mutual insurance and insurance funds did attenuate outflows of bank deposits during the Panic of 1857. Average declines in total deposits were 2.5- and 3.6-percentage points smaller by 1858 for banks in counties covered by mutual insurance or an insurance fund, respectively, for an additional year, versus banks in contiguous border counties not so covered. In the crisis year of 1857 itself, the average decline in total deposits were 9.9-percentage points smaller for banks in counties covered by an insurance fund for an additional year, versus banks in contiguous border counties not so covered. Double liability and branch banking, however, do not appear to have been associated with differential changes in deposit levels from before the crisis to after.

Estimated coefficients reported in columns 2 and 6 of Table 4 reveal that double liability, mutual insurance, and insurance fund coverage were associated with differential changes in interbank lending during the 1857 crisis. In the crisis year of 1857, the average decline in interbank lending was 2-percentage points smaller for banks in counties covered by double liability for an additional year, versus banks in contiguous border counties not so covered. By 1858, interbank lending had risen by

91.3-percentage points in counties covered by double liability for an additional year, relative to in contiguous border counties not so covered. In contrast, though the average decline in interbank lending in 1857 was 6.4-percentage points smaller for banks in counties covered by mutual insurance for an additional year, the average decline was 6.3-percentage points greater for banks in counties covered by an insurance fund for an additional year, versus banks in contiguous border counties not so covered. However, by 1858, average changes in interbank lending were no larger or smaller for banks in counties covered by mutual insurance or an insurance fund, versus banks in contiguous counties not covered.

Estimated coefficients reported in columns 3, 4, 7, and 8 of Table 4 indicate that mutual insurance coverage and branch banking strongly attenuated average declines in overall lending, while insurance fund coverage amplified declines in lending and circulation. In 1857, banks in counties allowing branch banking increased lending by 259-8-percentage points, relative to banks in counties which prohibited branch banking, while overall lending declined by 8.8-percentage points more in counties covered by an insurance fund for an additional year, versus in counties not so covered. In 1858, banks in counties allowing branch banking increased lending and notes circulation by 369-8- and 39.8-percentage points, respectively, relative to banks in contiguous counties which prohibited branch banking, while overall lending and circulation increased by 4.0- and 1.2-percentage points more at banks in counties covered by mutual insurance for an additional year, versus in contiguous counties not so covered. In contrast, in 1857, banks in counties covered by an insurance fund for an additional year contracted overall lending by 8.8-percentage points more than banks in contiguous border counties not so covered. By 1858, overall lending and notes circulation contracted by 14.5- and 1.9-percentage points more, respectively,

at banks in counties covered by an insurance fund for an additional year, versus in contiguous counties not so covered.

Results presented in Table 4 therefore strongly suggest that coverage by bank liability insurance schemes did not generally attenuate the transmission of reserve drains to credit contraction. While liability insurance was associated with smaller declines in bank deposits, only mutual insurance schemes were associated with correspondingly smaller declines in aggregate lending and note circulation, while banks covered by insurance funds in fact experienced larger contractions of lending and circulation. Branch banking, however, was strongly associated with relative increases in aggregate lending and circulation, while double liability was associated with large relative increases in interbank lending specifically.

7 Conclusion

In this paper, I exploit historical border discontinuities in the provision of bank liability insurance, extended bank shareholder liability, and branch banking laws in the pre-Civil War United States to analyze the effectiveness of alternative policy approaches to attenuating financial instability. Contrary to conventional narratives of pre-Federal Deposit Insurance Corporation banking history, I find that the absence of bank liability insurance did not exacerbate banking sector instability. In fact, coverage by public liability insurance schemes appears to have amplified rather than attenuated bank risk-taking and the probability of bank failure, during both crisis and non-crisis years, and furthermore to have intensified the transmission of adverse financial shocks to the real economy through credit retrenchment. In contrast, extended shareholder liability, in the form of double liability, and geographic bank diversification through branching significantly lowered the

probability of bank failure during both crisis and non-crisis years, with the former strongly associated with more conservative bank management.

Specifically, I find that relative to banks in contiguous border counties with limited liability and unit banking, banks in counties with double liability and branch banking faced significantly lower probabilities of failure during both crisis and non-crisis years. Banks in branch banking counties furthermore experienced smaller declines in overall lending and banknote circulation during financial crises, while banks in double liability counties experienced relative increases in interbank lending. In addition, relative to banks in contiguous border counties with limited liability, banks in counties with double liability were less levered, less reliant on interbank lending, and less exposed to real estate assets, while banks in counties with branch banking were less exposed to state and local government debt, relative to banks in contiguous border counties with unit banking.

In contrast, relative to banks in contiguous border counties without liability insurance funds, banks in counties with liability insurance funds faced significantly higher probabilities of failure during both crisis and non-crisis years, and furthermore experienced larger declines in overall lending and banknote circulation. I also find that bank coverage by liability insurance funds was associated with higher leverage, greater reliance on short-term funding, and greater exposure to spatially correlated state and local government debt. Moreover, not only did insurance fund coverage fail to mitigate balance sheet retrenchment during financial crises, banks in counties covered by a liability insurance fund actually contracted lending and note circulation during financial crises by more than banks in contiguous counties not covered.

The effects of mutual liability insurance schemes, meanwhile, were mixed. While banks covered by a mutual insurance system in a given year were no more or less

likely to fail, the longer the mutual insurance system had been in effect, the lower the probability of bank failure during non-crisis, but not crisis, years. Though banks in counties covered by a mutual guarantee scheme were more levered and relied more heavily on short-term funding than banks in contiguous border counties not covered, they were also less exposed to state and local government debt, and experienced smaller contractions in lending and note circulation during financial crises.

The results of this paper therefore strongly suggest that more contemporary approaches to mitigating banking sector instability through socialization of bank losses is generally sub-optimal and, in the case of paid-in insurance fund guarantees of bank liabilities, actually counterproductive. In contrast, allowing banks greater flexibility to diversify geographically and extending bank shareholder liability for institutional losses beyond simple limited liability were historically highly effective means of attenuating the risk of bank failure and, in the latter instance, moderating bank risk-taking. Further research is required, however, to explore the effects of pre-FDIC bank liability insurance and extended liability on bank size and banking sector competition.

References

Acheson, G. and J. Turner. (2006). "The Impact of Limited Liability on Ownership and Control: Irish Banking, 1877-1914." *Economic History Review* 59 (2): 320-346.

Alston, L, W. Grove, and D. Wheelock. (1994). "Why Do Banks Fail? Evidence from the 1920s." *Explorations in Economic History* 31: 409-431.

Bernanke, B. (1983). "Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression." *American Economic Review* 73: 257-276.

Bodenhorn, H. (2003). *State Banking in Early America: A New Economic History*. New York: Oxford University Press.

Bodenhorn, H. (2014). "Extended Liability at Early American Banks." Mimeo.

Bordo, M. and H. James. (2010). "The Great Depression Analogy." Financial History Review 17 (2): 127-140.

Calomiris, C. (1989). "Deposit Insurance: Lessons from the Record." *Economic Perspectives*: 10-30.

Calomiris, C. (1990). "Is Deposit Insurance Necessary? A Historical Perspective." *Journal of Economic History* 50: 283-295.

Calomiris, C. and C. Kahn. (1991). "The Role of Demandable Debt in Structuring Optimal Banking Arrangements." *American Economic Review* 81: 497-513.

Calomiris, C. and L. Schweikart. (1991). "The Panic of 1857: Origins, Transmission, and Containment." *Journal of Economic History* 51(4): 807-834.

Calomiris, C. and E. White. (1994). "The Origins of Federal Deposit Insurance." In Goldin, C. and G. Libecap, eds. *The Regulated Economy: A Historical Approach to Political Economy*. Chicago: University of Chicago Press.

Calomiris, C., and J. Mason. (2003). "Consequences of Bank Distress During the Great Depression ." *American Economic Review* 93 (3): 937-947.

Calomiris, C. and S. Haber. (2014). *Fragile by Design: The Political Origins of Banking Crises and Scarce Credit*. Princeton: Princeton University Press.

Carlson, M. (2001). "Are Branch Banks Better Survivors? Evidence from the Depression Era." Federal Reserve Board Working Paper No. 2001–51.

Carlson, M. and K. Mitchener. (2006). "Branch Banking, Bank Competition, and Financial Stability." *Journal of Money, Credit, and Banking* 38 (5): 1293-1328.

Carlson, M. and K. Mitchener. (2009). "Branch Banking as a Device for Discipline: Competition and Bank Survivorship during the Great Depression." *Journal of Political Economy* 117 (2): 165-210.

Diamond, D. and P. Dybvig. (1983). "Bank Runs, Deposit Insurance, and Liquidity." *Review of Economic Studies* 51: 392-414.

Diamond, D. and P. Dybvig. (1986). "Banking Theory, Deposit Insurance, and Bank Regulation. Journal of Business 59: 55-68.

Esty, B. (1998). "The Impact of Contingent Liability on Commercial Bank Risk Taking." *Journal of Financial Economics* 47:189-218.

Evans, L., and N. Quigley. (1995). "Shareholder Liability Regimes, Principle-Agent Relationships, and Banking Industry Performance." *Journal of Law and Economics* 38 (2): 497–520.

Federal Deposit Insurance Corporation. (1998). *A Brief History of Deposit Insurance in the United States*. Washington, D.C.: International Conference on Deposit Insurance.

Friedman, M. and A. Schwartz. (1963). *A Monetary History of the United States 1867-1960*. Princeton: Princeton University Press.

Grossman, R. (2001). "Double Liability and Risk-Taking." *Journal of Money, Credit, and Banking* 33: 143-159.

Grossman, R. (2007). "Fear and greed: The Evolution of Double Liability in American Banking, 1865–1930." *Explorations in Economic History* 44: 59-80.

Hickson, C., and J. Turner. (2003) "The Trading of Unlimited Liability Bank Shares in Nineteenth-Century Ireland: The Bagehot Hypothesis." *Journal of Economic History* 63 (4): 931–958.

Hickson, C., J. Turner, and C. McCann. (2005) "Much Ado about Nothing: The Limitation of Liability and the Market for 19th Century Irish Bank Stock." *Explorations in Economic History* 42 (3): 459–76.

Jaremski, M. (2010). "Free Bank Failures: Risky Bonds vs. Undiversified Portfolios." *Journal of Money, Credit and Banking* 42 (8): 1565–1587.

Macey, J., and G. Miller. (1992). "Double Liability of Bank Shareholders: History and Implications." *Wake Forest Law Review* 27: 31–62.

Mitchener, K. (2005). "Bank Supervision, Regulation, and Financial Instability during the Great Depression." *Journal of Economic History* 65: 152-185.

Mitchener, K. (2007). "Are Supervision and Regulation Pillars of Financial Stability? Evidence from the Great Depression." *Journal of Law and Economics* 50: 273-302.

Mitchener, K. and G. Richardson. (2013). "Skin in the Game? Risk, Leverage, and the Consequences of New Deal Financial Legislation." *Explorations in Economic History* 50: 508-525.

Rockoff, H. (1974). "The Free Banking Era: A Reexamination." *Journal of Money, Credit, and Banking* 6: 141-167.

Rolnick, A. and W. Weber. (1983). "New Evidence on the Free Banking Era." *American Economic Review* 73: 1080-1091.

Temin, P. (2010). "The Great Recession and the Great Depression." Daedalus 139 (4): 115-124.

Wacht, R. (1968). "Branch Banking and Risk." *Journal of Financial and Quantitative Analysis* 3: 97-107.

Weber, W. (2008). Balance Sheets for U.S. Antebellum State Banks. Research Department, Federal Reserve Bank of Minneapolis.

Weber, W. (2011). "Bank Liability Insurance Schemes Before 1865." Research Department, Federal Reserve Bank of Minneapolis Working Paper 679.

Wheelock, D. (1992). "Regulation and Bank Suspensions: New Evidence from the Agricultural Collapse of the 1920s." *Journal of Economic History* 52: 806-825.

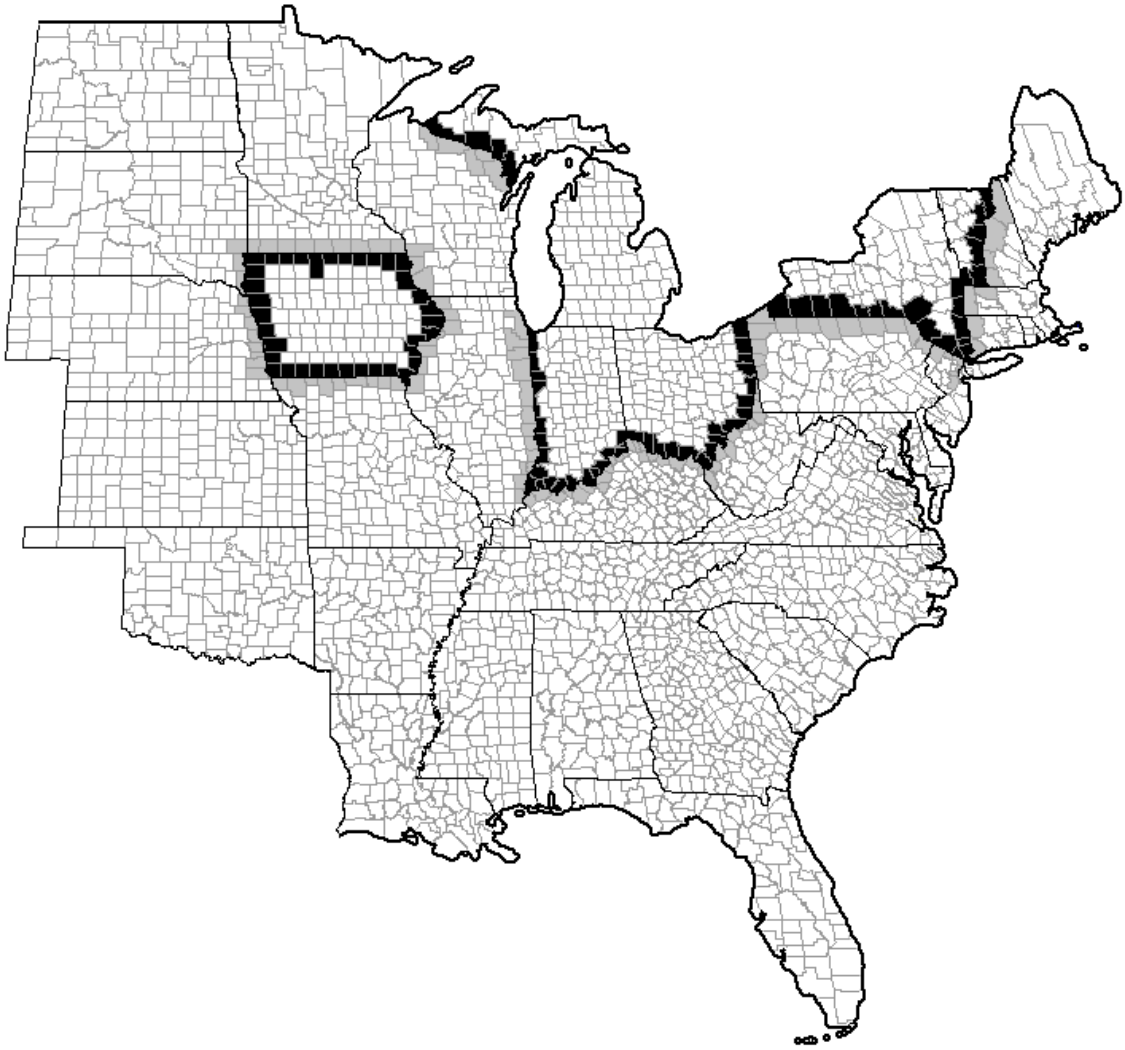
Wheelock, D. (1993). "Government Policy and Banking Market Structure in the 1920s." *Journal of Economic History* 53 (4): 857-879.

Wheelock, D. (1995). "Regulation, Market Structure, and the Bank Failures of the Great Depression." *Federal Reserve Bank of St. Louis Review* 77: 27-38.

Wheelock, D, and P. Wilson. (1995). "Explaining Bank Failures: Deposit Insurance, Regulation, and Efficiency." *The Review of Economics and Statistics* 77 (4): 689-700.

Wheelock, D, and P. Wilson. (2000). "Why do Banks Disappear? The Determinants of U.S. Bank Failures and Acquisitions." *Review of Economics and Statistics* 82 (1): 127-138.

Figure 1: Contiguous Border County Sample



■ = Liability Insurance □ = No Insurance

Figure 2: Insurance Fund and Mutual Insurance States, 1807-1863

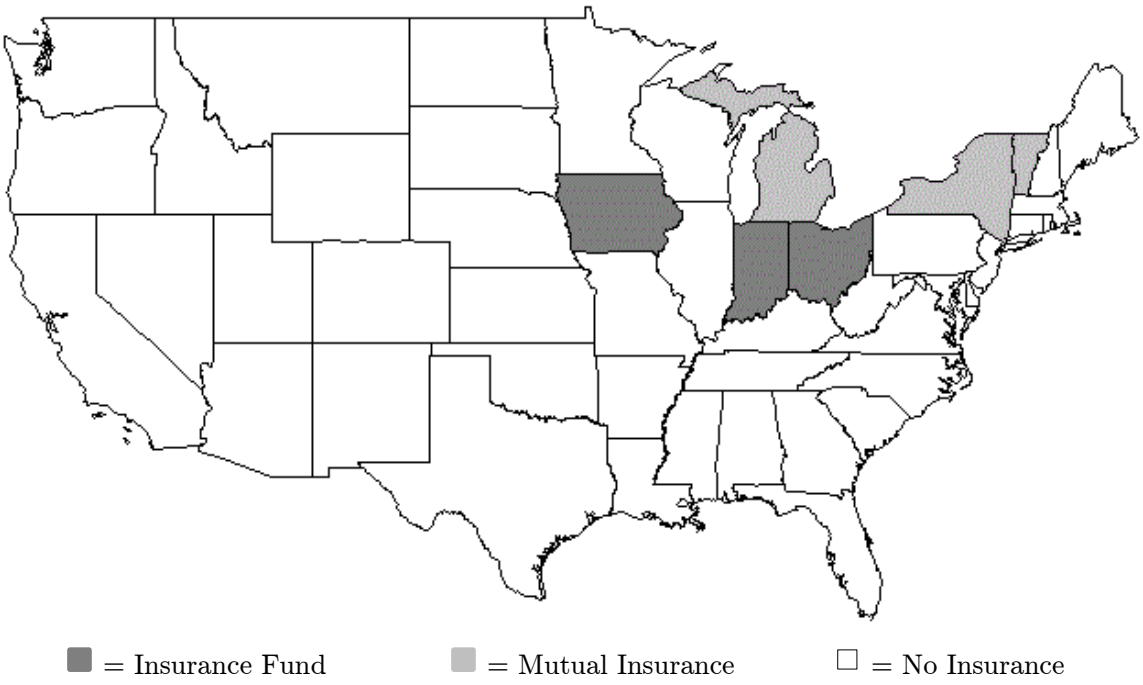


Figure 3: Double Liability States, 1807-1863

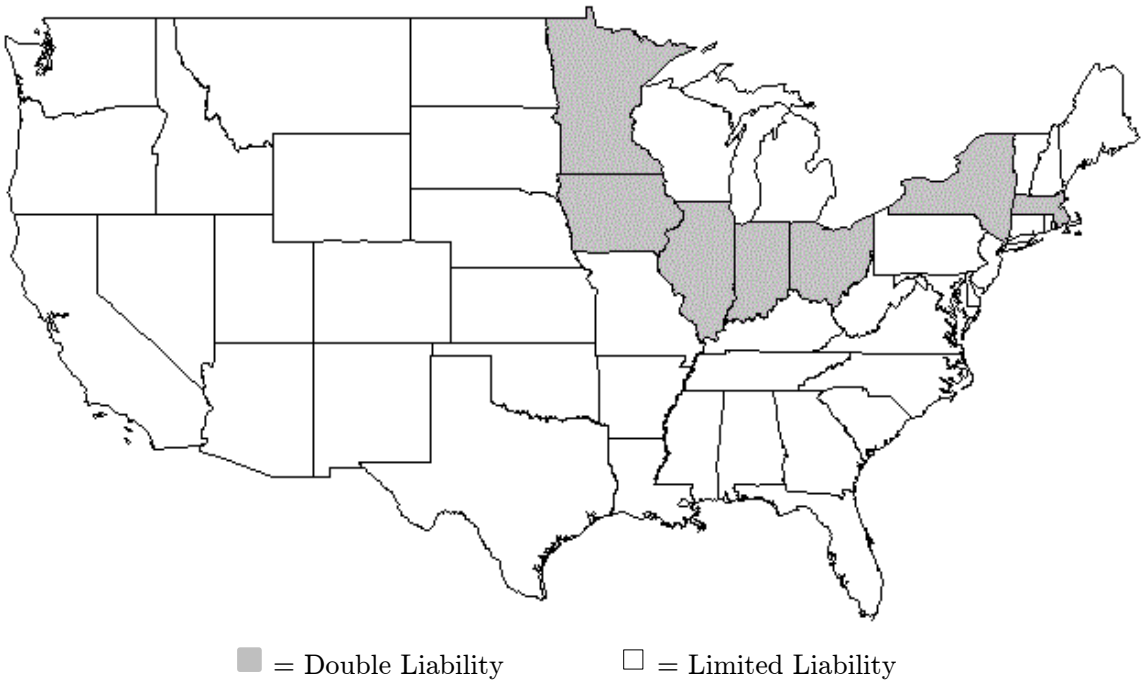


Figure 4: Branch Banking States, 1807-1863

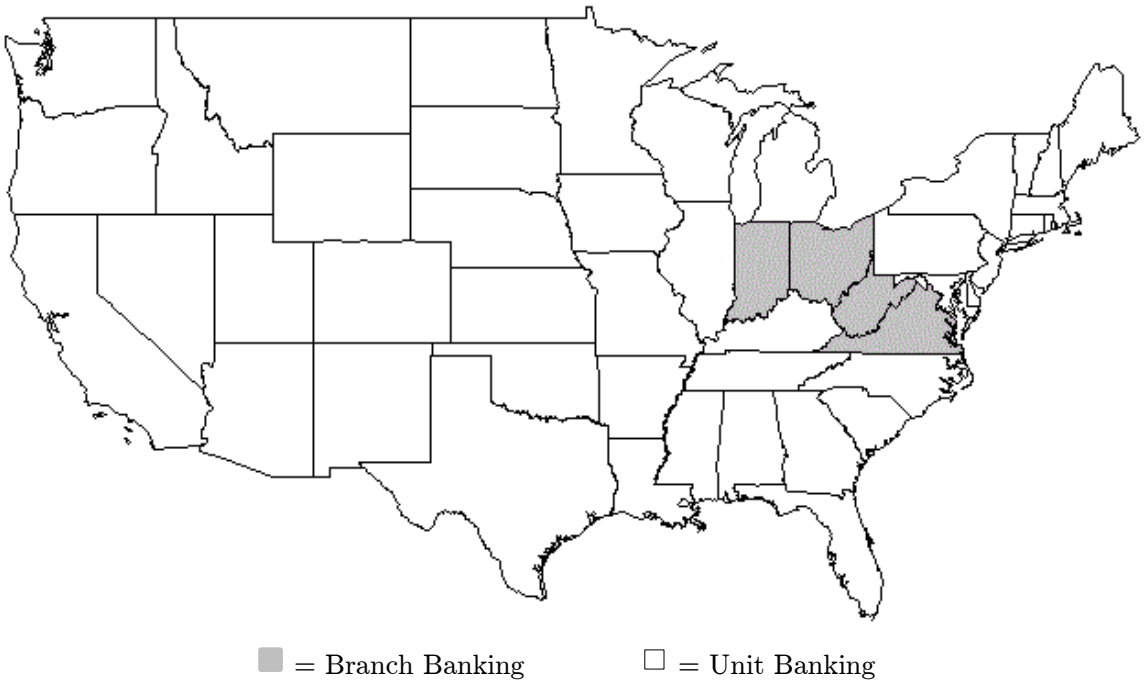


Table 1: Summary Statistics

	Mutual Insurance	**Insurance Fund**	**No Insurance**	**Double Liability**	**Limited Liability**	**Branch Banking**	**Unit Banking**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Failure Rate	0.236	0.406	0.180	0.156	0.378	0.236	0.308
Leverage Ratio	3.508	2.972	2.352	3.086	2.568	2.745	2.777
Deposit Ratio	0.192	0.194	0.103	0.220	0.114	0.126	0.164
Notes Ratio	0.404	0.287	0.368	0.296	0.358	0.369	0.324
Interbank Ratio	0.015	0.054	0.024	0.032	0.040	0.036	0.037
Real Estate Ratio	0.045	0.030	0.064	0.027	0.058	0.064	0.040
State and Local Bonds Ratio	0.144	0.002	0.053	0.073	0.018	0.082	0.027
N	1055	4329	3953	3644	5693	2116	7221

Notes: Each column reports sample averages of the indicated variable by mutual insurance, insurance fund, double liability, and branch banking coverage.

Table 2: Failure Probability by Deposit Insurance, Double Liability, and Branching Coverage

	Fail 1807-1863	Fail 1837	Fail 1857	Fail 1807-1863, ex. 1837 and 1857
	(1)	(2)	(3)	(4)
Panel A: Binary				
Mutual Insurance	0.060	0.028*	0.007	0.064
	(0.06)	(0.02)	(0.04)	(0.06)
Insurance Fund	0.167**	-0.019	0.184***	0.177**
	(0.08)	(0.03)	(0.06)	(0.08)
Double Liability	-0.354***	-0.008	-0.060**	-0.355***
	(0.05)	(0.02)	(0.03)	(0.06)
Branch Banking	-0.126*	0.024	-0.219***	-0.130**
	(0.06)	(0.02)	(0.06)	(0.07)
N	797	183	406	779
R^2	0.134	0.04	0.183	0.135
Panel B: Continuous				
Mutual Insurance	-0.020***	-0.001	-0.002	-0.019***
	(0.00)	(0.00)	(0.00)	(0.00)
Insurance Fund	0.004	-0.001	0.006**	0.004
	(0.00)	(0.00)	(0.00)	(0.00)
Double Liability	-0.021***	-0.001	0.000	-0.022***
	(0.00)	(0.00)	(0.00)	(0.00)
N	797	183	406	779
R^2	0.257	0.026	0.173	0.261

Notes: Each column reports LPM-estimated coefficients for the probability of bank failure by mutual insurance, insurance fund, double liability, and branch banking coverage. All regressions control for latitude and longitude, population density and the number of municipalities with more than 2,500 inhabitants in the most proximate decennial census year, farm and manufacturing output per capita in 1860, and county, county-pair, and state-by-year fixed effects. Panel A estimated coefficients are for binary variables for coverage in year t, while panel B estimated coefficients are for continuous variables for the number of years covered by an insurance fund, mutual insurance, or double liability through year t. Robust standard errors are reported in parentheses and clustered at the bank, state, and border pair level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 3: Balance Sheet Metrics by Liability Insurance, Double Liability, and Branching Coverage

	Leverage Ratio	**Deposits / Liabilities**	**Notes / Liabilities**	**Interbank Borrowing / Liabilities**	**Real Estate Lending / Assets**	**State and Local Bonds / Assets**
	(1)	(2)	(3)	(4)	(5)	(6)
Mutual Insurance (*Years*)	0.023***	0.006***	-0.006***	0.001***	-0.000	-0.002***
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Insurance Fund (*Years*)	0.051***	0.004***	0.003*	-0.001*	-0.000	0.012***
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Double Liability (*Years*)	-0.008*	0.000	0.000	-0.001***	-0.001***	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Branch Banking	-0.307	-0.029	-0.033	0.018	-0.005	-0.106***
	(0.20)	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)
N	9401	9401	9401	9401	9401	9401
R^2	0.020	0.273	0.209	0.107	0.080	0.295

Notes: Each column reports estimated coefficients for average levels of the indicated dependent variable by years of coverage by mutual insurance, an insurance fund, or double liability through year t and branch banking coverage in year t. All regressions control for latitude and longitude, population density and the number of municipalities with more than 2,500 inhabitants in the most proximate decennial census year, farm and manufacturing output per capita in 1860, and county, county-pair, and state-by-year fixed effects. Robust standard errors are reported in parentheses and clustered at the bank, state, and border pair level. *** p < 0.01, ** p < 0.05, * p < 0.10

Table 4: Post-1857 Changes in Balance Sheet Metrics by Liability Insurance, Double Liability, and Branching Coverage

	1857				*1858*			
	Deposits	**Due to Banks**	**Loans and Discounts**	**Circulation**	**Deposits**	**Due to Banks**	**Loans and Discounts**	**Circulation**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mutual Insurance (*Years*)	0.007	0.064**	0.009	0.032	0.025***	-0.046	0.040***	0.012**
	(0.01)	(0.02)	(0.01)	(0.10)	(0.01)	(0.18)	(0.01)	(0.01)
Insurance Fund (*Years*)	0.099***	-0.063**	-0.088***	0.012	0.036**	-0.480	-0.145***	-0.019**
	(0.02)	(0.03)	(0.02)	(0.24)	(0.02)	(0.41)	(0.03)	(0.01)
Double Liability (*Years*)	-0.007	0.020*	-0.009	-0.037	-0.006	0.913***	-0.019	-0.002
	(0.01)	(0.01)	(0.01)	(0.08)	(0.01)	(0.17)	(0.01)	(0.01)
Branch Banking	0.671	-0.056	2.598***	1.479	-0.024	-0.955	3.695***	0.398**
	(0.51)	(1.04)	(0.55)	(5.55)	(0.35)	(8.46)	(0.59)	(0.19)
N	325	325	325	325	519	519	519	519
R^2	0.151	0.039	0.106	0.008	0.065	0.084	0.100	0.020

Notes: Each column reports estimated coefficients for average changes in the indicated dependent variable by years of coverage by mutual insurance, an insurance fund, or double liability through 1857 and branch banking coverage in 1857. All regressions control for latitude and longitude, population density and the number of municipalities with more than 2,500 inhabitants in the most proximate decennial census year, farm and manufacturing output per capita in 1860, nd county, county-pair, and state-by-year fixed effects. Robust standard errors are reported in parentheses and clustered at the bank, state, and border pair level. *** p < 0.01, ** p < 0.05, * p < 0.10