Skin in the Game: Liability Insurance, Contingent Capital, and Financial Stability[*]

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ABSTRACT: I exploit historical border discontinuities before the U.S. National Bank Act of 1863 to investigate the effects of liability insurance, extended shareholder liability, and branching on bank activity and financial stability within contiguous county pairs. I find that while double liability and branching lowered the probability of bank failure, public and mutual liability insurance generally elevated the probability of failure in both crisis and non-crisis years. Banks with double liability experienced smaller declines in deposits, note circulation, and lending during crises, while mutually insured banks experienced larger declines. I also find that liability insurance and double liability significantly affected ex ante risk-taking; insured banks substituted deposits and interbank borrowing for note issuance, increased exposure to real estate and interbank lending, and reduced cash reserves, while banks with double liability were less levered, less exposed to real estate, less reliant on deposits for funding, and maintained higher cash reserves. Finally, though I find no evidence of a trade-off between stability and credit provision, there is evidence of trade-offs between stability and industrial development.

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

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1 Introduction

A central theme to discussions of the financial crisis of 2008-09 is the role of excessive leverage by financial institutions due to implicit guarantees of bank liabilities. Yet studies have found that explicit guarantees by poorly designed or imperfectly priced public deposit insurance can also, in the absence of effective regulatory constraints on risk-taking, generate similarly perverse incentives through the introduction of moral hazard (Keeley 1990; Kane 1995; Calomiris and Jaremski 2016a). Moreover, while there has been considerable interest in the potential for contingent capital to facilitate resolution of distressed institutions without risking public capital or systemic collapse (Dewatripont and Tirole 2012; Bulow and Klemperer 2013; Flannery 2014, 2016), the implications for bank risk-taking antecedent to crises have received less attention. Finally, though recent research has examined the effects of geographic diversification on risk reduction in banking, these studies have by necessity relied on limited observational time horizons (Deng and Elyiasiana 2008; Fang and van Lelyveld 2014).

To address these gaps in the literature, I exploit historical discontinuities at contiguous interstate county borders in the United States between 1794 and 1863 to investigate the effects of bank liability insurance, extended shareholder liability, and geographic diversification on bank activity and stability. I find that while branching lowered the probability of bank failure in non-crisis years, and double liability in both non-crisis and crisis years, public and mutual liability insurance generally elevated the probability of failure. Moreover, I find that whereas long-term coverage by double liability was associated with lower risk-taking, the reverse was true of long-term coverage by mutual insurance or public insurance of circulating notes. Finally, I also find that long-term double liability attenuated, while long-term mutual insurance amplified, credit disintermediation during crises.

The effects of bank liability insurance, equity bail-ins through extended liability, and geographic diversification have been the subjects of considerable interest in historical contexts.

Calomiris (1989, 1990), Wheelock and Wilson (1995), Weber (2014), and Calomiris and Jaremski (2016b) find that public insurance schemes prior to the establishment of the Federal Deposit Insurance Corporation engendered 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 branching was generally a more effective means of protecting the payments system than insurance of bank liabilities. Meanwhile, though Grossman (2001) and Mitchener and Richardson (2013) find that banks in states with double liability had lower leverage, higher liquidity ratios, and lower failure rates than banks in states with limited liability, Bodenhorn (2016) instead observes higher measured leverage among double liability banks.

The problem with existing studies, however, is that variation in bank liability rules across states was likely highly non-random, correlating with differences in economic activity, as well as underlying social and cultural attitudes toward banking and bank regulation. Such unobservable correlates could result in significant omitted variable bias. To address this threat to identification in the literature, I employ a regression discontinuity approach, exploiting historical discontinuities in the provision of liability insurance, extended liability, and unit banking laws at contiguous interstate county borders in the pre-Civil War U.S. Using a panel dataset spanning 1794-1863, I estimate average differences in failure rates and balance sheet metrics for banks in counties covered by liability insurance, double liability, or unit banking laws, versus banks in paired contiguous border counties not covered. Utilizing recently digitized nineteenth-century decennial census data, I also directly control for a richer set of county-level covariates than was previously possible. Moreover, whereas prior studies have estimated binary treatment effects in any given year, my primary focus is instead the effects of longer periods of coverage by liability insurance, double liability, or branching on bank activity and failure rates. This approach allows for analysis of the longer-term effects of the relevant policy treatments on ex ante bank behavior.

I find that while double liability in any given year was not associated with lower predicted probabilities of bank failure, the longer the period of coverage by double liability, the lower the probability of bank failure, in both crisis and non-crisis years. Similarly, while the permission of branch banking in any given year was generally unassociated with differences in the predicted probability of bank failure, the longer the period of coverage by branching, the lower the probability of bank failure, though only during non-crisis years. In contrast, while the effects of public and mutual insurance, of all bank debts or circulating notes only, in any given year on the probability of bank failure were mixed, the longer the period of coverage by mutual insurance of all debts or circulating notes only, or by public insurance of circulating notes, the higher the probability of failure during non-crisis, crisis, or all years, respectively.

I also find that public and mutual liability insurance, double liability, and branch banking significantly affected bank lending portfolios and methods of funding, with implications for balance sheet risk. Over the long term, double liability was strongly associated with lower risk-taking; not only were banks operating under double liability less levered, they also maintained higher reserve ratios, were less reliant on deposits versus notes for funding, and relatively less exposed to real estate. While branching was associated with greater reliance on interbank borrowing, it was also associated with less reliance on deposits versus notes, higher reserve ratios, and lower real estate exposure. In contrast, mutual insurance of circulating notes had a significant positive effect on bank leverage, while both public and mutual insurance of circulating notes or all debts were associated with increased exposure to real estate and/or interbank lending, greater reliance on deposit-taking and/or interbank borrowing versus note issuance, and lower reserve ratios. These results, as well as results from estimating treatment effects on the probability of bank failure, are robust to placebo tests exploiting pseudo-discontinuities at contiguous intrastate county borders.

Additionally, I find that long-term double liability significantly attenuated outflows of bank deposits and declines in note circulation during the Panic of 1857, and was associated with large relative increases in both aggregate lending and interbank lending during and immediately

following the crisis. In contrast, long-term coverage by mutual liability insurance amplified both deposit withdrawals and contractions in note circulation, as well as contractions in overall and interbank lending, while public liability insurance and branching were generally ineffective at mitigating credit disintermediation during the crisis.

Finally, in contrast to Rajan and Zingales (1998), while I find no evidence of a trade-off between stability and credit provision, results do reveal limited evidence of a trade-off between stability and industrial development. Specifically, though longer periods of coverage by double liability and branching were associated with increased banking sector concentration, they were not associated with differences in credit or circulating notes per capita, whereas mutual insurance had a negative effect on both per-capita provision of notes and credit. However, mutual insurance of bank liabilities was positively associated with capital investment in manufacturing and manufacturing output, and negatively associated with average per-acre farm values, which suggests that the insurance of bank liabilities may have had distributional effects on investment.

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 bank 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 at the U.S. state level. 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 liabilities which are redeemable on a first-come, first-served basis and backed by longer-term "opaque" 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 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 for redemption (Diamond and Dybvig 1983). Such fears can become self-fulfilling as financial institutions facing reserve drains are consequently compelled to engage in forced asset sales, 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 also has the potential to introduce substantial moral hazard if the insurance is imperfectly or unfairly priced. With privatized gains and socialized losses, banks are encouraged to substitute debt for equity and to maintain lending portfolios with higher risk-return profiles, while depositors and other creditors have diminished incentives to monitor bank risk through withdrawal of funds from high-risk banks.

Calomiris (1990), Wheelock and Wilson (1995), and Weber (2014) accordingly find that pre-FDIC state-level experiments with bank deposit 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 larger declines in asset values. Calomiris (1990) and Weber (2014) also find, however, that privately administered mutual insurance schemes with mutual monitoring were generally more effective at mitigating the problem of moral hazard, reducing 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 higher 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 spatial and 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 a competition externality that, by raising efficiency and profitability, improved the survivability of incumbent, non-branched banks.

The extant theoretical and historical literature suggests that double liability for bank shareholders was introduced to attenuate moral hazard, but was ambiguously effective in doing so. Ceteris paribus, efficient contract design holds that in contexts 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 banking if knowledge of the true value of a bank's assets is asymmetric—owners know more than creditors—and if bank creditors are more risk averse than bank owners. Assuming the standard contractual model in banking—issuing short-term, liquid liabilities to fund longer-term, opaque and relatively illiquid loans—we would expect these conditions to hold (Esty 1998; Hickson and Turner 2003).[2]

Moreover, if depositors are 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) shows that with contingent liability, equity value is equal to the value of being long a call option with an exercise price equal to the face value of deposits (D) minus the maximum liability assessment (L), and short a bond with a face value equal to maximum liability (L):

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

[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).

$$EV = max[BV - (D - L), 0] - L$$

where BV denotes the bank value. Different liability rules can therefore affect equity payoff functions, as illustrated in Figure 1; if $BV < D - L$, possible negative returns on equity will be increasing in contingent liability. Under the extreme of unlimited liability, equity payoffs consist of being long a call option with a strike price of 0 and short a bond equal to D. But while extended liability thus exposes shareholders to a contingent call on the bond, lowering shareholder incentives to assume additional risk, it also creates an implicit, off-balance-sheet increase in bank capital, such that funding costs and measured leverage may fall. In theory, the net effect on the risk-taking incentives of shareholders and risk-monitoring incentives of creditors is therefore unclear.

The extant empirical evidence suggests that U.S. state-level double liability regimes may have 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, though the record is mixed. 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. But Bodenhorn (2016) finds that double liability was in fact associated with higher measured bank leverage.

In contrast to the present study, however, the extant empirical literature relies on cross-sectional data, state-by-state case studies, or else national-level panels using cross-state variation 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 branching

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 geolocation. Because border counties share relatively similar economic, geographic, social, 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 or re-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 qualifying as bank capital (FDIC 1998).[3] Between 1831 and 1858, five additional 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, Iowa, and New York (post-1842) schemes insured only circulating bank notes.

[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, but from 1841 newly chartered and re-chartering banks could choose.

The New York-style public 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 public insurance funds, bank commissioners—of which there were 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 fund (FDIC 1998; Weber 2014). In contrast, under the mutual guaranty programs in Indiana, 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 (FDIC 1998; Weber 2014).

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 subsequent credit void and in response to the Panic of 1837, many states enacted laws intended to ease barriers to entry into banking. Rather than mandating that chartered banks participate in a liability insurance scheme, these laws permitted banks to post bonds and mortgages with state officials in amounts equal to their outstanding note issues. Participation in state insurance programs therefore declined as more banks elected to become "free banks," undermining the original design of the insurance systems and raising the risk of adverse selection. 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

[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 stipulated 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).

Bank Act of 1863, membership in the state insurance systems declined to the point that they ceased to exist effectively (FDIC 1998; Weber 2014).

In addition to liability insurance, antebellum bank regulation also varied in 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 2016). 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 (2016) 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

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

shareholders who 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 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 liability, and it soon thereafter became "a dead letter everywhere" (Macey and Miller 1992).

It is important to note that for the entirety of the period of analysis, U.S. banking remained highly fragmented. All banks of issue and deposit were established at the state level, and interstate banking was proscribed. In 1818, New York, for instance, prohibited any institution from issuing notes, accepting deposits, or extending loans without explicit legislative charter, while Ohio banned circulation of out-of-state notes (Bodenhorn 2003). Even after the relaxation of charter requirements during the "free banking" period from 1838-1863, the absence of uniformity in supervisory authority and regulatory standards meant transaction costs were high across state lines.[6] Due to the lack of nation-wide clearinghouses, moreover, bank liabilities generally traded at discounts that were increasing in distance from the bank of origin. Finally, most state insolvency and bankruptcy laws favored in-state debtors and discriminated against out-of-state creditors, which further limited capital mobility across state borders (Bodenhorn 2003; Egan 2015).

4 Data

I examine the impact of bank liability insurance (public or mutual insurance, of all debts or circulating bank notes only), extended (double) shareholder liability, and unit banking laws on U.S. financial stability between 1794 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

[6] In particular, "free banking" laws imposed minimum capital requirements and mandated that capital subscriptions be paid up through purchases of state bonds, with the state comptroller then printing notes on behalf of the bank in strict proportion (Bodenhorn 2003).

(2008) 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 then pair contiguously adjacent interstate border counties and, for placebo tests in Section 6.6, contiguously adjacent intrastate border counties.[7] Weber (2015) additionally contains indicators for whether, as of 1861, a given bank had failed, closed, or was still in existence.

I obtain dates for coverage by a public insurance fund or mutual insurance from FDIC (1998), dates for coverage by double liability from Mitchener and Jaremski (2015) and Bodenhorn (2016), and dates for permission of branch banking from Dewey (1910) and Chapman and Westerfield (1942). After 1838 and 1841, respectively, newly chartered banks in New York and Vermont were no longer required to join the public liability insurance schemes, with most electing not to (Bodenhorn 2003; Weber 2014). I therefore classify only New York and Vermont banks chartered through 1838 and 1841, respectively, as covered by a public liability insurance fund during those periods for which membership was no longer mandated. The entire contiguous border county sample, coded by liability insurance coverage, is presented in Figure 2. The sample constitutes an unbalanced panel over 65 years of 972 banks located in 202 counties in 31 states and 157 contiguous county pairs, with 34,436 observations in total.[8]

Historical county-level population data, including both total population and population residing in municipalities with more than 2,500 inhabitants, are from the 1820, 1830, 1840, 1850, and 1860 decennial censuses.[9] Agricultural and manufacturing output by value (natural logarithm transformed), as well as binary indicator variables for the county-level presence of a railway and/or navigable waterway, are from the 1840, 1850, and 1860 censuses.[10] I assign county-level values to individual bank observations by the most proximate census year. All observations within years 0

[7] I define contiguously adjacent counties as counties sharing a common land or riparian border.

[8] Many banks in the sample have multiple observations within a single year.

[9] I do not use population statistics from the pre-1820 decennial censuses as many counties have incomplete data.

[10] County-level agricultural and manufacturing output data, as well as data on the presence of a navigable waterway, are not available prior to the 1840 census. Data on the presence of a railway are not available prior to the 1850 census.

through 4 of a decade are thus assigned values from the immediately preceding census; all observations in years 5 through 9 of a decade are thus assigned values from the immediately succeeding 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 (a public insurance fund or mutual insurance, insuring all bank debts or circulating bank notes only), double liability, or branch banking for an additional year, versus failure rates and balance sheet metrics for banks in contiguous border counties not so covered. I define bank failure, F_{icsbt}, for banks in county c, in state s, along border segment b, at time t (in year n) as a binary variable assuming a value of 1 if bank i failed and t was the final observation for bank i, and 0 otherwise.[11] I therefore estimate:

$$F_{icsbt} = \beta_{0t} + \beta_{1t}Public_{st}^{All} + \beta_{2t}Public_{st}^{Notes} + \beta_{3t}Mutual_{st}^{All} + \beta_{4t}Mutual_{st}^{Notes} \quad (1)$$
$$+ \beta_{5t}Double_{st} + \beta_{6t}Branch_{st}$$
$$+ \boldsymbol{X}_{ct}'\delta + \lambda_c + \phi_{bn} + \varepsilon_{icsbt}$$

and

$$Y_{icsbt} = \beta_{0t} + \beta_{1t}Public_{st}^{All} + \beta_{2t}Public_{st}^{Notes} + \beta_{3t}Mutual_{st}^{All} + \beta_{4t}Mutual_{st}^{Notes} \quad (2)$$
$$+ \beta_{5t}Double_{st} + \beta_{6t}Branch_{st}$$
$$+ \boldsymbol{X}_{ct}'\delta + \lambda_c + \phi_{bn} + \varepsilon_{icsbt}$$

[11] 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_{icsbt} is the outcome variable of interest for bank i, in county c, in state s, along border segment b, at time t (in year n). $Public_{st}^{All,Notes}$, $Mutual_{st}^{All,Notes}$, $Double_{st}$, and $Branch_{st}$ are continuous variables denoting the number of years state s at time t had mandated public liability insurance (covering *All* debts or just *Notes*), mutual liability insurance (covering *All* debts or just *Notes*), double liability, or allowed branch banking, respectively; $\boldsymbol{X}_{ct}$ is a vector of county-level covariates that includes total population and population residing in municipalities of more than 2,500 inhabitants, agricultural and manufacturing output by value (in natural logarithms), and railway and navigable waterway indicator variables; λ_c is a set of county fixed effects; ϕ_{bn} is a set of contiguous county pair-by-year-specific fixed effects; and ε_{icsbt} is an error term encompassing all other omitted factors.

As an alternative specification, I also estimate Eqs. (1) and (2) with $Public_{st}^{All,Notes}$, $Mutual_{st}^{All,Notes}$, $Double_{st}$, and $Branch_{st}$ as binary indicator variables equal to 1 if state s at time t mandated public liability insurance (covering *All* debts or just *Notes*), mutual liability insurance (covering *All* debts or just *Notes*), double liability, or allowed branch banking, respectively, and equal to 0 otherwise. Reclassifying $Public_{st}^{All,Notes}$, $Mutual_{st}^{All,Notes}$, $Double_{st}$, and $Branch_{st}$ as binary variables and comparing the estimated coefficients with estimated coefficients for their continuous analogs allows us to distinguish the effects of changes in bank incentives, which may require time to manifest in observable outcomes, from the effects of simple regulatory implementation or non-implementation.

In addition, to evaluate whether banks in counties covered by liability insurance, double liability, or branch banking for a longer period experienced systematically different balance sheet changes during and in the immediate aftermath of a crisis, compared to banks in contiguous border counties not so covered, in Section 6.3 I also estimate average differences in balance sheet changes at the policy discontinuity thresholds in 1857 and 1858, relative to 1856 means:

$$Y_{icsb1857,1858} - Y_{icsb1856} = \beta_{0t} + \beta_{1t}Public_{st}^{All} + \beta_{2t}Public_{st}^{Notes} + \beta_{3t}Mutual_{st}^{All} + \beta_{4t}Mutual_{st}^{Notes} + \beta_{5t}Double_{st} + \beta_{6t}Branch_{st} \quad (3)$$

$$+ \boldsymbol{X}_{ct}'\delta + \lambda_c + \phi_{bn} + \varepsilon_{icsbt}$$

with $Public_{st}^{All,Notes}$, $Mutual_{st}^{All,Notes}$, $Double_{st}$, and $Branch_{st}$ again as continuous variables denoting the number of years state s at time t (during 1857 and 1858) had mandated public liability insurance (covering *All* debts or just *Notes*), mutual liability insurance (covering *All* debts or just *Notes*), double liability, or allowed branch banking, and all other independent variables as defined in Eqs. (1) and (2).

To examine whether there existed a trade-off between banking sector stability, on the one hand, and the provision of money and credit, on the other, in Section 6.4 I also estimate average county-level differences in credit and note circulation per capita, number of banks, and banking sector concentration by assets and note circulation, for counties covered by liability insurance (a public insurance fund or mutual insurance, insuring all bank debts or circulating bank notes only), double liability, or branch banking for an additional year, versus credit and circulation per capita, number of banks, and banking sector concentration by assets and note circulation in contiguous border counties not so covered. I therefore estimate the following equation:

$$\begin{aligned} Y_{csbt} = {} & \beta_{0t} + \beta_{1t} Public_{st}^{All} + \beta_{2t} Public_{st}^{Notes} + \beta_{3t} Mutual_{st}^{All} + \beta_{4t} Mutual_{st}^{Notes} \\ & + \beta_{5t} Double_{st} + \beta_{6t} Branch_{st} \\ & + \boldsymbol{X}_{ct}'\delta + \lambda_c + \phi_{bn} + \varepsilon_{csbt} \end{aligned} \tag{4}$$

where Y_{csbt} is the outcome variable of interest for county c, in state s, along border segment b, at time t, and all independent variables are as defined in Eqs. (1)-(3).

Finally, to examine whether there existed a trade-off between banking sector stability and industrial and agricultural development, in Section 6.5 I also estimate average county-level differences in manufacturing and agricultural output, capital invested in manufacturing, and infrastructural (railway and navigable waterway) development, for counties covered by public or mutual liability insurance, double liability, and/or unit banking laws for an additional year, versus changes in manufacturing and agricultural output, capital invested in manufacturing, and infrastructural development in contiguous border counties not so covered. Each outcome Y_{csbn} in

county c, in state s, along border segment b, in census year n (1840, 1850, or 1860)[12] is regressed on continuous variables $Public_{st}^{All,Notes}$, $Mutual_{st}^{All,Notes}$, $Double_{st}$, and $Branch_{st}$; county-level covariates ($\boldsymbol{X}_{cn}$);[13] county fixed effects (λ_c); contiguous county pair-by-year-specific fixed effects (ϕ_{bn}); and an error term (ε_{csbn}):

$$\begin{aligned} Y_{csbn} = {} & \beta_{0n} + \beta_{1n} Public_{sn}^{All} + \beta_{2n} Public_{sn}^{Notes} + \beta_{3n} Mutual_{sn}^{All} + \beta_{4n} Mutual_{sn}^{Notes} \\ & + \beta_{5n} Double_{sn} + \beta_{6n} Branch_{sn} \\ & + \boldsymbol{X}_{cn}'\delta + \lambda_c + \phi_{bn} + \varepsilon_{csbn} \end{aligned} \tag{5}$$

The identification assumption in Eqs. (1) through (3) is that $E(Public_{st}^{All,Notes}, \varepsilon_{icsbt})$, $E(Mutual_{st}^{All,Notes}, \varepsilon_{icsbt})$, $E(Double_{st}, \varepsilon_{icsbt})$, $E(Branch_{st}, \varepsilon_{icsbt}) = 0$,[14] that is, that assignment to coverage by public or mutual liability insurance, double liability, and branch banking 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 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, social, 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, population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and

[12] Data for the relevant outcome variables are not available prior to the 1840 census.

[13] Covariates included in the vector $\boldsymbol{X}_{cn}$ in the estimation of Eq. (5) are total population and population residing in municipalities of more than 2,500 inhabitants. Natural logarithm of agricultural and manufacturing output by value and railway and navigable waterway indicators in year n are excluded as independent variables from estimations of Eq. (5) in which they are the dependent variable, but included otherwise.

[14] For Eqs. (4) and (5), the analogous identification assumptions are $E(Public_{st,n}^{All,Notes}, \varepsilon_{csbt,n})$, $E(Mutual_{st,n}^{All,Notes}, \varepsilon_{csbt,n})$, $E(Double_{st,n}, \varepsilon_{csbt,n})$, $E(Branch_{st,n}, \varepsilon_{csbt,n}) = 0$.

manufacturing output by value, and whether or not a given county had access to a railway and/or navigable waterway—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 may have varied across counties but were constant over time. Finally, fourth, by including state-by-year fixed effects I control for unobservable variables, such as year-specific shocks, that may have varied over time but were constant across states.

To the extent that state banking laws and the prohibition of interstate banking effectively prohibited engagement in key aspects of the banking trade across state borders, contamination of untreated groups is attenuated. Nonetheless, as a robustness check of the sharpness of the relevant policy discontinuities, in Section 6.6 I administer a placebo test by exploiting intrastate county borders. Analogously to Eqs. (1) and (2), I therefore estimate average differences in bank failure rates and balance sheet metrics for banks in interstate counties covered by liability insurance (public or mutual, insuring all bank debts or notes only), double liability, or branch banking for an additional year, versus failure rates and balance sheet metrics for banks in contiguous within-state, interior counties also covered:

$$\begin{aligned} F_{icsbt} = {} & \gamma_{0t} + \gamma_{1t} Public'_{st}{}^{All} + \gamma_{2t} Public'_{st}{}^{Notes} + \gamma_{3t} Mutual'_{st}{}^{All} + \gamma_{4t} Mutual'_{st}{}^{Notes} \\ & + \gamma_{5t} Double'_{st} + \gamma_{6t} Branch'_{st} \\ & + \boldsymbol{X}_{ct}'\delta + \lambda_c + \phi_{bn} + \varepsilon_{icsbt} \end{aligned} \tag{6}$$

and

$$\begin{aligned} Y_{icsbt} = {} & \gamma_{0t} + \gamma_{1t} Public'_{st}{}^{All} + \gamma_{2t} Public'_{st}{}^{Notes} + \gamma_{3t} Mutual'_{st}{}^{All} + \gamma_{4t} Mutual'_{st}{}^{Notes} \\ & + \gamma_{5t} Double'_{st} + \gamma_{6t} Branch'_{st} \\ & + \boldsymbol{X}_{ct}'\delta + \lambda_c + \phi_{bn} + \varepsilon_{icsbt} \end{aligned} \tag{7}$$

The identification assumption in Eqs. (6) and (7) is that $E(Public'_{st}{}^{All,Notes}, \varepsilon_{icsbt})$, $E(Mutual'_{st}{}^{All,Notes}, \varepsilon_{icsbt})$, $E(Double'_{st}, \varepsilon_{icsbt})$, $E(Branch'_{st}, \varepsilon_{icsbt}) = 0$, that is, that assignment to interstate border adjacency or non-adjacency within each intrastate contiguous county pair is uncorrelated with differences in outcome residuals in either county. If the interstate

discontinuities are sharp, we should expect estimated coefficients of treatment with the pseudo-discontinuity placebos, $Public'_{st}{}^{All,Notes}$, $Mutual'_{st}{}^{All,Notes}$, $Double'_{st}$, $Branch'_{st}$, to be zero. Non-zero estimates of γ_{1t}, γ_{2t}, γ_{3t}, γ_{4t}, γ_{5t}, γ_{6t} in Eqs. (6) and (7) would indicate intrastate discontinuities in the relevant policy variables, which would suggest possible contamination of untreated interstate-border groups through cross-border banking is biasing estimated treatment effects.

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 observation will have m replicates in my data set if it is located in a county belonging to m 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. 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 segment levels separately (Cameron, Gelbach, and Miller 2006; Dube, Lester, and Reich 2010).[15]

6 Results

6.1 Probability of bank failure

Results of estimating Eq. (1) for average differences in the probability of bank failure by public liability insurance, mutual liability insurance, double liability, and unit banking law coverage are presented in Table 2. Panel A reports estimated coefficients on continuous variables indicating the number of years of coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking through time t, while panel B reports estimated coefficients on binary variables indicating coverage at time t. Estimating both continuous and binary treatment effects allows me to distinguish the effects of changes in bank

[15] Because the sample includes only 30 state clusters, I adjust standard errors for clustering using bias-reduced linearization (Bell and McCaffrey 2002; Angrist and Pischke 2009).

incentives, which may require time to manifest in observable variables, from the effects of simple regulatory implementation or non-implementation.

Estimated coefficients reported in panel A of Table 2 reveal that a longer period of coverage by double liability was associated with a lower probability of bank failure, during both crisis and non-crisis years. Estimated coefficients reported in columns 1 and 4 indicate that for the entire 1794-1863 period, banks in counties with an additional year of coverage by double liability had a 0.1-percentage point lower probability of failure, and a 0.2-percentage point lower probability of failure during non-crisis years specifically, than banks in contiguous border counties without. Estimated coefficients reported in panel A, columns 2 and 3, meanwhile, reveal that an additional year of coverage by double liability was also associated with a lower probability of institutional failure during the crises of 1837 and 1857.[16] Banks in counties with an additional year of coverage by double liability had a 1.0-percentage point lower probability of bank failure during the Panic of 1857, and a non-statistically 1.3-percentage point lower probability of failure during the Panic of 1837, than banks in contiguous border counties without.

Estimated coefficients reported in panel A of Table 2 reveal that a longer period of permission of branch banking was associated with a lower probability of bank failure during non-crisis, but not crisis, years. Estimated coefficients reported in columns 1 and 4 indicate that for the entire 1794-1863 period, banks in counties with branch banking for an additional year had a 0.1-percentage point lower probability of bank failure, as well as a 0.1-percentage point lower probability of failure during non-crisis years specifically, than banks in contiguous border counties without. Estimated coefficients reported in columns 2 and 3, however, indicate that banks in counties with an additional year of branch banking were no more or less likely to fail during the Panics of 1837 and 1857 than banks in contiguous border counties without.

Results presented in panel A of Table 2 suggest that longer periods of coverage by liability insurance, with the exception of public insurance of all debts, generally had positive effects on the

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

probability of bank failure. Estimated coefficients reported in columns 1 and 4 reveal that for the entire 1794-1863 period, an additional year of coverage by public insurance of circulating notes or mutual insurance of all debts was associated with 0.1- and 1.2-percentage point higher predicted probabilities of bank failure, respectively, and 0.1- and 0.8-percentage point higher probabilities of failure during non-crisis years specifically. While banks in counties covered for an additional year by mutual insurance of all debts were no more or less likely to fail during the Panics of 1837 and 1857 than banks in contiguous border counties not covered, an additional year of coverage by public insurance of circulating notes was associated with a 0.2-percentage point higher probability of failure during the Panic of 1857.

Results presented in panel A, columns 3 and 4 of Table 2 also indicate that while banks in counties with an additional year of coverage by mutual insurance of all circulating notes were 2.2-percentage points more likely to fail during the Panic of 1857, they were statistically no more or less likely to fail during non-crisis years, or over the course of the entire 1794-1863 period, than banks in contiguous border counties without. Banks in counties with an additional year of coverage by public insurance of all debts, meanwhile, were statistically no more or less likely to fail at any time during the entire period, during crisis or non-crisis years, relative to banks in contiguous border counties without.

Estimated coefficients reported in panel B, columns 1 through 4 of Table 2, meanwhile, suggest that the mere existence of a public liability insurance scheme, either of all debts or circulating notes only, in a given year (crisis or non-crisis) was unassociated with the probability of bank failure. In contrast, banks in counties covered by mutual insurance of all debts during the Panic of 1837 had a 7.9-percentage point lower probability of failure than banks in contiguous border counties not covered, while banks in counties covered by mutual insurance of circulating notes in a given non-crisis year had a 6.2-percentage point (5.2-percentage point for the entire 1794-1863 period) lower probability of failure than banks in contiguous border counties not covered.[17]

[17] Though these results are only statistically significant at the level of 10%.

Estimated coefficients reported in panel B, columns 1 through 4 of Table 2 indicate that while banks in counties permitting branch banking in a given non-crisis year or during the Panic of 1857 were no more or less likely to fail than banks in contiguous border counties with unit banking, branch banking was associated with 5.1-percentage point higher probability of failure during the Panic of 1837.[18] Meanwhile, though banks in counties covered by double liability in 1837-1838 had a 3.3-percentage point lower probability of failure than banks in contiguous border counties with single liability, for the entire 1794-1863 period and for non-crisis years specifically, banks in counties covered by double liability in a given year were no more or less likely to fail than banks in contiguous border counties not covered

Results presented in Table 2 therefore present a highly nuanced picture. Generally, the longer banks were covered by double liability, the lower the probability of failure during both crisis and non-crisis years. Otherwise, while double liability during the Panic of 1837 was associated with a lower probability of bank failure, coverage by double liability in any single year was unassociated with the probability of failure. Similarly, the longer banks were allowed to branch, the lower the probability of failure during non-crisis, but not crisis, years. But the permission of branch banking in any single year was otherwise generally unassociated with the probability of bank failure.

In contrast, though public insurance of circulating notes in any single year was unassociated with the probability of bank failure, the longer banks were covered by public insurance of circulating notes, the higher the probability of failure during both non-crisis and crisis years. Finally, though coverage by mutual insurance of all debts during the 1837 crisis specifically, and of circulating notes in any single non-crisis year generally, was associated with a lower probability of failure, the longer banks were covered by mutual insurance of all debts and circulating notes, the higher the probability of failure during non-crisis and crisis years, respectively.

Together, results reported in Table 2 therefore strongly suggest that the length of time during which banks were covered by public or mutual liability insurance, double liability, or branching,

[18] Though this result is only statistically significant at the level of 10%.

rather than simply whether they were covered, was an important predictor of the probability of bank failure. In particular, longer periods of coverage by double liability or branch banking were associated with lower probabilities of bank failure, though in the latter case only in non-crisis years. In contrast, longer periods of coverage by liability insurance, either public or mutual, were variably associated with higher probabilities of failure in crisis or non-crisis years, or both.

6.2 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 the effects of years covered by liability insurance (public or mutual, of all debts or circulating notes only), double liability, and branch banking on bank balance sheets are reported in Tables 3 and 4.

Estimated coefficients reported in column 1 of Table 3 indicate that coverage by double liability and mutual insurance of circulating notes had significant effects on average leverage ratios. Banks in counties with an additional year of coverage by double liability were 3.6 percentage points less levered than banks in contiguous border counties without. In contrast, banks in counties covered by mutual insurance of circulating notes for an additional year were 43.0-percentage points more levered than banks in contiguous border counties without. Longer-term coverage by branch banking, public insurance of all debts or circulating notes, or mutual insurance of all debts do not appear to have had significant effects on bank leverage ratios.

Results reported in columns 2-4 of Table 3 indicate that public and mutual liability insurance, double liability, and branch banking also had significant effects on the composition of bank lending portfolios. Estimated coefficients presented in column 2 of Table 3 indicate that the ratio of real estate lending to total assets was 0.1- and 0.04-percentage points higher at banks in counties with an additional year of coverage by public insurance of circulating notes and all debts, respectively, than at banks in contiguous border counties without. Similarly, the ratio of real estate lending to

total assets was 0.1-percentage points higher both at banks in counties with an additional year of coverage by mutual insurance of circulating notes, and at banks in counties with an additional year of coverage by mutual insurance of all debts, than at banks in contiguous border counties without. In contrast, the ratio of real estate lending to total assets was 0.02- and 0.1-percentage points lower at banks in counties with an additional year of coverage by double liability and branch banking, respectively, than at banks in contiguous border counties without.

Estimated coefficients presented in column 3 of Table 3 indicate that the ratio of interbank lending to total assets was 0.1- and 0.4-percentage points higher at banks in counties with an additional year of coverage by public insurance of circulating notes or all debts, respectively, than at banks in contiguous border counties without. Similarly, the ratio of interbank lending to total assets was 0.7-percentage points higher at banks in counties with an additional year of coverage by mutual insurance of circulating notes than at banks in contiguous border counties without. In contrast, the ratio of interbank lending to total assets was 0.7-percentage points lower at banks in counties with an additional year of coverage by mutual insurance of all debts than at banks in contiguous border counties without. Longer-term coverage by double liability or branch banking, however, were unassociated with differences in interbank lending as a fraction of all bank assets.

Results presented in columns 1-4 of Table 4 indicate that public and mutual liability insurance, double liability, and branch banking also had significant effects on the composition of bank funding. Estimated coefficients reported in column 1 of Table 4 reveal that the ratio of deposits to total liabilities at banks in counties with an additional year of coverage by mutual insurance of all debts or circulating notes was 0.9- and 1.2-percentage points higher, respectively, than at banks in contiguous border counties without. In contrast, the ratio of deposits to total liabilities at banks in counties with an additional year of coverage by public insurance of all debts, double liability, or branch banking was 0.3-, 0.4-, and 0.2-percentage points lower, respectively, than the deposit ratio at banks in contiguous border counties without. Longer-term coverage by public insurance

of circulating notes, however, does not appear to have been associated with differences in deposits as a fraction of all bank liabilities.

Estimated coefficients reported in column 2 of Table 4 indicate that the ratio of bank notes to total liabilities at banks in counties with an additional year of coverage by double liability or branch banking was 0.3- and 0.1-percentage points higher, respectively, than the notes ratio at banks in contiguous border counties without. In contrast, the ratio of notes to total liabilities at banks in counties with an additional year of coverage by mutual insurance of all debts was 0.5-percentage points higher than at banks in contiguous border counties without. Longer-term coverage by mutual insurance of circulating notes and public insurance of circulating notes or all debts, however, do not appear to have been associated with differences in bank notes as a fraction of all bank liabilities.

Estimated coefficients in column 3 of Table 4 reveal that the ratio of interbank borrowing to total liabilities at banks in counties with an additional year of coverage by public insurance of notes or all debts, mutual insurance of notes or all debts, or branching was 0.1-, 0.2-, 0.6-, and 0.03-percentage points higher, respectively, than the interbank borrowing ratio at banks in contiguous border counties without. Longer-term coverage by double liability or mutual insurance of all debts, however, do not appear to have been associated with differences in interbank borrowing as a fraction of all bank liabilities.

Estimated coefficients reported in column 4 of Table 4 indicate that the ratio of cash holdings to total liabilities at banks in counties with an additional year of coverage by public insurance of notes or mutual insurance of notes or all debts was 0.3-, 0.4-, 0.8-percentage points lower, respectively, than the cash reserve ratio at banks in contiguous border counties without. In contrast, the cash reserve ratio at banks in counties with an additional year of coverage by public insurance of circulating notes, double liability, or branch banking was 0.1-, 0.1-, and 0.3-percentage points higher, respectively, than at banks in contiguous border counties without

Results presented in Table 3 therefore reveal that public and mutual liability insurance, double liability, and branch banking significantly affected bank lending portfolios and methods of funding, with consequent effects on balance sheet risk. Longer-term coverage by double liability was strongly associated with more conservative bank borrowing and lending; not only were banks with double liability less levered, they also maintained higher cash reserve ratios, relied more on note issuance versus deposits for funding, and had lower relative exposure to real estate. While the longer-term permission of branch banking was associated with greater reliance interbank borrowing, it also seems to have been associated with less reliance on deposits versus notes, higher cash reserves, and lower real estate exposure.

In contrast, while it appears that only mutual insurance of circulating notes had a significant positive effect on bank leverage over the long term, both public and mutual insurance of circulating notes or all debts had significant effects on the risk profile of bank lending and funding. In general, longer-term public and mutual liability insurance was associated with increased exposure to real estate and/or interbank lending, and greater reliance on deposit-taking and/or interbank borrowing versus notes issuance. Longer-term coverage by liability insurance was also associated with the maintenance of lower cash reserves as a fraction of total liabilities.

6.3 Post-crisis credit-intermediation

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 (from 1856, pre-crisis averages) in note circulation, deposits, and total and interbank lending during the Panic of 1857, with results presented in Table 5.

Estimated coefficients reported in columns 1 and 2 of Table 5 indicate that average declines in note circulation and deposits were 47.7- and 25.7-percent smaller, respectively, in 1857-1858 for banks in counties with an additional year of coverage by double liability, versus banks in

contiguous border counties without. In contrast, banks in counties with an additional year of coverage by mutual insurance of notes or all debts experienced 50.8- and 16.4-percent larger declines, respectively, in note circulation, and 26.8- and 27.5-percent larger declines, respectively, in deposits. Longer-term coverage by branch banking or public insurance of notes or all debts do not appear to have been associated with differential changes in note circulation or deposits during the crisis of 1857.

Estimated coefficients reported in columns 3 and 4 of Table 4 reveal that banks in counties with an additional year of coverage by double liability relatively increased total lending, and interbank lending specifically, by 21.7- and 20.9-percent more, respectively, in 1857-1858 than banks in contiguous border counties without. In contrast, banks in counties with an additional year of coverage by mutual insurance of circulating notes relatively contracted total lending by 20-percent in 1857-1858, versus banks in contiguous border counties without. Banks in counties with an additional year of coverage by mutual insurance of all debts, meanwhile, relatively contracted interbank lending by 55.7-percent in 1857-1858, versus banks in contiguous border counties without. Though banks in counties with an additional year of coverage by public insurance of all debts relatively increased total lending by 0.4-percent in 1857-1858, versus banks in contiguous border counties without, they also experienced relative contractions in interbank lending by 2.0-percent. Longer-term coverage by branch banking or public insurance of notes do not appear to have been associated with differential changes in note circulation or deposits during the crisis of 1857.

Results presented in Table 5 therefore suggest that longer-term coverage by double liability significantly attenuated outflows of bank deposits and declines in note circulation during the Panic of 1857. Double liability, moreover, was also associated with large relative increases in both aggregate lending and interbank lending specifically. In contrast, longer-term coverage by mutual liability insurance amplified both deposit withdrawals and contractions in note circulation, as well as declines in overall lending and interbank lending specifically. Public liability insurance and

branch banking, meanwhile, were generally ineffective at mitigating credit disintermediation during the crisis.

6.4 Credit availability and industry concentration

To test whether liability insurance, double liability, or branch banking were associated with differences in per-capita provision of banking services, I also estimate average county-level differences in credit and note circulation per capita, number of banks, and banking sector concentration by assets and note circulation, for counties with an additional year of coverage by liability insurance (public or mutual insurance, insuring all bank debts or circulating bank notes only), double liability, and/or unit banking laws, versus credit and circulation per capita, number of banks, banking sector concentration by assets and note circulation in contiguous border counties without. Results from estimating Eq. (4) are reported in Table 6.

Estimated coefficients reported in columns 1 and 2 of Table 6 indicate that longer-term coverage by public liability insurance (of all debts or notes only), double liability, or branch banking generally do not appear to have been associated with differential levels of aggregate lending per capita or note circulation per capita, though per-capital lending was $1.46 higher in counties with an additional year of coverage by branch banking, relative to in contiguous border counties without. In contrast, per-capital lending was $4.81 and $6.68 lower in counties with an additional year of coverage by mutual insurance of notes and all debts, respectively, relative to in contiguous border counties without. Note circulation was also $4.74 lower per person in counties with an additional year of coverage by mutual insurance of all debts, versus in counties without.

Estimated coefficients reported in column 3 of Table 6 reveal that longer-term coverage by public or mutual liability insurance or branching had significant negative effects on the number of banks operating. Counties with an additional year of coverage by public insurance of notes or all debts, mutual insurance of notes, or branching had 0.123, 0.148, 0.469, and 0.247 fewer banks,

respectively, than contiguous border counties without. In contrast, counties with an additional year of double liability had 0.214 more banks than contiguous border counties without.

Estimated coefficients reported in columns 4 and 5 of Table 6, meanwhile, indicate that longer coverage by double liability or branching also had significant effects on banking sector concentration. Counties with an additional year of coverage by double liability or branching scored 0.004 and 0.003 points higher, respectively, on Herfindahl indices of industry concentration by assets and note circulation, than contiguous border counties without, indicating a higher degree of industry concentration.[19] Meanwhile, counties with an additional year of coverage by mutual insurance of notes scored 0.008 points higher on the Herfindahl index of industry concentration by note circulation, than contiguous border counties without. Longer coverage by public liability insurance (of notes or all debts) or mutual insurance of all debts do not appear to have been associated with different levels of industry concentration by total assets or note circulation.

Results presented in Table 6 therefore suggest that counties with longer coverage by public liability insurance, double liability, or branch banking were no more or less banked than counties without, as measured by lending and notes per capita. But counties with mutual insurance of bank liabilities were generally underbanked relative to counties without, while both public and mutual insurance of bank liabilities were associated with fewer banks. Finally, while longer-term coverage by branch banking seems to have been associated with fewer and larger banks, longer coverage by double liability was associated both with more banks and a higher degree of industry concentration, indicating greater dispersion in bank size.

6.5 Productivity and development

To test whether liability insurance, double liability, and branch banking were associated with differences in productivity and economic development, I also estimate Eq. (5) for average county-

[19] I construct Herfindahl indices of industry concentration by total assets and note circulation of the form $H = \sum_{i=1}^{N_c} s_i^2$, where s_i is bank i's share of total county-level banking assets or notes in circulation, and N_c the number of banks in county c.

level differences in manufacturing and agricultural output, as well as development of railways and navigable waterways, with results presented in Table 7.[20]

Estimated coefficients reported in columns 1 through 4 of Table 7 indicate that longer-term coverage by public insurance (of all debts or just notes), double liability, or branch banking were not associated with county-level differences in total output per capita (manufacturing and agricultural), total manufacturing output, the number of manufacturing establishments, or the value of capital invested in manufacturing. However, relative to in contiguous border counties without, total output per person and aggregate manufacturing output in counties with an additional year of coverage by mutual insurance of circulating notes were greater by $266.53 and 1 percent, respectively. Counties with an additional year of coverage by mutual insurance of all debts or just circulating notes also had, respectively, 15.9- and 12.4-percent more capital invested in manufacturing, relative to counties without.

Estimated coefficients reported in columns 5 through 8 of Table 6 indicate that public or mutual insurance (of all debts or just notes), double liability, and branch banking were unassociated with county-level differences in the presence of a railway or navigable waterway, or agricultural output. Public insurance (of all debts or just notes), mutual insurance of all debts, and double liability were also unassociated with county-level differences in assessed farm values per acre. However, average farm values per acre were $2.12 lower in counties with an additional year of coverage by mutual insurance of circulating notes, relative to counties without, while average farm values per acre were $0.66 higher in counties with an additional year of coverage by branch banking, relative to counties without.

Results presented in Table 7 therefore suggest that the mutual insurance schemes established in Ohio and Iowa, mutually insuring all circulating bank notes, were associated with increased capital investment in manufacturing, higher manufacturing output, and lower average farm values.

[20] Antebellum banks were not directly funding canals and railroads, but did indirectly finance such large-scale capital investment by providing shorter-term working capital through bill discounting.

In contrast, public liability insurance, mutual insurance of all debts, double liability, and branch banking were for the most part unassociated with differences in manufacturing and agricultural productivity and economic development.

6.6 Placebo exercise

Tables 8 and 9 report results from estimating Eqs. (6) and (7) for average differences in bank failure rates and balance sheet metrics for banks in interstate border counties covered by liability insurance (public or mutual insurance, insuring all bank debts or notes only), double liability, or branch banking for an additional year, versus failure rates and balance sheet metrics for banks in contiguous within-state, interior counties also covered.

Estimated coefficients reported in Table 8 in general suggest no systematic variation in bank failure rates at the pseudo-discontinuity thresholds. Estimated coefficients reported in columns 2 and 3 of Table 8 indicate that banks in border counties covered by branch banking for an additional year had 0.03- and 0.1-percentage point higher probabilities of failure, respectively, during the financial crises of 1837 and 1857, versus banks in contiguous within-state, interior counties also covered. However, an additional year of branching in border counties was otherwise unassociated with differences in predicted probabilities of bank failure, relative to branch banking in contiguous interior counties also covered, as were, analogously, an additional year of coverage by public or mutual insurance (of all debts and notes) or double liability.

Estimated coefficients reported in Table 9 similarly, in general, suggest no systematic variation in bank balance sheet metrics at the pseudo-discontinuity thresholds. Estimated coefficients reported in columns 2 and 7 suggest that real estate lending as a fraction of total assets, and cash reserves as a fraction of total liabilities, were both lower for banks in border counties covered by public insurance of circulating notes for an additional year, relative to real estate and cash reserve ratios at banks in contiguous interior counties also covered. Estimated coefficients reported in columns 4 and 5 indicate that deposits and notes as fractions of total liabilities, were higher and

lower, respectively, for banks in border counties covered by mutual insurance of circulating notes for an additional year, relative to deposit and note ratios at banks in contiguous interior counties also covered. Column 4 also reveals that deposits as a fraction of total liabilities was lower for banks in border counties with branch banking for an additional year, versus for banks in contiguous interior counties also covered, while column 7 indicates that cash reserve ratios were higher for banks in border counties covered by mutual insurance of all debts for an additional year, relative to cash reserve ratios at banks in contiguous interior counties also covered.

Results presented in Tables 8 and 9 are therefore consistent with sharp interstate discontinuities, and inconsistent with intrastate pseudo-discontinuities, in public and mutual liability insurance, double liability, and branch banking. If interstate-border treatment groups were affected by contamination of the interstate-border control groups through cross-border banking, we would expect to observe discontinuities in estimated treatment effects at the most proximate intrastate borders. In general, however, it is not possible to reject the null hypotheses that the estimated effects of treatment with the pseudo-discontinuities $Public'_{st}{}^{All,Notes}$, $Mutual'_{st}{}^{All,Notes}$, $Double'_{st}$, $Branch'_{st}$ are equal to zero. Moreover, non-zero estimated coefficients are generally of the opposite sign to what we would expect to result, through cross-border banking, from contamination of the interstate-border control groups, and/or are statistically significant only at the level of 10%.

7 Conclusion

I exploit historical discontinuities at contiguous county borders in the pre-Civil War U.S. to analyze the effectiveness of alternative policy approaches to attenuating financial instability. I find that while longer periods of coverage by branch banking lowered the probability of bank failure in non-crisis years, and longer-term coverage by double shareholder liability lowered the probability of failure in both non-crisis and crisis years, public and mutual liability insurance generally elevated the probability of failure the longer they were in effect, in crisis as well as non-

crisis years. Moreover, I find that whereas longer-term coverage by double liability was associated with lower risk-taking, the reverse was true of longer-term coverage by public insurance of circulating notes and mutual insurance. These results are robust to placebo tests exploiting pseudo-discontinuities at contiguous intrastate county borders. Finally, I also find that double liability attenuated, while mutual insurance amplified, credit disintermediation during crises, which suggests that the implicit, off-balance-sheet equity buffer provided by double liability may have mitigated counterparty risk during crises.

Though I find no evidence that the increased stability provided by longer-term coverage by double liability or branching was at the cost of lower money supply, credit availability, or industrial development, I also find that mutual insurance of bank liabilities was positively associated with capital investment in manufacturing and manufacturing output, and negatively associated with per-capita credit provision and per-acre farm values. These results suggest that the insurance of bank liabilities may have had non-trivial distributional effects on investment.

The results of this paper therefore indicate that branch banking was not as effective as previous studies have estimated in attenuating the risk of bank failure. Though branching did lower the probability of bank failure the longer it was in effect, this was true only during non-crisis years; Compared to previous studies, the results of this paper also suggest that public liability insurance, though generally ineffective, was not as counterproductive as previously estimated. Finally, again in comparison to prior studies, I find that double shareholder liability was more, and mutual liability insurance less, effective in balancing broad credit provision with banking stability.

Further research is needed to evaluate whether and how additional nuances in double liability rules, state chartering requirements, and the design and implementation of antebellum liability insurance programs—in particular, variation in capital requirements, examination standards and commission composition, and the structure of assessments—may have correlated with differential outcomes. Also, this and previous studies may be omitting potential interaction effects between liability insurance and double liability, and between double liability and branching. Lastly, as

results suggest that the insurance of bank liabilities was not entirely neutral with respect to capital investment, further research into possible trade-offs between financial stability and industrial development is merited.

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Figure 1: Equity Payoff Functions under Contingent Liability

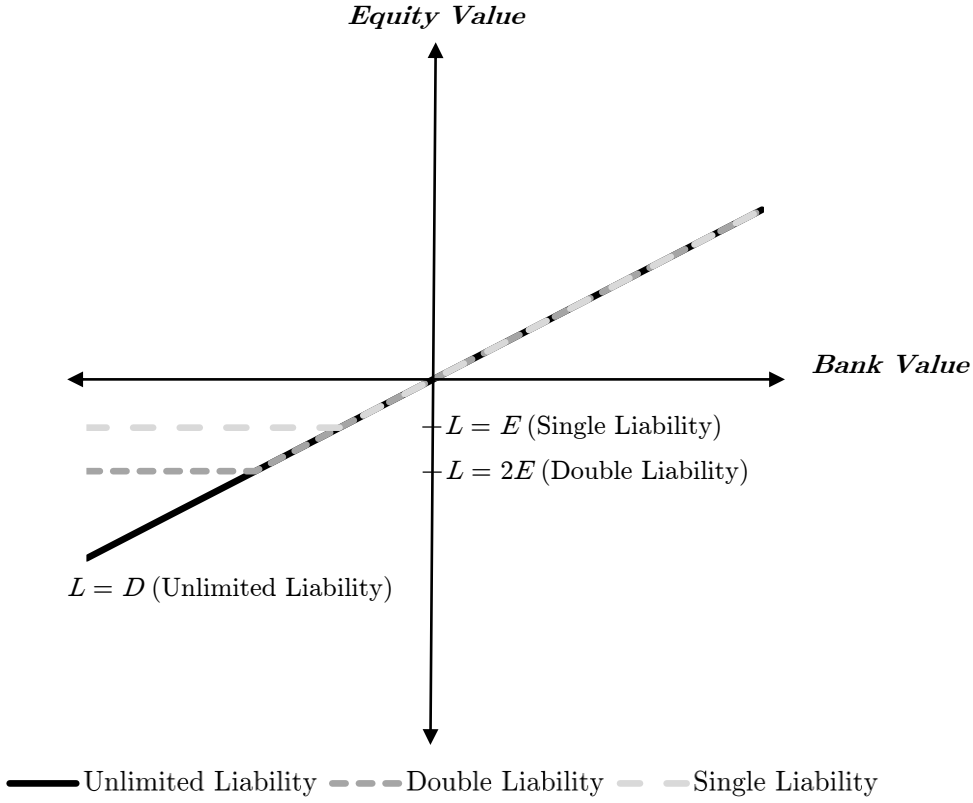
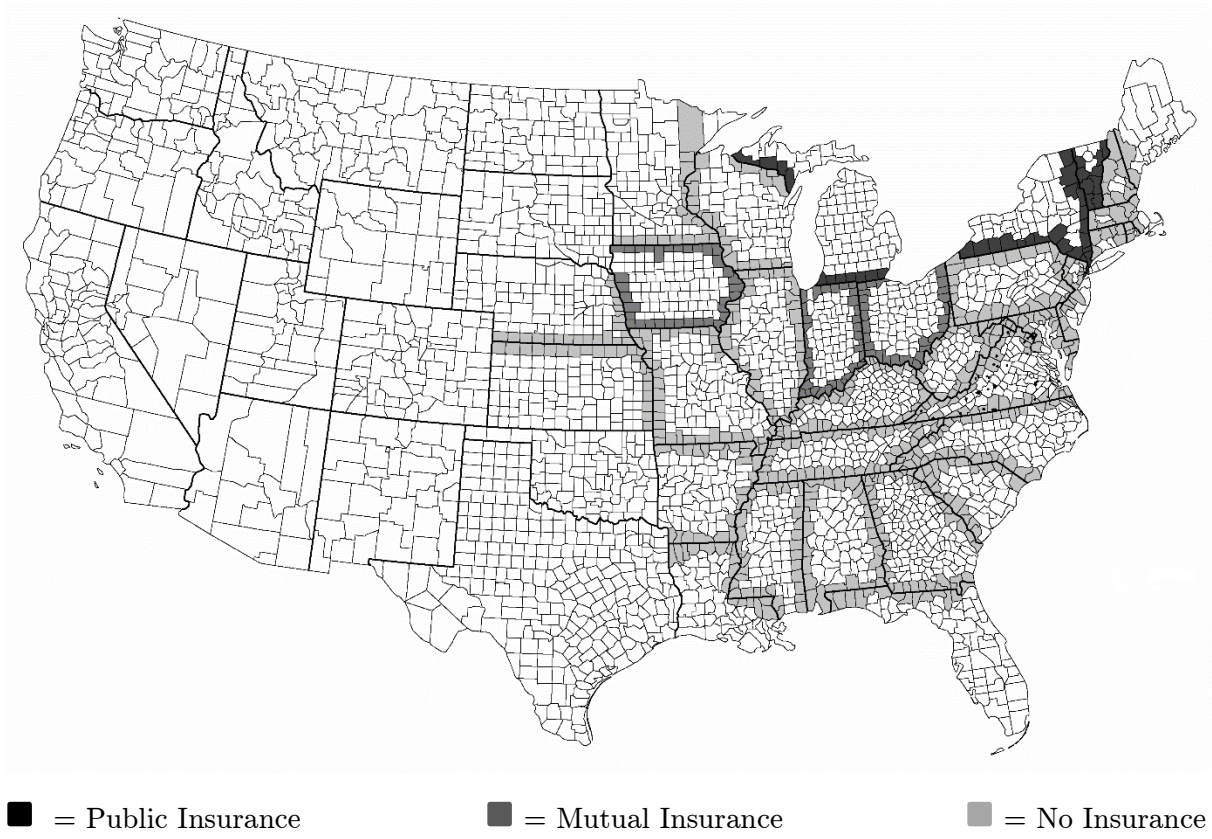


Figure 2: Contiguous Border County Sample



■ = Public Insurance ■ = Mutual Insurance ■ = No Insurance

Table 1: Summary Statistics

	Public Insurance	Mutual Insurance	No Insurance	Double Liability	Limited Liability	Branch Banking	Unit Banking
Failure Rate	0.379	0.365	0.145	0.094	0.336	0.187	0.203
Leverage Ratio	3.246	3.978	2.075	2.232	2.541	2.990	2.195
Deposit Ratio	0.226	0.241	0.135	0.160	0.153	0.215	0.141
Notes Ratio	0.247	0.332	0.261	0.239	0.286	0.284	0.253
Interbank Borrowing Ratio	0.065	0.035	0.025	0.024	0.047	0.057	0.027
Real Estate Lending Ratio	0.023	0.014	0.021	0.017	0.027	0.027	0.020
Interbank Lending Ratio	0.082	0.111	0.072	0.067	0.085	0.090	0.071
Cash Ratio	0.091	0.122	0.055	0.050	0.083	0.100	0.054
N	7248	797	26362	19472	14935	7429	26978

Notes: Each column reports sample averages of the indicated variable by public liability insurance (of all debts or circulating notes only), mutual liability insurance (of all debts or circulating notes only), double liability, and branch banking coverage.

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

	(1)	(2)	(3)	(4)
	Fail 1794-1863	Fail 1837	Fail 1857	Fail 1794-1863, ex. 1837 and 1857
Panel A: Continuous				
$Public^{Notes}$	0.001***		0.002**	0.001*
	(0.00)		(0.00)	(0.00)
$Public^{All}$	-0.001	0.007	-0.001	-0.001
	(0.00)	(0.01)	(0.00)	(0.00)
$Mutual^{Notes}$	0.005		0.022***	0.008
	(0.00)		(0.01)	(0.00)
$Mutual^{All}$	0.012***	0.024	0.008	0.008**
	(0.00)	(0.07)	(0.02)	(0.00)
Double	-0.001***	-0.013	-0.010**	-0.002***
	(0.00)	(0.01)	(0.00)	(0.00)
Branch	-0.001**	-0.005	0.003	-0.001***
	(0.00)	(0.01)	(0.02)	(0.00)
N	31594	3115	2743	25603
R^2	0.077	0.092	0.258	0.068
Panel B: Binary				
$Public^{Notes}$	0.006		0.296	0.011
	(0.01)		(0.22)	(0.01)
$Public^{All}$	0.009	-0.004	-0.044	0.016
	(0.01)	(0.02)	(0.03)	(0.01)
$Mutual^{Notes}$	-0.051*		0.073	-0.062*
	(0.03)		(0.18)	(0.03)
$Mutual^{All}$	0.107	-0.079***	-0.043	0.067
	(0.08)	(0.03)	(0.19)	(0.08)
Double	0.026	-0.033***	-0.272	0.029
	(0.02)	(0.01)	(0.22)	(0.02)
Branch	-0.069	0.051*	0.114	-0.114
	(0.07)	(0.03)	(0.07)	(0.08)
N	31594	3115	2743	25603
R^2	0.074	0.090	0.258	0.068

Notes: Each column reports LPM-estimated coefficients for the probability of bank failure by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking coverage (β's in Eq. (1)) in the indicated years. Panel A reports estimated coefficients on continuous variables indicating the number of years of coverage by liability insurance, double liability, or branch banking through time t, while Panel B reports estimated coefficients on binary variables indicating coverage at time t. All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and manufacturing output by value, and railway and navigable waterway indicators in the most proximate decennial census year. Also included are county and border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

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

	(1) Leverage Ratio	(2) Real Estate Lending / Assets	(3) Interbank Lending / Assets
$Public^{Notes}$	-0.023	0.001***	0.001***
	(0.03)	(0.00)	(0.00)
$Public^{All}$	-0.031	0.000**	0.004***
	(0.02)	(0.00)	(0.00)
$Mutual^{Notes}$	0.430***	0.001*	0.007***
	(0.08)	(0.00)	(0.00)
$Mutual^{All}$	0.017	0.001**	-0.004***
	(0.03)	(0.00)	(0.00)
Double	-0.036**	-0.000*	0.000
	(0.01)	(0.00)	(0.00)
Branch	-0.007	-0.001***	0.000
	(0.01)	(0.00)	(0.00)
N	33968	33977	34294
R^2	0.034	0.126	0.244

Notes: Each column reports estimated coefficients for average levels of the indicated dependent variable by years of coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking (β's in Eq. (2)). All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and manufacturing output by value, and railway and navigable waterway indicators in the most proximate decennial census year. Also included are county and border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 4: Balance Sheet Liability Metrics by Liability Insurance, Double Liability, and Branching

	(1)	(2)	(3)	(4)
	Deposits / Liabilities	Notes / Liabilities	Interbank Borrowing / Liabilities	Cash / Liabilities
$Public^{Notes}$	0.000	0.000	0.001**	0.001***
	(0.00)	(0.00)	(0.00)	(0.00)
$Public^{All}$	-0.003***	-0.001	0.002***	-0.003***
	(0.00)	(0.00)	(0.00)	(0.00)
$Mutual^{Notes}$	0.012***	-0.003	0.006***	-0.004***
	(0.00)	(0.00)	(0.00)	(0.00)
$Mutual^{All}$	0.009***	-0.005***	0.000	-0.008***
	(0.00)	(0.00)	(0.00)	(0.00)
Double	-0.004***	0.003***	0.000	0.001***
	(0.00)	(0.00)	(0.00)	(0.00)
Branch	-0.002***	0.001**	0.000**	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)
N	34091	34091	34091	33977
R^2	0.596	0.532	0.370	0.431

Notes: Each column reports estimated coefficients for average levels of the indicated dependent variable by years of coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking (β's in Eq. (2)). All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and manufacturing output by value, and railway and navigable waterway indicators in the most proximate decennial census year. Also included are county and border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 5: Post-1857 Changes in Balance Sheet Metrics by Liability Insurance, Double Liability, and Branching Coverage

	(1)	(2)	(3)	(4)
	Circulation	Deposits	Loans and Discounts	Interbank Lending
$Public^{Notes}$	-0.001	0.001	0.000	0.005
	(0.00)	(0.00)	(0.00)	(0.00)
$Public^{All}$	0.001	-0.004	0.004*	-0.020***
	(0.00)	(0.00)	(0.00)	(0.01)
$Mutual^{Notes}$	-0.508***	-0.268***	-0.200***	-0.611
	(0.03)	(0.04)	(0.04)	(0.43)
$Mutual^{All}$	-0.164***	-0.275***	0.324	-0.557***
	(0.04)	(0.07)	(0.28)	(0.10)
Double	0.477***	0.257***	0.217***	0.209***
	(0.03)	(0.05)	(0.03)	(0.06)
Branch	0.003	-0.049	0.017	-0.049
	(0.04)	(0.04)	(0.03)	(0.08)
N	2573	2558	2570	2521
R^2	0.185	0.129	0.277	0.149

Notes: Each column reports estimated coefficients for average percent changes in the indicated dependent variable in 1857 and 1858, relative to 1856 means, by years of coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking (β's in Eq. (3)). All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and manufacturing output by value, and railway and navigable waterway indicators in the most proximate decennial census year. Also included are county and border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 6: Credit Provision, Number of Banks, and Industry Concentration by Liability Insurance, Double Liability, and Branching

	(1) Total Credit per Capita	(2) Circulation per Capita	(3) Number of Banks	(4) Herfindahl (Assets)	(5) Herfindahl (Circulation)
$Public^{Notes}$	0.157	-0.052	-0.123*	0.003	0.003
	(0.48)	(0.26)	(0.07)	(0.00)	(0.00)
$Public^{All}$	0.627	0.024	-0.148**	0.003	0.003
	(0.78)	(0.14)	(0.07)	(0.00)	(0.00)
$Mutual^{Notes}$	-4.812**	-1.415	-0.469***	0.006	0.008**
	(2.42)	(0.93)	(0.16)	(0.00)	(0.00)
$Mutual^{All}$	-6.679**	-4.739**	0.079	-0.003	-0.003
	(2.72)	(2.00)	(0.07)	(0.00)	(0.00)
Double	0.213	-0.111	0.214*	0.004***	0.004**
	(0.87)	(0.54)	(0.11)	(0.00)	(0.00)
Branch	1.456*	0.674	-0.247***	0.003*	0.003**
	(0.77)	(0.48)	(0.09)	(0.00)	(0.00)
N	4121	4121	4121	4121	4121
R^2	0.536	0.517	0.729	0.746	0.745

Notes: Each column reports estimated coefficients for average levels of the indicated dependent variable by years of coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking (β's in Eq. (4)). All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and manufacturing output by value, and railway and navigable waterway indicators in the most proximate decennial census year. Also included are county and border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 7: Manufacturing, Infrastructure, and Agriculture by Liability Insurance, Double Liability, and Branching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Output per Capita	Manufacturing Output	Manufacturing Establishments	Capital Invested in Manufacturing	Water	Rail	Agricultural Output	Farm Value per Acre
$Public^{Notes}$	-1.504	0.006	0.881	-0.014	0.005	0.008	0.002	0.036
	(14.31)	(0.01)	(4.98)	(0.01)	(0.00)	(0.00)	(0.01)	(0.12)
$Public^{All}$	1.891	-0.011	0.592	-0.007	0.003	0.004	0.003	0.071
	(21.30)	(0.01)	(5.49)	(0.02)	(0.00)	(0.01)	(0.01)	(0.12)
$Mutual^{Notes}$	266.531**	0.010*	-4.92	0.124**	0.000	-0.006	-0.012	-2.121***
	(102.61)	(0.00)	(18.42)	(0.06)	(0.00)	(0.00)	(0.02)	(0.37)
$Mutual^{All}$	-2.208	0.029	6.378	0.159**	-0.002	0.026	0.031	-0.369
	(34.71)	(0.02)	(6.24)	(0.06)	(0.00)	(0.02)	(0.03)	(0.38)
Double	-25.543	0.009	-1.66	0.018	-0.002	-0.005	0.011	-0.195
	(52.82)	(0.01)	(7.17)	(0.03)	(0.00)	(0.01)	(0.03)	(0.25)
Branch	-19.449	-0.004	10.752	0.016	0.000	-0.003	-0.006	0.675*
	(43.93)	(0.01)	(9.17)	(0.04)	(0.00)	(0.01)	(0.02)	(0.40)
N	355	348	344	355	355	355	354	355
R^2	0.861	0.983	0.979	0.900	0.969	0.861	0.925	0.993

Notes: Each column reports estimated coefficients for average levels of the indicated dependent variable by years of coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking (β's in Eq. (5)). All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural (columns (2)-(6)) and manufacturing (columns (5)-(8)) output by value, and railway and navigable waterway indicators (columns (1)-(4) and (7)-(8)) in the most proximate decennial census year. Also included are county and border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 8: Failure Probability by Liability Insurance, Double Liability, and Branching Placebos

	(1)	(2)	(3)	(4)
	Fail 1794-1863	Fail 1837	Fail 1857	Fail 1794-1863, ex. 1837 and 1857
$Public'^{Notes}$	0.000		0.000	0.000
	(0.00)		(0.00)	(0.00)
$Public'^{All}$	0.001	0.000	0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
$Mutual'^{Notes}$	0.000		-0.000	0.000
	(0.00)		(0.00)	(0.00)
$Mutual'^{All}$	-0.000	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
$Double'$	0.000	0.000	0.001	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
$Branch'$	0.000	0.000*	0.001**	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
N	34122	3364	2962	27651
R^2	0.072	0.091	0.254	0.065

Notes: Each column reports LPM-estimated coefficients for the probability of bank failure by years of interstate-border coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking (γ's in Eq. (6)) in the indicated years. All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and manufacturing output by value, and railway and navigable waterway indicators in the most proximate decennial census year. Also included are county and intrastate border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, most proximate interstate border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 9: Balance Sheet Metrics by Liability Insurance, Double Liability, and Branching Placebos

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Leverage Ratio	Real Estate Lending / Assets	Interbank Lending / Assets	Deposits / Liabilities	Notes / Liabilities	Interbank Borrowing / Liabilities	Cash / Liabilities
Public' ^{Notes}	0.008	-0.000*	0.000	0.000	0.000	0.000	-0.000*
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Public' ^{All}	0.006	0.000	-0.000	0.000	-0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mutual' ^{Note}	-0.004	0.000	0.000	0.000*	-0.000*	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mutual' ^{All}	0.009	-0.000	0.000	0.000	0.000	0.000	0.000*
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Double'	0.008	0.000	0.000	0.000	0.000	0.000	-0.000
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Branch'	0.000	0.000	0.000	-0.000**	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	36685	36695	37038	36818	36818	36818	36695
R^2	0.033	0.119	0.230	0.577	0.527	0.361	0.407

Notes: Each column reports estimated coefficients for average levels of the indicated dependent variable by years of interstate-border coverage by liability insurance (public or mutual insurance, of all debts or circulating notes only), double liability, or branch banking (γ's in Eq. (6)). All regressions control for county population, urban population (population residing in municipalities of more than 2,500 inhabitants), agricultural and manufacturing output by value, and railway and navigable waterway indicators in the most proximate decennial census year. Also included are county and intrastate border pair-by-year fixed effects. Robust, BRL standard errors are reported in parentheses and clustered at the bank, most proximate interstate border segment, and state levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$