Shareholder Liability and Bank Failure*

Felipe Aldunate

Dirk Jenter

Arthur Korteweg

Peter Koudijs

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Abstract:

Does additional shareholder liability reduce bank failure? We compare the performance of around 4,400 state-regulated banks of similar size in neighboring U.S. states with different liability regimes during the Great Depression. We find that additional shareholder liability reduced bank failure by 30%. Results are robust to a diff-in-diff analysis incorporating National banks (which faced the same regulations in every state), and are not driven by other differences in state regulation, FED membership, or differential selection into state and nationally regulated banks. Our results suggest that exposing shareholders to more downside risk reduces bank risk taking.

JEL codes:

Keywords: Limited Liability, Bank Risk Taking, Financial Crises, Great Depression

* Felipe Aldunate: Pontificia Universidad Católica de Chile, Business School, 4860 Vicuña Mackenna, Santiago, Chile (fealduna@uc.cl). Dirk Jenter: London School of Economics and Political Science, Houghton Street, London WC2A 2AE, UK (d.jenter@lse.ac.uk). Arthur Korteweg: University of Southern California, Marshall School of Business, 3670 Trousdale Parkway, Los Angeles, CA 90089, USA (korteweg@marshall.usc.edu). Peter Koudijs: Stanford University, 655 Knight Way, Stanford, CA 94306, USA (koudijs@stanford.edu). The authors declare that they have no relevant or material financial interests related to the research described in this paper. We thank seminar participants at the University of Exeter, LSE, Stanford, USC and Yale for feedback. We are grateful to Peter DeMarzo, Felipe González, Naomi Lamoreaux, Paul Pfleiderer, and Amit Seru for valuable comments and suggestions. We thank Stanford Library for help digitizing the State Bank reports. All errors are our own. Aldunate acknowledges funding from Proyecto FONDECYT Iniciación #11160874 and CGCUC.

Agency problems between shareholders and creditors are a core friction in modern corporate finance, and banking corporations are particularly prone to them. Banks have the privilege of issuing deposits, which form the basis of the payment system. This allows them to be highly levered, creating strong incentives for risk shifting. Moreover, there are large negative externalities from excessive risk taking: bank failures can lead to widespread financial crises and large output losses (Boyd, Kwak and Smith 2005).

Since the beginning of modern banking in the early 19th century, policy makers and regulators have been aware of these problems and have devised a variety of tools to rein in bank risk taking. One often-used tool was to force bank shareholders to face some form of additional liability. In the U.S. from 1817 onwards, shareholders in most banks had double liability, meaning that for a bank share with a par (or paid-in) value of $100, they faced an additional penalty of (at most) $100 in case the bank failed. When the National Banking system was set up in 1864, Senator Sherman, one of its architects, stated that double liability was meant to "prevent the stockholders and directors of a bank from engaging in hazardous operations". This system remained the norm until 1933, when the American banking system was restructured.

In this paper, we evaluate whether double liability is an effective tool to reduce bank failures. To do so, we compare the performance of U.S. banks during the Great Depression with different levels of shareholder liability. While most U.S. banks had double liability for shareholders, some state-regulated ("State") banks had "single" (limited) liability. This allows us to compare double- and single-liability banks that were geographically close and similar in size. We also use a difference-in-difference strategy incorporating nationally regulated ("National") banks that faced the same regulations in every state.

We find that double liability strongly reduced the probability of bank failure. We consider three dimensions of failure: outright suspensions, acquisitions (where we consider the acquired bank as failed), and "troubled raising", the issuance of new equity to replenish capital. "Total trouble" (aggregating these three measures) was around 30% lower for banks in states with double liability. This effect is strongest for acquisitions, with single-liability banks more than 50% more likely to be acquired. We also find suggestive evidence that surviving banks in double liability states wrote down less capital (indicative of fewer losses) and lost less deposits (indicative of a smaller reduction in confidence). As a result, the size of their balance sheets shrank less.

In 1928, before the Depression, banks in double liability states did not have lower leverage or higher cash holdings. This suggests that their lower failure rate was not due to lower ex-ante risk taking in these observable dimensions. Instead, the lower failure rates may be due to the extension of safer loans before 1929, and/or to less risk shifting afterwards once banks sustained their first losses ("gambling for resurrection").

We use National banks in the same states, which were subject to double liability and faced the same regulations everywhere, as additional controls for local shocks. In diff-in-diff estimations our results become slightly stronger. We also investigate whether states differed on other regulatory dimensions that could explain our results. Although bank regulation varied from state to state, it was not systematically weaker in states with single liability. Finally, we test whether FED membership or the differential selection into National or State banks can explain our results – neither appears to be the case.

Our results are important for at least two reasons. First, since the Global Financial Crisis of 2008, there have been ongoing efforts to make the banking system safer. One proposal that has received much attention involves raising capital requirements, in part to strengthen the incentives of bank shareholders to reduce risk taking.[1] So far, empirical work has been hampered by the fact that there is very little cross-sectional variation in capital requirements.[2] Another popular proposal is to increase the downside exposure of decision makers in banks.[3] The double liability of bank shareholders in the Great Depression accomplished both. By imposing penalties in case of bank failure it increased shareholders' incentives to monitor banks. Importantly, it did so without actually increasing banks' capital buffers, allowing us to isolate the incentive effects of higher capital requirements. Double liability also affected the incentives of bank managers and directors, since both were typically significant shareholders.[4] Our results therefore suggest that higher capital requirements and additional liability for bank managers can be a successful tool to reduce risk taking in banking.

[1] See, for example, Admati and Hellwig (2013), and Bhagat and Bolton (2014).

[2] Barth, Caprio and Levine (2008) use differences in capital requirements between countries. However, these might reflect deeper institutional and economic differences.

[3] See, for example, Rajan (2008), Blinder (2009), Hill and Painter (2015, p. 190), Kay (2015, p. 279), Luyendijk (2015, p. 254), Cohan (2017, p. 146) and Goodhart and Lastra (2019).

[4] Macey and Miller (1992, p. 56). Share ownership did become more dispersed in the late 1920s. Kane and Wilson (1998) argue that the McFadden Act of 1927, which reduced the minimum par value of shares, lead to a wider dispersion of share ownership.

Second, during the early 1930s the U.S. faced its largest banking crisis in its history. Its causes are still widely debated.[5] Our paper contributes to this literature by examining to what degree incentive problems and risk-taking by banks were to blame for bank failures. Our results suggest that greater risk-taking by single liability banks significantly aggravated the severity of the crisis.

Double liability stipulates that, in case of bank failure, the banking supervisor levies a penalty on shareholders (up to the par or paid-in value of their shares) that is used to satisfy the bank's depositors and other creditors. All else equal, the possibility of this additional penalty should reduce shareholders' risk-taking preferences, leading to less failure (Macey and Miller, 1992, Esty, 1998). There are, however, several countervailing forces that might make double liability ineffective (we discuss these in more detail in the next section). First, since deposit insurance was not available during our sample period, depositors might not allow single liability banks to lever up as much as double liability banks. Second, double liability depositors may permit more risk taking while expending less effort on monitoring (Calomiris and Wilson, 2004, Anderson, Barth, and Choi, 2018), mitigating or even reversing the incentive effects of enhanced liability. Finally, adverse selection of investors who own double liability bank stock might reduce its effectiveness (Winton, 1993, Kane and Wilson, 1998), although empirical evidence does not support this hypothesis (Hickson and Turner, 2003a, 2003b, 2005, Acheson and Turner, 2006, 2008, Turner, 2009, Bodenhorn, 2015).

The prior literature finds mixed evidence on the effects of double liability on bank risk taking and failure. Some studies show evidence consistent with reduced risk taking. Using a sample of 84 banks in California, Illinois, and Missouri in the early 20th century, when liability rules for state-chartered banks varied by state, Esty (1998) finds that asset and equity return volatility were lower for banks operating under stricter liability rules. Koudijs, Salisbury and Sran (2019) find that New England banks whose managers had additional liability made safer loans, were less likely to delay the recognition of losses, and lost less capital after the Panic of 1873. Outside the U.S., Turner

[5] See, amongst many others, Friedman and Schwartz (1963) on the role of bank runs and the fall in the money supply, Bernanke (1982) on the drop in intermediation capital, Eichengreen (1992) on the role of the international Gold Standard, Calomiris and Mason (2003) on the role of fundamentals and regional shocks, Richardson and Troost (2009) on the role of individual Federal Reserve banks and Mitchener and Richardson (2018) on the role of interbank networks.

(2014) provides qualitative evidence that unlimited shareholder liability was associated with fewer bank failures in the U.K.

Other studies are less supportive. Grossman (2001), using U.S. state-level data from 1892-1930, observes less bank failure in states with additional liability during normal times, but more bank failure during periods of banking crises, in particular 1930. Calomiris and Wilson (2004) show that between 1929 and 1933, additional liability was associated with higher, not lower, asset return volatility for a sample of around 40 banks in New York City. Goodspeed (2019), studying pre-1863 data, finds that banks with double liability were less likely to fail in the Panic of 1837, however, this effect is not present in other years.

Given the theoretical questions about double liability's effectiveness and the contradictory empirical evidence, the impact of additional shareholder liability on bank risk taking remains an open question. Our paper brings new evidence to bear by studying the effects of a large economic shock – the Great Depression – on the failure of banks with different liability regimes. We focus on bank failure as the ultimate measure of risk taking. We improve on the existing literature by carefully creating comparison groups. We select neighboring state pairs to control for regional shocks and take Federal Reserve Bank districts into account to homogenize regulatory regimes. We focus on banks of similar size to ensure that size differences are not driving our results. Our large, hand-collected data set of around 4,400 individual banks across 8 state-pairs allows us to further control for other covariates that may explain bank failure.

More precisely, we compare the failures of state-regulated banks ("State banks") in states that had single liability with those in neighboring double-liability states. We compare like-with-like as best as we can. Richardson and Troost (2009) show that the policies of different Federal Reserve banks differed greatly during the Great Depression, with significant impact on bank outcomes. Therefore, we focus on state pairs that were part of the same Federal Reserve district. Wicker (1996) and Calomiris and Mason (2003) show that banking panics often had a strong regional character. We therefore require the paired states to have similar failure rates of National banks, which faced the same regulation everywhere. Federal Reserve (1932) and Wheelock (1995) show bank size to be a strong predictor of failure during the Great Depression, with much higher failure rates for small banks. Therefore, we restrict ourselves to banks that are on the common support of bank size within each state-pair, and we control for bank size in our regressions.

Our sample selection procedure, described in Section III and Online Appendix Section A, leads us to consider six single liability states: Alabama, Connecticut, Missouri, New Jersey, Tennessee, and Virginia. These are matched to six neighboring double liability states: Georgia, Kentucky, Massachusetts, Maryland, New York and Pennsylvania. For our analysis, we split up states that were part of two different FED districts (Connecticut, New Jersey, Kentucky, Missouri, and Tennessee). As a result, our analysis spans eight State-FED district pairs. The map in Figure 1 has details.

This paper is related to a broader literature on the impact of double liability on bank outcomes. Anderson and Watugala (2017) and Anderson, Barth, and Choi (2018) consider deposit withdrawals as a form of bank distress. They find that banks with more shareholder liability suffered smaller withdrawals during the Panic of 1893 and the Great Depression, respectively. They argue that depositors in banks with additional liability had weaker incentives to monitor and that additional liability weakened depositor discipline. We observe similar results but have a different interpretation. In line with our failure results, we argue that smaller deposit outflows are indicative of double-liability banks being in better health to begin with, or of less subsequent risk shifting, rather than of reduced depositor discipline.

Another strand of the literature focuses on bank leverage as a measure of risk taking. Theoretically, the impact of double liability on leverage is ambiguous. On the one hand, double liability reduces the incentive to take more risk by increasing leverage. On the other hand, the additional claim against shareholders in bankruptcy allows banks to raise more debt at more attractive terms. Using different datasets, and studying different periods, this literature finds mixed results. Some papers observe a negative impact of double liability on leverage (Grossman 2001, Mitchener and Richardson 2013, Koudijs, Salisbury and Sran 2019), while others find no or a positive effect (Evans and Quigley 1995, Bodenhorn 2015, Grodecka and Kotidis 2016, Anderson and Watugala 2017, Anderson, Barth, and Choi 2018).

Even though we find that double liability was effective in reducing bank failure, it was quickly repealed after 1933 (Mitchener and Richardson 2013). What explains this apparent discrepancy? Macey and Miller (1992) argue that abolishing double liability was a political decision that was not necessarily economically optimal. During the Great Depression, many shareholders had to pay double liability claims, right at the moment when they were already in serious financial trouble.

Many of them were not involved in the banks' management and, therefore, not directly to blame for failure. This created political resentment against the system. Wilson and Kane (1996) argue that dispersed share ownership undermined the efficacy of double liability. The creation of deposit insurance, in combination with increased government monitoring, appeared sufficient to safeguard the financial system and double liability was repealed. According to Macey and Miller (1992, p. 32), "history shows that the nation took a wrong turn when it abandoned double liability for a system of governmentally administered deposit insurance." Our results are consistent with this claim, at least to the extent that double liability appears to have been effective in curbing risk taking and increasing bank stability.

The rest of the paper is organized as follows. Section I discusses double liability and its expected effects on risk taking and bank survival. Section II reviews the historical background, providing more information about different liability regimes for banks and developments during the Great Depression. Section III reviews our data and reports summary statistics. Section IV provides the main empirical analysis. Section V examines alternative hypotheses that could explain our findings. Section VI concludes.

I. Conceptual framework

The key difference between single (SL) and double liability (DL) is that under the latter regime shareholders incur a penalty in case the bank fails. This is different from higher capital requirements as the additional money that shareholders are expected to pay is not available before a bank fails. As such, DL does not have the same "buffer" function that higher capital requirements have. But its impact on shareholders' incentives is similar.

Holding the leverage of the bank constant, shareholders will be more averse to DL banks investing in riskier assets as shareholders have greater personal exposure to losses. Shareholders in SL banks, on the other hand, are protected by limited liability and have standard risk-shifting incentives. These are aggravated by the quality of bank assets being largely *unobservable* to depositors, and banks being unable to commit ex ante to making safer loans. As a result, SL banks should take more risk and be more likely to fail than DL banks in bad states of the world.

It is not obvious, though, how the liability regime affects bank leverage. Leverage is mostly *observable* to depositors, and with callable deposits the bank's lack of commitment is not a relevant

issue (Calomiris and Kahn 1991, Diamond and Rajan 2001). This creates ambiguous predictions. On the one hand, DL banks might have higher leverage, as depositors accept lower interest payments because they understand that DL banks endogenously take less risk on the asset side. In response, banks might decide to issue more deposits and increase their leverage, reversing some of the direct incentive effect of DL on the riskiness of banks' assets. At the same time, SL banks might take on less leverage to commit themselves to investing in safer assets. In the extreme, these effects might undo the effect of DL altogether and create a situation where DL banks are more highly levered than SL banks, yet take the same amount of risk on the asset side. On the other hand, DL banks might have lower leverage simply because their shareholders are more exposed to bank failure. Koudijs, Salisbury and Sran (2019) analyze the case when bankers are risk averse. Ex ante, they value the fact that they are able to walk away from the bank's deposits as this creates risk sharing between them and depositors. Imposing DL reduces this risk sharing and makes bankers reluctant to increase leverage. As a result, they take less risk on the asset side than they would under SL. It is ultimately an empirical question which of these effects dominates.

The literature has identified a number of reasons why, even keeping leverage constant, DL might be ineffective or could even be counterproductive. First, depositor discipline, highlighted by many as an important device for reducing bank risk (Calomiris and Kahn 1991, Diamond and Rajan 2001), might be severely weakened. Depositors in DL banks will receive a payout in case the bank fails, which might reduce the amount of monitoring effort they are willing to exert (Calomiris and Wilson, 2004, Anderson, Barth, and Choi, 2018). Second, it is possible that DL shareholders are adversely selected. That is, only people with no personal wealth to lose might be willing to buy bank shares. Such people would have only weak incentives to rein in risk taking (Winton, 1993, Kane and Wilson, 1998). Moreover, if skill and personal wealth are positively correlated, the quality of shareholder monitoring might go down. New York Governor, and future U.S. President, Martin Van Buren signaled this already in 1839 when he spoke of the potential "low character" of bank shareholders with DL (Knox 1900, p. 400). Third, DL might simply not affect shareholder behavior if banks' charter values are so high that taking risks that might lead to bank failure would always be value destroying (Keeley 1990).

The grand sum of all of these forces is that there is no clear theoretical prediction whether DL banks will be riskier than SL banks in equilibrium, making this, ultimately, an empirical question.

II. Historical background

In our empirical design, we compare failure rates of state regulated banks across state borders with different liability regimes. We use nationally regulated banks, that all faced the same regulations, to estimate a differences-in-differences regression. In this section, we provide more details how the U.S. banking system was regulated and briefly discuss how the Great Depression played out for the banking system.

A. Structure of the banking system in 1920s

For political reasons, the American banking system of the 1920s was organized around locally operated banks. Branching, if allowed, was typically restricted to the same city, town, or (sometimes) county. In two states in our sample, Virginia and Maryland, banks could branch statewide. No bank operated across state lines. Banks traditionally focused on making loans to firms (including the discounting of commercial paper), but over time had also ventured in lending money on the collateral of real estate and securities. There were some limits to entry: in particular, banks could only obtain a bank charter if they raised a minimum amount of (equity) capital (Federal Reserve 1932, White 1983, Mitchener 2005).

Banks were either regulated at the national or state level, depending what type of charter a bank operated under. The regulator for National banks was the Office of the Comptroller of the Currency (OCC), for State banks this was the local state banking department. Regulation under the two systems could differ substantially. First of all, all shareholders of National banks faced double liability, whereas, in some states, State banks had single liability. Second, National banks typically had higher reserve and minimum capital requirements. Third, National banks faced more restrictions on their loan portfolios. Most importantly, loans backed by real estate (important for banks in in rural areas) were restricted to 25% of total equity capital.[6] Fourth, the supervision of state bank departments was considered laxer than that of the OCC. Finally, until the McFadden Act of 1927, National banks faced considerable restrictions in their ability open bank branches, whereas, in certain states, State banks faced no such restrictions (White 1983, Robertson 1995, Mitchener 2005).

[6] Such loans were deemed too illiquid and long term and would therefore lead to too much maturity mismatch (Federal Reserve 1932, p. 126).

National banks were automatically a member of the Federal Reserve System, which gave them access to the FED's discount window. State banks could decide to become a member if they fulfilled the same capital and reserve requirements as National banks (White 1983, p. 98, 135). Smaller, rural banks typically decided not to become members. First, they often did not have enough capital to qualify. Second, they had little collateral that would be eligible at the FED's discount window and they could obtain indirect access through their FED-member correspondents in large cities. Third, in their line of business, they typically held few reserves so that the FED's high reserve requirements were particularly costly. Fourth, reserves at the FED paid no interest, whereas money deposited at their correspondent banks did (White 1983, p. 133-4, 156). Larger state banks often did become FED members. They retained "their full charter and statutory rights". Compared to National banks, they continued to face fewer restrictions on their loan portfolios. They were able to branch statewide (if allowed by state law), a right National banks only obtained after 1927. Moreover, even though the FED had the right to examine State member banks on an ad hoc basis, the local state banking department, which was seen as "less exacting" than the OCC, remained their primary regulator (Federal Reserve 1932, p. 25, 31, White 1983, p. 166).

As such, we can distinguish between two types of State banks. The first were small, rural banks, that either did not have enough capital to be eligible to become a National bank or a member of the Federal Reserve system, or who decided the costs did not outweigh the benefits. The second were larger city banks who did want to be a FED member, but who valued more lenient regulation and (presumably) preferred to deal with the state regulator, and therefore did not seek a national charter.[7]

Within the category of State banks, we can distinguish two groups: banks and trust companies. The latter had originally been chartered in the late 19th century to act as trustees to manage the estates of affluent clients, family trusts, married women, deceased individuals, etc. Over time, trust companies obtained the rights to issue deposits, make loans and discount commercial paper. By the end of the 1920s, at least for the states in our sample, State regulators had largely leveled the playing field, and few, if any, regulatory differences remained between banks and trust companies (Federal Reserve 1932, p. 54, 58). According to White (1983, p. 40), "by the early 20th century,

[7] Based on a questionnaire, the Federal Reserve concluded in 1932 that prestige was the main reason to apply for a national charter, while the ability to branch, fewer restrictions on real estate loans, better ability to carry on a trust business, and laxer supervision were the main motivations for pursuing a state charter (Federal Reserve 1932, p. 100).

many trust companies were almost indistinguishable from state banks". To reflect that the former could engage in both banking and trust management, they typically had to hold higher amounts of capital. If banks wanted to enter the trust business, they had to fulfill State statute requirements for trusts as well. In our empirical design, we do not distinguish between the two.

B. Regulation

Banks faced numerous regulations. First of all, most states had rules on the types of loans banks could make, or the classes of securities they could invest in. Apart from loans on real estate, there were restrictions on loans to individual borrowers (to avoid under-diversification), and bank officers. On top of that, banks faced reserve requirements, forcing them to hold a certain percentage of deposits as cash or as deposits either with the FED or with larger banks in traditional money centers. Second, banks had to hold a certain minimum dollar amount of paid-in capital (equity). Dividends could only be paid out of current profits. Third, banks faced regulation of their board and officers. The supervisory board had to have a minimum number and each had to hold a minimum number of shares, typically ten. Bank officers often had to sign bonds, which would pay out in case they acted in bad faith[8] and there were criminal penalties for bad behavior. Finally, there were rules for the operation of a state's banking department, stipulating the frequency and nature of bank examinations and the authority of the banking department with respect to troubled banks (White 1983, State statutes).

On many dimensions, the state banking laws were copies of the National Banking Act (regulating National Banks) and, therefore, relatively homogenous across states. Nevertheless, on other dimensions, important differences remained (Mitchener 2005, 2007). The choice for single or double liability was one of them. In addition, there were differences in minimum capital and reserve requirements, restrictions on particular loan types, the authority of state banking departments, and limits on branch banking. In Section V.A we provide more details and show that the regulation of banks was not systematically different between states with double or single liability.

Federal deposit insurance did not exist in the 1920s. While different states had experimented with state deposit insurance schemes earlier in the century, all had failed before the end of the 1920s

[8] Bonds had to have good sureties. At least in theory, this led to a positive selection of people into banks.

(Aldunate 2019, Calomiris and Jaremski 2019). In our empirical design, we only use states that did not have state deposit insurance earlier in the 1920s.

C. Liability for bank shareholders

Additional liability for bank shareholders was an important tool for regulators to curb risk taking. Around 1830, most U.S. states had regulations that limited shareholders' liability to their invested capital (Blumberg 1985). Banks were the exception, and many states introduced additional liability. For example, New York had double liability for bank shareholders between 1827 and 1829, and then again after 1850. Massachusetts and Pennsylvania introduced it in 1811 and 1808, respectively. After limiting its force in 1850 by only protecting banknotes, both reintroduced double liability in full around 1870 (Bodenhorn 2015, Mitchener and Jaremski 2015). The table below provides the years of introduction of double liability for the states in our sample. By 1893, 36 years before the onset of the Great Depression, the situation had solidified and no further changes occurred afterwards.

GA	KY	MA	MD	NY	PA
1893	1893	Pre-1870	1851	1850	1876

Sources: Bodenhorn (2015), Mitchener and Jaremski (2015), State statutes

There are multiple reasons why states introduced double liability for their banks. Mitchener and Jaremski (2015) suggest that it was originally introduced as a relatively cheap form of regulation, in lieu of creating a (costly) separate banking department that could monitor banks. Of the 39 states that eventually introduced double liability, 32 did so before the creation of their banking department. Another reason for states to introduce double liability after 1865 was the fact that National Banks, by the banking act of 1864, also had it, presumably nudging some states to introduce it as well. Finally, Grossman (2007) provides evidence that states with a history of financial instability, and those with a larger financial sector, were more likely to adopt double liability.

Under double liability, shareholders faced a penalty in case the bank failed, up to the par value of their shares (which corresponded to paid-in capital). Macey and Miller (1992) argue that this was strictly enforced and that the courts widely upheld it. There were a number of additional rules to prevent investors from escaping their claims. If a share was sold after a bank had gotten into trouble, the seller remained liable. In some states, the seller remained liable for up to a year after

the transaction in case the purchaser became insolvent (State statutes). During the Great Depression, many shareholders were hit by double liability claims.[9] The incidence of claims was so widespread, that it appears to have fomented a political movement to end the institution of double liability (Macey and Miller 1992).

D. Great Depression

During the Great Depression, many banks became troubled. After the U.S. stock (and real estate) markets crashed in October 1929, the banking system soon came under pressure. According to Friedman and Schwartz (1963), there were three banking panics between 1929 and 1933. By March 1933, most states had proclaimed a "Bank Holiday" for their banks, suspending payments, which newly elected President Roosevelt quickly extended to banks nationwide. After granting the FED powers to create emergency currency, many banks were reopened and the crisis dissipated (Silber 2009). More than a third of all commercial banks existing in 1929 permanently closed their doors during the Depression.

The banking panics had a strong regional character (see, amongst others, Wheelock 1995, Wicker 1996, Calomiris and Mason 2003). The majority of banks that failed were small and rural. These banks had suffered most from the agricultural depression of the 1920s. Moreover, rural areas appear to have been "overbanked" – state regulators especially seem to have allowed too many small banks charters. (Wheelock 1995, FED 1932, p. 125).

As is the case in much of the literature (see, for example, Wheelock 1995), our sample runs up to February 1933. After the National Banking Holiday in early March 1933, there was significant government intervention. All banks were closed and only those permitted by regulators could reopen their doors. In part, this decision could have been driven by general economic considerations, not directly related to the risk-taking of the bank, or even political factors. Furthermore, many banks recapitalized by issuing preferred stock to the Reconstruction Finance Company (RFC). As with other (early) Depression-time programs, it is possible that allocation of RFC funds was at least in part political (Wallis 1998, Mason 2003, Wallis, Fishback and Cantor 2006).

[9] Double liability on bank stock was one of the particular concerns for Ohio lawyer Benjamin Roth chronicling the economic consequences of the Great Depression (Roth 2009).

E. Mergers/acquisitions, suspensions

A bank was "troubled" if it had sustained losses so that its paid-in capital (the largest part of a bank's equity) was impaired. If this happened, a bank had multiple options[10]. The most benign was to simply write down its capital (and reduce the size of the bank). This was complicated by the fact that a bank could not reduce its capital below the required amount. Alternatively, it could try to raise capital from outsiders or, in certain states, it could level a (typically voluntary) assessment on existing shareholders to make up the deficit.

If a bank was unable to fix the impairment to its capital, the bank was forced to close its doors. If still solvent, a bank would typically try to make a deal with another, non-troubled, bank. First of all, it could try to sell its assets to this bank and use the revenues to repay depositors, paying out the surplus to shareholders. During the Great Depression, this was difficult to accomplish. Due to the adherence to the Gold Standard and the occurrence of bank runs, there was a high demand for cash, both with the public and the banks. Few banks were able or willing to use the cash they did have available to purchase slow assets. Therefore, banks typically tried to merge or consolidate with a stronger bank that would both take over its assets and liabilities, and no cash was required. This was risky for the acquiring bank. Dissenting shareholders could enforce their right to be bought out at the "true" value of their shares. Moreover, acquiring another bank's liabilities put its own liabilities at risk, something that was sometimes strictly forbidden by law. If such a merger or acquisition proved impossible, a troubled bank could ask another bank to act as its liquidating agent. In this case, the stronger bank would take the assets into liquidation (presumably for a fee). If the revenues were sufficient to meet liabilities, the surplus would be returned to the original shareholders. If the revenues were not sufficient, the original shareholders, if subject to double liability, would remain responsible for the deficit.

If insolvent, a bank was taken into receivership. Depending on the state, either the court appointed a receiver, or the banking department automatically assumed this role. If this happened, the receiver typically sought to liquidate the bank's assets. Typically, it would sell off all "acceptable assets" to another bank, who would then usually be involved in the liquidation of all doubtful assets (for a fee). Attempts to have the bank merge with another institution were often frustrated

[10] This section is based on Columbia Law Review, 32-8 (Dec. 1932), pp. 1395-1410

by court cases from dissenting shareholders or creditors, especially if the receiver needed approval from the courts. If subject to double liability, original shareholders remained liable for any deficits.

III. Data

A. State selection

Wheelock (1995) and others have pointed out that there was a strong regional component to bank failures in the Great Depression, which mainly affected small and rural banks. Richardson and Troost (2009) provide evidence there was significant variation in the policies of regional Federal Reserve banks. Therefore, we focus on state-pairs that (1) share a border, (2) are in the same Federal Reserve district, (3) have similar failure rates of National Banks, and (4) have similar (state) bank sizes. For our analysis, we split up states that were part of two different Federal Reserve districts. We omit all state-FED districts that had fewer than 50 state banks. Online Appendix A provides more details regarding our sample selection procedure.

Our final sample consists of 6 states with single liability (SL) spanning 8 state-FED districts (see Figure 1). We match these to state-FED districts with double liability (DL). Georgia and the part of Kentucky that is in Fed district 8 each serve as a match to two SL states, and their banks enter the sample twice. We correct standard errors to account for this duplication.

B. Sources

We use two different data sources. We obtain information on bank failures from forms St. 6386 recorded by the Federal Reserve Board of Governors' Division of Bank Operations.[11] A nationwide reporting network had been established in the 1920s to collect uniform and comprehensive information about suspensions, mergers or acquisitions, and other bank changes. The data cover all banks, including for National and State banks, Trust companies and banks that were not a member of the Federal Reserve (Richardson 2007). We hand-collected the data for all 12 states in our sample.

We obtain annual bank balance sheet data between 1928 and 1933 from the OCC's annual reports (for National banks) or from state bank reports (for State banks). The latter are not available for Maryland, Pennsylvania and Tennessee, and we use Rand McNally's *Banker's Directory*

[11] The forms are currently located in the National Archives: Record group 82, file number 434.-1

instead.[12] If available, we prefer to use the state banking reports, as we believe their numbers to be more accurate. We collect this information for all banks with published data. The reported balance sheet categories are relatively coarse. While the liability side of the balance sheet is fairly detailed, the asset side is not. We are only able to distinguish between cash-like reserves, and a line item comprising loans and securities. We do not have information about the composition of the latter. This is one of the main reasons we look at bank failure as our key outcome variable. Again, we hand-collected the data for all 12 states in our sample.

Finally, we use various sources to obtain more information about differences in regulatory regimes. First, we use Mitchener and Richardson (2013) to determine which states either had single or double liability for their banks. Second, we use a 1932 FED publication to obtain information on State bank regulators, and we use FED bulletins from 1929 for reserve requirements and rules on branch banking. Finally, we locate the original state statutes on *Heinonline.org* to determine minimum capital requirements, state-level restrictions on bank's asset portfolios and other regulatory differences.

C. Common support of bank size

The majority of banks that failed during the Great Depression were rural and small. According to Wheelock (1995), bank size itself, and characteristics related to size such as (lack of) diversification, were an important cause of failure. Therefore, to compare like with like, we use banks of similar size. Specifically, we restrict the sample to the common support of bank sizes in each pair, both when comparing State banks across state borders and when comparing State and National Banks (details are in Online Appendix B). Due to practical limitations we do not implement a formal matching procedure.[13]

Table 1 summarizes the distribution of bank size, both before and after restricting the sample to the common support. Panel A reports the full sample. Two features stand out. First, National banks were on average larger than State banks, despite the existence of a number of very large State banks. Second, states with DL had State banks that were on average 6 times larger than SL State banks. Therefore, if size is indeed negatively correlated with failure, DL state banks will appear

[12] For Alabama and Georgia the state banking department only published data every 2 years.

[13] When trying to implement such a procedure, we found that we frequently matched to the same banks, thereby overweighting a few particular banks and underweighting other banks of similar size. Focusing on the common support gives all banks with similar size equal weights.

safer even if the liability regime itself is unimportant. This effect is largely (but not entirely) driven by the fact that some of the DL states in our sample - New York, Pennsylvania and Massachusetts - featured the largest banks in the country. Consistent with this finding, National banks in DL states were also 2.5 times bigger than those in SL states.

Panel B reports statistics for the common support sample. Here, size difference are much smaller, as the largest and smallest banks in each pair tend to be omitted. The total number of banks drops by around 16%. The decrease in observations is largest for SL state banks. Remaining size differences go in the same direction as Panel A. Most importantly, State banks in SL states still appear significantly smaller than the other banks in the sample. Panel C implements weights such that we weight each state-pair equally. That is, if a state-pair has many banks, for example Pennsylvania-New Jersey, it will be down-weighted to look like the average pair. Our regression analyses consistently implement this weighting scheme, ensuring that our aggregate results are not dominated by the banking centers of New York and Pennsylvania. This further reduces average size differences, but State banks in SL states still appear smaller. Looking at medians, however, State banks in SL and DL states look almost indistinguishable, although they do look much smaller than National banks. For the 25th size percentile we observe the same pattern, while the 75th percentile is relatively homogenous across all four categories. To summarize, the State banks in our final sample are generally of similar size across SL and DL states, but are smaller than National banks. To account for any remaining size differences, we add size controls to some of our regression analyses.

D. Variables

Outcome variables

Our first set of outcome variables deals with the condition of bank balance sheets in 1928. In particular, we look at (1) bank leverage (the ratio of total debt-to-assets) and (2) the ratio of cash-to-deposits. We winsorize each variable at the 1st^{h} and 99th percentile. Both variables measure the riskiness of bank balance sheets: a higher leverage ratio makes a bank more sensitive to shocks in the value of its assets, and a lower cash-to-deposits ratio makes a bank more sensitive to runs, an important consideration in the absence of deposit insurance.

Our primary outcome of interest is bank failure. We consider three different measures: (3) outright suspensions, (4) mergers/acquisitions and (5) troubled raising. Category (3) is straightforward. For

(4) we determine which bank in a merger/acquisition actually disappeared by looking at the charter under which the combined bank continued. For measure (5) we condition on surviving banks and identify new equity raising by looking at increases in paid-in capital.[14] In particular, using annual balance sheet data, we look at whether a bank increased its paid-in capital at any point between 1928 and the end of 1932. We do not count equity raising as troubled if it was associated with any mergers/acquisitions or if the total amount of equity in 1932 was higher than in 1928. This leaves us with equity raising events that presumably resulted from a bank's need to recapitalize. This measure misses troubled raising if a bank, in the same fiscal year, both wrote down paid-in capital and raised new equity to make up for that deficit. Unfortunately, this is a limitation of the available annual data.

While predictions for bank suspension are unambiguous (we expect SL banks to take more risk and therefore to suspend more frequently), those for mergers/acquisitions are not. Other banks and outside equity providers will only be willing to invest in a bank if there is positive net value. If losses are too large, no one is willing to assume the bank's deposits and other debts. The bank will simply suspend. If the additional losses faced by SL banks were sufficiently large, it is therefore possible that we observe *many* more suspensions but fewer mergers or acquisitions.

In our baseline regressions, we aggregate these three items as (6) "total trouble". Just as for suspensions, predictions for total trouble are unambiguous. If SL banks suffered substantially larger losses than DL banks, they should have been more likely to *either* suspend, merge or raise capital, even if predictions for the latter two are ambiguous. Moreover, calculating total trouble addresses the issue that state regulators may have acted differently in case a bank got into trouble depending on their regulatory authority. In particular, certain regulators may have assisted in arranging a merger, while others may have pushed for immediate liquidation. Looking at aggregate trouble efficiently combines these cases.

As secondary outcome variables we look at (7) capital write-downs, (8) changes in deposits and (9) changes in total assets (the size of a bank's balance sheet). For (7) we take the log-difference between total equity at the end of 1932 and 1928, omitting all capital raising. That is, suppose

[14] If a bank issued new equity, it had to increase its paid-in capital. Retained earnings (which includes capital raised in excess of par) would only go up if a bank managed to issue shares above par.

paid-in capital increased during a fiscal year from C1 to C2, then we subtract C2-C1 from total equity at the end of 1932. For (8) and (9) we simply look at log-changes between 1928 and 1932.

Explanatory variables

Our key right-hand side variable is whether a state mandated single or double liability. As additional controls, we use information from the 1928 bank balance sheets, in particular size (total amount of assets), leverage and cash/deposits.

E. Summary statistics

Table 2 presents the summary statistics for all relevant variables (excluding size) for all State and National banks in our sample. What stands out is that, as of end-of-1928, bank's leverage was relatively high (though not as high as today). On average, a 20% shock to asset values would be sufficient to wipe out equity. This masks considerable heterogeneity. In particular, Figure E.1. in the Online Appendix shows that larger banks had more leverage.

Around 25% of banks in our sample failed between 1928 and February 1932, predominantly through suspensions. The main reason why this is lower than the national average of 45% is that we end the sample in February 1933, before the National Banking Holiday. Troubled raising was relatively rare, only 2.5% of banks pursued this option, although we may miss a substantial number of raining events due to data limitations. On average, banks lost a substantial amount of deposits during the Depression, around 30%. Surprisingly, capital write-downs were much more limited. This is likely because these variables are only calculated for surviving banks. It therefore appears that capital was only written down in meaningful amounts when a bank failed.

IV. Empirical results

In this section, we first lay out our empirical strategy, motivating the single and double difference estimators we use. We then discuss bank leverage and cash holdings in 1928 at the onset of the Great Depression, bank failure between 1928 and February 1933, and capital write-downs and reductions in deposits and total assets. Finally, we link our findings back to our conceptual framework.

A. Empirical strategy

In our baseline empirical tests we compare bank outcomes $Y_{i,s}$ between the two state-FED districts in each pair. Initially, the tests are restricted to State banks. For each separate pair $p \in [1,8]$ we run the following regression:

$$Y_{i,s} = \alpha + \beta SL_s + \varepsilon_{i,s} \quad (1)$$

where *i* indexes a bank and *s* a state-FED district within a pair. Coefficient α is the average outcome for banks in the state-FED district with DL, β is the average difference in outcomes between state-FED districts with SL and DL.

There is a question how to aggregate these coefficients over all 8 pairs. If we were to run a simple pooled regression with all banks, our careful matching between state-FED districts would be lost. This is a problem if there are large differences in the baseline failure rates between pairs *and* the number of banks in each state-FED district. In that case, the states with the largest number of banks will dominate the SL and DL groups. Depending on the severity of the Depression in these states, this will lead to upward or downward bias in our coefficients. Table E.1 in the Appendix shows that the number of banks in each state-FED district differ dramatically and this is a relevant concern. In response, we use pair-specific weights to make sure that each pair is weighted equally, effectively down-weighting states with many banks. This yields the same aggregate coefficients as simply taking the average over the 8 individual pairs. As an alternative, we run pooled regressions with pair fixed effects. Results, presented in Section V.D, are quantitatively similar.

Our careful selection of state-pairs notwithstanding, there is a concern that these estimates are biased if DL and SL states are hit by different economic shocks. Following the literature[15], we therefore bring National banks, which faced DL in every state, into the analysis. Due to the differences in regulation discussed in Section II.A, it is difficult to compare National and State banks directly, even if the latter were members of the Federal Reserve system. However, we can use the differential outcomes for National banks to control for differences in economic shocks between states by subtracting that difference from our estimates of β in Eqn. (1). Concretely, we estimate the following difference-in-difference equation for all pairs separately:

[15] See for example Grossman (2001) and Mitchener and Richardson (2013).

$$Y_{i,s,b} = \alpha + \beta SL_s + \gamma SB_{i,b} + \delta SL_s SB_{i,b} + \varepsilon_{i,s,b} \quad (2)$$

where *b* indexes whether bank *i* is a State or National bank and SB_b is a dummy taking a value of one for State banks. The coefficient of interest, δ, is the diff-in-diff estimate of the impact of SL on bank outcomes. If our selection of state-pairs was sufficiently careful, we would not expect the diff-in-diff estimate δ in Eqn. (2) to be significantly different from the single difference estimate of β in Eqn (1). As before, we run this equation for all state pairs separately and take averages of the resulting coefficient to arrive at the aggregate effects.

Throughout, we report standard errors that are clustered at the individual bank level to reflect the fact that banks from Georgia and Kentucky (8) enter the sample twice (leading to duplicate observations). This approach assumes that residuals are independent across individual banks. There are two reasons why this might not hold. First, the liability regime faced by banks only varies at the state level. This could lead to within-state correlation of residuals. Second, banks within the same pair were presumably exposed to similar shocks and this could lead to within-pair correlation of residuals. To deal with this, we also double-cluster our standard errors at the state and state-pair level. Since both New Jersey and Tennessee are split into two separate FED districts, and each occur in two different pairs, there is no perfect overlap between the two levels of clustering. In total, we have 12 states and 8 pairs in our data. We apply the wild cluster bootstrap to obtain p-values that account for the limited number of clusters (Cameron, Gelbach and Miller, 2008 and Roodman, MacKinnon, Nielsen and Webb, 2019). Throughout, double-clustered p-values are reported in square brackets below the coefficient of interest.

B. Leverage and cash holdings in 1928

The first set of results relates to bank balance sheets in 1928, in particular bank leverage (debt-to-assets) and cash-to-deposits. Results are in Tables 3 and 4, where the single difference estimates are in Panels A, and the double difference estimates in Panels B. Each column presents results for one of the 8 state-Fed district pairs in our sample, and the final column gives the average.

The tables indicate significant heterogeneity in the effect of SL on leverage and cash-to-deposits across state-pairs. In some states, the effect is positive, whereas in others it is negative. Standard errors for the within-pair estimates are not adjusted for the fact that the liability regime only differs at the state level and should be interpreted with caution. The aggregate results in Column (9)

indicate no systematic difference in leverage between SL and DL banks; the effect is economically small, both in the single and double difference, and statistically indistinguishable from zero. For cash-to-deposits the aggregate results have different signs in the single and double difference specifications. In both, the economic effect is relatively small and statistically insignificant in both the single and double difference. Overall, these results imply that, on *observables* and controlling for size, the SL banks in our sample do not appear riskier on the eve of the Great Depression.

C. Bank failure, 1929-Feb. 1933

Next we turn to bank failure, the most important outcome variable in our tests. The baseline results are in Table 5, in which we analyze our measure for total trouble. We find that, consistently across all 8 pairs, SL banks faced a higher probability of failure (although, again, standard errors for the individual pair regressions should be interpreted with caution). The effect is not restricted to a specific geographic area. For example, in the single difference the estimates are largest for Connecticut-Massachusetts, Virginia-Maryland, and Missouri-Kentucky, three very different state pairs. The aggregate effect in Column (9) is statistically significant, both in the single and double difference estimates. The economic effect of SL is comparable in both specifications, if anything the effect is stronger in the double difference. In the single difference, SL banks face a 40% higher probability of failure.

In Table 6 we add additional controls to these estimates, for brevity we focus on the aggregate results. For comparison, Column (1) replicates Column (9) from Table 5. In Columns (2) and (3) we control for bank size, either using log(total assets) or quintiles of the total asset distribution. Because we restrict ourselves to banks that share common support in terms bank size, we do not expect this to have much an effect on the coefficient estimates. The table confirms this expectation (if anything the results become stronger). In Columns (4) and (5) we add controls for initial 1928 bank leverage (debt-to-assets) and cash-to-deposits. Since SL and DL did not look systematically different on these dimensions in 1928, we do not expect this to have much effect on the coefficients. Again, the table confirms this. Altogether, the results suggest that bank size or initial *observable* balance sheet conditions cannot explain our results.

In Table 7 we split the "total trouble" variable into its constituent parts. Results indicate that SL had a substantial effect on suspensions and is particularly prominent in mergers/acquisitions. In the single difference, SL increases the probability of suspensions by 23% and exits through a

merger by 66%. The effect is only statistically significant for mergers/acquisitions. There is no effect on troubled raising. This might not be surprising given that only 2.5% of banks appeared to have recapitalized by raising new equity. Results are similar in the double difference, where the economic effect on suspensions is virtually the same, though more noisily estimated. The effect on mergers/acquisitions and troubled raising is somewhat larger.

Forms St. 6386 report the immediate reasons for suspensions (this information is not given for mergers/acquisitions). In Table E.2 in the Online Appendix we explore the most important reason that drives our results. Most important is "slow paper" – loans that were not repaid at maturity. There is also a role for "heavy withdrawals" – bank runs – but this effect is only half as large as for slow paper.

D. Losses and changes in deposits and total bank size, 1929-1932

The previous results indicate that banks with SL were more likely to fail. Next we study what happened to capital write-downs, deposits and total assets, all in terms of percentages of 1928 initial values. Results are in Table 8. Again, for brevity, we focus on aggregate results. For completeness, in the odd-numbered columns we report estimates for all banks, including those that failed, for which we take the last available information about capital, deposits or assets *before failure*. In the even-numbered columns we restrict the analysis to surviving banks. In Columns (1) and (2) we consider capital write-downs. Surprisingly, the average amount of capital write-downs is limited (only around 3% for DL State banks), suggesting that capital was only written down in case a bank actually failed. Nevertheless, SL banks wrote down around 4 percentage points more. In the double difference, the effect increases to 10 percentage points. This effect is only statistically significant in the double difference. In Columns (3) and (4) we consider the loss of deposits. Here the baseline effect is larger. DL banks lose around 33% of deposits, whereas SL banks experienced an additional decrease of 5 percentage points. In the double difference this effect is of similar economic magnitude. However, this effect is statistically significant in neither specification. In Columns (5) and (6) we consider total assets. The effects are similar: DL banks saw their assets fall by on average 20%, SL saw an additional decrease of 5 percentage points. Again, the effect is statistically insignificant. In sum, even for surviving banks, SL seems to have had additional negative consequences for bank outcomes, although this effect is only statistically significant for capital write-downs in the double-difference specification.

E. Discussion

The evidence points to a clear conclusion: limited liability for bank shareholders increased the risk of bank failure during the Great Depression. Banks with SL were more likely to suspend or to be acquired by stronger banks. Quantitatively, the results are large. Limited liability for bank shareholders increased the risk of failure from about 25 to 35%. Economically and statistically, the results are strongest for acquisitions. This suggests that losses suffered by SL banks did not necessarily push them into negative equity but did force them to look for a stronger bank to effectively inject fresh equity. The results suggest that raising equity in capital markets was a less common strategy, though we may miss a significant amount of raising due to data limitations. Finally, SL banks that did survive faced larger capital write-downs and losses of deposits.

These effects not driven by *observable* risk taking: in 1928, there were no systematic differences in leverage or cash holdings. Rather the effect appears to come from *unobservable* risk taking, either in the form of greater asset risk before 1929 or in the form of risk shifting after the Depression started. These results are in line with the conceptual framework of Section I where we argued that having SL or DL has ambiguous predictions for *observable* characteristics such as leverage, but, holding these observables constant, clear-cut implications for *unobservable* risk taking.

V. Concerns and robustness

In this section, we discuss a number of concerns with our identification strategy and the robustness exercises we perform in response. We discuss other differences in regulation apart from shareholder liability, the impact of FED membership, the potential differential selection into State and National Banks, and, finally, we replicate our results using fixed effects rather than weights.

A. Regulatory regimes

A key concern with our analysis is that regulation between SL and DL states could have differed in other ways. One possibility is that regulators in SL states tried to compensate by dialing up regulation in other dimensions. If that were the case, our estimates would be downward biased and the true effect would be even stronger. Another, more concerning, possibility is that regulators in SL states were generally more lenient, leading to upward bias. In response, we examine differences in regulation between within state-FED district pairs. To determine which elements were

important, we rely on the existing literature, especially Federal Reserve (1932), White (1983), and Mitchener (2005, 2007).

First, we explore minimum reserve and capital requirements. Higher reserve requirements mean more cash is available in case of a depositor run. Higher capital requirements imply lower leverage for banks at the constraint and lead to higher barriers to entry, especially for smaller (potentially weaker) banks. Within each state-FED district, for each bank in our sample, we determine the reserve and capital requirements for the town or city a bank is located in (as of 1929). We then present the 20th, 50th, and 80th percentiles of the bank-level distribution. Reserve requirements are for demand deposits only. Results are in Table 9. Although there are some differences within pairs, there are no systematic difference between SL and DL states. For both reserves and capital, requirements were stricter for SL banks in 3 pairs, less strict in another 3 pairs and equally strict in the remaining 2 pairs. This is consistent with the lack of systematic difference in 1928 leverage and cash-to-deposits (Tables 3 and 4), the two variables most sensitive to these requirements.

Second, we use the relevant state laws to construct a measure of other bank-level restrictions, especially on the asset side. Federal Reserve (1932) emphasizes that there was significant variation in this dimension. From a careful reading of the national and state banking laws, we identify 8 different categories. These include restrictions on making loans on real estate, discounting activities, holding corporate securities, and others. Details are in Online Appendix C. As a baseline we consider National banks. For each category, we determine from the state statutes whether the law in a particular state was laxer (-1), equally strict (0) or stricter (+1) than the national law. For topics the National Banking Act stayed silent on (in particular loans to officers and directors) we either code a state as equally lax (0) or stricter (1). We take the simple unweighted sum of these 8 categories. Results are in Table 10, Column (1). A higher score indicates tighter restrictions. Again, although there is substantial heterogeneity, there are no systematic differences between SL and DL states. The law was more restrictive for SL banks in 4 pairs, and less restrictive in the other 4 pairs.

Third, we examine the quality of the state regulator. According to Federal Reserve (1932) there was considerable variation across states. Based on a 1929 American Bankers's Association survey sent out to state regulators (amended with individual state statutes), Federal Reserve (1932) discuss

nine categories of regulator quality.[16] These cover the regulator's general authority, tenure and salary of its head, the frequency of bank examinations, and related topics. Details are in Online Appendix D. Each category contains multiple sub-categories. For each we assign states a score between 0 and 1, where 0 is the worst system in place and 1 the best. We present the sum of these scores, where we weight each of the nine main categories equally. Results are in Table 10, Column (2). Again, although there is considerable variation within state pairs, there are no systematic differences between SL and DL states. Regulator quality was higher for SL banks in 2 pairs, lower in another 4 pairs, and roughly the same in the remaining 2 pairs.

Finally, we consider branching restrictions. States with more restrictive branching requirements might have been riskier because banks were less well diversified (Wheelock 1995, Mitchener 2005). Moreover, there was often intense pressure in these states to open banks in small, rural communities that could not be served by the branch of a larger bank. Such banks were often too small and too dependent on local economic conditions that they were at a high risk of failure (Federal Reserve 1932, Wheelock 1995). Though not obvious, it is possible that SL states were more likely to have stricter rules on branching. Results, based on Federal Reserve (1931), are in Table 10, Column (3). There are three categories: "Prohibited" indicates that no branches were allowed whatsoever (although banks could typically open local agencies to receive deposits and pay checks), "Limited" indicates branching was allowed within the same town, city or municipality, and "Allowed" indicates branching was allowed in other locations within the same state. The table suggests that branching requirements were broadly the same within state pairs. Geographical diversification, and the possibility to open branches in smaller communities, would only have been possible in states were branching was "Allowed". There are only two states in our sample where this was the case, Maryland (DL) and Virginia (SL), which are in the same pair. When looking at differences between "Limited" and "Prohibited" in the other 7 pairs, branching appears to have been less restrictive for SL banks in 1 pair, more restrictive in another 2 pairs, and equally restrictive in the remaining 4 pairs.

In sum, other regulatory differences are unlikely to explain the fact that SL banks failed more. To verify this, we run our baseline regression for total trouble controlling for these regulatory

[16] To the best of our knowledge, Mitchener (2005) was the first to analyze the data from the American Banker's Association's survey.

differences. Results are in Online Appendix Table E.3. Consistent with Mitchener (2005), higher reserve requirements and stricter branching restrictions are associated with more total trouble. The former likely reflects the fact that states with a riskier financial system imposed stricter requirements to begin with, the latter that states with less branching featured more underdiversified banks. Minimum capital requirements, bank level restrictions and regulator quality are not correlated with total trouble. Consistent with Table 10, the inclusion of each regulatory dimension *on its own* does not affect the effect of SL on total trouble. If anything, the effect becomes (marginally) stronger. If all regulatory differences are introduced jointly, the effect does decrease from 9.5 to 7.4 percentage-points (though still statistically significant with a p-value of 0.056). In this specification there are five additional variables to capture differences between a total of 14 states. This leads to collinearity issues which attenuates the effect of SL.

B. Federal Reserve membership

State banks had access to the Federal Reserve system if they fulfilled certain requirements. Access to the FED's discount window may have reduced their probability of failure. Averaging over all state-pairs, FED membership rates were 8% for SL State banks and 12% for DL State banks. This suggests that at least part of our effect might be driven by FED membership. However, there are at least two reasons why FED membership may not be so worrisome. First, becoming a FED member is an endogenous choice. Higher rates of membership might be indicative that DL banks sought to take less risk by submitting to a stricter regulator. In other words, FED membership would be a channel through which DL affects risk taking. Second, FED membership could also have *increased* the probability of bank failure. During the Great Depression, FED policies were quite restrictive and not as liberal as expected. This might have led FED member banks to hold too little liquidity (Carlson and Wheelock 2018).

To further check whether our effect is driven by FED membership, we restrict the analysis to non-members. Consistent with our state selection algorithm we require each State-FED district to have at least 50 non-member banks. This is the case for all pairs. We rerun all regression for the 7 different ex post outcome variables. Since National banks were FED members by default, we can only estimate a single difference. Results are in Table 11, Panel A. The results are quantitatively similar to the full sample results.

C. Selection into State and National Banks

State banks had the possibility to re-charter as a National bank and vice versa. This is cause for concern if there is different selection in SL and DL states. In particular, in DL states the liability regime did not make a difference for choosing a State or National charter. In SL states the liability regime did make a difference. On the one hand, riskier banks might have preferred SL. On the other hand, riskier banks might have used DL to convince depositors they were in good hands. If the former effect dominated then this would bias our estimates upwards, because we would attribute bank failure to the liability regime rather than the inherent riskiness of banks.

To make sure that endogenous selection into SL state banks is not driving our results, we restrict the sample to State banks that had paid-in capital that was too low to be eligible for a National charter and who could not have easily switched charters. In particular, we only include banks with 80% or less of the paid-in capital required by national banks in that location. Again, we require at least 50 banks in each state, which implies dropping pairs (1) through (4).[17] Again, we can only run a single difference on this sample. Results are in Table 11, Panel B. Coefficient estimates are quantitatively similar to the full sample estimates, although more noisily estimated with a p-value in the total trouble regression of 0.092. This indicates that differential selection into State and National banks does not explain our results.

D. State-pair fixed effects

In our baseline analysis, we implement weights such that each state-FED district pair is weighted equally in the regression and there is a straightforward correspondence between the within-pair and aggregate results. In this section, we present estimates using pair fixed effects, which by-and-large accomplish the same thing. In particular, for the single difference estimates, we run the following regression

$$Y_{i,s,p} = \beta SL_{s,p} + \eta_p + \varepsilon_{i,s,p} \tag{3}$$

for all 8 pairs jointly, where η_p are state-FED district fixed effects. For the double difference we run:

[17] Results are robust to keeping state-FED districts with at least 25 such State banks or dropping this restriction altogether.

$$Y_{i,s,b,p} = \delta SL_{s,p} SB_b + \eta_p + \eta_p \times SL_{s,p} + \eta_p \times SB_b + \varepsilon_{i,s,b,p} \quad (4)$$

where, to run a proper difference-in-difference, we also include interactions between the pair fixed effects and the State bank and SL indicators.

Table E.4 in the Online Appendix focuses on total trouble. Column (1), for reference, reports our main results using the pair-specific weights, and Column (2) includes the fixed effects. As expected, weights and fixed effects lead to quantitatively similar results.

VI. Conclusion

The evidence presented in this paper shows that double liability for banks shareholders was effective in reducing bank failure in the Great Depression. The effect is present for all eight state-FED district pairs that we analyze and, in the aggregate, seems to have reduced bank failure by 30%. This suggest that agency conflicts between depositors and shareholders were an important contributor to the severity of the Great Depression.

A relevant question is whether increasing shareholder liability would be effective in reducing bank riskiness and financial fragility today. One key difference between then and now is that the shareholder base for banks in the 1920s appears less dispersed (Macey and Miller 1992), even though the stock market boom of the 1920 did widen it (Kane and Wilson 1998). Bank managers were typically large shareholders and therefore there was a relatively short distance between liability and decision making authority. We conjecture that the effect that we find mainly comes from bank managers having more skin-in-the-game. This is supported by Koudijs, Salisbury and Sran (2019) who study New England banks in the 1870 and show that exposing bank managers to additional liability was effective in reducing risk. This leads us to conclude that current proposals that focus on the *liability of bank management* have the greatest chance of being effective in curbing bank risk taking and increasing financial stability.

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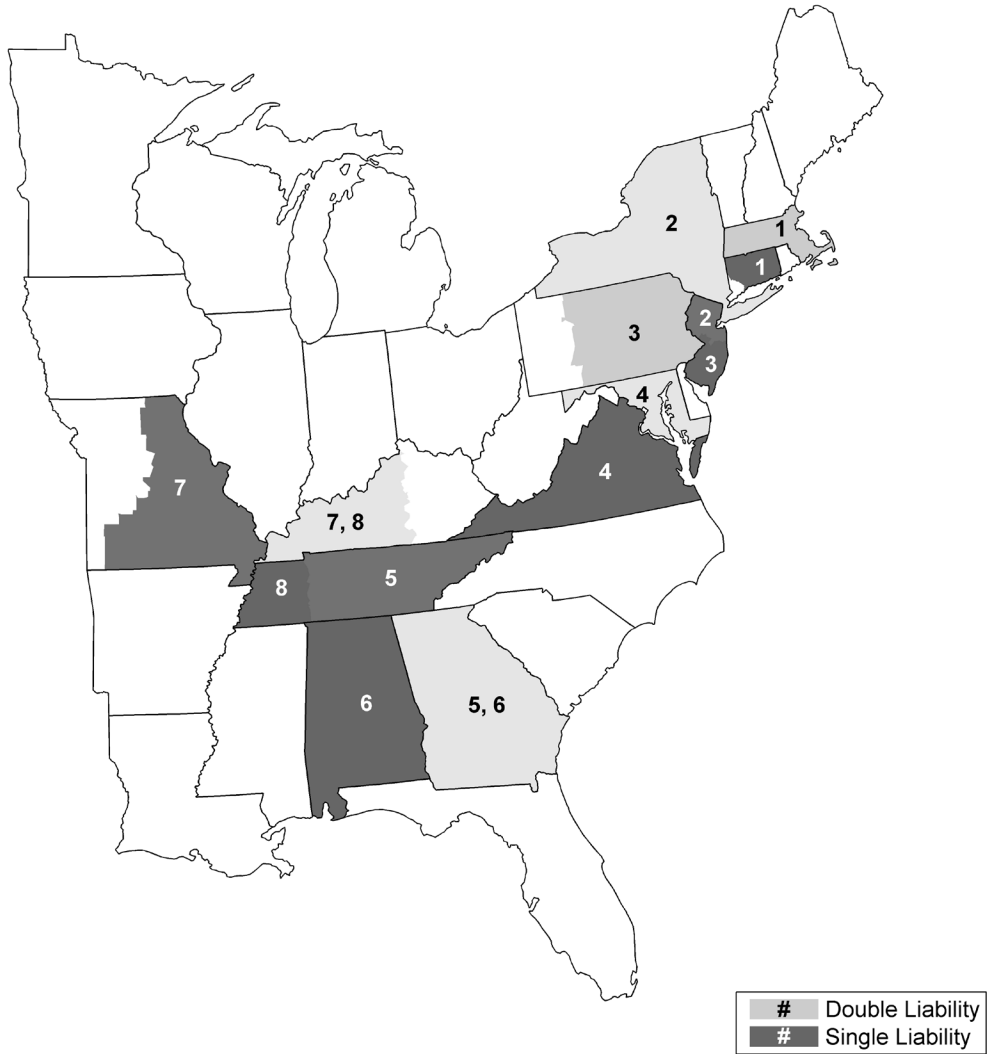
VIII. Figures and Tables

Figure 1: Map with state-FED districts in the sample



Note: Numbers indicate the eight state-FED districts pair we use in the paper.

Table 1: Bank size

Bank Type	Liability Regime	mean	min	25th	median	75th	max	N
Panel A: Complete Sample								
Statebank	Single	1,366,892	12,000	146,856	283,105	724,046	160,496,272	2,175
Statebank	Double	5,993,708	25,642	206,341	528,240	1,915,185	1,050,000,000	2,313
National	Single	3,345,512	93,332	601,056	1,188,819	2,761,409	160,094,784	816
National	Double	8,001,298	119,648	716,525	1,442,722	3,035,793	1,470,000,000	1,656
Panel B: Common support sample								
Statebank	Single	1,447,568	121,137	258,326	449,768	1,103,966	48,647,704	1,517
Statebank	Double	2,262,427	91,178	267,012	625,147	1,893,445	57,978,368	1,993
National	Single	2,575,686	93,332	605,613	1,169,519	2,516,503	48,010,680	785
National	Double	2,590,650	150,046	721,466	1,402,848	2,809,110	44,891,744	1,567
Panel C: Common support sample with weights								
Statebank	Single	1,939,299	121,137	286,591	613,120	1,700,480	48,647,704	1,517
Statebank	Double	2,473,425	91,178	269,975	641,238	2,028,380	57,978,368	1,993
National	Single	2,407,476	93,332	564,173	1,061,458	2,258,970	48,010,680	785
National	Double	2,200,522	150,046	601,264	1,118,547	2,105,412	44,891,744	1,567

Note: Panel A gives the distribution of 1928 bank size (total assets) and the number of banks in our full sample. Panel B gives the resulting distribution after we restrict the sample to the common support within each state-pair. Panel C takes the banks from Panel B and weights banks such that each state-FED district pair has equal weight.

Table 2: Summary statistics

Variable	mean	min	25th	median	75th	max	N
Panel A: State banks							
Leverage (debt/assets), 1928	0.813	0.332	0.779	0.837	0.877	0.932	4,408
Cash over deposits, 1928	0.195	0.036	0.097	0.147	0.246	0.784	4,359
Exits via suspensions	0.166	0.000	0.000	0.000	0.000	1.000	4,408
Exits via mergers/acquisitions	0.108	0.000	0.000	0.000	0.000	1.000	4,408
Troubled raising	0.025	0.000	0.000	0.000	0.000	1.000	4,126
Total trouble	0.296	0.000	0.000	0.000	1.000	1.000	4,408
Capital write-downs	-0.039	-0.701	-0.124	-0.012	0.064	0.532	4,128
Log change in deposits	-0.293	-1.550	-0.498	-0.251	-0.055	0.757	4,081
Log change in total assets	-0.176	-0.999	-0.347	-0.170	-0.014	0.683	4,129
Panel B: National Banks							
Leverage (debt/assets), 1928	0.844	0.536	0.814	0.858	0.893	0.934	2,352
Cash over deposits, 1928	0.191	0.041	0.120	0.171	0.235	0.646	2,352
Exits via suspensions	0.112	0.000	0.000	0.000	0.000	1.000	2,352
Exits via mergers/acquisitions	0.073	0.000	0.000	0.000	0.000	1.000	2,352
Troubled raising	0.025	0.000	0.000	0.000	0.000	1.000	2,266
Total trouble	0.207	0.000	0.000	0.000	0.000	1.000	2,352
Capital write-downs	-0.093	-0.816	-0.187	-0.049	0.028	0.505	2,267
Log change in deposits	-0.290	-1.375	-0.466	-0.264	-0.103	0.741	2,268
Log change in total assets	-0.182	-0.953	-0.318	-0.182	-0.066	0.672	2,268

Note: Summary statistics for all banks in our common support samples. Panel A: State banks in our single difference common support sample. Panel B: National banks in our double difference common support sample. Note that the number of state banks in the double difference common support sample is smaller than in Panel A. We apply weights such that each state-FED district pair has equal weight. Except where stated otherwise variables are calculated over the period between the end of 1928 and the end of 1932 (or February 1933 in case of suspensions or merger/acquisitions).

Table 3: Leverage (Debt/Assets), 1928

	(1) CT(1)-MA	(2) NJ(2)-NY	(3) NJ(3)-PA(3)	(4) VA-MD	(5) TN(6)-GA	(6) AL-GA	(7) MO(8)-KY(8)	(8) TN(8)-KY(8)	(9) All-Weights
Panel A: Single difference									
SL	-0.016	-0.020	0.017	-0.038	0.043	0.028	-0.007	-0.011	-0.001
	(0.017)	(0.008)	(0.012)	(0.009)	(0.009)	(0.008)	(0.005)	(0.009)	(0.004)
									[0.970]
Cons.	0.849	0.861	0.795	0.848	0.753	0.753	0.823	0.823	0.813
	(0.012)	(0.004)	(0.005)	(0.007)	(0.006)	(0.006)	(0.004)	(0.004)	(0.003)
N	173	529	472	446	614	594	1176	404	4408
Adj. R^2	-0.001	0.012	0.006	0.042	0.029	0.016	0.001	0.001	-0.000
Panel B: Double difference									
SL x State	0.032	-0.029	0.008	-0.025	-0.009	-0.002	0.003	-0.022	-0.006
	(0.020)	(0.009)	(0.014)	(0.009)	(0.012)	(0.013)	(0.010)	(0.016)	(0.006)
									[0.594]
SL	-0.048	0.011	0.008	-0.009	0.059	0.020	-0.001	0.022	0.008
	(0.016)	(0.005)	(0.008)	(0.006)	(0.010)	(0.011)	(0.009)	(0.015)	(0.005)
State	0.015	-0.001	-0.027	-0.007	-0.024	-0.028	-0.022	-0.018	-0.014
	(0.011)	(0.004)	(0.005)	(0.007)	(0.010)	(0.009)	(0.007)	(0.008)	(0.004)
Cons.	0.844	0.863	0.825	0.865	0.801	0.803	0.860	0.856	0.840
	(0.006)	(0.003)	(0.002)	(0.005)	(0.008)	(0.008)	(0.006)	(0.007)	(0.003)
N	367	1259	1082	552	624	663	945	370	5862
Adj. R^2	0.065	0.023	0.030	0.076	0.160	0.044	0.028	0.083	0.014

Note: The independent variable is the ratio of all liabilities divided by total assets. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present estimates for individual pairs and the aggregate sample. For the latter we use pair-specific weights such that each pair has equal weight. The coefficient estimates in Column (9) therefore give the average of Columns (1) to (8). In parentheses we report standard errors (in Column (9) bootstrapped at the individual bank level). In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Table 4: Cash/Deposits, 1928

	(1) CT(1)-MA	(2) NJ(2)-NY	(3) NJ(3)-PA(3)	(4) VA-MD	(5) TN(6)-GA	(6) AL-GA	(7) MO(8)-KY(8)	(8) TN(8)-KY(8)	(9) All-Weights
Panel A: Single difference									
SL	0.026	-0.003	-0.011	0.060	-0.114	-0.051	0.027	0.154	0.011
	(0.014)	(0.008)	(0.006)	(0.008)	(0.012)	(0.014)	(0.008)	(0.015)	(0.006)
									[0.825]
Cons.	0.104	0.127	0.127	0.099	0.343	0.343	0.188	0.187	0.190
	(0.006)	(0.005)	(0.002)	(0.005)	(0.010)	(0.010)	(0.007)	(0.007)	(0.004)
N	168	526	466	444	599	592	1164	400	4359
Adj. R^2	0.015	-0.001	0.013	0.099	0.123	0.020	0.012	0.241	0.001
Panel B: Double difference									
SL x State	-0.028	0.000	-0.036	0.003	-0.054	-0.043	-0.024	0.017	-0.021
	(0.020)	(0.008)	(0.009)	(0.011)	(0.020)	(0.020)	(0.016)	(0.032)	(0.010)
									[0.234]
SL	0.052	0.001	0.023	0.042	-0.056	-0.008	0.034	0.120	0.026
	(0.015)	(0.004)	(0.007)	(0.007)	(0.016)	(0.015)	(0.014)	(0.026)	(0.008)
State	-0.052	-0.003	0.010	-0.013	0.064	0.064	-0.013	-0.016	0.005
	(0.008)	(0.005)	(0.003)	(0.007)	(0.015)	(0.015)	(0.010)	(0.011)	(0.006)
Cons.	0.155	0.123	0.118	0.113	0.263	0.263	0.193	0.195	0.178
	(0.005)	(0.003)	(0.002)	(0.005)	(0.012)	(0.012)	(0.008)	(0.009)	(0.005)
N	363	1256	1076	551	615	661	937	369	5828
Adj. R^2	0.173	-0.002	0.038	0.094	0.141	0.042	0.031	0.275	0.007

Note: The independent variable is the ratio of all cash items divided by total assets. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present estimates for individual pairs and the aggregate sample. For the latter we use pair-specific weights such that each pair has equal weight. The coefficient estimates in Column (9) therefore give the average of Columns (1) to (8). In parentheses we report standard errors (in Column (9) clustered at the individual bank level). In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Table 5: Total trouble, pair-by-pair

	(1) CT(1)-MA	(2) NJ(2)-NY	(3) NJ(3)-PA(3)	(4) VA-MD	(5) TN(6)-GA	(6) AL-GA	(7) MO(8)-KY(8)	(8) TN(8)-KY(8)	(9) All-Weights
Panel A: Single difference									
SL	0.124	0.046	0.056	0.150	0.064	0.122	0.173	0.029	0.096
	(0.072)	(0.041)	(0.066)	(0.040)	(0.037)	(0.039)	(0.029)	(0.045)	(0.018)
									[0.020]
Cons.	0.260	0.222	0.429	0.142	0.251	0.256	0.212	0.216	0.248
	(0.044)	(0.022)	(0.025)	(0.031)	(0.023)	(0.023)	(0.025)	(0.025)	(0.012)
N	173	529	472	446	614	594	1176	404	4408
Adj. R^2	0.012	0.001	0.001	0.031	0.003	0.016	0.035	-0.001	0.011
Panel B: Double difference									
SL x State	0.205	0.073	0.030	0.152	0.142	0.133	0.015	0.163	0.114
	(0.090)	(0.052)	(0.078)	(0.069)	(0.086)	(0.082)	(0.081)	(0.114)	(0.034)
									[0.006]
SL	-0.073	-0.036	0.036	-0.063	-0.049	0.004	0.124	-0.147	-0.026
	(0.052)	(0.032)	(0.039)	(0.052)	(0.075)	(0.070)	(0.074)	(0.099)	(0.027)
State	0.091	0.021	0.315	-0.046	-0.082	-0.055	-0.007	-0.016	0.028
	(0.054)	(0.028)	(0.028)	(0.056)	(0.061)	(0.059)	(0.060)	(0.065)	(0.024)
Cons.	0.171	0.204	0.112	0.200	0.324	0.303	0.217	0.231	0.220
	(0.031)	(0.017)	(0.014)	(0.045)	(0.056)	(0.053)	(0.053)	(0.059)	(0.021)
N	367	1259	1082	552	624	663	945	370	5862
Adj. R^2	0.061	0.004	0.132	0.006	0.002	0.007	0.018	0.017	0.015

Note: The independent variable is "Total trouble", which consists of bank suspensions, mergers/acquisitions, and trouble raising. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present estimates for individual pairs and the aggregate sample. For the latter we use pair-specific weights such that each pair has equal weight. The coefficient estimates in Column (9) therefore give the average of Columns (1) to (8). In parentheses we report standard errors (in Column (9) clustered at the individual bank level). In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Table 6: Total trouble, additional controls

	(1) No controls	(2) log(Assets)	(3) Size quintiles	(4) log(Assets) + Controls	(5) Size quintiles + Controls
Panel A: Single difference					
SL	0.096	0.103	0.098	0.099	0.091
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
	[0.020]	[0.002]	[0.0002]	[0.001]	[0.001]
Cons.	0.248	0.239	0.246	0.244	0.225
	(0.012)	(0.012)	(0.023)	(0.012)	(0.025)
N	4408	4408	4408	4391	4391
Adj. R^2	0.011	0.014	0.017	0.047	0.047
Panel B: Double difference					
SL x State	0.114	0.115	0.116	0.125	0.130
	(0.034)	(0.036)	(0.034)	(0.035)	(0.034)
	[0.006]	[0.012]	[0.007]	[0.016]	[0.007]
SL	-0.026	-0.028	-0.026	-0.045	-0.046
	(0.027)	(0.030)	(0.027)	(0.029)	(0.027)
State	0.028	0.025	0.026	0.059	0.053
	(0.024)	(0.027)	(0.026)	(0.026)	(0.026)
Cons.	0.220	0.227	0.221	0.198	0.196
	(0.021)	(0.023)	(0.033)	(0.023)	(0.034)
N	5862	5862	5862	5851	5851
Adj. R^2	0.015	0.018	0.015	0.056	0.054

Note: The independent variable is "Total trouble", which consists of bank suspensions, mergers/acquisitions, and trouble raising. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present estimates for the aggregate sample where we use pair-specific weights such that each pair has equal weight. In parentheses we report standard errors clustered at the individual bank level. In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019). Column (1) corresponds to Column (9) in Table 5 and is the baseline. Columns (2) and (4) include log(Total Assets) as control, Columns (3) and (5) include dummies for size quintiles. Columns (4) and (5) includes 1928 leverage and cash/deposits as control variables.

Table 7: Type of failure

	(1) Suspensions	(2) Mergers/Acquisitions	(3) Troubled raising
Panel A: Single difference			
Single	0.033	0.056	0.007
	(0.015)	(0.013)	(0.007)
	[0.231]	[0.023]	[0.380]
Cons.	0.149	0.081	0.021
	(0.010)	(0.007)	(0.004)
N	4408	4408	4126
Adj. R^2	0.002	0.008	0.000
Panel B: Double difference			
SL x State	0.031	0.066	0.022
	(0.026)	(0.023)	(0.011)
	[0.274]	[0.038]	[0.177]
SL	-0.001	-0.017	-0.011
	(0.021)	(0.019)	(0.008)
State	0.035	-0.001	-0.009
	(0.020)	(0.015)	(0.007)
Cons.	0.112	0.081	0.031
	(0.017)	(0.013)	(0.006)
N	5862	5862	5607
Adj. R^2	0.006	0.007	0.001

Note: Independent variables are the constituent parts of "Total trouble" and are indicated at the top of each column. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present estimates for the aggregate sample where we use pair-specific weights such that each pair has equal weight. In parentheses we report standard errors clustered at the individual bank level. In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Table 8: Other outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Capital write-downs (%)		Log-change in deposits (%)		Log-change in assets (%)	
Panel A: Single difference						
Single	-3.633	-4.054	-2.361	-5.065	-2.579	-4.984
	(0.860)	(1.070)	(1.588)	(1.961)	(1.176)	(1.420)
	[0.153]	[0.228]	[0.750]	[0.511]	[0.627]	[0.350]
Cons.	-2.147	-3.132	-28.375	-33.134	-16.586	-19.631
	(0.626)	(0.740)	(1.053)	(1.228)	(0.797)	(0.924)
N	4128	2992	4081	2959	4129	2993
Adj. R^2	0.007	0.008	0.001	0.004	0.002	0.007
Panel B: Double difference						
SL x State	-8.359	-10.017	0.630	-4.418	-0.411	-3.950
	(1.600)	(1.895)	(3.023)	(3.542)	(2.156)	(2.476)
	[0.021]	[0.016]	[0.882]	[0.319]	[0.921]	[0.302]
SL	4.560	5.650	-2.270	0.051	-1.957	-0.721
	(1.279)	(1.484)	(2.523)	(2.913)	(1.752)	(1.982)
State	8.846	9.354	-0.298	0.444	0.309	0.891
	(1.200)	(1.415)	(2.089)	(2.492)	(1.502)	(1.739)
Cons.	-11.556	-13.084	-28.067	-33.211	-17.407	-20.803
	(0.988)	(1.167)	(1.790)	(2.166)	(1.246)	(1.454)
N	5610	4389	5578	4365	5612	4391
Adj. R^2	0.021	0.023	0.000	0.002	0.001	0.004
Survivors	N	Y	N	Y	N	Y

Note: This table present results for capital write-downs, and changes in deposits and assets, all presented in percentages. Odd numbered columns include all banks where, for failed banks, we take the last available observation *before failure*). Even numbered columns include banks that survived until February 1932. We calculate log changes between 1928 and the end of 1932, or earlier if the bank fails. For capital write-downs we first calculate banks' log-total capital in 1928 (paid-in capital and retained earnings). We then subtract the end-of-period log-total capital, from which we deduct any equity issuances that took place over the period. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present estimates for the aggregate sample where we use pair-specific weights such that each pair has equal weight. In parentheses we report standard errors clustered at the individual bank level. In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Table 9: Reserve and capital requirements (State banks)

Pair	state	single	Reserve Requirement			Capital Requirements		
			20th	50th	80th	20th	50th	80th
1	MA	0	15%	15%	15%	75,000	100,000	200,000
	CT (1)	1	12%	12%	12%	50,000	50,000	100,000
2	NY	0	10%	12%	12%	25,000	50,000	100,000
	NJ (2)	1	15%	15%	15%	100,000	100,000	100,000
3	PA (3)	0	15%	15%	15%	25,000	125,000	125,000
	NJ (3)	1	15%	15%	15%	100,000	100,000	100,000
4	MD	0	15%	15%	15%	25,000	25,000	100,000
	VA	1	10%	10%	10%	25,000	25,000	50,000
5	GA	0	15%	15%	15%	25,000	25,000	25,000
	TN (6)	1	10%	10%	10%	20,000	20,000	100,000
6	GA	0	15%	15%	15%	25,000	25,000	25,000
	AL (6)	1	15%	15%	15%	10,000	15,000	25,000
7	KY (8)	0	7%	7%	7%	15,000	15,000	15,000
	MO (8)	1	15%	15%	15%	15,000	15,000	25,000
8	KY (8)	0	7%	7%	7%	15,000	15,000	15,000
	TN (8)	1	10%	10%	10%	20,000	20,000	50,000

Note: Within each state-FED district, for each State bank in our common support sample, we determine the reserve requirement and capital requirement for the town or city a bank is located in. We then present the 20^{th}, 50^{th}, and 80^{th} percentiles of the bank-level distribution. Reserve requirements are for demand deposits only. Sources: Federal Reserve Bulletin (1929) for the reserve requirements, State statutes and session laws for the capital requirements, where needed supplemented with information from Polk's.

Table 10: Other differences in state regulation

Pair	State	Single	(1) Restrictions on bank risk taking	(2) Quality regulator	(3) Branch banking
1	MA	0	-2.83	5.4	Limited
	CT (1)	1	-0.33	5.4	Prohibited
2	NY	0	-2.33	6.3	Limited
	NJ (2)	1	-3.00	5.6	Limited
3	PA (3)	0	-1.50	5.3	Limited
	NJ (3)	1	-3.00	5.6	Limited
4	MD	0	-2.67	6.0	Allowed
	VA	1	-5.67	4.6	Allowed
5	GA	0	-1.83	6.1	Limited
	TN (6)	1	-1.33	5.2	Limited
6	GA	0	-1.83	6.1	Limited
	AL (6)	1	-0.83	5.8	Prohibited
7	KY (8)	0	-1.67	5.3	Prohibited
	MO (8)	1	-2.67	6.4	Prohibited
8	KY (8)	0	-1.67	5.3	Prohibited
	TN (8)	1	-1.33	5.2	Limited

Note: Restrictions on bank risk taking We identify eight different restrictions on banks' asset holdings. For each of those we take the National Banking Law as baseline. If a state had a stricter regulation we code this up as +1, if it was more lenient as -1, and equally strict as 0. We then take the (unweighted) sum over the eight categories. Information reflects the law as of 1929. *Quality regulator*: Federal Reserve (1932, Table 2) provides nine different dimensions of state regulator quality, such as the term and salary of the bank commissioner and the powers to intervene in banks' operations (based on a 1929 American Bankers Association survey of bank regulators and state statutes). Within each dimension there are multiple categories, based on which we give each state a score between 0 and 1. We present the sum of these scores, where we weight each of the 9 dimensions equally. Maximum possible score: 9. *Branch banking*: "Prohibited": no branches allowed, although banks could typically open local agencies to receive deposits and pay checks. "Limited": branching allowed within town, city or municipality. "Allowed": branches allowed in other locations in the home state. Sources: State statutes and session laws, Federal Reserve (1931, 1932), Federal Reserve Bulletin (1929).

Table 11: Robustness: results for non-FED members and smaller banks

	(1) Exit Susps.	(2) Exit Mergers	(3) Troubled raising	(4) Total trouble	(5) Capital write-downs	(6) Log-change in deposits	(7) Log-change in assets
Panel A. non-FED members							
SL	0.027	0.069	0.006	0.101	-0.031	-0.061	-0.054
	(0.015)	(0.014)	(0.007)	(0.019)	(0.011)	(0.020)	(0.015)
	[0.370]	[0.033]	[0.436]	[0.006]	[0.313]	[0.392]	[0.290]
Cons.	0.154	0.075	0.020	0.248	-0.036	-0.328	-0.197
	(0.011)	(0.007)	(0.004)	(0.012)	(0.008)	(0.013)	(0.010)
N	3976	3976	3722	3976	2683	2652	2684
Adj. R^2	0.001	0.012	0.000	0.012	0.005	0.006	0.008
Panel B. Smaller banks							
SL	0.053	0.047	0.020	0.114	-0.014	-0.068	-0.054
	(0.031)	(0.018)	(0.007)	(0.034)	(0.016)	(0.041)	(0.028)
	[0.495]	[0.017]	[0.125]	[0.092]	[0.294]	[0.508]	[0.344]
Cons.	0.188	0.042	0.000	0.230	-0.036	-0.483	-0.302
	(0.025)	(0.012)	(0.000)	(0.026)	(0.013)	(0.032)	(0.021)
N	1359	1359	1228	1359	886	878	886
Adj. R^2	0.003	0.008	0.009	0.015	0.001	0.005	0.007

Note: This table present results for bank suspension, mergers/acquisitions, troubled raising, total trouble (a sum of the preceding three categories), capital write-downs, and changes in deposits and assets. Columns (5) to (7) only contain banks that survived until February 1932. Panel A: we restrict the sample to State banks that were not a member of the FED. We require at least 50 banks in each state which is the case for all pairs. Panel B: we restrict ourselves to State banks that were not (directly) able to convert into a National bank because of the relatively low level of their paid-in capital. We require at least 50 banks in each state and therefore omit pairs (1) through (4). *SL*: banks with Single Liability for shareholders. We present estimates for the aggregate sample where we use pair-specific weights such that each pair has equal weight. In parentheses we report standard errors clustered at the individual bank level. In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Online Appendix

A. State selection

For this paper, we match each single liability (SL) state (with a sufficient number of state banks) to *one* neighboring double liability (DL) state that we consider the best match. We then collect individual bank level data for the selected states (collecting this information for all possible states would be too costly and time intensive). Some states are split by two different Federal Reserve Districts. During the Great Depression, Federal Reserve banks could have different policies in place, with large differences in bank outcomes (Richardson and Troost 2009). We therefore consider each state-FED district separately.

We rely on a simple algorithm to determine the best match where we rely on aggregate state-level data from *All Bank Statistics*. In particular, we consider the failure rates of National Banks between the end of 1928 and 1932 and the average size of State Banks in 1928. Our analysis focuses on the differences in the failure rates of *State Banks* by liability regime. We use the failure rates of *National Banks* to select states that faced similar financial-economic shocks. The aggregate state-level failure data is annual and we only consider failures up to 1932 to stay as close as possible to the individual bank level failure data we collect, which runs up to February 1933. We use average bank size to ensure that we look at states with similar types of banks. Unfortunately, these data are not broken down by state-FED district, and only available at the state level.

When selecting DL states, we focus on those in the same FED district. Furthermore, we omit those that had state deposit insurance in place at any point during the 1920s. The concern is that the financial systems of such states were fundamentally different and that deposit insurance led to a larger number of banks, with a greater appetite for risk (Aldunate 2019, Calomiris and Jaremski 2019). Wheelock (1995) argues that, even though state insurance deposit insurance had ended everywhere by 1929, its effects lingered on in the early 1930s, causing more bank failures. As no SL state had state deposit insurance in place, that would make such states unsuitable matches.

1. We start with all SL states that have at least 50 State Banks in 1928. Within the same FED district, we consider all their DL neighbors (all turn out to have at least 50 state banks in 1850). Goal is to find one appropriate match.
2. We omit DL states with state deposit insurance in place at any point during the 1920s.

3. We omit DL states for which the failure rate of National Banks is more than 15 percentage-points (p.p.) different from the SL state in question. This cutoff is based on the distribution of state-level National Bank failure rates, which has a standard deviation of 13%.
4. If there are still multiple candidates left, we pick the DL state for which the average bank size is the closest to the SL state in question.

Table A1 gives a detailed application of this algorithm to the 9 SL states in 1928. Following the same numbering as above:

1. Connecticut (FED district 2), Delaware and Rhode Island had fewer than 50 State Banks.
2. We omit Louisiana (FED districts 6 and 11) and Missouri (FED district 10) because all DL neighbors in the same FED district had deposit insurance at some point during the 1920s. Of the remaining state-FED districts, Connecticut (FED district 1), New Jersey (FED districts 2 and 3) and Tennessee (FED district 6) only have one possible match. In all cases, the difference in failure rates of National Banks is small: 3, 2, 0, and 6 p.p. respectively.
3. For Tennessee (FED district 8), one potential match (Arkansas) drops out because its National Bank failure rate is too high, leaving Kentucky (difference of -4 p.p.). For Virginia, both North Carolina and West Virginia drop out for the same reason, leaving Maryland (difference of 1 p.p.).
4. After this step, Alabama and Missouri (FED district 8) still have multiple candidates and we pick the best candidates based on average bank size.

   For Alabama, we pick Georgia. Based on the failure rates of National Banks, Florida would be an appropriate match as well, but while the average bank in Georgia is approximately as big as in Alabama, Florida banks are nearly twice as big.

   For Missouri (FED district 8) we pick Kentucky (FED district 8). While Arkansas and Illinois also have similar bank failure rates, the average bank size is much closer in Kentucky (almost identical, in fact). The difference in failure rates is smallest with Illinois. Problem here is that Illinois is split up in two different FED districts: one in the north, one in the south. We would match Missouri to the southern part, whereas around two-thirds of Illinois banks were located in the north (OCC 1928). We therefore do not have a good sense of the national bank failure rate in the south, especially since the north included Chicago, which, as the second largest financial center of the country, presumably was exposed to a different set of shocks.

Table A1. State selection

Panel A: States in sample (final match in bold)

SL State	Neigh. DL State(s)	FED district	Deposit Insurance	Nat. Bank failure rate	Diff.	Av. state bank size 1928 ($000)	Diff.
Alabama		6	N	32%		$533	
	Florida	6	N	37%	5%	$951	$418
	Georgia	**6**	**N**	**35%**	**3%**	**$523**	**-$10**
	Mississippi	6-8	Y				
Connecticut		1	N	11%		$3,745	
	Massachusetts	**1**	**N**	**14%**	**3%**	**$9,226**	**$5,481**
Missouri		8		35%		$772	
	Arkansas	8	N	47%	12%	$467	-$305
	Illinois	7-8	N	38%	3%	$2,148	$1,376
	Kentucky	**4-8**	**N**	**24%**	**-11%**	**$724**	**-$48**
New Jersey		2		16%		$6,165	
	New York	**2**	**N**	**18%**	**2%**	**$19,011**	**$12,845**
New Jersey		3		16%		$6,165	
	Pennsylvania	**3**	**N**	**16%**	**0%**	**$4,207**	**-$1,958**
Tennessee		6		28%		$673	
	Georgia	**6**	**N**	**35%**	**6%**	**$523**	**-$149**
Tennessee		8		28%		$673	
	Arkansas	8	N	47%	19%	$467	-$206
	Kentucky	**4-8**	**N**	**24%**	**-4%**	**$724**	**$51**
	Mississippi	6-8	Y				
Virginia		5		17%		$868	
	Maryland	**5**	**N**	**18%**	**1%**	**$3,159**	**$2,291**
	North Carolina	5	N	55%	38%	$808	-$60
	West Virginia	5	N	37%	20%	$1,144	$276

Panel B: States omitted from sample

SL State	Neigh. DL State(s)	FED district	Deposit Insurance
Louisiana		6	
	Mississippi	6-8	Y
Louisiana		11	
	Texas	11	Y
Missouri		10	
	Kansas	10	Y
	Oklahoma	10	Y
	Nebraska	10	Y

Omitted from the Table are the following SL states (FED districts) because they had fewer than 50 state banks in 1928: Connecticut (2), Delaware, and Rhode Island

B. Common support of bank size

We restrict our main analyses to banks that, within a state-FED district pair, share the same common support in terms of bank size. We proceed as follows to construct the samples for the single and double difference estimates:

Single difference

1. We start with each individual SL bank in a given state-FED district
2. We select all DL state banks in the neighboring state-FED district for which total assets are at most 25% different. For banks with assets smaller than $100,000, we select all DL banks for which the difference in total assets is at most $25,000.
3. We keep all SL banks that are matched to at least one DL bank
4. We keep all selected banks in the sample, each with equal weight. In other words, we do not include duplicates, except for Georgia and Kentucky (8) which we use twice as a control state.

Double difference

1. We start with each individual SL bank in a given state-FED district
2. We select all DL state banks in the neighboring state-FED district for which total assets are at most 25% different. For banks with assets smaller than $100,000, we select all DL banks for which the difference in total assets is at most $25,000. *We do the same for National Banks in each state-FED district*
3. *We keep all SL banks that are matched to at least one bank in each of the three control groups (DL State banks, National banks in own state-FED district, National banks in neighboring state-FED district)*
4. We keep all selected banks in the sample, each with equal weight. In other words, we do not include duplicates, except for Georgia and Kentucky (8) which we use twice as a control state

C. Restrictions on bank risk taking

State banking departments had different rules and restrictions in place for their banks in terms of what types of loans they could make, and what other types of activities they could engage in. These were all pinned down by local state laws. Based on a careful reading and comparison of the laws, we identify eight important categories. We then proceed to score each state for each of these eight categories. For each state, we first read through the state statute most recent to 1929. We then read all relevant session laws between the publication of the state statute and 1929 to reconstruct the state of affairs per 1929. State statutes and session laws are available through *Heinonline* and *Making of Modern Law*. We take the National banking law per 1927 as the baseline (there were no changes between 1927 and 1929). We score states as follows: For each category, we determine whether the state law was laxer (-1), equally strict (0) or stricter (1) than the national law. For categories on which the National law stayed silent we either code a state as equally lax (0) or stricter (1). If there are clear difference in how strict the law was across states, we use fractions, e.g. -1/3 or +1/2 to indicate so. We take the simple unweighted sum over these categories. Results are in the main text. Here, we list the different categories that we consider, together with the baseline from the National banking law.

	Category	National banking law
1	Holding corporate securities	Cannot hold corporate stock
2	Insurance	Cannot guarantee any loans or bonds
3	Limits on discounting bills of exchange	Limits on maturities (<6 months for domestic bills, <3 months for foreign) and total amount (<50% of equity capital for each)
4	Loans on the collateral of real estate	Max. 25% of equity capital or 50% of time deposits. Max. LTV 50%
5	Loans to individual borrowers	Max 10% of equity capital, except for different forms of safe commercial paper
6	Loans to officers and directors	Not regulated
7	Owning (lending on the security of) shares in the own bank	Restricted, only to secure existing debts
8	Usury limit on loans	7%, unless stipulated otherwise by the state of residence

All eight categories reflect a certain dimensions of risk taking. To start with the first, it was considered risky for banks to directly hold corporate stock, either as investment or as part of securities underwriting. Second, providing insurance, most frequently in the form of

guaranteeing payments on bonds or loans a bank had placed with the investing public exposed the bank to off-balance sheet tail risk. Third, discounting bills of exchange was an important activity for banks and its was deemed unwise to lend on too long maturities and to extend too much credit that way. Fourth, lending on real estate, in particular farm lands (residential mortgages were provided through other types of non-commercial banks, was seen as risky due to volatile land prices. Fifth, large loans to individual borrowers made the bank undiversified and opened the door to capture and fraud. Sixth, loans to officers and directors were seen as risky as there would be a danger of inside dealing an tunneling. Seventh, owning or lending on the security of the shares in the own bank was effectively a form of higher payout to shareholders and would have de facto increased the leverage of the bank. Finally, a higher usury limit would have made it possible for bankers to lend to high risk borrowers.

D. Quality of state regulator

Federal Reserve (1932) provides state-level information about nice different regulator characteristics. Information comes from a survey the American Banker Association sent out in 1929 to state regulators, amended by state statutes. Each of the nine categories contains several subcategories. For each we use the information provided to give a state a score between 0 and 1, where 0 is the worst system in place and 1 the best. In the main text, we present the sum of these scores, where we weight each of the nine main categories equally. Here, we list all categories and subcategories, and provide details about scoring:

	Category	Sub-category	Description	Score
1	Supervisory agencies		Under other department	0
			Separate	1
2	Type of supervisory agency		Single official under control of / appointed by board of bankers	0
			Single official + board of bankers	0.5
			Single official	1
3	Method of selecting commissioner or supervisor		Selection by banks	0
			Selection by (political) commission	0.5
			Appointed by governor	1
4	Term of office of supervisor		3 years or less	0
			4 years	0.333
			5 or 6 years	0.666
			Indefinite	1
5	Salaries of supervisors		< $5,000	0
			$5,000-$10,000	0.5
			>$10,000	1
6	Method of selection of examiners		Supervisory agency + governor or board	0
			Supervisory agency	0.5
			Civil service	1
7	Powers-relative to the organization of new banks	Principal discretionary powers in passing on applications for new charters	Commissioner	1
			Banking board	1
		Must be assured of legitimate purpose and/or integrity of applicant	No/Yes	0/1
		Must take into consideration the public need and convenience for banking facilities	No/Yes	0/1

8	Powers relevant to banking operations	Examinations – frequency	Not stipulated	0
			Annual	0.5
			More than annual	1
		Examinations – discretionary powers	No	0
			Yes	1
		Stockholders required to make good impairment of capital	No/Yes	0/1
		May limit borrowing by banks	No/Yes	0/1
		May require removal of undesirable and/or illegal assets	No/Yes	0/1
		May *order* removal of officers or employees	No/Yes	0/1
		May *recommend* removal of officers or employees	No/Yes	0/0.5
		May *order* removal of directors	No/Yes	0/1
		May *recommend* removal of directors	No/Yes	0/0.5
9	Powers relevant to insolvent banks	May liquidate the bank	No/Yes	0/1
		May appoint a receiver	No/Yes	0/1
		May *apply* for the appointment of a receiver	No/Yes	0/0.5

E. Additional figures and tables

Figure E.1: Leverage and size, 1928 (State and National banks)

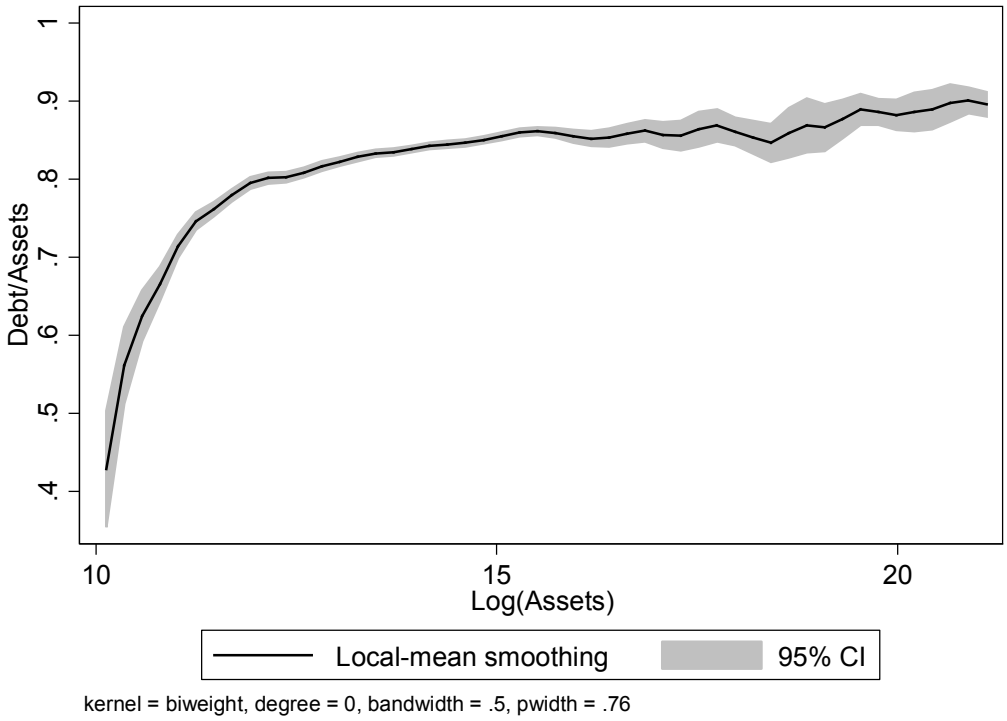


Table E.1: Number of State banks per state-FED district

Pair	State	Number of state banks
1	MA	100
	CT (1)	73
2	NY	365
	NJ (2)	164
3	PA (3)	406
	NJ (3)	66
4	MD	127
	VA	319
5	GA	347
	TN (6)	267
6	GA	348
	AL (6)	246
7	KY (8)	278
	MO (8)	898
8	KY (8)	269
	TN (8)	135

Table E.2: Exits via Suspensions Composition

	(1) All suspensions	(2) Slow paper	(3) Failure Correspondent	(4) Failure of large debtor	(5) Defalcation	(6) Heavy Withdrawals	(7) Other
Panel A: Single difference							
SL	0.033	0.018	-0.003	-0.001	-0.001	0.008	0.004
	(0.015)	(0.011)	(0.002)	(0.001)	(0.004)	(0.009)	(0.007)
	[0.231]	[0.561]	[0.409]	[0.589]	[0.842]	[0.603]	[0.728]
Cons.	0.149	0.069	0.005	0.001	0.013	0.055	0.024
	(0.010)	(0.007)	(0.002)	(0.001)	(0.003)	(0.006)	(0.005)
N	4408	4393	4393	4393	4393	4393	4393
Adj. R^2	0.002	0.001	0.000	0.000	-0.000	0.000	-0.000
Panel B: Double difference							
SL x State	0.031	0.017	-0.005	-0.001	-0.007	0.008	0.015
	(0.026)	(0.021)	(0.003)	(0.001)	(0.005)	(0.016)	(0.009)
	[0.274]	[0.537]	[0.203]	[0.723]	[0.208]	[0.732]	[0.040]
SL	-0.001	-0.001	0.001	-0.000	-0.000	0.008	-0.010
	(0.021)	(0.017)	(0.001)	(0.000)	(0.002)	(0.012)	(0.005)
State	0.035	-0.002	0.006	0.002	0.013	0.025	0.007
	(0.020)	(0.016)	(0.002)	(0.001)	(0.004)	(0.011)	(0.007)
Cons.	0.112	0.068	0.000	0.000	0.002	0.028	0.015
	(0.017)	(0.014)	(0.000)	(0.000)	(0.002)	(0.009)	(0.004)
N	5862	5848	5848	5848	5848	5848	5848
Adj. R^2	0.006	0.000	0.002	0.000	0.004	0.005	0.003

Note: This table present results for bank suspensions that resulted in banks exits. Column (1) presents the results for all cases. Columns (2) to (7) split the sample according to the reason(s) listed as the primary reason for the suspension. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present estimates for the aggregate sample where we use pair-specific weights such that each pair has equal weight. In parentheses we report standard errors clustered at the individual bank level. In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Table E.3: Total trouble, controlling for other regulatory differences

	(1) Reserves	(2) Capital	(3) (1)+(2)	(4) Bank Risk	(5) Regulator	(6) Branching	(7) (4)+(5)+(6)	(8) All
SL	0.096	0.108	0.107	0.098	0.099	0.091	0.093	0.074
	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.020)	(0.021)
	[0.003]	[0.012]	[0.002]	[0.003]	[0.003]	[0.003]	[0.033]	[0.056]
Reserve req. (%)	1.292		1.206					2.360
	(0.293)		(0.297)					(0.388)
Min. capital req. ($000)		0.516	0.338					0.328
		(0.140)	(0.135)					(0.130)
Bank risk restr. (score)				0.012			0.000	-0.002
				(0.008)			(0.009)	(0.009)
Quality Regulator (score)					0.013		0.004	-0.095
					(0.015)		(0.017)	(0.022)
Branching restr. (score)						-0.064	-0.062	-0.149
						(0.027)	(0.033)	(0.037)
Cons.	0.083	0.208	0.065	0.272	0.171	0.277	0.251	0.523
	(0.039)	(0.014)	(0.039)	(0.019)	(0.089)	(0.017)	(0.105)	(0.112)
N	4408	4274	4274	4408	4408	4408	4408	4274
Adj. R^2	0.018	0.018	0.023	0.011	0.011	0.012	0.012	0.032

Note: This table presents the single difference results for total trouble, controlling for difference in regulatory dimensions. *Reserve reqs.*: Reserve requirements on demand deposits, in percentage of deposits. *Min. Capital req.*: minimum capital requirements, in $000 (see Table 9 for more details on both). *Bank risk restrict*: Restrictions on bank risk, scored relative to National Banking Act. *Quality regulator*: score based on Federal Reserve (1932). *Branching restr.*: Restrictions on branching (See Table 10 for details on these three dimensions). In parentheses we report standard errors clustered at the individual bank level. In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).

Table E.4: Total trouble, pair fixed effects vs weights

	(1) Weights	(2) Pair f.e.
Panel A: Single difference		
SL	0.096	0.104
	(0.018)	(0.017)
	[0.002]	[0.002]
Cons.	0.248	0.268
	(0.012)	(0.036)
N	4408	4408
Adj. R^2	0.011	0.027
Panel B: Double difference		
SL x State	0.114	0.100
	(0.034)	(0.030)
	[0.006]	[0.001]
SL	-0.026	
	(0.027)	
State	0.028	
	(0.024)	
Cons.	0.220	0.157
	(0.021)	(0.030)
N	5862	5862
Adj. R^2		

Note: The independent variable is "Total trouble", which consists of bank suspensions, mergers/acquisitions, and trouble raising. *SL*: banks with Single Liability for shareholders. *State*: banks regulated at the state level. We present three type of estimates for the aggregate sample. In Column (1) we use no weights or pair fixed effects. In Column (2), which is the same as Column (9) in Table 5, we use pair-specific weights such that each pair has equal weight. In Column (3) we include pair fixed effects, interacted in the double difference with the SL and State bank dummies. In parentheses we report standard errors clustered at the individual bank level. In square brackets we report the p-values from wild cluster bootstrap double-clustering at the state and state-pair level, using default Rademacher weights (Cameron, Gelbach and Miller 2008, Roodman, MacKinnon, Nielsen and Webb, 2019).