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Abstract

Does enhanced shareholder liability reduce bank failure? We compare the performance of around 4,200 state-regulated banks of similar size in neighboring U.S. states with different liability regimes during the Great Depression. The distress rate of limited liability banks was 29% higher than that of banks with enhanced liability. Results are robust to a diff-in-diff analysis incorporating nationally-regulated banks (which faced the same regulations everywhere) and are not driven by other differences in state regulations, Fed membership, local characteristics, or differential selection into state-regulated banks. Our results suggest that exposing shareholders to more downside risk can successfully reduce bank failure.

JEL-Codes: G210, G280, G320, N220.

Keywords: limited liability, bank risk taking, financial crises, Great Depression.

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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 and allow banks to be highly levered. Combined with limited liability for bank shareholders, this creates strong risk shifting incentives. Moreover, excessive risk taking has large negative externalities: bank failures can lead to widespread financial crises and large output losses, and bailouts are costly.[1]

Since the beginning of modern banking in the early 19th century, policy makers and regulators 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 enhanced liability. From 1817 onwards, shareholders in most U.S. 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 enhanced shareholder liability is an effective tool to reduce bank failures. To do so, we compare the performance of U.S. banks with different shareholder liability regimes during the Great Depression. 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 find that single liability strongly increased the probability of bank failure. We consider four dimensions of distress: permanent suspensions, acquisitions (where we consider the acquired bank as failed), temporary suspensions (which typically led to a recapitalization), and "troubled raising" (the issuance of new equity to replenish capital). "Total trouble" (aggregating these four measures) was 29% higher for banks with single liability. The effect is strongest for permanent suspensions and acquisitions, with single liability banks 20% more likely to suspend and 69% more likely to

[1] On the output losses associated with banking crises see, among others, Allen and Gale (2000), Diamond and Rajan (2005), Boyd, Kwak and Smith (2005), Allen and Carletti (2006), Acharya and Yorulmazer (2008), Reinhart and Rogoff (2009), Ivashina and Scharfstein (2010), Acharya, Shin, and Yorulmazer (2011), Iyer and Peydro (2011), Jorda, Schularick and Taylor (2013), Acharya, Le, and Shin (2017), and Baron, Verner, and Xiong (2021). On costly bailouts, see, for example, Acharya, Drechsler, and Schnabl (2014).

be acquired. Acquisitions were commonly used to resolve bank distress during the Great Depression (see Section II.E and Carlson (2010)).[2] We also find suggestive evidence that single liability banks wrote down more capital (indicative of larger losses) and lost more deposits (indicative of a greater reduction in confidence) than double liability banks. As a result, the size of their balance sheets shrank more.

In 1928, before the Depression, banks with single liability did not have higher leverage or lower cash holdings. This suggests that their higher failure rates during the Depression were not due to greater ex-ante risk taking in these observable dimensions. Instead, the higher failure rates might have been due to the extension of riskier loans before 1929, and/or to more risk shifting once banks sustained their first losses ("gambling for resurrection"). The perception of greater risk, whether real or imagined, and a weaker capital position might have also led to more runs on single liability banks (Goldstein and Pauzner 2005, Egan, Hortaçsu and Matvos 2017). We evaluate this possibility in Section IV.

We use National banks in the same states as additional controls for local shocks. National banks faced uniform regulations and were subject to double liability everywhere. Our conclusions hold up in this diff-in-diff analysis. 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, the endogenous selection into State or National banks, being located in (central) reserve cities, or other location characteristics can explain our results – none of them appear to do so.

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 focus has been on raising capital requirements, in part to incentivize shareholders to reduce bank risk taking.[3] Empirical work on this idea has been hampered by the fact that there is little cross-sectional variation in capital requirements within countries, and by the difficulty of separating the incentive effect of additional capital from the mechanical effect of higher capital buffers on bank failures. Because

[2] Richardson (2007b) and Mitchener and Richardson (2020), amongst others, interpret banks being acquired during the Great Depression as a sign of distress.
[3] See, for example, Admati and Hellwig (2013) and Bhagat and Bolton (2014).

double liability's penalty payments become available only after a bank fails (and therefore do not *directly* change its solvency), our study isolates the incentive effects of increasing shareholders' downside exposure. Our findings indicate that capital requirements stabilize banks not only by increasing capital buffers, but also by changing bank behavior.

Our results also speak to proposals to increase the downside exposure of key decision makers in banks through, for example, deferral requirements or clawbacks in executive pay.[4] Several studies have shown that aligning bankers' incentives with limited liability shareholders, without additional downside exposure, causes excessive risk taking, hiding of losses, and less equity issuance.[5] Our results suggest that exposing bankers to additional downside risk would be effective. During our sample period, bank managers and directors typically had substantial equity holdings (Macey and Miller 1992, p. 56), so double liability significantly increased their exposure.

The second reason why our results are important is that, even though the Great Depression has been analyzed widely, the causes of this largest banking crisis in U.S. history are still debated.[6] Our paper contributes by showing that greater risk taking incentives by single liability banks significantly magnified 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 primary effect of this additional penalty should be to reduce shareholders' risk taking preferences, leading to less failure (Macey and Miller 1992, Esty 1998). There are, however, several forces that might weaken or even reverse the incentive

[4] The Squam Lake report by French et al. (2010), which discusses fixes for the financial system in the wake of the Global Financial Crisis of 2008, recommends withholding a fixed amount of compensation, effectively turning bank managers into inside creditors (Sundaram and Yermack 2007, Edmans and Liu 2011). Greenwood et al. (2017) echo this recommendation, and Van Bekkum (2016) finds that more inside debt held by bank managers induces less risk taking. See also Rajan (2008), Blinder (2009), Bolton, Mehran, and Shapiro (2015), Hill and Painter (2015, p. 190), Kay (2015, p. 279), Luyendijk (2015, p. 254), Cohan (2017, p. 146), and Goodhart and Lastra (2019).

[5] See, for example, Berger, Imbierowicz, and Rauch (2016), Flanagan and Purnanandam (2020), and Goetz, Laeven, and Levine (2020).

[6] See, amongst many others, Friedman and Schwartz (1963), Wicker (1996), and Mitchener and Richardson (2020) on the role of bank runs and the fall in the money supply, Bernanke (1983) on the drop in intermediation capital, Eichengreen (1992) on the role of the international Gold Standard, Temin (1976), White (1984), and Calomiris and Mason (1997, 2003) on the role of fundamentals and regional shocks, Eichengreen and Mitchener (2004) on the role of credit booms, Richardson and Troost (2009) and Carlson, Mitchener, and Richardson (2011) on the role of regional Federal Reserve banks, and Richardson (2007a), Heitfield, Richardson, and Wang (2017), Carlson and Wheelock (2018), Da, Mitchener, and Vossmeyer (2018), Mitchener and Richardson (2019), Calomiris, Jaremski, and Wheelock (2019), and Jaremski and Wheelock (2020) on the role of interbank networks.

effects of double liability (we discuss these in more detail in the next section). First, with no deposit insurance during our sample period, depositors might not allow single liability banks to lever up as much as those with double liability. Second, depositors in double liability banks might permit more risk taking while expending less effort on monitoring (Calomiris and Wilson 2004, Anderson, Barth, and Choi 2018). Finally, adverse selection of double liability shareholders might reduce its effectiveness (Winton 1993, Kane and Wilson 1998), although empirical evidence does not support this concern.[7]

The small literature on the effects of enhanced shareholder liability on bank distress and failure has found mixed results. Some studies indicate that limited liability increases distress probabilities. For example, Turner (2014) provides qualitative evidence that limited shareholder liability in 19th century U.K. was associated with more bank failures. Koudijs, Salisbury, and Sran (2019) find that New England banks whose managers had less personal liability lost more capital after the Panic of 1873. Other studies are less supportive. Grossman (2001), using U.S. state-level data from 1892-1930, observes more bank failure in states with single liability during normal times, but fewer failures during periods of banking crises, in particular 1930. Mitchener (2005, fn. 67), using U.S. county-level data from 1929-1933, finds no statistically significant relation between shareholder liability and bank suspensions. Goodspeed (2019), studying pre-1863 U.S. data, shows that banks with single liability were more likely to fail in the Panic of 1837, yet were (insignificantly) less likely to fail in non-crisis years.[8]

Given the theoretical questions and mixed empirical evidence, the effect of shareholder liability on bank distress remains an open question. Our paper offers new evidence by studying the effects of a large economic shock – the Great Depression – on banks with different liability regimes. We improve on the existing literature by assembling a large sample of individual banks, by hand-collecting failure data for each bank, and, most importantly, by carefully creating comparison groups. We select neighboring state pairs to control for regional shocks and take Federal Reserve 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 hand-collected data of around 4,200

[7] See, for example, Hickson and Turner (2003a, 2003b, 2005), Acheson and Turner (2006, 2008), Turner (2009), and Bodenhorn (2015).

[8] Relatedly, Colvin (2018) finds a negligible impact of the endogenously chosen shareholder liability regimes of small, specialized SME banks on their failure rates during the Dutch financial crisis of the 1920s.

individual State banks across eight state pairs also allows us to control for other covariates that may explain bank failure.

Our analysis compares 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 to the best of our ability. Richardson and Troost (2009) show that the policies of different Federal Reserve banks varied greatly during the Great Depression, with significant impact on bank outcomes. Therefore, we analyze 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. Hence, we require the paired states to have similar failure rates of National banks, which faced the same regulations everywhere. Federal Reserve (1932) and Wheelock (1995) observe much higher failure rates for small banks during the Great Depression. Therefore, we restrict our sample 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 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, Maryland, Massachusetts, New York, and Pennsylvania. We split up states that were part of two different Fed districts (Connecticut, Kentucky, Missouri, New Jersey, Pennsylvania, and Tennessee). As a result, our analysis spans eight state-Fed district pairs. The selected pairs are illustrated in Figure 1.

Our findings add to a broader literature on the effects of shareholder liability on bank risk taking and its consequences. Different from this literature, we measure risk taking using bank distress, an ex-post measure. This has two advantages. First, distress is easily observable. Available bank balance sheets lack detailed informed about the composition of bank assets, which makes constructing reliable ex-ante measures of asset risk difficult. Moreover, if banks hide risk, it will be invisible on the balance sheet. Second, risk taking has a straightforward effect on distress probabilities. Its effect on several variables examined in prior studies is, as we will argue, ambiguous.

Anderson and Watugala (2017) and Anderson, Barth, and Choi (2018) use deposit outflows to measure bank distress. They find that banks with less shareholder liability suffered larger withdrawals during the Panic of 1893 and the Great Depression, respectively. They argue that limiting shareholder liability increased depositor discipline by strengthening depositors' incentives to monitor. We observe similar results but have a different interpretation. Given their higher failure rates, we argue that larger deposit outflows are indicative of single liability banks' worse health, rather than of increased depositor discipline. Moreover, deposit outflows paint an incomplete picture, as they are observable for surviving banks only.

Other papers focus on proxies for asset risk. Using a sample of 84 publicly traded State banks in California, Illinois, and Missouri in the early 20th century, Esty (1998) finds that limited liability was associated with higher asset and equity return volatility. In contrast, looking at a sample of around 40 publicly traded New York City banks, Calomiris and Wilson (2004) show that between 1929 and 1933, limited liability was associated with lower, not higher, asset return volatility. Koudijs, Salisbury, and Sran (2019) find that New England banks whose managers had less personal liability made riskier loans in the 1870s.

Another strand of the literature uses bank leverage as measure of risk taking. Theoretically, the impact of limited liability on leverage is ambiguous. On the one hand, not having to pay a penalty in bankruptcy is an incentive to choose higher leverage. On the other hand, limited liability might increase the ex-ante cost of debt, so banks might choose to borrow less. Analyzing different datasets and time periods, studies find mixed results. Some papers report a positive effect of limited liability on leverage (Grossman 2001, Mitchener and Richardson 2013, Koudijs, Salisbury, and Sran 2019), while others find no or a negative 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 distress, it was quickly repealed after 1933 (Mitchener and Richardson 2013). What explains this incongruity? Macey and Miller (1992) argue that abolishing double liability was a political decision that was not economically optimal. During the Great Depression, many shareholders had to pay double liability claims, right at a moment when they were already in financial trouble. Many of them were not involved in the banks' management and, therefore, not directly to blame for failure.[9] This created political resentment. The creation of deposit insurance, in combination with increased government

[9] Wilson and Kane (1996) argue that dispersed share ownership undermined the efficacy of double liability.

monitoring, appeared sufficient to safeguard the financial system, and double liability was repealed (White 2011). 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."[10] 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 this paper is organized as follows. Section I discusses single and double liability and their expected effects on risk taking and bank survival. Section II reviews the historical background, focusing on bank liability regimes and developments during the Great Depression. Section III explains our data and reports summary statistics. Section IV presents the main empirical analysis. Section V examines alternative explanations for our results. Section VI concludes.

I. Conceptual framework

In this section we first discuss the differences between double liability and capital requirements. We then analyze the effects of double liability on banks' risk taking incentives.

A. Double liability vs. capital requirements.

The key difference between single (SL) and double liability (DL) is that under DL shareholders pay a penalty in case the bank fails. This makes DL to some degree comparable to higher capital requirements (or adding contingent capital). The crucial difference, however, is the timing of when this additional capital becomes available. With higher capital requirements, it is available before banks fail, and before any bankruptcy costs are incurred. With DL, the additional capital is only available afterwards. As such, DL does not have the same "buffer" function that capital requirements have. For example, if a DL bank has half the book capital of an SL bank – so both have the same total (contingent and non-contingent) capital – the DL bank requires only half as large a drop in asset values to become insolvent.[11] Moreover, because shareholders' additional payments are made after failure, DL exposes them to bankruptcy costs. Consequently, DL provides strong incentives to limit risk.

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[10] Deposit insurance is problematic ex-ante (e.g., Kareken and Wallace 1978, Chan, Greenbaum, and Thakor 1992, Boot and Thakor 1993, Freixas and Rochet 1998, Goldstein and Pauzner 2005) and may also not fully prevent bank runs ex-post (Iyer and Puri 2012, Artavanis et al. 2019, Martin, Puri, and Ufier 2020).

[11] In addition, because shareholders had to sell illiquid assets, DL payments often arrived with delay (Macey and Miller 1992), which further reduces the buffer function of DL.

Having to deliver additional capital only after a bank fails is an advantage of DL over higher capital requirements if shareholders are liquidity constrained. For example, bank shareholders might need the additional capital for their private consumption or businesses and might be unable to borrow using bank shares as collateral.[12] This increases DL banks' charter values (compared to SL banks with higher capital requirements) and makes failure more costly, so DL shareholders have an even stronger incentive to safeguard banks (Hellmann, Murdock and Stiglitz 2000). This benefit has to be traded off against the larger administrative burden of collecting penalties after a bank fails.

B. Double liability and bank risk taking

How do risk taking incentives, on the asset and/or the liability side of the balance sheet, differ for SL and DL shareholders?

First, hold book leverage constant. In that case, DL shareholders' additional downside exposure should make them more averse to increasing asset risk. Shareholders with SL, on the other hand, are protected by limited liability and have standard risk shifting incentives, especially if the bank cannot commit to safe lending and if the quality of its assets is unobservable. SL banks should therefore take more asset risk than DL banks and be more likely to fail in bad states of the world. Moreover, after a negative shock, SL banks have stronger incentives to further increase risk ("gamble for resurrection") and weaker incentives to raise new capital (Admati et al. 2018).

Of course, leverage may differ between SL and DL banks, potentially undoing any effect on asset risk. However, the effect of the liability regime on bank leverage is ambiguous. With leverage itself observed, there should be little incentive for shareholders to increase risk on the liability side, especially since deposits are callable. All else equal, DL banks might choose lower leverage simply because bank failure is more costly for their shareholders. Koudijs, Salisbury, and Sran (2019) show that if bankers are risk averse, they value the option to default on bank deposits since it shares risk between them and depositors. DL reduces this risk sharing and induces bankers to choose lower leverage. This, in turn, further reduces their risk taking on the asset side.

Conversely, DL banks might choose higher leverage, as depositors charge lower interest because of the additional payment in default and because they understand that DL banks take less asset risk. Higher leverage in turn encourages risk shifting and reverses some of the direct incentive

[12] National and state banking acts typically restricted banks from making loans on the collateral of bank shares.

effect of DL on risk taking. At the same time, SL banks might choose lower 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 level of risk on the asset side.

Even keeping leverage the same, the literature has identified several other reasons why DL might be ineffective or even counterproductive. First, depositor discipline, highlighted by many as important for reducing bank risk (e.g., Calomiris and Kahn 1991, Diamond and Rajan 2001), might be weakened. Depositors in DL banks receive a payout in case the bank fails, which reduces their optimal monitoring effort (Calomiris and Wilson 2004, Anderson, Barth, and Choi 2018). Second, DL shareholders might be adversely selected. That is, only people with little personal wealth might be willing to hold bank shares, and would have only weak incentives to rein in risk taking (Winton 1993, Kane and Wilson 1998). Moreover, if skill and wealth are positively correlated, the quality of shareholder monitoring might decrease. New York Governor, and future U.S. President, Martin Van Buren voiced this concern in 1839 when he warned of the potential "low character" of shareholders with DL (Knox 1900, p. 400). Third, DL might have no effect if banks' charter values are so high that shareholders never want to take risks that might lead to bank failure.[13]

To summarize, DL provided regulators with a tool to curb bank risk taking that might have been equally (or even more) effective than modern capital requirements. However, bankers' and others' endogenous responses to DL may have (partially) undermined its effectiveness. It is ultimately an empirical question whether DL achieved its goal of reducing bank risk and failure.

II. Historical background

In this section, we provide more detail of the structure and regulation of the U.S. banking system during our sample period, and we briefly discuss how the Great Depression played out for the banking system.

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[13] Keeley (1990), Suarez (1994), and Repullo (2004) model the link between charter values and risk taking. On the importance of charter values, see Petersen and Rajan (1994, 1995), Berger and Udell (1995), Demsetz, Saidenberg, and Strahan (1996), Dahiya, Puri, and Saunders (2003), Berger et al. (2005), Song and Thakor (2007), Hellmann, Lindsey, and Puri (2008), Drucker and Puri (2009), Bharath et al. (2011), Ivashina and Kovner (2011), Iyer and Puri (2012), Puri, Rocholl, and Steffen (2017), and Ben-David, Palvia, and Stulz (2020).

A. Structure of the banking system in the 1920s

The American banking system of the 1920s was organized around local banks. Branching, if allowed, was typically restricted to the same town or (sometimes) county. In only 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 into lending money on the collateral of real estate and securities. There were barriers to entry: banks could only obtain a charter if they raised a minimum amount of equity capital (Federal Reserve 1932, White 1983, Mitchener 2005, 2007).

Banks were regulated at either the national or state level, depending on what type of charter a bank operated under.[14] The regulator for National banks was the Office of the Comptroller of the Currency (OCC), for State banks it was the local state banking department. Regulations could differ substantially. First, shareholders of National banks faced double liability, whereas in some states, State banks had single liability. Second, National banks typically had higher reserve and capital requirements. Third, National banks faced more restrictions on their loan portfolios. Most importantly, loans backed by real estate (important for rural banks) were restricted to 25% of total equity capital.[15] Fourth, the supervision by state banking departments was typically laxer than that by the OCC.[16] Finally, until the McFadden Act of 1927, National banks faced more restrictions on opening branches than State banks (White 1983, 2011, Robertson 1995, Jayaratne and Strahan 1996, Mitchener 2005, 2007).

National banks were automatically members of the Federal Reserve System, which gave them access to the Fed's discount window. State banks could decide to become members if they fulfilled the same capital and reserve requirements as National banks (White 1983, p. 98, 135). Smaller, rural banks typically decided not to do so. First, many did not have enough capital to qualify. Second, many had little collateral eligible at the Fed's discount window, and they could obtain indirect access through their Fed-member correspondent banks (we discuss correspondent banks in section V.E). Third, they typically held few reserves so the Fed's higher reserve requirements

[14] Our State bank category contains both banks and trust companies. We combine the two because, for the states in our sample, few regulatory differences remained between them by the end of the 1920s (Federal Reserve 1932, p. 54, 58, White 1983, p. 40).
[15] Such loans were deemed too illiquid and long term, thus creating too much maturity mismatch (Federal Reserve 1932, p. 126). We analyze restrictions on State banks' loan portfolios in Section V.A.
[16] Agarwal, Lucca, Seru, and Trebbi (2014) show that this continues to be true in recent years.

were particularly costly. Fourth, reserves at the Fed paid no interest, whereas money deposited at correspondent banks did (White 1983, p. 133-4, 156). Larger State banks often did become Fed members, often passing through discount window liquidity to other banks in their network (Anderson, Calomiris, Jaremski, and Richardson 2018). Even though the Fed had the right to examine State member banks on an ad hoc basis, the local state banking department remained their primary regulator (Federal Reserve 1932, p. 25, 31, White 1983, p. 166). Compared to National banks, they continued to face fewer restrictions on their loan portfolios, and they were able to branch statewide (if allowed by state law), a right National banks only obtained after 1927.

We can, therefore, distinguish between two types of State banks. The first were small, often rural banks, that did not have enough capital to become a National bank or join the Federal Reserve system, and for whom the costs likely far outweighed the benefits. The second were larger, often urban banks who became Fed members, but who valued more lenient regulation or preferred to deal with the state regulator, and therefore did not seek a national charter.[17] In our empirical analysis, we ensure that our results hold when dropping the latter group.

B. The regulation of State banks

State banks faced numerous regulations. Most states restricted the types of loans banks could make and the securities they could invest in. There were typically limits on real estate loans, on loans to individual borrowers, and on loans to bank officers. State banks also faced reserve requirements, forcing them to hold a minimum percentage of deposits as cash or as deposits with the Fed or larger banks. On the liability side of the balance sheet, banks had to maintain a minimum dollar amount of paid-in equity capital. In addition, banks had a "surplus" account to which they could add retained earnings.[18] No dividends could be paid from paid-in or surplus capital. In case of losses, banks would first write down their surplus. If this was insufficient, they would next write down their paid-in capital, although it could not fall below the statutory minimum. On average, paid-in capital constituted about 50% of total equity.

[17] 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, greater ability to carry on a trust business, and laxer supervision were the main motivations for pursuing a state charter (Federal Reserve 1932, p. 100).
[18] The par value of a share equaled its paid-in value. If a bank issued new shares above par, the difference between the issuance price and the par value was added to the surplus account.

The governance of banks was also regulated. Boards had to have a minimum number of directors, and each director had to own a minimum number of shares. Bank officers in many states were required to sign bonds, which would pay out in case they acted in bad faith, and there were criminal penalties for bad behavior. State banking laws also set rules for state banking departments, stipulating the frequency and nature of bank examinations and the authority of the department over troubled banks (see White 1983, and various state statutes).

Because state banking laws closely followed the National Banking Act (which regulated National banks), the laws were relatively homogenous. Nevertheless, important differences remained (Mitchener 2005, 2007). The choice of single or double liability, discussed in the next section, was one of them. In addition, there were differences in capital and reserve requirements, in restrictions on particular loan types, in the authority of state banking departments, and in limits on branch banking. Section V.A provides more detail and, important for interpreting our results, shows that the regulations were not systematically different between single and double liability states.

Several U.S. states experimented with deposit insurance schemes in the early 20th century, all of which closed during the 1920s or early 1930s (Chung and Richardson 2006, Aldunate 2019, Calomiris and Jaremski 2019). As deposit insurance might have long-lasting effects on the structure of the banking system, for example by increasing the number of small banks, we exclude the affected states from our analysis.[19]

C. Liability for bank shareholders

Additional liability for bank shareholders was seen as an important tool to curb risk taking. By 1830, most U.S. states limited shareholders' liability to their invested capital (Blumberg 1985). Banks were the exception, and many states increased bank shareholders' liability during the 19th century. For example, New York banks had double liability between 1827 and 1829, and then again after 1850. Massachusetts and Pennsylvania introduced it in 1811 and 1808, respectively. After limiting it in 1850 by only protecting banknotes, both states reintroduced full double liability around 1870 (Bodenhorn 2015, Mitchener and Jaremski 2015). The table below shows the years double liability was (re-)introduced in our sample states. By 1893, 36 years before the onset of the Great Depression, the laws had solidified and no further changes occurred.

[19] Federal deposit insurance did not exist until 1934, which is after our sample period.

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

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

There were multiple reasons why states introduced double liability for their banks. Mitchener and Jaremski (2015) suggest that it was a relatively cheap form of regulation, in lieu of creating a costly banking regulator. Of the 39 states that eventually introduced double liability, 32 did so before the creation of their banking department. Another impetus was the banking act of 1864, which introduced double liability for National banks and nudged several states to do so as well. Finally, Grossman (2007) shows 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 (equal to paid-in capital). Macey and Miller (1992) report that double liability was strictly enforced and widely upheld by courts. There were a number of safeguards to prevent investors from escaping claims. If shares were 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 a sale in case the purchaser became insolvent, even if the bank had not yet failed at the time of sale. During the Great Depression, many shareholders were hit by double liability claims (Roth 2009). The claims were so widespread that it fomented a political movement to end double liability (Macey and Miller 1992).

D. Great Depression

Many U.S. banks became troubled during the Great Depression. After the stock (and real estate) markets crashed in October 1929, the banking system soon came under pressure, with three banking panics between 1929 and 1933 (Friedman and Schwartz 1963). In February 1933, many states proclaimed a "bank holiday" for their banks, suspending withdrawals, which newly elected President Roosevelt extended to banks nationwide on March 6, 1933. 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 in existence in 1929 vanished during the Depression.

The banking panics had a strong regional character (see, amongst others, Wheelock 1995, Wicker 1996, Calomiris and Mason 2003, Heitfield, Richardson, and Wang 2017, and Mitchener and

Richardson 2019). The majority of banks that failed were small and rural. These banks had been hit hardest by the agricultural depression of the 1920s. Moreover, rural areas appear to have been "overbanked", that is, state regulators seem to have allowed too many bank charters (Wheelock 1995, Federal Reserve 1932, p. 125). We take these patterns into consideration when matching neighboring single and double liability states for our empirical analysis.

As is the case in much of the literature (see, for example, Wheelock 1995), our sample runs up to February 1933. It therefore excludes bank closures caused by the banking holidays. During the national banking holiday, all banks were closed and only those permitted by regulators could reopen. These decisions might have, at least in part, been driven by broader economic or political considerations rather than the health of each bank.[20] In addition, the bank failure data we use in this paper is based on a Federal Reserve reporting system that did not track bank closures during state or national banking holidays (Richardson 2007c).

E. Troubled banks[21]

A bank was "troubled" if it had sustained losses such that its paid-in capital (the lion's share of most banks' equity) was impaired. A troubled bank had multiple options. The most benign was to write down its capital and reduce the size of its balance sheet. This was constrained by the requirement to maintain capital at or above the regulatory minimum dollar amount. Alternatively, a bank could try to raise capital from outsiders or, in certain states, it could levy a (typically voluntary) assessment on existing shareholders to make up the deficit. Such recapitalizations might take place after a bank had temporarily suspended.

If a bank was unable to fix the capital impairment, it was forced to make a deal with another bank, or close. If still solvent, a bank would typically try to negotiate a deal. It could try to sell its assets to a non-troubled bank and use the proceeds to repay depositors, returning any surplus to shareholders. During the Great Depression, this was difficult to accomplish. Due to the Gold Standard and the occurrence of bank runs, there was high demand for cash by both the public and banks. Few banks were willing to use their cash to purchase "slow" assets.

[20] Moreover, many banks recapitalized by issuing preferred stock to the Reconstruction Finance Corporation (RFC). As with other Depression-era programs, it is possible that the allocation of RFC funds was at least in part political (Wallis 1998, Mason 2003, Wallis, Fishback, and Glaeser 2007).
[21] This section is based on Columbia Law Review, 32-8 (Dec. 1932), pp. 1395-1410, and Upham and Lamke (1934).

Troubled banks therefore typically tried to get acquired by a stronger bank that would take over both its assets and its liabilities, with no cash payment (Richardson 2007b, Carlson 2010). According to Upham and Lamke (1934, p. 117), such acquisitions, "important among state as well as national banks, were very numerous." An acquisition was risky for the acquirer. Dissenting shareholders of the acquired bank could sue to be bought out at the "true" value of their shares. Moreover, acquiring additional liabilities might put the acquirer's other liabilities at risk, which in some states was forbidden by law.[22]

As expected, the vast majority of acquisitions in our sample were associated with impaired bank capital. Comparing the pre-acquisition capital positions of the acquirer and target to that of the combined post-deal entity, paid-in capital was written down in 84% of deals.[23] On average, acquirer and target combined wrote down 24% of paid-in capital and 21% of total equity (23% and 20%, respectively, in the median deal). If we assume that the acquiring banks did not write down any of their capital, the target banks (which were typically smaller) lost on average 65% of paid-in capital and 73% of total equity, and 100% of both at the median. This contrasts sharply with banks in our sample not involved in an acquisition in a given year, which experienced on average year-on-year increases of 3% in paid-in capital and no changes in total equity.

If no acquirer could be found, a troubled bank could ask another bank to act as its liquidating agent. In this case, the stronger bank would (for a fee) liquidate the assets of the troubled bank. If the revenues were sufficient to meet liabilities, the surplus went to the shareholders of the failed bank. If the revenues were insufficient, the same shareholders, if subject to double liability, remained responsible for the deficit.

If no deal of any type was possible, the troubled bank would be taken into receivership. Depending on the state, either the court appointed a receiver, or the banking department assumed this role. The receiver typically sought to liquidate the bank's assets. It would sell off all "acceptable assets"

[22] This was true in Connecticut, Georgia, New Jersey, and New York. Granja, Matvos, and Seru (2017) find that in modern times, failed banks are predominantly acquired by well-capitalized local banks operating in similar lines of business. If local banks are undercapitalized, then less similar, remote banks step in.
[23] This data, described in detail in Section III.C, was collected on forms St. 6386 by the Fed Board of Governors. The capital positions are for all acquisitions in our sample, involving state or national banks, for which this information is available. Around 30% of acquisition forms are incomplete and do not report the banks' capital positions.

to another bank, who would usually also handle (for a fee) the liquidation of all doubtful assets. If subject to double liability, the failed bank's shareholders remained liable for any deficit.

III. Data and empirical strategy

A. State selection

We match each of the nine single liability (SL) states in 1928 to one neighboring double liability (DL) state. Wicker (1996) 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 of significant variation in the policies of regional Federal Reserve banks. Therefore, we select state pairs that (1) are direct neighbors, (2) are in the same Federal Reserve district, (3) have similar failure rates of National Banks, and (4) have similar State bank sizes. Online Appendix A provides details of the procedure. We split states that were part of two different Federal Reserve districts and match at the state-Fed district level. We omit all state-Fed districts with fewer than 50 State banks in 1928, and all states that had state-level deposit insurance schemes in the early 20th century.[24] We use National bank failure rates to match states that suffered similar shocks during the Great Depression. National banks faced DL in all states, so their failure rates provide a useful measure of the severity of the banking crises in each state. We use average bank sizes to match states with similar types of banks.

Our final sample consists of six single liability states spanning eight state-Fed districts, each matched to one neighboring state-Fed district with double liability (see Figure 1). Georgia and the part of Kentucky in Fed district 8 each serve as a match to two SL states, so their banks enter the sample twice. We correct all standard errors to account for this duplication.

B. Empirical strategy

In our baseline tests we compare bank outcomes $Y_{i,s}$ (defined below) between the two state-Fed districts in each of the eight pairs, where *i* indexes a bank and *s* a state-Fed district within a pair. For the single-difference analysis, we restrict the sample to State banks and run the following regression for each state-Fed district pair:

$$Y_{i,s} = \alpha + \beta SL_s + \varepsilon_{i,s} \tag{1}$$

[24] The former eliminates two of the SL states, the latter eliminates all potential DL-matches to one SL state.

The SL indicator identifies the state-Fed district with single liability. The intercept, *α,* measures the average outcome for banks in the state-Fed district with DL, while *β* measures the average difference in bank outcomes between state-Fed districts with SL and those with DL.

When combining all pairs in the same regression, we weight each observation such that each pair receives equal weight, independently of the number of banks. This yields coefficients that are the simple average of the coefficients from the eight individual pairs.[25] Without weights, if there are differences in bank outcomes across pairs, our estimates would skew towards the state-Fed districts with the most banks. Online Appendix Table E.1 shows that there are large differences in the number of banks across state-Fed districts, with the largest number in the Missouri-Kentucky pair.

Our careful selection of state pairs notwithstanding, the estimates from Eqn. (1) might be biased if DL and SL states are hit by systematically different economic shocks. Following the literature, we bring National banks, which faced DL in every state, into the analysis.[26] Due to regulatory differences (see Section II.A) and size differences (see Section III.D), National and State banks are not directly comparable. However, we can use the differential outcomes of National banks in different states to control for state-level economic shocks. Given that our state selection is meant to minimize differences in National bank failure rates within each pair, the results from this double difference analysis should be interpreted with caution. In the extreme, if the paired SL and DL states are hit by the exact same economic shocks, the inclusion of National banks only adds noise.

Concretely, we estimate the following difference-in-differences equation for each pair:

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

Subscript *b* indexes whether bank *i* is a State or National bank, and $SB_{i,b}$ is an indicator 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 of *δ* in Eqn. (2) to be significantly different from the single difference estimate of *β*

[25] As a robustness test, we also run unweighted regressions with pair fixed effects. The results, shown in Online Appendix Table E.5, are similar.
[26] See for example Grossman (2001) and Mitchener and Richardson (2013).

in Eqn. (1). As in the single-difference analysis, when pooling pairs in the same regression, we weight observations such that each pair receives equal weight.

Throughout, we report standard errors that are clustered at the individual bank level because banks from Georgia and Kentucky (Fed district 8) enter the sample twice, resulting in duplicate observations. Residuals, however, might also be dependent across banks, for at least two reasons. First, state-level shocks might cause bank outcomes to be correlated within states. Second, regional shocks might cause bank outcomes to be correlated within pairs. For the pooled regressions combining all pairs, we therefore also show p-values from double-clustering at the state and state-Fed district pair level. Since both New Jersey and Tennessee are split into two Fed districts, and each occur in two different pairs, there is only partial overlap between these two levels of clustering. To account for the small number of clusters – there are 12 states and 8 pairs in our data – we obtain p-values using the wild cluster bootstrap (Cameron, Gelbach, and Miller 2008, Roodman, Nielsen, MacKinnon, and Webb 2019).[27]

C. Sources

We hand collect data from a variety of sources. The information on individual bank failures was recorded on forms St. 6386 by the Fed Board of Governors' Division of Bank Operations.[28] In the 1920s, a nationwide reporting network had been established to collect uniform and comprehensive information about bank suspensions, mergers and acquisitions, and other changes. The data cover all banks, including National and State banks, trust companies, and banks that were not members of the Federal Reserve.[29] We collect these data for all 12 states in our sample.

We obtain bank-level annual balance sheet data for 1928 to 1933 from OCC annual reports (for National banks) and from reports by the various state banking departments (for State banks). The state reports are not available for Maryland, Pennsylvania, and Tennessee, so we use Rand McNally's *Bankers' Directory* instead.[30] If available, we prefer the state reports, as we believe them to be more accurate. The reported balance sheet categories are coarse, especially on the asset

[27] We bootstrap coefficients, even though bootstrapping t-statistics is more standard. The latter requires estimating a variance-covariance matrix in each bootstrap iteration. If any of these estimates is not positive definite, the t-statistic is not defined, which we encounter in several regressions with additional control variables. Bootstrapping coefficients avoids this problem. Comparing approaches (where possible) suggests that ours yields more conservative p-values.
[28] The forms are currently located in the National Archives: record group 82, file number 434.-1.
[29] See Richardson (2007b, 2007c) and references therein for a detailed description of this source.
[30] For Alabama and Georgia the state banking department only published data every other year.

side. For several states, we can only distinguish between cash-like reserves and a line item comprising loans and securities, with no information about its composition. This lack of detail makes measuring asset risk difficult. Moreover, because risk shifting should by definition not be observable by depositors, measuring asset risk would be a challenge even with detailed balance sheet data. We therefore prefer bank distress as our key outcome variable.

We collect information about differences in state-level regulations from several sources. Mitchener and Richardson (2013) carefully reconstruct which states imposed single or double liability on bank shareholders. Federal Reserve (1932) provides information on State bank regulators, and Fed bulletins from 1929 report reserve requirements and restrictions on branching for State banks. Finally, we study original state statutes and session laws (available through *Heinonline.org*) to determine minimum capital requirements, restrictions on banks' asset portfolios, and other regulatory differences.

D. 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. On the other hand, Online Appendix Figure E.1 shows that, in our sample larger banks had higher leverage in 1928, which might have made them more likely to fail. Therefore, to compare like with like, our analysis compares banks of similar size.

We restrict both the single and the double difference samples to the common support of bank sizes in each state-Fed district pair. For each SL State bank, we select all DL State banks in the neighboring state-FED district with total assets between 75% and 125% (or ±$25,000, whichever is greater) of the SL State bank. For the double difference sample, we use the same cut-offs to also select National banks in the same and in the neighboring state-FED district. Each matched bank is retained only once, even if selected multiple times. To remain in the single-difference sample, SL State banks need to have at least one matched DL State bank, and, to remain in the double-difference sample, at least one match in each of the three other groups. Details are in Online Appendix B.[31]

[31] When attempting one-to-one matching, we repeatedly matched to the same banks, thereby overweighting a small number of banks and underweighting others of similar size. Focusing on the common support gives all banks with similar size equal weight.

Table 1 summarizes the distribution of bank sizes, both before and after restricting the sample to the common support. Statistics for the single (double) difference samples are on the left (right). Panel A reports results for the unrestricted samples. Two patterns stand out. First, as expected, National banks were on average larger than State banks. Second, State banks in DL states were on average four times larger than those in SL states. Therefore, if larger banks failed less, DL State banks might appear safer even if the liability regime is irrelevant. This effect is largely (but not entirely) driven by some of the DL states in the sample – New York, Pennsylvania, and Massachusetts – that were home to some of the largest banks in the country. This also explains why our DL states have larger National banks.

Panel B describes the common support samples. The size differences are much smaller, as some of the largest and smallest banks in each pair have been omitted. In the single difference sample, the number of banks falls only slightly. In the double difference sample, it drops by around 15%, as many small State banks and some of the largest State and National Banks drop out, due to the requirement that SL State banks have at least one match in each of the three other groups. Even though the differences are reduced, State banks in SL states remain smaller than other banks.

Panel C applies the weights described in Section III.B, which ensure that each state-Fed district pair receives the same weight, so that pairs with more banks do not dominate. Weighting further reduces the size differences. Nevertheless, State banks in SL states remain on average somewhat smaller than their counterparts in DL states. Looking at medians, however, State banks in SL and DL states are almost indistinguishable, though both remain smaller than National banks.

To summarize, the State banks in our final sample are of comparable 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 regressions and show that the results are unchanged. Section V.D also shows that the SL and DL samples are balanced in terms of rural versus urban banks.

E. Variables

Outcome variables

Our primary outcome is bank distress. We consider four different measures: (1) permanent suspensions, (2) being acquired, (3) temporary suspensions, and (4) troubled raising. Category (1) is self-explanatory. For (2), we determine which bank in a merger or acquisition disappeared based on the charter under which the combined bank continued. Category (3) means that a bank suspended but reopened at a later point in time. Such banks were typically recapitalized in the interim, with shareholders and directors putting in fresh equity and depositors relinquishing some of their claims (Carlson 2010).

For (4), we use balance sheet data to identify new equity raisings as an increase in paid-in capital in any year between 1929 and 1932. We do not classify an equity raising as troubled if the bank's total equity in its last year in our sample was higher than in 1928, or if it acquired another bank in the year its paid-in capital increased. The goal is to omit equity raisings that are unlikely to result from banks' need to recapitalize. This measure misses troubled raisings if a bank wrote down paid-in capital and raised (at least as much) new equity within the same fiscal year. This is an unfortunate limitation of using annual data.[32]

For our baseline regressions, we aggregate the four distress outcomes into (5) "total trouble." This simplifies the predictions and addresses the concern that different state regulators may have treated troubled banks differently. For example, some regulators may have assisted in arranging acquisitions, while others may have pushed for liquidations. Using total trouble makes our analysis robust to such differences.

As secondary outcome variables we use (6) capital write-downs, (7) changes in deposits, and (8) changes in total assets (the size of bank balance sheets). For (6) we take the log-difference between total equity at the end of 1932 and 1928, subtracting the (approximate) amount of capital raised. Specifically, if paid-in capital increased during any fiscal year, we subtract that increase from total equity at the end of 1932 before computing the log-difference.[33] For (7) and (8) we simply use log-changes from 1928 to 1932.

Finally, to examine whether DL and SL banks were visibly different already before the Great Depression, we analyze their balance sheets in 1928. We focus on (9) leverage (the ratio of liabilities to assets) and (10) the ratio of cash (including deposits at other banks) to deposits,

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[32] Some banks experienced multiple forms of distress. In 30 cases, a bank suspended temporarily before a permanent suspension or being acquired. In 12 cases, a banked conducted a troubled raising before a permanent or a temporary suspensions or being acquired. In 17 cases, a bank suspended (without reopening) before being acquired – we code these cases simply as acquisitions and not also as permanent suspensions.

[33] This is an approximation for two reasons. First, if equity was sold above par, it increased both paid-in and surplus capital. Second, if a bank both wrote down and raised equity in the same year, we underestimate the amount raised.

winsorizing both at the 1st and 99th percentile. Both variables measure the riskiness of bank balance sheets. Higher leverage makes a bank more sensitive to declines in asset values, and a lower cash-to-deposits ratio makes it more vulnerable to runs, an important consideration in the absence of deposit insurance.

Explanatory variables

Our key right-hand side variable is whether a state mandated single or double liability for State banks. In some of our analyses, we use characteristics of 1928 bank balance sheets, in particular size (total assets), leverage, and cash/deposits, as additional controls. As these balance sheet characteristics might be endogenous to the liability regime, their inclusion could bias the coefficient on the regime. We therefore include these controls in robustness tests only.

F. Summary statistics

Table 2 shows descriptive statistics for 1928 balance sheets and for the outcome variables, which are measured from the end of 1928 to the end of 1932 (February 1933 for suspensions and acquisitions). The table includes separate statistics for State and National banks, and for the single and double difference common support samples. Observations are weighted such that all pairs receive equal weight, independently of the number of banks.

At the end of 1928, State banks had mean and median leverage, measured as liabilities/assets, of 82% and 84%, respectively. Given such high leverage, it is unsurprising that many banks failed during the Great Depression. 17% of State banks suspended permanently, 12% were acquired, 3% suspended temporarily, and 3% used a troubled raising. Combining the four outcomes identifies 33% of State banks and 22% of National banks as being in trouble.[34]

From 1928 to 1932, both State and National banks saw their deposits shrink by almost 30% on average, and their balance sheets by almost 20%. Surprisingly, capital write-downs were much more limited, especially for State banks. This suggests that banks were reluctant to recognize losses and write down equity, and that regulators did not force them to do so. The frequent equity write-downs observed during acquisitions (noted in Section II.E) are not captured in Table 2, and are likely due to the acquiring bank insisting on a write-down of the target's assets.

[34] These rates are lower than the 45% reported by Friedman and Schwartz (1963). The main reason is that our analysis ends in February 1933, before the National Banking Holiday.

IV. Empirical results

We first examine bank leverage and cash holdings before the Great Depression. We then present our main results on bank distress between 1928 and February 1933, followed by an analysis of capital write-downs and reductions in deposits and total assets. Finally, we link our findings back to our conceptual framework.

A. Leverage and cash holdings in 1928

We first compare bank balance sheets in 1928, focusing on leverage (liabilities/assets) and cash-to-deposits, which are observable to depositors. In the conceptual framework of Section I, the effect of the liability regime on leverage is ambiguous. On the one hand, SL banks have an incentive to choose higher leverage, because their shareholders have more downside protection than those in DL banks. On the other hand, to compensate for their stronger risk taking incentives, SL banks might have to pay higher deposit rates than DL banks with similar leverage. In response, SL banks might choose lower leverage. By the same logic, the effect of SL on cash-to-deposits is ambiguous as well.

Results for leverage and cash-to-deposits are in Tables 3 and 4, respectively, with the single difference estimates in Panel A and the double difference estimates in Panel B. Columns (1)-(8) show separate estimates for the eight state-Fed district pairs in our sample. The regression in the final column combines all eight pairs and applies weights so that each pair receives equal weight, resulting in coefficients that are the average of those from the individual pairs.

The results show no consistent effect of SL on leverage or cash-to-deposits, with different signs on the estimate in different state-Fed district pairs. The standard errors for the individual-pair estimates, even though clustered at the bank level, do not allow for in-state correlations across banks. They should therefore be interpreted with caution. The combined estimate for leverage in Column (9) of Table 3 show no systematic difference between SL and DL banks; the point estimate is economically small, both in the single and double difference, and statistically indistinguishable from zero.[35] For cash-to-deposits, the aggregate estimate in Column (9) of Table 4 has different signs in the single and double difference. In both, the effect is small and insignificant. Hence, there

[35] Unlike for the individual pairs, the statistical significance of the aggregate effects is assessed using wild cluster bootstraps with double-clustering at the state and state-Fed-district-pair level, which allows for in-state and in-pair correlations across banks. The corresponding *p*-values are in square brackets. See Section II.B for details.

is no evidence that SL banks took more *observable* risk on their balance sheets before the Great Depression. They might, however, have taken greater *unobservable* risk (e.g., by making riskier loans), which should be revealed through higher distress rates in the subsequent downturn.

B. Bank distress, 1929 - February 1933

We turn to bank distress, our main focus, and start the analysis with our measure of "total trouble." In the conceptual framework of Section I, the effect of SL on bank risk taking depends on the endogenous response of bank leverage to the liability regime. Given that SL and DL banks chose similar leverage in our sample, we predict SL banks to take more unobservable risk, and to more frequently gamble for resurrection after the initial shocks of the Depression. As a result, we expect SL banks to suffer greater losses in the Depression and, thus, to be more likely to suspend, be acquired, or raise capital.

The results in Table 5 confirm this prediction. SL banks suffered a higher probability of distress in all eight pairs in the single difference, and in seven pairs in the double difference (although, again, standard errors for the individual pair regressions in columns (1)-(8) should be interpreted with caution). The effect is not restricted to a specific geographic area. For example, the single difference estimates are largest for Connecticut-Massachusetts, Alabama-Georgia, and Missouri-Kentucky, three very different state pairs. The aggregate effect in Column (9) is large. In the single difference, SL banks faced an 8.4 percentage point higher probability of distress (p-value = 0.030), 29% more than the baseline rate in DL states. The effect is even larger in the double difference, but, with a p-value of 0.105, also more noisily estimated.

Table 6 adds additional controls. For brevity we only report aggregate results for all pairs combined. For comparison, Column (1) replicates Column (9) of Table 5. Column (2) controls for 1928 leverage and cash/deposits. Since SL and DL banks were similar on these dimensions in 1928, we do not expect the effect of SL to change much. The estimates confirm this. Columns (3) and (4) add controls for 1928 bank size using log(total assets) and indicators for total asset quintiles, respectively. Because the sample was already restricted to banks on the common support of bank size, we do not expect size controls to matter much. The results again confirm this. Altogether, Table 6 suggests that neither observable ex-ante balance sheet conditions nor bank size can explain the much higher distress rate of SL banks.

In Table 7 we split the "total trouble" variable into its constituent parts – permanent suspensions, acquisitions, temporary suspensions, and troubled raising. Given similar leverage ratios, we expect SL banks to suffer more permanent suspensions. The predicted effects of SL on acquisitions, temporary suspensions, and troubled raising are, however, ambiguous. Other banks and shareholders (old or new) will only invest in a bank if it has positive net value. If losses are too large, no one will agree to contribute new equity or assume the bank's liabilities, ruling out acquisitions, most temporary suspensions (which typically involved a recapitalization by existing shareholders), and equity issues. Moreover, SL shareholders might have had weaker incentives to recapitalize. Therefore, if the additional losses faced by SL banks were sufficiently large, it is possible that they suffered (many) more permanent suspensions but fewer of the other distress outcomes.

Empirically, Table 7 shows SL banks suffered more permanent suspensions, acquisitions, and troubled raisings. In absolute terms, the largest effect is on acquisitions, followed by suspensions and troubled raising. Using the single difference estimates, SL banks had a 5.9 percentage point higher probability of being acquired (69% more than DL banks), a 3.1 percentage point higher probability of a permanent suspension (20% more), and an 0.7 percentage point higher probability of a troubled raising (33% more). SL banks suffered 0.9 percentage point fewer temporary suspensions, so were slightly less likely to close, recapitalize and reopen, consistent with SL shareholders being less willing to contribute new equity. The magnitude of the SL effect on both troubled raising and temporary suspensions is small, in part because few banks experienced these outcomes (DL baselines of 2.1 and 3.3%, respectively). The double difference results in Panel B are similar, with somewhat larger effects of SL on acquisitions and troubled raising.

For a simple indicator of bank failure, the last column of Table 7 combines permanent suspensions and acquisitions, both of which ended a bank's existence. A bank permanently suspended when it had (close to) negative net value; it would seek an acquisitions if it still had some positive net value but was unable to survive on its own without fresh capital. During the Depression, acquisitions were frequently used to absorb banks with substantially impaired capital (see Section II.E). In the single difference analysis, SL banks had a 9.0 percentage point higher probability of failure (p-value = 0.042), 37.5% more than the failure rate of DL banks. The SL effect increases to 9.7 percentage points in the double difference but also becomes more noisy (p-value = 0.145).

Table E.2 in the Online Appendix explores why SL banks were more likely to permanently suspend. The immediate causes of suspensions (but not of acquisitions) were reported on forms St. 6386. Most important was "slow paper" – loans that were not repaid at maturity. The second largest contribution was from "heavy withdrawals" – bank runs – but it was only about 30% as large as that from slow paper. There is no evidence that SL banks suspended more frequently because of failures of correspondent banks or large debtors, or due to fraud ("defalcation").

This evidence suggests that the higher distress rate of SL banks was not due to classic bank runs (Diamond and Dybvig 1983). First, the additional permanent suspensions seem to have been primarily caused by solvency issues. Second, the SL effect was strongest for acquisitions, which are unlikely to have followed runs. Given their speed, runs would likely result in suspensions rather than acquisitions. Moreover, many runs were part of local banking panics (Friedman and Schwartz 1963, Mitchener and Richardson 2020) that also affected potential acquirers, reducing their ability to take over troubled banks (Carlson 2010).

C. Capital write-downs, changes in deposits, and changes in bank size, 1929-1932

The previous section has shown that SL banks were more likely to experience distress and fail during the Depression. This section examines whether this was also reflected in the balance sheets of banks that had not (yet) failed. We examine capital write-downs, changes in deposits, and changes in total assets, all in terms of percentages of their 1928 values. Results are in Table 8. For brevity, we only present the aggregate results for all state-Fed district pairs combined. Columns (1a), (2a), and (3a) report estimates for all banks, using the last available data before failure for those that failed. The corresponding "b"-columns restrict the analysis to banks that survived until February 1933.

Column (1) focuses on capital write-downs. Despite the severity of the Depression, write-downs were on average only around 3% for DL State banks, suggesting that banks were slow to recognize losses. Nevertheless, based on the single difference estimates, SL banks wrote down an additional 3.6 percentage points. In the double difference, the effect increases to more than 9 percentage points and becomes statistically significant. Column (2) analyzes the loss of deposits. Here the baseline is larger. Focusing on surviving banks, DL banks lost around 33% of deposits, and SL banks an additional 4.5 percentage points.[36] The double difference shows an SL effect of similar magnitude, but neither estimate is statistically significant. Column (3) examines changes in total assets. The results are similar: the assets of surviving DL banks fell by 19% on average, those of SL banks by an insignificant additional 4.6 percentage points.

In sum, balance sheets provide some evidence that SL had negative consequences for bank outcomes, but with limited statistical significance. None of the estimates reflect any actual bank *failures*, as we either use the last observed data before failure or drop failing banks altogether. Given banks' apparent unwillingness to recognize losses, it is difficult to detect bank distress using balance sheet data. This underscores the advantage of using information on actual suspensions and acquisitions from forms St. 6386 in our main analysis.

D. Summary and discussion

Our evidence points to a clear conclusion: limited liability for bank shareholders increased bank distress and failure during the Depression. The effects are large – limited liability increased the overall distress rate from less than 29 to 37%. SL banks were more likely to suspend and much more frequently acquired. This suggests that many SL banks, even though not necessarily insolvent, were forced to find an acquirer to (effectively) inject fresh equity. Recapitalizations, whether from existing or new shareholders, were much less common, though it is possible that we miss a significant number of equity raisings due to data limitations. Finally, SL banks suffered larger capital write-downs and losses of deposits, even though these differences tend to be statistically insignificant.

The worse performance of SL banks does not seem driven by more bank runs. Nor was it driven by observable risk taking: in 1928, there were no systematic differences in leverage or cash holdings. Instead the effect appears to come from unobservable risk taking, either in the form of greater asset risk before 1929 or worse risk shifting during the Depression. This is in line with the conceptual framework of Section I, where we argued that having SL or DL has ambiguous implications for observable choices, such as leverage, but, conditional on these choices, clear-cut predictions for unobservable risk taking.

[36] This does not imply that SL banks suffered more bank runs, as these deposit declines predate bank failure. It is, however, consistent with a gradual loss of trust and with banks trying to unlever.

V. Concerns and robustness

In this section, we discuss several concerns with our identification strategy and present the robustness exercises we perform in response. We examine differences in regulations other than shareholder liability, the impact of Fed membership, selection into State and National Banks, different local (county) characteristics, and differential experiences of (central) reserve city banks. Finally, we replicate our results using pair fixed effects rather than weights.

A. State-level regulatory regimes

A key concern is that SL and DL states might have had other banking regulations that were correlated with the liability regime. One possibility is that regulators in SL states tried to compensate for stronger risk taking incentives by tightening other regulations. If that were the case, our already large estimates of the effect of SL on distress rates would be downward biased. A more concerning possibility is that regulators in SL states were generally more lenient, leading to upward bias. We investigate these concerns by hand-collecting and comparing banking regulations across our state-Fed district pairs. To determine which elements of regulation were important, we follow the existing literature, especially Federal Reserve (1932), White (1983), and Mitchener (2005, 2007).

First, we examine minimum reserve and capital requirements. Higher reserve requirements mean more cash is available in case depositors run. Higher capital requirements imply lower leverage for banks at the constraint and higher barriers to entry, especially for smaller (potentially weaker) banks. For each bank in our sample, we determine its reserve and capital requirements (as of 1928) based on the town it was located in.[37] Reserve requirements are for demand deposits only. Table 9 presents the 20th, 50th, and 80th percentiles of the bank-level distributions of the two requirements for each state-Fed district. Although there are differences within pairs, there are no systematic differences between SL and DL states. Reserve and capital requirements were stricter for SL banks in three pairs, less strict in three pairs, and equally strict (or mixed depending on banks size) in the remaining two pairs. This is consistent with the absence of systematic differences between SL and DL banks in 1928 leverage and cash-to-deposits, the two variables most sensitive

[37] Capital and reserve requirements were functions of the status and population of the town or city the bank was located in. Capital requirements are hand-collected from state statutes and session laws; reserve requirements are from Federal Reserve Bulletin (1928).

to these requirements, in Tables 3 and 4. Aggregating across pairs, SL banks on average faced slightly stricter requirements, which means that, if anything, we underestimate the effect of SL.

Second, we use state statutes and session laws to construct a measure of other restrictions on bank risk taking in 1929. 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 eight relevant categories. These include restrictions on making real estate loans, discounting activities, and holding corporate securities. Details are in Online Appendix C. As baseline we use the regulations of National banks in the National Banking Act. For each category, we determine whether the law in a particular state was laxer (-1), equally strict (0), or stricter (+1) than the national law. For loans to officers and directors, which the national law did not constrain, we either code a state as equally lax (0) or stricter (+1). For each state, we take the simple unweighted sum of the eight 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 laws were more restrictive for SL banks in four pairs and less restrictive in the other four. On average, SL and DL banks faced similar restrictions.

Third, we assess the quality of the state regulator. Federal Reserve (1932) documents considerable variation across states (see also Mitchener 2005, 2007). Based on a 1929 American Bankers Association survey of state regulators (amended with state statutes), Federal Reserve (1932) discusses nine categories of regulator quality, some of which have multiple sub-categories. 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. For each (sub-)category, we score states between 0 and 1, where 0 is the lowest quality in our sample and 1 the highest. Table 10, Column (2), presents the sum of these scores, giving equal weight to each of the nine main categories. Again, although there is considerable variation within pairs, there are no systematic differences between SL and DL states. Regulator quality was higher for SL banks in two pairs, lower in four pairs, and roughly the same in the remaining two. On average, regulator quality was similar for SL and DL banks.

Finally, we examine branching restrictions. Banks subject to more restrictive branching might have been less diversified and therefore riskier. Constraints on branching created pressure to open independent banks in small, rural communities. Such banks were at a high risk of failure due to their lack of size and dependence on local economic conditions (Federal Reserve 1932, Wheelock 1995). There is also evidence that branching restrictions reduced competition, leaving weak banks in the system (Carlson 2004, Mitchener 2005, Carlson and Mitchener 2006, 2009). Using data from Federal Reserve (1931), Table 10 Column (3) compares branching restrictions within our pairs. "Prohibited" indicates that no branches were allowed (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 within the same state.

Branching restrictions were the same within most of our pairs. Geographical diversification and opening branches in smaller communities was only possible in states where branching was "Allowed". There are only two such states in our sample, Maryland (DL) and Virginia (SL), which are in the same pair. In the other seven pairs, branching was less restricted for SL banks in one pair, more restricted in two pairs, and equally restricted in the remaining four pairs.

In sum, regulatory differences between states other than the liability regime are unlikely to explain why SL banks failed more often. To further verify this, we add controls for regulatory differences to our baseline regression for total trouble. Results are in Online Appendix Table E.3. Consistent with Tables 9 and 10, the inclusion of each regulatory dimension on its own does not change the effect of SL on total trouble. If anything, the effect becomes marginally stronger. When all regulatory differences are included together, the effect of SL does decrease from 8.4 to 6.3 percentage points. In this specification there are five additional variables to capture differences between 12 states; this overfitting likely attenuates the effect of the liability regime.

B. Federal Reserve membership

Some State banks were members of the Federal Reserve system, which gave them access to the Fed's discount window and may have reduced their probability of failure (Richardson and Troost 2009, Carlson, Mitchener, and Richardson 2011). Averaging across the state-Fed district pairs, Table E.1 in the Online Appendix shows that Fed membership rates were 8% for SL State banks and 12% for DL State banks. Thus, our results might be in part driven by Fed membership. However, there are several reasons that speak against this. First, the differences in membership rates vary across state-Fed district pairs: in four pairs the membership rate is higher for the DL state, in the other four it is higher for the SL state. Second, becoming a Fed member is an endogenous choice, so higher membership rates might indicate that DL banks sought to constrain risk by submitting to a stricter regulator. In other words, Fed membership might be a channel through which DL made banks safer. Third, Fed membership could have *increased* the probability of bank failure. During the Great Depression, Fed policies were not as liberal as expected, which might have led member banks to hold too little liquidity (Carlson and Wheelock 2016, 2018).

To test whether our results are affected by Fed membership, we restrict the sample to non-members and rerun the analyses of all seven ex-post outcome variables. Each state-Fed district has at least 50 non-member banks, satisfying our state selection algorithm (see Online Appendix A). Since National banks were Fed members by default, we only estimate the single difference regressions. Results are in Table 12, Panel A. The SL effects are quantitatively similar to the full sample estimates, suggesting that Fed membership is not driving our results.

C. Selection into State and National banks

It was possible for State banks to re-charter as National banks, and vice versa. In SL states, the charter directly determined the liability regime, as State (but not National) charters came with single liability, while in DL states it did not. Consequently, there is a concern that different types of banks might have selected different charters in SL and DL states.

In particular, in SL states, riskier banks might have chosen State charters (and thus SL) to protect their shareholders. On the other hand, riskier banks might have chosen National charters (and thus DL) to convince depositors of the banks' trustworthiness. The first mechanism would bias our estimate of the effect of SL upwards, as we would attribute bank failures to SL rather than to the greater inherent riskiness of the banks. The second mechanism would result in a downward bias.

To verify that selection into SL is not driving our results, we restrict the sample to State banks whose paid-in capital was too low to be eligible for a National charter. Specifically, we only retain State banks with at most 80% of the paid-in capital required for a National bank in their location. These banks could not have easily switched charters. We again require at least 50 State banks in each state-Fed district, which forces us to drop pairs (1) through (4).[38] Since the remaining banks are by design not comparable to National banks, we present only the single difference.

[38] The results are robust to requiring 25 State banks per state-Fed district and to dropping this requirement altogether.

Results for all seven ex-post outcome variables are in Table 12, Panel B. The SL effects are similar to the full sample estimates. If anything, the effect on total trouble is larger. This suggests that differential selection into State and National banks does not explain our results.

D. County characteristics

The Great Depression proved especially harsh for small rural banks (Wheelock 1995). We therefore assess whether the single and double liability State banks in our sample differed in how rural they were. Using data from the 1920 and 1930 censuses, we compare two measures of urbanization, as well as manufacturing and agricultural output per capita, of the counties in which our banks were located. Our analysis assigns the county characteristics to each bank and then averages across banks in the same state-Fed district.

Table 11 shows that the single and double liability State banks in our sample had similar county characteristics. There are differences within some pairs, but no systematic differences between single and double liability banks. On average, the counties of the two groups look almost identical. This is perhaps not surprising given our careful matching of state pairs and our focus on the common support of bank sizes.

To further verify that differences in bank locations do not affect our results, we add controls for county characteristics to our baseline total trouble regression. The results are in Table E.4 in the Online Appendix. The coefficient on the SL indicator remains virtually unchanged.

E. Reserve cities

The Great Depression might have affected banks in reserve and central reserve cities more severely.[39] Most banks that were not Fed members met their reserve requirements in part by holding interbank deposits at correspondent banks in (central) reserve cities. In addition, Fed member banks deposited excess reserves at correspondent banks as they paid higher interest than reserves at the Fed (Mitchener and Richardson 2019, Jaremski and Wheelock 2020, Anderson, Erol and Ordoñez 2020).

Interbank deposits exposed correspondent banks to rapid outflows when other banks suffered shocks or runs. Mitchener and Richardson (2019) and Calomiris, Jaremski, and Wheelock (2019) document severe contagion effects of panics that originated at country banks on (central) reserve

[39] The only two central reserve cities were New York City and Chicago. Sixty-four other cities were reserve cities.

city banks.[40] Aggregating across our state pairs, only 3.4% of our SL State banks were located in (central) reserve cities, compared to 9.7% of DL State banks. This is mainly because our DL states contain New York City, Boston, and Philadelphia. Thus, if reserve city banks were more likely to fail, we might underestimate the effect of SL.

To examine this further, we restrict the sample to banks not located in (central) reserve cities and rerun the analyses of our seven ex-post outcome variables. We again require at least 50 State banks in each state-Fed district, which is the case for all pairs. Results for the single difference are in Table 12, Panel C. As conjectured, the effects of SL are slightly larger than in the full sample. For example, the effect on total trouble is 10.3 percentage points, compared to 8.4 percentage points in the full sample, and less noisily estimated (p-value of 0.020 vs 0.030). The untabulated double difference results are similar, with an SL effect on total trouble of 10.7 percentage points (compared to 10.0 in the full sample).

F. State-pair fixed effects

Throughout our analyses, we have weighted observations such that each state-Fed district pair receives equal weight, independently of the number of banks. This creates a straightforward correspondence between the within-pair and the aggregate results. In this section, we present alternative regression estimates using pair fixed effects, which absorb differences in average outcomes across pairs but allow pairs with more banks to have greater influence.

For the single difference estimates, we run the following regression

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

for all eight pairs combined, where $p \in [1,8]$ identifies state-Fed district pairs and η_p are pair fixed effects. For the double difference we run

$$Y_{i,s,b,p} = \delta SL_s SB_{i,b} + \eta_p + \eta_p \times SL_s + \eta_p \times SB_{i,b} + \varepsilon_{i,s,b,p} \tag{4}$$

where, to saturate the difference-in-differences specification, we include interactions between the pair fixed effects and the State bank (SB) and SL indicators.

[40] Calomiris and Carlson (2017) document the role of interbank networks in the Panic of 1893.

Table E.5 in the Online Appendix reports regression results for total trouble. Column (1), for comparison, uses the pair-specific weights used elsewhere in the paper, while Column (2) includes pair fixed effects. As expected, weights and fixed effects produce similar results. In the single difference, the effect of SL on total trouble is 9.2 percentage points when using fixed effects, slightly larger than the 8.4 percentage points estimated using weights.

VI. Conclusion

The evidence in this paper shows that limited liability for bank shareholders increased bank distress during the Great Depression. The effect is present in all eight state-Fed district pairs in our sample. In the aggregate, the distress rate of single liability banks was 29% higher than that of double liability banks. This suggests that limited liability, by increasing risk taking incentives, was an important contributor to the severity of the Great Depression.

What do these results imply for today? Modern regulations often focus on capital requirements, which also increase bank shareholders' downside exposure. Our results suggest that downside exposure reduces risk taking incentives. Consequently, higher capital requirements might stabilize banks not only by increasing capital buffers, but also by changing bank behavior (Admati and Hellwig 2013).

An important question is whether increasing shareholder liability would still be effective today. One key difference between then and now is that bank shareholders in the 1920s were less dispersed (Macey and Miller 1992), even though the stock market boom of the 1920s widened ownership (Kane and Wilson 1998). Bank managers were typically also large shareholders, reducing the distance between shareholder liability and decision-making authority.

We conjecture that the effect we document mainly comes from bank managers and directors having more skin-in-the-game. This is supported by Koudijs, Salisbury and Sran (2019) who study New England banks in the 1870s and show that exposing bank managers to additional liability reduced risk. This leads us to conclude that current proposals to increase the downside exposure of banks' key decision makers are likely to increase bank stability.

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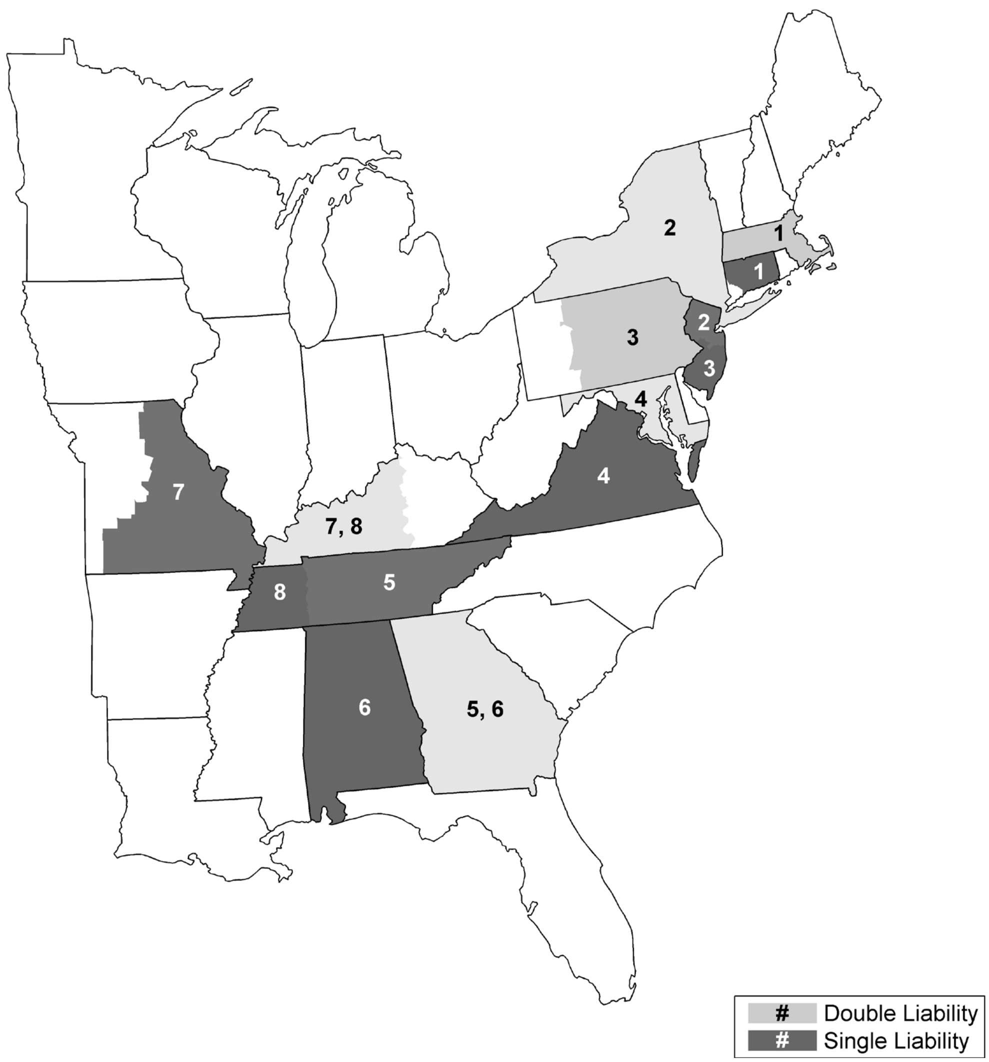
Figures and Tables

Figure 1: State-Fed district pairs



Note: The numbers identify the eight state-Fed district pairs used in the analysis. Numbers in dark font on a light background indicate districts in double liability states, while white numbers on a dark background indicate districts in single liability states. Some states, such as New Jersey, are split into two following Federal Reserve districts, with each part belonging to a separate pair. Other states, such as Georgia, serve as control for two single liability states.

Table 1: Bank size

Bank type	State bank liability regime	Single difference sample					Double difference sample				
		Mean	**Median**	**Min**	**Max**	**N**	**Mean**	**Median**	**Min**	**Max**	**N**
Panel A: Complete sample											
State	Single	1,365	282	12	160,496	2,086	1,365	282	12	160,496	2,086
State	Double	5,342	540	26	1,049,597	2,212	5,342	540	26	1,049,597	2,212
National	Single						3,237	1,182	93	160,095	784
National	Double						6,688	1,407	120	1,471,817	1,579
Panel B: Common support sample											
State	Single	1,319	282	12	160,496	2,078	1,396	447	121	48,648	1,455
State	Double	2,887	532	26	198,413	2,144	2,245	625	91	57,978	1,920
National	Single						2,540	1,162	93	48,011	756
National	Double						2,499	1,375	150	44,892	1,502
Panel C: Common support sample with weights											
State	Single	2,256	492	12	160,496	2,078	1,836	604	121	48,648	1,455
State	Double	3,055	595	26	198,413	2,144	2,399	634	91	57,978	1,920
National	Single						2,370	1,043	93	48,011	756
National	Double						2,137	1,113	150	44,892	1,502

Note: Panel A shows the distribution of bank sizes (defined as total assets in thousands of U.S. dollars) and the number of banks in the full sample in 1928, separately for State and National banks in single and double liability states. Panel B shows the size distribution after restricting the sample to the common support within each state-Fed district pair. Panel C weights the banks from Panel B such that each state-Fed district pair has equal weight, irrespective of the number of banks in the pair. The single difference and double difference samples, as well as the construction of the common support samples, are described in Section III.

Table 2: Summary statistics

	Single difference sample					Double difference sample				
	Mean	**25th**	**Median**	**75th**	**N**	**Mean**	**25th**	**Median**	**75th**	**N**
Panel A: State banks										
Total assets, 1928 ($000s)	2,655	209	532	1,872	4,222	2,118	279	618	1,834	3,375
Leverage, 1928	0.815	0.780	0.837	0.878	4,222	0.828	0.791	0.843	0.881	3,375
Cash/deposits, 1928	0.196	0.097	0.147	0.246	4,186	0.186	0.096	0.141	0.233	3,351
Total trouble	0.328				4,222	0.321				3,375
Permanent suspensions	0.171				4,222	0.166				3,375
Acquired	0.115				4,222	0.111				3,375
Temporary suspensions	0.028				4,222	0.030				3,375
Troubled raising	0.025				4,045	0.026				3,273
Capital write-downs (%)	-3.972	-12.50	-1.264	6.295	4,044	-4.553	-13.52	-1.747	6.443	3,272
Log change in deposits (%)	-29.80	-50.29	-25.85	-5.871	4,003	-29.56	-49.67	-25.31	-6.283	3,244
Log change in total assets (%)	-17.95	-35.06	-17.47	-1.668	4,045	-18.33	-35.45	-17.49	-1.827	3,273
Panel B: National Banks										
Total assets, 1928 (000s)						2,254	564	1,066	2,125	2,258
Leverage, 1928						0.843	0.813	0.856	0.892	2,258
Cash/deposits, 1928						0.192	0.120	0.172	0.238	2,258
Total trouble						0.223				2,258
Permanent suspensions						0.116				2,258
Acquired						0.078				2,258
Temporary suspensions						0.010				2,258
Troubled raising						0.025				2,226
Capital write-downs (%)						-9.701	-18.85	-5.170	2.523	2,225
Log change in deposits (%)						-29.54	-47.92	-26.65	-11.46	2,226
Log change in total assets (%)						-18.52	-32.06	-18.51	-7.020	2,226

Note: Summary statistics for the common support samples. Panel A: State banks in the single difference (left) and double difference (right) common support samples. Panel B: National banks in the double difference common support sample. Observations are weighted such that each state-Fed district pair has equal weight. Except where stated otherwise, variables are calculated between the end of 1928 and the end of 1932 (February 1933 in case of suspensions and acquisitions). *Leverage* is total liabilities divided by total assets. *Cash/deposits* is all cash items (including deposits due from other banks) divided by total deposits. *Total trouble* combines *permanent suspensions*, being *acquired*, *temporary suspensions*, and *troubled raising*. *Capital write-downs* are the log-change in total equity, subtracting any increase in paid-in capital over the period; a 10% reduction in total equity is coded as -10. For permanently suspended or acquired banks, *capital write-downs*, *log changes in deposits*, and *log changes in total assets* are calculated using data from the last available year.

Table 3: Leverage (Liabilities/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-Weighted
Panel A: Single difference									
SL	-0.011	-0.022	0.014	-0.033	0.047	0.024	-0.006	-0.010	0.001
	(0.015)	(0.008)	(0.012)	(0.008)	(0.009)	(0.008)	(0.005)	(0.009)	(0.004)
									[0.973]
Cons.	0.851	0.863	0.796	0.849	0.757	0.757	0.825	0.824	0.815
	(0.011)	(0.004)	(0.005)	(0.007)	(0.006)	(0.006)	(0.004)	(0.004)	(0.003)
N	164	510	461	431	580	563	1,127	386	4,222
Adj. R^2	-0.003	0.016	0.004	0.040	0.047	0.013	0.001	0.001	-0.000
Panel B: Double difference									
SL x State bank	0.039	-0.031	0.006	-0.025	-0.009	-0.003	0.004	-0.020	-0.005
	(0.021)	(0.009)	(0.014)	(0.009)	(0.012)	(0.013)	(0.010)	(0.017)	(0.006)
									[0.705]
SL	-0.058	0.011	0.008	-0.007	0.061	0.021	0.002	0.020	0.007
	(0.017)	(0.005)	(0.008)	(0.006)	(0.010)	(0.011)	(0.009)	(0.015)	(0.005)
State bank	0.013	0.001	-0.027	-0.005	-0.020	-0.025	-0.020	-0.016	-0.012
	(0.011)	(0.004)	(0.004)	(0.007)	(0.010)	(0.010)	(0.008)	(0.008)	(0.004)
Cons.	0.847	0.863	0.826	0.863	0.798	0.802	0.858	0.854	0.839
	(0.006)	(0.003)	(0.002)	(0.005)	(0.009)	(0.008)	(0.007)	(0.007)	(0.003)
N	342	1,216	1,057	532	597	638	897	354	5,633
Adj. R^2	0.086	0.025	0.031	0.067	0.169	0.042	0.023	0.066	0.012

Note: The independent variable is total liabilities divided by total assets in 1928. *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. Columns (1) through (8) present estimates for individual state-Fed district pairs. Column (9) reports estimates for the aggregate sample, using pair-specific weights such that each pair has equal weight. The estimates in Column (9) are therefore the average of those in Columns (1) to (8). Standard errors clustered at the individual bank level are in parentheses. In Column (9), p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

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-Weighted
Panel A: Single difference									
SL	0.022	-0.002	-0.010	0.058	-0.123	-0.057	0.031	0.156	0.009
	(0.014)	(0.008)	(0.006)	(0.008)	(0.012)	(0.014)	(0.008)	(0.015)	(0.006)
									[0.843]
Cons.	0.103	0.126	0.127	0.101	0.352	0.351	0.186	0.185	0.192
	(0.006)	(0.005)	(0.002)	(0.005)	(0.010)	(0.010)	(0.007)	(0.007)	(0.004)
N	160	507	455	430	570	562	1,120	382	4,186
Adj. R^2	0.010	-0.002	0.011	0.091	0.140	0.025	0.016	0.251	0.001
Panel B: Double difference									
SL x	-0.036	-0.001	-0.035	0.001	-0.061	-0.051	-0.016	0.014	-0.023
State bank	(0.021)	(0.008)	(0.009)	(0.012)	(0.020)	(0.021)	(0.017)	(0.032)	(0.010)
									[0.237]
SL	0.058	0.002	0.024	0.042	-0.055	-0.004	0.032	0.130	0.029
	(0.016)	(0.004)	(0.007)	(0.008)	(0.016)	(0.015)	(0.015)	(0.026)	(0.008)
State bank	-0.053	-0.002	0.010	-0.013	0.069	0.071	-0.020	-0.022	0.005
	(0.008)	(0.005)	(0.003)	(0.008)	(0.015)	(0.015)	(0.011)	(0.011)	(0.006)
Cons.	0.154	0.122	0.118	0.114	0.262	0.261	0.195	0.197	0.178
	(0.006)	(0.003)	(0.002)	(0.006)	(0.012)	(0.011)	(0.008)	(0.009)	(0.005)
N	338	1,213	1,051	531	591	637	895	353	5,609
Adj. R^2	0.199	-0.002	0.037	0.088	0.153	0.049	0.036	0.310	0.008

Note: The independent variable is all cash items (including deposits due from other banks) divided by total deposits in 1928. *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. Columns (1) through (8) present estimates for individual state-Fed district pairs. Column (9) reports estimates for the aggregate sample, using pair-specific weights such that each pair has equal weight. The estimates in Column (9) are therefore the average of those in Columns (1) to (8). Standard errors clustered at the individual bank level are in parentheses. In Column (9), p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table 5: Total trouble

	(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-Weighted
Panel A: Single difference									
SL	0.122	0.050	0.052	0.108	0.060	0.115	0.149	0.018	0.084
	(0.076)	(0.042)	(0.067)	(0.046)	(0.039)	(0.041)	(0.032)	(0.048)	(0.019)
									[0.030]
Cons.	0.284	0.237	0.448	0.218	0.282	0.287	0.266	0.264	0.286
	(0.047)	(0.023)	(0.025)	(0.037)	(0.025)	(0.025)	(0.027)	(0.027)	(0.013)
N	164	510	461	431	580	563	1,127	386	4,222
Adj. R^2	0.010	0.001	0.001	0.012	0.003	0.013	0.024	-0.002	0.008
Panel B: Double difference									
SL x	0.176	0.077	0.013	0.112	0.151	0.149	-0.038	0.161	0.100
State bank	(0.096)	(0.054)	(0.080)	(0.076)	(0.090)	(0.085)	(0.086)	(0.122)	(0.036)
									[0.105]
SL	-0.065	-0.035	0.048	-0.072	-0.072	-0.016	0.151	-0.154	-0.027
	(0.058)	(0.033)	(0.041)	(0.056)	(0.078)	(0.072)	(0.078)	(0.107)	(0.029)
State bank	0.104	0.027	0.326	0.014	-0.087	-0.052	0.035	0.019	0.048
	(0.057)	(0.029)	(0.029)	(0.063)	(0.065)	(0.062)	(0.064)	(0.069)	(0.026)
Cons.	0.179	0.211	0.121	0.219	0.358	0.329	0.232	0.245	0.237
	(0.03)	(0.018)	(0.014)	(0.049)	(0.059)	(0.055)	(0.057)	(0.062)	(0.022)
N	342	1,216	1,057	532	597	638	897	354	5,633
Adj. R^2	0.053	0.006	0.130	0.006	0.002	0.006	0.017	0.024	0.015

Note: The independent variable is *total trouble*, which combines *permanent suspensions*, being *acquired*, *temporary suspensions*, and *troubled raising*. *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. Columns (1) through (8) present estimates for individual state-Fed district pairs. Column (9) reports estimates for the aggregate sample, using pair-specific weights such that each pair has equal weight. The estimates in Column (9) are therefore the average of those in Columns (1) to (8). Standard errors clustered at the individual bank level are in parentheses. In Column (9), p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table 6: Total trouble, additional controls

	(1) No controls	(2) Controls	(3) log(Assets) + Controls	(4) Size quintiles + Controls
Panel A: Single difference				
SL	0.084	0.089	0.088	0.088
	(0.019)	(0.019)	(0.020)	(0.020)
	[0.030]	[0.027]	[0.031]	[0.033]
Cons.	0.286	0.281	0.316	0.318
	(0.013)	(0.013)	(0.101)	(0.026)
N	4,222	4,186	4,186	4,186
Adj. R^2	0.008	0.019	0.019	0.020
Panel B: Double difference				
SL x	0.100	0.095	0.094	0.110
State bank	(0.036)	(0.035)	(0.035)	(0.035)
	[0.105]	[0.107]	[0.118]	[0.119]
SL	-0.027	-0.0320	-0.020	-0.020
	(0.029)	(0.029)	(0.029)	(0.029)
State bank	0.048	0.052	0.049	0.039
	(0.026)	(0.026)	(0.026)	(0.027)
Cons.	0.237	0.237	0.388	0.282
	(0.022)	(0.022)	(0.119)	(0.035)
N	5,633	5,609	5,609	5,609
Adj. R^2	0.015	0.021	0.021	0.023

Note: The independent variable is *total trouble*, which combines *permanent suspensions*, being *acquired*, *temporary suspensions*, and *troubled raising*. *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. All estimates are for the aggregate sample and use pair-specific weights such that each state-Fed district pair has equal weight (cf. Column (9) of Table 5). Column (1) replicates Column (9) of Table 5. Columns (2) through (4) include 1928 leverage and cash/deposits as additional control variables. Columns (3) and (4) add log(total assets) and dummies for size quintiles, respectively, as controls. Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table 7: Type of distress

	(1) Permanent Suspensions	(2) Acquired	(3) Temporary Suspensions	(4) Troubled raising	(5) Perm. Susp. or Acquired
Panel A: Single difference					
SL	0.031	0.059	-0.009	0.007	0.090
	(0.015)	(0.014)	(0.007)	(0.007)	(0.018)
	[0.331]	[0.101]	[0.448]	[0.547]	[0.042]
Cons.	0.155	0.085	0.033	0.021	0.240
	(0.010)	(0.007)	(0.005)	(0.004)	(0.012)
N	4,222	4,222	4,222	4,045	4,222
Adj. R^2	0.001	0.008	0.000	0.000	0.010
Panel B: Double difference					
SL x	0.030	0.067	-0.011	0.021	0.097
State bank	(0.027)	(0.025)	(0.010)	(0.011)	(0.034)
	[0.375]	[0.158]	[0.407]	[0.054]	[0.145]
SL	-0.004	-0.016	-0.001	-0.010	-0.020
	(0.022)	(0.020)	(0.007)	(0.008)	(0.028)
State bank	0.035	-0.001	0.025	-0.009	0.033
	(0.021)	(0.016)	(0.009)	(0.007)	(0.025)
Cons.	0.118	0.086	0.010	0.029	0.204
	(0.018)	(0.014)	(0.006)	(0.006)	(0.022)
N	5,633	5,633	5,633	5,499	5,633
Adj. R^2	0.005	0.007	0.005	0.001	0.013

Note: The independent variables are the constituent parts of *total trouble* and are indicated at the top of each column. Since banks could experience multiple forms of trouble, the coefficients do not add up to the ones in Table 5 (Column 9) and Table 6 (Column 1). Column (5) combines *permanent suspensions* and being *acquired*. *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. All estimates are for the aggregate sample and use pair-specific weights such that each state-Fed district pair has equal weight (cf. Column (9) of Table 5). Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table 8: Other outcomes

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
	Capital write-downs (%)		Log-change in deposits (%)		Log-change in assets (%)	
Panel A: Single difference						
SL	-3.604	-3.635	-2.533	-4.468	-2.877	-4.603
	(0.877)	(1.063)	(1.611)	(1.968)	(1.196)	(1.450)
	[0.217]	[0.236]	[0.742]	[0.593]	[0.636]	[0.432]
Cons.	-2.203	-2.945	-28.625	-32.629	-16.662	-19.363
	(0.635)	(0.749)	(1.068)	(1.225)	(0.811)	(0.928)
N	4,044	2,826	4,003	2,796	4,045	2,826
Adj. R^2	0.007	0.007	0.001	0.003	0.002	0.006
Panel B: Double difference						
SL x	-9.004	-9.558	0.233	-3.799	-1.066	-3.443
State bank	(1.629)	(1.907)	(3.063)	(3.575)	(2.201)	(2.520)
	[0.026]	[0.019]	[0.954]	[0.360]	[0.809]	[0.388]
SL	5.044	5.570	-1.703	0.050	-1.693	-0.663
	(1.301)	(1.507)	(2.551)	(2.945)	(1.788)	(2.006)
State bank	9.588	9.465	0.205	0.522	0.714	0.966
	(1.222)	(1.436)	(2.124)	(2.516)	(1.549)	(1.769)
Cons.	-12.202	-12.872	-28.836	-33.132	-17.785	-20.714
	(1.010)	(1.186)	(1.822)	(2.187)	(1.292)	(1.480)
N	5,497	4,198	5,470	4,177	5,499	4,198
Adj. R^2	0.025	0.023	0.000	0.001	0.001	0.003
Survivors	N	Y	N	Y	N	Y

Note: The independent variables are *capital write-downs* in Column (1), the *log-change in deposits* in Column (2), and the *log-change in assets* in Column (3), all in percentages. Columns with an "a" include all banks. Columns with a "b" include only banks that survived until February 1933. *Capital write-downs* are the log-difference between total equity at the end of 1928 and 1932 (or the last observed year if the bank does not survive), subtracting any increase in paid-in capital over this period, multiplied by 100. *Log-change in deposits* and *log-change in assets* are similarly defined from the end of 1928 to the end of 1932 (or the last observed year if the bank does not survive). *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. All estimates are for the aggregate sample and use pair-specific weights such that each state-Fed district pair has equal weight (cf. Column (9) of Table 5). Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table 9: Reserve and capital requirements (for State banks)

Pair	State-Fed district	Single liability	Reserve Requirements 20th	Reserve Requirements 50th	Reserve Requirements 80th	Capital Requirements 20th	Capital Requirements 50th	Capital Requirements 80th
1	CT (1)	1	12%	12%	12%	50,000	50,000	100,000
	MA	0	15%	15%	15%	50,000	100,000	200,000
2	NJ (2)	1	15%	15%	15%	100,000	100,000	100,000
	NY	0	10%	12%	12%	25,000	50,000	100,000
3	NJ (3)	1	15%	15%	15%	100,000	100,000	100,000
	PA (3)	0	15%	15%	15%	25,000	125,000	125,000
4	VA	1	10%	10%	10%	25,000	25,000	50,000
	MD	0	15%	15%	15%	25,000	25,000	100,000
5	TN (6)	1	10%	10%	10%	20,000	20,000	100,000
	GA	0	15%	15%	15%	25,000	25,000	25,000
6	AL (6)	1	15%	15%	15%	10,000	15,000	25,000
	GA	0	15%	15%	15%	25,000	25,000	25,000
7	MO (8)	1	15%	15%	15%	15,000	15,000	25,000
	KY (8)	0	7%	7%	7%	15,000	15,000	15,000
8	TN (8)	1	10%	10%	10%	20,000	20,000	50,000
	KY (8)	0	7%	7%	7%	15,000	15,000	15,000
All	All	1	10%	15%	15%	20,000	50,000	100,000
	All	0	7%	15%	15%	15,000	25,000	100,000

Note: Percentiles of the bank level distribution of reserve and capital requirements for each state-Fed district. We determine the two requirements for each State bank in the single difference common support sample based on the town or city it was located in. Reserve requirements are for demand deposits only. The last two rows (labeled "All") report percentiles for the full sample using pair-specific weights such that each state-Fed district pair has equal weight. Sources: Federal Reserve Bulletin (1928) for reserve requirements; state statutes and session laws for capital requirements, supplemented with information from Polk's Bankers Encyclopedia (various issues) where needed.

Table 10: Other differences in the regulation of State banks

Pair	State-Fed district	Single liability	(1) Restrictions on bank risk taking	(2) Regulator quality	(3) Branch banking
1	CT (1)	1	-0.33	5.4	Prohibited
	MA	0	-2.83	5.4	Limited
2	NJ (2)	1	-3.00	5.6	Limited
	NY	0	-2.33	6.3	Limited
3	NJ (3)	1	-3.00	5.6	Limited
	PA (3)	0	-1.50	5.3	Limited
4	VA	1	-5.67	4.6	Allowed
	MD	0	-2.67	6.0	Allowed
5	TN (6)	1	-1.33	5.2	Limited
	GA	0	-1.83	6.1	Limited
6	AL (6)	1	-0.83	5.8	Prohibited
	GA	0	-1.83	6.1	Limited
7	MO (8)	1	-2.67	6.4	Prohibited
	KY (8)	0	-1.67	5.3	Prohibited
8	TN (8)	1	-1.33	5.2	Limited
	KY (8)	0	-1.67	5.3	Prohibited
All	Average	1	-2.27	5.5	
	Average	0	-2.04	5.7	

Note: Restrictions on bank risk taking: We identify eight restrictions on banks' assets in state laws. For each restriction we use the National Banking Act as baseline and code state laws as laxer (-1), equally strict (0), or stricter (+1). For categories not in the National Banking Act we code states as equally lax (0) or stricter (+1). If there were differences in strictness across states, we use fractions, e.g., -1/3 or +1/2, to indicate so. See Online Appendix C for details. The table reports the unweighted sum of the eight category scores as of 1929. *Regulator quality*: Federal Reserve (1932, Appendix Table II) describes nine dimensions of state regulator quality, such as its powers to intervene in banks' operations and the term and salary of the bank commissioner (based on a 1929 American Bankers Association survey of bank regulators and state statutes). We score each dimension between 0 and 1. Some dimensions have subcategories, each of which we score between 0 and 1 and average. See Online Appendix D for details. The table reports the unweighted sum of the scores over the nine dimensions. *Branch banking*: "Prohibited" means no branches allowed, although banks could typically open local agencies to receive deposits and pay checks. "Limited" means branches allowed within the same town, city, or municipality. "Allowed" means branches allowed in other locations in the home state. The last two rows (labeled "All") report equal-weighted averages of the results across the state-Fed district pairs. Sources: State statutes and session laws, Federal Reserve (1931, 1932), Federal Reserve Bulletin (1929).

Table 11: County characteristics

Pair	State-Fed district	Single liability	(1) Manufacturing output (per capita)	(2)	(3) Crop value (per capita)	(4)	(5) Urban population (%)	(6)	(7) Population in cities over 25k (%)	(8)
			1920	**1930**	**1920**	**1930**	**1920**	**1930**	**1920**	**1930**
1	CT (1)	1	982	896	38	21	65.37	69.39	48.35	52.61
	MA	0	992	745	14	8	93.91	89.13	62.48	63.31
2	NJ (2)	1	1,199	1,009	19	8	80.58	87.37	54.97	55.47
	NY	0	763	812	93	41	60.81	62.12	39.32	39.09
3	NJ (3)	1	630	551	66	36	58.94	60.00	36.83	31.05
	PA (3)	0	738	680	60	27	61.99	65.59	36.13	37.91
4	VA	1	167	246	165	92	20.11	21.30	13.03	13.03
	MD	0	342	386	151	85	28.71	31.20	18.76	18.99
5	TN (6)	1	147	146	152	80	14.86	18.49	5.977	7.980
	GA	0	173	154	204	97	15.75	17.71	6.845	6.781
6	AL (6)	1	155	144	141	92	13.91	17.23	5.883	6.134
	GA	0	174	156	204	97	15.62	17.65	6.534	6.501
7	MO (8)	1	161	173	250	96	18.33	21.67	5.143	5.786
	KY (8)	0	120	116	204	103	17.10	18.67	7.689	8.652
8	TN (8)	1	103	99	215	143	13.01	16.12	5.682	6.453
	KY (8)	0	102	96	209	106	14.98	16.49	5.723	6.323
All	Average	1	443	408	131	71	35.64	38.94	21.98	22.31
	Average	0	425	393	142	70	38.61	39.82	22.93	23.44

Note: Averages of State banks' county characteristics, by state-Fed district, for the single difference common support sample. Data are from the 1920 and the 1930 censuses. *Manufacturing output (per capita)*: manufacturing output (in U.S. dollars) divided by total population. *Crop value (per capita):* value of crops (in U.S. dollars) divided by total population. *Urban population (percent):* urban population divided by total population, times 100. Urban areas are defined as cities and other incorporated places with at least 2,500 inhabitants and include other political subdivisions with at least 10,000 inhabitants and a population density of at least 1,000 per square mile. *Population in cities over 25k (percent):* population in cities with over 25,000 inhabitants divided by total population, times 100. The last two rows (labeled "All") report equal-weighted averages of the results across the state-Fed district pairs. Source: Haines, Michael R. and Inter-university Consortium for Political and Social Research (ICPSR). Historical, Demographic, Economic, and Social Data: The United States, 1790-2002.

Table 12: Robustness: results for subsets of State banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total trouble	Permanent Suspensions	Acquired	Temporary Suspensions	Troubled raising	Permanent Susp. or Acquired	Capital write-downs (%)	Log-change in deposits (%)	Log-change in assets (%)
Panel A: Non-Fed members									
SL	0.093	0.025	0.073	-0.007	0.008	0.097	-3.302	-5.259	-5.271
	(0.020)	(0.016)	(0.015)	(0.007)	(0.007)	(0.020)	(1.133)	(2.120)	(1.549)
	[0.023]	[0.441]	[0.060]	[0.555]	[0.504]	[0.035]	[0.304]	[0.533]	[0.384]
Cons.	0.286	0.161	0.079	0033	0.020	0.240	-3.053	-32.63	-19.35
	(0.013)	(0.011)	(0.008)	(0.006)	(0.004)	(0.013)	(0.799)	(1.337)	(1.028)
N	3,809	3,809	3,809	3,809	3,646	3,809	2,541	2,511	2,541
Adj. R^2	0.009	0.001	0.013	0.000	0.000	0.011	0.006	0.004	0.008
Panel B: State banks with limited capital									
SL	0.093	0.045	0.049	-0.014	0.020	0.093	-1.452	-6.641	-5.018
	(0.037)	(0.033)	(0.019)	(0.013)	(0.007)	(0.036)	(1.731)	(4.370)	(3.041)
	[0.063]	[0.328]	[0.000]	[0.367]	[0.047]	[0.078]	[0.125]	[0.508]	[0.375]
Cons.	0.275	0.204	0.045	0.037	-0.000	0.248	-3.084	-47.89	-30.09
	(0.029)	(0.026)	(0.013)	(0.012)	(0.000)	(0.028)	(1.427)	(3.405)	(2.336)
N	1,292	1,292	1,292	1,292	1,206	1,292	819	811	819
Adj. R^2	0.009	0.002	0.009	0.001	0.009	0.010	0.001	0.005	0.006
Panel C: State banks not located in (central) reserve cities									
SL	0.103	0.041	0.069	-0.010	0.006	0.110	-3.448	-5.335	-5.141
	(0.020)	(0.015)	(0.014)	(0.007)	(0.007)	(0.019)	(1.080)	(1.980)	(1.458)
	[0.010]	[0.208]	[0.050]	[0.414]	[0.570]	[0.017]	[0.275]	[0.532]	[0.387]
Cons.	0.268	0.146	0.075	0.035	0.021	0.220	-3.189	-32.37	-19.30
	(0.013)	(0.010)	(0.007)	(0.006)	(0.004)	(0.012)	(0.773)	(1.234)	(0.934)
N	3,937	3,937	3,937	3,937	3,776	3,937	2,674	2,653	2,674
Adj. R^2	0.012	0.003	0.012	0.001	0.000	0.015	0.006	0.005	0.008

Note: Column (1) present results for *total trouble*. Columns (2) through (5) use its four constituent components (*permanent suspensions*, being *acquired*, *temporary suspensions*, and *troubled raising*). Column (6) combines *permanent suspensions* and being *acquired.* Columns (7) through (9) use *capital write-downs*, the *log-change in deposits*, and the *log-change in assets*, using only banks that survived until February 1933. Panel A includes only State banks that were not Fed members. Requiring at least 50 banks per state-Fed district retains all pairs. Panel B includes only State banks that could not easily convert into National banks because of insufficient paid-in capital. Requiring at least 50 banks per state-Fed district drops pairs (1) through (4) of Figure 1. Panel C includes only State banks that were not located in reserve or central reserve cities. Requiring at least 50 banks per state-Fed district retains all pairs. *SL* is an indicator variable that equals one for states with single liability State banks. All estimates are for the aggregate sample and use pair-specific weights such that each state-Fed district pair has equal weight (cf. Column (9) in Table 5). Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Online Appendix

A. State selection

We attempt to match each single liability (SL) state (with a sufficient number of State banks) to one neighboring double liability (DL) state that is the closest match. We then collect individual bank level data for the selected states. Some states are split into two different Federal Reserve Districts. During the Great Depression, different Federal Reserve banks had different policies, with large effects on bank outcomes (Richardson and Troost 2009). We therefore consider each state-Fed district separately and match only within the same Fed district.

To determine the best match we use aggregate data from Federal Reserve (1956). In particular, we compare the failure rates of National banks in 1929 – 1932 and the average size of State banks at the end of 1928. As these data are not broken down by state-Fed district, we use state-level information. We use the failure rates of National banks to select states that faced similar financial and economic shocks during the Great Depression.[41] We use average bank sizes to match states with similar types of banks.

We drop eight DL states that provided state-level deposit insurance at any time during the 1920s (none of the SL states had deposit insurance). Deposit insurance might have had long-lasting effects on the structure of the banking system by, for example, increasing the number of small banks (Aldunate 2019, Calomiris and Jaremski 2019). Consistent with this concern, Wheelock (1995) shows that, even for states where deposit insurance ended before 1929, its effects lingered on, causing more bank failures in the early 1930s.

The sequence of the matching process is as follows:

1. We start with all nine SL states in 1928. We consider all their DL neighbors within the same Fed district as potential matches.
2. We require each state-Fed district to have at least 50 State banks.
    - ⇨ Three SL state-Fed districts (Connecticut (district 2), Delaware, and Rhode Island) are dropped. No DL neighbors are dropped.
3. We drop all states with state deposit insurance at any time during the 1920s.

[41] We use these annual state-level failure rates up to 1932 to match the observation period of the bank-level data, which ends in February 1933.

    - ⇨ SL states Louisiana (districts 6 & 11) and Missouri (district 10) are dropped because all potential DL matches had deposit insurance during the 1920s.
4. We eliminate DL states for which the failure rate of National banks differs by more than 15 percentage points from the SL state. This cutoff is motivated by the distribution of state-level National bank failure rates, which has a standard deviation of 13%, and the desire to retain at least one potential match per SL state-Fed district.
    - ⇨ DL states Arkansas (potential match for Tennessee (district 8)), North Carolina, and West Virginia (both potential matches for Virginia) are dropped.
5. If there are multiple potential matches left, we pick the DL state for which the average State bank size (measured by book assets) is the closest to the SL state.

Table A1 shows the results of this matching process, as well as the state-level National bank failure rates and average State bank sizes used in the process.

Table A1. State selection

Single liability (SL) states in the sample and their matched double liability (DL) neighbors. Final matches are in bold.

SL State	Neighboring DL States	Fed district	Deposit insurance in 1920s	National bank failure rate 1929-32	Diff.	Average State bank size in 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

Note: The table omits the SL states (Fed districts) Connecticut (2), Delaware, and Rhode Island because they had fewer than 50 State banks in 1928, as well as Louisiana (6 & 11) and Missouri (7) because all neighboring DL states in the same Fed district had state-level deposit insurance during the 1920s.

B. Common support of bank size

We restrict the sample to banks that, within each state-Fed district pair, are on the common support in terms of bank size (measured by book assets). We construct the single and double difference common support samples as follows:

Single difference sample

1. Start with each SL State bank in a given state-Fed district.
2. Select all DL State banks in the paired state-Fed district with total assets between 75% and 125% of the SL bank's assets. For SL banks with less than $100,000 in assets, select all DL banks for which the difference is at most $25,000.
3. Retain all SL State banks that are matched to at least one DL State bank.
4. If an SL State bank is retained, retain all matched DL State banks. Each DL bank is included once, even if selected multiple times, except for Georgia and Kentucky (8), which are used twice as control states.

Double difference sample

1. Start with each SL State bank in a given state-Fed district.
2. Select all DL State banks in the paired state-Fed district with total assets between 75% and 125% of the SL bank's assets. For SL banks with less than $100,000 in assets, select all DL banks for which the difference is at most $25,000.
3. Repeat Step 2 for National banks in the same state-Fed district, and again for National banks in the paired state-Fed district.
4. Retain all SL State banks that are matched to at least one bank in each of the three control groups (DL State banks in paired state-Fed district, National banks in own state-Fed district, and National banks in paired state-Fed district).
5. If an SL State bank is retained, retain all matched DL banks selected in Steps 2 and 3. Each DL bank is included once, even if selected multiple times, except for Georgia and Kentucky (8), which are used twice as control states.

C. Restrictions on bank risk taking

Different states had different rules and restrictions for the types of loans State banks could make and what other activities they could engage in. These restrictions were governed by local state laws. Based on a careful reading of these laws we identify eight important categories and score them for each state.

To reconstruct the state of affairs as of 1929, we first read the state statutes most recent to 1929, followed by all relevant session laws between the publication of the statute and 1929. State statutes and session laws are available through *HeinOnline* and *The Making of Modern Law*. We take the National Banking Act from 1927 as baseline (there were no changes between 1927 and 1929) and, for each of the eight restrictions, score states as laxer (-1), equally strict (0), or stricter (+1). For categories not in the national law we code states as equally lax (0) or stricter (+1). If there were clear differences between state laws, we use fractions, e.g., -1/3 or +1/2, to indicate so. In the main text and Table 10, we report the unweighted sum of the scores over the eight categories. Here we list the categories, together with the baseline from the National Banking Act:

	Category	**National Banking Act**
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 (less than 6 months for domestic bills, less than 3 months for foreign ones) and total amounts (max. 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. loan-to-value ratio of 50%
5	Loans to individual borrowers	Max. 10% of equity capital, except for some forms of safe commercial paper
6	Loans to officers and directors	Not regulated
7	Owning (lending on the security of) shares in the bank itself	Restricted, only to secure existing debts
8	Usury limit on loans	7%, unless stipulated otherwise by local state laws

All eight categories address aspects of risk taking. Starting with the first, it is risky for banks to directly hold corporate stock, either as investment or as part of securities underwriting. Second, providing insurance, for example by guaranteeing payments on bonds or loans a bank has placed with the public, exposes the bank to off-balance sheet risk. Third, discounting bills of exchange, which was an important activity for banks, creates more risk the longer the maturities and the larger the amounts. Fourth, lending on real estate, especially farmland (residential mortgages were provided through other types of non-commercial banks), was risky due to volatile land prices. Fifth, large loans to individual borrowers make banks undiversified and open the door to capture and fraud. Sixth, loans to officers and directors entail the danger of inside dealing and tunneling. Seventh, purchasing or lending on the security of shares in a bank itself is effectively a payout to shareholders and reduces the bank's equity. Finally, a higher usury limit creates incentives to lend to riskier borrowers.

D. Quality of State bank regulators

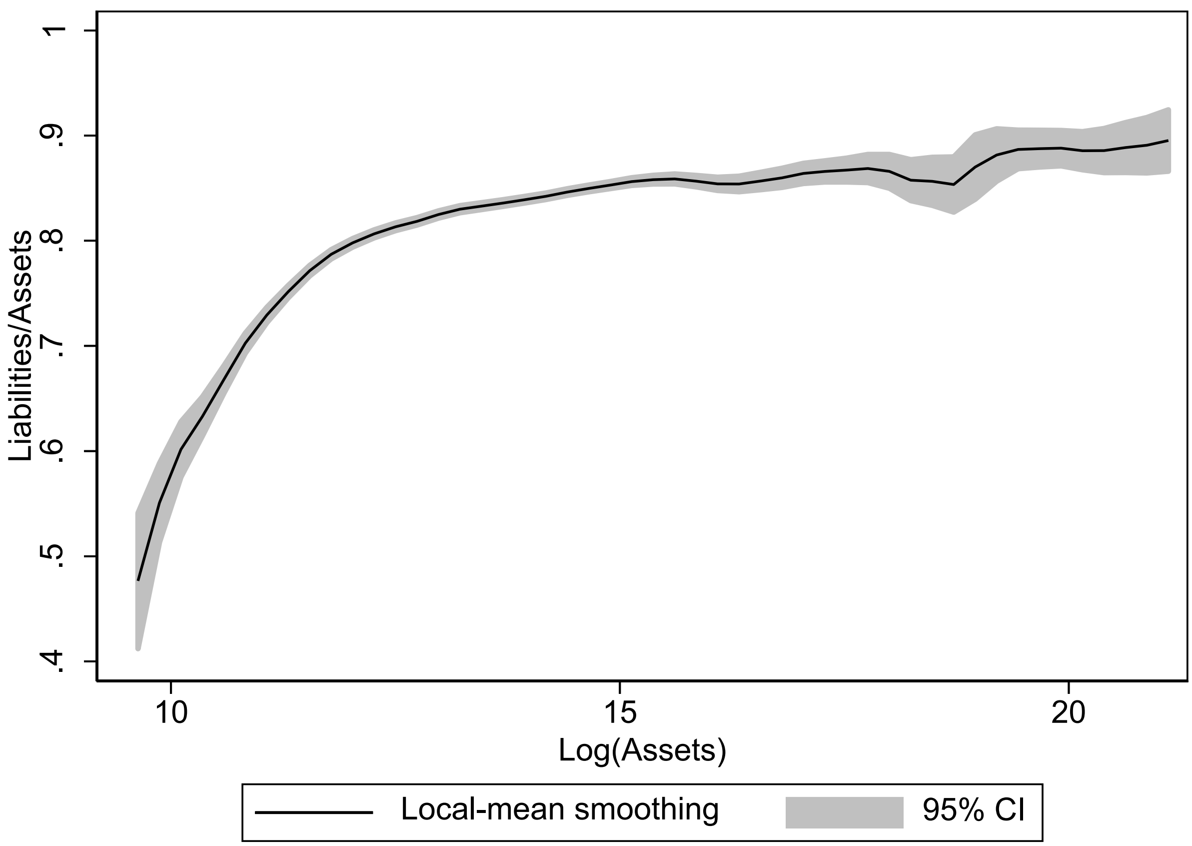
Federal Reserve (1932, Appendix Table II) provides state-by-state information about nine characteristics of State bank regulators. The information comes from a 1929 survey of state regulators by the American Bankers Association and from state statutes. Some of the nine characteristics have subcategories. For each (sub)category we score states between 0 and 1, assigning 0 to the worst system and 1 to the best. In the main text and in Table 10, we report the unweighted sum of the scores over the nine characteristics (averaging across subcategories to obtain a category score first, if needed). Here, we list all categories and subcategories and describe the scoring:

	Category	Subcategory	Description	Score
1	Status of supervisory agency		Under other department	0
			Separate	1
2	Type of supervisory agency		Single official under control of / appointed by banking board	0
			Single official + banking board	0.5
			Single official	1
3	Method of selecting commissioner or supervisor		Selected by banks	0
			Selected 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 selecting examiners		Supervisory agency + governor or board	0
			Supervisory agency	0.5
			Civil service	1
7	Powers in 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 for and convenience of banking facilities	No/Yes	0/1
8	Powers relevant to banking operations	Examinations – frequency	Not stipulated Annual More than annual	0 0.5 1
		Examinations – discretionary powers	No/Yes	0/1
		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 as a function of bank size, 1928 (State and National banks)



Note: Kernel-weighted local polynomial regression of bank leverage on bank size in 1928 for all State and National banks in the complete sample (corresponding to Table 1, Panel A). Leverage is defined as total liabilities divided by total assets, and bank size is defined as log(total assets). The figure is produced using Stata's *lpoly* command with a polynomial of degree zero (local mean smoothing). We use the default kernel (Epanechnikov) with the default rule-of-thumb bandwidth (0.3) and pilot bandwidth (0.46) for the standard error calculation.

Table E.1: State banks and Fed membership by state-Fed district

Pair	State-Fed district	Single liability	Number of State banks	Fed members (%)
1	CT (1)	1	69	5.8%
	MA	0	95	22.1%
2	NJ (2)	1	160	33.8%
	NY	0	350	26.3%
3	NJ (3)	1	64	9.4%
	PA (3)	0	397	17.1%
4	VA	1	307	3.6%
	MD	0	124	1.6%
5	TN (6)	1	254	0%
	GA	0	326	12.0%
6	AL (6)	1	236	5.1%
	GA	0	327	11.9%
7	MO (8)	1	860	5.3%
	KY (8)	0	267	1.5%
8	TN (8)	1	128	3.9%
	KY (8)	0	258	0.8%
All	Average	1	2,078	8.4%
	Average	0	2,144	11.7%

Note: The number of State banks and the percentage that were Fed members in each state-Fed district in 1928 for the single difference common support sample. The last two rows (labeled "All") report the total number of single and double liability State banks in the sample and the average of the Fed membership percentages across the state-Fed district pairs.

Table E.2: Causes of permanent suspensions

	(1) All suspensions	(2) Slow paper	(3) Failure of correspondent	(4) Failure of large debtor	(5) Defalcation	(6) Heavy withdrawals	(7) Other
Panel A: Single difference							
SL	0.031	0.018	-0.003	-0.001	-0.001	0.006	0.004
	(0.015)	(0.011)	(0.002)	(0.001)	(0.004)	(0.010)	(0.008)
	[0.331]	[0.517]	[0.315]	[0.338]	[0.810]	[0.828]	[0.826]
Cons.	0.155	0.073	0.005	0.002	0.012	0.057	0.025
	(0.010)	(0.008)	(0.002)	(0.001)	(0.003)	(0.006)	(0.005)
N	4,222	4,207	4,207	4,207	4,207	4,207	4,207
Adj. R^2	0.001	0.001	0.000	0.000	-0.000	-0.000	-0.000
Panel B: Double difference							
SL x	0.030	0.020	-0.005	-0.001	-0.006	0.004	0.014
State bank	(0.027)	(0.022)	(0.003)	(0.001)	(0.005)	(0.016)	(0.009)
	[0.375]	[0.516]	[0.127]	[0.553]	[0.216]	[0.882]	[0.452]
SL	-0.004	-0.003	0.001	-0.000	-0.000	0.008	-0.010
	(0.022)	(0.018)	(0.001)	(0.000)	(0.002)	(0.012)	(0.005)
State bank	0.035	-0.003	0.006	0.002	0.012	0.025	0.008
	(0.021)	(0.018)	(0.003)	(0.001)	(0.004)	(0.012)	(0.007)
Cons.	0.118	0.072	0.000	0.000	0.002	0.030	0.016
	(0.018)	(0.015)	(0.000)	(0.000)	(0.002)	(0.010)	(0.005)
N	5,633	5,620	5,620	5,620	5,620	5,620	5,620
Adj. R^2	0.005	0.000	0.002	0.000	0.003	0.004	0.003

Note: The independent variables are indicators for permanent suspensions with different reported causes. Column (1) presents results for all permanent suspensions, and replicates Column (1) of Table 7. Columns (2) to (7) distinguish by the primary reason(s) for the suspension reported on form St. 6386. *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. All estimates are for the aggregate sample and use pair-specific weights such that each state-Fed district pair has equal weight (cf. Column (9) of Table 5). Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

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	0.085	0.095	0.094	0.087	0.086	0.081	0.081	0.063
	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)	(0.021)	(0.022)
	[0.023]	[0.017]	[0.014]	[0.023]	[0.050]	[0.033]	[0.075]	[0.132]
Reserve requirements (%)	1.158		1.072					2.151
	(0.314)		(0.323)					(0.409)
Minimum capital requirements ($000)		0.468	0.305					0.291
		(0.150)	(0.146)					(0.142)
Restrictions on bank risk taking (score)				0.011			0.001	-0.001
				(0.008)			(0.010)	(0.010)
Regulator quality (score)					0.009		0.000	-0.090
					(0.016)		(0.018)	(0.023)
Branching restrictions (score)						0.058	0.055	0.136
						(0.029)	(0.036)	(0.041)
Cons.	0.137	0.250	0.123	0.307	0.236	0.253	0.255	0.420
	(0.042)	(0.016)	(0.043)	(0.020)	(0.094)	(0.020)	(0.102)	(0.103)
N	4,222	4,091	4,091	4,222	4,222	4,222	4,222	4,091
Adj. R^2	0.013	0.013	0.017	0.008	0.008	0.009	0.009	0.024

Note: Single difference regressions for *total trouble* with controls for regulatory differences across states. *Total trouble* combines *permanent suspensions*, being *acquired*, *temporary suspensions*, and *troubled raising*. *SL* is an indicator variable that equals one for states with single liability State banks. *Reserve requirements*: reserve requirements on demand deposits for each bank, in percent of deposits. *Minimum capital requirements*: minimum capital requirements for each bank, in $000. See Table 9 for more details on reserve and capital requirements. *Restrictions on bank risk taking*: regulatory restrictions on bank risk taking, scored relative to the National Banking Act. A positive number means a stricter state regulator. *Regulator quality*: score based on Federal Reserve (1932). *Branching restrictions*: restrictions on branching (1 = prohibited, 0.5 = restricted, 0 = allowed). See Table 10 for more details on the previous three variables. All estimates are for the aggregate sample and use pair-specific weights such that each state-Fed district pair has equal weight (cf. Column (9) of Table 5). Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table E.4: Total trouble, controlling for county characteristics

	(1) County controls 1920	(2) County controls 1930	(3) County controls 1920 and 1930
SL	0.089	0.087	0.088
	(0.023)	(0.023)	(0.023)
	[0.029]	[0.030]	[0.037]
Manufacturing output (per capita) in 1920 ($000)	-0.043		-0.040
	(0.041)		(0.064)
Manufacturing output (per capita) in 1930 ($000)		-0.043	-0.010
		(0.046)	(0.068)
Crop value (per capita) in 1920 ($000)	0.088		0.164
	(0.132)		(0.1783)
Crop value (per capita) in 1930 ($000)		0.081	-0.177
		(0.251)	(0.350)
Urban population in 1920 (fraction)	0.049		-0.074
	(0.084)		(0.219)
Urban population in 1930 (fraction)		0.039	0.115
		(0.081)	(0.194)
Population in cities over 25k in 1920 (fraction)	0.158		0.128
	(0.078)		(0.219)
Population in cities over 25k in 1930 (fraction)		0.157	0.043
		(0.074)	(0.219)
Cons.	0.237	0.245	0.239
	(0.037)	(0.035)	(0.039)
N	4,222	4,222	4,222
Adj. R^2	0.019	0.018	0.018

Note: Single difference regressions for *total trouble* with controls for county characteristics. *Total trouble* combines *permanent suspensions*, being *acquired*, *temporary suspensions*, and *troubled raising*. *SL* is an indicator variable that equals one for states with single liability State banks. *Manufacturing output (per capita)*: manufacturing output (in $000) divided by total population. *Crop value (per capita):* value of crops (in $000) divided by total population. *Urban population:* urban population divided by total population. Urban areas are defined as cities and other incorporated places with at least 2,500 inhabitants and include other political subdivisions with at least 10,000 inhabitants and a population density of at least 1,000 per square mile. *Population in cities over 25k:* population in cities with more than 25,000 inhabitants divided by total population. Column (1) uses county characteristics from the 1920 census; Column (2) uses the 1930 census (see Table 11 for more details). To improve readability, unlike in Table 11, m*anufacturing output (per capita)* and *crop value (per capita*) are in thousands*,* while *urban population* and *population in cities over 25k* are fractions*.* All estimates are for the aggregate sample and use pair-specific weights such that each state-Fed district pair has equal weight (cf. Column (9) of Table 5). Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table E.5: Total trouble, pair fixed effects vs weights

	(1) Weights	(2) Pair f.e.
Panel A: Single difference		
SL	0.084	0.092
	(0.019)	(0.018)
	[0.030]	[0.000]
Cons.	0.286	0.297
	(0.013)	(0.037)
N	4,222	4,222
Adj. R^2	0.008	0.022
Panel B: Double difference		
SL x	0.100	0.088
State bank	(0.036)	(0.031)
	[0.105]	[0.001]
SL	-0.027	
	(0.029)	
State bank	0.048	
	(0.026)	
Cons.	0.237	0.167
	(0.022)	(0.031)
N	5,633	5,633
Adj. R^2	0.015	0.041

Note: The independent variable is *total trouble*, which combines *permanent suspensions*, being *acquired*, *temporary suspensions*, and *troubled raising*. *SL* is an indicator variable that equals one for states with single liability State banks. *State bank* is an indicator that equals one for State banks. The table shows two sets of estimates for the aggregate sample. Column (1), which replicates Column (9) of Table 5, uses pair-specific weights such that each state-Fed district pair receives equal weight. Column (2) instead includes pair fixed effects, interacted in the double difference (Panel B) with the *SL* and *State bank* indicators. Coefficients on the pair fixed effects and their interactions are omitted for brevity. Standard errors clustered at the individual bank level are in parentheses; p-values from a wild cluster bootstrap of coefficients with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.