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Shareholder Liability and Bank Failure*

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Abstract:

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

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. This allows them to be highly levered, creating strong incentives for risk shifting. Moreover, there are large negative externalities from excessive risk taking: bank failures can lead to widespread financial crises and large output losses (Allen and Gale, 2000, Diamond and Rajan, 2005, Boyd, Kwak and Smith, 2005, Allen and Carletti, 2006, Ivashina and Scharfstein, 2010, Iyer and Peydro, 2011, Acharya and Yorulmazer, 2008, Acharya, Shin, and Yorulmazer, 2011, Acharya, Le, and Shin, 2017) and bailouts are costly (Acharya, Drechsler, and Schnabl, 2014).

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

In this paper, we evaluate whether 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 double liability strongly reduced the probability of bank failure. We consider three dimensions of failure: outright suspensions, acquisitions (where we consider the acquired bank as failed), and "troubled raising" (the issuance of new equity to replenish capital). "Total trouble" (aggregating these three measures) was around 30% lower for banks with double liability. This effect is strongest for acquisitions, with single-liability banks more than 50% more likely to be acquired. As we explain in more detail in Section II.E, acquisitions were commonly used to resolve bank failures. We also find suggestive evidence that surviving double-liability banks wrote down

less capital (indicative of fewer losses) and lost fewer deposits (indicative of a smaller reduction in confidence) than single-liability banks. As a result, the size of their balance sheets shrank less. Combining the evidence, it appears that classic bank runs of the type described by Diamond and Dybvig (1983) may not have been a primary driver of bank failures during our sample period.

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

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

Our results are important for at least two reasons. First, since the Global Financial Crisis of 2008, there have been ongoing efforts to make the banking system safer. One proposal that has received much attention involves raising capital requirements, in part to strengthen the incentives of bank shareholders to reduce risk taking.[1] So far, empirical work has been hampered by the fact that there is very little cross-sectional variation in capital requirements, and it is difficult to separate the effect of pure additional capital from the incentive effects that it may engender.[2] Our analysis allows us to make this separation, since the additional capital from double liability is only available ex post, that is, in case of bank failure. Another popular proposal is to increase the downside exposure of decision makers in banks, as equity incentives alone may not be sufficient, and may even be counterproductive (Berger, Imbierowicz, and Rauch, 2016, Flanagan and Purnanandam, 2020, and

[1] See, for example, Admati and Hellwig (2013) and Bhagat and Bolton (2014).
[2] Barth, Caprio and Levine (2008) use differences in capital requirements between countries. However, these might reflect deeper institutional and economic differences.

Goetz, Laeven, and Levine, 2020).[3] Since bank managers and directors were both typically significant shareholders during our sample period[4], we can speak to the incentive effects of additional downside liability. Therefore, even if introducing double liability is not within the set of policies currently under consideration, our results are directly relevant for the debate on the empirical effects of additional liability for bank managers. Our findings suggest that such a policy can be an effective tool to reduce bank risk taking.

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

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[3] Increased downside exposure is proposed, for example, by Rajan (2008), Blinder (2009), Hill and Painter (2015, p. 190), Kay (2015, p. 279), Luyendijk (2015, p. 254), Cohan (2017, p. 146), and Goodhart and Lastra (2019). Specifically, 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 fix dollar amount of compensation, effectively turning managers into creditors of the bank. Greenwood et al. (2017) echo this recommendation. The role of inside debt in corporate governance is discussed in Sundaram and Yermack (2007) and Edmans and Liu (2011). Van Bekkum (2016) finds that higher inside debt holdings by bank managers induces lower bank risk-taking.

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

[6] See, amongst many others, Friedman and Schwartz (1963) 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, Calomiris and Mason (2003) on the role of fundamentals and regional shocks, Richardson and Troost (2009) on the role of individual Federal Reserve banks, and Mitchener and Richardson (2019?) on the role of interbank networks.

The prior literature finds mixed evidence on the effects of enhanced shareholder liability on bank risk taking and failure. Some studies show evidence consistent with reduced risk taking. Using a sample of 84 banks in California, Illinois, and Missouri in the early 20th century, when liability rules for state-chartered banks varied by state, Esty (1998) finds that asset and equity return volatility were lower for banks operating under stricter liability rules. Koudijs, Salisbury and Sran (2019) find that New England banks whose managers had additional liability made safer loans, were less likely to delay the recognition of losses, and lost less capital after the Panic of 1873. Outside the U.S., Turner (2014) provides qualitative evidence that unlimited shareholder liability was associated with fewer bank failures in 19th century U.K.

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

Given the theoretical uncertainty about double liability's effectiveness and the contradictory empirical evidence, the effect of additional shareholder liability on bank risk taking remains an open question. Our paper brings new evidence to bear by studying the effects of a large economic shock – the Great Depression – on banks with different liability regimes. We focus on bank failure as the ultimate measure of risk taking. 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 Bank districts into account to homogenize regulatory regimes. We focus on banks of similar size to ensure that size differences are not driving our results. Our hand-collected data set of around 4,400 individual state banks across 8 state-pairs allows us to further 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 as best as we can. Richardson and Troost (2009) show that the policies of different Federal Reserve banks

differed greatly during the Great Depression, with significant impact on bank outcomes. Therefore, we focus on state pairs that were part of the same Federal Reserve district. Wicker (1996) and Calomiris and Mason (2003) show that banking panics often had a strong regional character. We therefore require the paired states to have similar failure rates of National banks, which faced the same regulation everywhere. Federal Reserve (1932) and Wheelock (1995) show bank size to be a strong predictor of failure during the Great Depression, with much higher failure rates for small banks. Therefore, we restrict ourselves to banks that are on the common support of bank size within each state-pair, and we control for bank size in our regressions.

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

This paper is related to a broader literature on the effect of enhanced shareholder liability on bank behavior and outcomes. Anderson and Watugala (2017) and Anderson, Barth, and Choi (2018) use deposit withdrawals as a measure of bank distress. They find that banks with more shareholder liability suffered smaller withdrawals during the Panic of 1893 and the Great Depression, respectively. They argue that additional shareholder liability undermined depositor discipline as depositors had weaker incentives to monitor. We observe similar results but have a different interpretation. Given the much lower failure rate of double-liability banks, we argue that smaller deposit outflows are indicative of double-liability banks being in better health, rather than of reduced depositor discipline.

Another strand of the literature uses bank leverage as a measure of risk taking. Theoretically, the impact of double liability on leverage is ambiguous. On the one hand, double liability reduces the incentive to take more risk by increasing leverage. On the other hand, the additional claim against shareholders in bankruptcy allows banks to ex-ante raise more debt at more attractive terms. Analyzing different datasets and time periods, this literature finds mixed results. Some papers observe a negative effect of double liability on leverage (Grossman 2001, Mitchener and

Richardson 2013, Koudijs, Salisbury and Sran 2019), while others find no or a positive effect (Evans and Quigley 1995, Bodenhorn 2015, Grodecka and Kotidis 2016, Anderson and Watugala 2017, Anderson, Barth, and Choi 2018).

Even though we find that double liability was effective in reducing bank failure, it was quickly repealed after 1933 (Mitchener and Richardson 2013). What explains this apparent discrepancy? Macey and Miller (1992) argue that abolishing double liability was a political decision that was not necessarily economically optimal. During the Great Depression, many shareholders had to pay double liability claims, right at the moment when they were already in serious financial trouble. Many of them were not involved in the banks' management and, therefore, not directly to blame for failure.[7] This created political resentment against the system. The creation of deposit insurance, in combination with increased government monitoring, appeared sufficient to safeguard the financial system and double liability was repealed. According to Macey and Miller (1992, p. 32), "history shows that the nation took a wrong turn when it abandoned double liability for a system of governmentally administered deposit insurance."[8] Our results are consistent with this claim, at least to the extent that double liability appears to have been effective in curbing risk taking and increasing bank stability.

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

I. Conceptual framework

The key difference between single (SL) and double liability (DL) is that under DL shareholders incur a penalty in case the bank fails. This is different from higher capital requirements as the additional money that shareholders are expected to pay is not available until a bank fails. As such,

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

[8] 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, and Goldstein and Pauzner, 2005) and may also not fully prevent bank runs ex-post (Iyer and Puri, 2012, Artavanis et al., 2019, and Martin, Puri, and Ufier, 2020).

DL does not have the same "buffer" function that higher capital requirements have. But its impact on shareholders' incentives is similar.

In general, shareholders may have incentives to take excessive risks on the asset or the liability side of the balance sheet (or both) if these risks are not properly priced into interest rates by depositors and other creditors, or if they lack a commitment device to not shift risk ex post. With leverage itself observed, there is no material incentive for bank shareholders to shift risk on the liability side, especially since deposits are callable. Risk-shifting incentives are aggravated on the asset side, however, as the quality of bank assets is largely *unobservable* to depositors, and banks are unable to commit ex ante to making safer loans. Holding the book leverage of the bank constant, shareholders with DL will be more averse to investing in riskier assets as they have greater personal exposure to losses. Shareholders with SL, on the other hand, are protected by limited liability and have standard risk-shifting incentives. As a result, SL banks should take more asset risk and be more likely to fail than DL banks in bad states of the world.

Of course, leverage may be different between SL and DL banks, potentially undoing this effect on asset risk. How the liability regime affects bank leverage, though, is ambiguous. On the one hand, DL banks might choose lower leverage simply because their shareholders are more exposed to bank failure. Koudijs, Salisbury and Sran (2019) analyze the case when bankers are risk averse. Bankers value the fact that they are able to walk away from the bank deposits as this creates risk sharing between them and depositors. DL reduces this risk sharing and makes bankers choose lower leverage. This, in turn, further reduces their risk taking on the asset side.

On the other hand, DL banks might choose higher leverage, as depositors accept lower interest payments because they understand that DL banks take less asset risk. In response, banks might issue more deposits and increase their leverage, reversing some of the direct incentive effect of DL on the riskiness of banks' assets. At the same time, SL banks might take on less leverage to commit themselves to investing in safer assets. In the extreme, these effects might undo the effect of DL altogether and create a situation where DL banks are more highly levered than SL banks, yet take the same amount of risk on the asset side.

Even keeping leverage constant, the literature has identified a number of reasons why DL might be ineffective or even counterproductive. First, depositor discipline, highlighted by many as an important device for reducing bank risk (Calomiris and Kahn 1991, Diamond and Rajan 2001),

might be weakened. Depositors in DL banks receive a payout in case the bank fails, which reduces the ex-ante level of monitoring effort they are willing to exert (Calomiris and Wilson, 2004, Anderson, Barth, and Choi, 2018). Second, DL shareholders might be adversely selected. That is, only people with little personal wealth to lose might be willing to buy bank shares, and would have only weak incentives to rein in risk taking (Winton, 1993, Kane and Wilson, 1998). Moreover, if skill and personal wealth are positively correlated, the quality of shareholder monitoring might go down. New York Governor, and future U.S. President, Martin Van Buren 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 taking risks that might lead to bank failure would always be value destroying.[10]

To summarize, it is theoretically ambiguous whether DL is an effective tool to reduce bank risk taking in equilibrium, making this ultimately an empirical question.

II. Historical background

In this section, we provide more details how the U.S. banking system was regulated and we briefly discuss how the Great Depression played out for the banking system.

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 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 some limits to entry: banks could only obtain a charter if they raised a minimum amount of (equity) capital (Federal Reserve 1932, White 1994?, Mitchener 2005).

[10] Keeley (1990) discusses the link between charter value and risk-taking. For the importance of charter value, see Petersen and Rajan (1994, 1995), Berger and Udell (1995), Demsetz, Saidenberg, and Strahan (1996), Dahiya, Puri, Saunders (2003), Berger et al. (2005), Song and Thakor (2007), Hellmann, Lindsey, Puri (2008), Drucker and Puri (2009), Bharath et al. (2011), Ivashina and Kovner (2011), Iyer and Puri (2012), and Puri, Rocholl, and Steffen (2017).

Banks were either regulated at the national or state level, depending what type of charter a bank operated under.[11] 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 of all, shareholders of all National banks faced double liability, whereas, in some states, State banks had single liability. Second, National banks typically had higher reserve and minimum capital requirements. Third, National banks faced more restrictions on their loan portfolios. Most importantly, loans backed by real estate (important for rural banks) were restricted to 25% of total equity capital.[12] Fourth, the supervision of state banking departments was considered laxer than that of the OCC.[13] Finally, until the McFadden Act of 1927, National banks faced considerable restrictions in their ability to open branches, whereas, in most states, State banks faced fewer or no such restrictions (White 1994?, Robertson 1995, Jayaratne and Strahan 1996, Mitchener 2005).

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 1994?, 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 more detail in section V.E). Third, they typically held few reserves so that the Fed's higher reserve requirements were particularly costly. Fourth, reserves at the Fed paid no interest, whereas money deposited at correspondent banks did (White 1994?, p. 133-4, 156). Larger state banks often did become Fed members. 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 1994?, 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.

[11] 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 banks and trusts by the end of the 1920s (Federal Reserve 1932, p. 54, 58; White 1994?, p. 40).

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

[13] This continues to be true today (Agarwal, Lucca, Seru, and Trebbi, 2014).

As such, we can 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 a member of 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.[14] 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. 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, and dividends could only be paid out of current profits.

Bank governance was also regulated. Bank 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 the operation of state banking departments, stipulating the frequency and nature of bank examinations and the authority of the banking 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, restrictions on particular loan types, the authority of state banking departments, and limits on branch banking. Section V.A provides more detail and, important for the interpretation of our results, shows that the rules were not systematically different between single and double liability states.

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

Several U.S. states experimented with state deposit insurance schemes in the early 20th century, all of which closed during the 1920s or early 1930s (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. Federal deposit insurance did not exist until 1934, which is after our sample period.

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 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.

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 separate 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 some 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) argue that double liability was strictly enforced and that courts widely upheld it. There were a number of safeguards to prevent investors from escaping claims. If a share was sold after a bank had gotten into trouble, the seller remained liable. In some states, the seller remained liable for up to a year after 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 incidence of claims was so widespread that it fomented a political movement to end double liability (Macey and Miller 1992), as discussed in the introduction.

D. Great Depression

Many banks became troubled during the Great Depression. After the U.S. 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). By March 1933, most states had proclaimed a "Bank Holiday" for their banks, suspending withdrawals, which newly elected President Roosevelt quickly extended to banks nationwide. After granting the Fed powers to create emergency currency, many banks were reopened and the crisis dissipated (Silber 2009). More than a third of all commercial banks in existence in 1929 vanished during the Depression.

The banking panics had a strong regional character (see, amongst others, Wheelock 1995, Wicker 1996, and Calomiris and Mason 2003). The majority of banks that failed were small and rural. These banks had been hit the 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 small 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. After the National Banking Holiday in March 1933, there were significant government interventions. All banks were closed and only those permitted by regulators could reopen. This decision might have, at least in part, been driven by general economic considerations rather than the health of each bank, or even by political factors. Moreover, many banks recapitalized by issuing preferred stock to the Reconstruction Finance Corporation (RFC). As with other Depression-era programs, it is possible that allocation of RFC funds was at least in part political (Wallis 1998, Mason 2003, Wallis, Fishback, and Glaeser 2007).

E. Troubled banks

A bank was "troubled" if it had sustained losses so that its paid-in capital (the lion's share of most banks' equity) was impaired. A troubled bank had multiple options.[15] The most benign was to simply write down its capital (and reduce the size of its balance sheet). This was constrained by the fact that a bank could not reduce its capital below the regulatory minimum. Alternatively, it could try to raise capital from outsiders or, in certain states, it could level a (typically voluntary) assessment on existing shareholders to make up the deficit.

If a bank was unable to fix the 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 able or willing to use the cash they had to purchase "slow" assets.

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. This was risky for the acquiring bank. Dissenting target shareholders could sue to be bought out at the "true" value of their shares. Moreover, acquiring additional liabilities might put the acquirer's own liabilities at risk, which in some states was forbidden by law.[16] If such an acquisition proved impossible, 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 would be returned 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 a deal could not be made, 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" to

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

[16] Granja, Matvos, and Seru (2017) find that in modern times, failed banks are predominantly acquired by well-capitalized local banks operating in similar business lines. If local banks are undercapitalized, then less similar, remote banks step in.

another bank, who would then 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. Wheelock (1995) and others have pointed out that there was a strong regional component to bank failures in the Great Depression, which mainly affected small and rural banks. Richardson and Troost (2009) provide evidence 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 use National bank failure rates to match states that suffered similar shocks during the Great Depression.. National banks all faced DL and their failure rates therefore provide a useful baseline for the severity of the Great Depression's banking crises in each state. We use average bank sizes to match states with similar types of banks. 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.

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, and 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. Initially, the analysis is restricted to State banks. In this single difference sample we run the following regression for each state-Fed district pair:

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

The SL indicator identifies the state-Fed district with single liability. The coefficient α is the average outcome for banks in the state-Fed district with DL, and β is the average difference between banks in the state-Fed district 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. Without weights, the states with the most banks would dominate the SL and DL groups. Appendix Table E.1 shows that there are large differences in the number of banks across state-Fed districts. If there are also important differences in bank outcomes across pairs, this will skew our estimates towards state-Fed districts with many small banks, such as Missouri-Kentucky. In response, we apply pair-specific weights to ensure that each pair is weighted equally, independently of the number of banks. This yields the same results as simply taking the average over the 8 individual pairs.[17]

Our careful selection of state-pairs notwithstanding, the estimates from Eqn. (1) might be biased if DL and SL states are hit by different economic shocks. Following the literature, we bring National banks, which faced DL in every state, into the analysis.[18] Due to the regulatory differences mentioned in Sections II.A and bank size differences that we will discuss in III.D below, it is difficult to compare National and State banks directly. However, we can use the differential outcomes for National banks to control for differences in economic shocks between states by subtracting that difference from our estimates of β in Eqn. (1). Concretely, in the broader double difference sample, we estimate the following difference-in-differences equation for each pair:

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

where b indexes whether bank i is a State or National bank and SB_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 δ in Eqn. (2) to be significantly different from the single difference estimate of β in

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

Eqn. (1). As in the single-difference specification, 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 to reflect the fact that banks from Georgia and Kentucky (Fed district 8) enter the sample twice (resulting in duplicate observations). This approach assumes that residuals are independent across individual banks. There are two reasons why this might not hold. First, state-specific shocks could cause within-state correlation of residuals. Second, banks within the same pair might have been exposed to regional shocks, causing within-pair correlation of residuals. For the regressions combining all pairs, we therefore double-cluster our standard errors at the state and state-Fed-district-pair level. Since both New Jersey and Tennessee are split into two separate 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).

C. Sources

We hand collect data from a variety of sources. The information on individual bank failures is from forms St. 6386 recorded by the Fed Board of Governors' Division of Bank Operations.[19] 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 (Richardson 2007). We hand-collected the data for all 12 states in our sample.

We collect bank-level annual balance sheet data for 1928 to 1933 from the OCC's 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, and we use Rand McNally's *Banker's Directory* instead.[20] If available, we prefer the state reports, as we believe them to be more accurate. The reported balance sheet categories are coarse. While the liability side is fairly detailed, the asset side is not. For several states, we can only distinguish between cash-

[19] The forms are currently located in the National Archives: record group 82, file number 434.-1.
[20] For Alabama and Georgia the state banking department only published data every other year.

like reserves and a line item comprising loans and securities, with no information about the composition of the latter. As difficult as it is to measure asset risk with detailed balance sheet data (based on the theoretical insight that risk-shifting should not be easily discoverable by creditors), using balance-sheet items to measure asset risk is especially challenging in our data. For these reasons we prefer bank distress as our key outcome variable.

We use several sources to collect information about regulatory differences across states. Mitchener and Richardson (2013) report which states imposed single or double liability on bank shareholders. A 1932 Fed publication provides information on State bank regulators, and Fed bulletins from 1929 report reserve requirements and restrictions on branch banking. Finally, we carefully studied the original state statutes and session laws (available through *Heinonline.org*) to determine minimum capital requirements, state-level 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. Moreover, Appendix Figure E.1 shows that, for our sample, larger banks had higher leverage in 1928. Therefore, to compare like with like, our analysis compares banks of similar size. For both the single difference and the double difference samples, we restrict each sample to the common support of bank sizes in each state-Fed district pair. Details are in Online Appendix B.[22]

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 the full samples including all banks. Two features stand out. First, 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

[22] When trying to implement a formal matching procedure, we repeatedly matched to the same banks, thereby overweighting a small number of banks and underweighting other banks of similar size. Focusing on the common support gives all banks with similar size equal weight.

home to some of the largest banks in the country. Consistent with this observation, our DL states also have significantly larger National banks than our SL states.

Panel B describes the common support samples. Here, the size differences are much smaller, as some of the largest and smallest banks in each pair are omitted. In the single difference sample, the number of banks falls only slightly. In the double difference sample, it drops by around 16%, as many small State banks and some of the largest State and National Banks drop out, due to our requirement that SL State banks have at least one match in each of the three other groups. Even though the differences are less pronounced, State banks in SL states are still significantly smaller than other banks.

Panel C applies the weights described in III.B, which ensure that each state-pair is assigned the same weight, preventing pairs with more banks from dominating the analysis. Weighting further reduces the size differences, but on average, State banks in SL states remain 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. In Section V.B we also show that our 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 three different measures: (1) outright suspensions, (2) being acquired, and (3) troubled raising. Category (1) is straightforward. For (2), we determine which bank in a merger or acquisition disappeared based on the charter under which the combined bank continued. For (3), we identify new equity raising as an increase in paid-in capital in any year between 1929 and 1932, from balance sheet data. We do not classify an equity raising as troubled if the bank acquired another bank in the same year, or if its total equity at the end of the year was higher than in 1928. This leaves us with equity raising likely to result from banks' need to recapitalize. This measure misses troubled raisings if a bank wrote down paid-in

capital and raised new equity to make up for the decline within the same fiscal year. Unfortunately, this is a limitation of the annual nature of our data.

For our baseline regressions, we aggregate the three distress outcomes into (4) "total trouble".[23] This simplifies the predictions and addresses the concern that different state regulators may have treated troubled banks differently. 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 in regulators' behavior.

As secondary outcome variables we use (5) capital write-downs, (6) changes in deposits, and (7) changes in total assets (the size of bank balance sheets). For (5) 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 by ΔC during a fiscal year, we subtract ΔC from total equity at the end of 1932 before computing the log-difference.[24] For (6) and (7) we simply use log-changes between 1932 and 1928.

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 (8) leverage (the ratio of liabilities to assets) and (9) the ratio of cash to deposits, 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 shocks to asset values, and a lower cash-to-deposits ratio makes a bank 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. 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 variables might be endogenous to the liability regime, their inclusion could bias the coefficient on the liability regime. We therefore include them in robustness tests only.

[23] In our sample, banks either suspended or were acquired, but not both. In nine cases, a bank conducted a troubled raising before it suspended or was acquired.

[24] This is an approximation as equity could have been sold above par, leading to an increase in both paid-in and surplus capital.We also do not have data on retained earnings.

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). We present separate statistics for State and National banks and for the single and double difference common support samples. We weigh observations 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 81% and 84%, respectively. Given such high leverage, it is unsurprising that many banks failed during the Great Depression. 17% of State banks suspended, 11% were acquired, and 3% used a troubled raising. Combining the three outcomes identifies almost 30% of State banks and 21% of National banks as being in trouble.[25]

From 1928 to 1932, both State and National banks saw their deposits shrink on average by almost 30% 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.

IV. Empirical results

In this section, 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 – both of which are observable to depositors. In the conceptual framework of Section I, we argue that the effect of SL on leverage is ambiguous. On the one hand, shareholders in SL banks have an incentive to choose higher leverage, because they have more downside protection than their counterparts in DL banks. On the other hand, SL banks might have to pay depositors a higher interest rate than depositors in DL banks with the same leverage ratio, to compensate them

[25] These failure 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.

for the higher asset risk shifting incentives of SL. In response, SL shareholders might prefer lower leverage. By the same logic, the effect of SL on cash-to-deposits is also ambiguous.

Results are in Tables 3 and 4, respectively, with the single difference estimates in Panel A and the double difference estimates in Panel B of each table. Columns (1)-(8) present estimates for the eight state-Fed district pairs in our sample. The regression in the final column includes all pairs and applies weights to ensure that each pair receives equal weight, such that the coefficients are the average of the coefficients from the eight individual pairs. We find no consistent effect of SL on leverage or cash-to-deposits. The standard errors for these within-pair estimates are clustered at the bank level and do not allow for in-state correlations across banks. They should therefore be interpreted with caution. For leverage, the combined results 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.[27] For cash-to-deposits in Table 4, the aggregate estimate in Column (9) has different signs in the single and double difference. In both, the effect is small and insignificant. Hence, we find 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 in a downturn.

B. Bank distress, 1929 - February 1933

Next we turn to bank distress, the main focus of our analysis. We start with our measure of "total trouble." In the conceptual framework of Section I we argue that 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, SL banks are predicted to take more unobservable risk. As a result, we expect SL banks to suffer greater losses in the Depression and, thus, to be more likely to either suspend, be acquired, or raise capital.

The results in Table 5 confirm this prediction. Consistently across all eight pairs, SL banks faced a higher probability of distress (although, again, standard errors for the individual pair regressions on columns (1) through (8) should be interpreted with caution). The effect is not restricted to a

[27] Unlike 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.

specific geographic area. For example, the single difference estimates are largest for Connecticut-Massachusetts, Virginia-Maryland, and Missouri-Kentucky, three very different state pairs. The aggregate effect in Column (9) is large and highly significant. In the single difference, SL banks faced a 9.6 percentage point higher probability of distress, which is 40% higher than the baseline rate of 24.8% in DL states; if anything, the effect is slightly larger in the double difference.

In Table 6 we add additional controls. For brevity we only report the aggregate results for all pairs. Column (1) replicates Column (9) of Table 5 for comparison. Columns (2) and (3) control for bank size using, respectively, log(total assets) and indicators for total asset quintiles. Because we restrict the sample to banks that share common support in terms of bank size, we do not expect size controls to have a large effect. The table confirms this expectation; the results become stronger but the effect is marginal. Columns (4) and (5) repeat the regressions of columns (2) and (3) but add supplemental controls for bank leverage (liabilities/assets) and cash-to-deposits in 1928 to both specifications. Since SL and DL banks did not look systematically different on these dimensions in 1928, we do not expect this to have much of an effect either. Again, the estimates confirm this. Altogether, this suggests that neither bank size nor *observable* ex-ante balance sheet conditions can explain the much higher distress rate of SL banks.

In Table 7 we split the "total trouble" variable into its constituent parts – suspensions, acquisitions, and troubled raising. Given similar leverage ratios, we expect SL banks to take more risk and therefore to suspend more frequently. However, the predicted effects of SL on acquisitions and troubled raising are ambiguous. Other banks and outside equity providers will only be willing to invest in a bank if there is positive net value. If losses are too large, no one is willing to assume the bank's deposits and other debts, and the bank will simply suspend. If the additional losses faced by SL banks were sufficiently large, it is therefore possible that they suffered many more suspensions but fewer acquisitions and less troubled raising.

Empirically, all three distress measures are higher for SL banks. In absolute terms, by far the largest effect of SL (and the only one that is statistically significant) is on acquisitions, followed by suspensions and troubled raising. Using the single difference estimates, SL banks have a 5.6 percentage point higher probability of being acquired (which is 66% higher than double liability states), a 3.3 percentage point (23% greater than DL) probability of suspension, and a 0.7 percentage point (33% greater) probability of troubled raising. The absolute effect on troubled

raising is small, since only 2.5% of State banks appear to have recapitalized by raising new equity (see Table 2). The double difference results are similar, with somewhat larger effects of SL on acquisitions and troubled raising.

Table E.2 in the Online Appendix explores the reasons why SL banks were more likely to suspend. The immediate causes of suspensions are reported in forms St. 6386 (this information is not given for acquisitions). Most important was "slow paper" – loans that were not repaid at maturity. The second largest contribution comes from "heavy withdrawals" – bank runs – but this effect is only half as large as for 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).

Overall, the evidence that acquisitions, which are slow to materialize, are the main drivers of distress in SL states, suggests that classic (Diamond and Dybvig 1983) bank runs were not as prevalent during our sample period. Given its speed, a run would likely result in a suspension rather than an acquisition. Moreover, of the suspensions we observe, only a limited number appear to have been caused by actual runs. The evidence on deposit withdrawals below reinforces this conclusion.

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

The previous section shows that SL banks were more likely to experience distress and fail during the Depression. Next, we examine whether this is also reflected in the balance sheets of surviving banks. We focus on 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 present the aggregate results for all eight pairs combined. The odd-numbered columns report estimates using all banks. For those that failed, we use the last available information *before* failure. The even-numbered columns restrict the analysis to surviving banks only.

Columns (1) and (2) analyze capital write-downs. Surprisingly, average capital write-downs were small (only around 3% for DL State banks), suggesting that banks were reluctant to recognize losses. Nevertheless, based on the single difference estimates, SL banks wrote down around 4 percentage points more. In the double difference, the SL effect increases to 10 percentage points and becomes statistically significant. Columns (3) and (4) consider the loss of deposits. Here the baseline effect is larger. Focusing on the surviving banks, DL banks lost around 33% of deposits, and SL banks an additional 5 percentage points. In the double difference this effect is of similar

magnitude. However, neither result is statistically significant. Columns (5) and (6) examine changes in total assets. The results are broadly similar: the assets of surviving DL banks fell by 20% on average, those of SL banks by an insignificant additional 5 percentage points.

In sum, for surviving banks, balance sheets provide some evidence that SL had negative consequences for bank outcomes, but with limited statistical significance. The estimated effect of SL on deposit withdrawals and total assets adds to the evidence from the distress estimates (in the prior section) against classic bank runs as a primary phenomenon during our sample period. Bank runs would have led to bank failure, meaning that affected banks would not have been part of the set of surviving banks. Notably, the results weaken when failed banks are included, which suggests that failing banks did not write down their assets and recognize losses until the very end. More likely, when combined with the distress evidence, the results in Table 8 are driven by depositors reevaluating the risks of SL banks, forcing them to delever. This reduces the usefulness of balance sheet measures of bank distress.

D. Summary and discussion

Our evidence points to a clear conclusion: limited liability for bank shareholders increased bank distress and failures during the Depression. Banks with SL were much more likely to suspend or to be acquired. The effects are large: limited liability increased the distress rate from about 25 to 35%. The results are strongest for acquisitions. This suggests that losses suffered by SL banks did not necessarily push them into negative equity but did force them to look for a stronger bank to (effectively) inject fresh equity. Raising equity in capital markets was much less common, though it is possible that we miss a significant amount of raising due to data limitations. Finally, SL banks that survived suffered larger capital write-downs and losses of deposits, even though these effects tend to be statistically insignificant.

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

V. Concerns and robustness

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

A. State-level regulatory regimes

A key concern with our analysis is that SL and DL states may have had other banking regulations that were correlated with liability regime. One possibility is that regulators in SL states tried to compensate by dialing up regulation in other dimensions. If that were the case, our estimates of the effect of SL on distress rates would be downward biased and its true effect would be even stronger. Another, 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 analyzing banking regulations in all state-Fed district pairs. To determine which elements of regulation were important, we follow the existing literature, especially Federal Reserve (1932), White (1994?), and Mitchener (2005, 2007).

First, we examine minimum reserve and capital requirements. Higher reserve requirements mean more cash is available in case of a depositor run. Higher capital requirements imply lower leverage for banks that operate 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 1929) based on the town it was located in.[28] 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 two pairs, and equally strict in the remaining two pairs. This is consistent with the lack of systematic differences in 1928 leverage and cash-to-deposits (Tables 3 and 4), the two variables most sensitive to these requirements.

[28] 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).

Aggregating across pairs, SL banks seem on average to have faced slightly stricter requirements, which means that, if anything, we underestimate the effect of SL.

Second, we use the relevant 1929 state laws to construct a measure of other restrictions on bank risk-taking. 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 for National banks from 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 Banking Act did not restrict, 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 seem to have faced similar restrictions.

Third, we examine the quality of the state regulator. According to Federal Reserve (1932) there was considerable variation across states. Based on a 1929 American Bankers Association survey of state regulators (amended with state statutes), Federal Reserve (1932) discusses nine categories of regulator quality.[29] 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. Some categories have multiple sub-categories. For each, we assign states a score between 0 and 1, where 0 is the lowest quality system in our sample and 1 the highest. Table 10, Column (2), presents the sum of these scores, where we weight each of the nine categories equally. 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 pairs. On average, regulator quality was similar for SL and DL banks.

Finally, we consider branching restrictions. Banks subject to more restrictive branching might have been less diversified and therefore riskier (Wheelock 1995, Mitchener 2005). Moreover, lack of

[29] See Mitchener (2005) for the only previous use of this American Bankers Association survey we are aware of.

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). 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. The data show that branching restrictions were mostly the same within pairs. Geographical diversification, and opening branches in smaller communities, was only possible in states were 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, state regulatory differences other than 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. If all regulatory differences are introduced jointly, the effect does decrease from 9.5 to 7.4 percentage points (though still statistically significant at a p-value of 0.056). In this specification there are five additional variables to capture differences between 14 states. This causes collinearity issues that likely attenuate the effect of SL.

B. County characteristics

The Great Depression proved especially harsh for small rural banks (Wheelock 1995). We therefore assess whether the single and double liability banks in our sample differed in how rural or urban they were. Using data from the 1920 and 1930 censuses, we compare the counties in which our State banks were located. We focus on manufacturing and agricultural output per capita and on two measures of urbanization. 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 very 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 location do not affect our results, we add controls for county characteristics to our total trouble regression. The results are in Table E.4 in the Online Appendix. The coefficient on the SL dummy remains virtually unchanged.

C. 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. 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. This suggests that our results might be driven by Fed membership. However, there are at least three reasons why this might not be a concern. First, the difference in membership rates is not consistent across state-Fed district pairs: in four pairs the membership rate is higher for the DL state, whereas in the other four pairs the rate is higher for the SL state. Second, becoming a Fed member is an endogenous choice, so higher rates of membership might indicate that DL banks sought to take less risk by submitting to a stricter regulator. In other words, Fed membership might be a channel through which DL reduced risk taking. Third, Fed membership could also have *increased* the probability of bank failure. During the Great Depression, Fed policies were not as liberal as expected. This might have led Fed member banks to hold too little liquidity (Carlson and Wheelock 2018).

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

D. Selection into State and National Banks

It was possible for State banks to re-charter as National banks, and vice versa. This is cause for concern if there is different endogenous selection into SL and DL states. In particular, in SL states

the choice of a State or National charter directly affected the liability regime, while in DL states it did not.

Riskier banks might have preferred an SL regime to protect their shareholders. On the other hand, riskier banks might have chosen DL to convince depositors of the banks' trustworthiness. The former mechanism would bias our estimates 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 latter mechanism would result in a downward bias.

To check 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 include banks with at most 80% of the paid-in capital required for a National bank in their location. These State banks could not have easily switched charters. We again require at least 50 banks in each state-Fed district, which forces us to drop pairs (1) through (4).[30] Since these banks are by construction different from National Banks, we run only the single difference.

Results for all seven ex-post outcome variables are in Table 12, Panel B. The estimates are of similar magnitude to the full sample numbers, although more noisily estimated with a p-value of 0.092 in the total trouble regression. This suggests that differential selection into State and National banks does not explain our results.

E. Reserve cities

The Great Depression might have affected banks in reserve and central reserve cities more severely.[31] 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 preferred to deposit excess reserves at correspondent banks as they paid higher interest than reserves at the Fed (Source).

Large interbank deposits exposed correspondent banks to rapid outflows when other banks suffered shocks or runs. Mitchener and Richardson (2019) and Calomiris, Wheelock and … (2020) document severe contagion effects of panics that originated at country banks on (central) reserve

[30] Results are robust to keeping state-Fed districts with at least 25 State banks and to dropping this restriction altogether.

[31] The only two central reserve cities were New York City and Chicago. Reserve city banks were located in 64 other large cities.

city banks. Aggregating over our state pairs, we observe that only 2.7% of our SL State banks were located in (central) reserve cities, compared to 10.3% 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 regressions for the seven ex post outcome variables. We again require at least 50 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 SL effect on total trouble is 11.3 percentage points, compared to 9.6 percentage points in the full sample. The (untabulated) double difference results are similar, with an SL effect on total trouble of 12.0 percentage points (compared to 11.4% in the full sample).

F. State-pair fixed effects

Throughout our analyses, we weigh 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 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.

To be precise, 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 8 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

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

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

Table E.5 in the Online Appendix reports regression results for total trouble. Column (1), for reference, uses the original pair-specific weights, and 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 10.4 percentage points when using fixed effects, slightly larger than the 9.6 percentage points estimated using weights.

VI. Conclusion

The evidence presented in this paper shows that double liability for bank shareholders was effective in reducing bank distress in the Great Depression. The effect is present for all eight state-Fed district pairs in our sample and, in the aggregate, appears to have reduced the rate of bank distress by 30%. This suggests that single liability, by increasing banks' risk-taking incentives, was an important contributor to the severity of the Great Depression.

An important question is whether increasing shareholder liability would be effective in reducing bank riskiness and financial fragility today. One key difference between then and now is that the shareholder base for banks in the 1920s was less dispersed (Macey and Miller 1992), even though the stock market boom of the 1920s did widen it (Kane and Wilson 1998). Bank managers were typically also large shareholders, reducing the distance between shareholder liability and decision-making authority. Another important difference is that in the modern system of deposit insurance, there is less incentive for depositors to monitor, heightening the need for a disciplining device for bank management.

We conjecture that the effect we estimate mainly comes from bank managers having more skin-in-the-game. This is supported by Koudijs, Salisbury and Sran (2019) who study New England banks in the 1870s and show that exposing bank managers to additional liability reduced risk. This leads us to conclude that current proposals that focus on the *liability of bank management* have the greatest chance of being effective in curbing risk taking and increasing financial stability.

VII. References

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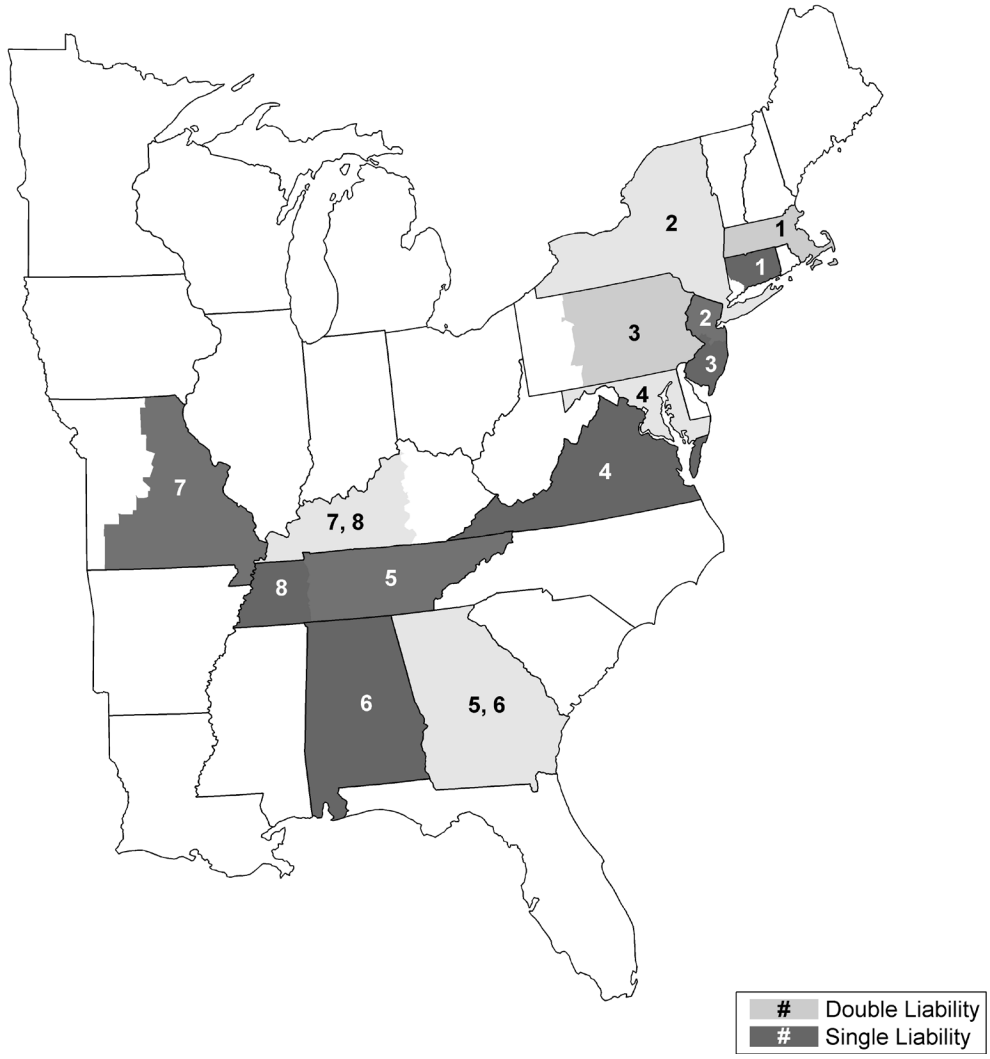
VIII. Figures and Tables

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 separate pairs following the Federal Reserve districts. Other states, such as Georgia, serve as control for two single liability states.

Table 1: Bank size

Bank type	Liability regime	Single difference sample					Double difference sample				
		Mean	Median	Min	Max	N	Mean	Median	Min	Max	N
Panel A: Complete sample											
State	Single	1,367	283	12	160,496	2,175	1,367	283	12	160,496	2,175
State	Double	5,994	528	26	1,050,000	2,313	5,994	528	26	1,049,597	2,313
National	Single						3,346	1,189	93	160,095	816
National	Double						8,001	1,443	120	1,471,817	1,656
Panel B: Common support sample											
State	Single	1,322	282	12	160,496	2,168	1,448	450	121	48,648	1,517
State	Double	2,956	523	26	198,413	2,240	2,262	625	91	57,978	1,993
National	Single						2,576	1,170	93	48,011	785
National	Double						2,591	1,403	150	44,892	1,567
Panel C: Common support sample with weights											
State	Single	2,264	490	12	160,496	2,168	1,939	613	121	48,648	1,517
State	Double	3,105	580	26	198,413	2,240	2,473	641	91	57,978	1,993
National	Single						2,407	1,061	93	48,011	785
National	Double						2,201	1,119	150	44,892	1,567

Note: Panel A shows the distribution of bank sizes in 1928 (defined as total assets in thousands of U.S. dollars) and the number of banks in the full sample, 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 weighs the banks from Panel B such that each state-Fed district pair has equal weight, independent of the number of banks in the pair.

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)	2,684	206	529	1,872	4,408	2,206	279	621	1,864	3,510
Leverage, 1928	0.813	0.779	0.837	0.877	4,408	0.827	0.791	0.843	0.881	3,510
Cash/deposits, 1928	0.195	0.097	0.147	0.246	4,359	0.186	0.096	0.14	0.232	3,476
Total trouble	0.296				4,408	0.292				3,510
Suspensions	0.166				4,408	0.163				3,510
Acquired	0.108				4,408	0.106				3,510
Troubled raising	0.025				4,126	0.027				3,341
Capital write-downs	-0.039	-0.124	-0.012	0.064	4,128	-0.046	-0.134	-0.017	0.065	3,343
Log change in deposits	-0.293	-0.498	-0.251	-0.055	4,081	-0.290	-0.491	-0.246	-0.058	3,310
Log change in total assets	-0.176	-0.347	-0.170	-0.014	4,129	-0.181	-0.351	-0.172	-0.015	3,344
Panel B: National Banks										
Total assets, 1928 (000s)						2,304	577	1,076	2,169	2,352
Leverage, 1928						0.844	0.814	0.858	0.893	2,352
Cash/deposits, 1928						0.191	0.120	0.171	0.235	2,352
Total trouble						0.207				2,352
Suspensions						0.112				2,352
Acquired						0.073				2,352
Troubled raising						0.025				2,266
Capital write-downs						-0.093	-0.187	-0.049	0.028	2,267
Log change in deposits						-0.290	-0.466	-0.264	-0.103	2,268
Log change in total assets						-0.182	-0.318	-0.182	-0.066	2,268

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 divided by total deposits. Total trouble combines bank suspensions, being acquired, and troubled raising. Capital write-downs are the log-change in total equity, subtracting any increase in paid-in capital over the period. For suspended or acquired banks, capital write-downs, log changes in deposits, and log changes in total assets are calculated using the last available fiscal year-end.

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	-0.016	-0.020	0.017	-0.038	0.043	0.028	-0.007	-0.011	-0.001
	(0.017)	(0.008)	(0.012)	(0.009)	(0.009)	(0.008)	(0.005)	(0.009)	(0.004)
									[0.970]
Cons.	0.849	0.861	0.795	0.848	0.753	0.753	0.823	0.823	0.813
	(0.012)	(0.004)	(0.005)	(0.007)	(0.006)	(0.006)	(0.004)	(0.004)	(0.003)
N	173	529	472	446	614	594	1176	404	4408
Adj. R^2	-0.001	0.012	0.006	0.042	0.029	0.016	0.001	0.001	-0.000
Panel B: Double difference									
SL x State	0.032	-0.029	0.008	-0.025	-0.009	-0.002	0.003	-0.022	-0.006
	(0.020)	(0.009)	(0.014)	(0.009)	(0.012)	(0.013)	(0.010)	(0.016)	(0.006)
									[0.594]
SL	-0.048	0.011	0.008	-0.009	0.059	0.020	-0.001	0.022	0.008
	(0.016)	(0.005)	(0.008)	(0.006)	(0.010)	(0.011)	(0.009)	(0.015)	(0.005)
State	0.015	-0.001	-0.027	-0.007	-0.024	-0.028	-0.022	-0.018	-0.014
	(0.011)	(0.004)	(0.005)	(0.007)	(0.010)	(0.009)	(0.007)	(0.008)	(0.004)
Cons.	0.844	0.863	0.825	0.865	0.801	0.803	0.860	0.856	0.840
	(0.006)	(0.003)	(0.002)	(0.005)	(0.008)	(0.008)	(0.006)	(0.007)	(0.003)
N	367	1,259	1,082	552	624	663	945	370	5,862
Adj. R^2	0.065	0.023	0.030	0.076	0.160	0.044	0.028	0.083	0.014

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

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	0.026	-0.003	-0.011	0.060	-0.114	-0.051	0.027	0.154	0.011
	(0.014)	(0.008)	(0.006)	(0.008)	(0.012)	(0.014)	(0.008)	(0.015)	(0.006)
									[0.825]
Cons.	0.104	0.127	0.127	0.099	0.343	0.343	0.188	0.187	0.190
	(0.006)	(0.005)	(0.002)	(0.005)	(0.010)	(0.010)	(0.007)	(0.007)	(0.004)
N	168	526	466	444	599	592	1164	400	4359
Adj. R^2	0.015	-0.001	0.013	0.099	0.123	0.020	0.012	0.241	0.001
Panel B: Double difference									
SL x State	-0.028	0.000	-0.036	0.003	-0.054	-0.043	-0.024	0.017	-0.021
	(0.020)	(0.008)	(0.009)	(0.011)	(0.020)	(0.020)	(0.016)	(0.032)	(0.010)
									[0.234]
SL	0.052	0.001	0.023	0.042	-0.056	-0.008	0.034	0.120	0.026
	(0.015)	(0.004)	(0.007)	(0.007)	(0.016)	(0.015)	(0.014)	(0.026)	(0.008)
State	-0.052	-0.003	0.010	-0.013	0.064	0.064	-0.013	-0.016	0.005
	(0.008)	(0.005)	(0.003)	(0.007)	(0.015)	(0.015)	(0.010)	(0.011)	(0.006)
Cons.	0.155	0.123	0.118	0.113	0.263	0.263	0.193	0.195	0.178
	(0.005)	(0.003)	(0.002)	(0.005)	(0.012)	(0.012)	(0.008)	(0.009)	(0.005)
N	363	1,256	1,076	551	615	661	937	369	5,828
Adj. R^2	0.173	-0.002	0.038	0.094	0.141	0.042	0.031	0.275	0.007

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

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	0.124	0.046	0.056	0.150	0.064	0.122	0.173	0.029	0.096
	(0.072)	(0.041)	(0.066)	(0.040)	(0.037)	(0.039)	(0.029)	(0.045)	(0.018)
									[0.002]
Cons.	0.260	0.222	0.429	0.142	0.251	0.256	0.212	0.216	0.248
	(0.044)	(0.022)	(0.025)	(0.031)	(0.023)	(0.023)	(0.025)	(0.025)	(0.012)
N	173	529	472	446	614	594	1176	404	4408
Adj. R^2	0.012	0.001	0.001	0.031	0.003	0.016	0.035	-0.001	0.011
Panel B: Double difference									
SL x State	0.205	0.073	0.030	0.152	0.142	0.133	0.015	0.163	0.114
	(0.090)	(0.052)	(0.078)	(0.069)	(0.086)	(0.082)	(0.081)	(0.114)	(0.034)
									[0.006]
SL	-0.073	-0.036	0.036	-0.063	-0.049	0.004	0.124	-0.147	-0.026
	(0.052)	(0.032)	(0.039)	(0.052)	(0.075)	(0.070)	(0.074)	(0.099)	(0.027)
State	0.091	0.021	0.315	-0.046	-0.082	-0.055	-0.007	-0.016	0.028
	(0.054)	(0.028)	(0.028)	(0.056)	(0.061)	(0.059)	(0.060)	(0.065)	(0.024)
Cons.	0.171	0.204	0.112	0.200	0.324	0.303	0.217	0.231	0.220
	(0.031)	(0.017)	(0.014)	(0.045)	(0.056)	(0.053)	(0.053)	(0.059)	(0.021)
N	367	1,259	1,082	552	624	663	945	370	5,862
Adj. R^2	0.061	0.004	0.132	0.006	0.002	0.007	0.018	0.017	0.015

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

Table 6: Total trouble, additional controls

	(1) No controls	(2) log(Assets)	(3) Size quintiles	(4) log(Assets) + Controls	(5) Size quintiles + Controls
Panel A: Single difference					
SL	0.096	0.103	0.098	0.099	0.091
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
	[0.002]	[0.003]	[0.0002]	[0.001]	[0.001]
Cons.	0.248	0.239	0.246	0.244	0.225
	(0.012)	(0.012)	(0.023)	(0.012)	(0.025)
N	4408	4408	4408	4391	4391
Adj. R^2	0.011	0.014	0.017	0.047	0.047
Panel B: Double difference					
SL x State	0.114	0.115	0.116	0.125	0.130
	(0.034)	(0.036)	(0.034)	(0.035)	(0.034)
	[0.006]	[0.012]	[0.007]	[0.016]	[0.007]
SL	-0.026	-0.028	-0.026	-0.045	-0.046
	(0.027)	(0.030)	(0.027)	(0.029)	(0.027)
State	0.028	0.025	0.026	0.059	0.053
	(0.024)	(0.027)	(0.026)	(0.026)	(0.026)
Cons.	0.220	0.227	0.221	0.198	0.196
	(0.021)	(0.023)	(0.033)	(0.023)	(0.034)
N	5,862	5,862	5,862	5,851	5,851
Adj. R^2	0.015	0.018	0.015	0.056	0.054

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

Table 7: Type of distress

	(1) Suspensions	(2) Acquired	(3) Troubled raising
Panel A: Single difference			
SL	0.033	0.056	0.007
	(0.015)	(0.013)	(0.007)
	[0.231]	[0.023]	[0.380]
Cons.	0.149	0.081	0.021
	(0.010)	(0.007)	(0.004)
N	4,408	4,408	4,126
Adj. R^2	0.002	0.008	0.000
Panel B: Double difference			
SL x State	0.031	0.066	0.022
	(0.026)	(0.023)	(0.011)
	[0.274]	[0.038]	[0.177]
SL	-0.001	-0.017	-0.011
	(0.021)	(0.019)	(0.008)
State	0.035	-0.001	-0.009
	(0.020)	(0.015)	(0.007)
Cons.	0.112	0.081	0.031
	(0.017)	(0.013)	(0.006)
N	5,862	5,862	5,607
Adj. R^2	0.006	0.007	0.001

Note: The independent variables are the constituent parts of "total trouble" and are indicated at the top of each column. *SL* is an indicator variable that equals one for states with single liability State banks. *State* is an indicator that equals one for State banks. All estimates are for the aggregate sample and use pair-specific weights such that each pair has equal weight. Standard errors clustered at the individual bank level are in parentheses. P-values from wild cluster bootstraps with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

Table 8: Other outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Capital write-downs (%)		Log-change in deposits (%)		Log-change in assets (%)	
Panel A: Single difference						
SL	-3.633	-4.054	-2.361	-5.065	-2.579	-4.984
	(0.860)	(1.070)	(1.588)	(1.961)	(1.176)	(1.420)
	[0.153]	[0.228]	[0.750]	[0.511]	[0.627]	[0.350]
Cons.	-2.147	-3.132	-28.375	-33.134	-16.586	-19.631
	(0.626)	(0.740)	(1.053)	(1.228)	(0.797)	(0.924)
N	4,128	2,992	4,081	2,959	4,129	2,993
Adj. R^2	0.007	0.008	0.001	0.004	0.002	0.007
Panel B: Double difference						
SL x State	-8.359	-10.017	0.630	-4.418	-0.411	-3.950
	(1.600)	(1.895)	(3.023)	(3.542)	(2.156)	(2.476)
	[0.021]	[0.016]	[0.882]	[0.319]	[0.921]	[0.302]
SL	4.560	5.650	-2.270	0.051	-1.957	-0.721
	(1.279)	(1.484)	(2.523)	(2.913)	(1.752)	(1.982)
State	8.846	9.354	-0.298	0.444	0.309	0.891
	(1.200)	(1.415)	(2.089)	(2.492)	(1.502)	(1.739)
Cons.	-11.556	-13.084	-28.067	-33.211	-17.407	-20.803
	(0.988)	(1.167)	(1.790)	(2.166)	(1.246)	(1.454)
N	5,610	4,389	5,578	4,365	5,612	4,391
Adj. R^2	0.021	0.023	0.000	0.002	0.001	0.004
Survivors	N	Y	N	Y	N	Y

Note: The independent variables are capital write-downs and changes in deposits and assets, all in percentages. Odd numbered columns include all banks. Even numbered columns include only banks that survived until February 1933. Capital write-downs are the log-difference between total equity at the ends 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. Log-changes in deposits and assets are similarly 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* is an indicator that equals one for State banks. All estimates are for the aggregate sample and use pair-specific weights such that each pair has equal weight. Standard errors clustered at the individual bank level are in parentheses. P-values from a wild cluster bootstrap 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			Capital Requirements		
			20th	50th	80th	20th	50th	80th
1	CT (1)	1	12%	12%	12%	50,000	50,000	100,000
	MA	0	15%	15%	15%	75,000	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: For each State bank in the single difference common support sample, we determine its reserve and its capital requirement based on the town or city it is located in. The table reports the 20th, 50th, and 80th percentiles of the bank-level distribution of requirements for each state-Fed district. Reserve requirements are for demand deposits only. The last two rows (labeled "All") report percentiles using pair-specific weights such that each pair has equal weight. Sources: Federal Reserve Bulletin (1928) for reserve requirements, state statutes and session laws for capital requirements, where needed supplemented with information from Polk's Bankers Encyclopedia (various issues).

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' asset holdings in state laws. For each restriction we use the National Banking Law as baseline and code state laws 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 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 the term and salary of the bank commissioner and its powers to intervene in banks' operations (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 within the dimension. See Online Appendix D for details. The table reports the unweighted sum of the scores across 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) Crop value (per capita)		(3) Urban population (percent)		(4) Population in cities over 25k (percent)	
			1920	**1930**	**1920**	**1930**	**1920**	**1930**	**1920**	**1930**
1	CT (1)	1	981	896	37	21	0.657	0.696	0.487	0.528
	MA	0	1,003	753	13	7	0.940	0.894	0.629	0.637
2	NJ (2)	1	1,211	1,016	18	7	0.810	0.878	0.556	0.561
	NY	0	772	822	92	40	0.613	0.626	0.403	0.400
3	NJ (3)	1	633	554	65	35	0.596	0.606	0.376	0.316
	PA (3)	0	737	679	61	28	0.617	0.653	0.360	0.378
4	VA	1	165	244	162	90	0.207	0.218	0.138	0.138
	MD	0	339	380	154	87	0.277	0.303	0.179	0.182
5	TN (6)	1	151	150	151	80	0.157	0.193	0.070	0.089
	GA	0	173	156	205	97	0.163	0.181	0.074	0.074
6	AL (6)	1	157	146	140	91	0.141	0.174	0.059	0.061
	GA	0	174	158	205	97	0.161	0.180	0.071	0.071
7	MO (8)	1	167	180	249	95	0.188	0.221	0.059	0.065
	KY (8)	0	118	113	205	103	0.169	0.185	0.074	0.083
8	TN (8)	1	115	110	211	140	0.142	0.175	0.070	0.080
	KY (8)	0	100	94	210	106	0.149	0.164	0.055	0.061
All	Average	1	448	412	129	70	0.362	0.395	0.227	0.230
	Average	0	427	394	143	71	0.386	0.398	0.231	0.236

Note: The table reports, for the single difference common support sample, averages across State banks of characteristics of the counties banks are located in, by state-Fed district. Data are from the 1920 and the 1930 censuses: *Manufacturing output (per capita)*: manufacturing output divided by total population. *Crop value (per capita):* value of crops divided by total population. *Urban population (percent):* urban population divided by total population. Urban areas are defined as cities and other incorporated places with at least 2,500 inhabitants and also 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. 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) Total trouble	(2) Suspen-sions	(3) Acquired	(4) Troubled raising	(5) Capital write-downs (%)	(6) Log-change in deposits (%)	(7) Log-change in assets (%)
Panel A. Non-Fed members							
SL	0.101	0.027	0.069	0.006	-3.666	-5.588	-5.438
	(0.019)	(0.015)	(0.014)	(0.007)	(1.141)	(2.118)	(1.522)
	[0.006]	[0.370]	[0.033]	[0.436]	[0.293]	[0.466]	[0.336]
Cons.	0.248	0.154	0.075	0.020	-3.263	-33.306	-19.734
	(0.012)	(0.011)	(0.007)	(0.004)	(0.790)	(1.338)	(1.021)
N	3,976	3,976	3,976	3,722	2,683	2,652	2,684
Adj. R^2	0.012	0.001	0.012	0.000	0.007	0.005	0.008
Panel B. State banks with limited capital							
SL	0.114	0.053	0.047	0.020	-1.666	-6.320	-5.223
	(0.034)	(0.031)	(0.018)	(0.007)	(1.692)	(4.320)	(2.981)
	[0.092]	[0.495]	[0.017]	[0.125]	[0.255]	[0.563]	[0.438]
Cons.	0.230	0.188	0.042	0.000	-3.460	-49.549	-30.775
	(0.026)	(0.025)	(0.012)	(0.000)	(1.380)	(3.431)	(2.316)
N	1,359	1,359	1,359	1,228	886	878	886
Adj. R^2	0.015	0.003	0.008	0.009	0.001	0.004	0.006
Panel C. State banks not located in (central) reserve cities							
SL	0.113	0.043	0.065	0.006	-3.742	-5.675	-5.334
	(0.019)	(0.015)	(0.013)	(0.007)	(1.087)	(1.972)	(1.428)
	[0.001]	[0.160]	[0.013]	[0.490]	[0.258]	[0.475]	[0.325]
Cons.	0.231	0.141	0.072	0.022	-3.457	-32.994	-19.673
	(0.012)	(0.010)	(0.07)	(0.004)	(0.764)	(1.239)	(0.932)
N	4,094	4,094	4,094	3,849	2,826	2,803	2,827
Adj. R^2	0.015	0.003	0.011	0.000	0.007	0.005	0.008

Note: This table presents results for "total trouble", its three components (suspensions, being acquired, troubled raising), capital write-downs, and changes in deposits and assets. Columns (5) to (7) use only banks that survived until February 1933. Panel A: only State banks that were not Fed members. Requiring at least 50 banks per state-Fed district retains all pairs. Panel B: 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). Panel C: 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 pair has equal weight. Standard errors clustered at the individual bank level are in parentheses. P-values from wild cluster bootstraps with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.

IX. 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, Federal Reserve banks had different policies, with large differences in bank outcomes (Richardson and Troost 2009). We therefore consider each state-Fed district separately, and we only match within the same Fed district.

To determine the best match we use aggregate data from *All Bank Statistics*. In particular, we consider 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.[32] We use average bank size 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 selection and 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.

[32] These state-level failure rates are annual, so we use them 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	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 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 a state-Fed district pair, are on the same common support in terms of bank size (measured by book assets). We construct the single and double difference 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 neighboring 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. Retain all selected 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 a control state.

Double difference sample:

1. Start with each SL State bank in a given state-Fed district.
2. Select all DL State banks in the neighboring 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 neighboring 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 neighboring state-Fed district, National banks in own state-Fed district, and National banks in neighboring state-Fed district).
5. Retain all DL banks selected in Step 3. Each bank is included once, even if selected multiple times, except for Georgia and Kentucky (8), which are used twice as a control state.

C. Restrictions on bank risk-taking

Different state banking departments 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 the laws we identify eight important categories and score each of 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 law 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 in 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 law:

	Category	**National banking law**
1	Holding corporate securities	Cannot hold corporate stock
2	Insurance	Cannot guarantee any loans or bonds
3	Limits on discounting bills of exchange	Limits on maturities (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 (LTV) 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, and 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 the bank itself is effectively a payout to shareholders and reduces the amount of equity. Finally, a higher usury limit creates incentives to lend to riskier borrowers.

D. Quality of State bank regulators

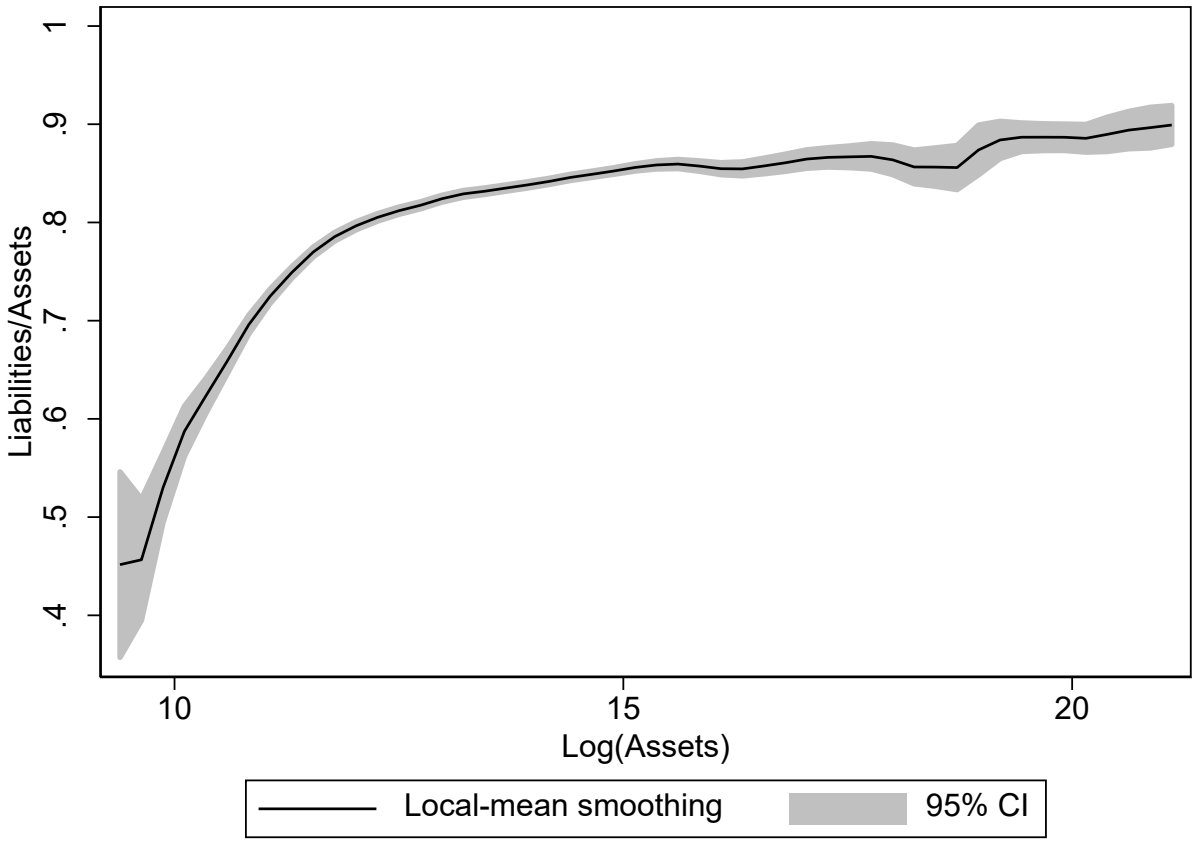
Federal Reserve (1932, Table II) provides state-by-state information about nine characteristics of State bank regulators. The information comes from a 1929 survey of state regulators by the American Bankers Association, and from state statutes. Some of the nine characteristics have subcategories. For each (sub)category we score states between 0 and 1, where 0 is the worst system and 1 the best. In the main text and in Table 10, we report the unweighted sum of the scores across 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 Separate	0 1
2	Type of supervisory agency		Single official under control of / appointed by banking board Single official + banking board Single official	0 0.5 1
3	Method of selecting commissioner or supervisor		Selection by banks Selection by (political) commission Appointed by governor	0 0.5 1
4	Term of office of supervisor		3 years or less 4 years 5 or 6 years Indefinite	0 0.333 0.666 1
5	Salaries of supervisors		< $5,000 $5,000-$10,000 >$10,000	0 0.5 1
6	Method of selecting examiners		Supervisory agency + governor or board Supervisory agency Civil service	0 0.5 1
7	Powers in the organization of new banks	Principal discretionary powers in passing on applications for new charters	Commissioner Banking board	1 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: The figure shows a 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 1). 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 a 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	73	5.5%
	MA	0	100	21.0%
2	NJ (2)	1	164	32.9%
	NY	0	365	26.3%
3	NJ (3)	1	66	10.6%
	PA (3)	0	406	17.5%
4	VA	1	319	3.4%
	MD	0	127	1.6%
5	TN (6)	1	267	0%
	GA	0	347	12.1%
6	AL (6)	1	246	5.3%
	GA	0	348	12.1%
7	MO (8)	1	898	5.6%
	KY (8)	0	278	1.4%
8	TN (8)	1	135	3.7%
	KY (8)	0	269	0.7%
All	Average	1	2,168	8.4%
	Average	0	2,240	11.6%

Note: This table reports, for the single difference common support sample, the number of State banks in each state-Fed district in 1928 and the percentage of State banks that are Fed members. 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 bank 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	0.033	0.018	-0.003	-0.001	-0.001	0.008	0.004
	(0.015)	(0.011)	(0.002)	(0.001)	(0.004)	(0.009)	(0.007)
	[0.231]	[0.561]	[0.409]	[0.589]	[0.842]	[0.603]	[0.728]
Cons.	0.149	0.069	0.005	0.001	0.013	0.055	0.024
	(0.010)	(0.007)	(0.002)	(0.001)	(0.003)	(0.006)	(0.005)
N	4,408	4,393	4,393	4,393	4,393	4,393	4,393
Adj. R^2	0.002	0.001	0.000	0.000	-0.000	0.000	-0.000
Panel B: Double difference							
SL x State	0.031	0.017	-0.005	-0.001	-0.007	0.008	0.015
	(0.026)	(0.021)	(0.003)	(0.001)	(0.005)	(0.016)	(0.009)
	[0.274]	[0.537]	[0.203]	[0.723]	[0.208]	[0.732]	[0.040]
SL	-0.001	-0.001	0.001	-0.000	-0.000	0.008	-0.010
	(0.021)	(0.017)	(0.001)	(0.000)	(0.002)	(0.012)	(0.005)
State	0.035	-0.002	0.006	0.002	0.013	0.025	0.007
	(0.020)	(0.016)	(0.002)	(0.001)	(0.004)	(0.011)	(0.007)
Cons.	0.112	0.068	0.000	0.000	0.002	0.028	0.015
	(0.017)	(0.014)	(0.000)	(0.000)	(0.002)	(0.009)	(0.004)
N	5,862	5,848	5,848	5,848	5,848	5,848	5,848
Adj. R^2	0.006	0.000	0.002	0.000	0.004	0.005	0.003

Note: The independent variables are indicators for bank suspensions with different reported causes. Column (1) presents results for all suspensions. Columns (2) to (7) distinguish by the primary reason for the suspension reported on form St. 6386. *SL* is an indicator variable that equals one for states with single liability State banks. *State* is an indicator that equals one for State banks. All estimates are for the aggregate sample and use pair-specific weights such that each pair has equal weight. Standard errors clustered at the individual bank level are in parentheses. P-values from wild cluster bootstraps 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	0.096	0.108	0.107	0.098	0.099	0.091	0.093	0.074
	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.020)	(0.021)
	[0.003]	[0.001]	[0.002]	[0.003]	[0.003]	[0.003]	[0.033]	[0.056]
Reserve requirements (%)	1.292		1.206					2.360
	(0.293)		(0.297)					(0.388)
Minimum capital requirements ($000)		0.516	0.338					0.328
		(0.140)	(0.135)					(0.130)
Restrictions on bank risk-taking (score)				0.012			0.000	-0.002
				(0.008)			(0.009)	(0.009)
Regulator quality (score)					0.013		0.004	-0.095
					(0.015)		(0.017)	(0.022)
Branching restrictions (score)						0.064	0.062	0.149
						(0.027)	(0.033)	(0.037)
Cons.	0.083	0.208	0.065	0.272	0.171	0.277	0.251	0.523
	(0.039)	(0.014)	(0.039)	(0.019)	(0.089)	(0.017)	(0.105)	(0.112)
N	4,408	4,274	4,274	4,408	4,408	4,408	4,408	4,274
Adj. R^2	0.018	0.018	0.023	0.011	0.011	0.012	0.012	0.032

Note: This table presents single difference regressions for "total trouble" with added controls for regulatory differences across states. "Total trouble" combines bank suspensions, being acquired, 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 Law. *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 pair has equal weight. Standard errors clustered at the individual bank level are in parentheses. P-values from wild cluster bootstraps 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	0.099	0.097	0.099
	(0.022)	(0.022)	(0.022)
	[0.001]	[0.000]	[0.002]
Manufacturing output (per capita) in 1920 (thousands)	-0.031		-0.032
	(0.040)		(0.061)
Manufacturing output (per capita) in 1930 (thousands)		-0.029	-0.001
		(0.043)	(0.063)
Crop value (per capita) in 1920 (thousands)	0.021		0.098
	(0.122)		(0.162)
Crop value (per capita) in 1930 (thousands)		-0.039	-0.189
		(0.238)	(0.320)
Urban population in 1920 (percent)	0.080		0.036
	(0.082)		(0.216)
Urban population in 1930 (percent)		0.057	0.034
		(0.077)	(0.189)
Population in cities over 25k in 1920 (percent)	0.101		0.045
	(0.074)		(0.214)
Population in cities over 25k in 1930 (percent)		0.113	0.064
		(0.070)	(0.214)
Cons.	0.204	0.213	0.209
	(0.034)	(0.033)	(0.036)
N	4,408	4,408	4,408
Adj. R^2	0.022	0.022	0.021

Note: This table presents single difference regressions for "total trouble" with added controls for county characteristics. "Total trouble" combines bank suspensions, being acquired, and troubled raising. *SL* is an indicator variable that equals one for states with single liability State banks. *Manufacturing output (per capita)*: manufacturing output divided by total population. *Crop value (per capita):* value of crops divided by total population. *Urban population (percent):* urban population divided by total population. Urban areas are defined as cities and other incorporated places with at least 2,500 inhabitants and also 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 more than 25,000 inhabitants divided by total population. 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. All estimates are for the aggregate sample and use pair-specific weights such that each pair has equal weight. Standard errors clustered at the county level are in parentheses. P-values from wild cluster bootstraps 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	0.096	0.104
	(0.018)	(0.017)
	[0.002]	[0.002]
Cons.	0.248	0.268
	(0.012)	(0.036)
N	4,408	4,408
Adj. R^2	0.011	0.027
Panel B: Double difference		
SL x State	0.114	0.100
	(0.034)	(0.030)
	[0.006]	[0.001]
SL	-0.026	
	(0.027)	
State	0.028	
	(0.024)	
Cons.	0.220	0.157
	(0.021)	(0.030)
N	5,862	5,862
Adj. R^2	0.015	0.041

Note: The independent variable is "total trouble", which combines bank suspensions, being acquired, and troubled raising. *SL* is an indicator variable that equals one for states with single liability State banks. *State* is an indicator that equals one for State banks. We present two sets of estimates for the aggregate sample. In Column (1), which is the same as Column (9) in Table 5, we use pair-specific weights such that each state-Fed district pair receives equal weight. In Column (2) we include pair fixed effects, interacted in the double difference with the *SL* and *State* 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 wild cluster bootstraps with double-clustering at the state and state-Fed-district-pair level, using default Rademacher weights, are in square brackets.