Stealing Deposits: Deposit Insurance, Risk-Taking and the Removal of Market Discipline in Early 20th Century Banks

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Abstract

Deposit insurance reduces liquidity risk by removing the incentives of depositors to withdraw from banks when concerned about bank insolvency risk. However, it also can increase insolvency risk by encouraging reckless behavior by insured banks. Unlike modern systems that cover virtually all depository institutions, only a handful of U.S. states installed deposit insurance laws before 1920 and those laws only applied to some of the depository institutions within those states. These experiments present a unique testing ground for investigating four questions. First, we are able to show that deposit insurance on net increased systemic risk. Second, we show that deposit insurance increased risk by removing market discipline that had been constraining erstwhile uninsured banks. It thereby encouraged them to increase their insolvency risk, and permitted them to compete aggressively for the deposits of uninsured banks operating nearby. Third, we show that deposit insurance did not produce a systemic growth in deposits rather it simply shifted deposits from uninsured banks to insured ones. Fourth, we show that increased risk was driven by the actual operation of deposit insurance and the removal of market discipline rather than by the circumstances that led to the passage of deposit insurance.

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1.Introduction

Deposit insurance spread throughout the world in the latter half of the 20th century, a process that largely reflected a combination of external and internal political pressures favoring its adoption (Demirgüç-Kunt, Kane and Laeven 2008). Part of those external pressures identified includes the endorsement of deposit insurance by the International Monetary Fund in its best practices. Deposit insurance is also part of the European Union's requirements for membership. Despite its overwhelming political support, there is a large empirical literature suggesting that the moral-hazard costs of deposit insurance (Merton 1977) have out-weighed its liquidity-risk-reduction benefits. Research by Brewer (1995), Caprio and Klingebiel (1996), Martinez-Peria and Schmukler (2001), Calomiris and Powell (2001), Demirgüç-Kunt and Detragiache (2002), Honohan and Klingebiel (2003), Demirgüç-Kunt and Huizinga (2004), Cull, Senbet and Sorge (2005), Barth, Caprio and Levine (2006), Demirgüç-Kunt, Kane and Laeven (2008), Beck and Laeven (2008), Laeven and Valencia (2013), Yan, Skully, Avram and Vu (2014), Calomiris and Chen (2016) and many others indicates that deposit insurance is the single most important contributor to the unprecedented wave of frequent and costly banking crises that has gripped the world over the past four decades. The separation between policy recommendations and economic studies is nothing new but it begs the questions of whether the last four decades were an aberration or whether the empirical studies may have failed to identify other contributing influences that produced both the rise of deposit insurance and banking instability.

Most studies of the effects of deposit insurance are based on cross-country comparisons, or on comparisons across time within countries, which contrast the behavior of insured banking systems with uninsured banking systems.[1] Despite attempts by these authors to control for other

[1] Exceptions include Brewer (1995) and Yan, Skully, Avram and Vu (2014), which are based on cross-sectional comparisons among banks within a country. Brewer achieves identification by comparison the behavior of

influences that coincide with the creation or expansion of deposit insurance, or the use in some of these studies of instruments to explain the creation of deposit insurance, it is conceivable that some of the positive association between deposit insurance and increased bank risk may reflect exogenous increases in risk that encourage the passage of deposit insurance. If true, the risk-creating effects of deposit insurance could be exaggerated.

In this study, we examine a near ideal environment from the standpoint of identification – the state deposit insurance experiments of the early twentieth century in the United States. These systems created deposit insurance for state-chartered commercial banks that operated in parallel to the uninsured system of national banks within the same states and uninsured state and national banks operating in bordering states. We are able to employ detailed information about the locations, economic environments, and balance sheet characteristics of insured and uninsured banks in an environment of "unit banking" where single-office banks operated in specific locations. We are also able to distinguish between the endogenous passage of deposit insurance and its effects on banking system risk by constructing placebo tests related to the delayed implementation of deposit insurance in some states.

Our findings not only corroborate the prior literature on the moral hazard consequences of deposit insurance, but we are also able to show *how* the introduction of deposit insurance created systemic risk. We find conclusive evidence that deposit insurance caused risk to increase in the banking system by removing market discipline that had been constraining uninsured banks' risks, which allowed deposits to move from prudent banks to risky ones. Insured banks were able to use insurance to compete away deposits from uninsured banks located nearby. Depositors applied strict market discipline on uninsured banks when evaluating whether to place

institutions that have suffered large losses vs. those that have not. Yan et al. (2014) contrast different types of institutions within Australia that were differentially affected by deposit insurance protection. These studies likely suffer less than others from possible endogeneity bias in identifying the effects of deposit insurance.

their deposits in those banks. But depositors' decisions to place funds in insured banks were made irrespective of the financial soundness of those institutions. Because depositors did not discipline insured banks, those banks were constrained only by regulatory standards (primarily, these consisted of a minimum capital-to-deposits ratio, a minimum reserves-to-deposit ratio, and in some cases, a maximum interest rate paid on deposits).[2] Insured banks maintained high loan-to-asset ratios and kept their capital ratios close to the regulatory minimum. Given the high asset risk undertaken by insured banks, the regulatory limits on leverage proved inadequate to prevent bank insolvency. Insured banks seemingly were betting on the permanence of agricultural price increases that had occurred during World War I, and depositors seemingly believed in the deposit insurance systems' ability to protect them. When price increases were reversed, the insured banking systems collapsed and many depositors were left with losses.[3]

2. Historical Background

Bank liability insurance began in the United States as a remedy to the constraint of "unit" (single office) banking that dominated the U.S. system historically (Calomiris and Haber 2014, Chapter 6). Removing the incentive for depositors or note holders to demand repayment from banks was especially appealing to unit banks due to a variety of systemic risk issues. First, unit banks were unable to diversify the location of their lending, which tended to make them highly susceptible to local shocks (e.g., declines in a particular crop price). Second, the thousands of geographically isolated U.S. unit banks were not able to coordinate their responses to common shocks by pooling their resources in the face of withdrawal risk. Third, the pyramidal structure of clearings in the U.S. system tended to magnify liquidity risks. Restricted to a single office

[2] See Warburton (1959) for details.
[3] For an analysis of those collapses and the exceptionally large losses of the insured systems, see Warburton (1959), Calomiris (1990, 1992), and Goldenweiser et al. (1932).

location, banks had to hold deposits with correspondent banks in larger financial centers to make payments and collect checks as well as drafts on distant locations. Because the demands for money and credit were highly seasonal, the interbank network allowed small banks to earn interest on their reserves during slack periods and draw down their balances or borrow from their city correspondents when local demands for money and credit were high; however, the occasional "seasonal stringency" in money markets transmitted shocks across the banking system, propagating panics and sometimes causing suspensions of convertibility. In these cases, many respondent banks that had nothing to do with the panic were left facing bank runs without access to their reserves or emergency liquidity.[4]

Antebellum banking systems in the North created two versions of liability insurance.[5] The Indiana model chartered a limited number of banks with unlimited mutual liability for each other's liabilities. The system also vested the group of member banks with regulatory and supervisory authority over each other, including strong disciplinary powers. The Indiana system spread to Ohio and Iowa, and was associated with the successful mitigation of liquidity risk for its members. For example, during the severe Panic of 1857, the Indiana and Ohio insurance systems avoided suspension of convertibility (Calomiris 1989, 1990; Calomiris and Schweikart 1991). This successful state-level system was ended by the National Banking Acts as its member banks were amongst the first to take out national bank charters.

The New York model created a "Safety Fund" that all banks in the state were required to pay into. Overseen by three bank comptrollers that had little supervisory or disciplinary powers, the fund was to be used to payout any failed banks deposits. The New York model spread to

[4] For more detail on the interbank network and panics see Kemmerer (1910), Sprague (1910), James (1978), Calomiris and Gorton (1991), Wicker (2000), James and Weiman (2010), Bordo and Wheelock (2013), Mitchener and Richardson (2015), Carlson and Wheelock (2015), Calomiris and Carlson (2016b).
[5] For summaries of the key features of the antebellum and postbellum systems, see Golembe and Warburton (1958), Warburton (1959), and Calomiris (1989).

Vermont and Michigan. In all cases it failed to provide protection against systemic liquidity risk, and ended in systemic insolvency and collapse. New York state even had to issue a bonds in order to raise enough money to pay off noteholders in good time after the Panic of 1839.

The relative success of the Indiana model reflected the incentives that it created for limiting moral hazard. The combination of a small number of members, unlimited mutual liability, and strong regulatory and supervisory authority meant that protection against system risk was credible, and also that individual members had the ability and the incentive to monitor and discipline one another to prevent excessive risk-taking by members at the expense of the group. Alternatively, the New York model created no such incentives and the large number of members limited each member's exposure to loss. New York members thus had little incentive or ability to police each other's actions. (Calomiris 1989).

The National Banking Acts not only led to the disappearances of early state-level experiments with mutual liability insurance, but they also created a dual banking system by allowing banks to choose whether they were chartered and regulated by their state's law (these banks were called state banks) or by the Comptroller of the Currency (these banks were called national banks). State banks had lower capital and reserve requirements than national banks, but the tax placed on state bank notes in 1865 effectively drove most rural state banks either to apply for a national charter or to close (Jaremski 2013).[6] It was not until the rise in the use of checking accounts that state banks returned in large numbers.

Because the dual banking system perpetuated the fragmented, unit banking structure of the U.S. banking system, the peculiar instability of U.S. banks persisted into the late 19th and early 20th century – a time when other countries' banking systems were not experiencing such

[6] The number of state banks fell from over 1,600 in 1860 to under 300 in 1869, while the number of national banks rose from 0 to over 1,600.

severe shocks (Bordo 1985). The return of state banks coupled with the Panic of 1893 pushed some states to consider once again the question of deposit insurance, but no state took action until after the Panic of 1907.[7]

The history of early 20th century deposit insurance of U.S. banks exhibits some apparently puzzling aspects. One puzzle is the failure to learn from the design errors of the antebellum era when building the postbellum insurance systems. Early experimentation in the antebellum period identified a successful approach (the Indiana model) and an unsuccessful approach (the New York model). The Indiana model never reappeared, yet the failed New York model was revived in several states. In all those cases, the New York approach to the insurance of state-chartered banks once again ended in systemic collapses.[8] The simplest answer for this behavior is that the Indiana model was not feasible for a large number of member banks. As the number of member banks rises, the incentives of any member to monitor and enforce other members' adherence to collective rules is weakened. Unlimited mutual liability and self-regulation simply cannot operate in a system with many banks (Calomiris 1989).

A more puzzling aspect of U.S. deposit insurance history is the decision to enact federal deposit insurance in 1933 in spite of the failures of the state experiments during the preceding decade. The puzzle deepens when one considers that the collapses made contemporaries, including President Franklin Roosevelt, keen observers of the incentive problems of deposit

[7] White (1981) posits that state legislatures did not take action after 1893 because the depression was the result of bank defaults rather than bank runs. Interestingly, while the passage of laws was prompted by the Panic of 1907, the amount of bank failures was not a significant driver of passage. White (1983) finds no significant correlation between the state bank failure rate and deposit insurance adoption, and Chung and Richardson (2006) also find that suspension rates were low relatively similar across states.

[8] Calomiris (1990, 1992) reports results linking deposit insurance to increased bank risk and greater severity of loan losses. Wheelock and Wilson (1995) show that after the passage of insurance banks in Kansas saw increased failure risk even after controlling for bank efficiency differences. Hooks and Robinson (2002) show that banks in Texas saw increased failure risk due to increased loan concentration and decreased capital ratios. That said, Chung and Richardson (2006) find that deposit insurance states experienced significantly fewer bank suspensions that were attributed by examiners to bank runs and significantly more that were attributed by examiners to mismanagement, but they find no overall rise in total suspensions as the result of insurance.

insurance. Commenting in 1932 to the *New York Sun*, candidate Roosevelt wrote that deposit insurance "would lead to laxity in bank management and carelessness on the part of both banker and depositor. I believe that it would be an impossible drain on the Federal Treasury" (Quoted in Prins 2009, p. 139). Calomiris and White (1994) show that proposals for federal deposit insurance had been rejected since the 1880s because it was recognized as socially undesirable, special interest legislation promoted by unit bankers. Calomiris and White (1994), Economides, Hubbard and Palia (1996), Calomiris (2010), Calomiris and Haber (2014) and many others argue that the unique political circumstances of 1933 created an opportunity for the passage of deposit insurance, in spite of opposition by the Federal Reserve, the U.S. Treasury, the American Bankers Association (which mainly represented large banks), and powerful political figures such as President Roosevelt and Senator Carter Glass.

An alternative explanation to this puzzle is that the systemic risk consequences of deposit insurance were exaggerated by opponents. Although the eight states that enacted deposit insurance protection all witnessed banking system collapses, perhaps those collapses reflected the exogenous high risk of banking in those states, which itself might have led those states to adopt deposit insurance. Existing empirical studies have argued against this possibility by comparing the behavior of insured states to their neighboring states (Calomiris 1990, 1992), but neighboring states may have been exogenously less risky, owing to their local crops, geography or other characteristics.

In this paper, we implement a new microeconomic empirical approach that clearly identifies the extent to which the adoption of deposit insurance by U.S. states in the early 20th century was a causal factor in competing away uninsured banks' deposits, promoting excessive risk taking of banks, and leading to the eventual collapse of those insurance systems. We collect

and analyze data for individual banks, including both state-chartered and national banks, and including both state-chartered banks that were covered by deposit insurance and those that were not. Our analysis encompasses both state systems with voluntary and compulsory participation in deposit insurance.

Our micro-level analysis allows us to show how deposit insurance changed competition in the market for deposits. Only a handful of states installed deposit insurance laws and those laws only applied to state regulated banks (i.e., state banks) even though federally regulated banks (i.e., national banks) were similar and operated in the same locations. We thus are able to utilize a difference-in-difference-in-difference specification to identify the effect of deposit insurance. Specifically, we observe the aggregate differences between deposit insurance states and others, the differences between covered and non-covered banks in a state, and the difference in covered and non-covered banks across deposit insurance states and others. Moreover, since several of the laws were passed in the same years but implemented in different subsequent years, we are able to separate whether it was a region-specific economic shock that led to the passage of deposit insurance from the effect of deposit insurance.

Section 3 develops a model of how competition reallocates deposits from uninsured to insured banks, and develops testable hypotheses for our econometric analysis. Section 4 reviews the history of deposit insurance adoption in the early 20th century and summarizes aggregate data on the changing allocation of deposits that accompanied the passage of deposit insurance. Section 5 describes our data set. Section 6 reports our findings on the effects of deposit insurance. In Section 6, we begin with an analysis of state-level data, followed by the reporting of our main results using bank-level data. Section 7 concludes.

3. Theory of Deposit Insurance In A Competitive Bank Environment

Before consulting the narrative or econometric evidence on state deposit insurance during the early 20th century, it is helpful to discuss competition in the deposit market and develop hypotheses that will serve as the basis for the tests we perform in the following sections.

In money markets, such as deposits, debtholders not only price risk, but demand a very low level of default risk. Following the theories and empirical evidence of this risk intolerance in uninsured deposit markets,[9] we assume that uninsured banks are forced by market discipline to target a low level of default risk on their deposits. Specifically, we assume that the actuarially fair default risk premium on deposits (p) must be less than or equal to the required level, Z. Uninsured banks with $p > Z$ will suffer deposit outflows.[10] Uninsured banks satisfy this market discipline constraint by maintaining sufficiently low asset risk (s_A) and a sufficiently high equity-to-assets ratio (E/A).

Figure 6 uses the Black Scholes model to derive the combination of asset risk and equity-to-assets that satisfies $p = Z$ which appears as a convex line.[11] Points beneath and to the right of that line are those for which $p > Z$, and points above and to the left of the line are those for which $p < Z$.

Asset risk here is defined as the standard deviation of asset returns. If bank assets consist of loans and riskless cash assets, the standard deviation of asset returns is equal to the loan-to-assets ratio (L/A) multiplied by the standard deviation of returns to the loan portfolio (s_L). Thus,

[9] See Gorton and Pennacchi (1990), Calomiris and Kahn (1991), Calomiris, Himmelberg and Wachtel (1995), Martinez Peria and Schmukler (2001), Calomiris and Powell (2001), Calomiris and Wilson (2004) and Calomiris and Carlson (2016a).

[10] For simplicity of exposition, we assume here that all uninsured banks target the same low default risk. The fact that failure rates historically were higher for uninsured state banks than for national banks suggests that national banks were targeting somewhat lower default risk. We incorporate that possibility into our empirical analysis.

[11] Figure 6 is adopted from Calomiris and Wilson (2004).

an uninsured bank experiencing deposit outflows because $p > Z$ can end those outflows by raising *E/A*, by lowering *L/A*, or by lowering s_L.

Insured banks, in contrast, can attract deposits so long as (1) insurance is regarded as credible protection, and (2) they are able to pay a slight premium over the amount paid by uninsured banks. Two points warrant emphasis. First, the only way for insured banks to fund their higher payment of deposit insurance profitably is to undertake greater risk. Thus, insured banks that attract deposits from uninsured banks must also increase their asset risk per deposit dollar (*Hypothesis 1*). Second, for deposit insurance to be credible, depositors must believe that despite the increased risk taking of their bank, they will be protected against loss. This latter caveat is important because as the losses associated with insured banks' risks become visible, collective protection will disappear and depositors will run on their banks (recall that the state deposit insurance funds were not backed by the state).[12] For instance, the post-World War I collapse of commodity prices produced enormous losses and deposit insurance in all eight states eventually ceased to provide protection to depositors. Ultimately, depositors lost a substantial fraction of their investments because the states refused to bailout the funds.

As Merton (1977) and many others have noted, insured banks face strong incentives to minimize their capital ratios and maximize their asset risk because doing so allows them to reap a subsidy from an underpriced put option implicit in deposit insurance: As insured banks increase their level of *p*, their expected return increases relative to their cost of funding.

The implications of this model are as follows. First, insured banks can attract deposits from each other or from uninsured banks by paying a premium greater than *Z*, so long as insurance protection is regarded as credible. Second, insured banks will only be able to offer that

[12] Ultimately depositors suffered large losses on insured deposits. This suggests that either they did not anticipate the risk increases resulting from deposit insurance, or that they anticipated government protection of failed banks (there was some precedent in the antebellum experiments for lending from governments to insurance systems).

higher deposit interest rate profitably by targeting a default risk greater than *Z*. This, in turn, implies that the availability of high risk opportunities is an important contributor to the growth of insured banks(an implication that is consistent with the aggregate deposit growth facts discussed in Section 4.1). Third, uninsured banks cannot compete with insured banks that enjoy high-risk opportunities because uninsured banks have no way of offering an interest rate premium greater than *Z* on deposits for which $p = Z$. Fourth (a restatement of *Hypothesis 1*), the creation of credible deposit insurance combined with high risk opportunities should, therefore, allow insured banks to attract funds from uninsured banks to fund increased risks.

Fifth, the amount of deposits that flow from the uninsured to the insured banks depends on the number of depositors who regard insurance protection as credible. Rational depositors who believe that most or all the insured banks are targeting high risk related to a common risk factor (e.g., temporarily inflated commodity prices that are likely to decline and cause losses for all banks) will not move their funds to insured banks. Over time, as common risks that threaten collective protection become observable, deposits should cease to flow into the insured banking system, and at some critical value of observable aggregate expected loss, deposits should begin to flow out of the insured system.[13] Note that if all depositors fully understood from the beginning the risks that insured banks were actually taking and the systematic losses that would result from those risks, then few deposits would flow to insured banks, and those banks would face market discipline similar to uninsured banks.

Sixth (*Hypothesis 2*), uninsured banks (state and national banks prior to the passage of deposit insurance, and national banks after its passage) compete mainly with each other for the deposits that do not flow to the insured banks, and they do so on the basis of their soundness: Uninsured banks that experience declines in their equity-to-assets ratio, rises in their loan-to-

[13] See also the evidence in Wheelock and Wilson (1995).

assets ratio, or declines in their loan, ceteris paribus, should lose deposits relative to other uninsured banks. Moreover, we would not expect the same discipline relationships to hold for insured banks.

4. State Deposit Insurance Schemes of the Early 20th Century

Eight states passed deposit insurance laws from 1908 to 1917.[14] Similar to the New York Model, each law created a fund that would be used to reimburse depositors in the event of a failed member bank. The funds were not guaranteed by the states themselves, but rather the credibility of insurance protection depended upon the value of the existing fund and the promise of future assessments on banks. The laws stipulated each bank's annual assessment (typical a very small fraction of their deposits minus capital), as well as limiting the extra assessment that banks could be forced to pay to replenish the fund during an emergency. States typically also installed additional regulations. Some installed extra bank supervision or more qualified examiners, while others increased capital and reserve ratio requirements of member banks.

The major differences across the deposit insurance systems revolved around whether insurance was mandatory. Kansas and Washington passed voluntary laws that gave state banks the choice of whether to opt into the system. Texas allowed banks to opt out of the state's deposit insurance system if they were willing to employ an alternative means of insuring their deposits.[15] South Dakota also passed a voluntary deposit insurance law in 1909. That law, however, did not give rise to an insurance system because the creation of the system depended on obtaining a

[14] The dates are: Oklahoma in 1908, Texas and Kansas in 1909, Nebraska in 1909 (modified to take effect in 1911), South Dakota in 1909 (modified to take effect in 1916), Mississippi in 1914, North Dakota in 1916, and Washington in 1917. Many of the states sought to include national banks in their system, but the Supreme Court ruled against the laws and national banks were not allowed to join.

[15] However very few banks took advantage of this opportunity. At most, 9 percent of banks opted to purchase an insurance bond. (Hooks and Robinson 2002).

required number of members before it could begin operation. The choice of voluntary deposit insurance seems to have been a political concession to large banks rather than a practical concern. When given a choice, many large banks chose not to join the system. For instance, at least 35 percent of banks chose to remain outside the Kansas' system (Wheelock and Kumbhakar 1995), and more than 60 percent of banks remained outside the Washington's system (*Annual Report of the Bank Commission of the State of Washington* 1918-1920).

The laws were geographically and temporally concentrated. Figure 1 shows the geographical pattern of insured states and the comparison group of non-insured neighboring states (whose characteristics are described in Table 1) that we will focus on in some of our analysis. Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota form a column down the middle of the country, and first five of these to pass a law enacted it in either 1908 or 1909. However both Nebraska's and South Dakota's laws sat dormant until additional legislation was passed which overcame the obstacles limiting the creation of their insurance systems.[16] The two geographic outliers (Mississippi and Washington) both seemingly installed their systems as a hasty reaction to bank failures in their state (Robb 1921).

As we highlight in Table 1, the geographic pattern of deposit insurance matched a particular set of circumstances. Small and undiversified banks in rural areas were the main supporters of deposit insurance as they had the most to gain from protection against credit risk and liquidity risk. Large state banks and national banks in urban areas fought the legislation as they did not want to be responsible for risky agricultural loans. Insurance laws were passed in states where small state banks held substantial power in the legislature. As described by White (1981, p. 539) deposit insurance states had "firmly established unit banking within their

[16] In Nebraska, the operation of the system awaited the results of a Supreme Court decision. In South Dakota, the original legislation set conditions for the launching of insurance which were not realized.

boundaries and were all in relatively undiversified regions where business propensity in general depended on one or two commodities."[17] Rural and agricultural states in the Midwest and South Central were prime candidates for deposit insurance. Indeed, in addition to the eight states that passed insurance laws, several others in these regions (e.g., Colorado, Minnesota, and Missouri) nearly passed deposit insurance legislation during the period. [18] (Cooke 1910; White 1981)

The insurance funds in all eight states that enacted deposit insurance became insolvent in the 1920s and all of them but Texas failed to repay depositors fully (Warburton 1959). The sharp commodity price declines of the early 1920s were largely to blame. While the insurance funds had experienced some failures before, they were few enough to be covered by imposing extra assessments. However, the dramatic drop in crop prices in 1920 and 1921 caused many borrowers to default on their loans, and as a result, banks began to fail at a high rate.[19] The insurance funds were able to string out payments for a time, but it became apparent that they did not have enough funds to cover losses. Moreover, member banks were reluctant make additional payments and many adopted national bank charters in order to avoid assessments (Warburton 1959). Each of the insurance funds suspended payments at some point during the 1920s. In almost every case, insurance legislation was fully repealed later in that decade.

4.1. Stealing Deposits: Aggregate Data

Small and rural banks pushed for deposit insurance as a means to avoid bank runs and panics; however, they likely also hoped that insurance would bring in new deposits. Consistent

[17] Deposit insurance was only created in one state (i.e., Washington) that previously allowed even limited branching and where small state banks did not hold an overwhelming majority.
[18] Some of the geographic similarity among insured state banking systems might also have reflected regulatory competition. For example, Robb (1921, 107-112) describes that Kansas banks along the Oklahoma border pushed hard for the passage of deposit insurance in order to avoid competition with Oklahoma's insured banks.
[19] Calomiris and White (1994) show that the 1920s represented the first major decline in the relative number of small banks in the country, and the beginning of a steady increase in the average size of banks. Alston et al. (1994) also find that most suspensions during the 1920s were from small banks in rural areas.

with the model explaining how insurance favored the ability of risky banks to compete for deposits in Section 3, state banks aggressively sought to take advantage of the new legislation to attract business. Many banks advertised deposit insurance in their windows and some even changed their names to add the word "Guaranty" to their name.

Before deposit insurance passed, uninsured national banks and state banks competed for deposits based on the stand-alone qualities of each bank, which determined the risks borne by each bank's depositors. How did the passage of deposit insurance affect the aggregate amount of deposits in the state and national banking system of the affected states? If growth in deposits occurred within the state-chartered system, then did that reflect the creation of new deposits or the transfer of deposits from uninsured banks? Were additions to insured banks' deposits simply transfers from national banks rather than new deposits pulled out from under mattresses? The answer to these questions have important ramifications for the degree of deposit loss caused by the passage of deposit insurance as deposits in uninsured banks did not experience the same problems in the 1920s.

To examine the aggregate effect of the legislation, Figure 2 illustrates the number of banks and aggregate deposits separately for three state groups: early adopters, late adopters, and non-adopters of deposit insurance.[20] The figures show that deposit insurance states experienced similar growth trends in deposits and banks as non-deposit insurance states surrounding the installation date. Indeed, the data suggest that deposit insurance was not a immediate boon to a state's banking system, as there is no sudden growth around 1909. The only differential growth between deposit insurance and non-deposit insurance states occurs after 1914. This sudden growth likely reflected the large increase in crop prices during World War I. Deposit insurance

[20] For purposes of the aggregate analysis, we lump together states where insurance was compulsory and those where it was voluntary. We will show in that the effects are similar in our microeconomic analysis below.

states were amongst the largest agricultural states and deposit insurance might have provided bankers with the opportunity to compete for deposits (as discussed in theory in Section 3). It also offered farmers with sufficient confidence in the persistence of the commodity price increase an incentive to borrow against the land values and revenues associated with those high prices to expand their operations (Alston, Grove, and Wheelock 1994; Rajan and Ramcharan 2014). These aggregates show that the commodity price rise of World War I seems to have contributed to the expansion of the insured banking systems more so than other agricultural states.

To illustrate the dramatic rise and fall in agricultural prices during the early 20th century, we construct a price index and output index for twelve staple crops for 1904 through 1925. Figure 3 shows that prices more than tripled from 1904 to 1919, under the influence of World War I's contraction in global supply, and then fell after 1919. As Table 2 shows, farm real estate values rose substantially in agricultural states and then declined sharply. The decline was particularly steep for western states. Interestingly, the decline in farm land values for deposit insurance states was comparable or even slightly lower than for non-deposit insurance states, suggesting that non-deposit insurance neighboring states on average suffered greater exogenous shocks than deposit insurance states.

To examine *Hypothesis 1*, Figure 4 displays the ratio of state to national banks and deposits (normalized to 1900's value). There are clear jumps in state banking relative to national banking surrounding the passage of deposit insurance. The number of state banks relative to national banks jumps for the early adopters in 1909 but not for late adopters. Alternatively, state bank deposits jump relative to national bank deposits in 1909 for early adopters and in 1916 for late adopters, yet the ratio actually declines for other states during those exact periods. The jumps thus correspond to the dates of deposit insurance's passage, and do not seem to be part of a

broader trend. The ratios also clearly illustrate that the boom in agricultural areas during WWI led to expansion of state banks in all states, but more so in deposit insurance states.

The aggregate data allow us to examine whether the simple passage of a law led to the expansion of state bank deposits or whether it was the actual use of the law that mattered. Nebraska and South Dakota passed deposit insurance laws in 1909 that fell dead on the books. It was not until additional laws were passed in Nebraska in 1911 and in 1915 in South Dakota that deposit insurance became a reality in those states. Figure 5 shows that there was only a slight growth in state bank deposits relative to national bank deposits after the passage of the inactive laws, but the pattern of non-DI states in Figure 4.There is not a large jump in state bank deposits relative to national bank deposits until after their deposit insurance funds were made active in each state. We conclude that the anticipation of insurance was not enough to spur depositors to move their deposits.

The passage of deposit insurance does not seem to have had a large aggregate effect on the total amount of deposits in the banking system, but instead shifted deposits from national banks to insured state banks. Of course, it is likely that some of the growth in state banking occurred for reasons other than deposit insurance. Because of regulations that limited national banks' ability to engage in real estate lending, the commodity price increases and agricultural land boom of the World War I era likely would have caused relative growth in the state banks of the insured states even in the absence of the passage of deposit insurance. The rest of the paper introduces a rich microeconomic database and empirical analysis to control for other factors and determine the extent to which deposit insurance was responsible for the growth of insured banks and the lending risks they undertook. Most importantly, we are able to investigate the extent to

which increased state bank risk taking and growth coincided with one another, and whether they were a consequence of deposit insurance.

5. Data

We construct two databases to investigate deposit competition and risk attributes of banks before and after enacting deposit insurance. For each database, we restrict the sample to those six western states that adopted deposit insurance states before 1914 and the states adjacent to them. We do not include Mississippi and Washington because these insured states are geographic outliers and hence do not fit well with our comparison group of western states. The sample thus focuses our empirical analysis on a large region in the middle of the country. Because deposit insurance was primarily a feature of agricultural states without branching, the sample provides a comparison of insured and uninsured banks with otherwise similar business concerns and regulations. Moreover, both the insured and uninsured states experienced similar exogenous shocks to agricultural commodity prices.

The first is an annual state-level database that covers all banks and states from 1900 through 1920. The data come from *All Bank Statistics* and were digitized by Flood (1998). The data reported in *All Bank Statistics* provides a separate breakdown of the aggregate balance sheet of all state banks and all national banks in each state. Thus, for each variable of interest, in each year, there are two observations per state, one for state banks and one for national banks. We use this database to differentiate between aggregate effects on state banks and national banks while controlling for differences across states and over time.

The second is a biannual bank-level database from 1900 through 1920. National bank data were published annually by the Comptroller of the Currency, and state bank data were

published separately by each state. While the national bank data are complete for each year and were digitized by Jaremski (2013), many states did not publish data until after 1907 and most only published information every other year.[21] We digitized the data of all states in the sample region that started publishing reports before 1908. As shown in Table 3, missing states are usually in the west (e.g., Arizona and Utah) where banking was still in its infancy. When single year gaps in the data for a particular state exist, we interpolate those values using a linear trend of surrounding data. Out of 66,944 observations used in our sample, 5,533 are interpolated. Because most of the gaps all exist after the passage of deposit insurance, the interpolating strategy (which introduces some noise into the post-insurance data), if anything, should reduce the chance of finding significant differences between insured and uninsured banks.[22] The resulting biannual database contains 66,944 observations and spans 9,067 state banks and 1,922 national banks.

We augment the bank balance sheet data in several ways. We also employ county-level Census data assembled by Haines (2004), which contain information each for decade. We assume that the census variables grow linearly over time, which permits us to construct annual estimates from the decennial observation.[23] We also add other information, such as whether a county had a clearinghouse in operation from Jaremski (2015).

6. Empirical Evidence

As our aggregate analysis in Section 5 shows, deposit insurance was not associated with a sudden jump in aggregate deposits; however, lending weight to *Hypothesis 1*, it seems to have

[21] See Mitchener and Jaremski (2015) for a detailed discussion of balance sheet reporting by states.
[22] The gaps that exist before 1908 are almost all for Iowa because the state reported balance sheet data on odd years instead of even before 1906. The data are thus available every two years, but we have to adjust to obtain information that matched the timing of other states.
[23] Counties are aggregated to their 1900 county boundaries to provide consistent measures across time.

dramatically increased deposits at state banks relative to national banks. This section models the growth of deposits (and banks) using a variety of demographic and economic variables as well as time and location fixed effects. The models are able to identify whether there was an aggregate effect from deposit insurance on deposit growth and risk taking, beyond that predicted by economic growth. Our analysis particularly focuses on how insured state banks were able to gain by competing for deposits flowing out of national banks and uninsured state banks.

We proceed in two steps. First, we begin by examining the state-level data. Each observation is a state-banktype-year (where banktype equals either state banks or national banks) and the data cover all the selected states from 1900 through 1920. Second, we examine the biannual bank-level data. Each observation is defined at a bank-year f and the data cover all states that published data prior to 1908 and continued through 1920. The individual bank data allow us to study specific bank characteristics and control for differential growth at a local level. The primary advantage of the aggregate data is that it is more complete, as it includes all states. The aggregate data analysis also considers how deposit insurance affects entry, as captured by the changing number of banks. We cut off the sample in 1920 because banks begin to flee the insured state system either by closing or switching from state to national charters during the early 1920s, which would distort our analysis.

6.1. State-Level Model of Deposit Competition

We model the growth of banks and deposits for banktype *i* in state *s* during year *t* using a linear model. The model is:

$$Y_{i,s,t} = a + \beta_1 DI_{s,t} + \beta_2 DI_{s,t} * StateBank_i + \beta_3 Post_t * StateBank_t + \beta_4 X_{s,t} + t_t + u_{i,s} + e_{i,s,t} \quad (1)$$

where $Y_{i,s,t}$ is either the logarithm of the number of banks or value of deposits for the particular bank-type,[24] $DI_{s,t}$ is a dummy variable that takes a value of 1 if deposit insurance was active in the state during the year[25], $StateBank_i$ is a dummy variable that takes a value of 1 if the observation was from state banks, $Post_t$ is a dummy variable that takes a value of 1 if the observation was after 1908, $X_{s,t}$ is a vector of census variables including the logarithm of population, the logarithms of crop and manufacturing output per person, and the fraction urban, t_t is a vector of year fixed effects, $u_{i,s}$ is a vector of state-banktype fixed effects, and $e_{i,s,t}$ is the robust error term. We include as controls some variables that one could argue are endogenous to the passage of insurance. For example, if insurance increased bank lending on risky real estate, it may have affected crop output. Including these extra controls should thus produce a more conservative result, because controlling for such variables reduces the estimated impact of deposit insurance.

The full model is essentially a difference-in-difference-in-difference model with national banks in deposit insurance states (who were not subject to deposit insurance) and state and national banks in non-deposit insurance states as the control groups. The state-bank type fixed effects control for possibility that deposit insurance states were always different. The deposit insurance dummy variable accounts for the effect of the introduction of deposit insurance relative to non-deposit insurance states. The interaction between the state bank dummy and the post 1908 dummy accounts for the potential that state banks across all states grew differently from national banks after deposit insurance was installed. Finally, the interaction between the

[24] It is important to control for bank type because state banks, whether insured or uninsured, were less constrained in their ability to lend against real estate, and in other ways, relative to national banks.

[25] The state-level data do not distinguish state banks in Kansas who did not join the system. We thus combine voluntary and involuntary deposit insurance systems together for now. However, we show in Appendix Table A.1 that the state-level results are similar when separating the types of systems. Furthermore, in Section 6.2.1., we show that the bank-level results are also similar when properly labeling non-insured state banks in Kansas.

deposit insurance dummy and the state bank dummy accounts for the extra effect of deposit insurance on state banks. When the interaction is excluded, β_1 is the average effect on both bank types; however, when the interactions are included, β_3 is the effect of deposit insurance on state banks controlling for differential national bank growth in deposit insurance states (β_1) and differential state bank growth relative to national banks in non-deposit insurance states (β_2). Note that the estimated growth of national banks in deposits insurance states is just β_1 whereas the estimate growth of state banks in deposit insurance states is $\beta_1 + \beta_2 + \beta_3$, but we can only attribute the β_3 to a causal effect of deposit insurance.

We estimate equation (1) in Table 4 for the entire sample period as well as for a reduced period. The reduced sample period is helpful to separate the immediate effect of deposit insurance from its long-run effect. As previously discussed, deposit insurance may have encouraged farmers to take advantage of the large increase in prices during WWI. As such, we might expect deposit insurance states to have higher levels of deposits during this period even if the immediate effect is small or negative.

The pattern of coefficients suggests that the aggregate number of banks and deposits was unchanged by the introduction of deposit insurance. The coefficient on either time period is not statistically different from zero. However, deposit insurance increased the value of deposits for state banks relative to national banks. The interaction between $DI_{s,t}$ and the state bank dummy is positive, large and statistically significant across both time periods. The coefficient on $DI_{s,t}$ is negative but statistically insignificant, suggesting that some national banks might have lost deposits due to deposit insurance, but not all.

It is useful to translate the coefficients into examples. According to the model of individual deposits for the full period, a national bank in a non-deposit insurance state would be

expected to have -2.2 percentage points fewer deposits, a state bank in a non-deposit insurance state would be expected to have 15.6 percentage point more deposits, and a state bank in a deposit insurance state would be expected to have 37.8 percentage points (i.e., -0.022 + 0.156 + 0.238) more deposits after the installation of deposit insurance. We consider the effect of deposit insurance to be 23.8 percentage points because other factors might be producing the national bank and uninsured state bank effects. The results thus support *Hypothesis 1* but fall short of proving that all of the deposit increase in insured banks came from uninsured national banks in their same state.

The results indicate that deposits grew in state banks relative to national banks upon the introduction of deposit insurance. To further confirm these results, we examine whether deposit insurance states and state banks in those states were on different trajectories prior to the legislation. Essentially, the model assumes that states that installed deposit insurance were on the same trend as other states and in the absence of the legislation they would have continued to be similar. The parallel trends assumption is important to test at the state-level as it is the level of aggregation where the decision was made. We therefore model deposits from 1900 through 1908 and test whether deposit insurance states and their state banks were on different trends. The model is:

$$D_{i,s,t} = a + \beta_1 Trend_t + \beta_2 DIEver_s * Trend_t + \beta_3 DIEver_s * StateBank_i + \beta_4 DIEver_s * StateBank_i * Trend_t + \beta_5 X_{s,t} + t_t + u_{i.s} + e_{i,s,t} \quad (2)$$

where $D_{i,s,t}$ is the logarithm of deposits, $Trend_t$ is a linear trend, $DIEver_s$ is a dummy variable that takes a value of 1 if the state ever installed deposit insurance, and the rest of the variables retain their definitions. In this case, we estimate the model with and without state-banktype fixed

effects. In the models without these fixed effects, we include $DIEver_s$ as a separate variable to account for any constant differences between deposit insurance states and other states.

The model sets up a test of whether deposit insurance states had different trends before 1908 (i.e., $\beta_2 \neq 0$) and whether state banks in deposit insurance states had different trends than national banks in deposit insurance states before 1908 (i.e., $\beta_4 \neq 0$). The results, reported in Table 5, show no evidence of a differential trend amongst states. None of the interactions are statistically significant. In fact, the standard errors for the state bank interaction are quite large.

Although state-level analysis provides insight into the overall effect of the introduction of deposit insurance, there are advantages to analyzing individual bank-level data from the standpoint of identification. Not only is the sample size larger, but we are able to control for fixed characteristics of individual banks, and therefore, estimate within-bank effects from introducing deposit insurance. We also can control for the state banks that opted out of Kansas' insurance system. We emphasize that our state-level analysis is superior from the standpoint of tracking systemic consequences because our fixed effects approach only utilizes variation in behavior within banks that exist prior to and after the introduction of deposit insurance in each state. For that reason, it does not capture aggregate effects associated with entry.

6.2. *Bank-Level Model of Deposits*

Before formally analyzing the competition for deposits that occurs between state banks and national banks, it is helpful to illustrate the wide geographic diversity in county-level growth that is missed by the aggregate analysis. Figure 7 shows that state bank deposits at the county level displayed unusually high growth rates relative to national banks in all states, but the growth was particularly large in states that adopted deposit insurance. To be more specific, state bank

deposits seemed to grow much more in the western counties of deposit insurance states and national bank growth seems effectively random across states. The varying geographic patterns of deposit growth show that it is important to consider disaggregated differences in the economic environment and control for county-level factors that could be producing these patterns.

We model the determinants of deposit growth at the bank-level in much the same way as at the state-level. Because of the level of disaggregation, we are able to better account for local economic growth that would influence deposit growth at particular banks. Specifically, we match each bank with its county's demographic and economic characteristics instead of state aggregates. We also are able to install additional control variables for local bank competition using the number of banks and for local financial development using a dummy denoting whether the county had a clearinghouse association in operation. Moreover, we are able to separate the state banks in Kansas that opted out of the voluntary system. Now with *i* denoting bank and *s* denoting county and *t* denoting biannual observations, the model is:

$$Y_{i,s,t} = a + \beta_1 DI_{s,t} + \beta_2 DI_{s,t} * Member_i + \beta_3 Post_t * StateBank_t + \beta_4 X_{s,t} + t_t + u_{i,s} + e_{i,s,t} \quad (3)$$

Where $Member_i$ is a dummy that takes a value of 1 for state banks that were members of the deposit insurance system[26], $X_{s,t}$ now includes the extra county-level variables mentioned above, $u_{i.s}$ is a vector of bank fixed effects, $e_{i,s,t}$ is clustered at the county-level, and all other variables retain their definitions.

[26] Note that this dummy is only different from the state bank dummy for Kansas. We obtain a list of state bank members from the Kansas State Report in 1920 because they did not publish a list in any year prior. We assume that everyone on the list in 1920 were members of the insurance fund for all years, and any other banks were non-members. The assumption is probably not too far off. It was difficult to leave the system and most banks did not push to leave until the after the banking problems that occurred in early 1920s. Appendix Table A.2 shows that insured banks in Kansas experienced significant higher deposit growth even when compared to uninsured state banks in the same state.

As before, we separate the short and long-run effect of deposit insurance in Table 6. The bank-level results are similar but much stronger than the state-level results, particularly for national banks. First and foremost, deposit insurance seems to have decreased deposits at the average bank in the short run and it was not until after WWI that they are associated with a positive effect. Specifically, the average bank in a deposit insurance state was predicted to have lost 6.7 percent of deposits by 1914, yet have gained 6 percent by 1920. The dramatic coefficient swing is not the result of South Dakota's law, as the results are similar when throwing the state out of the sample. Instead, it seems to have been the result of the rise in prices during WWI.

Separating the results for national and state banks, deposit insurance had a negative effect on national banks across both sample periods. The coefficient is always negative, significant, and usually quite large. Deposit insurance reduced the average national bank's deposits by 19.3 percent in the short-run and 13.5 percent in the long-run. On the other hand, the effect on state banks is always positive. Deposit insurance is estimated to have increased the deposits of insured banks between 16.3 percent and 23.4 percent. As before it is useful to think of the total change in deposits for each group. By 1920, the model predicts national banks in deposit insurance states to have 9.7 percentage points fewer deposits, uninsured state banks in non-deposit insurance states to gain 10.7 percentage points more deposits, and insured state banks to gain 24.4 percent (i.e., -0.097+0.109+0.234). Thus when controlling for local as well as regional economic growth, we confirm *Hypothesis 1*: insured banks seemingly attract deposits away from national banks.

While similar, there are some differences between Table 4 and Table 6. Both predict that insured banks would gain deposits and the coefficients for the full period are even quite close. Alternatively, the national bank coefficients are substantially lower for the state-level results. This difference is primarily driven by the entry and exit of banks, as new banks that entered or

existing state banks that converted to a national charter would not be picked up by the bank-level regression.[27] The national bank aggregates benefited from a few large state banks choosing to become national banks rather than become subjected to deposit insurance as well as new national banks likely not losing many of their deposits.

The rest of the columns of Table 6 examine how deposit insurance affected banks with different characteristics. Because deposit insurance legislation was pushed by small banks, we interact $DI_{s,t}$ with a dummy denoting whether the bank was in the lower quantile of capital for all banks.[28] We also interact $DI_{s,t}$ with a dummy denoting whether the bank appeared in the sample after 1904 to capture whether the effect help new banks without much reputation more than other banks. The results show that small and young state banks benefited the most from the legislation, particularly by 1920. A small insured state bank gained an additional 8.6 to 16.4 percent more deposits than a large insured state bank, whereas a young insured state bank gained an additional 4.3 and 11.5 percent more deposits than an old insured state bank. The results also indicate that young national banks had fewer deposit stripped from them. An old national bank was expected to lose between 22.9 in the short-run and 16 percent in the long-run yet a young national bank was actually expected to gain 1.8 (i.e., -0.229+0.247) and 8.1 (i.e., -0.16+0.241) percent respectively. As old national banks tended to be large and highly regarded for security, it seems like depositors who were concerned about safety were the ones who moved their funds after the advent of deposit insurance. Again this helps explain the differences between the state-level and bank-level analysis.

[27] The differential results could also be the result of more accurate controls on economic activity and population as national banks tended to concentrate in large cities with manufacturing.
[28] This cutoff is $16,000. Since national banks were required to have at least $25,000 in capital, the definition excludes all national banks.

6.2.1 Additional Bank-Level Specifications of Deposits

The previous specifications have indicated that deposit insurance shifted deposits from national banks to state banks rather than encouraging new deposits to enter the system. To provide supporting evidence for the results, we provide two additional specifications.

The conclusions drawn from the full sample are dependent upon there being a close connection between the sample of states and between national and state banks within each state. The choice of states immediately surrounding the deposit insurance states was intended to provide a comparison of similar economic and environmental factors. However, the eastern portions of states like Missouri and Iowa might have been different from the western portions of Nebraska and Kansas. To provide a narrower geographic comparison, Table 7 compares only banks in counties along the border between a deposit insurance state and a non-deposit insurance state.[29] The counties included in this analysis are shown in Figure 8. The results are similar to those in Table 6, and only a few differences stand out. First, the effect of deposit insurance is positive even in the short-run for all banks and is less negative on national banks when broken out. These changes are likely caused by border banks being able to attract deposits from national banks in their county as well as from nearby state and national banks in the nearby state. Indeed, the positive growth for all state banks after 1908 is eliminated for the full period. The significant effect of deposit insurance on younger banks also becomes insignificant for the full sample.

Next, we examine whether combining voluntary and involuntary deposit insurance biases our results. We test whether the estimated effect on state banks choosing to adopt deposit

[29] For the full sample of years, we do not consider banks along the border of South Dakota and Nebraska because both would have active deposit insurance laws after 1915. For the reduced sample of years, we include these banks but exclude the border between South Dakota and other non-deposit insurance states because there would be no differential between the two until 1915.

insurance is different from state banks that were forced to adopt it.[30] Likewise the analysis allows us to see whether the two structures affected national banks differently. We thus divide $DI_{s,t}$ into two separate deposit insurance dummies: one denotes states with voluntary insurance and another that denotes states with involuntary insurance. In Table 8, we see that the general results hold, although there are slight coefficient differences. Regardless of the deposit insurance type, the coefficient on the interaction between deposit insurance and being a member is positive and significant. The negative effect on the average bank also persists. The only large difference between the two systems is that young insured banks in the voluntary system did not experience significantly larger deposit gains.

6.3. Deposit Composition and Risk Taking

While the bank-level results strongly support *Hypothesis 1*'s claim that insured banks would compete away the depositors of other systems, we still need to examine whether they did so by taking on more risk. We therefore examine how banks' portfolio changed once they became covered by insurance. Building off the theoretical framework, we examine bank risk using three ratios. Due from Banks plus Cash to Assets measures the amount of liquid and risk free assets. Loans to Assets measures the degree of risky and illiquid investments. Capital to Assets measures the degree of bank leverage and the size of the buffer banks kept to make up for losses. Similar to equation (3), the model is:

$$Y_{i,s,t} = a + \beta_1 DI_{s,t} + \beta_2 DI_{s,t} * Member_i + \beta_3 Post_t * StateBank_t + \beta_4 X_{s,t} + t_t + u_{i,s} + e_{i,s,t} \quad (4)$$

[30] Appendix Table A.3 provides the same analysis but only for the boundary counties.

where $Y_{i,s,t}$ is one of the three balance sheet ratios described above, and the rest of the variables take their previous definitions.

The results in Table 9 lend further support for *Hypothesis 1*. The installation of deposit insurance seems to have encouraged insured banks to change their composition and take more risk. As the ones protected by deposit insurance from bank runs, state banks reduced the amount of reserves they were holding, increased their proportion of loans, and increased their leverage (i.e., lowered the capital to asset ratio) over the full period. If anything, the short-run results for loans and reserves are even larger. Alternatively, uninsured banks decreased their loans and increased the ratio of capital to assets.

Coupled with the previous results, these results show that insured banks took more risk and attracted more deposits, whereas uninsured banks reduced their risk exposure. Given the subsequent agricultural price collapse, the system would have been significantly better off had deposits stayed at uninsured banks. The installation of deposit insurance not only exposed more depositors to risk but also helped lead the investment bubble that developed in the late 1910s.

6.4 Does Deposit Insurance Remove Market Discipline?

So far, we have examined the behavior of depositors, and have shown that on net they moved their deposits from uninsured to insured institutions. We have also found that this movement was associated with an increase in insured banks' risk. Presumably, insured banks seeking new growth opportunities paid high interest rates to attract those deposits. Hypothesis 2 leads us to expect that the installation of deposit insurance created two classes of banks: disciplined (uninsured) and undisciplined (insured). Insured banks that took more risk and provided more interest were not disciplined by depositors. Depositors rewarded higher interest

but did not punish higher risk. Uninsured banks lost deposits to insured banks because their low risk level prevented them from competing for high-interest deposits. Uninsured banks competed with one another for deposits based on their ability to demonstrate to the market that their risk was sufficiently low (based on a function of observable fundamentals, including leverage, their loans-to-assets ratio and observable loan risk).

We test this hypothesis by examining the response of depositors to the specific balance sheet characteristics of insured and uninsured banks. Following our theoretical framework, we model the change in deposits as reacting to the previous value of the bank's loan to asset ratio, capital to asset ratio, and owned real estate to assets ratio.[31] We expect that deposits of uninsured banks will respond positively to the capital ratio and negatively to the other two ratios. Once deposit insurance is operating, we expect that the coefficients of each of these three variables will be reduced in absolute value, but that this reduction will occur only for insured banks.

The regressions model is a reduced form forecasting model of deposit outflows. Depositors control the change in deposits and bankers target the ratios, which respond with a lag to the lending decisions of the banks, which results in cross-sectional differences in three key variables.[32] Because uninsured state banks were historically more likely to fail than national banks, we exclude them from the analysis to avoid having to take into account two different target levels of risk for uninsured state and national banks. We estimate the model for the entire period in two ways: as a single panel and in individual biannual cross-sections. Doing so identifies whether depositor behavior differed across periods. The panel model is:

[31] Used by studies such as Calomiris and Mason (1997, 2003), owned real estate contains foreclosed properties, and thus is a proxy of previous loan failures. The historical reports of the Comptroller and state officials do not include information on income or asset quality, preventing the use of direct measures of risk such as loan losses or non-performing assets

[32] In theory, banks could respond to losses by reducing dividend payout or raising new shares, but studies have shown that banker responses to shocks often take the form of loan reductions (e.g., Calomiris and Wilson 2004).

$$\Delta D_{i,s,t} = a + \beta_1 DI_{s,t} + \beta_2 Y_{i,t-2} + \beta_3 Y_{i,t-2} * DI_{s,t} + \beta_4 X_{s,t} + t_t + u_{i,s} + e_{i,s,t} \quad (5)$$

where $Y_{i,t-2}$ is a vector of the three balance sheet ratios described above in the previous period, and all the other variables retain their definitions. The cross-sectional model is:

$$\Delta D_{i,s} = a + \beta_1 DI_s + \beta_2 Y_{i,t-2} + \beta_3 Y_{i,t-2} * DI_s + \beta_4 X_s + e_{i,s} \quad (6)$$

The first column of Table 10 shows the panel results and the remainder of the columns present the results for individual years.[33] The results confirm *Hypothesis 2*. Depositors seem to have disciplined banks in the absence of deposit insurance; however, once in place, banks' risk characteristics became irrelevant to their ability to attract deposits. This is shown by the fact that the coefficients of the three risk characteristics interacted with the presence of deposit insurance have roughly equal and opposite signs to the coefficient values for insured banks. This indicates a zero effect of any of these risk characteristics for insured deposits. Simply put, the depositors of insured banks ignored the warning signs of increasing failure risk for insured banks.

Interestingly a comparison of the panel and cross-section results shows that the removal of discipline occurs primarily during the WWI period. For instance, the coefficient on the interaction is only positive and significant for loans in 1916, for owned real estate in 1916 through 1920, and for the capital ratio the coefficient is negative for 1914 through 1920. In other words, depositors were ignoring the warning signs of insured banks specifically when they were making risky bets that the price increases of World War I would be permanent.

7. Conclusion

Bank liability insurance was a U.S. invention designed to mitigate the destabilizing consequences of unit banking. Despite its revealed shortcomings of moral hazard during the

[33] Appendix Table A.4 provides the results when we break the results down by voluntary and involuntary deposit insurance systems.

antebellum period, the New York antebellum model of deposit insurance was applied in eight states during the early 20th century. Deposit insurance systems were associated with unusually high rates of expansion during World War I and unusually high bank losses after World War. I.

Our paper is able to identify clearly the role of deposit insurance on depositor and banker behavior because we can compare the behavior of insured and uninsured banks located in the same states as well as banks in neighboring states. We do so first through state-level aggregate comparisons, which track the overall shifts in resources between the two systems within each state, and second, through panel and cross-sectional analyses of individual banks (where we focus on within-bank changes in behavior associated with the passage of deposit insurance).

First, we are able to show that deposit insurance on net increased insured banks' default risk and banking system risk. Once they became insured, state banks increased their asset risk and their leverage. Nevertheless, deposits flowed from low-risk uninsured banks to high-risk insured banks.

Second, we show that deposit insurance did not produce a systemic growth in deposits. Rather, it mainly shifted deposits from uninsured banks to insured ones.

Third, we show that deposit insurance increased risk by removing market discipline that had been constraining erstwhile uninsured banks. Depositors apparently believed that insurance protection was credible and, therefore, were willing to move deposits to banks despite their observably high risk characteristics. Deposit insurance encouraged banks to increase their insolvency risk because doing so did not prevent them from competing aggressively for the deposits of uninsured banks operating nearby. In fact, increasing risk was necessary to fund the higher interest payments that presumably attracted depositors.

Fourth, we are able to rule out endogeneity bias with respect to the passage of deposit insurance. We show that increased systemic risk was a direct consequence of the operation of deposit insurance and its removal of market discipline, not an indirect consequence of the circumstances that led to the passage of deposit insurance. Two states that passed deposit insurance, but delayed its implementation, did not experience risk increases until the insurance system actually began to operate.

The history of deposit insurance in the United States and internationally has been a process of increasing systemic risk in the name of reducing systemic risk. The deeper lesson of that history is that economic models that attempt to explain the attraction of deposit insurance are less relevant than political ones (Demirgüç-Kunt, Kane and Laeven 2008, Calomiris 2010, Calomiris and Haber 2014).

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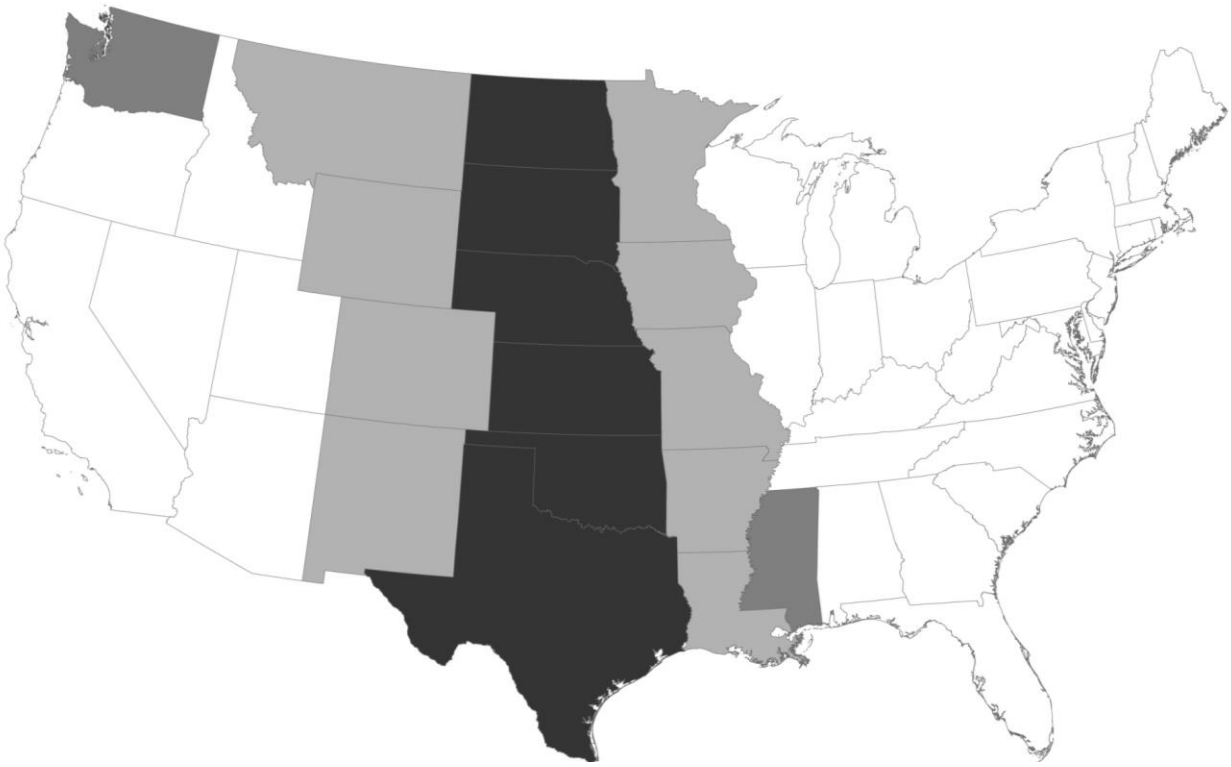
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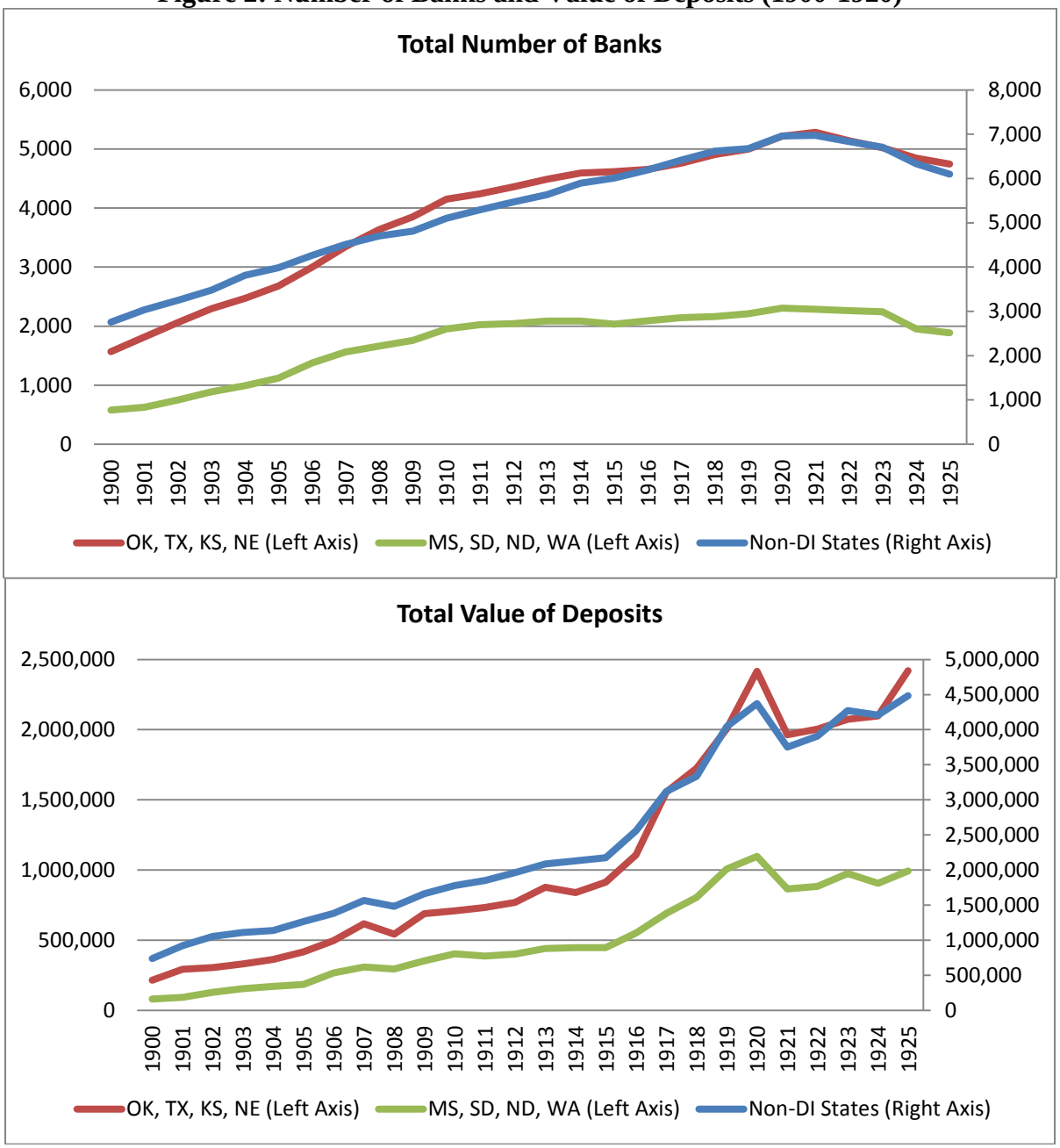
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Figure 1: Map of DI States and Comparison States



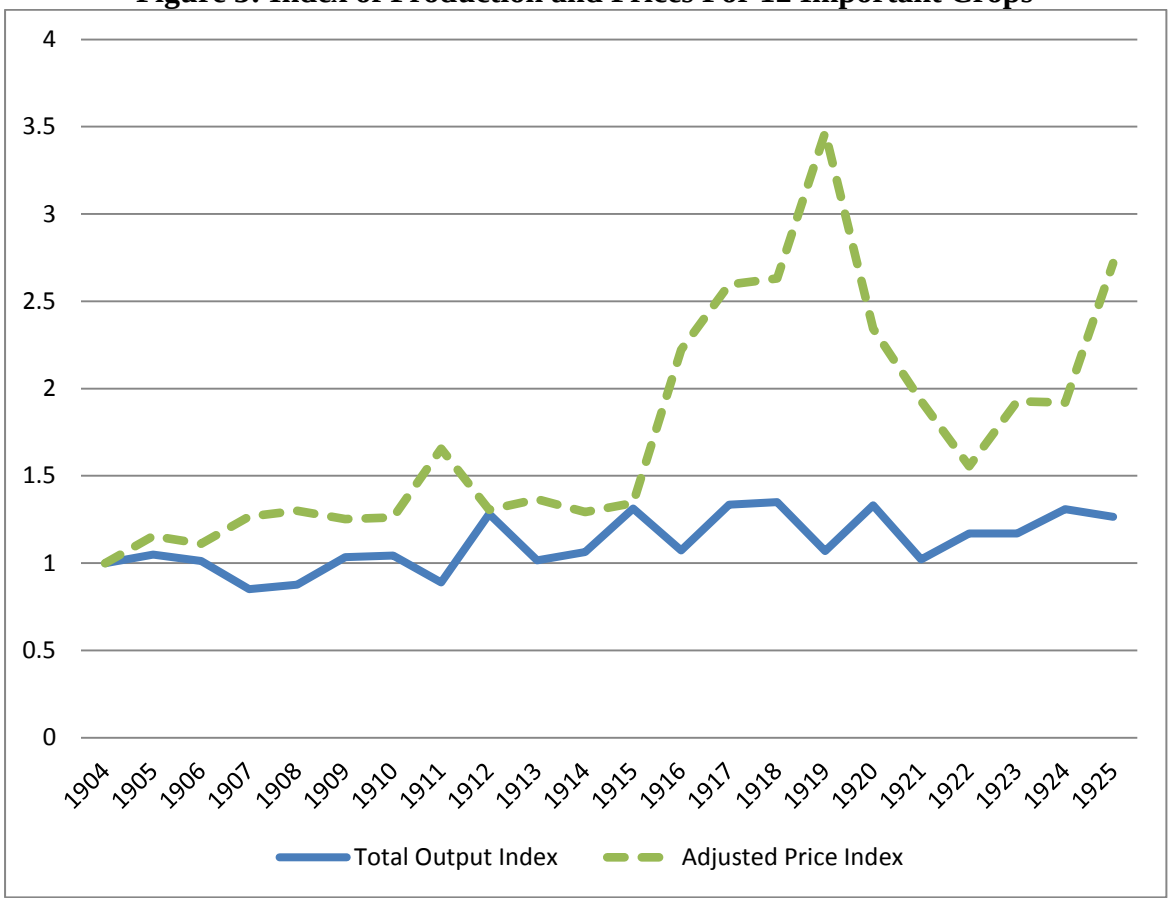
Notes: The figure maps out deposit insurance states included in the analysis in black, deposit insurance states not included in the analysis in grey, and bordering non-deposit insurance states that we use as a comparison group in light gray.

Figure 2: Number of Banks and Value of Deposits (1900-1920)



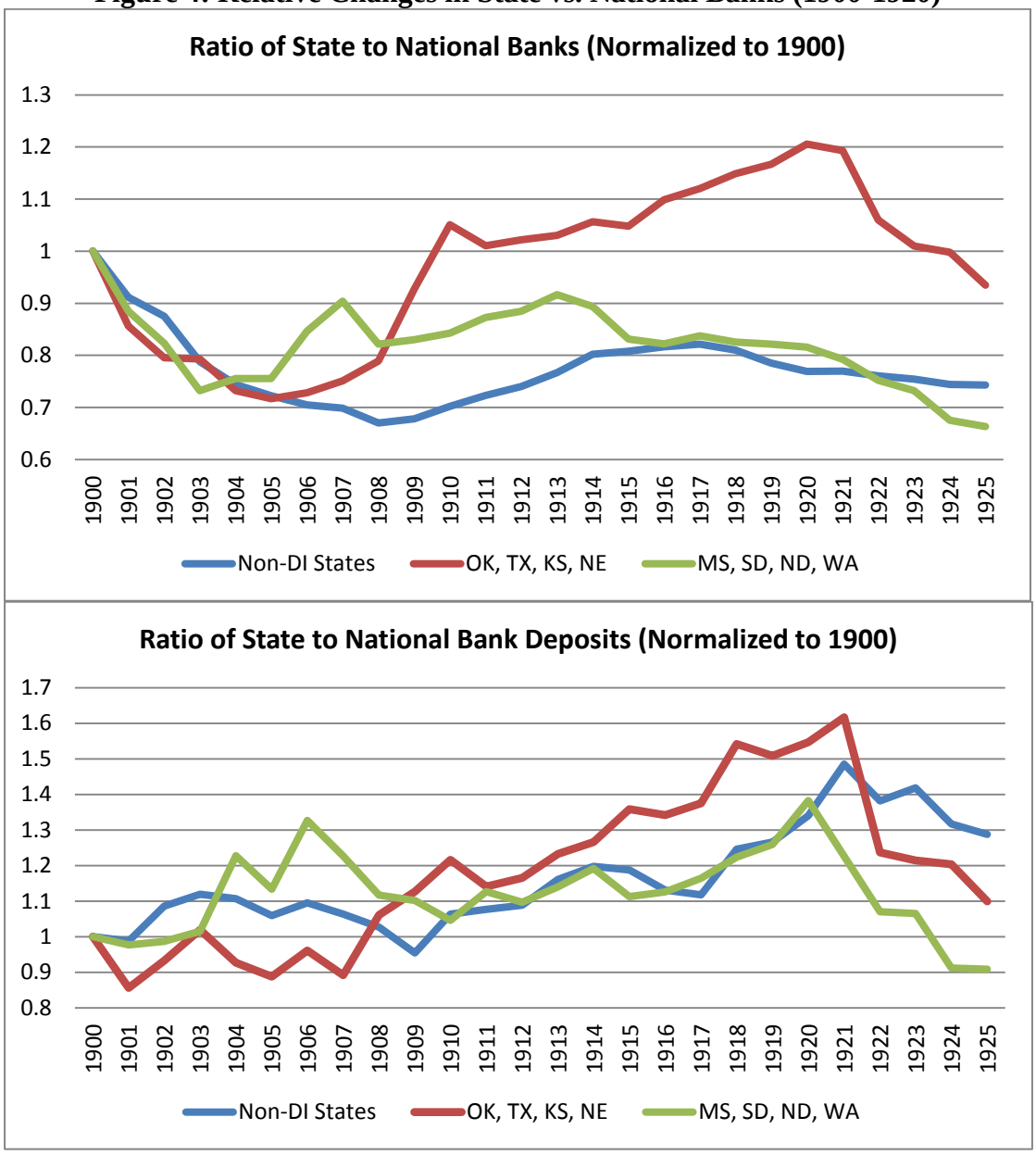
Notes: Figures display the aggregate number of banks or deposits by state group. See data section for sources.

Figure 3: Index of Production and Prices For 12 Important Crops



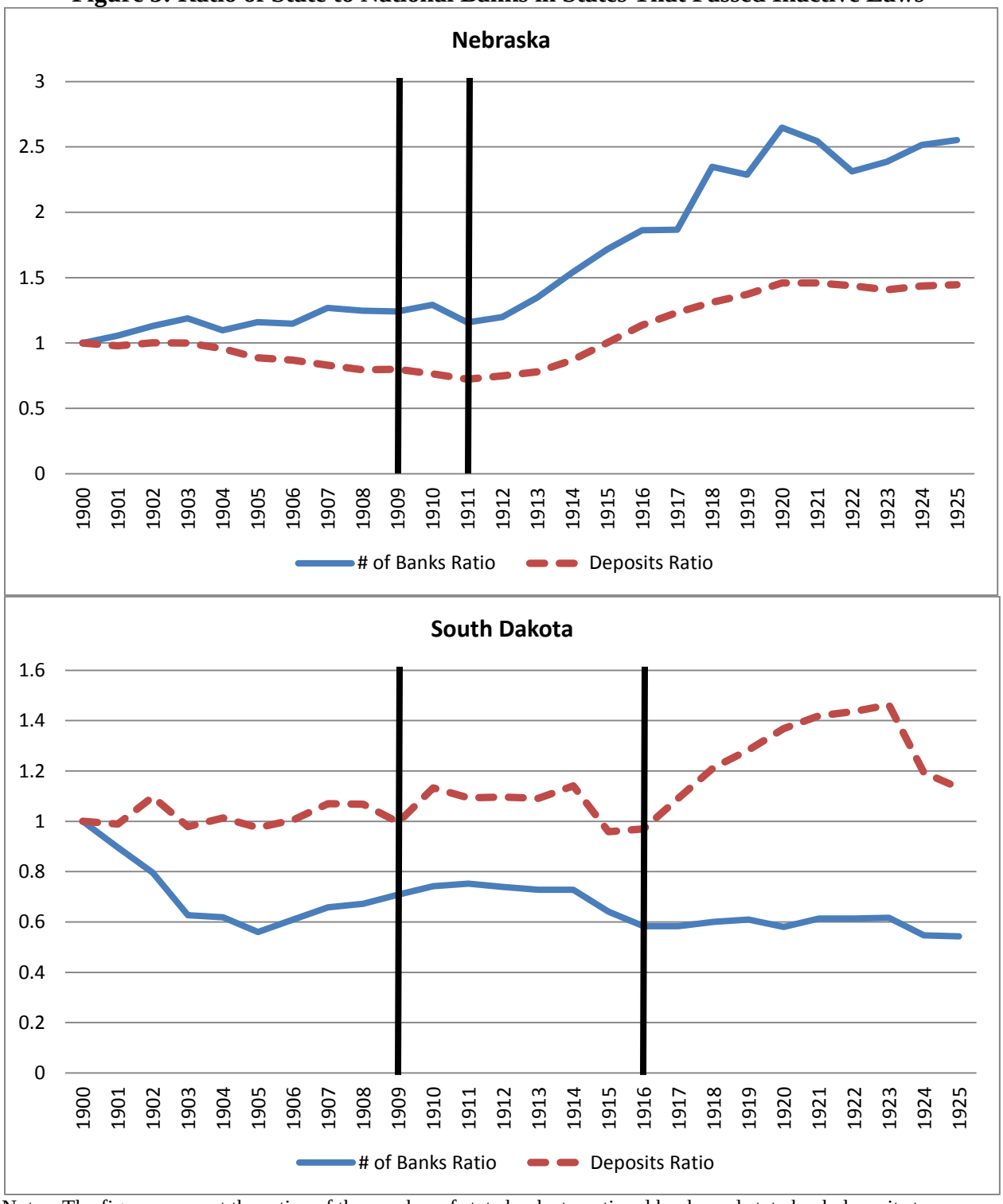
Notes: Table presents output and price indices for 12 crops: corn, barley, flaxseed, rice, oats, wheat, hay, rye, buckwheat, cotton, tobacco, sweet potatoes, and Irish potatoes. Output is based off the physically quantity produced and price is adjusted for unit values.

Figure 4: Relative Changes in State vs. National Banks (1900-1920)



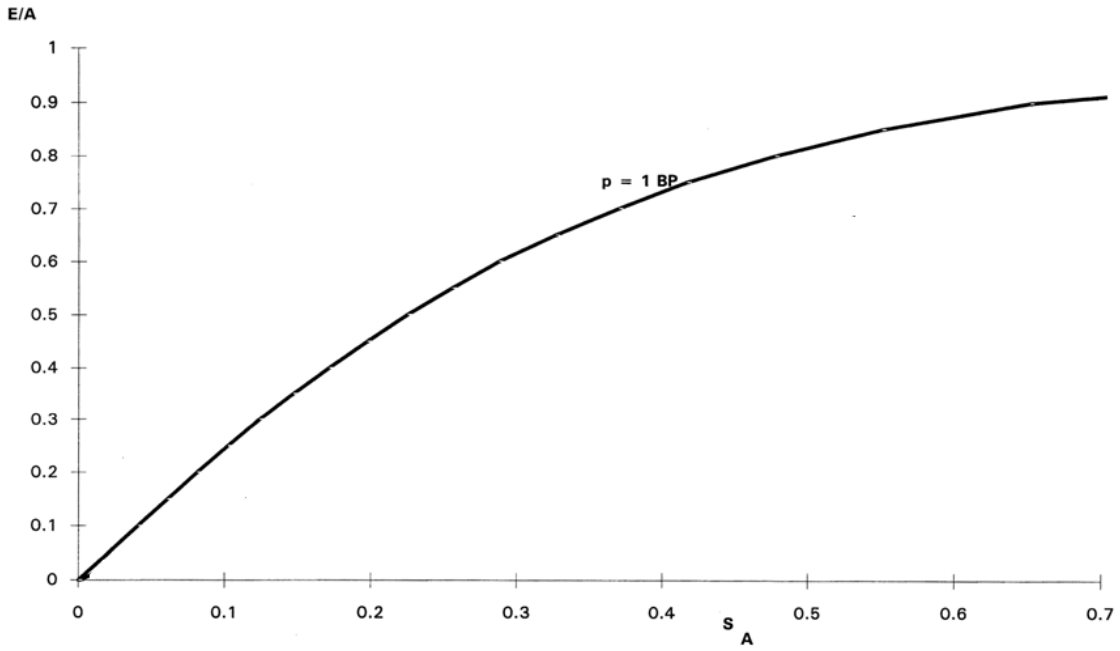
Notes: Figures display the ratio of state bank aggregates to national bank aggregates by state group. The ratios for each group are normalized to 1 in 1900. See Data section for sources.

Figure 5: Ratio of State to National Banks in States That Passed Inactive Laws



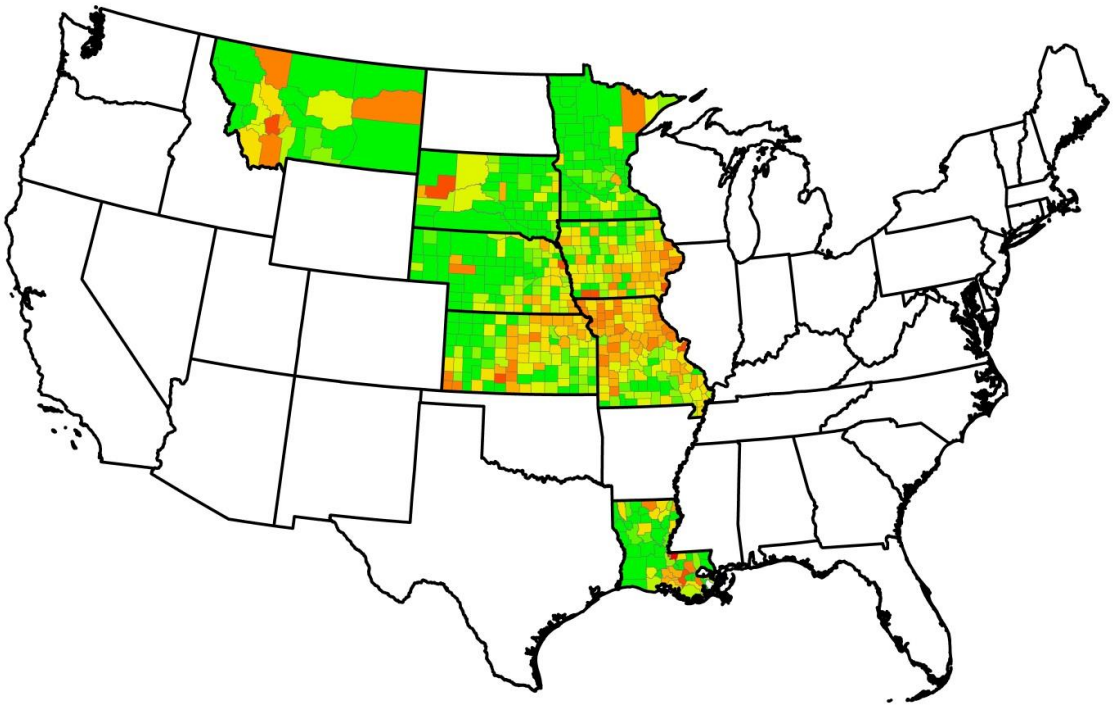
Notes: The figures present the ratios of the number of state banks to national banks and state bank deposits to national bank deposits in each state during each year. The ratios for each group are normalized to 1 in 1900. See Data section for sources. The first line denotes each state's passage of an inactive deposit insurance law and the second line denotes the year deposit insurance was made active by additional legislation. See Data section for sources.

Figure 6: Combination of Asset Risk and Equity-to-Assets in Black Scholes

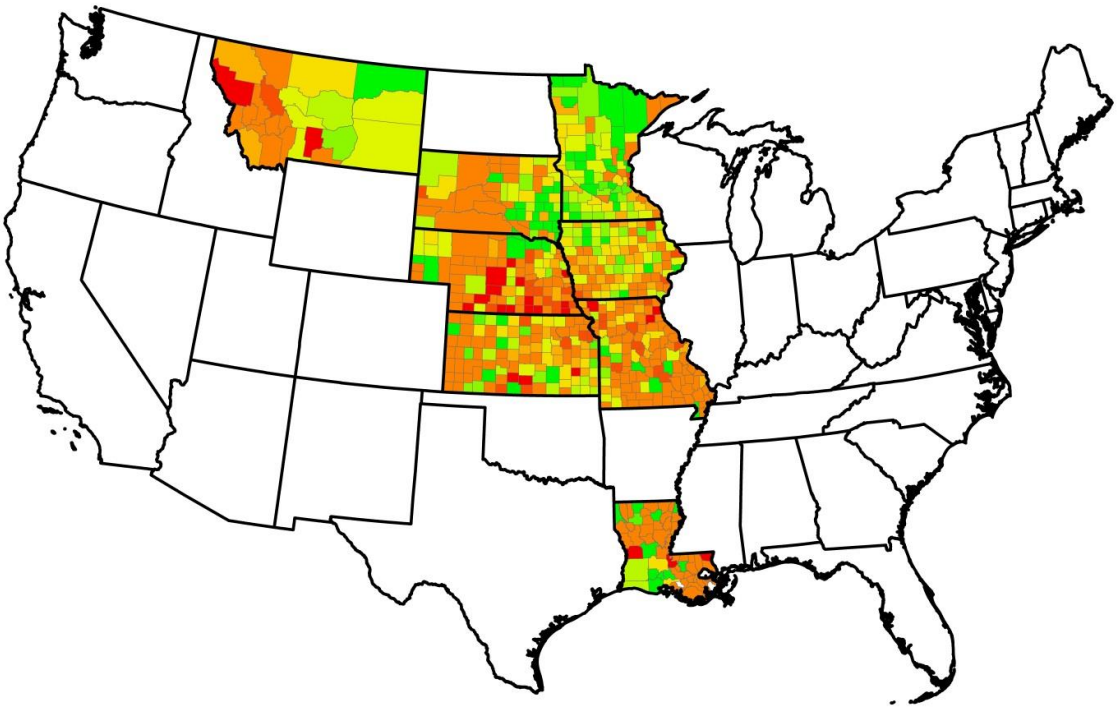


Notes: The figure displays that combination of asset risk and equity-to-assets that equates that the actuarially fair default risk premium on deposits (p) to the required level of default risk in a Black Scholes. Figure adopted from Calomiris and Wilson (2004).

Figure 7: %Change in Deposits 1908-1920
Panel A: State Banks



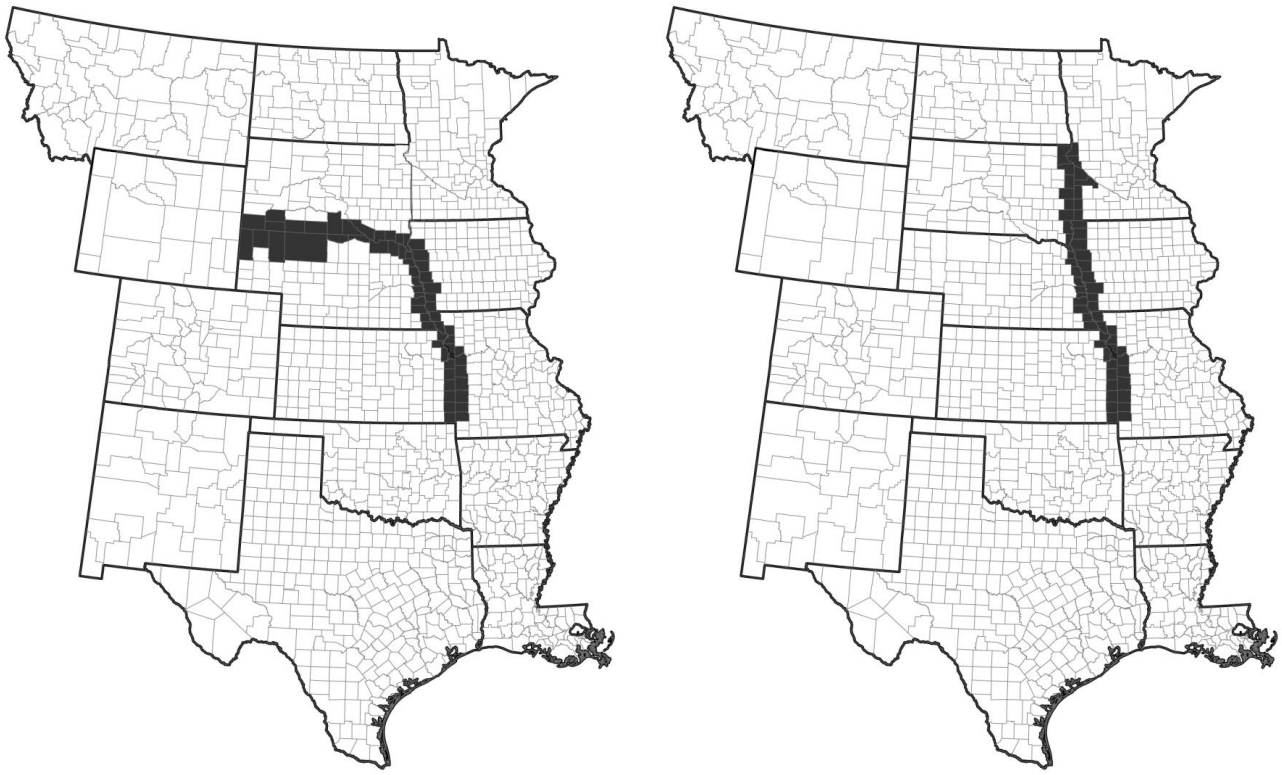
Panel B: National Banks



Notes: Maps provide the percent change in county-level deposits for state and national banks between 1908 and 1920. Colors denote the size of the change. Red counties lost the most and dark green counties gained the most. See Data section for sources.

Figure 8: Border Counties

Panel A: Borders in 1900-1914 Sample **Panel B: Borders in 1900-1920 Sample**



Notes: Shaded counties denote counties that are included in the "Border County" regressions.

Table 1: Characteristics of Deposit Insurance States

	Branching Allowed	Fraction Urban	Crop Output Per Person	Bank Failure Rate 1903-08	# of State Banks	# of National Banks	Avg Assets of State Banks	Avg Assets of National Banks	Paid In Capital Gini Coeff.	Acres in Largest Crop
KS*	0	27.9%	99.4	1.7%	750	209	127,095	502,958	44.8%	53.0%
MS*	0	10.9%	62.8	4.6%	289	30	197,348	669,863	48.9%	37.5%
ND*	0	10.6%	235.8	1.9%	422	132	69,448	244,971	35.9%	63.5%
NE*	0	25.8%	125.0	0.8%	629	210	123,152	612,671	49.8%	57.5%
OK*	0	18.6%	65.7	3.1%	496	309	59,892	222,361	43.7%	61.0%
SD*	0	12.9%	164.6	3.3%	413	90	102,520	341,215	46.0%	38.0%
TX*	0	22.9%	60.8	2.1%	507	534	110,570	426,832	54.5%	31.5%
WA*	0	51.8%	54.9	10.0%	230	63	386,385	1,468,324	60.9%	79.5%
DI States	0	22.7%	109	3.4%	467	197	147,051	561,149	48.1%	52.7%
AR	0	12.1%	57.7	8.5%	325	41	152,233	538,476	56.0%	47.0%
CO	0	50.0%	50.1	2.0%	135	115	222,792	1,057,124	54.5%	27.0%
IA	0	29.6%	109.6	1.0%	1231	317	240,943	542,900	44.1%	60.5%
NM	0	14.6%	24.7	0.0%	27	42	151,347	386,391	37.9%	46.5%
MN	0	39.8%	72.2	0.6%	640	263	186,406	761,341	58.0%	30.5%
MO	0	41.2%	51.9	1.2%	1031	122	329,713	2,766,051	75.6%	68.0%
MT	0	35.4%	65.6	2.7%	91	41	410,690	980,026	45.8%	47.5%
LA	1	29.4%	38.2	0.8%	183	37	508,298	1,662,140	72.6%	52.5%
Non-DI Middle States	12.5%	31.5%	59	2.1%	458	122	275,303	1,086,806	55.6%	47.4%
AL	0	16.4%	51.4	3.9%	201	77	246,546	626,804	54.3%	37.5%
AZ	1	29.1%	24.7	11.4%	30	14	354,242	616,693	38.5%	40.0%
CA	1	60.8%	53.5	2.3%	480	140	1,165,170	1,831,569	68.2%	53.0%
CT	0	64.7%	17.6	0.5%	135	81	2,326,150	1,398,864	47.7%	46.0%
DE	1	47.7%	36.1	0.0%	13	28	1,939,751	599,001	54.2%	58.0%
FL	0	28.1%	36.1	5.8%	104	40	184,477	843,514	56.1%	56.0%
GA	1	20.0%	63.0	3.0%	500	97	177,710	681,595	55.6%	36.5%
ID	0	18.9%	84.0	2.8%	115	39	175,940	445,080	49.7%	44.5%
IL	0	60.4%	51.8	0.7%	1122	410	637,255	1,626,815	68.8%	60.0%
IN	0	40.8%	59.0	1.0%	552	243	284,693	812,720	52.0%	55.0%
KY	1	23.8%	47.2	1.3%	453	146	215,767	715,304	60.0%	70.5%
MA	1	88.5%	8.9	1.5%	298	199	3,359,166	2,619,930	53.2%	48.5%
MD	1	50.6%	27.3	4.6%	107	102	1,539,595	1,424,763	71.2%	46.0%
ME	1	35.0%	41.0	1.3%	92	78	1,433,605	712,871	41.9%	44.5%
MI	1	45.8%	45.0	1.5%	616	97	437,624	1,460,980	57.8%	29.5%
NC	1	13.7%	49.2	4.7%	296	69	149,974	617,310	60.5%	47.0%
NH	0	50.8%	30.7	2.5%	65	58	1,467,579	586,282	33.2%	37.0%
NJ	1	75.5%	14.0	2.2%	131	174	2,288,778	1,214,383	53.4%	44.5%
NV	0	17.0%	63.7	33.3%	32	10	497,646	1,034,779	61.2%	36.0%
NY	1	77.9%	19.5	3.3%	592	424	5,956,509	5,014,294	76.6%	41.5%
OH	0	54.5%	39.4	3.7%	715	366	647,493	1,311,713	66.8%	49.0%
OR	0	43.9%	59.3	7.2%	139	64	409,494	824,112	55.0%	58.5%
PA	0	59.4%	18.6	3.0%	555	766	1,750,218	1,501,572	61.5%	30.0%
RI	1	90.6%	7.5	2.8%	34	23	5,603,607	1,881,683	56.4%	57.5%
SC	1	15.0%	66.2	2.9%	234	30	208,992	878,518	47.3%	32.0%
TN	1	19.4%	43.1	7.2%	326	87	228,776	876,978	63.4%	61.0%
UT	0	45.0%	40.2	0.0%	57	21	621,715	1,093,651	54.1%	52.5%
VA	0	22.2%	38.4	0.9%	254	106	266,436	1,010,315	61.5%	55.5%
VT	0	26.7%	60.2	2.2%	50	52	1,363,960	595,354	35.8%	43.5%
WI	0	42.3%	50.5	1.5%	458	131	291,191	1,183,424	61.3%	40.0%
WV	0	17.8%	27.9	2.0%	174	96	395,354	611,169	50.4%	61.0%
WY	0	29.5%	59.7	2.7%	47	31	116,784	515,068	43.0%	63.0%
Non-DI States	46.9%	41.6%	42	3.9%	281	134	1,148,194	1,161,472	55.3%	48.0%

Notes: See Data section for sources.

Table 2: Change in Farm Real Estate Per Acre (1913-1925)

	% Change in Value of Farm Real Estate Per Acre	
	1913-1920	**1920-1925**
Kansas	51	-19
Mississippi	118	-34
Nebraska	79	-32
North Dakota	45	-28
Oklahoma	66	-20
South Dakota	81	-37
Texas	74	-14
Washington	40	-17
DI States	**69.3**	**-25.1**
Arkansas	122	-20
Colorado	41	-31
Iowa	113	-34
Louisiana	98	-22
Minnesota	113	-27
Missouri	67	-30
Montana	26	-37
New Mexico	44	-31
Non-DI Middle States	**78.0**	**-29.0**
Alabama	77	-11
Arizona	65	-56
California	67	10
Connecticut	37	10
Delaware	39	-3
Florida	78	75
Georgia	117	-40
Idaho	72	-34
Illinois	60	-27
Indiana	61	-32
Kentucky	100	-30
Maine	42	2
Maryland	66	-5
Massachusetts	40	8
Michigan	54	-6
Nevada	35	-41
New Hampshire	29	11
New Jersey	30	24
New York	33	3
North Carolina	123	-7
Ohio	59	-23
Oregon	30	-13
Pennsylvania	40	-4
Rhode Island	30	14
South Carolina	130	-34
Tennessee	100	-19
Utah	67	-20
Vermont	50	-7
Virginia	89	-7
West Virginia	54	-8
Wisconsin	71	-12
Wyoming	76	-54
Non-DI States	**63.2**	**-10.5**

Notes: Information taken from Calomiris (1992).

Table 3: Middle States Sample Data Availability at Bank-Level

States	Years When Balance Sheet Data Available	Missing Report With Data	Included in Sample
Arkansas	1914, 1916, 1918, 1921		No
New Mexico	1917-1918, 1921	1919-1920	No
Wyoming	None Available		No
Colorado	1908-1921		No
North Dakota	1900-1910, 1912	1911	No
Oklahoma	1908, 1910, 1912 ,1914, 1916, 1918, 1920		No
Texas	1905-1912, 1914	1913	No
Iowa	1901, 1903, 1905, 1906, 1908, 1910, 1912, 1914, 1916, 1918, 1921		Yes
Kansas	1900, 1902 ,1904, 1906 ,1908 ,1910, 1914, 1918		Yes
Louisiana	1900-1902, 1904-1911, 1913-1915, 1917, 1919, 1921	1903, 1912	Yes
Minnesota	1900-1914, 1916-1920		Yes
Missouri	1900, 1902, 1904, 1906, 1908, 1910, 1912 ,1914, 1916, 1918, 1920		Yes
Montana	1900-1906, 1908, 1910, 1912, 1914-1920		Yes
Nebraska	1893-1916, 1918, 1920		Yes
South Dakota	1902, 1904, 1906, 1908, 1910, 1912 ,1914, 1916, 1918, 1920		Yes

Notes: Tables displays information on the state banking reports published by the various states. Only those states that passed deposit insurance before 1914 and surrounding states are included. "Years When Balance Sheet Data is Available" denotes the years when balance sheets were published in the reports and the reports have survived. "Missing Report With Data" denotes the years when balance sheet is likely to have been reported but the reports have not survived. "Included in Sample" denotes whether the state's data was included in the sample.

Table 4: Linear Determinants of Banks and Deposits at the State-Level (1900-1920)

	ln(# of Banks)				ln(Individual Deposits)			
	1900-1920		1900-1914		1900-1920		1900-1914	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DI Active In State	-0.032	-0.092	-0.055	-0.154	0.097	-0.022	0.018	-0.096
	[0.075]	[0.092]	[0.095]	[0.110]	[0.071]	[0.075]	[0.081]	[0.076]
State Bank * Post-1908		0.151		0.097		0.156*		0.084
		[0.096]		[0.079]		[0.085]		[0.071]
DI Active in State * State Bank		0.121		0.198		0.238**		0.226*
		[0.149]		[0.183]		[0.099]		[0.113]
Location Fixed Effects?	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	660	660	450	450	660	660	450	450
R-squared	0.850	0.863	0.851	0.861	0.865	0.885	0.871	0.883

Notes: Tables displays the results of a linear regression with the dependent variable specified by the column titles. Each observation is either the state bank or national bank aggregate for a particular state in a particular year. Only those banks that passed deposit insurance before 1914 and surrounding states are included. Robust standard errors are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 5: Examining the Trends in Deposits Before Deposit Insurance (1900-1908)

	ln(Individual Deposits)			
	(1)	(2)	(3)	(4)
Linear Trend	0.040***	0.043**	0.040***	0.043***
	[0.012]	[0.016]	[0.012]	[0.015]
DI Ever Installed	-13.309		-21.180	
	[24.060]		[26.832]	
DI Ever Installed * Linear Trend	0.007	0.009	0.011	0.013
	[0.013]	[0.013]	[0.014]	[0.015]
DI Ever Installed * State Bank			16.168	
			[22.436]	
DI Ever Installed * State Bank * Linear Trend			-0.009	-0.009
			[0.012]	[0.011]
Location Fixed Effects?	None	State-Bank Type	None	State-Bank Type
Year Fixed Effects?	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes
Observations	270	270	270	270
R-squared	0.740	0.839	0.740	0.840

Notes: Tables displays the results of a linear regression with deposits as the dependent variable. Each observation is either the state bank or national bank aggregate for a particular state in a particular year. Only those states that passed deposit insurance before 1914 and surrounding states are included. Robust standard errors are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 6: Linear Determinants of Deposits at the Bank-Level

	ln(Individual Deposits)							
	1900-1920				1900-1914			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DI Active In State	0.060***	-0.097***	-0.097***	-0.160***	-0.067***	-0.165***	-0.165***	-0.229***
	[0.016]	[0.022]	[0.022]	[0.025]	[0.018]	[0.027]	[0.027]	[0.030]
State Bank*Post-1908		0.107***	0.109***	0.112***		0.099***	0.099***	0.096***
		[0.018]	[0.018]	[0.018]		[0.018]	[0.018]	[0.018]
DI Active in State*Member Bank		0.234***	0.141***	0.182***		0.163***	0.118***	0.150***
		[0.024]	[0.026]	[0.028]		[0.027]	[0.028]	[0.033]
DI Active in State*Member Bank *Small Bank			0.164***				0.086***	
			[0.028]				[0.029]	
DI Active in State*Young Bank				0.241***				0.247***
				[0.038]				[0.045]
DI Active in State*Member Bank *Young Bank				0.115**				0.043
				[0.046]				[0.054]
Location Fixed Effects?	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	66,902	66,902	66,902	66,902	42,229	42,229	42,229	42,229
R-squared	0.182	0.187	0.188	0.192	0.179	0.182	0.182	0.186

Notes: Tables displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only those banks that passed deposit insurance before 1914 and surrounding states are included. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 7: Linear Determinants of Deposits of Border Counties at the Bank-Level

	ln(Individual Deposits)							
	1900-1920				1900-1914			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DI Active In State	0.102***	-0.073*	-0.073*	-0.116**	0.066*	-0.053	-0.053	-0.115***
	[0.035]	[0.039]	[0.039]	[0.045]	[0.036]	[0.041]	[0.041]	[0.043]
State Bank*Post-1908		0.053	0.055	0.053		0.087*	0.087*	0.082*
		[0.043]	[0.043]	[0.043]		[0.045]	[0.045]	[0.045]
DI Active in State*Member Bank		0.258***	0.129*	0.219***		0.186***	0.097*	0.188***
		[0.051]	[0.065]	[0.063]		[0.042]	[0.049]	[0.049]
DI Active in State*Member Bank *Small Bank			0.241***				0.184**	
			[0.073]				[0.071]	
DI Active in State*Young Bank				0.229***				0.207***
				[0.064]				[0.054]
DI Active in State*Member Bank *Young Bank				0.096				0.075
				[0.096]				[0.082]
Location Fixed Effects?	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,906	7,906	7,906	7,906	5,690	5,690	5,690	5,690
R-squared	0.176	0.182	0.185	0.187	0.164	0.168	0.169	0.171

Notes: Tables displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only those banks that passed deposit insurance before 1914 and surrounding states are included. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 8: Separating Voluntary and Involuntary Deposit Insurance Systems at the Bank-Level

	ln(Individual Deposits)							
	1900-1920				1900-1914			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Voluntary DI Active In State	0.006	-0.095***	-0.143***	-0.167***	-0.095***	-0.169***	-0.202***	-0.236***
	[0.023]	[0.030]	[0.037]	[0.033]	[0.024]	[0.034]	[0.041]	[0.038]
Involuntary DI Active In State	0.093***	-0.101***	-0.106***	-0.148***	-0.033*	-0.157***	-0.161***	-0.211***
	[0.017]	[0.023]	[0.023]	[0.027]	[0.019]	[0.029]	[0.030]	[0.031]
State Bank * Post-1908		0.108***	0.099***	0.111***		0.100***	0.093***	0.097***
		[0.018]	[0.018]	[0.018]		[0.017]	[0.018]	[0.017]
Voluntary DI Active In State * Member of System		0.203***	0.177***	0.211***		0.148***	0.130***	0.169***
		[0.035]	[0.035]	[0.042]		[0.036]	[0.035]	[0.043]
Involuntary DI Active In State * Member of System		0.249***	0.150***	0.159***		0.170***	0.121***	0.121***
		[0.026]	[0.030]	[0.032]		[0.030]	[0.033]	[0.035]
Voluntary DI Active In State * Member of System * Small Bank			0.139***				0.094***	
			[0.036]				[0.034]	
Involuntary DI Active In State * Member of System * Small Bank			0.186***				0.107***	
			[0.031]				[0.032]	
Voluntary DI Active In State * Young Bank				0.329***				0.290***
				[0.058]				[0.060]
Involuntary DI Active In State * Young Bank				0.149***				0.166***
				[0.041]				[0.049]
Voluntary DI Active In State * Member of System * Young Bank				-0.071				-0.104
				[0.076]				[0.078]
Involuntary DI Active In State * Member of System * Young Bank				0.237***				0.197***
				[0.048]				[0.057]
Location Fixed Effects?	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	66,902	66,902	66,902	66,902	42,229	42,229	42,229	42,229
R-squared	0.183	0.187	0.189	0.192	0.179	0.182	0.183	0.185

Notes: Tables displays the results of an linear regression with deposits as the dependent variable. Each observation is a bank-year. Only those states that passed deposit insurance before 1914 and surrounding states are included. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 9: Linear Determinants of Bank-Risk Measures at the Bank-Level (1900-1920)

	1900-1920						1900-1914					
	(Cash in Vault+Due From Banks)/Assets		Loans/Assets		Capital/Assets		(Cash in Vault+Due From Banks)/Assets		Loans/Assets		Capital/Assets	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DI Active In State	-0.016***	-0.023***	0.025***	0.022***	0.005**	0.017***	-0.047***	-0.042***	0.039***	0.031***	0.017***	0.027***
	[0.003]	[0.005]	[0.003]	[0.005]	[0.002]	[0.003]	[0.005]	[0.006]	[0.005]	[0.006]	[0.003]	[0.004]
State Bank * Post-1908		-0.017***		0.009**		0.006**		-0.009*		0.011**		0.007***
		[0.004]		[0.004]		[0.003]		[0.005]		[0.005]		[0.003]
DI Active in State * Member Bank		0.009*		0.004		-0.018***		-0.008		0.012**		-0.017***
		[0.005]		[0.005]		[0.003]		[0.006]		[0.006]		[0.004]
Location Fixed Effects?	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	66,902	66,902	66,902	66,902	66,902	66,902	42,229	42,229	42,229	42,229	42,229	42,229
R-squared	0.159	0.160	0.085	0.086	0.282	0.283	0.099	0.100	0.116	0.117	0.121	0.123

Notes: Tables displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only those states that passed deposit insurance before 1914 and surrounding states are included. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 10: Forecasting Deposit Growth At State Banks Using Market Discipline Measures

	Change in ln(Individual Deposits) - Only State Banks in Sample									
	Panel 1900-1920	Cross-Sections								
		1904	1906	1908	1910	1912	1914	1916	1918	1920
DI Active In State	-0.358***				-0.349**	0.152	-0.027	-0.966***	0.108	0.165*
	[0.062]				[0.146]	[0.123]	[0.129]	[0.145]	[0.094]	[0.092]
L.Loans/Assets	-0.322***	-0.717***	-0.389***	-0.408***	-0.145	-0.398***	-0.243***	-1.583***	-0.150**	0.536***
	[0.065]	[0.102]	[0.072]	[0.071]	[0.093]	[0.080]	[0.080]	[0.100]	[0.059]	[0.067]
L.Loans/Assets*DI Active In State	0.568***				-0.213	-0.289*	0.006	1.654***	0.141	-0.018
	[0.110]				[0.210]	[0.149]	[0.162]	[0.175]	[0.121]	[0.119]
L.Capital/Assets	4.473***	2.549***	2.593***	2.647***	1.874***	2.506***	1.410***	3.681***	2.759***	2.580***
	[0.217]	[0.154]	[0.127]	[0.114]	[0.122]	[0.097]	[0.087]	[0.092]	[0.081]	[0.107]
L.Capital/Assets*DI Active In State	-0.698**				1.755***	0.052	-0.483**	-1.697***	-1.682***	-1.159***
	[0.333]				[0.346]	[0.193]	[0.211]	[0.193]	[0.210]	[0.232]
L.Real Estate Owned/Assets	-2.013***	-1.261***	-1.433***	-0.476*	0.787***	-1.455***	0.352	-5.042***	-0.647***	1.720***
	[0.652]	[0.367]	[0.324]	[0.288]	[0.291]	[0.266]	[0.216]	[0.227]	[0.233]	[0.301]
L.Real Estate Owned/Assets*DI Active In State	2.887***				-2.341**	-0.345	0.556	5.586***	2.834***	2.695***
	[0.734]				[1.114]	[0.675]	[0.690]	[0.488]	[0.540]	[0.701]
Location Fixed Effects?	Bank	None	None	None	None	None	None	None	None	None
Year Fixed Effects?	Yes	No	No	No	No	No	No	No	No	No
County-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,364	2,452	3,014	3,795	4,359	4,921	5,290	5,803	6,103	6,588
R-squared	0.238	0.136	0.161	0.166	0.117	0.196	0.088	0.349	0.193	0.148

Notes: Tables displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only those banks that passed deposit insurance before 1914 and surrounding states are included. All national banks are dropped from the sample. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table A.1: Linear Determinants of Banks and Deposits at the State-Level (1900-1920)

	ln(# of Banks)				ln(Individual Deposits)			
	1900-1920		1900-1914		1900-1920		1900-1914	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Voluntary DI Active In State	0.015	-0.006	-0.036	-0.069	-0.008	-0.111	-0.050	-0.130*
	[0.104]	[0.102]	[0.088]	[0.082]	[0.147]	[0.083]	[0.103]	[0.068]
Involuntary DI Active In State	-0.043	-0.111	-0.064	-0.186	0.122	-0.001	0.047	-0.078
	[0.089]	[0.094]	[0.135]	[0.132]	[0.079]	[0.078]	[0.104]	[0.085]
State Bank * Post-1908		0.152		0.098		0.157*		0.085
		[0.097]		[0.080]		[0.087]		[0.072]
Voluntary DI Active In State * Member of System		0.041		0.066		0.205**		0.160**
		[0.097]		[0.080]		[0.087]		[0.072]
Involuntary DI Active In State * Member of System		0.136		0.244		0.245**		0.250*
		[0.172]		[0.239]		[0.106]		[0.131]
Location Fixed Effects?	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type	State-Bank Type
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	660	660	450	450	660	660	450	450
R-squared	0.851	0.863	0.851	0.861	0.866	0.886	0.872	0.883

Notes: Tables displays the results of an linear regression with the dependent variable specified by the column titles. Each observation is either the state bank or national bank aggregate for a particular state in a particular year. Only those states that passed deposit insurance before 1914 and surrounding states are included. Robust standard errors are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table A.2: Linear Determinants of Deposits at the Bank-Level in Kansas (1900-1916)

	ln(Individual Deposits)							
	State and National Banks				Just State Banks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State Bank * Post-1908	0.255***	0.255***	0.255***	0.258***				
	[0.046]	[0.046]	[0.046]	[0.046]				
DI Member*Post-1908	0.100**	0.036	0.079*	0.037	0.094*	0.026	0.074	0.022
	[0.047]	[0.049]	[0.047]	[0.049]	[0.048]	[0.050]	[0.048]	[0.050]
DI Member*Post-1908*Small Bank		0.105**				0.112**		
		[0.049]				[0.049]		
DI Member*Post-1908*Border			0.132**				0.123**	
			[0.057]				[0.060]	
DI Member*Post-1908*Young Bank				0.274***				0.310***
				[0.044]				[0.045]
Location Fixed Effects?	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,076	8,076	8,076	8,076	6,427	6,427	6,427	6,427
R-squared	0.236	0.237	0.236	0.239	0.241	0.242	0.242	0.246

Notes: Tables displays the results of an linear regression with deposits as the dependent variable. Each observation is a bank-year. Only Kansas banks are included in the sample. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table A.3: Linear Determinants of Deposits of Border Counties at the Bank-Level

	ln(Individual Deposits)							
	1900-1920				1900-1914			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Voluntary DI Active In State	0.167***	-0.061	-0.190***	-0.117*	0.066	-0.083*	-0.171**	-0.123**
	[0.056]	[0.051]	[0.057]	[0.061]	[0.060]	[0.049]	[0.066]	[0.054]
Involuntary DI Active In State	0.074*	-0.081	-0.091*	-0.113*	0.066	-0.026	-0.035	-0.103*
	[0.041]	[0.053]	[0.054]	[0.058]	[0.040]	[0.055]	[0.056]	[0.056]
DI Active in State * State Bank		0.048	0.023	0.051		0.088*	0.071	0.084*
		[0.043]	[0.043]	[0.042]		[0.044]	[0.045]	[0.045]
Voluntary DI Active In State * Member of System		0.397***	0.355***	0.412***		0.261***	0.232***	0.276***
		[0.085]	[0.078]	[0.112]		[0.061]	[0.072]	[0.081]
Involuntary DI Active In State * Member of System		0.213***	0.129*	0.142*		0.137**	0.099	0.137**
		[0.063]	[0.076]	[0.075]		[0.054]	[0.061]	[0.062]
Voluntary DI Active In State * Member of System * Small Bank			0.319***				0.219*	
			[0.116]				[0.111]	
Involuntary DI Active In State * Member of System * Small Bank			0.190**				0.111	
			[0.076]				[0.079]	
Voluntary DI Active In State * Young Bank				0.282***				0.179**
				[0.092]				[0.072]
Involuntary DI Active In State * Young Bank				0.187**				0.211***
				[0.084]				[0.071]
Voluntary DI Active In State * Member of System * Young Bank				-0.134				-0.093
				[0.196]				[0.165]
Involuntary DI Active In State * Member of System * Young Bank				0.204*				0.175*
				[0.107]				[0.091]
Location Fixed Effects?	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census Variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,906	7,906	7,906	7,906	5,690	5,690	5,690	5,690
R-squared	0.177	0.184	0.187	0.189	0.164	0.168	0.170	0.171

Notes: Tables displays the results of an linear regression with deposits as the dependent variable. Each observation is a bank-year. Only those states that passed deposit insurance before 1914 and surrounding states are included. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table A.4: Forecasting Deposit Growth At State Banks Using Market Discipline Measures - Separating Voluntary and Involuntary Systems

	Change in ln(Individual Deposits)									
	Panel	Cross-Sections								
	1900-1920	1904	1906	1908	1910	1912	1914	1916	1918	1920
Voluntary DI Active In State	-0.151***				-0.192***	-0.116***	-0.164***	-0.029	-0.094***	0.065**
	[0.042]				[0.045]	[0.033]	[0.032]	[0.038]	[0.031]	[0.032]
Involuntary DI Active In State	-0.306***					-0.046	-0.112	-0.953***	-0.238**	0.443***
	[0.076]					[0.204]	[0.191]	[0.200]	[0.118]	[0.144]
L.Loans/Assets	-0.272***	-0.717***	-0.389***	-0.408***	-0.159*	-0.524***	-0.273***	-1.348***	-0.234***	0.563***
	[0.062]	[0.102]	[0.072]	[0.071]	[0.084]	[0.071]	[0.074]	[0.089]	[0.056]	[0.060]
L.Loans/Assets* Voluntary DI Member * DI Active	0.296*				0.112	-0.268***	0.374***	0.656***	0.594***	0.196
	[0.157]				[0.149]	[0.095]	[0.133]	[0.127]	[0.120]	[0.129]
L.Loans/Assets* Involuntary DI Member * DI Active	0.526***					0.204	-0.054	1.601***	0.438***	-0.313*
	[0.105]					[0.242]	[0.225]	[0.241]	[0.151]	[0.185]
L.Capital/Assets	4.465***	2.549***	2.593***	2.647***	2.105***	2.485***	1.319***	3.709***	2.626***	2.584***
	[0.215]	[0.154]	[0.127]	[0.114]	[0.117]	[0.090]	[0.084]	[0.088]	[0.079]	[0.101]
L.Capital/Assets* Voluntary DI Member * DI Active	-0.835				-0.334	1.263***	-1.061**	-2.278***	-2.300***	-1.185*
	[0.629]				[0.488]	[0.288]	[0.455]	[0.395]	[0.497]	[0.636]
L.Capital/Assets* Involuntary DI Member * DI Active	-0.784***					-1.003***	0.272	-1.636***	-0.757***	-1.957***
	[0.199]					[0.307]	[0.281]	[0.244]	[0.257]	[0.302]
L.Real Estate Owned/Assets	-1.907***	-1.261***	-1.433***	-0.476*	0.569**	-1.667***	0.353*	-4.710***	-0.713***	1.705***
	[0.652]	[0.367]	[0.324]	[0.288]	[0.287]	[0.256]	[0.212]	[0.222]	[0.229]	[0.293]
L.Real Estate Owned* Voluntary DI Member * DI Active	1.604				0.800	-2.526**	0.134	5.222***	1.427	1.714
	[1.435]				[1.512]	[1.126]	[1.253]	[1.065]	[1.254]	[1.483]
L.Real Estate Owned* Involuntary DI Member * DI Active	3.470***					3.633***	0.709	5.355***	2.936***	4.253***
	[0.549]					[1.050]	[0.983]	[0.597]	[0.628]	[0.886]
Location Fixed Effects?	Bank	None	None	None	None	None	None	None	None	None
Year Fixed Effects?	Yes	No	No	No	No	No	No	No	No	No
County-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,364	2,452	3,014	3,795	4,359	4,921	5,290	5,803	6,103	6,588
R-squared	0.238	0.136	0.161	0.166	0.112	0.204	0.091	0.343	0.193	0.152

Notes: Tables displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only those states that passed deposit insurance before 1914 and surrounding states are included. All national banks are dropped from the sample. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.