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

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February 2016

Abstract

Deposit insurance reduces liquidity risk by removing the incentives of depositors to withdraw from banks when concerned about 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 depository institutions within those states. Moreover, the dates of the passage and implementation of deposit insurance differ across states, helping control for the circumstances that led to the passage. These experiments present a unique testing ground for investigating the effect of deposit insurance. We show that deposit insurance increased risk by removing market discipline that had been constraining erstwhile uninsured banks. Insured banks increased their insolvency risk, and competed aggressively for the deposits of uninsured banks operating nearby.

JEL Codes: G21, G28, N22
Keywords: Deposit insurance, moral hazard, bank risk, and market discipline

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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).[1] Despite its overwhelming political support, there is a large empirical literature suggesting that the moral-hazard costs of deposit insurance have out-weighed its liquidity-risk-reduction benefits.[2] These papers show that deposit insurance is among the most important contributors to the unprecedented waves of costly banking crises that have washed over the world during the past four decades. The separation between policy recommendations and economic studies begs the questions of whether the last four decades were an aberration or whether empirical studies may have failed to identify other contributing influences that produced both the rise of deposit insurance and banking instability.

Most studies of deposit insurance are based on cross-country comparisons or comparisons across time within countries, and contrast the behavior of insured banking systems with uninsured banking systems.[3] Despite attempts by these authors to control for other influences that coincide with the creation or expansion of deposit insurance through explicit controls or through instruments that explain the creation of deposit insurance, it is conceivable that some of the positive association between deposit insurance and increased bank risk may

[1] Political pressures include the endorsement of deposit insurance by the International Monetary Fund and encouragement of its installation by the European Union.

[2] See 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), and Calomiris and Chen (2016).

[3] Exceptions include Brewer (1995) and Yan, Skully, Avram and Vu (2014). Brewer achieves identification by comparison the behavior of institutions that had suffered large losses vs. those that had not. Yan et al. 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.

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.[4] 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 to uninsured state and national banks operating in bordering states. Utilizing a comprehensive bank-level database spanning many states and years, 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 also 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 the market discipline that had been constraining uninsured banks' decision-making. Depositors applied strict market discipline on uninsured banks when evaluating whether to place their deposits in those banks, but seemingly ignored the financial soundness of insured banks. Insured banks thus were able to use insurance to compete away deposits from uninsured banks located nearby. Because they were constrained only by regulatory standards which often

[4] Aldunate (2015) uses a similar approach. In addition to a state-level analysis, he compares the growth of bank-level deposits in three groups (i.e., Nebraska/Colorado, South Dakota/Minnesota, and Mississippi/Alabama) between the year before deposit insurance and the year after. The short period prevents the study from controlling for pre-trends and choice of states places most of the post-deposit insurance years during the WWI agricultural price spike.

proved inadequate to prevent insolvency, insured banks raised their loan-to-asset ratios and kept their capital ratios close to the regulatory minimum.[5] 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 insurance systems' ability to protect them. When prices reversed in the early 1920s, the insured banking systems quickly collapsed and left depositors with losses.[6]

The rest of the paper proceeds as follows. Section 2 traces the broader history of the United States' struggles with implementing stable deposit insurance systems from which the deposit insurance experiments of the early 20th century arose. 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 details of the early 20th century state-deposit insurance systems 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, beginning with an analysis of state-level data followed by the reporting of our main analysis of bank-level data. Section 6 concludes.

2.Historical Background

Bank liability insurance began in the United States as a remedy to the systemic risk issues that the U.S. "unit" (single office) banking system produced (Calomiris and Haber 2014, Chapter 6). First, unit banks were unable to diversify the location of their lending, which tended to make

[5] During the period, regulation primarily 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. See Warburton (1959) for details.
[6] For an analysis of the collapses and large losses of the insured systems, see Goldenweiser et al. (1932, Warburton (1959), Calomiris (1990, 1992), Alston, Grove, and Wheelock (1994), and Rajan and Ramcharan (2014).

them 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 the U.S. clearings system magnified liquidity risks. Restricted to a single office location, banks had to hold deposits with correspondent banks in larger financial centers to make payments and collect checks and drafts on distant locations. Because the demands for money and credit were highly seasonal, banks earned interest on their reserves during slack periods and drew down their balances or borrowed 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 that left respondent banks without access to their reserves.[7]

Antebellum banking systems in the North created two versions of liability insurance.[8] The Indiana model chartered a limited number of banks with unlimited mutual liability for each other's liabilities. The system also vested member banks with regulatory and supervisory authority over each other. The Indiana system spread to Ohio and Iowa, and was associated with the successful mitigation of its members' liquidity risk. For example, during the severe Panic of 1857, the Indiana and Ohio insurance systems avoided the suspension of convertibility that occurred in other locations (Calomiris 1989, 1990; Calomiris and Schweikart 1991). These successful state-level systems were ended by the National Banking Acts as Indiana's and Ohio's member banks were amongst the first to take out national bank charters.

[7] 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), and Calomiris and Carlson (2016b).

[8] For summaries of the key features of the antebellum and postbellum systems, see Golembe and Warburton (1958), Warburton (1959), and Calomiris (1989).

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 repay the deposits of failed bank. The New York model spread to Vermont and Michigan, and in all cases it ended in systemic insolvency and collapse.[9]

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 supervisory authority meant that individual members had the ability and the incentive to monitor and discipline one another to prevent excessive risk-taking by members. Alternatively, the New York model created no such incentives because the large number of members limited each member's exposure to loss. New York members also had little to no 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 state banks to cease the issue of bank notes (Jaremski 2013). As such the dual banking system perpetuated the fragmented, unit banking structure of the U.S. banking system and the peculiar instability of U.S. banks persisted into the early 20th century – a time when other countries' banking systems were not experiencing such severe shocks (Bordo 1985).

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

[9] New York even had to issue bonds to pay off noteholders in good time after the Panic of 1839.

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 collapse.[10] 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 incentive of any member to monitor and enforce other members' adherence to collective rules is weakened (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 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). 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). As such the unique political circumstances of 1933 seemingly 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, and powerful

[10] 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.

political figures such as President Roosevelt and Senator Carter Glass. (Calomiris and White 1994, Economides, Hubbard and Palia 1996, Calomiris 2010, Calomiris and Haber 2014)

A potential 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 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 and promoting excessive risk taking of banks.[11] Because only a handful of states installed deposit insurance laws and those laws only applied to state banks even though national banks were similar and operated in the same locations, we 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 insured and uninsured banks in a state, and the difference in insured and uninsured 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 determine whether a region-specific economic shock was responsible for changes in banks' and depositors' behavior and the passage of deposit

[11] This buildup then may have been responsible for the eventual collapse of those insurance systems in the 1920s.

insurance, or alternatively, whether changes in behavior were the consequence of deposit insurance.

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, uninsured banks are forced by market discipline to target a low level of default risk on their deposits.[12] Specifically, 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.[13] 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). Based on the Black Scholes model, Figure 6 shows the combinations of asset risk and equity-to-assets that satisfy $p = Z$.[14] 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, then 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).

[12] 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).
[13] 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.
[14] Figure 6 is adopted from Calomiris and Wilson (2004).

Thus, 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 interest premium over the amount paid by uninsured banks. Two points warrant emphasis. First, 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 caveat is important because as the losses associated with insured banks' risks become visible, collective protection may disappear and depositors may have an incentive to run on their banks (recall that the state deposit insurance funds were not backed by the state).[15] Second, the only way for insured banks to profitably fund their deposit insurance assessment is to undertake greater risk. Thus, insured banks that attract deposits from uninsured banks must also increase their asset risk per deposit dollar.

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 (*Hypothesis 1*). 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)

[15] 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. Ultimately, depositors lost a substantial fraction of their investments because the states refused to bailout the funds. 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).

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. Note that if all depositors fully understood from the beginning the risks that insured banks were actually risk 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. Second, insured banks will only be able to offer that higher deposit interest rate and pay their insurance premium profitably by targeting a default risk greater than *Z (Hypothesis 2)*. 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 that will be 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 (*Hypothesis 3*), uninsured banks compete mainly with each other for the deposits that do not flow to 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-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.[16] Similar to the New York Model, each law created a non-state guaranteed fund that would be used to reimburse depositors in the event of a failed member bank. The laws stipulated each bank's annual assessment (typical a very small fraction of their deposits minus capital), as well as the maximum extra assessment that each bank could be forced to pay to replenish the fund during an emergency.[17] 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 insure their deposits by posting a collateral bond.[18] South Dakota also passed a voluntary deposit insurance law, but it did not give rise to an insurance system because the creation of the system depended on obtaining a required number of members before it could begin operation. When given a choice, many large banks chose not to join the system. 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

[16] 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 that national banks were not allowed to join.

[17] 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.

[18] At most, 9 percent of Texas state banks opted to purchase an insurance bond. (Hooks and Robinson 2002).

down the middle of the country, and the first five of these passed a law 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.[19] The two geographic outliers (Mississippi and Washington) both seemingly installed their systems as a hasty reaction to bank failures in their state (Robb 1921).[20]

As highlighted 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 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. Therefore, insurance laws were passed in states where small state banks held substantial power in the legislature.[21] As described by White (1981, p. 539) deposit insurance states had "firmly established unit banking within their boundaries and were all in relatively undiversified regions where business propensity in general depended on one or two commodities."[22] 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) narrowly defeated deposit insurance legislation during the period. (Cooke 1910; White 1981)

The insurance funds in all eight states 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

[19] 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.
[20] Washington's system also failed and was repealed within 4 years.
[21] 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.
[22] 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.

before, they were able to be covered by 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.[23] The insurance funds were able to string out payments for a time, but member banks were reluctant to make additional payments and many adopted national bank charters in order to avoid the extra assessments (Warburton 1959). Each of the insurance funds suspended payments on new failures at some point during the 1920s.

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 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 was 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. So how did the passage of deposit insurance affect the aggregate amount of deposits in the state and national banking system of the deposit insurance states relative to non-deposit insurance 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 answers to these questions have

[23] 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.

important ramifications for the degree of deposit loss caused by the passage of insurance because 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 deposit insurance adopters, late deposit insurance adopters, and non-adopters of deposit insurance in the geographic comparison group.[24] 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. 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 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).

Figure 3 illustrates the dramatic rise and fall in agricultural prices during the early 20th century. 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 also substantially rose and declined in agricultural states. The real estate decline was particularly steep for western states. 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-

[24] 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.

deposit insurance neighboring states on average suffered greater exogenous shocks than deposit insurance states.

To examine *Hypothesis 1*, Figure 4 displays the ratio of the number of state banks to national banks and the ratio of state bank deposits to national bank 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 the 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 a slight growth in state bank deposits relative to national bank deposits after the passage of the inactive laws, but the same pattern is also visible for non-deposit insurance states in Figure 4. There is not a large jump in state bank deposits in deposit insurance states relative to non-deposit insurance states until after their deposit insurance funds were made active. We conclude that the anticipation of insurance was not enough to spur depositors to move their deposits, and the differential rise in state banks deposits after 1909 was not a function of regional growth.

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 uninsured 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 deposit growth 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 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.

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.[25] We digitized the data of all states in the sample region that published reports from 1902 through 1920. 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.[26] Because most of the gaps exist after the passage of deposit insurance, the interpolating strategy (which introduces noise into the post-insurance data), if anything, should reduce the chance of finding significant differences between insured and uninsured banks.[27] The resulting biannual database contains 66,944 observations and spans 9,067 state banks and 1,922 national banks.

[25] See Mitchener and Jaremski (2015) for a detailed discussion of balance sheet reporting by state.
[26] Out of 66,944 observations used in our sample, 5,533 are interpolated.
[27] 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.

We augment the bank balance sheet data in several ways. We 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.[28] These controls are particularly important due to agricultural expansion during WWI. We also add other information on whether a county had a clearinghouse in operation from Jaremski (2015).

6. Empirical Evidence

As our aggregate analysis in Section 4 shows, deposit insurance was not associated with a sudden jump in aggregate deposits; however, lending weight to *Hypothesis 1*, it seems to have 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.

We proceed in two steps. First, we examine 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 a bank-year and the data cover all states that published data from 1902 and through 1920. The primary advantage of the individual bank data is that we can study specific bank risk characteristics and control for differential economic growth at a local level. Alternatively, the primary advantages of the state-level data is that it includes all the states and allows us to study how deposit insurance affects bank entry and exit, as captured by the changing

[28] Counties are aggregated to their 1900 county boundaries to provide consistent measures across time.

number of banks. In both analyses, we cut off the sample in 1920 because banks began 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,[29] $DI_{s,t}$ is a dummy variable that takes a value of 1 if deposit insurance was active in the state during the year[30], $StateBank_i$ 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, the percent change in crop output per period, and the fraction of population living in a location of 2,500 or more, 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 several variables as controls that one could argue are endogenous to the passage of insurance. For example, if insurance increased bank lending on risky real estate, it

[29] 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.

[30] 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.

may have affected crop output. These extra controls thus should produce a more conservative result because controlling for such variables reduces the estimated impact of deposit insurance.

The full model is a difference-in-difference-in-difference specification 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-banktype-fixed effects control for possibility that deposit insurance states were always different.[31] The time-fixed effects capture changes in each year that were common to all banks and thus control for macroeconomic factors and changes in federal regulation. 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 deposit insurance dummy and the state bank dummy accounts for the extra effect of deposit insurance on state banks. When the interactions are excluded, β_1 is the average effect of deposit insurance on state and national banks; however, when the interactions are included, β_3 is the effect of deposit insurance on state banks in deposit insurance states controlling for differential growth of all banks 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 deposit insurance states is just β_1 whereas the estimated growth of state banks in deposit insurance states is $\beta_1 + \beta_2 + \beta_3$, but we can only attribute β_3 to a causal effect of deposit insurance.

[31] To further support the model's identification, we examine whether deposit insurance states and state banks in those states were on different trajectories prior to the legislation. The difference-in-difference-in-difference model relies on the argument 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 tested whether deposit insurance states had different trends before 1908 and whether state banks in deposit insurance states had different trends than national banks in deposit insurance states before 1908. The results, reported in Appendix Table A.2, show no evidence of a differential trend amongst states or amongst state banks within states.

We estimate equation (1) in Table 4 for the entire sample period (1900-1920) as well as for a reduced period (1900-1914). 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 WWI price increases. As such, we might expect deposit insurance states to have higher levels of deposits during the late 1910s even if the immediate effect is small or negative.

The pattern of coefficients suggests that the aggregate number of banks and value of deposits was unchanged by the introduction of deposit insurance. In the models without interactions, the coefficient for either time period is not statistically different from zero. However, when the interactions are included, deposit insurance is shown to have increased the value of deposits for state banks relative to national banks. The coefficient on 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 but not all national banks lost deposits due to deposit insurance.[32]

To get a sense of magnitude, it is useful to translate the coefficients into examples. Between the installation of deposit insurance and 1920, a national bank in a non-deposit insurance state would be expected to have lost 2.6 percent in deposits, a state bank in a non-deposit insurance state would be expected to have gained 16.8 percent, and a state bank in a deposit insurance state would be expected to have gained 37.1 percent (i.e., -0.026 + 0.168 + 0.229). 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

[32] In fact, the bank-level regressions show that the deposit losses were largest in older national banks.

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.

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 for 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, but offers a better measured effect of deposit insurance on individual banks.

6.2. Bank-Level Model of Deposits

Before analyzing the competition for deposits that occurs between individual state banks and national banks, it is helpful to illustrate the wide geographic diversity in county-level deposit growth that is missed by the aggregate analysis. Figure 7 shows that state bank deposits displayed high growth rates relative to national banks in all states, but the growth was particularly large in states that adopted deposit insurance. State bank deposit growth was generally much higher in the western counties of deposit insurance states whereas 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 from insured banks that did not. Now with *i* denoting bank, *s* denoting county, and *t* denoting biannual observations, the model is:

$$Y_{i,s,t} = a + \beta_1 DI_{s,t} + \beta_2 DI_{s,t} * Member_i + \beta_3 Post_t * StateBank_t + \beta_4 X_{s,t} + t_t + u_{i,s} + e_{i,s,t} \quad (2)$$

Where $Member_i$ is a dummy that takes a value of 1 for state banks that were members of the deposit insurance system[33], $X_{s,t}$ includes all the previous variables as well as the ones 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.

The bank-level results in Table 5 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. It was not until after WWI that deposit insurance is associated with a positive average effect. Specifically, the average bank in a deposit

[33] Note that this dummy is only different from the state bank dummy for Kansas. The list of state bank members is first reported in the Kansas State Report in 1920. We assume that everyone on the list in 1920 were members of the insurance fund for all years, and all 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 after the banking problems of early 1920s. Results are similar but slightly lower when treating all Kansas state banks as insured banks. Appendix Table A.3 shows that insured banks in Kansas experienced significant higher deposit growth even when compared to uninsured state banks in the same state.

insurance state was predicted to have lost 5.4 percent of deposits between the installation of deposit insurance and 1914, yet have gained 7.3 percent by 1920. The dramatic coefficient swing is likely due to the rise in prices during WWI.[34]

Separating the results for national and state banks, deposit insurance had a negative, significant, and large effect on national banks across both sample periods. Deposit insurance reduced the average national bank's deposits by 15.4 percent in the short-run and 9.2 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 16.6 percent and 24.8 percent. As before it is useful to think of the total change in deposits for each group. Between the installation of deposit insurance and 1920, the model predicts that national banks in deposit insurance states would have lost 9.2 percentage points of deposits, uninsured state banks in non-deposit insurance states would have gained 9.2 percentage points more deposits, and insured state banks would have gained 24.8 percent (i.e., -0.092+0.092+0.248). Thus when controlling for local as well as regional economic growth, we confirm *Hypothesis 1*: insured banks attracted deposits away from uninsured national banks.

While similar, there are some differences between Table 4 and Table 5. Both predict that insured banks would gain deposits and the coefficients on the interaction for the full period are similar. Alternatively, the national bank coefficients are substantially lower for the state-level results. This difference is likely driven by the entry and conversion of banks, as new banks or existing state banks that converted to a national charter would not be picked up by the bank-level regression.[35] The national bank aggregates benefited from a few large state banks choosing to

[34] The results are similar when removing South Dakota (and its late law) from the sample.
[35] The differential results could also be the result of more accurate controls on economic activity and population.

become national banks rather than become subjected to the newly installed deposit insurance, as well as from the entry of new national banks.

The rest of the columns of Table 5 examine how deposit insurance affected banks with different characteristics. Because deposit insurance legislation was pushed for by small banks, we interact $DI_{s,t} * Member_i$ with a dummy denoting whether the bank was in the lower quantile of capital for all banks.[36] We also interact $DI_{s,t} * Member_i$ with a dummy denoting whether the bank appeared in the sample after 1904 to capture whether the effect helped new banks without much reputation more than older 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 10.8 to 18.6 percent more deposits than a large insured state bank, whereas a young insured state bank gained an additional 6.4 and 12.1 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 24.4 percent in the short-run and 18.3 percent in the long-run yet a young national bank was actually expected to gain 0.8 (i.e., -0.244+0.252) and 7.8 (i.e., -0.183+0.261) 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 installation of deposit insurance.

6.2.1 Additional Bank-Level Specifications of Deposits

The previous specifications 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, we provide two additional specifications.

[36] This cutoff is $16,000. Since national banks were required to have at least $25,000 in capital, the definition excludes all national banks.

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 deposit insurance states and the inclusion of county-level controls provide a comparison of similar economic and environmental factors. To provide an even narrower comparison, Table 6 compares only banks in counties along the border between a deposit insurance state and a non-deposit insurance state as it is very unlikely that any economic or environmental factors would have hit one side of the border but not the other.[37] The counties included in this analysis are shown in Figure 8. The results are similar to those in Table 5, and only a few differences stand out. The effect of deposit insurance is now positive but not significant in the short-run for all banks and is less negative on national banks when broken out. These changes are likely caused by insured border banks being able to attract deposits from uninsured national banks in their county as well as uninsured state and national banks in the nearby state.

Next, we test whether the estimated effect on state banks choosing to adopt deposit insurance is different from state banks that were forced to adopt it and whether the two types affected national banks differently.[38] 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 7, the coefficient on the interaction between deposit insurance and being a member is positive and significant regardless of the deposit insurance type. 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.

[37] 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.
[38] Appendix Table A.4 provides the same analysis but only for the boundary counties.

6.3. Deposit Composition and Risk Taking

The bank-level results strongly support *Hypothesis 1*'s claim that insured banks would compete away the depositors of other systems, but we still need to examine whether they also took on more risk (*Hypothesis 2*). 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. 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 $Y_{i,s,t}$ is one of the three balance sheet ratios described above, and the rest of the variables take their previous definitions.

The results in Table 8 confirm *Hypothesis 2*: the installation of deposit insurance seems to have encouraged insured banks to take more risk. As the ones protected by deposit insurance from bank runs, state banks increased their proportion of loans and increased their leverage (i.e., lowered the capital to asset ratio) over both periods, but the coefficient on reserves changes signs depending on the period studied. If anything, the short-run results for loans are 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, therefore, not only

exposed more depositors to risk but also likely helped lead to the investment bubble that developed in the late 1910s.

6.4 Does Deposit Insurance Remove Market Discipline?

So far, we have shown that depositors on net moved their deposits from uninsured to insured institutions, and this movement was associated with an increase in insured banks' risk. *Hypothesis 3* 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 the higher risk. Uninsured banks lost deposits to insured banks because their low required risk level prevented them from competing for high-interest deposits. They also 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, and capital to asset ratio. We also use owned real estate to assets ratio as a measure of loan risk.[39] 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 active, 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.

[39] 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 banking reports 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

The regression 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.[40] 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 in two ways: as a single panel from 1900 through 1920 and in individual biannual cross-sections. Doing so identifies whether depositor behavior differed across periods. The panel model is:

$$\Delta D_{i,s,t} = a + \beta_1 DI_{s,t} + \beta_2 Y_{i,t-2} + \beta_3 Y_{i,t-2} * DI_{s,t} + \beta_4 X_{s,t} + t_t + u_{i,s} + e_{i,s,t} \quad (4)$$

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

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

The first column of Table 9 shows the panel results and the remainder of the columns present the results for individual years.[41] The results confirm *Hypothesis 3*. 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 a similar size but opposite signs to the coefficient values for insured banks. This indicates a near zero effect of any of these risk characteristics for insured deposits. Simply put, the depositors ignored the typical warning signs of increasing failure risk for insured banks.

[40] 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).
[41] Appendix Table A.5 provides the results when separating voluntary and involuntary deposit insurance systems.

Interestingly, the cross-section results show that the removal of discipline occurred primarily during the WWI period. The coefficient on the interaction is only positive and significant for loans in 1916 and for owned real estate in 1916 through 1920, but the coefficient is negative for the capital ratio tin 1914 through 1920. In other words, depositors were ignoring the warning signs of insured banks specifically when those banks were making risky bets on the permanence of the WWI price increases.

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 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. 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. Deposits

flowed from relatively stable banks that survived the price decline after WWI to risky banks that did not survive. 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.

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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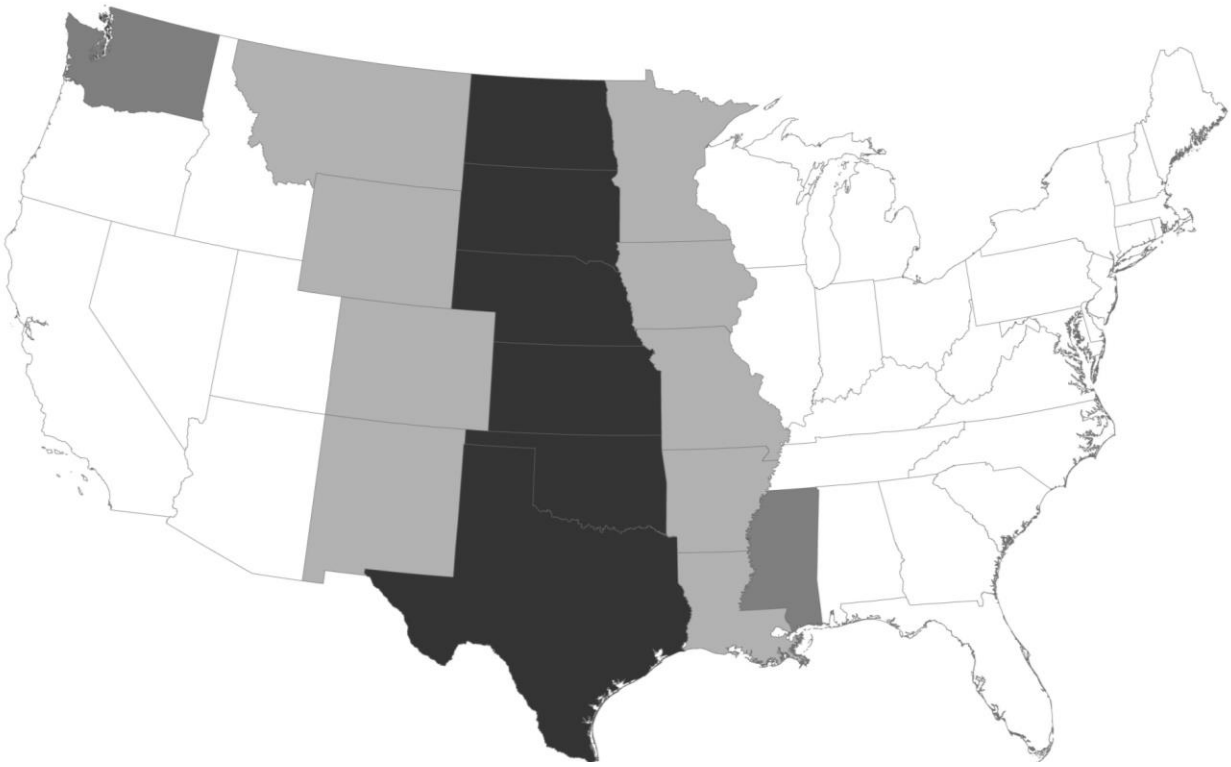
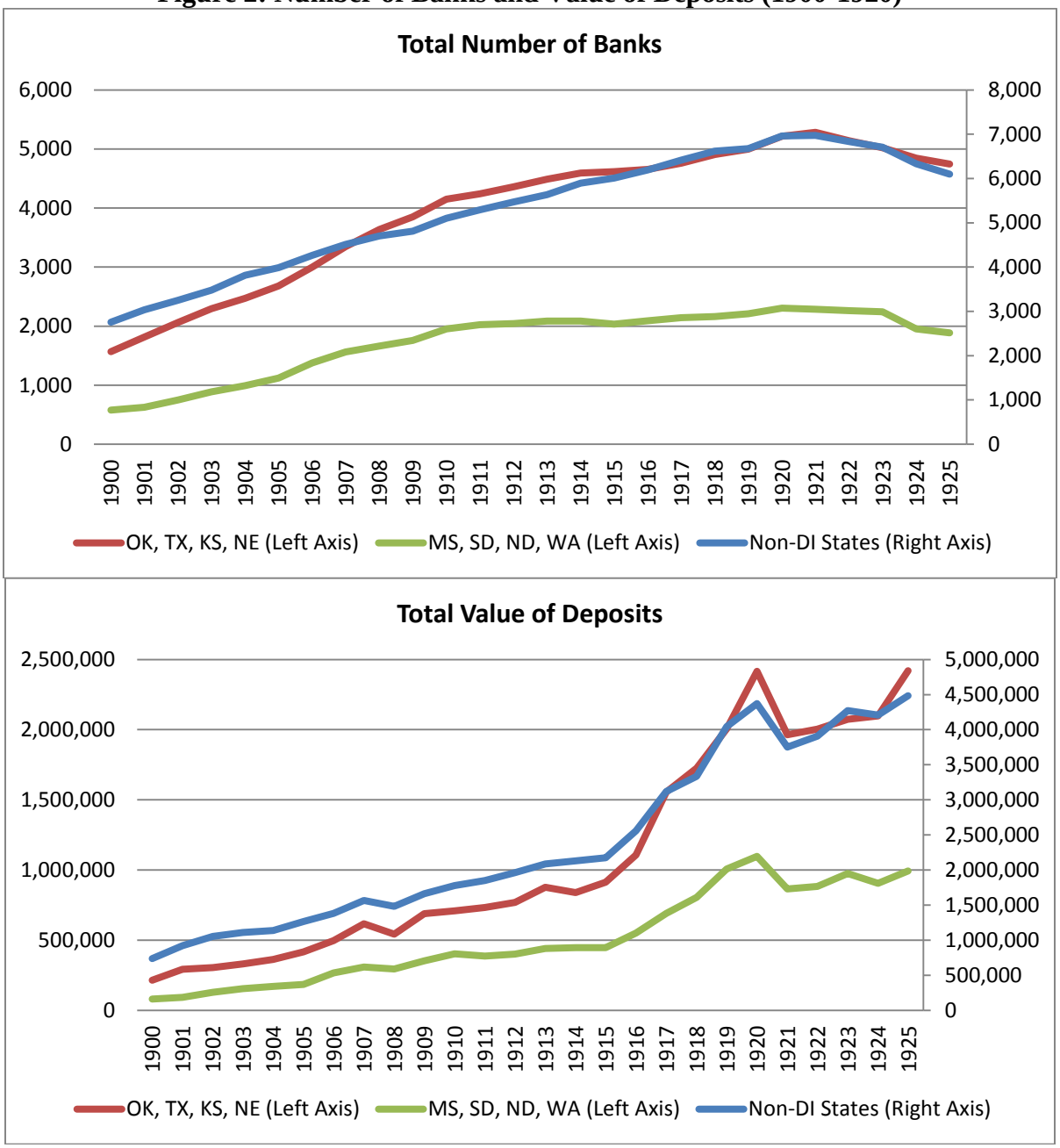
Figure 1: Map of Deposit Insurance States and Comparison States



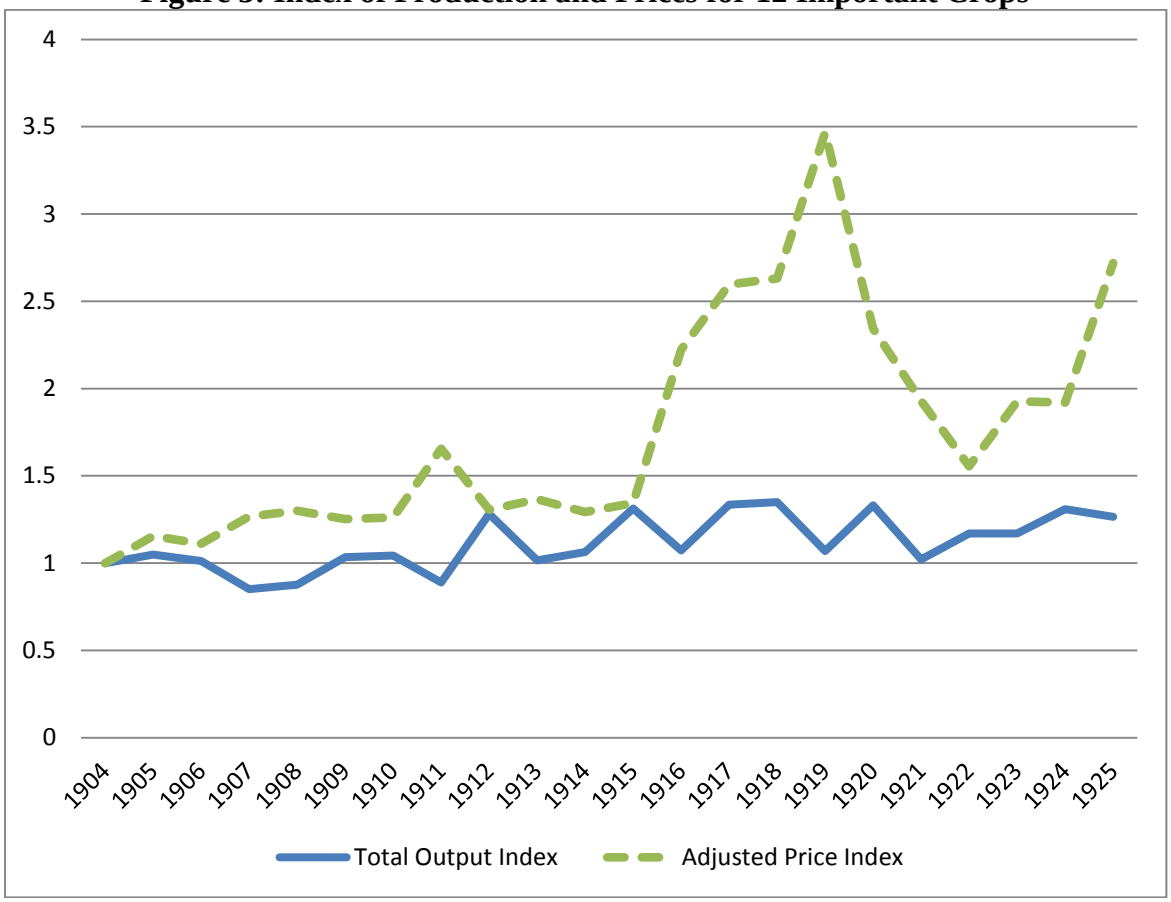
Notes: The figure maps out deposit insurance states included in the analysis in black, deposit insurance states not included in the analysis in dark grey, and bordering non-deposit insurance states that we use as a comparison group in light gray. Boundaries obtained from Minnesota Population Center (2004).

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



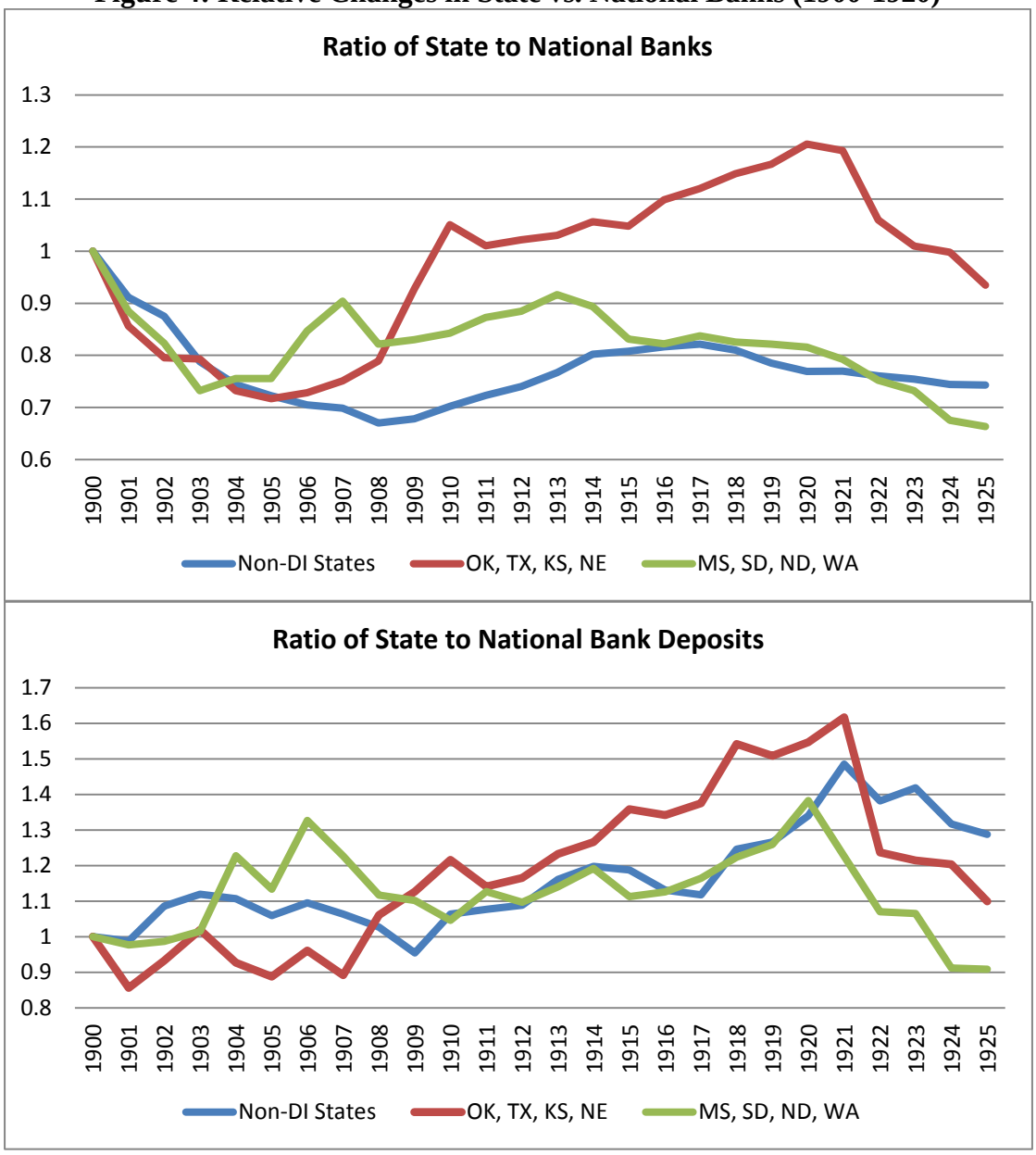
Notes: Figures display the aggregate number of banks or deposits by state group. "Non-DI States" consists only of the comparison group of non-deposit insurance states seen in Figure1. See data section for sources.

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



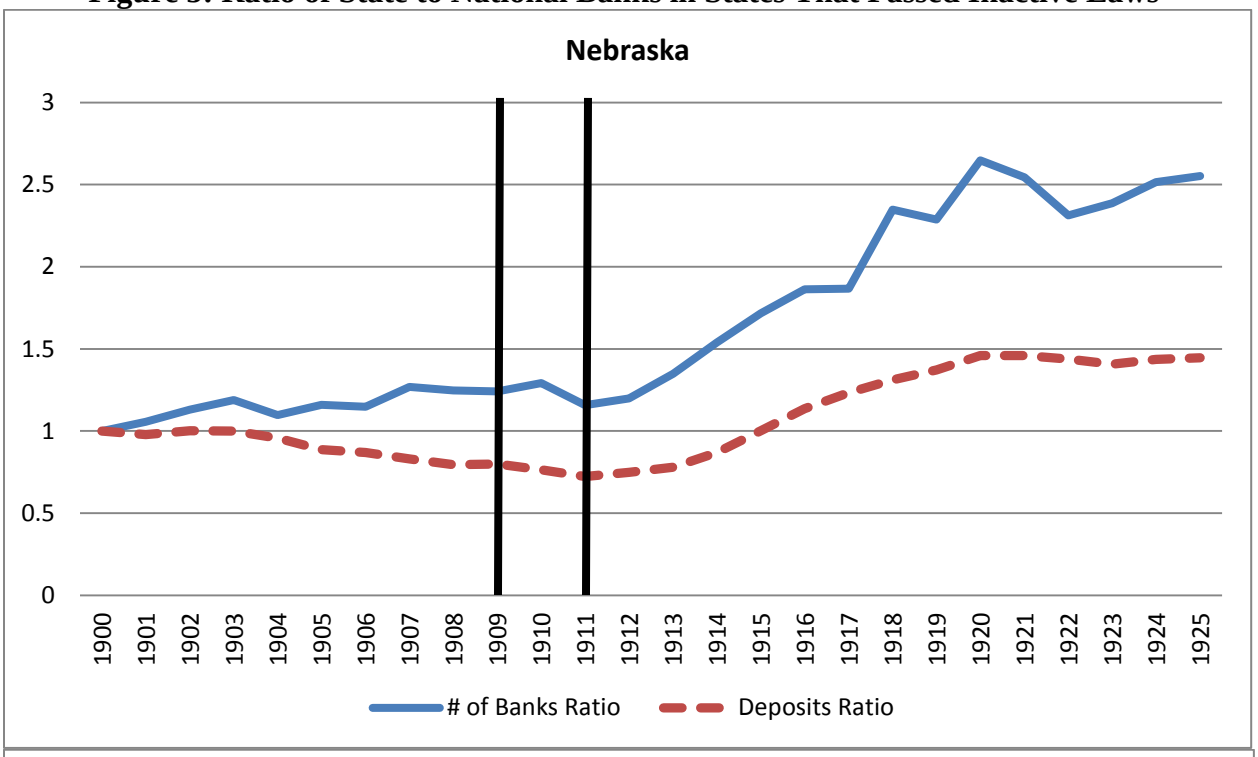
Notes: Table presents output and price indices for 12 crops: corn, barley, flaxseed, rice, oats, wheat, hay, rye, buckwheat, cotton, tobacco, sweet potatoes, and Irish potatoes. Output is based off the physical quantity produced and price is adjusted for unit values. All values are normalized to 1 in 1904.

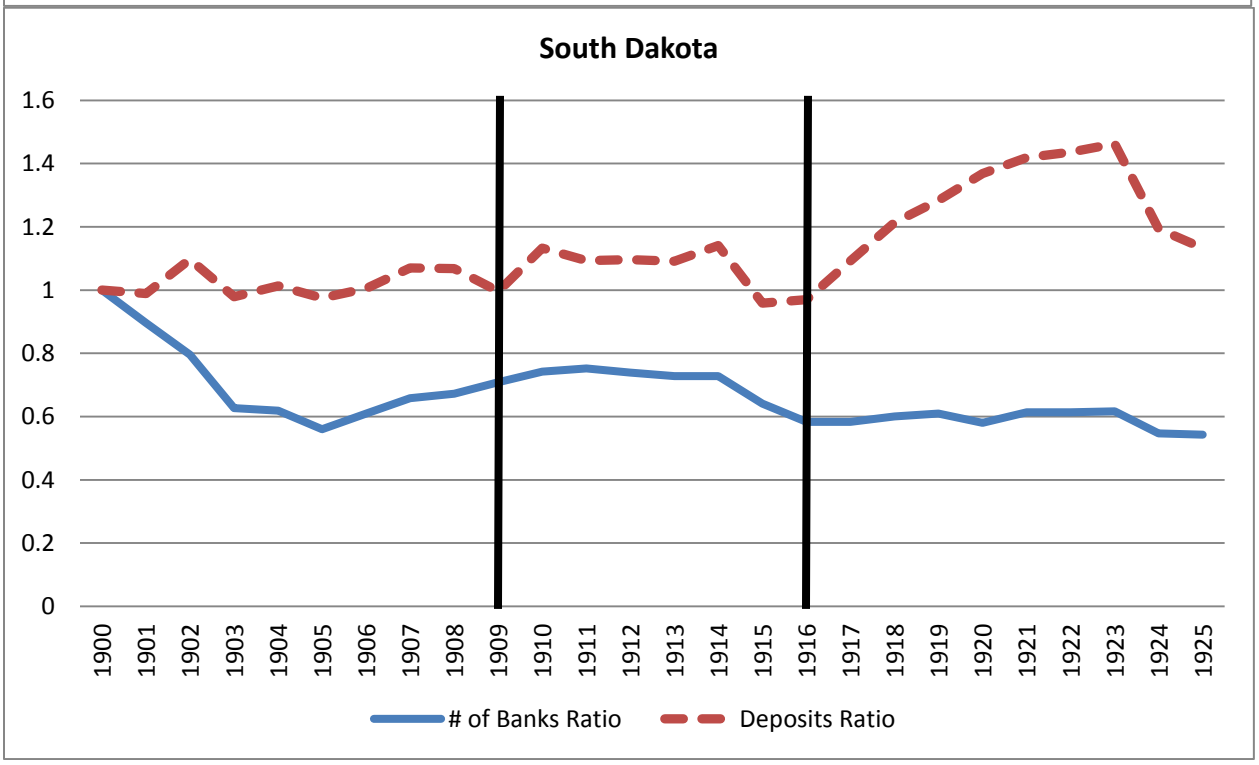
Figure 4: Relative Changes in State vs. National Banks (1900-1920)



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. "Non-DI States" consists only of the comparison group of non-deposit insurance states seen in Figure1. See Data section for sources.

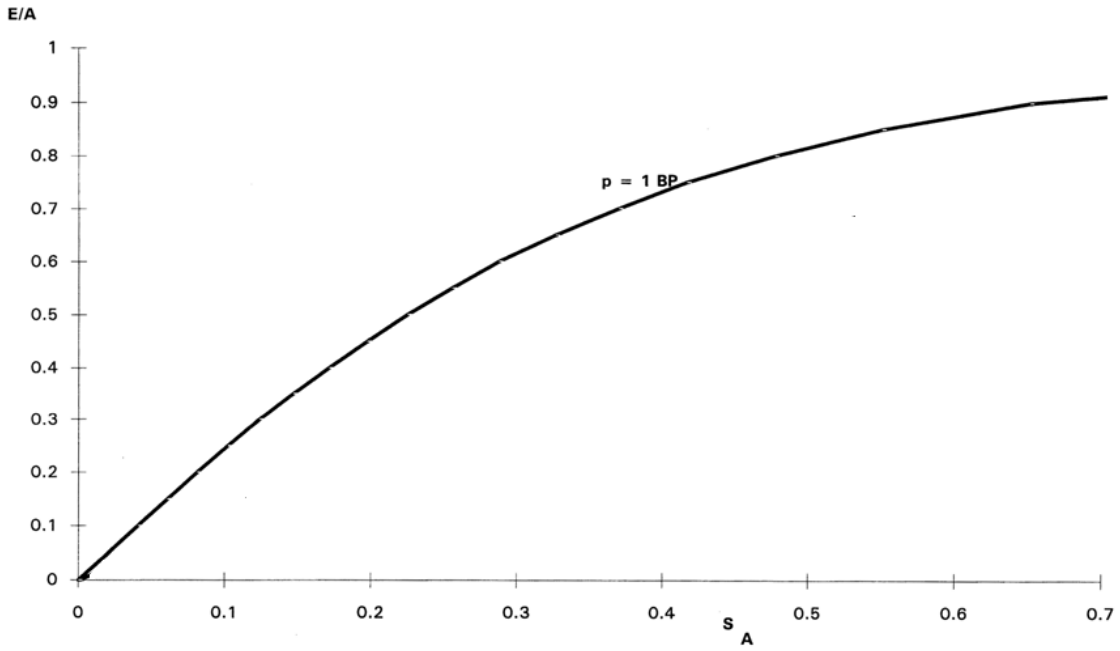
Figure 5: Ratio of State to National Banks in States That Passed Inactive Laws





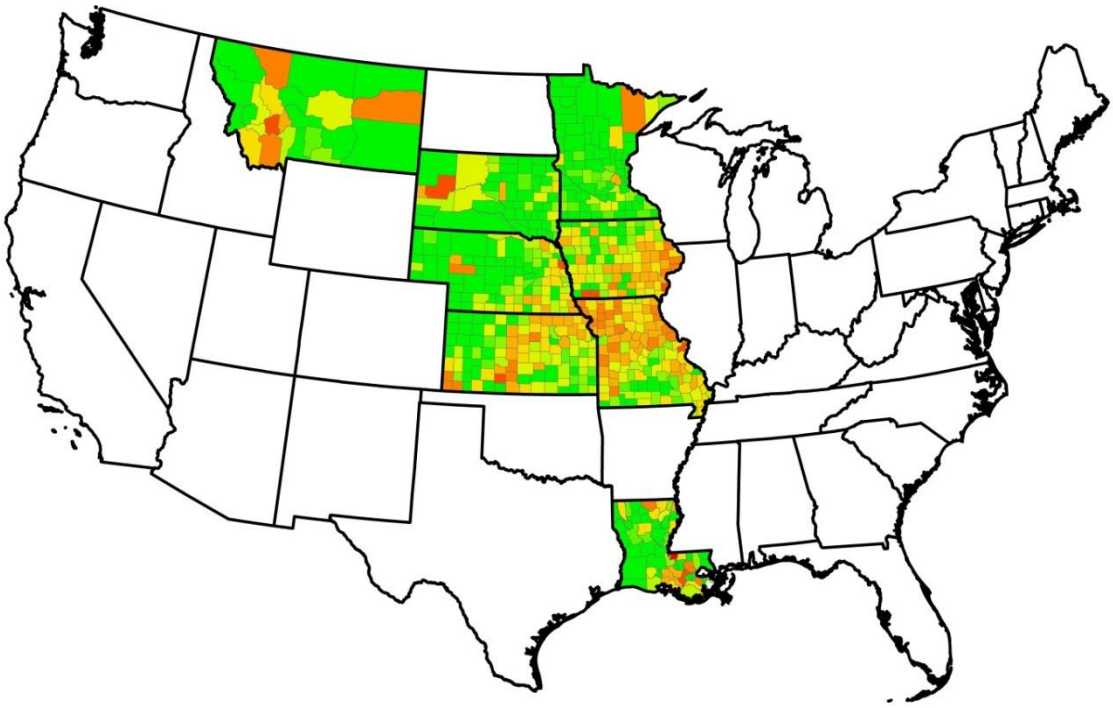
Notes: Figures present the ratios of the number of state banks to national banks (# of Banks Ratio) and state bank deposits to national bank deposits (Deposits Ratio) in each state during each year. The ratios for each group are normalized to 1 in 1900. The first line denotes each state's passage of 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

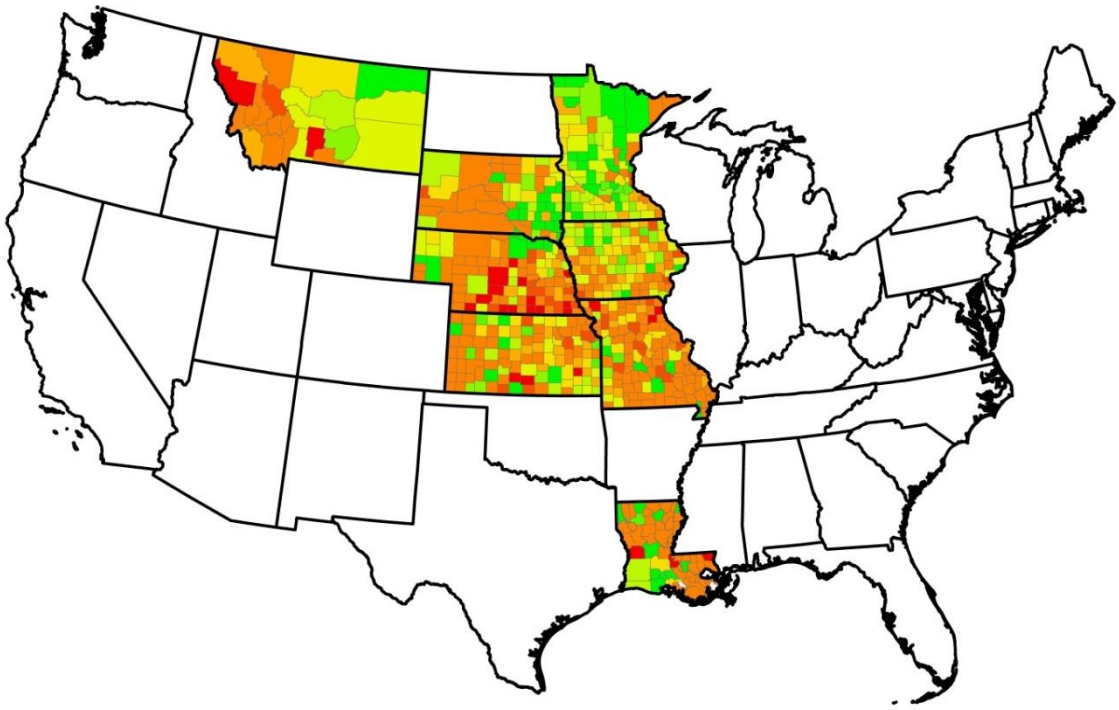


Notes: The figure displays the combination of asset risk and equity-to-assets that equates the actuarially fair default risk premium on deposits (p) to the required level of default risk in a Black Scholes. Figure adopted from Calomiris and Wilson (2004).

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



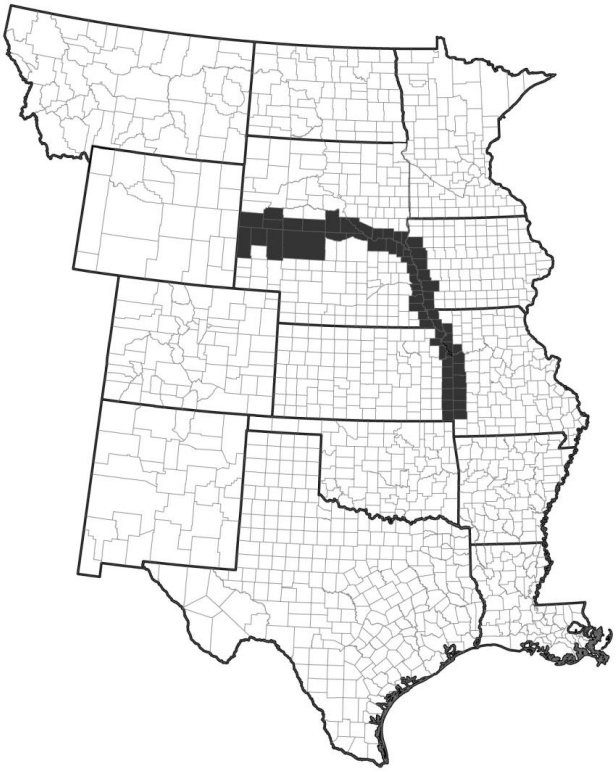
Panel B: National Banks



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. Boundaries obtained from Minnesota Population Center (2004). See Data section for sources.

Figure 8: Counties Included in Border County Regressions

Panel A: Border Counties in 1900-1914 Sample



Panel B: Border Counties in 1900-1920 Sample

Notes: Shaded counties denote counties that are included in the "Border County" regressions. Boundaries obtained from Minnesota Population Center (2004).

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 Comparison 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 Comparison 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: Data Availability at Bank-Level

States	Years When Balance Sheet Data Are Available	Missing Reports	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: Table displays information on the state banking reports published by the various states. Only states that passed deposit insurance before 1914 and surrounding states are included. "Years When Balance Sheet Data Are Available" denotes the years when balance sheets were published in the reports and the reports have survived. "Missing Reports" denotes years when balance sheet was reported but the reports have not been found. "Included in Sample" denotes states that will be included in the bank-level regressions.

Table 4: Effect of Deposit Insurance on 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	-0.091	-0.053	-0.151	0.089	-0.026	0.013	-0.097
	[0.075]	[0.092]	[0.094]	[0.109]	[0.072]	[0.075]	[0.081]	[0.075]
State Bank * Post-1908		0.153		0.099		0.168*		0.090
		[0.096]		[0.079]		[0.085]		[0.070]
DI Active in State * State Bank		0.119		0.196		0.229**		0.221*
		[0.148]		[0.182]		[0.098]		[0.111]
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	0.864	0.852	0.862	0.864	0.885	0.871	0.883

Notes: Table 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 comparison states are included. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, and the fraction of population living in a location of 2,500 or more. Robust standard errors are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 5: Effect of Deposit Insurance on Deposits at the Bank-Level (1900-1920)

	ln(Individual Deposits)							
	1900-1920				1900-1914			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DI Active In State	0.073***	-0.092***	-0.092***	-0.183***	-0.054***	-0.154***	-0.154***	-0.244***
	[0.015]	[0.019]	[0.019]	[0.021]	[0.016]	[0.023]	[0.023]	[0.024]
State Bank*Post-1908		0.092***	0.094***	0.091***		0.085***	0.085***	0.078***
		[0.015]	[0.015]	[0.015]		[0.015]	[0.015]	[0.015]
DI Active in State*Member Bank		0.248***	0.140***	0.184***		0.166***	0.107***	0.139***
		[0.021]	[0.024]	[0.025]		[0.023]	[0.026]	[0.028]
DI Active in State*Member Bank *Small Bank			0.186***				0.108***	
			[0.025]				[0.024]	
DI Active in State*Young Bank				0.261***				0.252***
				[0.029]				[0.030]
DI Active in State*Member Bank *Young Bank				0.121***				0.064
				[0.038]				[0.041]
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	66,391	66,391	66,391	66,391	41,835	41,835	41,835	41,835
R-squared	0.308	0.317	0.319	0.328	0.311	0.316	0.317	0.324

Notes: Table displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only states that published data between 1902 and 1920 are included in the regression (See Table 3). Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 6: Effect of Deposit Insurance on Deposits of Border Counties at the Bank-Level (1900-1920)

	ln(Individual Deposits)							
	1900-1920				1900-1914			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DI Active In State	0.093**	-0.083**	-0.085**	-0.169***	0.054	-0.065	-0.065	-0.174***
	[0.037]	[0.037]	[0.037]	[0.046]	[0.036]	[0.039]	[0.039]	[0.043]
State Bank*Post-1908		0.054	0.057	0.045		0.086*	0.087*	0.072
		[0.044]	[0.044]	[0.042]		[0.044]	[0.044]	[0.044]
DI Active in State*Member Bank		0.259***	0.116*	0.191***		0.187***	0.091*	0.180***
		[0.051]	[0.066]	[0.062]		[0.043]	[0.049]	[0.058]
DI Active in State*Member Bank *Small Bank			0.270***				0.197***	
			[0.074]				[0.071]	
DI Active in State*Young Bank				0.328***				0.293***
				[0.069]				[0.057]
DI Active in State*Member Bank *Young Bank				0.120				0.080
				[0.091]				[0.087]
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	7,928	7,928	7,928	7,928	5,691	5,691	5,691	5,691
R-squared	0.173	0.179	0.183	0.190	0.164	0.169	0.170	0.175

Notes: Table displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only banks in the border counties seen in Figure 8 are included in the regression. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 7: Separating The Effects of Voluntary and Involuntary Deposit Insurance Systems at the Bank-Level (1900-1920)

	ln(Individual Deposits)							
	1900-1920				1900-1914			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Voluntary DI Active In State	0.015	-0.086***	-0.147***	-0.159***	-0.082***	-0.153***	-0.194***	-0.218***
	[0.020]	[0.026]	[0.031]	[0.027]	[0.021]	[0.028]	[0.033]	[0.029]
Involuntary DI Active In State	0.110***	-0.102***	-0.109***	-0.153***	-0.020	-0.156***	-0.161***	-0.209***
	[0.018]	[0.023]	[0.023]	[0.027]	[0.018]	[0.029]	[0.029]	[0.032]
State Bank * Post-1908		0.093***	0.081***	0.096***		0.086***	0.077***	0.083***
		[0.015]	[0.016]	[0.015]		[0.014]	[0.015]	[0.014]
Voluntary DI Active In State * Member of System		0.205***	0.169***	0.203***		0.143***	0.120***	0.148***
		[0.032]	[0.033]	[0.038]		[0.031]	[0.031]	[0.036]
Involuntary DI Active In State * Member of System		0.273***	0.166***	0.178***		0.186***	0.133***	0.130***
		[0.025]	[0.030]	[0.031]		[0.030]	[0.033]	[0.035]
Voluntary DI Active In State * Member of System * Small Bank			0.175***				0.116***	
			[0.033]				[0.029]	
Involuntary DI Active In State * Member of System * Small Bank			0.196***				0.115***	
			[0.029]				[0.029]	
Voluntary DI Active In State * Young Bank				0.331***				0.279***
				[0.045]				[0.044]
Involuntary DI Active In State * Young Bank				0.159***				0.158***
				[0.041]				[0.050]
Voluntary DI Active In State * Member of System * Young Bank				-0.027				-0.037
				[0.065]				[0.063]
Involuntary DI Active In State * Member of System * Young Bank				0.245***				0.217***
				[0.048]				[0.058]
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	66,391	66,391	66,391	66,391	41,835	41,835	41,835	41,835
R-squared	0.308	0.317	0.320	0.327	0.311	0.316	0.317	0.323

Notes: Tables displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only states that published data between 1902 and 1920 are included in the regression (See Table 3). Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 8: Effect of Deposit Insurance on 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	-0.020***	-0.026***	0.028***	0.025***	0.005**	0.018***	-0.048***	-0.044***	0.039***	0.032***	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		-0.016***		0.009**		0.007***		-0.008*		0.011**		0.007***
		[0.004]		[0.004]		[0.002]		[0.005]		[0.005]		[0.002]
DI Active in State * Member Bank		0.009*		0.005		-0.019***		-0.007		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	66,391	66,391	66,391	66,391	66,391	66,391	41,835	41,835	41,835	41,835	41,835	41,835
R-squared	0.164	0.165	0.088	0.088	0.295	0.296	0.100	0.101	0.118	0.119	0.119	0.120

Notes: Table displays the results of a linear regression with the dependent variable listed in the column headings. Each observation is a bank-year. Only states that published data between 1902 and 1920 are included in the regression (See Table 3). Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 9: Forecasting Deposit Growth At State Banks Using Market Discipline Measures (1900-1920)

	Change in ln(Individual Deposits)									
	Panel	Cross-Sections								
	1900-1920	1904	1906	1908	1910	1912	1914	1916	1918	1920
DI Active In State	-0.360***				-0.343**	0.180	0.008	-0.959***	0.141	0.092
	[0.062]				[0.146]	[0.124]	[0.129]	[0.145]	[0.094]	[0.093]
L.Loans/Assets	-0.321***	-0.739***	-0.406***	-0.425***	-0.154*	-0.375***	-0.239***	-1.553***	-0.139**	0.494***
	[0.064]	[0.103]	[0.073]	[0.071]	[0.093]	[0.080]	[0.080]	[0.100]	[0.061]	[0.069]
L.Loans/Assets*DI	0.553***				-0.215	-0.328**	-0.047	1.650***	0.107	0.083
Active In State	[0.110]				[0.210]	[0.150]	[0.161]	[0.175]	[0.121]	[0.120]
L.Capital/Assets	4.453***	2.574***	2.615***	2.639***	1.889***	2.529***	1.470***	3.701***	2.767***	2.615***
	[0.216]	[0.154]	[0.127]	[0.114]	[0.122]	[0.097]	[0.087]	[0.092]	[0.081]	[0.106]
L.Capital/Assets*DI	-0.691**				1.712***	0.030	-0.540**	-1.702***	-1.717***	-1.119***
Active In State	[0.333]				[0.346]	[0.194]	[0.210]	[0.193]	[0.209]	[0.232]
L.Real Estate Owned/Assets	-2.017***	-1.192***	-1.411***	-0.474*	0.806***	-1.453***	0.144	-5.002***	-0.533**	1.402***
	[0.651]	[0.369]	[0.328]	[0.288]	[0.291]	[0.265]	[0.215]	[0.227]	[0.231]	[0.301]
L.Real Estate Owned/Assets*DI	2.870***				-2.302**	-0.381	0.599	5.612***	2.702***	2.835***
Active In State	[0.740]				[1.113]	[0.674]	[0.686]	[0.489]	[0.538]	[0.702]
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	44,458	2,453	3,015	3,799	4,362	4,924	5,295	5,809	6,136	6,626
R-squared	0.238	0.138	0.155	0.167	0.117	0.196	0.098	0.348	0.194	0.143

Notes: Table displays the results of a linear regression with the percentage change in deposits as the dependent variable. Each observation is a bank-year. Only states that published data between 1902 and 1920 are included in the regression (See Table 3). All national banks are dropped from the sample. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. 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: Effect of Deposit Insurance on 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	-0.004	-0.034	-0.066	-0.019	-0.115	-0.056	-0.133*
	[0.103]	[0.102]	[0.088]	[0.082]	[0.148]	[0.084]	[0.102]	[0.068]
Involuntary DI Active In State	-0.042	-0.110	-0.062	-0.183	0.114	-0.004	0.044	-0.079
	[0.089]	[0.094]	[0.134]	[0.131]	[0.079]	[0.078]	[0.104]	[0.084]
State Bank * Post-1908		0.154		0.100		0.169*		0.091
		[0.096]		[0.079]		[0.086]		[0.071]
Voluntary DI Active In State *		0.039		0.065		0.194**		0.153**
Member of System		[0.096]		[0.079]		[0.086]		[0.071]
Involuntary DI Active In State *		0.135		0.243		0.236**		0.245*
Member of System		[0.171]		[0.237]		[0.105]		[0.129]
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	0.852	0.864	0.852	0.863	0.865	0.886	0.872	0.884

Notes: Table 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 states that passed deposit insurance before 1914 and surrounding comparison states are included. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, and the fraction of population living in a location of 2,500 or more. Robust standard errors are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table A.2: 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	-14.837		-22.752	
	[24.586]		[27.453]	
DI Ever Installed * Linear Trend	0.008	0.009	0.012	0.014
	[0.013]	[0.013]	[0.014]	[0.016]
DI Ever Installed * State Bank			16.168	
			[22.530]	
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: Table 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 comparison states are included. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, and the fraction of population living in a location of 2,500 or more. Robust standard errors are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table A.3: Effect of Deposit Insurance on 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	0.240***	0.241***	0.240***	0.244***				
	[0.035]	[0.035]	[0.035]	[0.035]				
DI Member*Post-1908	0.108***	0.028	0.097**	0.034	0.103***	0.020	0.091**	0.021
	[0.037]	[0.041]	[0.038]	[0.040]	[0.037]	[0.042]	[0.038]	[0.042]
DI Member*Post-1908*Small Bank		0.130***				0.134***		
		[0.040]				[0.041]		
DI Member*Post-1908*Border			0.072				0.076	
			[0.059]				[0.060]	
DI Member*Post-1908*Young Bank				0.318***				0.351***
				[0.043]				[0.043]
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	7,999	7,999	7,999	7,999	6,350	6,350	6,350	6,350
R-squared	0.406	0.408	0.406	0.415	0.434	0.436	0.434	0.446

Notes: Table displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only Kansas banks are included in the sample. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. 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: Effect of Deposit Insurance on Deposits of Border Counties at the Bank-Level (1900-1920)

	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: Table displays the results of a linear regression with deposits as the dependent variable. Each observation is a bank-year. Only banks in the border counties seen in Figure 8 are included in the regression. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table A.5: 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	-0.309***				-0.185	0.391**	0.129	-0.848***	0.463***	0.043
	[0.104]				[0.182]	[0.176]	[0.224]	[0.224]	[0.157]	[0.143]
Involuntary DI Active In State	-0.358***					0.102	-0.078	-1.132***	-0.106	0.383**
	[0.077]					[0.202]	[0.195]	[0.208]	[0.123]	[0.150]
L.Loans/Assets	-0.333***	-0.790***	-0.502***	-0.377***	-0.159*	-0.375***	-0.242***	-1.565***	-0.147**	0.491***
	[0.067]	[0.114]	[0.075]	[0.069]	[0.090]	[0.078]	[0.081]	[0.102]	[0.062]	[0.070]
L.Loans/Assets* Voluntary DI Member * DI Active	0.516**				0.051	-0.874***	0.033	1.685***	-0.127	0.239
	[0.243]				[0.264]	[0.227]	[0.325]	[0.306]	[0.241]	[0.222]
L.Loans/Assets* Involuntary DI Member * DI Active	0.574***					0.021	-0.103	1.803***	0.317**	-0.219
	[0.106]					[0.239]	[0.230]	[0.249]	[0.156]	[0.192]
L.Capital/Assets	4.436***	2.597***	2.518***	2.474***	1.886***	2.526***	1.475***	3.696***	2.766***	2.619***
	[0.224]	[0.164]	[0.126]	[0.110]	[0.118]	[0.095]	[0.089]	[0.094]	[0.082]	[0.108]
L.Capital/Assets* Voluntary DI Member * DI Active	-0.809				-0.184	0.993***	-1.321***	-2.101***	-2.637***	-1.322**
	[0.619]				[0.492]	[0.302]	[0.465]	[0.407]	[0.513]	[0.663]
L.Capital/Assets* Involuntary DI Member * DI Active	-0.769***					-1.041***	0.165	-1.607***	-0.951***	-1.864***
	[0.203]					[0.301]	[0.286]	[0.250]	[0.262]	[0.310]
L.Real Estate Owned/Assets	-1.973***	-1.165***	-1.635***	-0.158	0.783***	-1.425***	0.139	-5.007***	-0.539**	1.357***
	[0.669]	[0.386]	[0.323]	[0.273]	[0.283]	[0.258]	[0.219]	[0.232]	[0.236]	[0.306]
L.Real Estate Owned* Voluntary DI Member * DI Active	1.725				0.647	-3.038***	-0.082	6.054***	0.998	1.862
	[1.480]				[1.472]	[1.113]	[1.292]	[1.099]	[1.286]	[1.519]
L.Real Estate Owned* Involuntary DI Member * DI Active	3.556***					3.318***	0.887	5.670***	2.739***	4.427***
	[0.559]					[1.026]	[0.999]	[0.610]	[0.642]	[0.905]
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	41,521	2,245	2,790	3,553	4,075	4,600	4,971	5,469	5,796	6,174
R-squared	0.242	0.140	0.162	0.172	0.103	0.208	0.105	0.348	0.201	0.139

Notes: Table displays the results of a linear regression with the percentage change in deposits as the dependent variable. Each observation is a bank-year. Only states that published data between 1902 and 1920 are included in the regression (See Table 3). National banks are dropped from the sample. Census variables include the logarithm of population, the logarithms of crop and manufacturing output per person, the percent change in crop output per period, the fraction of population living in a location of 2,500 or more, number of state banks, number of national banks, and whether a clearinghouse operated in the county. Standard errors clustered at the county-level are provided in brackets. * denotes significance at 10%; ** at 5% level and *** at 1% level.