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THE SLACK BANKER DANCES: DEPOSIT INSURANCE AND RISK-TAKING IN THE BANKING COLLAPSE OF THE 1920'S

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"The Slack Banker Dances:" Deposit Insurance and Risk-Taking in the Banking Collapse of the 1920s

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Abstract

This paper studies the effects of deposit insurance on bank behavior using individual bank data from Kansas in the 1920s. Kansas banks were severely stressed by the collapse of agricultural prices in 1920 and resulting increase in farm mortgage defaults. Because membership in the state deposit insurance system was voluntary, it is possible to compare the behavior of insured and non-insured banks facing similar exogenous circumstances. We find that deposit insurance encouraged excessive risk-taking, which helps to explain the comparatively high failure rate of insured banks. The deposit insurance fund ultimately failed to reimburse many depositors of failed banks. We find, however, no evidence of a decline in the credibility of insurance, and hence in the ability of insured banks to take excessive risks, before the system's collapse in 1926.

"The Slack Banker Dances:" Deposit Insurance and Risk-Taking in the Banking Collapse of the 1920s

"If the deposits of most depositors are as safe in one bank as in another, by reason of the government guaranty, a continually increasing proportion of bank customers are going to keep their deposits and do their banking business at those banks that are the most 'liberal' in their loan policies. For it is to be remembered that the weak banks get the same insurance as the strong ones, and, unlike the situation with other kinds of insurance, the bad risk pays no more for its insurance than the good one. This means competition among banks in slackness in the granting of loans. The bank with the loose credit policy gets the business and the bank with careful, cautious credit policy loses it. The slack banker dances and the conservative banker pays the fiddler. If the conservative banker protests, the slack one invites him to go to a warmer climate. Soon all are dancing and the fiddler, if paid at all, must collect from the depositors or from the taxpayers."[1]

The high number of bank and savings and loan failures in the United States since 1980 has provoked considerable interest in the causes of banking instability. Many researchers have blamed federal deposit insurance for encouraging banks and S&Ls to take excessive risks that resulted in more failures and greater losses than would have occurred otherwise.[2] Because depositors are insured against loss (to the extent of insurance coverage), they have no incentive to monitor their bank's activities or to demand risk premia on deposit interest rates. Consequently, a bank's expected profit from investing in high-risk assets is greater than it would be in the absence of deposit insurance. Risk-taking could be discouraged by charging banks risk-adjusted insurance premiums, but to date such a policy has not been implemented.[3]

The bank failures of the 1980s were startling, but not without precedent. Failures also rose sharply during the 1920s, averaging 635 per year from 1921 to 1929. While there was not federal insurance of bank deposits, eight states had insurance plans for their state-chartered

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[1] E. W. Kemmerer in an address to the Savings Bank Association of Massachusetts on September 14, 1933. [Association of Reserve City Bankers (1933, pp. 40-41)]

[2] See O'Driscoll (1988), Kane (1989), and Kaufman (1989, pp. 208-209), for example.

[3] Although federal deposit insurance has been in place since 1933, bank failures were not high until the 1980s because excessive risk-taking was discouraged by entry barriers that protected bank charter values. What incentive remained was contained by regulations that limited competition among banks and S&Ls for deposits. Over time, however, limits on entry have been relaxed and bank and S&L liabilities have been deregulated. High and volatile interest rates and a sharp recession in the early 1980s pushed many institutions toward insolvency, and thereby increased the incentive to take excessive risks. Deregulation allowed them to attract funds by offering high deposit rates plus federal insurance. The decline in agricultural, energy and real estate prices led to large loan defaults, bank and S&L insolvencies, and huge losses for the insurance funds. See Kane (1989) and Keeley (1990).

institutions.[4] From 1910 to 1920 insured banks grew rapidly, but after the collapse of commodity prices in 1920, loan defaults increased sharply and insured banks generally suffered larger losses and had higher failure rates than did non-insured banks.[5] This led Kemmerer and other contemporaries to conclude that deposit insurance encouraged excessive risk-taking and caused more bank failures than would have occurred otherwise.[6]

This paper takes a new look at the effects of deposit insurance during the 1920s. Previous research has used state level data to infer a relationship between deposit insurance and banking instability in this decade. While suggestive, most studies have not explored how deposit insurance affected bank behavior, particularly within the regulatory environment of a particular state. Here we use individual bank data from Kansas to study the impact of deposit insurance on risk-taking. The experience of Kansas is useful because of the stresses placed on the state banking system by the collapse of agricultural prices and increase in farm mortgage defaults. Moreover, because membership in the state deposit insurance system was voluntary, it is possible to compare the behavior of insured and non-insured banks facing similar exogenous circumstances.

Between September 1920 and September 1926, 122 state chartered banks failed in Kansas. Of those, 94 had been members of the insurance system (a 4.6% failure rate), and 28 had not (a 2.3% failure rate).[7] By contrast, only six federally chartered banks failed (a 0.8% failure rate).[8] Two effects of insurance might have caused the comparatively poor

[4] The states were Kansas, Mississippi, Nebraska, North Dakota, Oklahoma, South Dakota, Texas, and Washington.

[5] Calomiris (1990) finds that state banks in insurance states grew more rapidly than state banks in non-insurance states, after controlling for other aspects of bank structure, such as the extent of branch banking, and changes in economic activity. Then, during the 1920s, insured banks suffered larger asset declines than non-insured banks in other states. Alston, Grove and Wheelock (1991) find that the failure rates of rural banks were higher in states that had insurance systems during the 1920s, again after controlling for economic conditions and other variables suggested as causes of bank failures.

[6] See Cooke (1909, 1923), Robb (1921), Harger (1926), American Bankers Association (1933), and Association of Reserve City Bankers (1933) for further evidence that contemporaries understood well the incentives created by deposit insurance.

[7] We end our study in 1926 when, as discussed below, the withdrawal of most banks effectively ended deposit insurance in Kansas.

[8] National banks, trust companies, unincorporated banks, and state banks not meeting the various other membership requirements were ineligible for insurance system membership.

performance of insured banks. The Kansas system appears to have subsidized risk-taking, creating a "moral hazard" since insurance premiums were low and imperfectly tied to failure risk. Excessive risk-taking induced by insurance might thus have caused the higher failure rate of insured banks. Alternatively, since risk-prone banks benefit most from insurance in terms of lower deposit costs, the system may have merely sorted risk-prone from conservative banks. Thus, "adverse selection" might explain the higher failure rate of insured banks -- the system simply attracted banks that were more likely to fail in any event. A principal goal of this paper is to discern whether the Kansas system suffered from moral hazard, adverse selection, or both.[9]

In a previous study (Wheelock and Kumbhakar (1991)), we introduced a model that sought to explain simultaneously a bank's risk-taking and its decision whether carry deposit insurance. We estimated the model for 1910 to 1920, years when there were few failures and the insurance system was growing, both in terms of membership and portion of the state's bank deposits. We found both that deposit insurance encouraged risk-taking and that the insurance system attracted the most risk-prone banks.

In this paper we are interested in the behavior of Kansas banks when failures were high and the insurance system was under stress, and so we estimate our model from 1922 to 1926. A number of events, such as the failure of the state's largest insured bank in 1923 and the suspension of all insurance fund payments in 1925, likely affected perceptions about deposit insurance. If depositors began to question the credibility of insurance, they may have begun to monitor the use of their deposits, demand risk premia on deposit interest rates, and withdraw their funds from banks taking unacceptable risks. This would have reduced the incentive and

[9] We say that "adverse selection" was present if inherently risky banks were more likely to join the insurance system. A strict definition, however, requires the presence of asymmetric information (see Wilson (1989)). Since the risk measures that we observe, such as the capital/asset ratio, were available to Kansas banking officials, a finding that the average riskiness of insured banks was higher than that of non-insured banks is not necessarily evidence of adverse selection in the strict sense. Nevertheless, we choose to conform with the term's usage in the banking and deposit insurance literature (e.g., Calomiris (1989)). For moral hazard to occur, information need not by asymmetric. Since limited liability insures banks against extremely unfavorable outcomes, "moral hazard may not be resolved even where actions can be costlessly observed ex post" (Kotowitz (1989, p. 210)).

ability for insured banks to be riskier than non-insured banks, and we test whether these events discouraged insured banks from holding less capital than non-insured banks.[10]

To study further the impact of deposit insurance, we attempt to predict the failure of individual banks using balance sheet information on a date prior to failure. Mispriced deposit insurance encourages banks to hold riskier assets and less capital than they would otherwise. The experience of failed savings and loan institutions in the 1980s suggests, moreover, that capital and portfolio risk are interrelated. Kane (1989) shows that "zombie" S&Ls, i.e., those that were insolvent but permitted by regulators to remain open, often adopted very high-risk strategies in an attempt to recover solvency. Once equity has been wiped-out, shareholders stand to benefit if a gamble should pay-off but incur no loss if it does not. In the absence of insurance, depositors would withdraw their funds, and thereby effectively close an insolvent bank. But deposit insurance insulates depositors from risk, leaving the insurance fund or, as with federal insurance today, the taxpayer to absorb any loss. We test whether insured Kansas banks increased portfolio risk as their capital fell by including an interaction term of insurance status and capital in our failure prediction model.[11]

The Kansas Deposit Insurance System

Kansas was the second state to adopt an insurance system following the Panic of 1907. An increase in bank failures and the adoption of insurance by Oklahoma in early 1908 were the principal motivations. Robb (1921, pp. 107-12) notes that bankers located along the Oklahoma border lobbied intensely for insurance, fearing competition from the Oklahoma banks that eagerly advertised their insurance.

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[10] A notable difference between insurance today and the state systems of the 1920s is that the state systems were not guaranteed by the state. In the event that the insurance fund was insufficient to reimburse depositors, it was the depositors, not taxpayers, who lost. This difference is significant because if depositors lose confidence in the system they will, in theory, demand risk premia on deposit interest rates that erases the incentive for banks to take excessive risks.

[11] The inclusion of this interaction term and hence the explicit test of moral hazard extends the model in Wheelock (1992). That study found that insured banks had a greater probability of failure than non-insured banks, holding constant other balance sheet information, but did not test directly whether risk-taking increased as capital fell.

Deposit insurance was made voluntary in Kansas in response to complaints that insurance penalizes conservative banks by forcing them to protect depositors of banks that are more likely to fail. State officials were well aware that deposit insurance could be attractive to risk-prone institutions, and imposed a number of regulations to limit adverse selection. Banks were required to have been in business for at least one year and undergo an examination before being admitted to the insurance system. Insured banks were further required to maintain capital of at least 10 percent of total deposits,[12] and surplus and undivided profits of at least 10 percent of total capital.[13]

To limit risk-taking by insured banks, the state imposed interest rate ceilings on insured deposits and set insurance premiums that were inversely related to a bank's capital to deposit ratio. Premiums were initially set at 1/20th of 1% of a bank's insured deposits *less* capital and surplus. Because of the low assessment rate, however, the reward for holding extra capital was small relative to its cost.[14] If necessary to maintain the solvency of the insurance fund, assessments could be increased to 1/4th of 1% of deposits. Banks were required to deposit $500 of cash or eligible bonds with the state treasurer for each $100,000 of insured deposits to guarantee assessment payment. Banks could withdraw from the insurance system with six months notice; they remained liable, however, for assessments needed to reimburse depositors of failed banks during that period.[15] Finally, the state bank commissioner had the authority to suspend insurance for any bank found in violation of state regulations.[16]

In its early years the deposit insurance system was popular with both bankers and depositors. From 1909 to 1920, the number of insured banks and the deposits in those banks

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12 This regulation was repealed in 1917 [Warburton (1958a, p. 21)].

13 Total capital is the sum of the par value of the bank's stock, the paid-in surplus, and undivided profits.

14 A bank with $100,000 of eligible deposits, for example, would be charged $45 per year if it had capital and surplus of $10,000, or $42.50 if it had $15,000 of capital and surplus.

15 See Cooke (1909) for a complete list of membership requirements and a comparison with those of other states.

16 The reports of the bank commissioner do not state whether the insurance of any banks was suspended, and so we have been unable to determine whether this threat was credible. Apparently at least one bank lost its insurance, but Warburton (1958a, p. 15) reports that he found no other cases.

grew faster than those of non-insured state and national banks. The state bank commissioner reported in 1920 that

> The Guaranty Law has successfully gone through the experimental stage of its existence, and to-day stands as a cornerstone in the great financial structure of modern business.... It has grown in popularity among the people, and banks operating under it seem to grow and prosper. [Kansas (1920, p. 5)]

The collapse of farm output prices in mid-1920, and the resulting increase in loan defaults and bank failures soon changed perceptions about the deposit insurance system. Special assessments were imposed on insured banks to reimburse depositors of failed institutions, including a $1.4 million levy to reorganize the American State Bank of Wichita, the state's largest insured bank, which failed in 1923. After peaking at 65.6% of eligible banks in that year, insurance system membership began to decline as banks withdrew to escape the prospect of still more assessments.

Despite special insurance assessments in each year beginning in 1922, the insurance fund proved inadequate to reimburse depositors of all failed banks. The liability created in 1919 by the second failure of an insured bank exceeded the balance of the insurance fund. By 1923 the fund owed $5 million more than its accumulated balance of $852,000 [Warburton (1958a, p. 57)]. The deficit did not necessarily imply that the system was bankrupt, since depositors were reimbursed only after the liquidation of a failed bank's assets.[17] It should have been apparent, however, that the fund would not be able to pay all depositors of failed banks without higher assessments and a decline in failures.

Continued failures and inadequate revenue forced the state bank commissioner to suspend the payment of insurance claims in March 1925. On April 10, 1926, the state supreme court ruled that member banks could withdraw from the system simply by forfeiting the bonds or cash they had deposited as a guarantee of assessment payment. The apparent reduction in the cost of withdrawal led many banks to exit, and membership fell from 61.6% of eligible banks in December 1925, to 42.2% in December 1926, and to 8.9% in December

[17] Depositors of failed banks were issued interest bearing negotiable certificates that were redeemed as failed bank assets were liquidated.

1927 [FDIC (1956, p. 68)]. Although the fund was not closed until 1929, the supreme court decision effectively ended the insurance of bank deposits in Kansas.[18]

Over the life of the insurance system, depositors of just 27 failed banks recovered the entire amount of their insured deposits, while those of two other banks received 93% and 95% of their deposits [Warburton (1958a, pp. 27-29)]. No insurance payments were made to depositors of 88 member banks that failed [FDIC (1956, p. 58)]. On average, holders of insured deposits received 53% of their funds from liquidation of bank assets and 18% from the deposit insurance fund (including 7% from the reorganization of the American State Bank). The remaining 29% of insured deposits were never recovered.

Was there a Decline in the Credibility of Insurance?

While depositors of many failed banks ultimately discovered that the insurance system would not make them whole, *ex ante* they probably had faith in the system. The quick and complete reimbursement of depositors of the two insured banks that failed before 1920 likely enhanced confidence in the system. At some point, however, it must have become apparent that the deposit guaranty was "an experiment that failed" [Harger (1926)]. The system's deficit and the withdrawal of many banks led the bank commissioner to write in 1926 that "I can see little to encourage one to believe that the guaranty fund will ever pay out, and it is my hope that the next legislature will repeal the law..." [Kansas (1926, p. 4)]. Did the system lose credibility before 1926? And, if so, did that affect the behavior of depositors and hence of insured banks?

The sharp rise in bank failures after 1920, and the resulting increase in insurance fund liabilities and delays in payment of claims probably led some depositors to question the

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[18] Before the court ruling fixed the cost of withdrawal, a withdrawing bank was held liable for assessments needed to reimburse depositors of banks failing while the bank was a member of the insurance system, which included a mandatory six months notice period. A withdrawing bank lost the benefits of insurance, while saving only the amount of expected assessments needed to reimburse depositors of banks that failed more than six months in the future. The potential saving might have been large, but apparently before 1926 relatively few banks determined that it was large enough to warrant withdrawal. Only one bank in our sample withdrew between 1924 and 1926, and none did between 1920 and 1924.

promise of insurance and to shift their funds to banks that seemed less likely to fail. After reaching 43.8% of the state's bank deposits in 1921, insured banks then lost market share to non-insured state and national banks [FDIC (1956, p. 68)]. The failure of the American State Bank may have raised further doubts about the adequacy of the insurance fund, although Cooke (1923, p. 124) reports that when the bank failed "comparatively few depositors even went down to look in." Since the bank's reorganization protected depositors, the event might have enhanced the system's credibility. But further failures in 1923 "disturbed some depositors," according to Cooke (p. 124), and the suspension of all fund payments in 1925 undoubtedly increased concerns about the system. The withdrawal of a majority of member banks following the supreme court ruling in 1926 must have finally eliminated any faith in the system that remained.[19]

The comparatively high failure rate of insured Kansas banks suggests that the regulations imposed to limit risk-taking were not entirely effective. Table 1 reports a comparison of the capital adequacy of a sample of insured and non-insured state banks on balance sheet reporting dates from 1920 to 1926.[20] In each year the average capital/asset ratio of the insured banks was significantly less than that of the non-insured banks (at the .05 level or better). The difference in the ratios for insured and non-insured banks ranges from .0182 in 1920 to .0284 in 1926.[21] A similar comparison for an alternative measure of capital adequacy, the ratio of surplus and undivided profits to total loans and discounts (surplus/loans), reveals further that insured banks maintained less capital than non-insured

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[19] We are currently examining newspaper accounts in order to gain further insight into contemporary views of the system's credibility.

[20] Our random sample consists of approximately one-fourth the total number of state chartered banks that were eligible for deposit insurance in 1914 and also operating in each year from 1910 to 1920. We collected data for each bank from the Biennial Reports of the Kansas Commissioner of Banking that were published in even numbered years (except 1912 and 1916) from 1910 to 1926. Although each bank in our sample was in business from 1910 to 1920, mergers and suspensions eliminated some banks thereafter.

[21] The differences in the other years for which we have data (1910, 1914, and 1918) also fall within this range.

banks.[22] Since better capitalized banks can withstand a greater decline in asset value before becoming insolvent, this suggests why the failure rate of insured banks was higher than that of non-insured banks.

If depositors lost faith in the insurance system, the cost of deposits should have risen for insured banks, implying that the average deposits to assets ratio of insured banks should have fallen toward that of non-insured banks. Similarly, the capital/asset ratio of insured banks should have risen toward that of non-insured banks. In fact, the differences in the deposits/assets and capital/asset ratios of insured and non-insured banks peaked in 1926, as did the average deposits/assets ratio of insured banks. If there was a decline in the credibility of insurance before 1926, these data do not reveal it.

Simple comparison of capital/asset ratios for insured and non-insured banks does not indicate whether deposit insurance encouraged insured banks to hold less capital, or merely sorted inherently risk-prone from conservative banks.[23] We attempt to separate the possible moral hazard and adverse selection effects with following model:

$$Y_1 = \alpha_1 Y_2^* + \beta_1 X_1 + u_1 \qquad (1)$$

$$Y_2^* = \alpha_2 Y_1 + \beta_2 X_2 + u_2 \qquad (2)$$

where Y_1 measures bank risk and Y_2^* measures a bank's (unobserved) desire to belong to the deposit insurance system. We replace Y_2^* with Y_2, which is a dichotomous variable defined as:

$Y_2 = 1$ if $Y_2^* > 0$

$Y_2 = 0$ otherwise.

In other words, a bank joins the insurance system only when its desire to do so exceeds a certain threshold (which we normalize to zero). We measure risk with the capital/asset ratio,

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[22] We find that the surplus/loan ratio is a particularly useful predictor of bank failure: the lower the ratio, the more likely a bank was to fail. The difference in this ratio between insured and non-insured banks is statistically significant only in 1920.

[23] In Wheelock and Kumbhakar (1991) we attempted to predict insurance system membership in 1910 using balance sheet information from 1908, the year before insurance was begun. We found that risk-prone banks were more likely to join the system in that the lower a bank's capital/asset ratio in 1908 the higher the probability that it would have deposit insurance in 1910.

and hence the higher is this ratio, the lower is risk. Thus α_2 will be negative if adverse selection is present. Similarly, if deposit insurance leads a bank to increase risk, then α_1 will be negative. X_1 and X_2 represent exogenous variables we believe might have affected bank risk and the desire to carry deposit insurance.

We estimate (1) and (2) using a two-stage procedure. First we estimate the reduced form equations of (1) and (2) to construct the fitted values of Y_1 and Y_2^*, $\hat{Y}_1$ and $\hat{Y}_2^*$. Next we estimate (1) using OLS, replacing Y_2^* with $\hat{Y}_2$ and estimate (2) with maximum likelihood probit, replacing Y_1 with $\hat{Y}_1$.[24]

In addition to deposit insurance system membership, we include a number of variables as regressors in the capital/asset equation to explain bank risk. Banks in regions severely affected by economic distress would likely have suffered loan losses that reduced their capital/asset ratios regardless of whether or not they carried deposit insurance. Alston, Grove and Wheelock (1991) find that states with comparatively rapid increases in agricultural land value or improved acreage during World War I suffered the worst agricultural distress and had the highest bank failure rates following the collapse of commodity prices in 1920. Thus we include the percent change in county land value (ΔLandvalue), improved acreage (ΔImpacre), and the percent change in county population (ΔPop) from 1910 to 1920 to control for the effects of economic activity on capital/asset ratios.[25] We use an alternative measure of economic conditions, the percent change in county farm land and building value (ΔLBval) from 1920 to 1925 in one specification.

Another possible source of variation in bank capital/asset ratios stems from competitive forces brought about by transportation improvements in rural areas. After 1910 many farmers purchased an automobile or truck for the first time and rural roads were markedly improved. The impact of these improvements should have been most dramatic in rural areas where there were relatively many banks serving geographically isolated markets. Because branching was

[24] For a complete discussion of our model and estimator see Wheelock and Kumbhakar (1991).

[25] Changes in improved acreage tended to be highest in western counties since most of eastern Kansas was already cultivated by 1910, while changes in land value per acre were greatest in eastern Kansas.

not permitted, rural counties with low population densities typically had the highest numbers of banks per person. We thus include the ratio of total banks to county population (Bankpop) and the percent rural of county population (Rural) as regressors.[26] Finally we include bank age (Age) to capture any intangibles, such as management skill, that may be correlated with age and affected a bank's capital/asset ratio.[27]

Bank age may also have affected a bank's decision to join the deposit insurance system. Wheelock and Kumbhakar (1991) find that older banks were less likely to become members at the system's inception, perhaps because they already enjoyed a lower cost of deposits than their newer competitors. We expect that a bank's decision to join the system was also influenced by the actions of its closest competitors. In order to compete successfully for deposits, a bank might have been more likely to join the insurance system if most of its competitors were also members, regardless of its own preferences for risk. Banks in counties with few members might have felt less competitive pressure to join themselves. We therefore include the ratio of insured to total banks in a bank's county (DIratio) as a regressor. We also include the ratio of total banks to county population (Bankpop). Counties with the highest numbers of banks per capita probably experienced the greatest increases in competition from rural transportation improvements. Banks in these counties might have been more likely to join the deposit insurance system in effort to compete successfully in the new environment.

Table 2 reports second-stage estimates of the capital/asset model, and Table 3 reports estimates of the insurance system membership model. Equation 2.1 is an estimate for 1910 to 1920, taken from Wheelock and Kumbhakar (1991), for comparison. In these years we find evidence that insurance system membership encouraged risk-taking. The coefficient estimate on $\hat{DI}$ indicates that insurance system membership caused a bank's capital/asset ratio to decline

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[26] See Alston, Grove and Wheelock (1991) for references and analysis of the consequences of this technological change on bank failures.

[27] We also include regional and year dummy variables. A full description of our data and sources is presented in the appendix.

by .0077, which is approximately 40% of the average difference in this ratio between insured and non-insured banks from 1910 to 1920.

Equation 2.2 is the same specification estimated for 1922 to 1926. Again it appears that deposit insurance encouraged member banks to hold less capital than non-insured banks. The difference in the capital/asset ratios of insured and non-insured banks averaged .024 in these years, and thus the coefficient estimate on $\hat{DI}$ indicates that 50% of the difference can be explained by risk-taking caused by deposit insurance. We find also that the older a bank, the lower its capital/asset ratio. Finally, we note an apparent correlation between local economic activity from 1910 to 1920 and bank capital during the early 1920s. Banks in counties where population or land value increased most from 1910 to 1920 had systematically lower capital ratios during the 1920s, while those in counties where improved farm acreage increased most had higher capital ratios. Land value tended to increase most in eastern counties, where agricultural distress was most severe during the 1920s, while improved acreage rose the most in western counties from 1910 to 1920. Banks in counties where the change in farm land and building value from 1920 to 1925 was highest had lower capital/asset ratios (Equation 3.3).[28]

Equations 2.4 and 2.5 test whether the impact of deposit insurance on risk-taking changed over time. In Equation 2.4, we test for a break after 1922. The coefficient on $\hat{DI}1$ measures the impact of insurance in 1922, while that on $\hat{DI}2$ measures the impact in 1924 and 1926. In Equation 2.5, we test for a break after 1924, letting the coefficient on $\hat{DI}1$ measure the impact in 1922 and 1924, and that on $\hat{DI}2$ measure the impact in 1926. The point estimates indicate no decline in the effect of insurance system membership on bank risk. If anything, the impact appears greatest in 1926. As with the simple comparison of capital/asset ratios for insured and non-insured banks in Table 1, the model estimates in Table 2 suggest that insured banks continued to exploit deposit insurance through 1926.

During the first ten years of deposit insurance in Kansas, the system apparently attracted the most risk-prone banks. The coefficient on the capital/asset ratio ($\hat{C/A}$) in

[28] None of the coefficients on the regional or year dummies is statistically significant.

Equation 3.1 indicates that the lower a bank's ratio, the greater the likelihood that it would choose to belong to the insurance system. A bank's membership decision also appears to have been affected by the membership of its competitors: a bank was more likely to join the system if many of its local competitors were also members.

During the 1920s, a bank's membership decision again reflected the membership status of other local banks. We do not find, however, that the probability of membership was higher the lower a bank's capital/asset ratio in these years. Our results suggest that before 1920, deposit insurance attracted risk-prone banks and encouraged greater risk-taking. After 1920, we find that deposit insurance continued to encourage banks to hold less capital, but detect no evidence that the system attracted banks that were inherently more risk-prone.[29]

Deposit Insurance and Bank Failure

Insured banks had a higher failure rate than their non-insured competitors, and our empirical results indicate that deposit insurance encouraged banks to hold less capital than they would otherwise. In this section, we examine further the relationship between insurance and bank failure by attempting to determine the characteristics that made some banks more likely to fail than others. For each state bank that failed between September 1920 and September 1926, we obtained its most recently published balance sheet prior to failure.[30] Since balance sheets were published biennially (in August), the length of time between the balance sheet and failure dates could extend from one month to two years. We also collected data for similarly sized random samples of non-failing banks in the same biennial intervals.[31] We use these data to

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[29] Since our sample consists only of banks that operated since 1910, it omits any that were organized because of the presence of deposit insurance. This might bias our results against finding adverse selection.

[30] Here failure refers to any bank whose operation was suspended or halted by state regulators due to insolvency. It excludes banks that liquidated voluntarily. We also estimated our model with data from the second to most recent balance sheet before failure. As might be expected, these data are less useful for predicting failure, although we found no substantive differences with the estimates using data closer to failure date. These results are available upon request.

[31] We omitted any bank that had been chartered within the previous eighteen months because of the provision that banks chartered for less than one year were ineligible for deposit insurance.

estimate a probit model in which the dependent variable is set equal to 1 if the bank failed within two years of its most recent balance sheet date and to 0 if it did not.

The incentives for risk-taking created by deposit insurance are well known and derived theoretically by Merton (1977) and by Kareken and Wallace (1978). If insurance premiums do not increase with the level of bank risk, then banks have an incentive to assume more risk than they would in the absence of insurance. In Merton's model, insurance encourages a bank to hold riskier assets and a lower capital/asset ratio than it would otherwise.

Our finding that insured Kansas banks had lower capital/asset and surplus/loan ratios is consistent with Merton's model. The balance sheet data available for Kansas banks do not, however, reveal the quality of bank assets. We therefore include deposit insurance as a separate regressor in our failure prediction model to test whether it had an impact on failures apart from a possible influence on observed financial ratios. The insurance variable is a dummy, 1 if the bank was insured, 0 if not. We expect that the coefficient will be positive, i.e., that insurance increased the likelihood of failure.

It is important to note, however, that the effect of deposit insurance should depend on bank solvency. That is, the less capital that bank shareholders have at stake, the greater the incentive to gamble with bank assets. In the case where equity is entirely wiped-out, but deposit insurance and regulatory forbearance permit a bank to remain open, shareholders have an incentive to take extreme risks. Kane (1989) cites the failure to close insolvent institutions as the main reason why losses to the deposit insurance system grew explosively during the 1980s. Warburton (1958a, p. 19) reports that in Kansas, "Banks found to be insolvent or in financial difficulties were nursed along by the [banking] department instead of being closed." He gives no indication of when this policy was in effect, how many insolvent banks were permitted to remain open, or how banks responded to forbearance. He implies, however, that the policy was unsuccessful.[32] Even if bank capital is not completely eroded, there is an

[32] At least two other states experimented with forbearance--Nebraska and Texas. There is no indication of how many insolvent banks regained positive net worth, but in both states there were many subsequent closures of banks that had been insolvent for some time. See Calomiris (1989) and Warburton (1958b).

incentive to increase portfolio risk as net worth declines.[33] We test for this effect by interacting deposit insurance membership with the capital ratios in our failure prediction model, and expect that a decline in net worth increased the probability of failure more for insured banks than for non-insured banks.

We include a number of financial ratios, suggested by White (1984), as independent variables. The capital/asset and surplus/loans ratios are included since, for a given asset portfolio, the less a bank's capital, the lower its protection against failure: "If there is a significant difference in one of these ratios between failing and non-failing banks, it indicates that closure occurred in part because the banks had either suffered from defaults on their earning assets or invested insufficiently in capital given the risks embodied in their loan portfolio" (White, p. 123).

Loans tend to be the most risky assets that banks hold. It is likely, moreover, that the loans of rural unit banks in the 1920s were not well diversified. We therefore expect that the higher the ratio of loans and discounts to total assets (loans/assets), the greater the probability of bank failure. On the other hand, if a bank invested a large portion of its assets in high quality bonds it may have had less chance of failure. We include the ratio of total bonds to total assets (bonds/assets) as a regressor, but because the average quality of the bonds that Kansas banks held is not known, the sign of this variable's coefficient cannot be predicted.

Reserves provide banks with funds to accommodate deposit withdrawals. The higher the ratio of cash and exchange to total deposits (cash/deposits), the better able is a bank to satisfy these demands, and hence the coefficient of this variable should be negative. The primary source of funds for a bank are deposits. In the face of heavy deposit withdrawals or loan defaults, however, a bank may be unable to attract sufficient deposits to remain liquid, and therefore must resort to alternative sources of funds. A high ratio of short-term borrowings (bills payable and other liabilities) to total assets (bills pay./assets), suggests that a bank's condition is precarious and the greater the likelihood of its failure. On the other hand,

[33] See Furlong and Keeley (1989) and Keeley (1990).

we expect that the higher the ratio of total deposits to total assets (deposits/assets), the lower will be the probability of bank failure.

Bank size, as measured by the log of total assets (*ln* assets), and the number of years the bank had been chartered (Age) are included as additional independent variables. The majority of banks failing during the 1920s were small, rural unit banks. While the principal determinant of failure seems to have been the agricultural depression, other forces tended to enhance the fortunes of large banks relative to small banks. Reduced transportation costs brought about by improved roads and increased use of motor vehicles by farmers, for example, made it easier for rural residents to bank further from home and possibly take advantage of better terms offered by larger banks in bigger towns.[34] We therefore expect that larger banks were less likely to fail. We include bank age to capture such intangibles as management quality and goodwill, which may have made a bank less likely to fail. The coefficient on this variable should be negative.

Equations 4.1 and 4.2 in Table 4 are model estimates based on the entire data set. Equations 4.3 and 4.4 include only those banks that failed within twelve months of their balance sheet date, while Equation 4.5 includes only those failing between 13 and 24 months after their statement date.[35] Each regression indicates that the lower a bank's surplus to loans ratio, the higher was its probability of failure.[36] Banks with low capital were less able to withstand declining asset values. Our results suggest also that banks with large bond portfolios tended to have a lower chance of failure, as did those with high reserve ratios. Banks that relied heavily on bills payable and other short-term borrowings for funds tended to have a higher failure probability. There is some indication that the older a bank, the less likely it was

[34] Numerous studies have found evidence of economies of scale in banking, and there is evidence that city banks were able to offer customers better terms than could rural banks during the 1920s. Several contemporaries and historians have linked improvements in transportation to rural bank failures during the 1920s. See Alston, Grove and Wheelock (1991).

[35] To save space, we do not report the analogue of Equations 4.1 and 4.3 for banks failing more than twelve months after their balance sheet date.

[36] In general, this ratio was more useful for predicting failure than was the capital/asset ratio, probably because the capital/asset ratio is highly correlated with other ratios. White (1984) also found this dichotomy.

to fail, but there is no apparent relationship between bank size and failure after controlling for other effects.[37]

In addition to the financial ratios, deposit insurance membership is a useful predictor of failure. Its inclusion adds statistically significant explanatory power to the model.[38] Evaluated at the mean of the data, deposit insurance membership increases the probability of failure by 16%. The evidence is consistent with the hypothesis that insured banks held riskier portfolios, which increased their probability of failure.

A lesson of the S&L crisis of the 1980s is that risk-taking increases as a bank approaches insolvency. We expect, therefore, that insurance system membership will be especially useful for distinguishing banks near failure from non-failing banks. When banks failing more than 12 months after their balance sheet date are omitted, the coefficient on deposit insurance is nearly twice as large as when all data are used (compare Equations 4.3 and 4.1). The inclusion of deposit insurance also adds statistically significant explanatory power (at the .01 level).[39] At the mean values, insurance system membership increases the probability of failure by 18%.

To test further whether risk-taking increased as net worth declined, we include an interaction of deposit insurance status and the surplus/loan ratio ((DI)(S/L)). Doing so does not add statistically significant explanatory power, but the negative coefficient on this term is consistent with the hypothesis that insured banks became riskier, and hence more likely to fail, as their capital fell.[40]

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[37] Surprisingly, the results seem to indicate that the higher a bank's loan to asset ratio or the lower its deposit to asset ratio, the less its chance of failure. These results are likely due to multicollinearity, however, as loans/assets is correlated with cash/deposits (correlation coefficient of –0.79) and deposits/assets is correlated with bills pay./assets (correlation coefficient of –0.86). When cash/deposits and bills pay./assets are omitted, the coefficients on loans/assets and deposits/assets have the anticipated signs.

[38] A likelihood ratio test of the null hypothesis that the inclusion of deposit insurance as a regressor adds no explanatory power can be rejected at the .10 level. The test statistic is 3.604, while the critical chi-square value is 2.706.

[39] The test statistic equals 6.366, while the critical chi-square value is 6.635.

[40] As might be expected, the interaction term is highly correlated with its two components. Its correlation coefficient with deposit insurance membership is 0.64 and with surplus/loans is 0.61.

Conclusion

Researchers conclude that the present system of federal deposit insurance encourages excessive risk-taking that, coupled with partial deregulation, led to more bank and S&L failures during the 1980s than would have occurred otherwise. Contemporaries saw a similar phenomenon during the 1920s, and noted that deposit insurance permitted risk-prone banks to flourish. This paper contributes further evidence that deposit insurance encouraged excessive risk-taking during the 1920s by comparing the performance of insured and non-insured banks facing similar economic and regulatory conditions.

Economic theory predicts that a bank with deposit insurance will hold riskier assets and less capital than it would in the absence of insurance. We find that insurance encouraged Kansas banks to hold lower capital/asset ratios than non-insured banks. We also find that, holding capital constant, deposit insurance increased the probability that a bank would ultimately fail. And we find, moreover, that for a given decline in net worth, the probability of failure rose more for an insured bank than for a non-insured bank. Thus our evidence suggests that insured banks had riskier portfolios than non-insured banks, and that portfolio risk rose as net worth fell.

Like other state deposit insurance systems, the Kansas insurance fund was not guaranteed by the state. If the fund had insufficient assets to reimburse depositors of failed banks, then depositors, not taxpayers, suffered. Thus, if depositors began to question the solvency of the insurance system, they would have had an incentive to monitor bank risk, demand risk premia on deposit interest rates, and withdraw funds from banks taking unacceptably high risks. Once all credibility was gone, insured banks should have faced the same deposit supply curve as non-insured banks, and the incentive to take excess risk should have disappeared. We find, however, no evidence that the incentive for insured banks to hold less capital diminished over time in Kansas, despite increasing deficits in the state insurance fund and delays (and ultimately, suspension) in the payment of insurance claims.

TABLE 1

A Comparison of Insured and Non-insured Banks

1920

	C/A	S/L	D/A	obs.
Insured	.1314*	.0808*	.8379*	143
Non-insured	.1496	.0951	.8166	69

1922

	C/A	S/L	D/A	obs.
Insured	.1576*	.0941	.7896	140
Non-insured	.1809	.1047	.7700	62

1924

	C/A	S/L	D/A	obs.
Insured	.1583*	.1013	.8138	134
Non-insured	.1793	.1154	.7965	55

1926

	C/A	S/L	D/A	obs.
Insured	.1469*	.0959	.8408*	122
Non-insured	.1753	.1067	.8039	55

C/A is the capital/asset ratio; S/L is the surplus/loans ratio; D/A is the deposits/assets ratio.

* the hypothesis that the difference in the ratio for insured banks and for non-insured banks equals zero can be rejected (at the .05 level or better).

TABLE 2

A Test for Moral Hazard

Dependent Variable: Capital/Assets[a]

Variable	2.1	2.2	2.3	2.4	2.5
Intercept	9.52	16.55	15.95	16.13	16.28
	(6.87)***	(11.03)***	(12.59)***	(10.48)***	(10.53)***
$\hat{DI}$	−0.77	−1.22	−1.09		
	(2.86)***	(3.94)***	(3.37)***		
$\hat{DI1}$[b]				−1.37	−1.11
				(3.17)***	(3.25)***
$\hat{DI2}$[c]				−1.19	−1.45
				(3.35)***	(3.18)***
Age	−0.01	−0.07	−0.06	−0.07	−0.07
	(0.34)	(2.32)**	(2.01)**	(2.29)**	(2.27)**
Bankpop	0.46	1.50	1.15	1.46	1.49
	(0.42)	(1.40)	(1.12)	(1.36)	(1.39)
Rural	3.19	−0.78	0.23	−0.75	−0.75
	(2.71)***	(0.65)	(0.19)	(0.62)	(0.62)
ΔPop	0.01	−0.04		−0.04	−0.04
	(0.67)	(2.89)***		(2.91)***	(2.90)***
ΔImpacre	−0.00	0.05		0.05	0.05
	(0.27)	(2.68)***		(2.66)***	(2.70)***
ΔLandvalue	0.03	−0.05		−0.05	−0.05
	(1.86)*	(2.70)***		(2.72)***	(2.68)***
ΔLBval			−0.04		
			(1.56)*		
log like.	1183.82	880.18	871.85	880.58	880.50
obs.	820	568	568	568	568

Notes: t-statistics are in parentheses; ***, **, and * indicate statistically significant at the .01, .05, and .10 levels (two-tail tests).

[a] the coefficients in each regression have been multiplied by 100.

[b c] DI1 reflects the impact of insurance status before 1924 (Equation 2.4) or before 1926 (Equation 2.5), and DI2 reflects it thereafter.

Each regression also included four regional dummies and dummies for each balance sheet year.

TABLE 3

A Test for Adverse Selection
Dependent Variable: Deposit Insurance Membership

Variable	3.1[a]	3.3[b]
Intercept	0.50	−2.88
	(0.54)	(2.11)**
$\hat{C/A}$	−15.71	8.75
	(2.37)***	(1.22)
Age	0.01	0.01
	(1.40)	(1.15)
Bankpop	0.33	−0.20
	(1.26)	(0.77)
DIratio	3.23	3.72
	(9.55)***	(8.06)***
R^2	.39	.31
log like.	−377.45	−253.89
obs.	820	568

Notes: t-statistics are in parentheses; ***, **, and * indicate statistically significant at the .01, .05, and .10 levels (one-tail tests).

[a b] Equation 3.1 uses data from 1910-20 and Equation 3.2 uses data from 1922-26.

TABLE 4

Kansas Bank Failures: Probit Model Estimates

Variable	4.1[a]	4.2[a]	4.3[b]	4.4[b]	4.5[c]
Intercept	4.59	4.50	2.11	1.34	4.81
	(1.98)*	(1.93)*	(0.70)	(0.43)	(1.77)*
Surplus/	−6.19	−1.77	−6.14	−0.95	−1.53
Loans	(2.39)***	(0.45)	(1.51)*	(0.16)	(0.35)
Bonds/	−7.04	−6.82	−6.21	−5.63	−8.42
Assets	(2.46)***	(2.33)**	(1.77)*	(1.54)*	(2.29)**
Loans/	−6.60	−6.46	−8.23	−7.66	−6.00
Assets	(3.27)	(3.15)	(3.20)	(2.87)	(2.56)
Cash/	−7.80	−7.67	−9.86	−9.10	−6.74
Deposits	(4.04)***	(3.90)***	(3.68)***	(3.28)***	(3.08)***
Deposits/	1.84	1.52	6.38	6.08	0.08
Assets	(0.85)	(0.70)	(1.88)	(1.79)	(0.03)
Bills Pay./	5.67	5.41	11.46	11.31	3.69
Assets	(2.43)***	(2.31)**	(3.02)***	(2.97)***	(1.45)*
Insurance	0.39	0.88	0.76	1.29	0.93
	(1.89)**	(2.26)**	(2.41)***	(2.39)***	(2.03)**
(DI)(S/L)		−6.79		−8.70	−7.15
		(1.49)*		(1.21)	(1.39)*
Age	−0.01	−0.01	−0.02	−0.02	−0.001
	(0.57)	(0.66)	(1.39)*	(1.35)*	(0.06)
ln Assets	0.04	0.04	−0.001	0.01	0.04
	(0.29)	(0.24)	(0.01)	(0.03)	(0.22)
R^2	.25	.26	.36	.37	.19
Log Like.	−130.70	−129.60	−66.21	−65.48	−106.10
%Fail Correct	70.0	68.3	52.1	56.3	52.8
Observations	240	240	168	168	192
Failures	120	120	48	48	72

Notes: t-statistics are in parentheses; ***, **, * indicate statistically significant at the .01, .05, and .10 levels (one-tail tests); [a], [b], [c] Equations 4.1 and 4.2 include all failed banks, Equations 4.3 and 4.4 include only those failing within twelve months of their balance sheet date, and Equation 4.5 includes only those failing between 13 and 24 months of their balance sheet date.

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