Bank Deposit Pricing and Financial Distress: The Effects of Deposit Insurance and Depositor Segmentation

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Abstract

Financial distress has long been known to alter incentives of firms. Distressed firms have incentives to increase risk and gamble for survival since the cost of failure can be forced on to creditors. Past theoretical work and anecdotal evidence has suggested that when faced with financial distress and increased competition banks may gamble by raising deposit rates to attract funds and invest the funds in riskier assets. The gambling problem in distressed banks can be potentially made worse by deposit insurance which allows banks to generate funds at rates not commensurate with risk. This aggravation of moral hazard caused by deposit insurance has implications for bank deposit pricing in the sense that gambling banks may not need to bid up deposit rates as much. Past empirical evidence has found evidence that troubled banks raise deposit rates and attributed this to either gambling incentives or to market discipline enforced by uninsured depositors. This paper further examines deposit pricing strategy of distressed banks by examining multiple dimensions of deposit pricing. It provides fresh evidence for the gambling hypothesis and suggests that deposit insurance affects deposit pricing strategy of distressed banks. But I also find that deposit insurance is not the only factor; the evidence suggests that segmentation between various types of depositors also plays a significant role. The results imply that moral hazard is increased not only by deposit insurance but also by the convenience orientation of certain types of depositors.

Key Words: Banks, Deposit Insurance, Financial Distress, Pricing, and Depositor Type

JEL Classification: G21, G28, G33

1. Introduction

Because insured depositors have little motivation to monitor bank risk, they may allow banks to take excessive risk without requiring commensurate deposit rates in return. The reduced market discipline in bank deposit markets created by deposit insurance has long been a concern of regulators since this moral hazard problem comes at the expense of the final creditor, the FDIC[1]. Much of the research on market discipline and moral hazard in deposit rate setting has been examined in the context of the US banking crisis of the 1980s. This time period witnessed increased competition, a large number of bank failures, and unusually high deposit interest rates; Shoven et.al (1992) argue that it was bank deregulation during this time period that allowed for more competition and that this coupled with the existence of fixed premium deposit insurance created both the incentives and the ability for banks to compete more aggressively for deposits by bidding up deposit rates. Accordingly, it is generally believed that the lax regulatory environment and greater competition during this time period coupled with the existence of deposit insurance paved the way for this banking crisis. The extent of the crisis is easy to observe by comparing the crisis time period and later years; astoundingly, more banks and thrifts failed in each year between 1984 and 1992 then in all of the years between 1993 and 2004 combined (see figure 1).

The banking literature has often examined deposit pricing under distress under the framework of either reduced market discipline caused by deposit insurance or through gambling incentives of troubled banks caused by limited liability, which may be aggravated by deposit insurance. The market discipline literature has focused on the disciplining effect of uninsured depositors and the fact that risk of a bank or of the deposit insurer is the major factor allowing for some market discipline in bank deposit markets (Hannan and Hanweck, 1988; Park and Peristiani, 1998; and Cook and Spellman, 1994). In contrast, another stream of literature has

[1] Commercial bank and thrifts in the United States are insured by the Federal Deposit Insurance Corporation (FDIC) up to $100,000.

focused on the gambling incentives of distressed banks as the primary explanation for higher deposit rates of troubled banks (Hellman. et. al. , 1998; Hellman et. al, 2000; Keely, 1990). In this paper, I examine both of these rationales. In particular I analyze whether differential deposit pricing policies exist for distressed banks and how these policies vary with distress.

In banking as well as non-banking firms, limited liability creates a put option for owners and creates an incentive for risk taking (Myers, 1977); the problem is worse for distressed firms since the incentives for risk taking and gambling for survival are even greater (Titman, 1984; Gertner and Sharfstein , 1991). In banks this problem is potentially much more severe because deposit insurance increases the already increased risk-taking incentives of troubled banks. The excessive risk-taking or gambling explanation is also the most often sighted explanation for the excessive risk taking and high deposit rates offered by troubled banks during the 1980s banking crisis. Hellman et. Al. (2000) for example, present a banking firm specific model suggesting that that low-charter value banks may find it more profitable to gamble by bidding up deposit rates and then investing in riskier assets; this theoretical result suggests that banks facing increase competition have a lowered stream of expected profits and thus have incentives to gamble regardless of the presence of deposit insurance (Hellman. et. al., 1998). Keely (1990) further investigates the gambling behavior of low-charter value banks. He finds that CD rates for large time deposits, which he interprets to be a measure of bank risk, are higher for banks with low charter value. Although Keely concludes his results are driven by gambling incentives caused by deposit insurance and the ensuing moral hazard, they could just as well be attributed to the fact that a financially distressed bank is riskier; since large time deposits are largely uninsured, large time depositors may require better returns from troubled banks.

An alternate explanation for high deposit rates of distressed banks is based on market monitoring by certain classes of depositors. Uninsured depositors have often been thought of as part of the solution to the moral hazard problem since these depositors should require higher interest rates to compensate for increased risk. Consistent with this rationale, a stream of literature

suggests that uninsured depositors increase market discipline (Hannan and Hanweck, 1988; Park and Peristiani, 1998;Cook and Spellman,1994). Park & Peristiani (1998) and Cook and Spellman (1994), both of whom find that CD rates for uninsured thrift depositors increase significantly as distress of a bank risk increases, also interestingly discover that rates for insured depositors increase with risk, albeit not as significantly. Cook and Spellman attribute this to a lack of confidence in the solvency of the deposit insurer, the FSLIC[2]. Additionally, Park and Peristiani find that interest rates for NOW deposits, which are also mostly insured, are not affected by distress; they suggest this has to with these types of deposits being driven by transaction needs rather than by interest rates.

This paper builds on the works of Keely (1990), Hellman et. al. (1998, 2000), Park & Peristiani (1998), Cook and Spellman (1994) by making three important insights. First, both Park & Peristiani and Cook and Spellman attribute the increase of insured deposit rates with distress to a lack of confidence in the deposit insurer, the FSLIC. But this could also have been caused by gambling behavior as suggested by Hellman. Et. Al. (2000) and Keely (1990). In my study, I utilize the fact that commercial banks are insured by the FDIC and not the FSLIC. In addition, because the FDIC was not in as serious insolvency risk during the time period of study, I am able to separate out the two possible explanations for distressed banks raising insured deposit rates. My results suggest that, as with Park & Peristiani (1998) and Cook and Spellman (1994), that both uninsured and insured deposit rates increase (for investment oriented depositors). But since the FDIC was not in as serious risk of insolvency during the time period of study (relative to the FSLIC), the results imply that, contrary to Park & Peristiani's or Cook and

[2] Until 1989 thrifts were insured separately from commercial banks under the FSLIC. Under the Financial Institutions Reform, Recovery and Enforcement Act of 1989, it was abolished and its deposit insurance role was assumed by a new insurance fund, the Savings Association Insurance Fund (SAIF), which in turn was administered by the final creditor, the FDIC

Spellman's work, that the gambling explanation might be the primary factor responsible for higher deposit rates for insured depositors, at least in the case of commercial banks[3].

Second, I argue that since all depositors are not the same, distressed banks are likely to systematically pursue different deposit pricing policies for different types of depositors. Consistent with this view I find that despite that fact that both uninsured and insured deposit rates increase (excluding non-investment oriented depositors) with distress, the risk premium paid to uninsured depositors increases significantly with distress. Thus although past work (Park & Peristiani , 1998; Spellman , 1994) has found both these rates increase with distress, my paper is the first to show that the rates for insured depositors systematically increase less which suggests that regardless of gambling incentives, uninsured depositors continue to play an important monitoring role.

Finally, I find that the premium paid to investment oriented depositors over more convenience oriented depositors systematically increases with distress. Thus the relationships between (i) risk premium and distress and (ii) "investment" premium to distress suggest that moral hazard is amplified not only by deposit insurance as suggested by the risk premium, but also by the depositor lock-in-effect (convenience oriented depositors) as suggested by the "investor premium".

It is worth noting that deposit insurance need not increase risk-taking behavior or moral hazard. For instance, deposit insurance can be implicit (predictable bail outs if banks fail) or explicit. If deposit insurance is not legally guaranteed but implicit, introducing explicit deposit insurance may actually reduce moral hazard (Gropp and Vesala;2001, 2004); this is because excluding some depositors may lead to reduced risk taking incentives for banks as at least some depositors will have incentives to monitor them. Also, moral hazard may be effectively controlled despite the existence of deposit insurance if competition is limited, if banks can be made to hold

[3] Though the FDIC also faced potential insolvency during 1991, its problems were much less severe relative to the FSLIC. Also, the FDIC's troubles were not serious prior to 1991.

adequate capital, or if interest rate ceilings can be mandated (Hellmann et. al, 2000). This explains why despite the decades of existence of deposit insurance in many countries, only certain time periods in certain countries have witnessed excessive gambling behavior and moral hazard. Further, some researchers, like Karels & McClatchy (1999), have found no significant relationship between the degree of moral hazard and deposit insurance.

Nevertheless, in the absence of implicit deposit insurance, explicit deposit insurance should only work to increase moral hazard. Since explicit deposit insurance exists and has existed for decades in the U.S., deposit insurance is likely to increase moral hazard in the U.S. as suggested by Keeley (1990), Shoven et. al. (1992), Hellmann et. al. (2000), Thies and Gerlowski (1989), Grossman (1992), Gan (2004) and others. Further more, time periods of de-regulation and increased competition are likely to be associated with the greatest amount of bank gambling. As a result, I utilize U.S. data from the 1980s and early 1990s, a time period of turmoil in the banking industry with a great number of bank failures, to test my predictions.

The rest of paper proceeds as follows. In the next section I present my research design and predictions. In section 3, I describe the data and setting for the study. Finally, I present results in section 4 and draw some conclusions in section 5.

2. Research Design and Predictions

2.1 Research Design

To test my predictions that bank deposit pricing policies depend upon degree of financial distress, deposit insurance, and depositor type, I use a two-stage approach as follows:

First Stage → (1) $FD = g_1(X_1)$

Second Stage → (2) $DP=g_2(X_2, FD)$

(3) $DPD=g_2(X_2, FD)$

Here FD is a variable indicating degree of financial distress. DP represents deposit price for a particular type of deposit account. DPD represents the difference between two different types of deposit prices (multiple dimensions of deposit prices are examined). Not all deposit

price variables are equally susceptible to deposit insurance and different prices correspond to different depositor types; this helps in identifying the impact of deposit insurance and depositor type on bank pricing strategy. The explanatory variables X_1 and X_2 are a set of exogenous variables affecting degree of financial distress and deposit prices. In the first stage (equation 1), the degree of financial distress (FD) is estimated using as a logit model. This can be interpreted as a discrete time hazard rate model since each time-series observation is treated as a separate observation (Shumway,2001); the equivalence, Shumway points out, is because the asymptotic variance-covariance matrix is the same[4]. Additionally, logistic regression models have been commonly used in the banking and finance literature (Espahbodi, 1991;Hwang et Al., 1997; Park and Peristiani, 1998;Purnanandam, 2004) . The estimated probability of failure will then be used in the second stage as the proxy for degree of financial distress. This approach is helpful in relating the likelihood of distress directly to deposit pricing variables and thus will be helpful in evaluating my hypotheses. I use underlying factors likely to cause distress to proxy for likelihood of failure rather than a failure dummy (indicating future failure) because many banks that were in distress may have not actually failed. Thus this procedure helps to identify the behavior of distressed banks in general and not just those distressed banks that later failed.

The second stage regressions utilize a fixed effect regression approach to best account for bank level unobserved effects. The predicted value of FD is an estimated distress likelihood; to deal with the endogeneity problem in the second stage, predicted values for FD are used. Other potentially jointly determined right hand variables are lagged to avoid endogeneity issues. The regressions are run for each of three deposit prices and price differences.

Banks maintain multiple types of deposit accounts. Large time accounts, small time accounts, money market accounts (MMDA) and most savings accounts are usually considered to be non-transaction accounts where as negotiable order of withdrawal (NOW) accounts and other

[4] Shumway (2001) notes that given the practical equivalence of logit and the discrete time hazard model is it not surprising logit is used so often to test hazard models without mentioning why it works.

demand deposit accounts are classified as transaction accounts. But since only some of these deposits are fully insured, to account for the effect of deposit insurance, I need to further break down these classifications for the second stage of the study. Though all types of accounts have some deposits that are uninsured (above the $100,000 limit), a major portion of these are concentrated in large time deposits[5]. Thus for simplicity, I break deposit accounts into three categories and compute deposit rates separately for large time deposits (LTD), non-transaction excluding large time deposits (NTRD), and transaction deposits (TRND).

This allows the evaluating of differences in deposit pricing strategy for three different classes of deposit investors: (i) LTD investors who should be the least affected by deposit insurance, (ii) NTRD investors who are significantly affected by deposit insurance, and (iii) TRND investors who are also significantly affected by deposit insurance but also factor in the convenience issue of their relationship with a given bank in making investment decisions.

2.2 Predictions

We know from past literature that increased competition reduces bank charter values and increases incentives for risk taking (Keeley, 1990; Hellman et. al, 2000; Gan, 2004). But financial distress and low charter value are inherently related in that low charter value banks, who have a lower anticipated future stream of profits, are more likely to be in financial distress. Additionally, the risk taking incentives associated with low charter value may be further exacerbated by financial distress. Thus the assertion that gambling behavior of low charter value banks may be associated with the bidding up of deposit rates (Hellman et. al., 2000) is likely to be true of financially distressed banks. But though bidding up of deposit rates can play an important role in generating funds for distressed banks generally, these strategies need not be consistent across depositor type. In fact the particular strategy chosen should also depend on riskiness of deposits and the degree to which non-price factors affect the depositor bank relationship. Thus

[5] This simplification is likely to be roughly correct given that on average about 67% of deposits in accounts not fully insured were in large time deposit accounts even while large time deposits account for only about 11% of total deposits (based on my national sample of commercial banks between 1987 and 1992).

my hypotheses address three fundamental questions: Do distressed banks lower all dimensions of deposit prices? Do they lower some more than others? How does deposit insurance affect pricing strategy of these banks? More specifically, the hypotheses are as:

H1. Increased financial distressed leads banks to raise rates for large time depositors(LTD).

H2. Increased financial distressed causes banks to raise deposit rates for non-transaction account holders other than large time depositors (NTRD).

H3. Increased financial distressed will not cause banks to raise deposit rates for transaction account depositors (TRND).

H4: Increased financial distress leads banks to raise rates more for large time depositors(LTD) relative to other non-transaction account depositors (NTRD). Thus the risk premium should increase with distress.

H5: Increased financial distress causes banks to raise rates more for non- large time non-transaction account depositors(NTRD) relative to transaction account depositors (TRND). Thus the "investment" premium should increase with distress.

The first hypothesis is based both on the gambling hypothesis and the fact that large time deposits (which are defined as deposits above $100,000) are uninsured because they are above the FDIC insured limit. The gambling hypothesis as described by Hellman et. al. (2000) should lead troubled banks to bid up rates for all types of depositors including large time depositors in an effort to obtain funding for risky investments. But because large time deposits above $100,000 are not insured, they are inherently riskier compared to insured deposits. And since large time deposits often make up a significant chunk of bank funding (almost 20% for all banks during the time period of study), it is imperative for a distressed bank to do as much as possible to retain large time depositors or if possible expand deposits from these depositors to generate urgently needed funding (see table 1b). In order to keep large time depositors, distressed banks will have to offer a return consistent with the increased risk associated with potential

failure; thus distressed banks should be expected to offer higher deposit rates for large time deposits relative to less distressed banks.

The second hypothesis has little to do with risk and more to do with moral hazard and gambling behavior. Troubled banks will need to generate cash to fund risky investments in anyway possible. Since non-transaction account depositors (excluding large time) are mostly insured they would be likely be willing to fund distressed banks if motivated to do so by increased rates. Thus deposit insurance should allow these insured deposit investors to be among the best source of new funds and thus we should expect banks to bid up deposit rates to retain or expand deposits from this segment of depositors.

The fourth hypothesis is based on the premise that large time deposits are riskier than other types of deposits and regardless of the rate being paid on each of these types of deposits, the rate for large time deposits should be higher relative to non-large time deposits as distress increases. While, the gambling hypothesis suggests that rates for both large time depositors and non-large time non-transaction account depositors should increase for distressed banks, the much higher risk associated with large time deposits suggests that the rates for these types of deposit accounts should increase more.

The third and fifth hypotheses are based on the fact that transaction account deposit investors[6] are fundamentally different from large time and non-transaction non-large time deposit investors in that transaction depositors are much more likely to be local[7]. They are likely to choose a bank to invest deposits in more based on convenience than other types of depositors and thus will likely have higher switching costs and be less willing to shop around for a bank offering

[6] Past empirical studies in banking have defined depositors as either investors or alternatively as customers. For the purpose of this study we consider all depositors to be investors but note that some of these depositors care about convenience and other non-price aspects of their relationship with the bank more than others.

[7] Transaction accounts consist of the following: NOW (Negotiable Order of Withdrawal), demand deposits, ATS (Automatic Transfer Service), non-savings accounts from which payments can be made to third parties, and other non-savings accounts allowing payment through checks, drafts, or other similar instruments (FDIC RC-E).

better rates. This coupled with the fact that transaction deposits are mostly small and mostly insured suggests that distressed banks should not need to significantly raise rates to keep most transaction depositors. It also means that raising rates for these types of depositors is unlikely to be successful in generating substantial funding. For all of these reasons, it is unlikely distressed banks will raise deposit rates for transaction account depositors.

Overall, the hypotheses indicate that as distress increases, banks will pursue divergent pricing policies based on depositor type and whether a particular class of depositors is insured. It suggests that the risk premium (difference between LTD and NTR rates) will increase as distress increases and the "investment premium" (difference between NTR and TRN rates) will increase as distress increases. This implies also that moral hazard will increase the most for TRN depositors and the least for LTD depositors as distress increases follows (see figure 3 for a summary of these hypotheses).

3 Data and Construction of Variables

3.1 Data Sources

Commercial bank financial data is obtained on a quarterly basis from the FDIC between 1984 and 1992. This time period is exceptionally suited to the studying of the deposit pricing behavior of distressed banks given the extensive number of bank failures in this time period. Figure 1 describes failures for all U.S. banks and thrifts. The large variation in the overall interest rate environment during this time period, displayed in figure 2, also makes it an interesting time period to study bank deposit pricing strategies. Data on Treasury bill rates is obtained from the Federal Reserve historical dataset (available online); unemployment data is obtained from the Bureau of Labor Statistics (also online).

For the first stage of regressions where I estimate likelihood of failure, I include all active banks in the United States between 1984 and 1992 in my sample; banks that failed during the time period remain in the sample until the quarter of failure. For the second stage fixed effect regressions, I utilize the same national data-set but restrict my attention to the years between 1987

and 1989. The exclusion of the years 1984-1986 in the second stage was necessary because not all key variables of interest were available during this time period; the exclusion of years 1990-1992 was done to minimize any impact of FDIC insolvency risk to my results.

3.2 Construction of Variables

Summary statistics for first stage and second stage variables are provided in table 1a and table 1b respectively; all variables have been windsorized to the 1 % level[8]. More specific construction methodology for the variables used in the first and second stage of the analysis is shown below:

(1) Prices: Though deposit rate data is not readily available for all banks during this time period, interest expense and total deposit data from the FDIC can be used to compute average interest rates for a given quarter as has been done in numerous studies. In this paper, I compute deposit interest rate to be the ratio of interest expense to deposits following Shaffer (2002), Hannan & Prager (2004), Heitfield, &. Prager (2004), and others. Similar to most of these works, I first divide each bank's quarterly interest expenses for each type of account by the average of the current quarter's and previous quarter's end-of-quarter account balances for that account. Since deposit interest expense is reported on a consolidated basis, I calculated an annualized expense for each quarter prior to making the calculation. Thus based on past literature, I define as the deposit rate as the interest expense for a given quarter divided by the average of the total deposits in the quarter for each of the three types of accounts (large time, non-transaction non-large time, and transaction). For transaction account deposit rates however, following Hanan and Prager (2004), I adjust the deposit rate by subtracting out service charges from interest expense before dividing by average quarterly transaction deposits [9].

[8] Windsorizing involves setting the tail values of a particular variable to some specified quantile of the data (i.e. in this data the bottom and top 1% of each variable has been adjusted to the 1% and 99% level respectively).

[9] Service charges on deposit accounts include charges for maintenance , failure to maintain minimum balance , large number of checks drawn, exceeding minimum balance , early withdrawal , inactive account , NSF check , stop payments, certifying checks, or the accumulation or disbursement of

(2) Control Variables: The vector of control variables (X_2) used in second stage regressions includes proxies for size, concentration, and other more general controls. Proxies for these are defined as follows:

Size: Prior works have used number of employees, total assets (Ang. et al, 2002), natural log of total assets (Peek and Rosenberg, 1998) these to proxy for bank size; I follow the latter approach using natural log of assets.

Competition: For large time deposits and to a large extent non-transaction non-large time deposits, competition for deposits is likely to be national. Past papers have generally focused instead on local competition for deposits as explained by various types measures of concentration including the Herfindahl index, N-firm market share, the number of banks in the market, etc. FDIC Summary of Deposits (SOD) data, which is widely used to compute these measures, is unavailable during the time period of my sample. Instead, I focus on the fact that geographic restrictions prohibiting branching were largely established at the state level. Thus to proxy for level of competition at the state level, I use an indicator variable which indicates whether the state restricted branching in a given time period[10]. State level branching regulation data is obtained from Berger et. Al. (1995).

Quality and Efficiency in Generating Funds: I include a control variable indicating total banking offices (primarily branches). Prior work has argued that branching is a measure of bank quality (Dick, 1999); additionally, banks with more branches have more access to depositors and an easier access to funds. Both these factors imply that total offices should negatively affect bank pricing.

Experience: Older banks may have more experience and more likely to want to protect their

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IRA or Keogh plan accounts not handled by the trust department of the bank. Most of these are associated with Transaction accounts.

[10] Although concentration at the market level can not be calculated for my national sample, it can be reasonably proxied for using bank level data for states with branching restrictions since these restrictions usually prohibited branching outside a given county, city, or MSA. Using this method to estimate a Herfindahl index, I also estimate my second stage regressions only using observations from states and time periods of limited branching; the results (not reported)are largely the same.

charter values. Additionally, older banks may have more of a reputation to protect and are more likely to act conservatively in pricing strategies; they may also have a greater network of loyal deposit customers (at least at the convenience oriented deposit accounts) which might affect deposit pricing strategies.

Interest Rate Environment: The current interest rate environment at any given time will likely be a major factor in bank deposit pricing strategies. Similar to many past studies including Keeley (1990), this study uses the 3-month T-Bill Rate as the proxy for the interest environment. The Federal Reserve reports these using monthly rates so I first compute the average for each quarter to come up with a quarterly 3-month T-bill rate, which I use as a single quarterly observation.

Average Large CD Maturity: The average interest rates on large time deposits is based on the average interest expense and the average amount of these deposits in any given quarter. This could be affected by the average maturity of the large CDs. To account for this problem, I use a measure of average maturity similar to James (1987) and Keeley (1990). In particular the average maturity is a weighted average constructed using data on the amount of time deposits with maturities in various maturity horizons.[11] The measure is constructed only for large time deposit accounts due to lack of availability for small time deposit accounts. Although small deposit accounts make of a large portion of non-transaction non-large time deposits, since I don't analyze small deposit accounts separately, the lack of this data should not effect my conclusions.[12]

Dependence on Depositor Class: Some banks may depend more on large time depositors for funding while others may depend more on either non-transaction non-large time depositors or transaction depositors. Because higher dependence could affect deposit pricing strategies, I include a measure of dependence on each of the depositor classes as a control. I define

[11] For example, large time CDs with maturity of less than 3 months were assigned an average maturity of 1.5 months. Similarly large CDs with maturities in the range of 3 months to 12 months, 1 year to 3 years, and 3 or more years were assigned average maturities of 7.5 months, 24 months, and 36 months respectively.

[12] For my sample, about 65% of non-transaction non-large time deposits were made up of small time deposits.

dependence on a depositor class by being in the top quintile of banks in the percentage of total deposits contributed by a given class in a given year. According to table 2a, it appears about 19% of banks are highly dependent on each of the three deposit classes for funding.

Too Big To Fail Banks: Some researchers have argued that very large banks may be implicitly insured[13]. Since implicit deposit insurance will reduce the risk premium depositors are likely to demand, it may put downward pressure on rates for uninsured deposits. Thus I include a measure of banks that may be too fig to fail; I define this measure as banks in the top decile for size in a given year.

Failure Predictors: I use a large set of failure predictor variables (x_1) for use in the first stage of the estimation procedure; all financial variables used in the first stage regressions are scaled by assets. Based on Hwang (1997), I will use capital, profitability, and past due loans as predictors of failure; other variables are also included to the extent they have mentioned previously as proxies for risk.

Capital: Banks typically have multiple different types of capital ratios. Various papers have used different types but many have been found to be good predictors of bank failure with small caveats. Estrella et al. (1999) for example find that the leverage ratio (tier 1 capital/total assets) does not have a very different predictive power than other ratios such as the gross revenue ratio (tier 1 capital/gross revenue) or the risk-weighted capital ratio (tier 1 capital/ risk-weighted assets). The risk weighted capital ratio, which is also a good measure, is not available prior to 1990. In place of using any of these capital ratios, I will use the simple measure of total liabilities to total assets due its simplicity and easy interpretation.

[13] The high profile failure of Continental Illinois in 1984 for example gave the impression of implicit insurance as even large depositors (with deposits more than $100,000) were assured the safety of their deposits.

Other Financial Variables: Following Gan (2004), I also include brokered deposits since they might be a factor in increased risk-taking[14]. Additionally I will utilize the level of commercial and industrial loans (C&I loans) since this has been used as a proxy for commercial bank risk in the past (Gorton and Rosen, 1995; Demsetz et al., 1996). Finally, I include net income as a predictor to the extent it is a proxy for current profitability; I expect banks with low profitability to be more likely to fail.

Other Non-Financial Variables: I include a dummy indicating whether the bank was a unit bank since a lack of geographic diversity will increase exposure to a shock and make failure more likely. An unemployment rate (at the state level) is included in the model to proxy for local economic conditions which can also affect the likelihood of bank failure. Additionally, I include one-quarter change in employment since banks, like all firms, are likely to downsize in times of distress. Finally I include the 3-month T-bill rate and the 3-month volatility (standard deviation) in this rate; these variables will together help capture effects of macroeconomic interest rate environment.

4. Empirical Methodology and Results

4.1 First Stage: Overview and Results

The logistic regression in the first stage uses loans 90 days past due, liability to asset ratio, and other variables to predict probability of failure; results are presented in table 2. The dependent variable is a dummy indicating failed (1) or did not fail (0) in the next quarter and is regressed on quarterly observations of the banks in the sample between 1984 and 1992[15].

The mean for the resulting predicted failure probability variable is about .0054 which implies that on average, a bank during this period has a predicted probability of failure in the next

[14] The term "brokered deposits" implies that the deposits are obtained from or through the involvement or directly from a deposit broker; usually they are significantly costlier than core deposits in terms of interest payments and securing of large volumes of brokered deposits suggests banks are taking higher levels of risk to pay for them (Gan, 2004).

[15] For robustness, I also estimate the first stage logistic regression defining the dependent variable as failure in exactly 2 quarters, 3 quarters, or one year. The results are very similar (not reported).

two year of about 0.54%. The means for this variable including only banks that did not fail and did fail in the next quarter are .0043 and .2419 respectively[16]. The significant increase in the mean for banks that failed between these time periods suggests the model is doing a good job of capturing distress likelihood.

4.2 Second Stage: Overview

The second stage regressions examine the pricing strategies for each of three classes of deposit investors: (i) those holding large time deposits (LTD), (ii) non-transaction excluding large time deposits (NTRD), and (iii) transaction deposits (TRND). To test the first three hypotheses I regress deposit rates for LTD accounts, NTRD accounts, and TRND accounts on my proxy for distress and host of controls. The remaining three hypotheses are tested by regressing the differences in deposit rates LTD-NTRD (risk premium) and NTRD-TRND ("investment" premium) respectively, on distress and control variables. All second stage regressions are done via a fixed effect regression approach to avoid unobservable bank level effects affecting the results and using quarterly data between 1987 and 1992[17]. I also use the predicted values of distress, to eliminate potential endogeneity concerns for this variable.

4.2.1 Second Stage Results – Hypotheses 1,2, and 3

4.2.1.1. Deposit Rates and Distress

Results for tests of hypotheses 1-3 are provided in table 3a. A positive coefficient on the distress variable (probability of failure) would suggest that rates are higher for firms that are more distressed. As predicted, I find that both deposit rates for LTD accounts an NTRD accounts are significantly higher as distress increases; also as predicted, rates are not significantly higher for TRN accounts as distress increases. The higher deposit rates for LTD accounts is consistent with both the risk-premium and gambling explanations where as the higher deposit rates for NTRD

[16] The means are given only for the years 1987-1989 since this is time period of study in the second stage regressions.

[17] For robustness, I also estimate (i) 2nd stage regressions using the alternative time periods 1987-1990, 1988-1989, and 1988-1990, and (ii) using OLS regressions instead of fixed effects regressions. In all cases the results do not change qualitatively and in many cases are stronger (not reported).

should be mostly attributed to the gambling hypothesis. The lack of a significant rate increase as distress increases for TRND accounts is likely due to the convenience orientation of depositors holding these accounts; this makes raising rates unnecessary because TRND account holders are unlikely to switch banks and also unhelpful because raising rates is unlikely to attract a large amount of new funding. In fact, the results suggest that as distress increases, rates for TRND account holders actually decrease; this suggests that the lock-in-effect of transaction oriented depositors is stronger in magnitude than the gambling effect.

4.2.1.2 Deposit Rates and other Explanatory Variables

For TRND accounts, rates tend to decrease with size, since large banks may be have larger branch networks and thus easier access to deposit funding and may not need to offer as high rates. For LTD and NTRD rates I find that bank size has a positive effect on deposit rates which is in contrast to some studies that have found that larger banks tend to offer lower deposit rates; perhaps this is due to the time period. In contrast, I find that banks having a large number of offices tend to offer lower deposit rates for NTRD deposits but not for LTD or TRND deposits. I also find that the none of the rates tends to be lower for very large banks which is inconsistent with the too big to fail (TBTF) argument.

Whether a bank is highly dependent on a given type of deposit investor also seems to be significant in increasing deposit rates from that type of investor; this seems to hold for all three types of deposit accounts. Reduced competition (branching restrictions) tend to lower deposit rates offered for TRND accounts and NTRD accounts as expected but not for TRND accounts. Finally a length maturity for CDs tends to lower the deposit rate; this seems logical since the longer the maturity the lower the need to compete for new funding.

4.2.2 Second Stage Results: – Hypothesis 4,5, and 6

4.2.2.1. Deposit Rate Differences and Distress

To test hypotheses 4 and 5, I regress differences in deposit rates for LTD and NTRD accounts (i.e. the risk premium) and NTRD and TRND accounts (i.e. the "investment premium)

respectively on my proxy for distress and controls; results are shown in tables 3b. As expected both the risk premium and the "investment" premium tend to significantly be higher as the level of distress increases. Results for the difference in the first case suggests that the higher risk of uninsured deposits and gambling behavior of distressed banks are both factors affecting bank deposit pricing. Distressed banks systematically offer higher deposit rates for LTD accounts relative to NTRD accounts even though individually rates for both of these accounts increased significantly (as shown in results for hypotheses 1 and 2). In the latter case the significance is probably due to differences in priorities of NTRD and TRND depositors. Since TRND depositors are more convenience oriented, they require less of a rate markup which drives the "investment" premium up.

4.2.2.2. Deposit Rate Differences and other Explanatory Variables

Bank size did not seem to affect the regression involving the risk premium but did seem to significantly raise the "investment" premium. Bank age tends to be very significant in raising the risk premium but tends to significantly reduce the "investment" premium. The large bank dummy does not seem to affect either premium suggesting that the size variable already accounts for most of the affect on risk and "investment" premiums.

Whether a bank is dependent on a given class of depositor has a significant but inconsistent relationship on deposit rate differences. The risk premium is surprisingly positively affected by a high dependence on NTRD accounts but not by a high dependence on LTD accounts. The "investment" premium is positively related to high dependence on NTRD accounts and negatively related to high dependence on NTRND accounts as expected.

Branching restrictions tend to significantly decrease both the risk premium and the "investment" premium. In the second case, since branching restrictions reduce local competition for deposits, they might reduce the need for banks to obtain NTRD deposits at high rates from national depositors thus drive down the difference between NTRD and TRND rates. Similarly

reduced competition would reduce the need for banks to compete for LTD depositors and thus would drive down the risk premium.

5. Conclusions

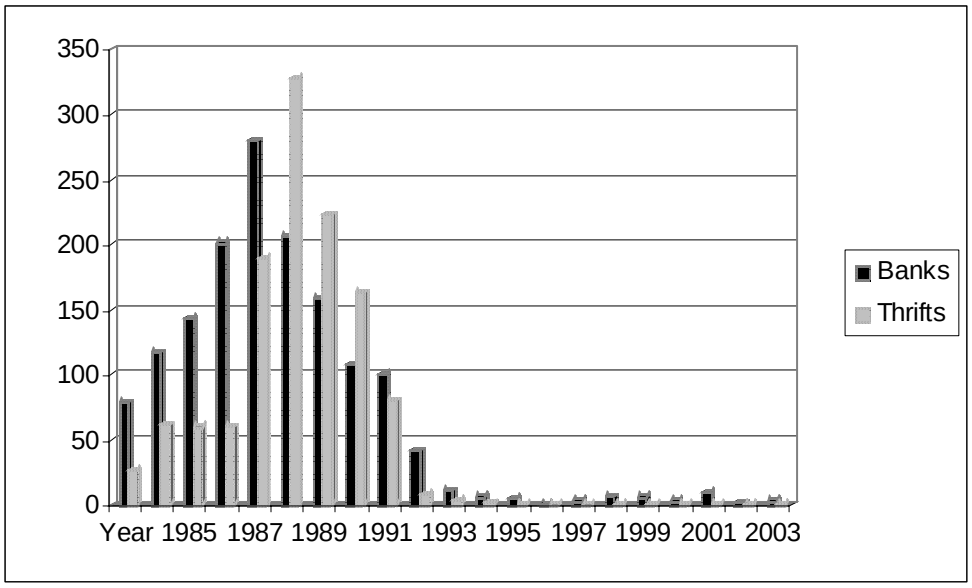
In general, the results provide strong evidence for my predictions. Like all financially troubled firms, a bank's debt pricing strategy is likely to be driven by the need to generate cash to boost liquidity to fund investments or to raise short term profitability. The deposit pricing strategy chosen however may not be uniform and instead will depend on institutional factors and also segmentation between different classes of deposit investors.

The most important institutional factor affecting pricing strategy of distressed banks is deposit insurance; the existence of fixed premium deposit insurance alters the nature of the more general creditor-owner conflict. For any distressed firm the incentive to generate funds to boost short-term profits or to gamble for survival exists; these funds in theory can be obtained directly through the financial markets. For most firms debt covenants make gambling difficult but for banks financing through depositors may be readily available to the extent deposit insurance exists. Because deposit insurance eliminates the incentive for depositors to monitor bank risk, it makes generating large amounts of funding, to use in risky investments, much easier. This seems to be, to a large extent what happened to financially distressed banks in U.S. during the time period studied.

But the fact that all dimensions of bank deposit rates do not increase with distress and the fact that some increase more than others suggests that deposit insurance does not seem to be the only factor affecting bank deposit pricing strategy. Differences between classes of depositors allow banks to tailor deposit pricing strategies to best obtain funding in the most cost-effective way. Distressed banks tend to increase deposit rates only for the most investment oriented depositors (non-transaction account depositors) and do not significantly raise rates for the least investment oriented depositors (transaction account depositors). Additionally, not fully insured investment oriented (large time) depositors tend to be offered rates higher than mostly insured

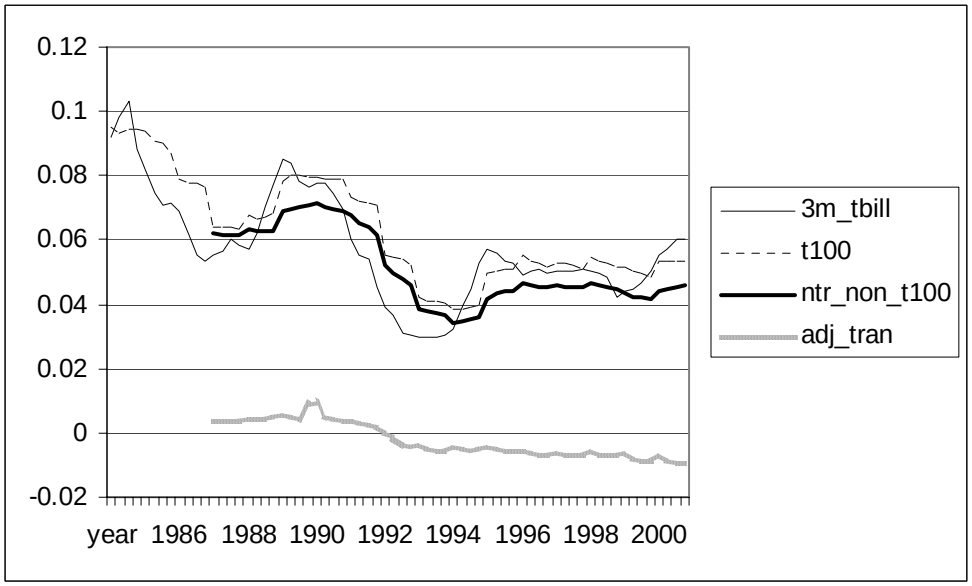
investment oriented (non-transaction non-large time) depositors. Thus distressed banks offer a premium both based on the increased risk (if deposits are uninsured) and for depositors being more investment oriented. Past works have generally suggested that troubled banks bid up deposit rates in a gamble for survival or that they may have to offer higher rates for uninsured depositors to compensate for the increased risk. My results suggest, that both explanations are partially correct in that they are both factors to varying degrees based on depositor class and that neither are significant factors for the least investment oriented depositors. The results provide fresh evidence that moral hazard is a issue in banking and moreover that it is increased by deposit insurance since distressed banks apparently raise rates less for investment oriented investors who have a larger portion of their deposits insured (non-large time non-transaction depositors) relative to more uninsured investment oriented investors (large time account depositors). The fact that deposit rates do not increase for transaction account holders as distress increases while other types of deposit rates increases is also important to consider; it suggest that moral hazard in conjunction with the convenience orientation of these depositors allows distressed banks to maintain this funding source at minimal cost regardless of risk. Thus the evidence suggests that both deposit insurance and the convenience orientation of a certain class of deposit investors imposes costs on the final creditor (the FDIC in this case) when a bank is in financial distress. Thus the results have important implications for regulators.

Figure 1: U.S. Commercial Bank And Thrift Failures (1984-2000)



Note: Figure 1 is based on data obtained from the FDIC Website . Banks refers to the commercial bank which includes the national member banks, state member banks, and state non-member banks. Thrifts include stock and mutual savings banks as well as other savings banks and savings and loans associations.

Figure 2: Deposit Interest Rates and T-Bill Rates (1984-2000)



Note: Figure 2 is based on treasury bill rates obtained from the Federal Reserve and financial data obtained from the FDIC. The abbreviations T100, NTR_NON_T100, and ADJ_TRAN refer to deposit rates on large time deposit accounts, non-transaction accounts excluding large time deposits, and adjusted transaction accounts respectively. The adjusting of transaction account deposit rates was done by subtracting a service charge rate. Data for non-transaction non large time and adjusted transaction account deposit rates was unavailable until 1987.

Figure 3: Distressed Bank Deposit Pricing Policies

Depositor Type	Mostly Uninsured Investment Oriented Depositors (LTD)	Mostly Insured Investment Oriented Depositors (NTRD)	Mostly Insured Convenience Oriented Depositors (TRND)
Hypothesized Factors Affecting Distressed Bank Deposit Rates	· Deposit Risk (↑) · Gambling Incentives (↑)	· Gambling Incentives (↑)	· Gambling Incentives (↑) · Lock in Effect (↓)
Expected Deposit Rate Behavior in response to higher distress	Highest Increase ⟷ Lowest Increase		
Inferred Increase in Moral Hazard resulting from higher distress	Lowest Increase ⟷ Highest Increase		

Note: Figure 3 is a summary of hypothesized relationships. LTD depositors refer to large time depositors (deposits in accounts with balances over $100k) and NTRD depositors deposits refer to non-transaction account depositors excluding LTD depositors. Finally, TRND depositors refer to transaction account depositors

Table 1a: Summary Statistics for 1st stage Regressions

Variable		All Banks	Banks that Failed Next Quarter	Banks That Did Not Fail Next Quarter
Ratio of Past Due Loans	mean	0.0136	0.0607	0.0134
to Assets	std. dev.	0.0162	0.0307	0.0159
Ratio of Liabilities	mean	0.9113	0.9686	0.9111
to Assets	std. dev.	0.0341	0.0255	0.034
Unit Bank	mean	0.4671	0.6276	0.4666
	std. dev.	0.4989	0.4836	0.4989
Ratio of Brokered	mean	0.0018	0.0119	0.0018
Deposits	std. dev.	0.0106	0.0276	0.0105
Ratio of Real Estate	mean	0.2141	0.2642	0.2139
Loans to All Loans	std. dev.	0.1392	0.1476	0.1391
Ratio of Operating Income	mean	0.0147	-0.0101	0.0148
to Assets	std. dev.	0.01	0.0162	0.0099
Supervised	mean	0.3321	0.4203	0.3319
by OCC	std. dev.	0.471	0.4938	0.4709
Unemployment	mean	6.5552	7.1262	6.5534
Rate	std. dev.	1.7968	1.5679	1.7972
T-Bill	mean	0.0547	0.0447	0.0547
Volatility	std. dev.	0.0999	0.0717	0.1
Diff. in	mean	-0.0018	-0.0011	-0.0018
T-Bill rate	std. dev.	0.0056	0.0052	0.0056
Diff. in	mean	0.0007	0.004	0.0007
Liability to Asset Ratio	std. dev.	0.0098	0.0163	0.0097
Diff. in	mean	-0.0389	-0.0832	-0.0388
Unemployment Rate	std. dev.	0.3174	0.3424	0.3173
Diff. in	mean	0.0197	-0.0554	0.02
Size	std. dev.	0.0893	0.1412	0.089
Diff. in	mean	0.9008	-0.0903	0.904
Employees	std. dev.	103.9382	41.1146	104.0779

Note: These summary states are based on national quarterly observations between 1984 and 1992.

Table 1b: Summary Statistics for 2nd Stage Regressions

Variable		All Banks	Banks that Failed Next Qtr	Banks That Did Not Fail Next Qtr
Prob. of Failure	mean	0.0054	0.2419	0.0043
Next Quarter	std. dev.	0.0381	0.2328	0.0307
Size	mean	10.724	10.5528	10.7247
	std. dev.	1.1879	1.3386	1.1871
Bank Age	mean	57.3574	39.5721	57.4389
	std. dev.	37.1148	35.4738	37.1027
Number of	mean	4.3495	2.0411	4.3601
Offices	std. dev.	18.3555	3.1002	18.3956
Large Time	mean	6.6073	6.8839	6.606
Average Maturity	std. dev.	4.7111	4.8286	4.7105
High Dependence Large Time	mean	0.1954	0.6316	0.1937
(Prev. Period)	std. dev.	0.3965	0.483	0.3952
High Dependence Non-Large Non-Transaction	mean	0.1962	0.0927	0.1966
(Prev. Period)	std. dev.	0.3971	0.2904	0.3974
High Dependence Transaction	mean	0.2013	0.1128	0.2017
(Prev. Period)	std. dev.	0.401	0.3167	0.4013
3-Month T-Bill	mean	0.0621	0.0617	0.0621
Rate	std. dev.	0.0071	0.0068	0.0071
Large Time	mean	0.0657	0.0765	0.0656
Deposit Rate	std. dev.	0.0185	0.0225	0.0184
NTR Non-Large Time	mean	0.0623	0.0671	0.0623
Deposit Rate	std. dev.	0.0068	0.0092	0.0068
Adj. Transaction	mean	0.0041	-0.0116	0.0042
Deposit Rate	std. dev.	0.0179	0.0221	0.0178

Note: These summary states are based on national quarterly observations between 1987 and 1989. Data from 1984 to 1986 was not used in the second stage because of key variables being unavailable prior to 1987; data post 1989 was also excluded to avoid FDIC solvency issues from affecting the results.

Table 2: Logistic Regression Results

Dependent Variable		Failed Next Quarter
90 days past	Coeff.	18.4594
due loan Ratio	T-Stat	15.5597
Liability	Coeff.	62.0598
to Asset Ratio	T-Stat	34.3390
Unit	Coeff.	0.3637
Bank	T-Stat	5.7252
Ratio of	Coeff.	7.7957
Brok. Deposits	T-Stat	6.2030
Ratio of	Coeff.	-0.5647
C/I Loans	T-Stat	-2.5788
Profitability	Coeff.	-14.0201
Ratio	T-Stat	-8.4778
Operating Inc.	Coeff.	-30.3265
To Assets	T-Stat	-11.3054
Supervised	Coeff.	-0.4515
By OCC	T-Stat	-7.0185
Unemployment	Coeff.	-0.0348
Rate	T-Stat	-1.9078
Volatilty	Coeff.	-1.1386
T-bill Rate	T-Stat	-2.6426
Diff. In	Coeff.	-41.9009
3-mont Tbill Rate	T-Stat	-6.2757
Diff. In	Coeff.	-1.1782
Large Time Dep. Rate	T-Stat	-0.9725
Diff. In	Coeff.	-31.0972
Liabilty to Asset Ratio	T-Stat	-11.3398
Diff. In	Coeff.	-0.2793
Unemployment Rate	T-Stat	-2.7671
Diff. In	Coeff.	-2.2702
Size	T-Stat	-7.6344
Diff. In	Coeff.	0.0001
Employment	T-Stat	0.4674
Number of Observations		476195.0000
Adjusted R-Square		0.4637

Note: These results were computed using a pooled regression of quarterly data between 1984 and 1992. The dependent variable is 1 if the bank failed in the next quarter and 0 otherwise.

Table 3a: Fixed Effects Regression Results – Deposit Rates And Financial Distress (1987-1989)

Dependent Variable		LTD Rate	NTRD Rate	TRND Rate
Probability of	Coeff.	0.0265	0.0097	-0.0215
Failure	T-Stat	11.5772	14.0236	-6.9485
Size	Coeff.	0.0032	0.0027	-0.0031
(Prev. Period)	T-Stat	8.5958	23.6292	-6.0757
Bank Age	Coeff.	0.005	0.0025	0.0066
(Prev. Period)	T-Stat	44.7005	74.2182	43.7172
Total Offices	Coeff.	0	-0.0001	0.0000
(Prev. Period)	T-Stat	0.8693	-16.1415	-0.1335
Large Bank	Coeff.	-0.0003	0.0002	0.0018
(Prev. Period)	T-Stat	-0.4478	1.169	1.9901
T-Bill	Coeff.	0.182	0.0757	-0.3136
Rate	T-Stat	22.3613	30.7131	-28.5234
Average Large CD Maturity	Coeff.	-0.0001		
(Prev. Period)	T-Stat	-9.575		
High Dependence Large Time	Coeff.	0.0007		
(Prev. Period)	T-Stat	5.3321		
High Dependence Non-Large Non-Transaction	Coeff.		0.0001	
(Prev. Period)	T-Stat		4.2292	
High Dependence Transaction	Coeff.			0.0208
(Prev. Period)	T-Stat			10.0123
No Statewide Branching	Coeff.	-0.0015	-0.0008	0.0006
(Prev. Period)	T-Stat	-7.5985	-14.1062	2.3813
Number of Observations		145938	145938	146478
Adjusted R-Square		0.0000	0.0000	0.0210

Note: For tables 3a results are based on fixed effect model regressions; dependent variables are all various types of deposit rates. The transaction account deposit rate was adjusted downwards by subtracting out service charges from interest paid. LTD refers to large time deposits (non-transaction), NTRD refers to non-transaction deposits other than large time, and TRND refers to transaction deposits.

Table 3b: Fixed Effects Regression Results – Deposit Rate Differences And Financial Distress (1987-1989)

Dependent Variable		Deposit Risk Premium	Deposit "Investment" Premium
Probability of	Coeff.	0.0165	0.0311
Failure	T-Stat	6.6738	9.6959
Size	Coeff.	0.0005	0.006
(Prev. Period)	T-Stat	1.2186	11.2564
Bank Age	Coeff.	0.0025	-0.0039
(Prev. Period)	T-Stat	20.6755	-25.1765
Total Offices	Coeff.	0.0001	-0.0001
(Prev. Period)	T-Stat	5.3539	-3.5022
Large Bank	Coeff.	-0.0006	-0.0013
(Prev. Period)	T-Stat	-0.8412	-1.4313
T-Bill	Coeff.	0.1056	0.3838
Rate	T-Stat	11.9744	33.6463
Average Large CD Maturity	Coeff.	-0.0002	
(Prev. Period)	T-Stat	-11.4012	
High Dependence Large Time	Coeff.	0.0002	
(Prev. Period)	T-Stat	0.692	
High Dependence Non-Large Non-Transaction	Coeff.	0.0019	0.0013
(Prev. Period)	T-Stat	7.3784	3.9397
High Dependence Transaction	Coeff.		-0.0036
(Prev. Period)	T-Stat		-11.0082
No Statewide Branching	Coeff.	-0.0007	-0.0014
(Prev. Period)	T-Stat	-3.1052	-5.1242
Number of Observations		145828	146453
Adjusted R-Square		0.0030	0.0882

Note: For tables 3b results are based on fixed effect model regressions; dependent variables are all differences between various types of deposit rates. The deposit risk premium is defined as difference between LTD and NTRD rates and the "investment" premium is defined as the difference between NTRD and TRND rates. LTD refers to large time deposits (non-transaction), NTRD refers to non-transaction deposits other than large time, and TRND refers to transaction deposits. The transaction account deposit rate was adjusted downwards by subtracting out service charges from interest paid.

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