Depositor Discipline at Failing Banks

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Uninsured depositors, whose deposits are not fully protected by federal deposit insurance, have an incentive to monitor banks' activities and impose additional funding costs on risky banks. This pricing is a form of market discipline, since the market penalizes banks for taking on greater risk. For banks that become troubled, market discipline can take a more severe form: Market participants may become unwilling to supply uninsured funds at any reasonable price. This study examines the effectiveness of depositor discipline at banks that failed in New England in the early 1990s.

With a growing number of commentators advocating an enhanced role for market discipline, it is important to assess the effectiveness of depositor discipline. Many argue that private sector stakeholders can play a significant role in constraining excessive risk-taking and encouraging prudent banking practices. Such discipline is particularly important as a bank approaches insolvency, when managers' aversion to risk can dissipate in a last-chance effort to salvage a failing institution. Given the enormous costs associated with past taxpayer-supported resolutions of financial crises in the United States and abroad, the potential effects depositors can have on bank behavior as a bank approaches insolvency is an important area of study.

A recent study by Billett, Garfinkel, and O'Neal (1998) raises a concern about the effectiveness of depositor discipline. The authors find that banks whose debt is downgraded by Moody's subsequently increase their use of insured deposits. This finding suggests that an increase in the required return on uninsured deposits, or the withdrawal of uninsured deposits, may have only a limited effect on banks' operating decisions. Since banks can turn to the insured deposit market, troubled banks may face only minor funding constraints. This study extends their work by considering the use of insured and uninsured deposits at failing banks. The empirical analysis examines whether failing banks in New England faced depositor discipline as they became troubled in the early 1990s, and

whether these banks attempted to shield themselves from this discipline.

Liability management at failing banks could differ from the behavior of banks in the Billett, Garfinkel, and O'Neal (1998) study for several reasons. First, the magnitude of the decline in uninsured deposits at banks that ultimately fail is far greater than the decline in uninsured deposits at the banks in the Billett, Garfinkel, and O'Neal study. Jordan (1998) shows that failing banks in New England experienced a 70 percent decline in their uninsured deposits in their final two years of operation. A decline of this size could be very difficult to offset by attracting new insured deposits.

Despite the magnitude of the gap and the close regulatory scrutiny, many failing banks increased their use of insured deposits enough to offset much of the shortfall created by the decline in uninsured deposits.

Another reason bank behavior could differ is that supervisory scrutiny of failing banks intensifies as the bank becomes more troubled. Such scrutiny could either limit or encourage a shift in funding toward insured deposits. If the regulators' primary goal was to minimize the exposure of the deposit insurance fund, banks may have faced limits on their ability to shift to insured financing. Alternatively, regulators may have viewed insured deposits as a means for troubled institutions to obtain relatively inexpensive and stable deposits, which possibly could increase the chances of the banks' survival. Regulators may also have believed that early closure of some banks would cause more widespread problems. They may have had an incentive to practice forbearance at banks where losses of uninsured deposits could exacerbate existing economic problems.

The primary finding of this study is that, despite the magnitude of the gap to fill, and despite the presence of close regulatory scrutiny, many failing banks increased their use of insured deposits enough to offset much of the shortfall created by the decline in uninsured deposits. For New England banks with large exposures to uninsured deposits, the decline in one type of uninsured deposit (jumbo CDs) would have caused an 18 percent decline in total deposits, were it not for an increase in a type of insured deposit (small CDs). On average, the increases in small CDs at failing banks more than offset the declines in jumbo CDs. To attract these new insured depositors, banks paid a premium over what competing banks were offering on similar small CDs.

These results have several policy implications, especially concerning the means of constraining activities at failing banks. If market discipline by depositors is to play an important role, changes in the supply of uninsured deposits, and changes in the pricing of these deposits, must affect bank behavior. The results of this paper suggest that such pricing and supply changes had only a modest impact on bank behavior, since the failing banks were able to substitute relatively cheaper insured funds for the expensive uninsured funds. It is important that supervisors be aware of any such shifts in deposit funding by troubled banks and closely monitor their risk-taking activities, since the effectiveness of market discipline diminishes as banks rely less on uninsured deposits.

I. Background: Banks' Choices of Deposit Funding

Banks offer several types of deposit accounts, which differ in terms of the services provided by the bank, the rate of return earned by the depositor, and the risk incurred by the depositor. Transaction accounts (primarily checking accounts) provide a convenient and safe means to make payments, but generally earn low or no interest on the principal amount in the account. Many banks require that the depositor pay a fee in order to cover the expense of servicing the account. The depositor incurs minimal risk from holding such accounts because of federal deposit insurance, as long as the deposit balance is $100,000 or less.

Savings accounts provide a safe, liquid means of accumulating wealth, but generally banks offer only modest interest rates on these accounts relative to alternative investments. Their appeal tends to be their safety, with accounts of $100,000 or less fully insured, and their liquidity. Some savings accounts also provide limited check-writing privileges.

The certificate of deposit (CD) account generally offers better interest rates than other deposit accounts, but depositors give up some liquidity, since they do not have the right to make withdrawals before a

specified date without an early withdrawal penalty. Banks issue CDs in denominations of $100,000 or less and in denominations greater than $100,000. The latter, known as jumbo CDs, are insured only for the first $100,000, and holders of these CDs face the risk of losing the part of their principal investment that exceeds $100,000.

When choosing the type of deposit account to use to raise additional funds, a bank must consider the relative cost of raising funds through each type of deposit. Generally, a bank obtains transaction and savings deposits through its retail branch network. Funds raised via the bank's "bricks and mortar" distribution centers are often termed "core" deposits, since switching costs limit withdrawals even if the rates of return on competing investment alternatives become more attractive. The costs associated with obtaining information and assessing the merits of alternative investments reduce the likelihood that depositors will switch to alternative investments. Switching costs can also include the difficulty of using inconvenient office locations, or the unfamiliar procedures of the institution providing the alternative investment.[1] Thus, banks' retail branch networks, which consumers traditionally have found convenient, along with the safety of insured deposits, provide banks with relatively inexpensive transaction and savings deposits.

When choosing the type of deposit account to use to raise additional funds, a bank must consider the relative cost of raising funds through each type of deposit.

The supply of inexpensive transaction and savings deposits is not limitless, however. At some point, raising additional funds via transaction and savings deposits will become costly. For example, to attract additional savings deposits, banks would have to offer rates above those of competitors. The increase in rates would have to be large enough so that depositors in other institutions would be willing to incur the costs of switching.[2] In addition, if the bank priced all savings deposits uniformly within the bank (the conventional practice), attracting the marginal depositor with higher rates would translate into an increase in interest expense for all savings accounts. Therefore, it can be costly for a bank to raise funds via savings or transaction deposits outside its core base. An alternative strategy would be to extend the "bricks and mortar" distribution channel in an attempt to expand the core base. However, this, too, would be costly and could require considerable time to implement.

Another source of funds for banks is the CD market, which is quite different from the transaction and savings deposit market. Depositors generally use CDs as an investment vehicle, and the supply of funds is more responsive to changes in interest rates than it is for transaction and savings accounts. A bank's retail branch network is still an important distribution channel for bank CDs, but banks also can attract CD customers from beyond their local retail branch network. This is especially true for jumbo CDs and brokered deposits, both of which are offered in national markets.[3] Because of the competitiveness of the CD market, interest rates paid on CDs generally are higher than those paid on interest-bearing transaction and savings accounts.

Holders of jumbo CDs, those CDs that are not fully insured, face default risk and thus demand a risk premium on those deposits. When pricing jumbo CDs, depositors must estimate the expected losses from a bank failure. These expected losses should reflect both the probability of failure and the magnitude of losses the holders will suffer if failure occurs. An extensive literature has examined the pricing of jumbo CDs. In general, the studies have shown that measures of bank risk do influence jumbo CD rates. Several studies examining the cross-sectional variation in jumbo CD rates show that banks with higher insolvency risk, more variable returns, and lower capital cushions pay relatively higher rates on jumbo CDs. (See Baer and Brewer 1986; Hannan and Hanweck 1988; and Hall,

[1] With the advances in information technology in recent years, these switching costs likely have fallen. For example, the Internet has reduced the cost of gathering information about competing investments, and it has provided a means to interact easily with financial institutions outside one's local market. See Jordan and Katz (1999) for a discussion of the impact information technology is having on financial institutions.

[2] Flannery (1982) provides a more extensive discussion of switching costs in the context of a banking firm and the impact these switching costs have on the pricing of banks' core deposits.

[3] Brokered deposits are those that banks obtain through a deposit broker, who sells participations in a given bank deposit account to one or more investors. It is common for brokered deposits to be issued in denominations of less than $100,000, so that they are covered by deposit insurance.

King, Meyer, and Vaughan 1999.) Ellis and Flannery (1992), examining the daily change in CD risk premia, show that bank CD rates immediately reflect the information embedded in bank stock prices, which includes changes in the information set regarding bank default probabilities.

The premium that holders of jumbo CDs demand suggests that banks minimizing their cost of funds should issue small CDs rather than jumbo CDs. However, if a bank's funding needs are large, the search costs of obtaining funds from many small depositors, all having deposits of less than $100,000, could be quite high. A bank could raise funds more quickly while incurring lower search costs by issuing CDs denominated above $100,000. As long as the cost associated with paying a premium on jumbo CDs is less than the search cost of obtaining many small deposits, banks will choose to issue jumbo CDs. This is especially true for banks that are well capitalized and not overly risky, where the premium on jumbo CDs relative to small CDs can be quite small.

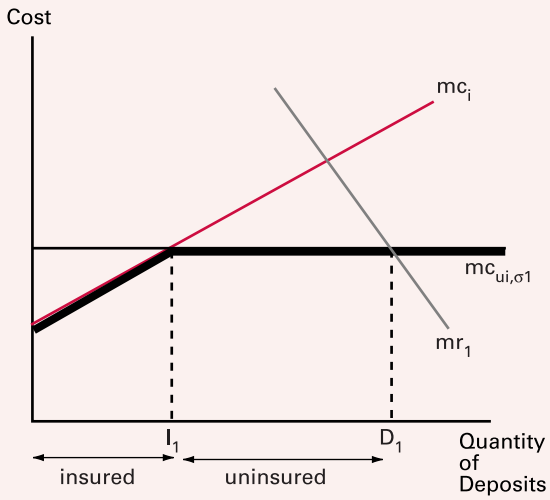
A point to emphasize is that the average rate banks pay on their transaction, savings, and small CD accounts will probably be lower than the average rate they pay on jumbo CDs. However, there is a point at which the marginal cost on these predominantly insured accounts will exceed the marginal cost banks face when obtaining funds via the jumbo CD market. Therefore, banks fund their operations with a combination of insured and uninsured deposits. The next section provides a more formal framework in which to evaluate a bank's choice of funding and, in particular, the ways a bank might alter its funding choices as its health deteriorates.

II. A Simple Model of Bank Liability Management

Consider a simple model of the banking firm.[4] In this framework, a bank's primary business is the extension of loans. Since a bank has finite opportunities in its lending business, the marginal revenue obtained from making an additional loan will decrease as the number (dollar amount) of loans extended increases. For example, a bank that has limited expertise in certain types of lending, such as a loan to a small business operating far from the bank's geographic concentration, would face diminishing marginal revenue from the loan-making business. Thus, the bank faces a downward sloping marginal revenue curve from lending, represented by curve mr_1 in Figure 1.

Figure 1

A Model of Bank Liability Management



To finance the bank's loan operations, this simple framework assumes a bank raises funds through a local market for insured deposits and a national market for uninsured deposits. The bank obtains insured deposits through its local retail branch network. Banks raising funds via this type of insured deposit market face an upward-sloping marginal cost curve for these funds, since an existing branch network provides a limited amount of "core" deposits. A bank attempting to obtain additional insured deposits would have to offer higher deposit rates and incur search costs to attract depositors away from competing banks. In Figure 1, curve mc_i represents the supply of insured deposits.

Banks also can raise funds via a national market for uninsured deposits. Since uninsured deposit markets are generally more competitive than the local insured deposit market, in this simple model it is assumed that the bank faces a flat marginal cost curve for uninsured deposits. That is, the bank is able to raise an unlimited amount of uninsured deposits at a

[4] See Billett, Garfinkel, and O'Neal (1998) and Klein (1971) for a more detailed discussion of this model.

deposit rate that will depend on the underlying riskiness of the bank, σ_1. In Figure 1, curve $mc_{ui\sigma 1}$ represents the supply of uninsured deposits. The greater the riskiness of the bank, the higher the deposit rate a bank must offer to compensate the depositor for accepting the risk of losing part of the principal invested.[5]

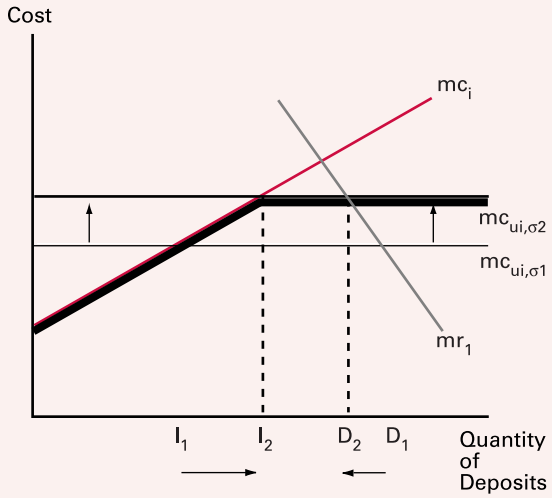
Facing the different costs of obtaining funds in the insured and uninsured deposit markets, a bank will choose the source of funds with the lowest marginal cost. In the model depicted in Figure 1, this would mean that a bank would obtain its initial funds via its local insured deposit market. The bank would continue to raise funds via this market until the cost of obtaining additional insured deposits exceeded the cost of raising funds in the national market for uninsured deposits. Once a bank reaches this threshold, it raises additional funds via the uninsured deposit market. Thus, the heavy black line in Figure 1 represents the bank's marginal cost curve for loanable funds.[6]

A profit-maximizing bank would equate its marginal revenue from its loan business to its marginal cost of raising deposits. In Figure 1, given a bank's risk level σ_1, in equilibrium the bank would raise a total of D_1 in deposits to finance its loan operations. The amount of insured deposits would equal I_1, and the amount of uninsured deposits would equal $(D_1 - I_1)$.

Now consider a bank that becomes troubled. As markets reassess the probability that a bank will fail, the interest rate at which they are willing to finance the bank's operations via uninsured deposits increases. This would correspond to a shift upward in the marginal cost curve of uninsured deposits $mc_{ui\sigma 1}$ to $mc_{ui\sigma 2}$, as shown in Figure 2. Given the change in the level of bank risk to σ_2, in equilibrium the new level of deposit funding falls to D_2. The total amount of deposit financing falls but the level of insured deposit financing increases to I_2. In this framework, banks faced with an increase in the cost of uninsured financing, relative to insured financing, reallocate their funding sources to place greater reliance on insured deposits.[7]

Figure 2

A Model of Bank Liability Management
(mc_{ui} Shifts Up)



The demand for loanable funds can also change. This is particularly true for the banks that will be examined in the empirical analysis of this paper. Demand shifts can be caused by several factors. For example, deterioration in general economic conditions can reduce the number of profitable lending opportunities for banks. In Figures 1 and 2, this would shift the demand for funds curve to the left, resulting in a decline in the equilibrium level and a change in the mix of deposits.

Another factor that could affect a bank's demand for funds is the regulatory requirement of a minimum capital-to-assets ratio. Attempts to satisfy capital requirements can encourage a bank to shrink its operations as it becomes financially troubled. Banks whose capital-to-assets ratio falls below the regulatory minimum could reduce their lending activity, thus reduc-

[5] The assumption that the marginal cost curve for uninsured deposits is flat is quite strong. In practice, the curve likely becomes upward-sloping at some point. For example, if relying heavily on uninsured deposits itself creates a riskier institution, uninsured depositors would demand higher risk premia as the level of uninsured deposits increased. How this assumption affects the analysis is discussed further below.

[6] This result holds even if the marginal cost curve of uninsured deposits is upward-sloping. As long as the slope of the marginal cost curve of insured deposits is greater than the slope of the marginal cost curve of uninsured deposits, and the cost of banks' initial core deposits is below that of initial uninsured deposits, banks would still raise funds via the insured deposit market until the cost of obtaining additional insured deposits exceeded the cost of raising funds in the national uninsured market.

[7] This result holds even if the marginal cost of uninsured deposits is upward-sloping. A shift in the relative cost of insured versus uninsured deposits would provide the incentive for banks to shift their funding toward insured deposits.

ing total assets, if they have difficulty raising new capital in their troubled state. This strategy can raise the bank's capital ratio (Peek and Rosengren 1995a, 1995b). The induced decline in lending would reduce the bank's demand for funds.

At banks operating in New England in the late 1980s and early 1990s, both of the above factors likely affected the demand for loanable funds. Therefore, it is difficult to distinguish the impact of shifts in the supply of funds by depositors, or depositor discipline, from the impact of shifts in the demand for funds by banks. However, the above framework suggests that changes in the levels of insured versus uninsured deposits can provide a means to identify whether depositor discipline (shifts in supply) was an important factor in banks' choice of deposit financing.

If demand shifts are driving declines in total deposits, with changes in supply playing only a minor role, one would not expect to see increases in the level of any of the deposit categories or increases in the rates paid on insured deposits.

Shifts in supply cause a relative change in the cost of insured versus uninsured deposits. Thus, for a given level of demand, a shift in supply implies that banks alter the mix of insured versus uninsured deposits. If the risk premium on uninsured deposits increases, raising the marginal cost of uninsured deposits relative to that of insured deposits, banks will substitute insured for uninsured deposits, increasing the level of insured deposits. Compare this result to one where the change in demand is driving deposit financing. A decline in the demand for loanable funds, holding constant the supply of funds, would not change the relative prices of deposit categories, and banks would let their most expensive deposits run off, the uninsured deposits, and retain their insured deposits. An important point to note: If demand shifts are driving declines in total deposits, with changes in supply playing only a minor role, one would not expect to see increases in the level of any of the deposit categories or increases in the rates paid on insured deposits. This is different from what would occur if a shift upward in the supply of loanable funds curve drives banks' choices of deposit funding.

With the above framework as a backdrop, the following empirical analysis examines the effectiveness of deposit discipline.

III. Empirical Results: Liability Management at Failing Banks

The sample of banks in this study includes all Federal Deposit Insurance Corporation (FDIC)-insured commercial and savings banks in the First Federal Reserve District (New England) that filed a Call Report for the first quarter of 1989, operated for at least seven quarters after the first quarter of 1989, and subsequently failed. Because of these sample selection requirements, the number of bank failures cited in this paper (65) differs slightly from those reported in other studies examining the New England banking crisis.[8]

The Use of Insured and Uninsured Deposits

This analysis focuses on deposit accounts as defined in bank Call Reports, where total deposits are divided into transaction accounts, savings accounts, small time deposits, and large time deposits. Transaction accounts are those that allow the depositor to make transfers easily for the purpose of making payments. The most common transaction account is the demand deposit account (checking account), but transaction accounts also include NOW accounts and ATS (automatic transfer) accounts. Savings deposits are not payable on any specified date, but the bank can require the depositor to provide written notice of an intended withdrawal not less than seven days in advance. Included in savings deposits are the passbook savings account, the statement savings account, and the money market deposit account (MMDA). The last deposit category is the time deposit, where the depositor does not have the right to make withdrawals without an early withdrawal penalty. Such deposits are commonly referred to as certificate of deposit accounts (CDs). The analysis that follows differentiates between time deposits with denominations of

[8] Bank data are merger adjusted. That is, if a merger occurs during the sample period, it is assumed that the surviving bank had always had the acquired bank's operations. For example, if bank 1 acquires bank 2 in 1990 Q1, bank 1's and bank 2's financial data are combined ("force-merged") for the quarters prior to 1990 Q1.

Table 1
Deposits at Failing Banks
Sample: 65 Banks that failed in New England, 1989 to 1995
Time Period: Two years before last Call Report before failure

Panel A: Mean Values				Deposit Type as a Percent of Total Deposits			
Jumbo CDs as % of Total Deposits	Obs.	Total Deposits ($000)	Total Deposits as % of Total Liabilities	Transaction Deposits	Savings Deposits	Small CDs	Jumbo CDs
Quartile 1	16	465,147	94.80	13.55	31.97	50.07	4.41
Quartile 2	16	735,788	88.64	13.85	25.78	52.50	7.87
Quartile 3	17	376,662	92.22	15.06	20.98	50.80	13.16
Quartile 4	16	927,040	92.47	11.60	15.86	50.34	22.20
Full Sample	65	622,321	92.04	13.54	23.61	50.92	11.93
Panel B: Median Values				**Deposit Type as a Percent of Total Deposits**			
Jumbo CDs as % of Total Deposits	Obs.	Total Deposits ($000)	Total Deposits as % of Total Liabilities	Transaction Deposits	Savings Deposits	Small CDs	Jumbo CDs
Quartile 1	16	409,147	96.38	9.70	31.12	51.05	4.25
Quartile 2	16	169,189	91.42	12.98	23.83	51.27	8.21
Quartile 3	17	269,464	95.21	13.44	21.30	49.59	13.24
Quartile 4	16	116,310	97.78	10.10	16.05	51.58	21.12
Full Sample	65	257,036	95.50	11.19	23.19	50.81	9.80

Source: Call Reports and author's calculations.

$100,000 or less (small CDs) and time deposits with denominations above $100,000 (jumbo CDs).

Deposit insurance protects depositors, up to $100,000 per account, from losses due to bank failure. Depositors can have uninsured funds in three of the four deposit categories described above, since some depositors hold transaction accounts and savings accounts that exceed the $100,000 insurance threshold. However, the majority of transaction and savings accounts have balances of less than $100,000. In this analysis, the focus will be on jumbo CDs, since at least some portion of each account exceeds the insured threshold, and on small CDs, since these deposits are fully insured.

Panel A of Table 1 describes the sampled banks' average use of various categories of deposits two years before the quarter in which they fail. All banks use both insured and uninsured deposits (jumbo CDs). On average, deposits represent 92 percent of all bank liabilities. About 88 percent of these deposits are held in predominantly insured accounts: 13.5 percent are in transaction accounts, 23.6 percent in savings accounts, and 50.9 percent in small CD accounts. The remaining 12 percent are held in jumbo CD accounts, uninsured above $100,000.

The sample of banks is also separated in Table 1 according to the degree to which they rely on jumbo CDs for funds. For each bank, the proportion of total deposits obtained via the jumbo CD market was determined. Banks were then ranked according to this measure and placed into quartiles. Panel A of Table 1 shows significant variation across banks in their reliance on jumbo CDs. The mean bank in the lowest quartile issues jumbo CDs amounting to less than 4.5 percent of its total deposits. In contrast, the average bank in the highest quartile raises funds amounting to 22.2 percent of its total deposits from the jumbo CD market. Panel B of Table 1 shows similar evidence for the median bank in each quartile.[9]

[9] For the sample of banks in this analysis, the reliance on large CDs as a source of financing is not directly related to bank size. The correlation coefficient between the reliance on large CDs and total assets is 0.09, which is not statistically significant. Comparing the results presented in Panel A of Table 1 with the results of Panel B in Table 1 also shows that there is not a direct relationship between bank size and the reliance of large CDs. Panel A shows that those banks that rely the most on large CDs (quartile 4), on average, are the largest banks (using total deposits as a measure of size). However, Panel B of Table 1, which presents the median bank in each quartile, shows that the median bank in quartile 4 is actually smaller than the median bank in all other quartiles. The difference between the mean and median for quartile 4 banks suggests that quartile 4 contains a few large banks, but also contains several smaller banks.

Table 2
Change in Deposits Over Final Eight Quarters of Operation
Sample: 65 Banks that failed in New England, 1989 to 1995

Panel A: Percent change over final 8 quarters of operations
(Median values, sign statistic in parentheses)

Jumbo CDs as % of Total Deposits	Obs.	Total Deposits	Transaction Deposits	Savings Deposits	Small CDs	Jumbo CDs
Quartile 1	16	−12.77*** (−7.0)	−5.55 (−3.0)	−7.62* (−4.0)	−13.09* (−4.0)	−39.90** (−5.0)
Quartile 2	16	−13.22*** (−7.0)	−18.81*** (−6.0)	7.76 (1.0)	−15.12 (−3.0)	−66.76*** (−7.0)
Quartile 3	17	−10.18 (−3.5)	−11.54 (−2.5)	.36 (.5)	6.85 (2.5)	−62.65*** (−8.5)
Quartile 4	16	−6.63 (−2.0)	−18.12 (−3.0)	.89 (.0)	44.44*** (7.0)	−61.28*** (−8.0)
Full Sample	65	−11.10*** (−19.5)	−12.57*** (14.5)	−.65 (−2.5)	2.95 (2.5)	−61.77*** (−28.5)

Panel B: Change over final 8 quarters of operations as a percent of total deposits
(Median values, sign statistic in parentheses)

Jumbo CDs as % of Total Deposits	Obs.	Total Deposits	Transaction Deposits	Savings Deposits	Small CDs	Jumbo CDs
Quartile 1	16	−12.77*** (−7.0)	−0.36 (−3.0)	−2.38* (−4.0)	−5.86* (−4.0)	−1.77** (−5.0)
Quartile 2	16	−13.22*** (−7.0)	−2.32*** (−6.0)	1.37 (1.0)	−8.59 (−3.0)	−7.03*** (−7.0)
Quartile 3	17	−10.18 (−3.5)	−1.27 (−2.5)	.09 (.5)	2.41 (2.5)	−10.71*** (−8.5)
Quartile 4	16	−6.63 (−2.0)	−1.79 (−3.0)	.09 (.0)	20.34*** (7.0)	−18.01*** (−8.0)
Full Sample	65	−11.10*** (−19.5)	−1.40*** (−14.5)	−.23 (−2.5)	1.58 (2.5)	−8.06*** (−28.5)

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.
Source: Call Reports and author's calculations.

Change in the Level of Deposits

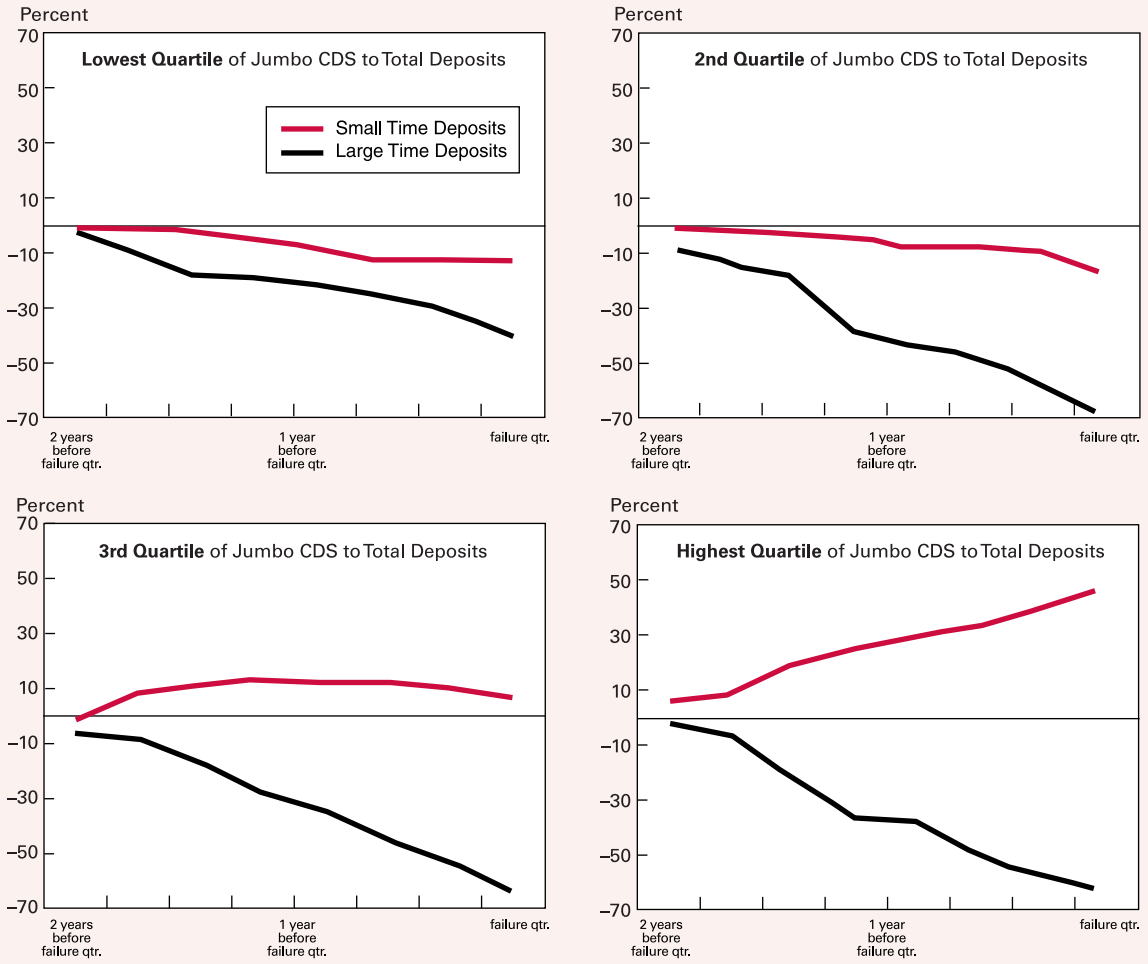
Panel A of Table 2 presents the percent changes in total deposits and in each deposit component over the final eight quarters of the banks' operation prior to failure. Panel B of Table 2 presents the change in each deposit component as a percent of total deposits eight quarters prior to failure.[10] For the full sample of banks, total deposits decline at the median bank by 11 percent. Jumbo CDs decline the most in percentage terms, 62 percent (Panel A), and are the primary contributor to the decline in total deposits. The decline in jumbo CDs reduced total deposits (measured as of eight quarters prior to failure) by 8 percent (Panel B). Transaction deposits decline by 13 percent, savings deposits by less than 1 percent (Panel A), both having only a modest impact on total deposits (Panel B). In contrast to these deposit accounts, small CDs at the median bank actually increase by 3 percent over the final eight quarters of operation. This increase in small CDs is consistent with banks and depositors shifting from uninsured deposits toward insured deposits, as banks become financially troubled.

Table 2 also separates banks into quartiles based on their use of jumbo CDs as of two years before their failure quarter. Interestingly, the increased use of small CDs over the final quarters of operations is concentrated at those banks that initially relied the most on jumbo CDs for their funding. Only banks in the top two quartiles increase their holdings of small CDs, with a sizable increase among those in the highest quartile. At the median bank in the highest quartile, jumbo CDs decline by 61 percent, but small CDs increase by 44 percent. Furthermore, as a percent of total deposits eight quarters prior to failure, the 18 percent decline in jumbo CDs is more than offset by the 20 percent increase in small CDs. Figure 3, which

[10] The percentage change in deposits was also calculated on a peer-adjusted basis. For each bank in the sample, a group of peer banks was identified as banks operating in the same state as the failing bank, and the percentage change in each deposit category was calculated for these peers. The peer-adjusted measure was calculated as follows: (% Δ in deposit category for failing bank) minus (% Δ in deposit category at median peer bank). Using this alternative measure does not qualitatively change the results of the paper.

Figure 3

Cumulative Percent Change in Selected Deposits at Sample Banks over Final Eight Quarters of Operation



Source: Call reports and author's calculations.

presents the cumulative percentage changes in small CDs and jumbo CDs over the final eight quarters of operation for each of the four quartiles presented in Table 2, shows a clear pattern. Increases in insured deposits offset declines in uninsured deposits for those banks with the greatest exposure to the uninsured deposit market.

Change in the Pricing of Deposits

The analysis next examines whether banks had to pay rates on insured deposits in excess of competitors' rates in order to obtain additional insured funds. Table 3 provides evidence that supports such bank behavior. Before discussing the results, however, it is important to explain the limitations of the pricing data used in this analysis.

The source of data for this analysis, bank Call Reports, does not explicitly report interest rates paid on deposits. The rates were constructed for this study using the detailed breakdown of interest expense on banks' income statements and the detailed breakdown

of deposit liabilities on the banks' balance sheets contained in the Call Reports. Interest rates on deposits were calculated as the ratio of interest expense over a quarter to the average quantity of deposits held by the bank over a quarter. Calculating interest rates in this manner can only serve as a proxy for the rates banks were currently offering on various deposit accounts. This measure more accurately represents the average cost of financing that the bank had incurred over the past several quarters. For example, since time deposits generally are held for several periods, the average cost of funds in any particular quarter will reflect the current cost of financing (if the bank raises additional funds in this market) as well as the cost of raising funds via this market in previous quarters (since a portion of those time deposits have not yet matured). In an environment where depositors are demanding higher risk premia and banks are allowing expensive deposits to run off, the interest rate calculated using Call Report data will underestimate the actual rate banks would have to pay in order to attract new funds via this market. One should keep this limitation in mind when examining the deposit pricing results of this study.

When examining the pricing of deposits, it is also important to estimate the premium banks are paying, rather than just considering the nominal interest rate. This is especially true when the general level of interest rates in the economy is changing. For example, because the analysis here examines a period of declining interest rates in the overall economy, the rates paid by most banks over the period fell. However, the interest rate spreads that many of the banks in the sample were paying over their competitors' rates (the premium) were increasing as the sample banks approached their failure date. For this reason, the analysis examines banks' premia rather than nominal interest rates. The premium is estimated as the interest rate spread, calculated as the rate paid by the bank less the rate paid by the median bank among its peers. Peer banks were identified using several alternative definitions, and the results are robust across these alternative definitions.[11] Table 3 presents the results for interest rate spreads where peers are identified as all banks operating in the same state as the failing bank.

[11] Peers were identified as all banks operating in the same state as the failing bank, all "healthy" banks in the same state as the failing bank (banks with a CAMEL rating of 1, 2, or 3), all banks operating in New England, and all "healthy" banks operating in New England.

Table 3 shows the interest rate spreads for the pricing of jumbo CDs (Panel A) and small CDs (Panel B) over two different periods. Also shown is the percent change in the volume of each of these deposit categories over the two periods. The first time period considered is the four quarters of operation ending a year prior to failure (quarter −8 through quarter −5). The second time period considered is the final four quarters of operation (quarter −4 through quarter −1). As in Tables 1 and 2, banks are separated into quartiles according to their initial use of jumbo CD financing.

Table 3 shows that the banks with the largest exposures to the jumbo CD market have interest rate spreads on deposits that are significantly different from zero. The median spread for these banks over quarters −8 through −5 is 28 basis points, which is significant at the 10 percent level. Over quarters −4 through −1, the median spread on jumbo CDs for these banks is 56 basis points, significant at the 1 percent level. Table 3 also shows that the volume of jumbo CDs declined over both of those periods.

The evidence is consistent with supply shifts playing an important role for banks with significant exposure to the uninsured market, but only a modest role for those banks with little exposure.

Interestingly, banks with the highest exposure to jumbo CD funding also paid a premium for their small CDs. The spread paid on small CDs is significantly different from zero at the 5 percent level in both periods. The median spread for these banks is 22 basis points over quarters −8 through −5 and 24 basis points over quarters −4 through −1. Apparently, these spreads are high enough to attract small CD depositors to these banks, with small CDs increasing by 24 percent over quarters −8 through −5, and 8 percent over quarters −4 through −1. Both increases are significant at the 1 percent level.

For banks in the second highest quartile, the

Table 3
Pricing of Jumbo and Small CDs
Sample: 65 Banks that failed in New England, 1989 to 1995

Panel A: Jumbo CDs (Median values, sign statistic in parentheses)

	Quarter −8 through Quarter −5 before Failure Quarter		Quarter −4 through Quarter −1 before Failure Quarter	
Jumbo CDs as % of Total Deposits	Interest Rate Spread (basis points)	% Change in the Level of Jumbo CDs	Interest Rate Spread (basis points)	% Change in the Level of Jumbo CDs
Quartile 1	−2.62 (0.0)	−18.15** (−6.0)	25.60 (1.0)	−25.61*** (−7.0)
Quartile 2	28.14 (3.0)	−37.61** (−5.0)	4.73 (1.0)	−54.64*** (−7.0)
Quartile 3	40.82 (3.5)	−26.52** (−6.5)	21.48 (3.5)	−45.91*** (−7.5)
Quartile 4	28.47* (4.0)	−34.29 (−3.0)	56.14*** (6.0)	−54.00*** (−8.0)

Panel B: Small CDs (Median values, sign statistic in parentheses)

	Quarter −8 through Quarter −5 before Failure Quarter		Quarter −4 through Quarter −1 before Failure Quarter	
Jumbo CDs as % of Total Deposits	Interest Rate Spread (basis points)	% Change in the Level of Small CDs	Interest Rate Spread (basis points)	% Change in the Level of Small CDs
Quartile 1	−8.25 (−1.0)	−4.55* (−4.0)	−2.23 (−1.0)	−8.56** (−5.0)
Quartile 2	27.15 (2.0)	−3.45 (−1.0)	10.48 (2.0)	−6.74** (−5.0)
Quartile 3	20.43 (3.5)	13.51** (4.5)	23.02** (4.5)	−1.34 (−.5)
Quartile 4	22.12** (5.0)	24.04*** (6.0)	24.30** (5.0)	8.49*** (6.0)

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.
Source: Call Reports and author's calculations.

patterns are similar to those in the highest quartile but the percent change in the volume of small CDs is not as large. For these banks, the percent increase in the volume of small CDs is significant in quarters −8 through −5, but the premium they pay on these deposits (20 basis points) is not significantly different from zero. As discussed above, the methodology for calculating interest rates does a fairly inaccurate job of calculating the marginal interest rate paid on these deposits, if sizable amounts were booked in earlier periods. If this is the case, looking at interest expense in future quarters could more accurately reflect the marginal financing costs in the current period. Then, looking at the pricing data in quarters −4 through −1 could reveal how banks in the third quartile were able to raise their insured deposits in quarters −8 through −5. Table 3 shows that these banks paid a premium of 23 basis points in their last quarters of operation, significantly different from zero at the 5 percent level.

The results in Tables 2 and 3 show that large uninsured depositors responded to the deteriorating health of the banks in this sample. Together, the evidence suggests that these banks faced a measurable increase in the cost of obtaining the marginal uninsured deposit, relative to the cost of obtaining the marginal insured deposit. In turn, the banks allowed the relatively expensive uninsured deposits to run off, while attracting new insured deposits. In order to obtain new funds via the insured deposit market, the banks paid a premium, attracting depositors away from competing banks. Such behavior is evident only for the banks with sizable exposure to the uninsured deposit market; banks with less exposure to uninsured deposits (those in quartiles 1 and 2) do not show the same patterns. This is consistent with supply shifts playing an important role for banks with significant exposure to the uninsured market, but only a modest role for those banks with little exposure.[12]

[12] One could offer an alternative explanation for the results of Table 2 and Table 3 by interpreting the increase in small CDs as a change in depositor preferences with regard to their preferred deposit account. For example, given the severe regional recession in

The Impact of FDICIA

In late 1991, the U.S. Congress passed the Federal Deposit Insurance Corporation Improvement Act. FDICIA had several directives; one of them required the FDIC to begin resolving failures in the least costly method, except in cases when a bank's failure would pose systemic risk. Prior to FDICIA, FDIC resolution of failed banks was primarily through "purchase and assumption." Under this method of failure resolution, an acquiring institution would purchase the failed bank and assume all of its liabilities. However, in these cases, the FDIC provided enough cash to cover any losses stemming from acquiring the assets of the failed bank. Often, in addition to insured depositors, the FDIC protected uninsured depositors from losses due to the bank failure. Since 1991, uninsured depositors have incurred more losses in the event of a bank failure.[13] Benston and Kaufman (1997) show that in 1991 uninsured depositors incurred losses in only 17 percent of bank failures, but in 1992, the FDIC failed to protect uninsured depositors in 54 percent of failures.

Another provision in FDICIA made it more difficult for regulators to treat a bank as "too big to fail." Post FDICIA, regulators could still consider a bank "too big to fail," but only when the failure of that institution would result in serious adverse effects on economic conditions or financial stability. In addition, FDICIA requires that regulators consult with the FDIC Board of Directors, the Board of Governors of the Federal Reserve System, the Secretary of the Treasury, the President of the United States, and the General Accounting Office before enacting the "too big to fail" provision. Thus, FDICIA did not eliminate the possibility that a bank would be considered "too big to fail"; however, it is now much tougher for regulators to follow such a policy (Benston and Kaufman 1997).

The change in bank failure resolution policy could have had an impact on the behavior of uninsured depositors. Unfortunately, trying to identify the effect this law had on depositor behavior during the New England banking crisis is difficult because of the timing of the crisis. Most of the bank failures in New England occurred either shortly after FDICIA was enacted or during 1991, when many of the provisions to be incorporated in the final legislation were becoming known to the marketplace. Even though Benston and Kaufman (1997) identified the change in FDIC closure policy as starting in 1992, changes in depositor behavior likely would have begun some time before 1992, since many of the changes that were to be required by the legislation were known in 1991 and the date when the law would be enacted was uncertain.

Given these caveats, Table 4 attempts to determine whether any changes in depositor behavior occurred, by grouping banks according to the date on which they failed. Three time periods are considered: the first two quarters of 1991 (14 bank failures); the last two quarters of 1991 (22 bank failures); and the period after 1991 (29 bank failures). Despite the difficulty in identifying the precise time when depositors realized that FDIC closure policy would change, Table 4 shows that the median percent decline in the level of jumbo CDs at failing banks was noticeably greater during the period immediately surrounding the passage of FDICIA than it was in early 1991. Higher interest rate spreads provide supporting evidence as well. The median rate on jumbo CDs (relative to peer banks) that a failing bank had to pay in its final two years of operation increased in the period immediately around the passage of FDICIA, and continued to increase further after 1991. Isolating those banks that relied most heavily on jumbo CDs, the magnitude of the median response was even stronger. These results suggest that the passage of FDICIA caused holders of jumbo CDs to be more responsive to changes in the financial health of the banks in this sample.

New England during the sample period, if a depositor experienced a job loss, the depositor might prefer small CDs to transaction accounts, in order to receive interest income to make up for lost wages. Such a switch in preferences would result in an increase in the level of small CDs, regardless of whether there was a change in depositors' assessments of the bank's riskiness. The empirical results suggest that this type of change in depositor preferences is not driving the results of this paper. First, the shift toward small CDs is only present at those banks with the highest exposure to large CDs. Panel A and Panel B of Table 2 show that the level of small CDs actually falls for banks in quartiles 1 and 2. Moreover, using a peer-adjusted change in deposits yields results that are qualitatively similar to the results presented in Table 2. Increases in the level of small CDs were not occurring at failing banks with little exposure to large CDs, or at relatively healthy peer banks. Thus, in order for this alternative explanation to be viable, one would have to believe that the impact the recession had on depositor preferences only affected the preferences of a specific group of depositors, those at failing banks with high exposures to large CDs. A second empirical result that suggests that this is not a viable explanation is the finding that failing banks in quartiles 3 and 4 paid a premium for their small CDs. If depositor preferences changed, now preferring small CDs over other accounts, banks would *not* be paying a premium on small CD deposits. In fact, if depositors now preferred small CDs over other accounts, one would expect that banks would have obtained these funds at a discount. The results in Table 3 show that these banks paid a premium for small CDs.

[13] More recent legislation, know as the depositor preference law, could also have altered the risks associated with holding uninsured deposits. This law made uninsured bank deposits senior to other types of bank liabilities. However, these changes occurred in 1995, after the sample period considered in this study.

Table 4
FDICIA and Jumbo CDs
Sample: 65 Banks that failed in New England, 1989–1995

Holdings and Interest Rate Spreads on Jumbo CDs—Pre- and Post-FDICIA periods
(Median values over final 8 quarters of operation)

	Full Sample of Banks			Banks in Highest Quartile for Jumbo CDs as a % of Total Deposits		
Date of Failure	Obs.	Interest Rate Spread (basis points)	% Change in the Level of Jumbo CDs	Obs.	Interest Rate Spread (basis points)	% Change in the Level of Jumbo CDs
1991 Q1 or Q2	14	15.11	−49.11	6	38.88	−51.59
1991 Q3 or Q4	22	43.68	−66.65	5	52.75	−73.40
After 1991 Q4	29	56.13	−62.65	5	130.81	−75.03
Test Statistic for difference in medians: 1991 Q1 or Q2 sample vs. After 1991 Q4 sample		−2.47**	2.04**		.84	−1.48
Test Statistic for difference in medians: 1991 Q1 or Q2 sample vs. the union of 1991 Q3 or Q4 sample and After 1991 Q4 sample		−2.33**	3.06***		−1.00	2.00**

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.
Source: Call Reports and author's calculations.

One concern regarding the results presented in Table 4 is that the "too big to fail" policy, as it was practiced prior to FDICIA, may be influencing the findings in this table. Three subsidiary banks of Bank of New England Corporation (BNE) failed in the first quarter of 1991. This was the largest bank holding company in New England at the time, and many believed, prior to its failure, that regulators would consider it "too big to fail."[14] This perception may have resulted in smaller interest rate spreads for BNE subsidiaries, and less of a deposit runoff, in the quarters prior to BNE's failure. Thus, an alternative interpretation of the results in Table 4 is that the relatively small interest rate spreads and deposit runoffs for the sample of banks that failed in the 1991 Q1 and Q2 periods are primarily driven by "too big to fail" banks, while the other periods are better represented by banks that were not "too big to fail." To check to see if BNE's subsidiaries are driving the results in Table 4, the analysis was replicated omitting BNE's three subsidiary banks. Interestingly, excluding these banks does not qualitatively alter the findings. They show only a slight increase in the interest rate spread and a slightly more negative deposit runoff when only non-BNE banks are considered in the failure periods of 1991 Q1 and Q2. The spread is still statistically lower than it is for banks that fail in later periods, and the percentage decline in large CDs is still statistically less negative than it is for banks that fail in later periods.

IV. Conclusion

The liability management activity documented in this study has implications for the closure policy for troubled banks. If banks relied heavily on uninsured deposits to fund their operations, a bank could continue to operate only so long as uninsured depositors were willing to continue their funding. In effect, markets could determine when a bank is to be closed, rather than relying on regulators. The evidence in this analysis suggests that uninsured depositors do react to the deterioration in bank health, at times reacting quite severely and starting as early as two years before the actual closure date of the bank. This implies

[14] Eventually regulators used the "purchase and assumption" method of failure resolution.

The findings of this study highlight the importance of close supervisory monitoring of troubled banks, given that the effectiveness of market discipline by depositors at the banks in New England diminished as many banks shifted their funding toward insured deposits.

that for many of the banks in this analysis, closure likely would have come at an earlier date, if not for their ability to raise funds in the insured deposit market.

To the extent that increases in insured deposits allow an orderly liquidation or sale of a distressed bank, it is beneficial to have regulators, rather than the market, make the closure decision. To the extent that a delayed closure decision allows a bank to take on additional risks that increase its eventual losses, the ability to raise additional funds in the insured deposit market can be detrimental. The evidence suggests that the latter scenario did not occur in the New England banking crisis. Jordan (1998) examines the activities of failing New England banks and finds little evidence supporting a shift to more risky activities. The lack of risk-shifting can be attributed, at least partially, to close regulatory scrutiny of these banks. In contrast to the New England experience, evidence from the nation's savings and loan crisis in the 1980s suggests that risk-shifting did occur at many institutions. Thus, the findings of this study highlight the importance of close supervisory monitoring of troubled banks, given that the effectiveness of market discipline by depositors at the banks in New England diminished as many banks shifted their funding toward insured deposits.

An important issue, not addressed in this study, is the effectiveness of depositor discipline at banks that do not fail. Looking solely at institutions that fail, one misses the most important rationale for deposit insurance: protecting solvent banks from depositor runs. An extension of this analysis, one the author is currently undertaking, will study the flows of insured and uninsured deposits at banks that did not fail.

References

Baer, Herbert and Elijah Brewer III. 1986. "Uninsured Deposits as a Source of Market Discipline: Some New Evidence." Federal Reserve Bank of Chicago *Economic Perspectives,* September/October, pp. 23–31.

Benston, George J. and George G. Kaufman. 1997. "FDICIA after Five Years." *Journal of Economic Perspectives*, vol. 11, pp. 139–58.

Billett, Matthew T., Jon A. Garfinkel and Edward S. O'Neal. 1998. "The Cost of Market versus Regulatory Discipline in Banking." *Journal of Financial Economics*, vol. 48, pp. 333–58.

Ellis, David and Mark J. Flannery. 1992. "Does the Debt Market Assess Large Banks' Risk?" *Journal of Monetary Economics*, vol. 30, pp. 481–502.

Flannery, Mark J. 1982. "Retail Bank Deposits as Quasi-Fixed Factors of Production." *The American Economic Review*, vol. 72, pp. 527–36.

Hall, John R., Thomas B. King, Andrew P. Meyer, and Mark D. Vaughan. 1999. "Do Uninsured Depositors and Bank Supervisors View Bank Risk Similarly? A Comparison of the Factors Affecting Jumbo-CD Yields and CAMEL Scores." Mimeo, Federal Reserve Bank of St. Louis.

Hannan, Timothy and Gerald A. Hanweck. 1988. "Bank Insolvency Risk and the Market for Large Certificates of Deposit." *Journal of Money, Credit and Banking,* vol. 20, pp. 203–11.

Jordan, John S. 1998. "Resolving a Banking Crisis: What Worked in New England." *New England Economic Review*, September/October, pp. 49–62.

Jordan, John S. and Jane Katz. 1999. "Banking in the Age of Information Technology." Federal Reserve Bank of Boston *Regional Review*, Q4, pp. 24–30.

Klein, Michael A. 1971. "A Theory of the Banking Firm." *Journal of Money, Credit and Banking*, vol. 3, pp. 696–709.

Peek, Joe and Eric S. Rosengren. 1995a. "The Capital Crunch: Neither a Borrower Nor a Lender Be." *Journal of Money, Credit and Banking*, vol. 27, pp. 625–38.

———. 1995b. "Banks and the Availability of Small Business Loans." Federal Reserve Bank of Boston *Working Paper*, No. 95-1.