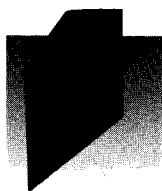# Ex ante risk and ex post collapse of S&Ls in the 1980s

Elijah Brewer III and
Thomas H. Mondschean

Since 1980, the Federal Savings and Loan Insurance Corporation (FSLIC) and its successor, the Resolution Trust Corporation (RTC), have recognized losses of over $125 billion. Between 1980 and 1989 the FSLIC spent approximately $55 billion resolving—that is, liquidating or merging into healthy institutions—546 failed thrift institutions (savings and loan associations and savings banks) with combined total assets of $192.7 billion. Between August 1989 and February 1992 the RTC resolved another 602 insolvent thrifts with assets of $186.1 billion.

Observers have attributed the huge cost of the S&L bailout to forbearance and moral hazard [Kane (1989), Barth, Bartholomew and Labich (1989), and Brumbaugh (1988), among others]. Forbearance—the failure to sell or liquidate an economically insolvent institution—has unquestionably played a major role in the S&L debacle. However, the role of moral hazard—the incentive for managers and shareholders to exploit underpriced deposit insurance by taking additional risk—has been harder to pin down. Some observers have argued that the cost of the S&L bailout would have been far lower if managers had not actively sought to increase their risk exposure. They point to the heavy losses that many economically insolvent thrifts experienced on their nontraditional investments. These investments are widely perceived to have been riskier than the residential mortgages in which thrifts traditionally specialized.

Several studies suggest that moral hazard was responsible for a significant portion of the thrift industry's losses during the 1980s [Benston and Koehn (1989), Cole (1990a and 1990b), Kane (1989), and McKenzie, Cole, and Brown (1992)]. However, two important questions relating to the importance of moral hazard remain unanswered. First, did the marketplace view the additional investments as risk increasing at the time they were made? Second, did these investments have a positive impact on the value of the S&Ls' common stock returns? If the answer to either of these questions is "no" then the view that moral hazard played an important role is less plausible.

The purpose of this article is to report on some recent empirical work that attempts to answer these two questions. This research examines the risk premiums on S&Ls' large certificates of deposit (CDs) and returns on and volatility of S&L common stock. These studies report evidence in support of the moral hazard hypothesis. The volatility of S&Ls' stock returns is used to identify those assets which ex post turned out to be risky. The risk premiums on the uninsured CDs issued by S&Ls are employed to demonstrate that, ex ante, the marketplace believed that these investments were causing the institutions' risk to increase. Final-

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ly, stock returns are used to demonstrate that the share prices of poorly capitalized S&Ls rose as these S&Ls increased the risk of their asset portfolio. This suggests that shareholders and managers of poorly capitalized institutions were indeed subject to moral hazard.

The article is organized into five sections. The first section examines S&L performance in the early and mid-1980s both to document some of the underlying causes of the S&L crisis and to describe the environment in which S&Ls were operating. The second section explains the economic incentives S&Ls had to increase risk exposure and how this greater risk exposure should be reflected in both the large CD and stock markets. The next sections present evidence concerning the impact of S&L risk taking on CD rates and common stock returns. The final section contains concluding remarks.

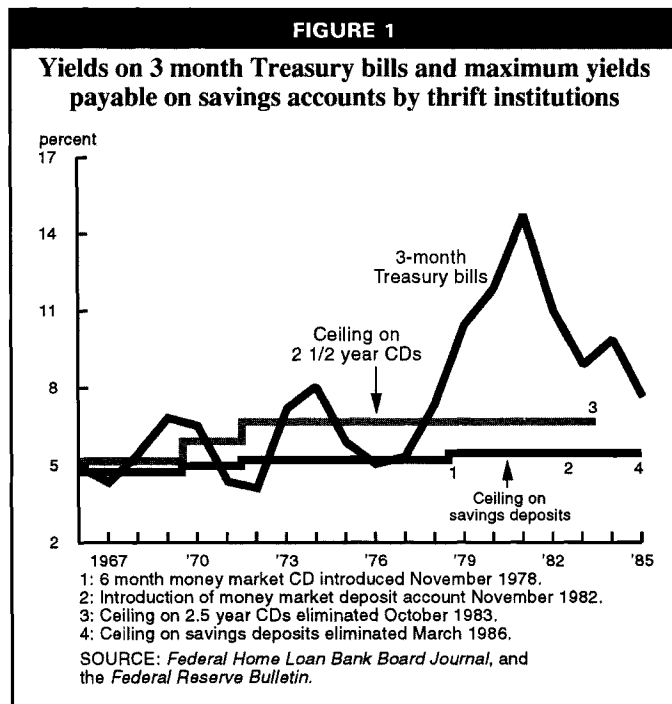## Setting the stage for disaster: interest rate and credit risks

Traditionally, savings and loan associations were consumer-oriented depository institutions which held long term, fixed rate mortgage loans financed largely by short term (and therefore variable rate) liabilities. Regulations established in the 1930s encouraged this specialization and enabled the savings and loan industry to grow rapidly. The qualified thrift lending test offered S&Ls favorable tax treatment in exchange for specializing in residential mortgage lending. S&Ls were encouraged to make long term, fixed rate mortgage loans and to fund them with short term funds that effectively were subject to immediate withdrawals.

Despite the mismatch between the maturities of their assets and liabilities created by these regulations, S&Ls remained profitable until the mid-1960s.[1] The average rate paid on their funds generally remained below the average yield on their longer term assets. S&Ls were able to mismatch asset and liability maturities without seriously affecting profitability because market interest rates remained relatively stable.

In the mid-1960s, however, rising rates of inflation, accompanied by rapidly rising market inter-

est rates, transformed the advantage of a steady stream of interest and principal payments from fixed rate mortgage loans into an overriding disadvantage. Another problem emerged when short term interest rates rose above the Regulation Q type ceiling rate, which, as may be seen from Figure 1, was generally the case during the late 1960s, the 1970s, and 1980s. In those periods when market interest rates rose above the ceiling rate, many depositors withdrew their funds in order to invest them where they could earn higher rates in the money market, resulting in outflows of S&L deposits. A sudden and severe outflow of funds forced S&Ls with insufficient liquid assets to borrow from the Federal Home Loan Bank System and slow down mortgage lending. Once market interest rates fell back below the ceiling rate, funds flowed back into S&Ls and mortgage lending resumed.

Except for a few periods between 1966 and the late 1970s, the average deposit rate paid by S&Ls was less than the average return on their longer term assets. As long as the accounting profits were positive, book value capital did not decline. Book value of capital was also bolstered because assets and liabilities were not written down to reflect the impact of higher interest rates. However, an increase in interest rates lowers the market value of a typical S&L's net worth because the market value of

FIGURE 1

Yields on 3 month Treasury bills and maximum yields payable on savings accounts by thrift institutions

1: 6 month money market CD introduced November 1978.
2: Introduction of money market deposit account November 1982.
3: Ceiling on 2.5 year CDs eliminated October 1983.
4: Ceiling on savings deposits eliminated March 1986.

SOURCE: *Federal Home Loan Bank Board Journal*, and the *Federal Reserve Bulletin*.

its long term assets declines more than the market value of its shorter term liabilities. Because S&Ls do not have to recognize these market value losses in their accounting, both regulators and the public may believe that an S&L has more capital than it actually has during periods of high market interest rates.

The effects of interest rate increases on S&L solvency grew progressively worse in the late 1970s. The increase in inflation and the subsequent period of monetary restraint resulted in substantially higher nominal interest rates for a longer period than at any time since the Civil War. As the gap between permissible deposit rates and market rates widened, depositors fled to higher yielding investments, such as Treasury bills and commercial paper. Those with insufficient resources to invest in these financial instruments directly turned to money market mutual funds, which permitted smaller savers to earn higher returns than S&Ls could offer.
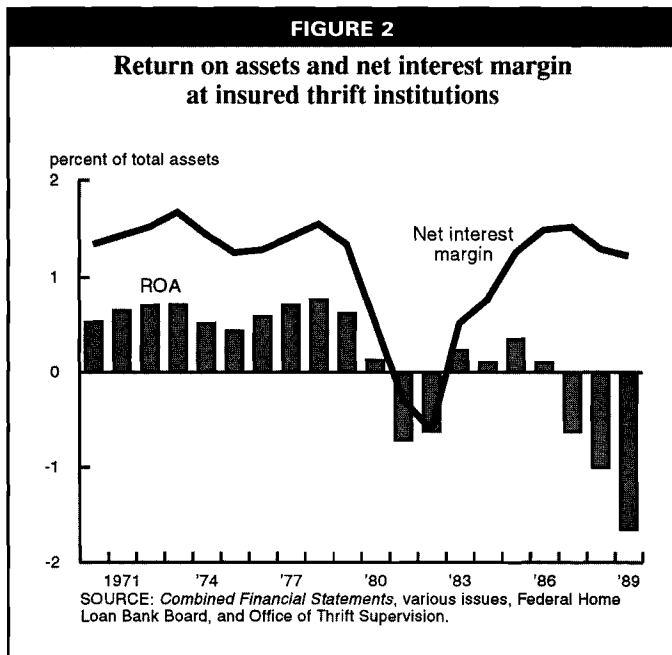
Because the size of deposit outflows was so large, S&Ls were permitted in November 1978 to offer a new type of deposit, a six month money market certificate whose interest rate was tied to the six month Treasury bill rate at the time. As a result, the deposit outflow slowed. However, because over 80 percent of S&L assets were invested in long term, fixed rate mortgage loans made previously at lower interest rates, the interest income on their asset portfolios did not increase as rapidly as their cost of funds, causing S&Ls to suffer large losses. In retrospect, the S&L industry failed to forecast accurately the level of nominal short term interest rates in the late 1970s and early 1980s; consequently, they charged a rate on long term, fixed rate mortgage loans that was too low to cover their future costs of deposits.[2]

Although much of the S&Ls' exposure to interest rate risk could have been mitigated by permitting them to offer adjustable rate mortgage loans that tied the mortgage interest rate to the cost of funds, few thrifts outside of state chartered S&Ls in California were permitted to issue such mortgage loans prior to 1979. After being prevented from doing so earlier by Congress, the Federal Home Loan Bank Board (FHLBB) authorized adjustable rate mortgage loans for all federally chartered S&Ls in California in January 1979, and it extended these powers nationwide in July of the same year. Besides adjustable rate

mortgage loans, S&Ls can manage interest rate risk by using derivative instruments such as financial futures to hedge or by lengthening the maturity of their deposits. Hedging involves taking a position in the futures market opposite that in the cash market so that, regardless of the movement in interest rates, losses in one market will be offset by gains in the other market. In July 1981, the FHLBB gave S&Ls permission to use financial futures to hedge their interest rate risk exposure. Other interest rate risk hedging instruments, such as swaps and options on financial futures, have become available only in recent years. Thus, the tools S&Ls now have for hedging their interest rate risk exposure became available too late to deal with the interest rate risk problems of the 1970s and early 1980s. Moreover, few S&Ls had the knowledge or experience to effectively use derivative instruments that were available during this period.

Figure 2 illustrates the consequences of S&L interest rate risk exposure. The accounting return on assets (ROA) for the industry was approximately -0.70 percent in 1981 and -0.60 percent in 1982, the first years of negative aggregate returns on assets for the S&L industry since the now defunct FSLIC was established in the early 1930s. Book net worth as measured by generally accepted accounting principles (GAAP) declined by over 37 percent between 1980 and 1982. Moreover, the level of market interest rates was so high in 1981 and 1982 that some 2/3 of all S&Ls were insolvent on a market value basis, since the market value of their longer term assets fell below the value of their liabilities.

In response to the problems that the S&L industry was experiencing, Congress and regulators lowered regulatory capital requirements from 5 percent to 3 percent. They also permitted S&Ls to count as part of capital as defined by regulatory accounting principles (RAP) net worth certificates (paper issued by the FHLBB to increase regulatory, though not economic, net worth), appraised equity capital, and qualifying subordinated debentures, and to defer losses on the sale of assets bearing below market interest rates. All of these items are excluded from net worth calculated using GAAP. Thus, the regulations effectively permitted some GAAP insolvent but RAP solvent S&Ls to remain open.

FIGURE 2

Return on assets and net interest margin at insured thrift institutions

percent of total assets

Net interest margin

ROA

1971   '74   '77   '80   '83   '86   '89

SOURCE: *Combined Financial Statements*, various issues, Federal Home Loan Bank Board, and Office of Thrift Supervision.

capital was negative due to a rise in interest rates [Kane (1985)]. Between 1982 and 1989, TAP capital increased; however, as indicated in Figure 3, the capital-asset ratio in 1989 was still below 1 percent.

By relaxing solvency rules, Congress and regulators allowed inadequately capitalized S&Ls to remain open to gamble for resurrection. This behavior exacerbated the damage incurred during the high interest rate period. In a recent study, the Congressional Budget Office estimated that the cost of not closing S&Ls in the year when they first became book value insolvent from 1980 through 1990 was over half of the estimated $127 billion cost (in 1990 dollars) of resolving them over this period [see CBO (1991)].

In addition to relaxing capital requirements, Congress increased asset powers for S&Ls by permitting them to make mortgage loans backed by commercial real estate as well as other types of nonmortgage loans and to hold junk bonds. Barth, Bartholomew, and Labich (1989) found that nontraditional activities and the capital forbearance policy of the FSLIC

While RAP clearly represents a softening of GAAP designed to present a more favorable picture of the industry's condition, many critics have argued that what is needed is just the opposite—accounting principles that value industry capital even more conservatively than GAAP. Generally accepted accounting principles allow S&Ls to count as part of capital the amount of goodwill and other intangible assets resulting from mergers. As a result of the supervisory mergers arranged by the Federal Home Loan Bank Board during the early 1980s, over $20 billion of additional goodwill was put on the books of S&Ls. Supervisory goodwill consists of the amount over market value of capital paid by one S&L to acquire another, troubled, S&L and is not related to a future rise in income, as is regular goodwill. According to Barth (1991), the effect of the supervisory mergers was to increase reported but not economic capital for a long time after the merger.
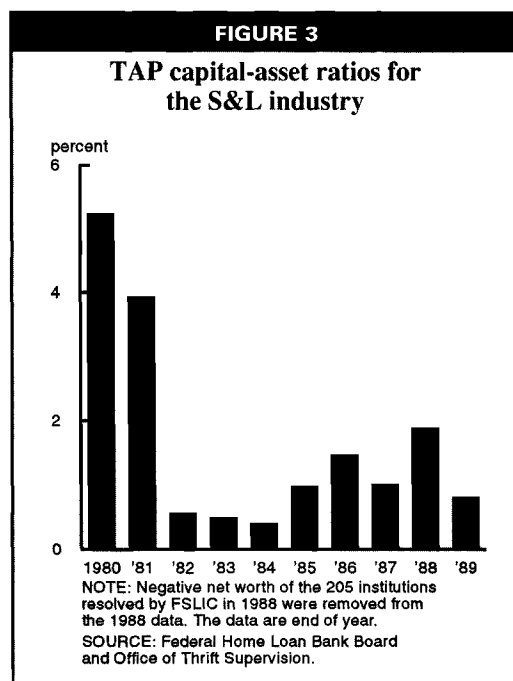
When goodwill and other intangible assets are subtracted from the GAAP measure, the result is net worth computed using tangible accounting principles (TAP). Figure 3 shows book value TAP capital-asset ratios for the S&L industry from 1980 to 1989. At the beginning of the 1980s, the TAP capital-asset ratio for the industry was approximately 5.2 percent. By the end of 1982, the TAP capital ratio had declined to only 0.55 percent and market value

FIGURE 3

TAP capital-asset ratios for the S&L industry

percent

1980 '81   '82   '83   '84   '85   '86   '87   '88   '89

NOTE: Negative net worth of the 205 institutions resolved by FSLIC in 1988 were removed from the 1988 data. The data are end of year.

SOURCE: Federal Home Loan Bank Board and Office of Thrift Supervision.

were significantly positively associated with resolution costs. Nevertheless, according to Barth (1991), the delay in reorganizing or closing poorly capitalized institutions was a more important factor affecting the magnitude of S&L losses than was deregulation.

Another factor which affected S&L behavior in the 1980s was access to underpriced deposit insurance. Brickley and James (1986) investigate the effect of underpriced deposit insurance on the common stock returns for financially weak institutions. Using S&L data for the period 1976 through 1983, they found that stock returns for financially weak S&Ls responded to changes in solvency rules as if deposit insurance were a valuable asset. In the next section we describe how underpriced deposit insurance is related to the moral hazard problem.

The theory of moral hazard

Financial theory suggests that changes in asset mix or financial leverage should influence expected returns on equity. Because shareholders hold residual claims on earnings, their interests often diverge from those of creditors. Because their liability is limited to the amount of their investment, shareholders have incentives to invest in risky assets if the increase in the firm's variance of returns from investing in these assets is sufficiently increased. If the investments pay off, shareholders keep all the gains; if losses are incurred, they are shared with creditors. These incentives exist with or without deposit insurance. Without deposit insurance, however, depositors would impose market discipline on the use of their funds either by requiring a higher return on their funds for bearing increased risk or by reducing the availability of funds to perceived riskier institutions. Thus, the willingness of firms to invest in risky assets is held in check by the concern of depositors for the safety of their funds.

In some instances, however, federal deposit insurance creates incentives for excessive risk taking by S&Ls. As with any insurance contract, the insured S&L, having been shielded from some of the consequences of its actions, has an incentive to act in a manner that increases the insurer's exposure to losses. The danger that the insured party may do so is referred to as "moral hazard." Private insurers try to minimize this behavior by charging more to insure

riskier firms and reserving the right to withdraw coverage should firm risk increase after insurance premiums are paid. However, S&L deposit insurance rates have been fixed independently of asset risk, so that riskier S&Ls are more likely to underpay for insurance. This means that deposit insurance becomes a valuable asset for undercapitalized S&Ls. The worth of deposit insurance can be modelled as a put option on the underlying assets of the institution [Merton (1977)]. As for any option, the value of the deposit insurance put option increases with increases in risk assumed through undercapitalization and changes in assets.

Underpriced, fixed rate deposit insurance need not lead managers and shareholders to take excessive risks. If regulators intervene early to limit such behavior, require owners to recapitalize poorly capitalized institutions, or, if preventive measures fail, take steps to resolve institutions through sale or liquidation as soon as they become economically insolvent, the costs of excessive risk taking would either be eliminated or would be borne by the institution's shareholders [Benston and Kaufman (1988)]. Unfortunately for the taxpayer, S&L regulators not only failed to close or recapitalize the large portion of the industry that had become insolvent because of the rise in interest rates during the early 1980s, they actually reduced capital requirements to match the new, lower level of S&Ls' capital. Worse, they frequently permitted insolvent institutions to be managed as if they were going concerns.

In order to test the moral hazard hypothesis, we must determine how various categories of assets are related to S&L risk. An increase in an S&L's risk profile should make the returns on its common stock more volatile, so stock return volatility provides a measure of the riskiness of an S&L's assets. We also need to determine whether the market perceived certain portfolio changes as increasing S&L risk. The impact of changes in risk on the value of deposit insurance and of the institution will not be reflected in accounting data. However, in selecting riskier combinations of mortgage and nonmortgage assets, an S&L may lead the debt and equity markets to revalue the S&L's portfolio. This information will be incorporated into the price of the S&L's shares and debt instruments. According to the moral hazard hypothesis, the value of an undercapitalized S&L and

hence the price of its shares should rise as asset risk increases. Consequently, if market participants perceive that an undercapitalized S&L is increasing risk, they ought to bid up the share price. To determine whether market participants perceived S&Ls to be increasing their risk, we look at the interest rates on uninsured CDs, which should be positively related to risk, and on stock returns, which should increase for undercapitalized S&Ls that increase risk.

The riskiness of S&L investments

In this section, we examine the relationship between two market based measures of risk—the volatility of stock returns and premiums on uninsured CDs—and S&L asset composition. Barth, Bartholomew, and Labich (1989) present evidence indicating that S&L acquisition and development loans (ADLs)—loans to finance the purchase of land and the accomplishment of all improvements required to convert it to developed building lots—were associated with greater losses and resolution costs. Recently, junk bond investments have been associated with some of the largest and most expensive S&L failures. A study by Brewer and Mondschean (1993) found that acquisition and development loans and investments in junk bonds increased S&Ls' risk exposure.

The relationship between an S&L's portfolio composition and the volatility of its stock returns provides a measure of the riskiness of various assets. Using quarterly data on a pooled time series, cross-sectional sample of 75 S&L organizations for the 1987-1989 period, Brewer and Mondschean (1993) regressed the stock return volatility, as measured by the standard deviation of stock returns, on financial leverage and the ratios of several asset categories to market capitalization. Controlling for leverage, we found that ADLs and junk bonds were positively related to stock return volatility while other mortgage assets, nonmortgage loans, and real estate direct investments were negatively related to the volatility measure. These results suggest that ADLs and junk bonds proved to be riskier than other assets available to S&Ls.

We next sought to determine whether uninsured depositors viewed these investments as being risky at the time they were made. To do this we specified a relationship between the interest rate paid on large certificates of deposit (deposits in excess of $100,000, which are not

insured), the amount of ADLs and junk bonds relative to market capitalization of S&L net worth, and a set of variables designed to proxy for other factors affecting the interest rate on S&L deposits.

We estimated a regression equation using the same 75 S&L organizations for the 1987-1989 period. We found a positive and statistically significant relationship between the proportions of both junk bonds and ADLs held relative to market capitalization and the interest rate paid on large CDs, holding other factors constant. This indicates that depositors demanded higher interest rates to compensate for bearing additional risk. Moreover, the risk premium paid by S&Ls holding junk bonds existed before the decline in junk bond prices in 1989.[3] We also found that CD rates were inversely related to an S&L's market capitalization-asset ratio, which is expected because a higher market capitalization-asset ratio represents a larger cushion against unexpected losses. These results are consistent with previous studies that found a risk premium in interest rates paid on large CDs.[4] Thus, we conclude that institutions with larger shares of ADLs and junk bonds in their portfolios were perceived as more risky by depositors and raised the expected liability to the deposit insurance fund even before the assets went bad.[5]

The potential for shareholders' gains from underpriced federal deposit insurance

The next question is whether the stock market in fact rewarded those institutions that increased their holdings of these risky assets. If we find that they were rewarded for taking additional risk, then we can conclude that shareholders and managers were in fact subject to moral hazard.

The value of shareholders' equity (MV) has three components: assets other than the net value of deposit insurance (A), explicit liabilities to creditors (L), and the option value of the deposit insurance contract (DI). That is, the value of shareholders' equity can be written as:

$$(1) \quad MV_{j,t} = A_{j,t} - L_{j,t} + DI_{j,t},$$

where $MV_{j,t}$ is the market value of equity for the jth S&L at the end of period t, $A_{j,t}$ is the value of total assets, $L_{j,t}$ is the value of liabilities, and $DI_{j,t}$ is the value of deposit insurance.[6] Follow-

ing Merton (1977), the value of the deposit insurance contract, DI can be written as:

$$(2) \quad DI_{j,t} = \delta \left(A_{j,t} / L_{j,t}, \sigma_A \right),$$

where $A_{j,t} / L_{j,t}$ is the ratio of total assets to total liabilities and σ_A is the volatility of asset returns. Using a capital asset pricing model derived from the finance literature, Brewer (1992) tested for moral hazard by examining the effect of changes in financial leverage and asset mix on stock returns. The model, discussed in detail in Brewer (1992), can be written as:

$$(3) \quad R_{j,t} = \sum_{k=1}^{K} \delta_k \left(\Delta A_{j,t}(k) / MV_{j,t} \right) + \text{Other Factors} + \varepsilon_{j,t} ,$$

where $R_{j,t}$ is the rate of return on common stock; $\Delta A_{j,t}(k)$ is the change in the holdings of the kth asset during period t of the jth S&L; $MV_{j,t}$ is the market value of capital of the jth S&L at the end of period t; and the parameter δ_k measures the impact of a change in the holdings of each of the k assets on the value of deposit insurance through the impact on total asset return volatility and therefore on stock returns. The other factors refer to variables such as changes in financial leverage, a stock market return index, and a long term Treasury bond return index; and $\varepsilon_{j,t}$ is a stochastic error term.

If deposit insurance is valuable to S&Ls beyond the premium paid and the market recognizes its value and rewards managers and shareholders for taking actions that further increase the value of deposit insurance, then the δ_k for risky assets should be positive. This gives value maximizing S&Ls incentives to shift risk to the deposit insurance fund in an attempt to expropriate wealth.

S&L asset risk exposure can be captured by the following individual asset categories: residential mortgage loans, commercial mortgage loans, acquisition and development loans, other mortgage assets, direct real estate investments, investments in service corporations; nonmortgage loans, and other nonmortgage assets. The δ_k should be larger for more risky assets if the moral hazard hypothesis is correct.

Brewer (1992) developed a procedure for testing the moral hazard hypothesis using Equation (3). First, S&Ls are ranked according to their risk of failure. Risk of failure is measured as the sum of one plus the mean return on common stock divided by the standard deviation of the rate of return on common stock. Intuitively, the risk of failure is an estimate of the number of standard deviations below the mean that the return on common stock would have to fall so as to render equity negative. Negative equity is one common definition of insolvency. High probability of insolvency is reflected in high standard deviation of common stock returns, low mean returns, and low capitalization ratios. The ordered sample is then divided into three groups: high risk, medium risk, and low risk.

Brewer used a sample of 63 S&Ls and S&L holding companies. The high risk category included the first 40 percent of S&Ls in the ordered sample, the medium risk category included the next 20 percent of S&Ls, and the low risk category was comprised of the remaining 40 percent of S&Ls in the ordered sample. Differences in average portfolio holdings of various assets are presented for the high and low risk S&Ls in Table 1. At the end of 1987, low risk S&Ls had on average greater propor-

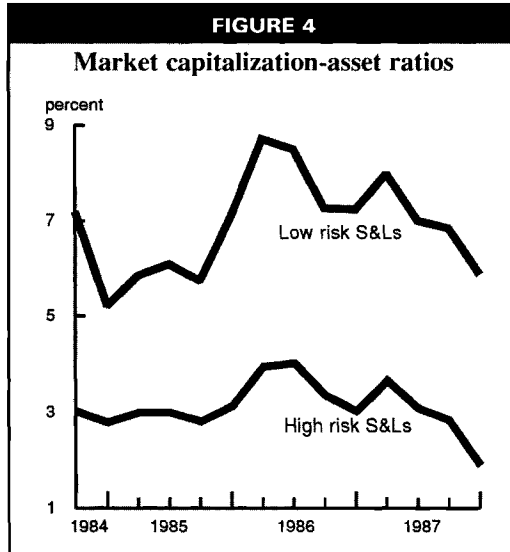| TABLE 1		
Selected financial ratios for high and low risk S&Ls (1987 average percent of total assets)		
	High risk	**Low risk**
Residential mortgage loans	.331 (.169)	.369 (.109)
Mortgage backed securities	.168 (.133)	.166 (.119)
Commercial real estate loans	.130 (.104)	.089 (.069)
Acquisition and development loans	.037 (.052)	.027 (.057)
Direct investments	.010 (.018)	.010 (.020)
Investments in service corporations	.023 (.033)	.017 (.022)
Consumer nonmortgage loans	.036 (.042)	.037 (.037)
Commercial nonmortgage loans	.023 (.036)	.023 (.036)

NOTE: Standard deviations are in parentheses below means.

tions of traditional (residential) mortgage loans than high risk S&Ls. High risk S&Ls tended to hold more commercial real estate loans and acquisition and development loans than low risk firms. Nevertheless, high risk S&Ls did not show dramatically different portfolio composition from low risk associations. However, analysis of S&L capital in market capitalization terms, as shown in Figure 4, paints a different picture.

Figure 4 presents the market capitalization-asset ratios for S&Ls classified as having high and low risks of failure in the fourth quarter of 1987. S&Ls which were classified as being high risk in the fourth quarter of 1987 had much lower market capitalization ratios in 1984. The high risk S&Ls in our samples had weaker capital positions even before they undertook nontraditional high risk investments. Because of their low market capitalization-asset ratios, high risk S&Ls would be more likely to benefit from risk increasing strategies and more likely to choose assets that increased risk and shareholder wealth at the expense of the FSLIC. Brewer (1992) found that over the 1981-87 period high risk S&Ls experience one time common stock return increases following a shift from residential mortgage loans to commercial mortgage loans, acquisition and development loans, investments in service corporations, and nonmortgage loans (commercial and consumer loans). In contrast, S&Ls in the low risk category experience no statistically significant association between these asset mix variables and S&L stock returns. The fact that the stock market responded positively to increased risk taking only for the high risk group of S&Ls supports the view that federal deposit insurance combined with in adequate capitalization created a moral hazard problem.
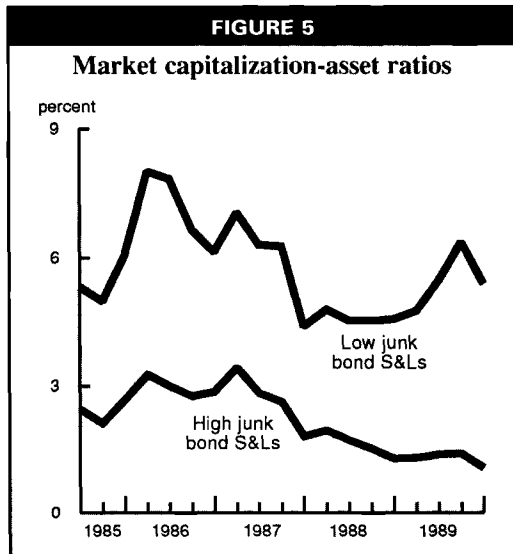
The impact of junk bond investments on S&L stock returns

Another test of the moral hazard hypothesis can be developed by examining the impact of junk bonds on S&L shareholders' equity returns. At the time they were issued it was widely recognized that junk bonds had the risk characteristics of both long term bonds and equity. Brewer and Mondschean (1993) used data on 75 S&L organizations whose stocks were traded on the New York Stock Exchange, American Stock Exchange, or over the counter from 1987 to 1989. S&Ls were classified as

FIGURE 4

Market capitalization-asset ratios

"high" junk bondholders or "low" junk bondholders. To be considered a high junk bondholder, an S&L in the sample must have ranked among the top 50 junk bondholders at the beginning of the sample period. The remaining S&Ls were classified as low junk bondholders. Figure 5 compares the average market capitalization-asset ratios for the 18 S&Ls in the sample classified as high junk bondholders with those for the 57 S&Ls classified as low junk bondholders. The 18 S&Ls in the high junk bond category had much lower capitalization ratios than the low junk bond group.

From the end of 1985 to the end of 1988, total S&L holdings of junk bonds grew from $5.59 billion to $14.64 billion, an increase of over 160 percent in three years. After the end of 1988, however, S&Ls began to reduce and/or write down their holdings of junk bonds, so that by the end of 1989 the amount held had declined to $10.46 billion, at least partly as a result of restrictions imposed by FIRREA. FIRREA, enacted in August 1989, required S&Ls to divest their holdings of junk bonds by July 1, 1994. The regulations implementing the act required S&Ls to record junk bonds at market rather than book value. Throughout the sample period, the top 50 holders had over 95 percent of all S&L junk bond holdings. These investments were large relative to the tangible capital of the S&Ls holding them. For the publicly traded S&Ls that were among the top 50 junk bondholders, the dollar value of junk bonds exceeded their tangible capital.

FIGURE 5

Market capitalization-asset ratios

In order to test the moral hazard hypothesis that the stock market should reward insured institutions with low capital which take additional risk, we divided our sample of 75 S&Ls into two groups using a 3 percent TAP capital-asset ratio as the cutoff point. Using a pooled time series, cross-section from 1987 to 1989, we regressed the quarterly stock return on the quarterly change in financial leverage and changes in the proportion of junk bonds and other assets relative to the market capitalization, controlling for overall stock and junk bond market effects. For more complete information on methodology and data sources, see Brewer and Mondschean (1993).

Our results indicate that, for low capital S&Ls, an increase in junk bonds yielded a one time increase in common stock returns. As expected, increases in junk bonds did not have a statistically significant effect on the common stock returns of high capital S&Ls. This result was consistent with an earlier finding by Brewer (1992). With the exception of real estate direct investments, all of the other asset mix variables have positive coefficients and most have significant impacts on the common stock returns of low capital S&Ls. These results support the notion that the stock returns of S&Ls on the edge of insolvency respond positively to increased risk as implied by the moral hazard hypothesis. They also suggest that access to deposit insurance is not as valuable for better capitalized S&Ls.

Conclusions

The empirical results reported in this paper suggest that there was evidence of moral hazard in the S&L industry in the period preceding the passage of FIRREA. Poorly capitalized S&Ls increased their risk exposure and were rewarded with higher stock returns. Uninsured depositors received higher CD rates from institutions with larger stock return volatility, greater exposure to junk bonds and ADLs, and lower capital-asset ratios. Thus, our work isolated two assets that both raised the value of the deposit insurer's liability and the stock returns of poorly capitalized institutions.

These findings suggest that it was moral hazard and not simply bad luck or delayed closure that led to the S&L crisis and increased its cost. The results also suggest that capital forbearance allowed S&Ls to take on excessive risk in many ways, including the purchase of junk bonds. S&Ls that were classified as high risk in 1987 and S&Ls that purchased large amounts of junk bonds had relatively lower capital-asset ratios. The lack of reserves in the FSLIC fund prevented S&L regulators from closing those institutions commonly known to be beyond hope of recovery. The conclusion is that capital forbearance was a gamble for the FSLIC. The risk inherent in this gamble came from the additional time forbearance gave managers to gamble for resurrection by making large volumes of high risk, potentially high profit loans. If the loans made good, the institutions would have reaped the profits, but if the loans soured and the lender went broke, the federal deposit insurer was liable for the losses, not the institutions' owners.

Underpriced, fixed rate deposit insurance provides an incentive for value maximizing S&Ls to take additional risks, since it induces a positive correlation between stock market returns and changes in holdings of risky assets. The evidence presented in this article suggests that the incentive to take excessive risk is strongest when there is little equity left. Poorly capitalized S&Ls tend to take excessive risks of all types (both in mortgage and nonmortgage investments). Prohibiting S&Ls from holding junk bonds (or other risky assets) will not prevent them from taking more risk because there are many ways for depository institutions to acquire assets which are at least as risky as junk bonds. Legislative action which attacks exces-

sive risk taking by prohibiting institutions from acquiring particular classes of risky assets is attacking the symptoms of the disease instead of its causes and is doomed to fail. If the incentives to increase risk are there, then value maximizing institutions will find a way to circumvent regulations and increase risk. The solution is to adopt policies that eliminate incentives for institutions with low capital to increase their risk exposure, as begun in the recently enacted Federal Deposit Insurance Corporation Improvement Act of 1991.

FOOTNOTES

[1] A depository institution's sensitivity to interest rate changes can also be calculated using durations of the assets and liabilities rather than their maturities. While maturity takes account only of the date of the last scheduled payment, duration averages the maturity of an instrument's future cash payments, with the present value of the cash payments serving as the weights.

[2] For a discussion of the importance of interest rate forecasts to S&Ls, see Kaufman (1972).

[3] In Brewer and Mondschean (1992), we examine the relationship between CD rates and several balance sheet variables for each quarter from March 1987 to June 1991. We report a positive correlation between junk bond holdings and CD rates for the entire sample period.

[4] See, for example, Baer and Brewer (1986), Hannan and Hanweck (1988), and James (1990).

[5] For a discussion of the impact of ADLs on the risk premiums on insured deposits, see Cook and Spellman (1991).

[6] See Kane (1985).

REFERENCES

Baer, Herbert, and Elijah Brewer III, "Uninsured deposits as a source of market discipline: some new evidence," *Economic Perspectives*, Federal Reserve Bank of Chicago, September/October 1986, pp. 23-31.

Barth, James R., *The Great Savings and Loan Debacle*, Washington, D.C., The AEI Press, 1991.

Barth, James R., Philip F. Bartholomew, and Carol Labich, "Moral hazard and the thrift crisis: an analysis of 1988 resolutions," *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, 1989.

Barth, James R., and Michael G. Bradley, "Thrift deregulation and federal deposit insurance," *Journal of Financial Services Research* 2, September 1989, pp. 231-259.

Benston, George J. and George G. Kaufman, "Risk and solvency regulation of depository institutions: past policies and current options," *Monograph Series in Finance and Economics*, Salomon Brothers Center for the Study of Financial Institutions, 1988.

Benston, George J. and Michael F. Koehn, "Capital dissipation, deregulation, and the insolvency of thrifts," unpublished paper, Emory University, December 1989.

Brewer, Elijah III, "The impact of the deposit insurance system on S&L shareholders' risk/return trade-offs," *Journal of Financial Services Research*, forthcoming, 1992.

Brewer, Elijah III and Thomas H. Mondschean, "The pricing of large certificates of deposit at savings and loan associations," unpublished paper, Federal Reserve Bank of Chicago, 1992.

_____, "An empirical test of the incentive effects of deposit insurance: the case of junk bonds at savings and loan associations," *Journal of Money, Credit and Banking*, forthcoming, 1993.

Brickley, James A., and Christopher M. James, "Access to deposit insurance, insolvency rules, and the stock returns of financial institutions," *Journal of Financial Economics* 16, July 1986, pp. 345-371.

Brumbaugh, R. Dan, Jr., *Thrifts under siege*, Cambridge, Mass., Ballinger Publishing Co., 1988.

Buser, Stephen A., Andrew H. Chen, and Edward J. Kane, "Federal deposit insurance, regulatory policy and optimal bank capital," *Journal of Finance* 36, March 1981, pp. 51-60.

Cole, Rebel A., "Agency conflicts and thrift resolution costs," Financial industry studies Working Paper No. 3-90, Federal Reserve Bank of Dallas, July 1990a.

_____, "Insolvency versus closure: why the regulatory delay in closing troubled thrifts?" Financial industry studies Working Paper No. 2-90, Federal Reserve Bank of Dallas, July 1990b.

Congressional Budget Office, "The cost of forbearance during the thrift crisis," *CBO Staff Memorandum*, June 1991.

Cook, Douglas O. and Lewis J. Spellman, "Federal financial guarantees and the occasional market pricing of default risk: evidence from insured deposits," *Journal of Banking and Finance* 15, December 1991, pp. 1113-1130.

Hannan, Timothy H., and Gerald A. Hanweck, "Bank insolvency risk and the market for large certificates of deposit," *Journal of Money, Credit, and Banking* 20, May 1988, pp. 203-211.

James, Christopher M., "Heterogeneous creditors and the market value of bank LDC loan portfolios," *Journal of Monetary Economics* 22, June 1990, pp. 325-346.

Kane, Edward J., *The Gathering Crisis in Deposit Insurance*, Cambridge, MA, MIT Press, 1985.

_____, *The S&L Insurance Mess*, Washington, D.C., Urban Institute Press, 1989.

Kaufman, George G., "The thrift institution problem reconsidered," *Journal of Bank Research* 3, Spring 1972, pp. 26-33.

McKenzie, Joseph A., Rebel A. Cole, and Richard A. Brown, "Moral hazard, portfolio allocation, and asset returns for thrift institutions," *Journal of Financial Services Research* 5, April 1992, pp. 315-339.

Merton, Robert C., "Analytical derivation of the cost of deposit insurance and loan guarantees: an application of modern option pricing theory," *Journal of Banking and Finance* 1, June 1977, pp. 3-11.

_____, "On the cost of deposit insurance when there are surveillance costs," *Journal of Business* 51, July 1978, pp. 439-452.

Resolution Trust Corporation, *RTC Review*, Vol. 3, April 1992.