Working Paper Series

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Working Papers Series
Issues in Financial Regulation
Research Department
Federal Reserve Bank of Chicago
April 1996 (WP-96-6)

FEDERAL RESERVE BANK OF CHICAGO

Alligators in the Swamp: the Impact of Derivatives on the Financial Performance of Depository Institutions*

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*We thank James Barth, Carolyn Brown, David Carter, Robert Eisenbeis, Joseph Haubrich, Roger Lundstrom, Anthony Saunders, Lewis Segal, Clifford Smith, and James Thomson for valuable comments and suggestions. The research assistance of Harvey Anderson, Nancy Andrews, and Peter Schneider is greatly appreciated. The views expressed here are solely those of the authors and do not represent the Board of Governors of the Federal Reserve System or the Federal Reserve Bank of Chicago. Most of this paper was completed while the first author was an associate professor of finance at the University of Illinois at Urbana-Champaign.

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ABSTRACT

It has been argued that underpriced federal deposit insurance provides incentive for insured institutions to increase the value of shareholder equity by expanding into activities that shift risk onto the deposit insurer. Derivative instruments have been used by firms to change their risk exposure. Permitting firms with substantial moral hazard incentives to utilize interest-rate derivative instruments could lead to higher rather than lower exposure to risk. This article, using a sample of savings and loan associations (S&Ls), examines the proposition that involvement with interest-rate derivatives instruments increases depository institutions' risk. We find that there is a negative correlation between risk and derivatives usage. In addition, S&Ls that used derivatives experienced relatively greater growth in their fixed-rate mortgage portfolios.

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Derivative instruments have become an increasingly important part of the product set used by depository institutions to manage their interest-rate risk exposure. As interest rates have become more volatile, depository institutions have recognized the importance of interest-rate futures and interest-rate swaps in reducing risk and achieving acceptable financial performance. Many researchers have documented that interest-rate risk and its effect on the volatility of earnings has a significant adverse impact on the common stock returns of depository institutions (see Flannery and James, 1984; Scott and Peterson, 1986; Kane and Unal, 1988, 1990; and Kwan, 1991). In coping with interest-rate risk, depository institutions may alter their business mix and move away from traditional lending activity to nontraditional activities. Deshmukh et al. (1983) argue that an increase in interest rate uncertainty encourages depository institutions to reduce their lending activities, which entails interest-rate risk, and to increase their provision of debt brokerage services. Derivative instruments may be useful to depository institutions because such instruments give firms a chance to hedge their exposure to interest-rate risk, complementing their lending activities. However, as recent articles in the *Wall Street Journal* (Jason and Taylor, 1994, Stern and Lipin, 1994) indicate, trading derivatives for profit is risky and may expose firms to large losses.[1]

This paper investigates the use of derivatives by savings and loan associations (S&Ls) over the years 1985-1989. Underpriced deposit insurance provided an incentive for S&Ls over this time period to increase the value of shareholder equity by investing in activities that shift risk onto the deposit insurer. Several studies suggest that this moral hazard behavior was responsible for a significant portion of the S&L's losses during the 1980s (Brewer, 1995; Brewer and Mondschean, 1994; Cole, 1993, 1990a, 1990b; Kane, 1989; McKenzie, Cole, and Brown, 1992). Benston and Koehn (1989) reported that increased emphasis on riskier nontraditional activities resulted in greater stock return volatility for poorly capitalized S&Ls but lower volatility for healthier associations. Brewer (1995) found that shifts in asset composition toward nontraditional activities resulted in increases in the return on equity for financially distressed S&Ls but had no effect on healthy institutions. This suggests that shareholders rewarded risk-shifting actions that raised the value of the deposit insurance subsidy. If a financially distressed institution wishes to increase its risk exposure, derivatives represent an alternative to balance sheet adjustments. An important issue is whether S&Ls used derivatives in a way intended to increase the value to them of deposit insurance. This is an important empirical issue because some analysts argue that derivatives are inappropriate instruments for institutions with federal deposit insurance. It is also important because many of the large losses of the S&L industry in the 1980s were borne by the taxpayer. Using several different measures of risk, we find that involvement with interest-rate derivatives instruments is not risk-increasing for our sample of S&Ls. Moreover, this "stylized fact" is supported by several tests rather than any single test. The popular view that S&Ls used derivatives to "gamble for resurrection" is not consistent with the evidence in this article. In addition, S&Ls which participate in derivatives experienced greater growth in their fixed-rate mortgage portfolios than S&Ls not involved in derivatives.

The remainder of this article is presented in the following four sections. The first section of this article examines the relationship between stock return volatility and an S&L's involvement in derivative activity. The second section examines whether derivative activities affect the risk premium on large certificates of deposit (CDs). The third section investigates the relationship between involvement in derivative activities and an S&L's mortgage lending. The four, and last, section offers a brief summary of our findings.

1. Firm Market Risk and Derivative Usage

A. Theoretical framework and model specification

The association between S&Ls' total risk and their use of derivatives can be measured by examining the relationship between the volatility of the return on equity and S&Ls' involvement in interest-rate derivative markets. The volatility of equity may be influenced by an S&L's investment policies. During the early 1980s, S&Ls were given broader powers to hold nontraditional assets. Nontraditional assets (Nontradast) include commercial real estate loans, acquisition and development loans, and junk bonds. If S&Ls altered the composition of their investment portfolios (moving, for example, from traditional assets to nontraditional assets), this might affect S&Ls' stock return volatility.[2]

An S&L's riskiness is also influenced by its ability to borrow and sell assets that have a ready market value without incurring substantial losses. The best indicator of this ability is an S&L's liquid assets (LIQUID) which are available to meet short-run cash outflows or to use as ready collateral for borrowing funds.

Thus,

$$\sigma_{j,t} = s_0 + s_1\, LEV_{j,t} + s_2\, LIQUID_{j,t} + s_3\, NONTRADAST_{j,t} + \nu_{j,t}\ , \tag{1}$$

where the LIQUID and NONTRADAST variables are divided by market value of capital; $\sigma_{j,t}$ is the equity volatility of the jth S&L in period t; $LEV_{j,t}$ is the financial leverage ratio of the jth S&L in period t; and $\nu_{j,t}$ is an error term.

The volatility of equity may also be influenced by an S&L interest-rate risk exposure. One measure that has been developed to capture an S&L interest-rate risk exposure is called the dollar maturity gap-- the difference between the dollar value of short-term assets and liabilities (where short-term is typically defined as maturities less than a year).[3] The maturity gap position is taken as a percent of total assets ($GAP_{j,t}$) to express the degree of interest-rate sensitivity relative to the S&L's total size. The presumption is that the higher the absolute value of the ratio, the more the S&L is exposed to unexpected interest rate changes. The expected relationship between the absolute value of the dollar maturity gap ratio and the risk measure is positive.

We include another variable in the specification to capture the operating risk of each S&L. The ratio of operating expense (including interest expense) to total income $ORISK_{j,t}$ captures the volatility of operating expenses relative to income. The risk of insolvency is directly related to the possibility of operating expenses overwhelming operating income (Lindley, Verbrugge, McNulty, and Gup, 1992). In order to allow for the impact of S&Ls' use of derivative instruments on the volatility of stock returns, an indicator variable, $DERIV_{j,t}$, is included in the specification. The $DERIV_{j,t}$ variable is then decomposed into two binary dummy variables. The first measure, $SWAP_{j,t}$, is an indicator variable equal to one if the jth S&L reports a nonzero notional value of swaps outstanding at time t and zero otherwise. The second measure, $FUTURE_{j,t}$, is an indicator variable equal to one if the jth S&L reports a nonzero long or short position in interest-rate futures contracts at time t and zero otherwise. Interest-rate swaps and futures contracts are examined separately because, in part, swaps are customized and less liquid instruments than futures. Thus, interest-rate swaps could have a different impact than interest-rate futures on S&L risk. Time dummy variables, DUM_t (t=2,...,T), are included in the equation to control for the effects on risk of changes in time-specific factors that are not captured by $LEV_{j,t}$, $LIQUID_{j,t}$, $NONTRADAST_{j,t}$, $GAP_{j,t}$, $ORISK_{j,t}$, and $DERIV_{j,t}$.[4]

To account for each of the above factors, an expanded model is used here. The expanded model is written as equation (2):

$$\sigma_{j,t} = s_0 + \sum_{t=2}^{T} s_{0,t} DUM_t + s_1 LEV_{j,t} + s_2 LIQUID_{j,t} + s_3 NONTRADAST_{j,t}$$

$$+ s_4 GAP_{j,t} + s_5 ORISK_{j,t} + s_6 DERIV_{j,t} + \nu_{j,t}. \qquad \textbf{(2)}$$

Estimation of equation (2) for a cross-section time series sample of S&Ls provides a test of the impact of derivatives usage on S&L market risk as reflected in the volatility of S&L equity returns.

B. Data and methodology

The data used in this paper are for 99 S&Ls whose stocks were traded on the New York Stock Exchange, American Stock Exchange, or Over the Counter and which filed Federal Home Loan Bank Board (FHLBB) Report of Condition data for each quarter over the 1985:3 - 1989:4 sample period. A few of the 99 S&Ls were resolved by thrift regulators prior to the end of the sample period. These institutions are included in the sample period for the quarters before resolution, and are excluded from the sample for the time period after resolution. Stock market data are from Interactive Data Services, Inc. For S&L holding companies, the assets of individual S&L subsidiaries are summed to construct the balance sheet variables discussed below.[5] The sample period covers 1985:3-1989:4. The sample starts no earlier than the third quarter of 1985 because S&Ls were not required to submit both interest-rate swap and futures data to regulators prior to this period. The sample period ends in the fourth quarter of 1989, which coincides roughly with the imposition of more stringent regulatory requirements on the S&L industry.

To obtain our measure of risk, we use daily stock market data. For each quarter of the years in the sample period, estimates of the average rate of return and standard deviation of return of an S&L's equity were made using data covering the three month period ending with the last day of the quarter.

Financial leverage (LEV) is calculated at the end of each quarter as the ratio of total asset value to S&L market value of capital. The market value of capital is calculated by multiplying the number of shares outstanding at the end of each quarter by the price of the S&L's common stock at the end of the quarter. The liquid asset ratio (LIQUID) was computed by taking cash plus investment securities in each quarter of the sample period and dividing this total by the market value of capital. NONTRADAST was computed by taking the sum of commercial real estate loans, acquisition and development loans, and junk bonds and dividing by market value of capital. The interest-rate risk of the S&L is measured by the maturity mismatch between the S&L's assets and liabilities. A measure of maturity mismatch, similar to the one used in Flannery and James (1984), is constructed from quarterly FHLBB Report of Condition data.[6] This measure represents the absolute value of the difference between the dollar value of assets subject to repricing within one year and the dollar value of liabilities subject to repricing within the same period divided by the S&L total assets.[7] Table 1 reports real estate lending and derivative usage for S&Ls in the sample. Real estate lending averaged about 70 percent of total assets throughout the sample period. While the percentage of sampled S&Ls participating in the interest-rate swap market has increased over time, the proportion of S&Ls using interest-rate futures is slightly lower.[8]

For a pooled cross-section, time series sample of S&Ls over the period 1985:3 through 1989:4, the relationship between stock return volatility, asset mix, and derivative activity was estimated by using a random effects model wherein the regression error is assumed to be composed of two components--an S&L-specific component and an observation-specific component.[9] In applying a GLS regression technique rather than ordinary least squares regression, the existence of other S&L-specific effects can be determined by the sample.

C. Empirical results

The results from estimating equation (2) are shown in Table 2. The estimates of the parameters represent their cross-sectional average values.[10] The results indicate a significant positive relationship between stock return volatility and financial leverage (LEV). The positive coefficient on the financial leverage variable indicates that a higher level of LEV implies a higher level of stock return volatility. Moreover, the coefficient on the nontraditional asset variable and GAP (which measures interest-rate risk) are positive and statistically significant. This is consistent with the hypothesis that stock return volatility reflects both credit risk and the interest-rate risk of the S&L. The coefficient on the operating risk variable is positive and statistically significant, suggesting that an increase in operating expenses relative to income raises the volatility of stock returns.[11]

To investigate whether derivative activities affect an S&L's risk, the regression reported in Table 2 was re-estimated with the SWAP and FUTURE variables. If the involvement in derivatives increases an S&L's risk, a positive relationship is expected between stock return volatility and the interest-rate derivative indicator variables. The results of this analysis are reported in columns (2) and (3) in Table 2.

A negative and statistically significant correlation is found between the volatility of stock return and an S&L's involvement in interest-rate swap agreements.[12] However, no statistically significant relationship is found between stock return volatility and an S&L's involvement in interest-rate futures contracts.[13] Thus, the evidence presented is not consistent with the view that S&Ls used derivatives to increase their exposure to risk.[14] Because the value of deposit insurance is embedded in our stock return measure which could have a dampening affect on an S&L stock return volatility, we also regressed the standard deviation of the accounting return on assets on the book capitalization ratio and the derivatives indicator variables. Those results also indicate a negative and significant correlation between the accounting-based measure of risk and the swap indicator variable.[15] This finding is consistent with the stock return volatility results.

2. CD Rates and Derivative Usage

Since derivative activity lowers stock return volatility, one would expect, *ceteris paribus*, a negative relation between the risk premium on an S&L's uninsured (or partially insured) deposits and an S&L's involvement in derivative activity. Following Baer and Brewer (1986), we test this hypothesis by estimating the following empirical model:

$$RCD_{j,t} = \beta_0 + \beta_1 RTB_t + \beta_2 MVA_{j,t} + \beta_3 RISK_{j,t} + \beta_4 SIZE_{j,t} + \beta_5 AGROWTH_{j,t} + \beta_6 DERIV_{j,t} + \omega_{j,t} , \quad (3)$$

where $RCD_{j,t}$ represents the interest rate paid by the jth S&L in period t on large, partially insured certificates of deposit (deposits in excess of $100,000) with maturity of six to twelve months. This data was obtained from the quarterly Report of Conditon. However, S&Ls were not required to submit deposit interest rate data to regulators prior to 1987; hence, our sample period in this section is from the first quarter of 1987 to the fourth quarter of 1989. RTB_t is the riskfree interest rate and is computed by taking the average of the yields on 182-day Treasury bills and 364-day Treasury bills.[16] The $DERIV_{j,t}$ variable measures the derivative activity of the S&L and is captured by two indicator variables, SWAP and FUTURE as defined earlier. $RISK_{j,t}$ is a measure of the default or credit risk of the S&L's asset portfolio and is obtained by multiplying the variance in stock returns in a quarter by the square of the market value of equity to total assets.[17] The variable $MVA_{j,t}$ is the ratio of the market value of common stock to total assets; $SIZE_{j,t}$ represents the natural logarithm of total assets; $AGROWTH_{j,t}$ is the percentage change in total assets; and $\omega_{j,t}$ is an error term.

Since CDs and Treasury bills are close but not perfect substitutes, we expect the coefficient on RTB to be positive but less than one. The listed CD rates of S&Ls are not adjusted as rapidly as market interest rates change. We predict the coefficient on MVA will be negative because a lower capital-asset ratio implies that there is a greater chance that the value of an S&L's assets will fall below the level needed to repay all depositors. We include an asset size measure as an additional explanatory variable to account for the possibilities that purchasers might view CDs of larger S&Ls as being more liquid. The asset growth variable, AGROWTH, was included because

Brewer and Mondschean (1994) found that asset growth was positively related to deposit rates, suggesting that rapidly growing institutions often bid more aggressively for funds.

Three versions of equation (3) are estimated. One version excludes $SWAP_{j,t}$ and $FUTURE_{j,t}$. The second version uses $SWAP_{j,t}$ as a measure of an S&L's involvement in derivative activity. The third version of equation (3) includes both measures ($SWAP_{j,t}$ and $FUTURE_{j,t}$) of an S&L's derivative activity involvement. The results are reported in Table 3. As expected, the CD rate is, for all three versions of the model, positively related to the Treasury bill rate and negatively related to the capital-asset ratio. Moreover, the coefficient on the RISK variable is significantly positive, indicating that depositors received higher interest rates for bearing additional risk. The results show a significantly positive relationship between S&L CD rates and asset growth.

When SWAP is used as an additional independent variable, in column 2 of Table 3, the results indicate a negative but insignificant relationship between S&L CD rate and interest-rate swap activity. The coefficient for the futures variable is negative and significant, suggesting that S&Ls CD rates are negatively related to involvement with interest-rate futures contracts. These results are consistent with the notion that derivatives are risk-moderating. These results are also consistent with previous studies that found a risk premium in interest rates paid on large CDs (see, for example Baer and Brewer, 1986). Thus, we conclude that S&Ls were not using interest-rate derivatives in a manner to increase the value of access to federal deposit insurance. The evidence, however, may be consistent with the notion that users are employing derivatives to allow them to hold mortgages. This issue is examined in the next section.

3. Derivative Usage and Mortgage Lending

Overall, the results in sections 1 and 2 indicate that an S&L's involvement in derivative products lowers its risk. A study by Brewer, Minton, and Moser (1994) finds that banks that utilized interest-rate derivatives experienced greater growth in their commercial and industrial loan portfolios than banks which did not use these financial instruments. We re-examine the notion that intermediaries' use of derivatives allows them to continue to provide credit by applying the Brewer, Minton, and Moser methodology to our sample of 99 S&Ls over the 1985-1989 time period.

The association between S&Ls' intermediation and their use of derivatives can be measured by examining the relationship between the growth in S&L mortgage loans and S&Ls' involvement in interest-rate derivative markets. The model used is a reduced-form equation for the growth in S&L mortgage loans (MTGA):

$$MTGA = \frac{MT_{j,t} - MT_{j,t-1}}{A_{j,t-1}} = f(DERIV_{j,t}, x_{j,t-1}) , \qquad (4)$$

where $MT_{j,t}$ is the volume of loans for S&L j in period t; $A_{j,t-1}$ is the previous period total assets; $DERIV_{j,t}$ is a defined as above; and $x_{j,t-1}$ is a vector of variables representing various supply and demand factors which influence an S&L's mortgage lending.

The supply and demand variables included in the empirical analysis are an S&L's: ratio of capital-to-assets (CRATIO); charter value (CVALUE); ratio of nonperforming mortgage loans to total mortgage loans (DELOAN); and size (SIZE). To control for differing economic conditons in the real estate markets, we included a measure of the vacancy rate for commercial real estate

(VCMORT); the percentage change in single family housing starts (SSTART); and the percentage change in multifamily housing starts (MSTART). The CRATIO is used to examine whether S&Ls with a higher capital-asset ratio at the beginning of the period grow their mortgage loan portfolios faster than other institutions. If capital regulation affects S&L lending, loan growth would be expected to be positively related to the beginning of period capital-asset ratio. However, to the extent that capital regulation is not binding, little, if any, relationship would be expected between the growth rate of mortgage loans of a given S&L and its capital-ratio at the beginning of the period.[18]

The market-to-book value capital ratio has been used as a proxy for charter value by Stigler (1964) to measure rents in oligopolistic markets. The idea is that charter value is capitalized into a firm's stock market value, but is not reflected in its book value. Thus, firms with valuable franchises will have market-to-book capital ratios that are greater than one.

The ratio of nonperforming mortgage loans could be an indicator of the state of the loan portfolio.[19] S&Ls with higher ratios of nonperforming loans may be weaker financially. If so, the nonperforming mortgage loan ratio would be expected to have a negative relationship with mortgage loan growth. We include an asset-size measure as an explanatory variable because firm size may serve as a proxy for S&L asset diversification. Small S&Ls typically lend in local markets and have less diversified portfolios than larger S&Ls. The vacancy rate for commercial real estate captures the economic environment in which an S&L operates.[20] A higher ratio could be indicative of a weaker economic environment and could be associated with weaker mortgage loan growth. The percentage change in single family housing starts is included to capture the outlook for the residential real estate mortgage market. S&Ls located in regions with weak housing conditions are likely to have fewer profitable opportunities than S&Ls located in regions with stronger housing conditions. One would expect mortgage loan growth to be positively related to the growth rate in regional single family housing starts. The growth rate in multifamily housing starts is included in the empirical specification for similar reasons.

Given the above discussion, a specification for equation (4) can be written as:

$$MTGA = b_0 + \sum_{t=2}^{T} b_{0,t} DUM_t + b_1 CRATIO_{j,t-1} + b_2 CVALUE_{j,t}$$
$$+ b_3 DELOAN_{j,t-1} + b_4 SIZE_{j,t-1} + b_5 SSTART_{j,t-1} + b_6 MSTART_{j,t-1}$$
$$+ b_7 VCMORT_{j,t-1} + b_8 DERIV_{j,t} + e_{j,t}, \qquad (5)$$

where DUM_t's are time-period dummy variables and $e_{j,t}$ is an error term. The estimation of equation (5) allows us to test whether derivative instruments are related with mortgage loan growth. We use the fixed-rate mortgage loans (FRMs) category as our measure of lending activity.[21] According to our hypothesis, an S&L's involvement in interest-rate derivatives is positively correlated with FRMs growth.

The capital ratio (CRATIO) is estimated as the ratio of S&L book value of GAAP net worth to S&L total assets at the beginning of the period. The chapter value measure (CVALUE) is calculated by dividing beginning of period book value GAAP net worth by the market value of capital. DELOAN is estimated as the ratio of nonperforming mortgage loans to S&L total mortgage loans at the beginning of the period. SIZE is computed by taking the natural logarithm of total assets at the beginning of the period. SSTART is measured by taking the lagged value of the percentage change in single family housing starts. Because the multifamily housing starts series is more volatile than that of single family housing starts, MSTART is computed by taking the four quarter moving average of the quarterly percentage change in multifamily housing starts. A measure of office vacancy at the beginning of the period in the area served by the S&L is constructed using vacancy rate data obtained from Coldwell Banker.

Table 4 reports the coefficient estimates of the determinants of fixed-rate mortgage lending using quarterly data from September 1985 to December 1989. The results show that CRATIO is positively related to growth in lending. A more rapid growth rate of multifamily housing starts had the expected positive effect on loan growth rate. The results indicate a significant positive relationship between fixed-rate mortgage lending and interest-rate swap activity. Equation (5) was also estimated using four alternative mortgage categories: growth rate of residential mortgage loans, commercial mortgage loans, mortgage-backed securities, and acquisition and development loans (results are not reported). Among the different mortgage categories, the growth rate of mortgage-backed securities exhibits the strongest positive correlation with the swap indicator variable. Overall, these results seem to suggest that derivatives complement mortgage lending activity, especially fixed-rate mortgage lending.

4. Conclusion

In this paper, we examine whether the substantial moral hazard incentives of the late 1980s led S&Ls to use interest-rate derivatives to increase their exposure to risk. We tested this hypothesis using data on S&L stock returns and interest rates paid on large CDs. We find that equity return volatility is negatively related to an S&L's involvement in derivatives. In addition, we find evidence that derivative users pay a lower rate on large CDs than nonusers.

Because lending services entail relatively more interest-rate risk, it has been claimed that an increase in interest rate uncertainty encourages depository institutons to reduce their provision of lending services, and to increase their provision of debt brokerage services. The results presented here indicate that derivatives provide some relief from this situation. They give firms a chance to hedge exposed asset and liability positions by allowing them to take a position in the derivative markets that is equal and opposite to a current or planned future position in the spot or cash market. Therefore, regardless of the movement in prices, losses in one market will be offset by gains in the other. Thus, an S&L lending services should increase with involvement with derivatives. We find that the growth in S&L fixed-rate mortgage loans is positively related with our derivatives indicator variable. Thus, the evidence taken together suggests that despite the existence of extreme moral hazard incentives during the last half of the 1980s few, if any, of our sampled S&Ls used derivatives to shift risk onto the deposit insurance fund. The results also support the notion that derivataive instruments provide incentives for S&Ls to increase their lending services.

Footnotes

[1] See Loomis (1994) for an insightful discussion of the concerns expressed about the risk exposure of firms using derivative instruments.

[2] Barth and Bradley (1989) find that, within the mortgage category, insolvent institutions have rapidly increased their commercial mortgage lending. Barth, Bartholomew, and Labich (1989) present evidence indicating that acquisition and development loans, which are loans to finance the purchase of land and the accomplishment of all improvement required to convert it to developed building lots, have a positive and statistically significantly effect on resolution costs. Lindley, Verbrugge, McNulty, and Gup (1992) find that the acquisition of non-traditional assets leads to a lower level of profitability. Brewer and Mondschean (1994) find that commercial real estate loans, acquisition and development loans, and junk bonds are positively correlated with stock return volatility.

[3] Ideally, an interest-rate risk exposure measure should reflect the relative duration of assets and liabilities. However, the lack of sufficiently detailed data (especially for liabilities) requires the use of a maturity measure.

[4] For a discussion of the existence of "other effects," see Balestra and Nerlove (1966).

[5] Of the 99 S&Ls in the sample, 25 had total assets of more than $5 billion as of year-end 1987. There were 48 S&Ls with total assets between $1-5 billion. The remaining 26 S&Ls had total assets less than $1 billion. At the end of 1987, the 99 S&Ls had about $456 billion in total assets. Expressed as a percentage of the industry's asset total, our sampled S&Ls constitute about 47 percent of industry assets.

[6] The Financial Institutions Reform, Recovery and Enforcement Act of 1989 dismantled the FHLBB, transferring all regulatory functions to the Office of Thrift Supervision, a new Treasury Department agency.

[7] Rate-sensitive assets exclude commercial real estate loans and acquisition and development loans.

[8] One of the major risks associated with over-the-counter type derivative instruments such as interest-rate swaps is the possibility of default by the counterparty to the swap. Thus, there will be a tendency for interest-rate swap dealers to engage in transactions with high quality S&Ls. However, to overcome this problem, low quality S&Ls could secure their transactions with collateral. Many swaps transactions include collateral of 10 to 30 percent of the notional principal to secure the agreement (see, Bowyer, Thompson, and Edward, 1987). Bowyer and Thompson (1989) indicate that some S&Ls collateralized their swap transactions with letters of credit from Federal Home Loan Banks (FHLBanks). In addition, many S&Ls may arrange swaps with their FHLBank. Of the 186 S&Ls using swaps at the end of June 1986, about 25 percent were with an FHLBank. Over 97 percent of those institutions doing swaps with an FHLBank were fixed-rate

payers. Since most S&Ls finance fixed-rate assets with variable-rate funds, this finding is not unexpected. This provides indirect evidence that interest-rate swaps are used to help an S&L to hedge its exposure to interest-rate risk, and the FHLBanks offer hedging opportunities to both low and high quality associations. We thank Clifford Smith for bring this point to our attention.

[9]They have also been referred to as error component models. See Greene (1993) and Wallace and Hussain (1969).

[10] Similar results were obtained when equation (2) was estimated using a fixed-effects model (with both time and S&L dummy variables) rather than a random effects model. White's (1980) heteroskedasticity-consistent estimate of the coefficients standard errors are used in computing all the tests statistics for the fixed-effects model. These results are available from the authors on request.

[11] To further analyze the relation between risk and S&L financial characteristics, the sample was divided into interest-rate swap users and nonusers. Equation (2) was then estimated for each of the two derivative classes of S&Ls. Using the fixed-effects model, we could not reject the null hypothesis that financial leverage and other financial variables coefficients are equal across derivative categories. We also could not reject the null hypothesis that financial leverage and other financial variables coefficients are equal across failed and nonfailed S&Ls. These results are available from the authors on request.

[12] Interest-rate swap activity is likely to vary by asset size and this could influence the volatility of an S&L stock return. To examine this issue, we divide the sampled S&Ls into six portfolios by size and swap activity (for a similar treatment for banks, see Gorton and Rosen, 1995):

(1) S&Ls holding swaps with total assets greater than $10 billion;
(2) S&Ls holding swaps with total assets between $1 billion and $10 billion;
(3) S&Ls holding swaps with total assets less than $1 billion;
(4) S&Ls not holding swaps with total assets greater than $10 billion;
(5) S&Ls not holding swaps with total assets between $1 billion and $10 billion;
(6) S&Ls not holding swaps with total assets less than $1 billion.

Equation (2) is re-estimated using an interest-rate swap indicator variable for each of the six portfolios (portfolio 6 indicator variable is suppressed) rather than a single interest-rate indicator variable. Based on the fixed-effects model, each of the coefficients of the interest-rate swap indicator variable is negative and statistically significant. In addition, the coefficient on portfolio 1(-1.9544) is greater than on portfolio 4 (-1.5673). This suggests that within the large S&L portfolio derivatives users tend to have on average lower risk than nonusers. Similar results were obtained for the other two portfolios. These results are available from the authors on request.

[13] The null hypothesis that the interest-rate swap and interest-rate futures coefficients, in the fixed-effects model, are equal can be rejected at the 0.01 level (χ_1^2=9.61). In the fixed-effects model, the White's standard errors are used in computing the test statistics.

[14] It is possible that the negative correlation that we found between stock return volatility and the interest-rate swap indicator variable may also show up in a negative correlation between stock returns and the derivatives indicator variable. To examine this issue, we estimated the following model:

$$RET_{j,t} = \beta_0 + \sum_{j=2}^{N} \beta_{0,j} W_j + \sum_{j=1}^{N} \beta_{1,j} W_j RMKT_t + \sum_{j=1}^{N} \beta_{2,j} W_j RINDEX_t$$

$$+ \beta_3 (GAP)_{j,t} RINDEX_t + \beta_4 SWAP_{j,t} + \mu_{j,t},$$

where $RET_{j,t}$ is the stock return of the jth S&L in period t; $RMKT_t$ is the rate of return on a value-weighted market portfolio; $RINDEX_t$ is a return index on a short-term U.S. government security; $GAP_{j,t}$ and $SWAP_{j,t}$ are defined as above; $\beta_{0,j}$ is an intercept term for the jth S&L (j=2,..,N); $\beta_{1,j}$ is the stock market beta coefficient of the jth S&L (j=1,...,N); $\beta_{2,j}$ measures the effect of interest rates on S&L stock returns; W_j is a cross-sectional dummy variable that equals one for the jth S&L and zero otherwise; and $\mu_{j,t}$ is an error term. The parameter β_4 is equal to -0.0944 with a t-statistic of -4.103. This result indicates that interest-rate swaps users have on average lower idiosyncratic stock returns than other S&Ls. The complete results are available from the authors on request.

[15] The cross-sectional regression results are (t-ratios are in parentheses):

STDROA =	0.6978	-	5.2866 BVA	-	0.2093 SWAP	+	0.1139 FUTURE
	(6.624)		(-3.129)		(-2.154)		(0.582)

$\bar{R}^2 = 0.0986$ F-Statistic = 4.573 N = 99

where BVA is the book value of generally accepted accounting principle net worth divided by total assets. STDROA is calculated by taking the standard deviation of the quarterly return on assets over the entire 1985:2-1989:4 sample period. SWAP and FUTURE are computed by averaging the quarterly observations over the sample period. These results suggest that, holding BVA constant, the volatility of the return on S&Ls' underlying assets, as reflected in the volatility of the accounting return on assets, is lower for derivatives users than for derivatives nonusers. Since the volatility of the return on assets is unaffected by changes in the value of deposit insurance, the finding that the swap indicator variable is negatively correlated with STDROA indicates that derivatives lower the variance of firm value as suggested by Mayers and Smith (1982) and Smith and Stulz (1985).

[16]Because the CD rate is for a deposit with a maturity between six and twelve months, it was necessary to develop a riskfree rate of interest that covers these two maturity dates.

[17]The calculation in the paper assumes that the variance of the return on debt is zero. This adjustment has been used by several other researchers including, Brewer and Mondschean (1994) and Marcus and Shaked (1984).

[18]There was a Federal Home Loan Bank Board growth regulation tied to capital in effect during our sample period. See, Federal Home Loan Bank Board (1985).

[19]Nonperforming loans are used to reflect the quality of the loan portfolio rather than loan loss provisions or charge-offs because DELOAN is almost completetely determined exogenously by the performance of the S&L's borrowers, while loan loss provisions and charge-offs are determined in significant part by endogenous regulatory pressures (see Berger and Udell, 1994).

[20]For each S&L, a vacancy rate for commercial office real estate was calculated using the vacancy rate for the metropolitan area where the institution is located. For S&Ls that had no metropolitan area in the Coldwell Banker data base, vacancy rates were assigned on the basis of rates for the region.

[21] We also estimated equation (5) using the growth rate of adjustable-rate mortgages (ARMs) as the dependent. During the early 1980s, federally chartered S&Ls were given authorization to design, issue, purchase, and otherwise participate in ARMs. Proponents of these instruments claim that ARMs allow greater portfolio diversification and greater flexibility in mortgage pricing, which reduces an S&L's interest-rate risk exposure.

Because ARMs offer a greater degree of flexibility in the earning power of mortgage portfolios by allowing interest rates on outstanding loans to change with market interest rates, an S&L's adjustable-rate mortgage loan growth is less likely to be related to its interest-rate derivative activity. The growth in ARMs reduces the need for an S&L to adjust the interest-rate sensitivity of its asset/liability composition through involvement in interest-rate derivatives activities. According to our hypothesis, an S&L involvement in interest-rate derivatives activities has little, if any, influence on ARMs growth. The empirical results are consistent with this prediction. The complete results are available from the authors on request.

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Table 1.
Real Estate Lending Activity and Derivative Usage by Sampled S&Ls, 1985-1989

Period	Number of thrifts	Average Total Assets[1]	Average Real Estate Loans/Total Assets	Users of Swaps	Average ratio to Total Assets[2]	Users of Futures	Average ratio of short future to Total Assets[3]	Average ratio of long future to Total Assets[3]
1985:4	91	3,446	69.93	38.46	5.41	10.99	6.03	0.00
1986:2	98	3,686	70.04	47.96	5.56	9.18	4.93	0.00
1986:4	99	4,023	69.95	52.52	6.25	9.09	7.93	0.00
1987:2	98	4,293	69.46	56.12	6.73	12.24	11.58	0.01
1987:4	97	4,690	69.70	56.70	7.43	12.37	7.75	0.08
1988:2	91	5,055	69.64	59.34	7.44	10.99	15.71	0.00
1988:4	87	5,146	69.70	58.62	8.08	8.04	1.64	0.00
1989:2	82	5,383	71.01	58.54	7.96	10.98	6.79	0.00
1989:4	75	5,056	70.76	58.67	8.45	6.67	12.72	0.00

[1] Total assets are expressed in millions of dollars.
[2] Average ratio to total assets equals the ratio of the notional principal amount of outstanding swaps to total assets for S&Ls reporting the use of swaps.
[3] Average ratio to total assets equals the ratio of the principal amount of outstanding futures to total assets for S&Ls reporting the use of futures.

Table 2
Relationship between S&L risk and financial characteristics, 1985:2 - 1989:4

Variable	(1)	(2)	(3)
Intercept	1.0482*** (2.701)	1.3102*** (3.327)	1.2831*** (3.241)
LEV	0.0014** (2.113)	0.0015** (2.175)	0.0014** (2.143)
GAP	2.2216*** (4.042)	2.1241*** (3.886)	2.1383*** (3.919)
LIQUID	0.0048 (1.259)	0.0051 (1.354)	0.0051 (1.354)
ORISK	0.3348*** (3.289)	0.3323*** (3.269)	0.3272*** (3.213)
NONTRADAST	0.0306*** (9.054)	0.0300*** (8.859)	0.0308*** (8.878)
SWAP	---	-0.6003*** (-3.094)	-0.6114*** (-3.135)
FUTURE	---	---	0.1747 (0.787)
Adj. R-Sq	0.3762	0.3873	0.3868
F-Statistic	46.34	46.54	44.63
N =	1730	1730	1730

Estimated equation:

$$\sigma_{j,t} = s_0 + \sum_{t=2}^{T} s_{0,t} DUM_t + s_1 LEV_{j,t} + s_2 LIQUID_{j,t} + s_3 NONTRADAST_{j,t} + s_4 GAP_{j,t} + s_5 ORISK_{j,t}$$

$$+ s_6 DERIV_{j,t} + \eta_{j,t} ,$$

where $\sigma_{j,t}$ equals the standard deviation of equity returns, DUM_t is a time dummy variable, $LEV_{j,t}$ is the ratio of total asset to S&L market value of capital,. $LIQUID_{j,t}$ is the sum of cash and investment securities divided by the market value of capital, $NONTRADAST_{j,t}$ is the sum of commercial real estate loans, acquisition and development loans, and junk bonds divided by market value of capital, $GAP_{j,t}$ is the absolute value of the difference between the dollar value of assets subject to repricing within one year and the dollar value of liabilities subject to repricing within the same period divided by the S&L total assets, $ORISK_{j,t}$ is the ratio of operating expense to total income, $DERIV_{j,t}$ measures the derivative activity of an S&L, and $\eta_{j,t}$ is an error term. The $DERIV_{j,t}$ variable is captured by two indicator variables, $SWAP_{j,t}$ and $FUTURE_{j,t}$. The first measure, $SWAP_{j,t}$, is an indicator variable equal to unity if an S&L reports a nonzero notional value of swaps outstanding at time t and zero otherwise. The second measure, $FUTURE_{j,t}$, is an indicator variable equal to unity if an S&L reports a nonzero long or short position in interest-rate futures contracts at time t and zero otherwise. T-statistics in parentheses are starred if coefficients are significantly different from zero at the 10(*),

Table 2 (Continued) Relationship between S&L risk and financial characteristics, 1985:2 - 1989:4

5(**), and 1(***) percent levels. Coefficient estimates of the time dummy variables are not reported but are available upon request from the authors.

Table 3
A pooled cross-section time series examination of the relationship between the interest rate paid on CDs with maturities between six and twelve months and the S&L involvement in derivative activities, 1987:1 - 1989:4

Variable	(1)	(2)	(3)
Intercept	1.4476*** (4.262)	1.2511*** (3.369)	1.1032*** (2.938)
RTB	0.8338*** (61.480)	0.8325*** (61.225)	0.8317*** (61.335)
MVA	-1.4420** (-1.985)	-1.5466** (-2.118)	-1.5377** (-2.108)
RISK	0.5833** (2.476)	0.5931** (2.517)	0.6000** (2.552)
SIZE	0.0141 (0.633)	0.0310 (1.205)	0.0423 (1.621)
AGROWTH	0.5037** (2.361)	0.4939** (2.313)	0.5102** (2.397)
SWAP	---	-0.0687 (-1.302)	-0.06311 (-1.196)
FUTURE	---	---	-0.1585*** (-2.755)
Adj. R-Sq	0.7653	0.7665	0.7689
F-Statistic	638.15	535.42	465.49
N =	978	978	978

Estimated equation:

$$RCD_{j,t} = \beta_0 + \beta_1 RTB_t + \beta_2 MVA_{j,t} + \beta_3 RISK_{j,t} + \beta_4 SIZE_{j,t} + \beta_5 AGROWTH_{j,t} + \beta_6 DERIV_{j,t} + \omega_{j,t} ,$$

where $RCD_{j,t}$ equals rate paid on large CDs with maturity of six to twelve months of the jth S&L in quarter t, RTB_t is the riskless rate of interest, $MVA_{j,t}$ is the ratio of market capital to assets, $RISK_{j,t}$ is a measure of credit risk, $SIZE_{i,t}$ is the natural logarithm of total assets, $AGROWTH_{j,t}$ is the percentage change in total assets , $DERIV_{j,t}$ measures the derivative activity of an S&L, and $\omega_{j,t}$ is an error term.

Table 4
Relationship between S&L fixed-rate mortgage lending activity and derivative activity, 1985:2 - 1989:4

Variable	(1)	(2)	(3)
Intercept	-0.0489** (-2.503)	-0.0287 (-1.376)	-0.0255 (-1.129)
CRATIO	0.1445*** (3.837)	0.1548*** (4.105)	0.1570*** (4.091)
CVALUE	-0.0000[1] (-0.235)	-0.0000[1] (-0.262)	-0.0000[1] (-0.294)
DELOAN	0.0878*** (3.019)	0.0958*** (3.287)	0.0965*** (3.264)
SIZE	0.0008 (0.744)	-0.0008 (-0.670)	-0.0010 (-0.746)
SSTART	-0.0023* (-1.790)	-0.0022* (-1.666)	-0.0022* (-1.648)
MSTART	0.0247*** (2.828)	0.0235*** (2.692)	0.0285*** (2.686)
VCMORT	-0.0003 (-1.036)	-0.0003 (-0.907)	-0.0003 (-0.881)
SWAP	---	0.0076*** (2.720)	0.0077*** (2.720)
FUTURE	---	---	0.0009 (0.236)
Adj. R-Sq	0.0533	0.0568	0.0563
F-Statistic	4.87	4.98	4.80
N =	1730	1730	1730

1. Rounded to zero.
Estimated equation:

$$MTGA_{j,t} = b_0 + \sum_{t=2}^{T} b_{0,t} DUM_t + b_1 CRATIO_{j,t-1} + b_2 CVALUE_{j,t} + b_3 DELOAN_{j,t-1} + b_4 SIZE_{j,t-1}$$

$$+ b_5 SSTART_{j,t-1} + b_6 MSTART_{j,t-1} + b_7 VCMORT_{j,t-1} + b_8 DERIV_{j,t} + e_{j,t} ,$$

where $MTGA_{j,t}$ equals the percentage growth in mortgage loans, DUM_t is a time dummy variable, $CRATIO_{j,t-1}$ is an S&L's ratio of book capital to assets, $CVALUE_{j,t}$ is the book-to-market value capital ratio, $DELOAN_{j,t-1}$ is the ratio

Table 4 (Continued) Relationship between S&L fixed-rate mortgage lending activity and derivative activity, 1985:2 - 1989:4

of nonperforming mortgage loans to total mortgage loans, $SIZE_{j,t-1}$ is the natural logarithm of total assets, $SSTART_{j,t-1}$ is the percentage change in single family housing starts, $MSTART_{j,t-1}$ is the percentage change in multifamily housing starts, $VCMORT_{j,t-1}$ is the vacancy rate for office buildings, $DERIV_{j,t}$ is a measure of an S&L participation in the interest-rate derivative markets; and $e_{j,t}$ is a stochastic error term. Coefficient estimates of the time dummy variables are not reported but are available upon request from the authors.