

Hedging and Coordinated Risk Management: Evidence from Thrift Conversions

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ABSTRACT

We provide an explanation for hedging as a means of allocating rather than reducing risk. We argue that when increases in total risk are costly, firms optimally allocate risk by reducing (increasing) exposure to risks that provide zero (positive) economic rents. Our evidence shows that mutual thrifts that convert to stock institutions increase total risk following conversion, consistent with their increased abilities and incentives for risk taking. They achieve this increase by hedging interest-rate risk and increasing credit risk. We provide some evidence that risk-management activities are related to growth capacity and management compensation structure attained at conversion.

CURRENT RISK-MANAGEMENT LITERATURE focuses on identifying equilibrium scenarios in which a firm minimizes the total variability of its cash flows (e.g., Smith and Stulz (1985) and Froot, Scharfstein, and Stein (1993)). In these models, the role of risk management is to mitigate the costs associated with cash flow volatility that result from capital market imperfections, thus creating value for shareholders. However, the existing models do not specify the source of variance in the distribution of firms' cash flows. They focus only on the benefits of risk management for reducing the *total* risk of a firm's portfolio. Consequently, these models ignore multidimensional risks and the possible covariation among risks within a firm.

By contrast, this paper argues that firms can use risk management to allocate the firm's total risk exposure among multiple sources of risk, rather than to reduce total risk. We consider the case where multiple sources of risk are bundled together in a single asset or liability and firms are unable to acquire these risks separately in the spot markets.¹ If risks are bundled,

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¹ The existence of multidimensionality in total firm risk is well acknowledged in the literature (e.g., Smith (1995)). For example, investment in a single project might expose a firm to such risks as input and output price risk, foreign exchange rate risk, interest-rate risk, credit risk, liquidity risk, market risk, or political risk.

then the firm's portfolio problem is constrained because a change in any one source of risk simultaneously affects other risks. Firms, however, can effectively unbundle risks using various cash market or derivative instruments. Given bundled risks, we are able to explain optimal risk reduction or hedging of certain risks even for firms attempting to *increase* total firm risk.

Specific predictions about optimal risk allocation require structure on the definition of "risk." We segregate risk into two types based on a firm's information advantage with respect to the source of risk. Firms earn rents or economic profits for bearing risk related to activities in which the firm has a comparative information advantage (*core-business risk*). By contrast, firms earn zero economic rents in efficient markets for bearing financial risks such as unexpected changes in interest rates, foreign currency exchange rates, or commodity prices (*homogeneous risk*).

In this paper, we investigate the allocation *between* core-business risk and homogeneous risk, specifically in the case of assets in which the two risks are bundled.² We argue that managers with compensation tied to firm value effectively use risk-management tools to substitute core-business risks (positive net present value (NPV) activities) for homogenous risks (zero NPV activities). This allocation is optimal whether the firm is maintaining its current level of total risk, or attempting to increase or decrease total firm risk. We denote the approach of simultaneously increasing core-business risk and decreasing homogeneous risk to achieve or maintain a target total risk level as *coordinated risk management*.

To test our predictions about coordinated risk allocation, we examine the quarterly credit and interest-rate risk decisions of 134 firms in the savings and loan (S&L) industry which converted from mutual to stock charters between 1984 and 1988. Because of the changes in risk-taking incentives and abilities that occurred at the time of conversion, we expect the converting thrifts to show increased total risk following conversion. Within the coordinated risk-management framework, we argue that the converting thrifts will achieve this increase in total risk by better coordinating their risk-management activities: increasing credit risk (core-business risk) and decreasing interest-rate risk (homogeneous risk). Coordination is optimal because increases in total risk are costly in the presence of regulatory capital requirements. Thus, the converting thrifts act as if they are implicitly constrained with respect to total risk.

Consistent with our prediction, we observe that thrifts increase credit risk and decrease interest-rate risk following conversion and this relation

² The term "allocation" is typically used in the existing literature to describe the allocation of risk across parties with different risk preferences (e.g., Mason (1995)). By contrast, we use the term allocation to represent the allocation of total risk between multiple sources such as interest-rate risk or credit risk. We define hedging as risk reduction, but not necessarily total risk reduction. A firm may reduce only one type of risk and simultaneously increase another.

is statistically significant. The result of both changes is an overall increase in total risk for the thrifts following conversion, as measured by stock return volatility. Our findings indicate that hedging is not only a risk-reduction tool, but is also a risk-allocation technique. The hedging of interest-rate risk that we document is associated with an attempt to increase, rather than decrease, total firm risk. Thus, hedging of interest-rate risk allows thrifts to unbundle the risks associated with their investment portfolios and increase total risk by taking on additional credit risk. This allocation represents the most favorable risk-return trade-off. We also provide evidence that such coordination of risks is not observed by thrifts that do not convert. This finding suggests that changes in organizational form in the savings and loan industry had a significant impact on risk-management practices.

Further analysis provides some evidence on the association between risk-management activities at converting thrifts and the growth capacity and managerial compensation structure attained at the time of conversion. These variables have been identified in prior literature as determinants of optimal hedging, or risk reduction, behavior (Smith and Stulz (1985) and Froot et al. (1993)). We report that institutions that acquire greater growth capacity at the time of conversion increase total risk following conversion and institutions anticipating low growth decrease total risk following conversion. Although the preconversion to postconversion changes are not significant, the difference between the two groups is consistent with the significantly greater interest-rate risk hedging following conversion that we observe for the high-growth institutions relative to the low-growth institutions. Related to managerial compensation, we show that institutions with greater managerial shareholdings significantly decrease total risk following conversion. Institutions with lower managerial shareholdings do not exhibit the same decreasing pattern in total risk, but the differences between the two groups are not significant. There are, however, significant differences in risk management related to managerial option holdings. Managers of converting thrifts that are granted options at the time of conversion increase total risk following conversion significantly more than managers of institutions that are not granted options.³ These cross-sectional results provide some support for the predictions of Froot et al. (1993) and Smith and Stulz (1985).

The paper proceeds as follows. Section I discusses the coordinated management of multiple risks within a firm and Section II adapts the coordinated risk management framework to converting thrifts and summarizes the paper's predictions for these institutions. We describe the sample and the methodology in Section III. The results are discussed in Section IV, and Section V summarizes the findings.

³ These latter results are consistent with the observed association between hedging and managerial compensation for gold mining firms (Tufano (1996a)).

I. Coordinated Risk Management

Consider a risk-neutral firm that is endowed with one risky asset. The economy consists of a series of state-contingent claims and firms are uncertain about the states.⁴ The risky asset may be viewed as a portfolio of multiple ownership claims or "projects," but the claims are bundled together such that a firm must take on all projects if it wants any. Assume that the firm has developed an information advantage with respect to the unsystematic risk related to a subset of the projects, referred to collectively as core-business projects. These projects have a positive NPV for the firm.

Further assume that these core-business risks cannot be acquired independently. They are bundled with the remaining subset of projects. The firm has neither an information advantage nor disadvantage relative to the market in assessing the unsystematic risk of these remaining projects. This suggests that their payoffs vary with relatively homogeneous, but not perfectly predictable, sources such as changes in commodity prices, interest rates, or exchange rates. Hence, the firm bears homogeneous financial price risks when it is forced to acquire these noncore projects that are bundled with the desired core-business projects.

The total variability of the portfolio's cash flow reflects the risk of both the core-business projects ("core-business risk") and the zero-NPV projects ("homogeneous risk"). Concrete examples of bundled assets with both core-business risks and homogeneous risks are common. For example, a farmer expects to earn rents resulting from superior equipment maintenance, crop selection, or soil preparation. Acting on these core-business skills, however, creates price risk associated with the crop.

The separation between core-business and homogeneous risks is not straightforward. Financial risks, such as interest-rate risk, represent a homogeneous risk for a firm that does not have a comparative advantage in predicting interest rates, but can represent a core-business risk for another firm. For example, Esty, Tufano, and Headley (1994) show that Banc One did not believe that interest-rate risk was a zero NPV risk for the bank in 1993. Further, Stulz (1996) argues that firms can develop a comparative advantage in predicting some financial prices by engaging in their primary business. This advantage shapes the firms' risk-management practices. If a firm views itself as having a comparative advantage in predicting financial prices, then financial price risks will be core-business risks for that firm, even though we use financial price risks as an example of a homogeneous risk. Because there is not a clear distinction between core-business risks and homogeneous risks, we do not expect that all firms will hedge similar risks to the same extent.

⁴ An alternative assumption leading to the same results is that the firm has assets-in-place that result from prior period operating, investment, and financing decisions. The expected payoffs to the assets vary through time.

The composition of risks becomes important only when increases in total risk are costly. The existing literature identifies multiple sources for costs of increasing total risk. For example, the risk management literature shows that capital market imperfections, such as imperfect managerial contracting, information asymmetry, and costs of financial distress, make total risk costly for firms by making firm value a concave function of expected cash flows (Smith and Stulz (1985) and Froot et al. (1993)). Additionally, market imperfections such as regulation create explicit costs associated with increases in total risk.⁵

If the risky asset were divisible between its component projects, the firm would seek only the positive NPV projects with core-business risk. The firm would not take on zero NPV projects with homogeneous risk. Because of the asset's indivisibility, however, the firm is forced to maximize return per unit of risk subject to the constraint that both risks must be acquired (or managed) simultaneously. For a firm that faces costs associated with increasing total risk, decreasing homogenous risk allows the firm to gain additional exposure to core-business risk and still maintain its target level of risk. We call this substitution of core-business risk (positive NPV activities) for homogenous risk (zero NPV activities) *coordinated risk management*. In contrast to the traditional concept of risk management, coordinated risk management is optimal whether the firm is attempting to maintain, increase, or decrease its current level of total risk.⁶

Derivative instruments are one tool that a firm can use to effectively separate homogenous risks from core-business risks when the two are bundled in a single asset. Thus, derivatives can be a useful tool not only for decreasing total firm risk, but also for increasing or maintaining total firm risk through coordination.⁷ We are not the first to argue that derivatives serve a purpose other than as a tool for risk reduction by risk-averse firms. Hol-

⁵ Identifying the source of costs associated with increases in total risk is not the focus of this analysis. We assume that at least one exists. We do however, exploit the previously identified sources of costs in the next section to make cross-sectional predictions about the extent of risk management.

⁶ The idea of coordination is well embraced in practice. For example, in a survey of corporate risk management, the following remark is noteworthy: "...firms should hedge whatever risks they have no comparative advantage in bearing, so that they can concentrate their efforts on those risks where they do have such an advantage: in the language of management, their core competence." (*Economist*, 1996, p. 5). Also, Stulz (1996) and Tufano (1996b) acknowledge that coordination is a well-known risk-management tool among practitioners.

⁷ In practice, we do not observe corner solutions representing total elimination of homogeneous risk with derivatives. One explanation for this partial hedging is that the transactions or liquidity costs related to instruments necessary to exactly match the risk of the underlying portfolio with a derivative instrument make full hedging prohibitively costly relative to the benefits. Another possibility is that firms actually attempt to fully hedge homogeneous risk ex ante but are not successful ex post. Finally, it may be the case that the market imperfections that make increases in total risk costly and create incentives for firms to maximize return per unit of risk do not change the firm's investment decisions given its current investment opportunity set.

brook Working's studies in the 1920s through 1940s suggest that firms with superior information about commodity prices use futures markets to trade on the basis.⁸ This profit-maximizing strategy may ultimately create risk reduction depending on the firm's underlying portfolio, but risk reduction is not the motivation for "hedging." Williams (1986) also argues that risk aversion is not the primary motivation for the use of futures markets. Williams and Working both suggest that hedging is an integral part of a firm's overall profit-maximizing investment strategy.

II. Risk Management at Converting Thrifts

We test for coordinated risk management in a sample of thrifts that convert from the mutual to stock form of ownership. Mutual-to-stock conversions have been used to recapitalize the thrift industry since the Garn-St Germain Act of 1982, which cleared legal barriers for regulatory approval of these transactions.⁹ From 1983 to 1988, 571 conversions issuing stock totaling \$10.1 billion were completed, compared to only 130 mutual-to-stock conversions between 1975 and 1982. Table I provides descriptive statistics about the thrift industry and its changing organizational structure during the 1980s. At the end of 1982, stock S&Ls managed only 30 percent of the industry's assets, but by the end of 1988, stock S&Ls controlled 74 percent of the industry's total assets. During the period 1982 to 1988, the S&L industry's asset base doubled from \$686 billion to \$1.4 trillion while the asset base of Federal Deposit Insurance Corporation (FDIC) insured banks grew only 41 percent from \$2.2 trillion to \$3.1 trillion.

A. Managing Changes in Total Firm Risk

Converting thrifts provide an interesting sample to test whether the use of hedging can be part of an overall strategy to increase total risk. We argue that converting thrifts will attempt to increase their overall level of firm risk following conversion due to changes that occur at the time of conversion. Hence, these institutions are a unique case relative to empirical studies of risk management that focus on firms with incentives to decrease total risk.

We predict that converting institutions will increase total firm risk following conversion for two major reasons.¹⁰ First, a converting institution's

⁸ See Culp and Miller (1995a and 1995b) for an excellent summary of Working's theories. See Chicago Board of Trade (1977) for a collection of Working's studies.

⁹ In a comprehensive report on conversions, Williams, Fleck, and Comizio (1987) write: "The Bank Board's second major challenge, therefore, was to make conversions more accessible and attractive for acquirers of insolvent savings institutions. In that respect, every dollar of outside capital raised could be a dollar that the financially strapped Federal Savings and Loan Insurance Corporation ("FSLIC") would not have to expend." (p. 238)

¹⁰ Empirical evidence confirms increased asset growth and risk taking postconversion (Hadaway and Hadaway (1981), Verbrugge and Goldstein (1981), Simons (1992), and Cordell, MacDonald, and Wohar (1993)).

Table I
Summary of the Thrift Industry and Thrift Conversions

Net worth is calculated according to generally accepted accounting principles (GAAP). During the sample period, thrift regulatory capital was calculated using regulatory accounting principles (RAP). RAP accounting is generally less conservative than GAAP, thus, RAP-based capital is generally higher than GAAP-capital. (Sources: Barth, Bartholomew, and Bradley (1990) and Maksimovic and Unal (1993)).

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Panel A: Savings and Loan Industry (FSLIC-insured)									
No. of institutions	3,993	3,751	3,287	3,146	3,136	3,246	3,220	3,147	2,949
Total assets (\$ billions)	\$604	640	686	814	978	1,070	1,164	1,251	1,352
Net worth (\$ billions)	\$32	27	20	25	27	34	39	34	46
Net income (\$ millions)	\$781	(4,631)	(4,142)	1,945	1,022	3,728	131	(7,779)	(12,057)
Stock institutions									
Percentage of institutions	20%	21	23	24	30	33	37	40	44
Percentage of total assets	27%	29	30	40	52	56	62	70	74
Panel B: Total Mutual Savings and Loan Conversions									
No. of conversions	16	37	31	83	96	78	86	130	98
Stock sold (\$ millions)	\$141	127	123	2,741	715	1,385	2,484	1,957	767

ability to take risk increases at the time of conversion. Although a converting institution's set of investment opportunities does not change, conversion provides financial slack and access to capital markets. Typically, conversion proceeds equal or exceed the book value of equity of the mutual thrift. Assuming that preconversion mutual equity meets regulatory capital requirements, doubling (at least) the capital ratio creates borrowing capacity that can be used to double the asset size of the thrift. Note that increasing thrift size does not necessarily imply increasing thrift risk. However, thrifts, in general, have incentives to grow by investing in riskier assets because of flat deposit insurance premiums that allow thrifts to shift risk to the government (Kane (1985, 1989)).¹¹

The excess financial slack created at conversion is unique to the converting thrifts. Nonconverting thrifts do not have access to equity markets and, thus, are more constrained by minimum regulatory capital requirements than the converting institutions. Established stock thrifts, unlike nonconverting mutuals, may issue additional capital to fund growth. However, there are costs associated with seasoned equity offerings (SEOs). In an SEO, the resolution of conflicts of interest between existing equityholders and new investors is costly (Asquith and Mullins (1986) and Masulis and Korwar (1986)). As demonstrated by Myers and Majluf (1984), information asymmetries between existing equityholders and new investors can lead to underinvestment problems. For initial public offerings by converting thrift institutions, there are no "existing" shareholders; thus, the costs of obtaining capital through conversion are lower than in subsequent offerings. Hence, converting institutions have higher growth capacity than either nonconverting mutuals or established stock thrifts.

The second reason we predict that converting institutions will increase total firm risk following conversion relates to the change in their managers' *incentives* for risk taking. Prior to conversion, mutual thrift managers are compensated by a fixed salary. As Masulis (1987) and Rasmusen (1988) observe, such a fixed-wage contract can be viewed as risky debt since its value decreases as asset risk increases. Upon conversion, shareholders are able to include stock and stock options in a manager's compensation contract and effectively tie managerial compensation to firm value.¹² In this case, managers benefit from an increase in firm value and hence will be more willing to take risks to achieve such an increase.

In order to achieve the predicted increase in total risk, the coordination of homogeneous and core-business risks is important because increases in total risk are costly for the converting thrifts. Thrift capital ratios are computed

¹¹ The acquired financial slack could be used by management for increased perquisite consumption. However, Maksimovic and Unal (1993) provide evidence that the market prices the conversion as if management is not expected to use the financial slack to leverage the firm at the expense of shareholders.

¹² Mayers and Smith (1981, 1986) make similar observations about differences in the incentives of managers of mutual and stock insurance companies.

as total regulatory capital relative to regulatory assets.¹³ Thrifts not meeting the minimum capital requirement potentially face regulatory "taxes," including increased oversight, restrictions on operating activities, or, ultimately, closure. Additionally, minimum regulatory capital requirements constrain a thrift institution's ability to grow because the requirements must be met annually, not on average over the term of investment projects. Hence, thrifts behave as if they are constrained with respect to total risk.

Although we predict that all converting thrifts will increase total firm risk following conversion, we also argue that there are differences in the degree to which these institutions have the ability and incentives to increase total risk. We rely on two strands of the risk management literature to predict cross-sectional variation in total risk and risk composition: the impact of compensation structure (Smith and Stulz (1985)) and the effect of expected underinvestment costs (Mayers and Smith (1989) and Froot et al. (1993)).

Smith and Stulz (1985) provide cross-sectional predictions about the association between compensation structure and total risk-taking. In their model, managers are assumed to be risk averse with indirect utility functions of wealth which are strictly concave. A manager's wealth consists of both pecuniary compensation and the payoff to his or her nontradable investment in the firm. Consequently, the firm's total cash flow volatility is transmitted to the manager's wealth volatility (Stulz (1996)).

Within this framework, we argue that managers of thrift institutions with lower shareholdings will increase total risk more than managers who have more wealth at stake. Higher share ownership provides risk-averse managers with greater incentives to control risks.¹⁴ In contrast, we predict greater total risk for thrifts whose managers hold more options.¹⁵ Smith and Stulz (1985) argue that managers with high levels of options have little incentive to engage in hedging activities, or, equivalently, have incentives for greater risk-taking, because option values increase with volatility.

In addition to the predicted association between compensation and *total* risk, we also predict an association between compensation and the coordi-

¹³ After the Financial Institutions Reform, Recovery and Enforcement Act of 1989 (FIRREA), institutions were required to meet minimum capital requirements with respect to "tangible" capital/tangible assets (1.5 percent); "core" capital/core assets (3 percent); and "risk-based" capital/risk-weighted assets (8 percent).

¹⁴ We recognize that an alternative for the manager is to hedge his investment outside the firm. However, there are practical limitations to implementing such a strategy. For example, managers may not take short positions in the firm's stock because of high transactions costs (due to illiquidity) or SEC or regulatory prohibitions on short sales.

¹⁵ In addition to holding a call option on the value of a levered institution, a thrift manager also holds a put option on the institution written by the government in the form of deposit insurance. Thus, a manager's net position with respect to the firm resulting from share ownership and this government guarantee is a long call with a strike price at the institution's debt level and a long put with a strike price at the debt level at which the regulators will liquidate the institution. If regulators exhibit forbearance and allow institutions to remain in operation despite technical insolvency, a manager of an institution near insolvency is long volatility and has more incentive to speculate than a manager holding only a call without the put option.

nation of risks. Prior to conversion, thrift managers with a fixed wage do not have incentives to manage the composition of risk. Conversion, however, provides managers with shares and options whose value is related to the value of the firm. Thus, conversion provides managers with the incentives to undertake activities that have a positive NPV for a given volatility of the firm. Therefore, we predict that managers of converting thrifts whose wealth is tied to firm value will coordinate risks more than managers of nonconverting mutual institutions. This prediction holds for all converting thrifts, regardless of the level of their share or option ownership. Once management has increased the total risk of the institution in response to the change in incentives and is in a steady state, however, we do not predict that the level of postconversion coordination will differ based on compensation structure. Rather, we expect that all thrifts with incentives to maximize value will substitute positive-NPV activities (core-business risk) for zero-NPV activities (homogenous risk) to achieve a target total risk level.

We derive a second cross-sectional prediction about risk-taking from Mayers and Smith (1989) and Froot et al. (1993), who show that firms with greater growth capacity face greater expected costs associated with volatility of internal wealth. Volatility creates expected underinvestment costs because a low cash flow outcome jeopardizes a firm's ability to undertake some investment projects. The magnitude of the expected underinvestment costs is positively related to a firm's growth opportunities. Hedging in the Froot et al. model or corporate insurance in the Mayers and Smith model creates value by minimizing the expected costs associated with underinvestment. Because expected underinvestment costs are greater when growth opportunities are higher, those thrifts that plan an aggressive postconversion growth plan have the most to gain from coordinating their credit and interest-rate risk to avoid underinvestment costs, even while increasing total risk. Therefore, we predict a positive association between growth opportunities and the change in total risk following conversion, and between growth opportunities and coordination.

B. Measures of Bundled Risks and Total Risk

Our analysis of the coordination of risk-management activities of bundled risks at thrift institutions focuses on management of the loan portfolio. Loan portfolios of thrift institutions, on average, constitute 70 percent of the assets of thrifts, and hence provide thrifts with the opportunity to dramatically increase total firm risk.¹⁶ Thrift loan portfolios also are an excellent example of bundled assets. S&Ls invest primarily in loans, either commercial or residential, financed by deposits or other debt. This balance-sheet structure exposes the institution to two sources of risk: (i) credit risk of the borrower, which represents unexpected changes in default arrival rates, and

¹⁶ On average for FSLIC-insured savings institutions during the 1984–1988 period, the remaining 30 percent of thrift assets consisted of cash and marketable investments (17 percent), real estate owned (4 percent), and other assets including goodwill (9 percent).

(ii) interest-rate risk, which represents unexpected changes in interest rates. Because both credit risk and interest-rate risk are bundled in loans, a thrift is forced to intermingle the management of its two most significant sources of risk in a single investment decision.

Consistent with prior literature, we define credit risk as a core-business risk. Edwards (1981) suggests that the costs of reducing credit risk include lost economic rents because financial institutions have a comparative advantage over other firms in making credit decisions. James (1987) empirically documents that banks have a comparative information advantage over the market at the origination of loan contracts.

Our empirical proxy for credit risk is the proportion of the loan portfolio that a thrift invests in commercial loans ("high-information" loans) relative to the size of its total loan (TL) portfolio ($HIGH/TL$). The total loan portfolio includes three components: residential nonconstruction mortgage loans (RES), investments in mortgage-backed pass-through securities (MBS), and construction and nonconstruction commercial loans. Commercial lending is a "high-information" activity because thrift institutions can develop a comparative advantage over the market to evaluate the unsystematic risk related to commercial loans. Furthermore, Lummer and McConnell (1989) document that this comparative advantage improves as the relationship between the lender and borrower becomes stronger.

By contrast, residential lending is the traditional activity on which thrift charters are based. Although a thrift institution has an accumulated comparative advantage in evaluating home mortgages, the application, reporting, and processing of home mortgage loans has become increasingly standardized. The credit quality of the borrower is typically measured by the applicant's conformance with respect to predetermined income/wealth ratios. Hence, we argue that residential lending is a low-information activity relative to commercial lending and thus does not provide the potential for significant abnormal returns. Likewise, investments in securitized loan portfolios are also a low-information activity. Mortgage-backed securities are generally guaranteed with respect to the principal amount so the default risk of the security is low. In fact, securitized loans can reduce total credit risk for the purchasing institution by providing a source of geographic or loan-size diversification.

An increase in commercial loans relative to total loans ($HIGH/TL$) corresponds to an increase in credit risk, so we predict an increase in $HIGH/TL$ after conversion. We construct this variable using quarterly data for thrift loan portfolios from call reports filed with the Federal Home Loan Bank Board (FHLBB), predecessor to the Office of Thrift Supervision (OTS).

We consider the interest-rate risk associated with an institution's lending activities to be a homogeneous risk or zero NPV activity. This risk results from the mismatch between the interest-rate sensitivity of loans and deposits. Diamond and Verrecchia (1982), in general, and Edwards (1981), Diamond (1984), and Campbell and Kracaw (1990), in particular, observe that interest rate changes are freely observable information. Further evidence

consistent with interpreting interest-rate risk as a homogeneous risk is the extensive availability of exchange-traded derivative instruments related to interest rates.¹⁷ In contrast, credit derivative contracts are generally customized swaps that resemble securitization transactions but have lower transactions costs, or options on credit risk premiums for portfolios of bonds (e.g., Baa-rated).¹⁸

Our empirical proxy for interest-rate risk (NET) is an institution's one-year maturity gap (GAP) net of the impact of off-balance-sheet hedging activities (HEDGE) scaled by total loans (commercial and residential loans and MBS). GAP is the difference between the book values of an institution's on-balance-sheet assets and its on-balance-sheet liabilities that mature in one year. Thrifts report gap for various maturity categories including zero-to-three months, three-to-six months, six months-to-one year, one-to-three years, three-to-five years, five-to-ten years, ten-to-twenty years, and greater than twenty years. The time to maturity of an interest-rate sensitive asset or liability as defined by the FHLBB is based on the remaining *contractual* maturity of the instrument. Embedded options are not considered. In particular, thrifts include adjustable-rate mortgages in the maturity category reflecting the period from the reporting date to the date of the next adjustment. We include passbook and NOW account balances in the one-year maturity category.

The impact of hedging activities on gap (HEDGE) represents either a decrease or an increase in an institution's one-year gap as a result of the use of off-balance-sheet derivative instruments. Institutions separately report the effects of derivatives use on each maturity-gap category under the heading "Impact of Hedging Activities." Because these off-balance-sheet activities are not net assets of the firm, but only change the maturity composition of existing assets and liabilities, the reported impact of derivatives on gap sums to zero across all maturity categories.¹⁹ The calculation of the impact is consistent across all institutions following guidelines set forth by

¹⁷ Historical contract success (and failure) has indicated five characteristics of successful exchange-traded futures contracts: "1) A sizable pool of assets or income at risk; 2) The instrument underlying the futures contract is an accurate reflection of that risk; 3) The instrument underlying the futures contract is not subject to manipulation or distortion; 4) There must be a regular source of information about the instrument or index so that participants may trade knowledgeably; and 5) The successful futures market must meet the requirements of the different (market) participants more efficiently than do the competing markets." (Petzel (1989), pp. 3-4).

¹⁸ Credit derivative contracts only became available in the early 1990s. As of 1995, the credit derivatives market has grown to \$2 billion in notional value with credit default swaps being the most commonly used instrument. Financial institutions may use the instruments to reduce default risk associated with loans made for "relationship purposes whether they make economic sense or not." (*American Banker*, September 26, 1995).

¹⁹ For example, an institution may report that the impact of "hedging" on the 0- to 12-month maturity category is positive \$100 million offset by an impact of negative \$100 million in the 5- to 10-year maturity category. In this example, the institution is effectively using derivatives to convert assets that mature in as many as ten years into assets with an effective maturity of less than twelve months (or liabilities that mature in as few as twelve months into liabilities with an effective maturity of ten years).

the FHLBB in "Section H, Maturity and Yield/Cost Information" Instructions (January 1989).

We assume that an institution with a perfectly matched net gap (NET/TL equal to zero) is exposed to less interest-rate risk than an institution with either a negative or positive one-year maturity gap. We predict that converting thrifts will shift NET/TL toward zero since it is a homogenous risk.

We recognize that duration gap (the difference between the durations of the institution's assets and liabilities), which considers the entire distribution of cash flows, is a better measure of an institution's interest-rate risk than net maturity gap (Bierwag and Kaufman (1985)). However, an institution's duration gap is not publicly available. Duration gap can be estimated using maturity-gap data but previous attempts have not provided a successful method of estimation.²⁰

Previous research, however, provides evidence that short-term maturity gap is related to the market's assessment of a financial institution's exposure to unexpected changes in interest rates (Flannery and James (1984) and Schrand (1997)). To test the robustness of these results for our sample institutions, we measure the association between one-year maturity gap, net of the impact of derivatives, scaled by total assets (NET/TA), and market interest-rate sensitivity. The results (not reported) suggest that our measure of interest-rate sensitivity is a reasonable proxy for the interest-rate beta of our sample institutions estimated using a two-factor market model.²¹

We consider the potential impact of interest-rate risk on credit risk to be of second-order importance. For example, interest rate increases can also increase default rates on loans. Additionally, derivatives used to hedge interest-rate risk expose an institution to credit risk because of the potential for counterparty default. We do not consider swap counterparty default risk to have the same credit risk implications for an institution as the risk associated with its investments.

In addition to separately measuring credit risk and interest-rate risk for the sample thrifts, we also create a proxy variable for total firm risk. Total firm risk is the standard deviation of weekly stock market returns for each institution for each quarter following conversion (VOL). Security returns are obtained from the Center for Research in Security Prices (CRSP).

III. Tests of Coordinated Risk Management at Converting Thrifts

A. Sample and Data Characteristics

Our sample consists of conversions completed between January 1, 1984, and December 31, 1988. The sample period begins in 1984 because data on interest-rate risk are not available from thrift regulatory reports prior to 1984. The sample period ends in 1988 because FIRREA, which was enacted

²⁰ See, for example, Bennett, Lundstrom, and Simonson (1986).

²¹ The results of this analysis are available from the authors upon request.

in 1989, toughened thrift capital requirements and introduced both new regulations and new regulators, which fundamentally changed the nature of the thrift operating environment.²²

Our sample is derived from 488 conversions during the sample period identified by Fleck (1990). Of these, 109 were supervisory conversions required by the FHLBB or conversions that occurred simultaneously with a merger. Supervisory mergers and merger-conversions are excluded from the sample because we are unable to measure interest-rate risk and credit risk of the converting institution separately from that of its "purchaser" following conversion. The sample of converting institutions includes 348 institutions (of the 379 qualifying conversions) for which we can identify a docket (regulatory identification) number.²³ We further restrict the institutions to those with total assets greater than \$100 million at each quarter end during the sample period. Controlling for size increases the likelihood of similarities across institutions with respect to their ability to access capital and derivatives markets (Gorton and Rosen (1995)) and their underlying production and cost functions (Carter and Stover (1991)). Institutions that are not FSLIC-insured are also excluded from the sample because of data availability. The final sample includes 134 converting institutions.

To mitigate the potential impact of confounding events on the results, we measure market volatility, interest-rate risk, and credit risk for the converting institutions relative to a control sample of stock-chartered institutions. Using CRSP and industry surveys, we are able to identify 50 institutions for our control sample that converted from mutual to stock charters no later than December 31, 1981. We impose this requirement to eliminate stock-chartered thrifts that are still experiencing postconversion growth as of the start of the sample period. After eliminating two thrifts with missing data, the control sample includes 48 stock-chartered institutions with available regulatory report data and 41 stock-chartered institutions with available returns data.

We also use a second control group of nonconverting mutual institutions. We obtain from thrift regulatory reports a sample of 1,565 institutions with mutual charters as of June 1989. After applying the criterion that size be greater than \$100 million at each quarter end during the sample period, this control sample includes 693 nonconverting mutual institutions.

For each converting institution j for each quarter t , we calculate the excess of the proxies for return volatility (VOL), interest-rate risk (NET/TL), and credit risk (HIGH/TL) over the mean of the corresponding variable for the

²² Furthermore, we cannot measure net interest-rate risk past March 1989. Instructions for calculating the impact of hedging changed significantly between the quarters ended March 1989 and June 1989. In particular, although gap increased (became more negative) 2.8 percent from March 1989 to June 1989, on average, the impact of hedging activities decreased 76 percent. This reflects a change in the reporting of stacked contracts and hedging of the mortgage pipeline. As a comparison, for the period from December 1988 to March 1989, gap increased (became more negative) by 1 percent, on average, and hedging activities increased by 4 percent.

²³ A docket number is unavailable if, subsequent to conversion, the institution changes its primary insurer to the FDIC or is closed by thrift regulators.

control group. Because stock-chartered and converting institutions are exposed to the same exogenous industry factors, these standardized variables reduce the impact on our results of time-series variation in risk-taking behavior that is unrelated to conversion. The names of all variables that are scaled relative to the control group have a prefix "XS" (excess). XSVOL is the weekly standard deviation of stock returns for converting thrift j during calendar quarter t minus the weekly standard deviation of stock returns for the control group during the same quarter. XSNET is the one-year maturity gap net of the impact of hedging scaled by total loans (commercial, residential, and MBS) for the converting thrift j at the end of calendar quarter t minus the same variable for a control group made up of stock thrifts. XSHIGH is the proportion of commercial loans to total commercial, residential, and mortgage-backed securities for the converting thrift j at the end of calendar quarter t minus the same variable for the control group.

B. Methodology

We analyze the time-series changes in total risk (XSVOL), interest-rate risk (XSNET), and credit risk (XSHIGH) following conversion using an ordinary least squares (OLS) regression that relates these risks (collectively, RISK) to indicator variables marking the position of the observation quarter relative to the event (conversion) quarter. We regress the RISK proxies for each institution j for each quarter t from March 1984 through December 1988 on time indicator variables as follows:

$$\text{RISK}_{jt} = \alpha + \sum_{k=-9}^{15} \beta_k \text{Time}(t+k) + e_{jt}, \quad (1)$$

where $\text{Time}(t+k)$ is an indicator variable equal to one if quarter t is k quarters from the conversion quarter; otherwise $\text{Time}(t+k)$ equals zero.²⁴

When we estimate the change in return volatility (XSVOL) postconversion, $\text{Time}(t+k)$ begins at the conversion quarter ($k=0$) because we cannot measure return volatility prior to conversion. The observation for institution j at $\text{Time}(t+0)$ represents the thrift's excess return volatility for the quarterly reporting period during which the conversion is completed.

XSNET and XSHIGH are a panel from nine quarters prior to conversion to fifteen quarters following conversion. The time frame is restricted by data availability, but allows sufficient opportunity for institutions to implement new strategies, even with respect to credit risk. Data are not available for all converting institutions across all time variables because the sample period is restricted to 1984 through 1988. For example, institutions converting dur-

²⁴ We estimate an alternative version of equation (1) that also includes five indicator variables that represent the five regions defined by the Resolution Trust Corporation: Northeast, Southeast, Central, Southwest, and West. These variables control for potential differences across geographic regions related to real-estate market conditions, growth opportunities, and regulatory oversight. The results (not reported) related to the changes in RISK are qualitatively similar.

ing the quarter ended December 1984 have data available beginning only three quarters prior to conversion or March 1984. At the other extreme, data for institutions converting during the quarter ended June 1988, for example, are available only through two quarters after conversion or December 1988. The interest-rate risk and credit risk observations for institution j at Time($t + 0$) represent the thrift's risk as of the end of the quarterly reporting period during which the conversion is completed.

The independent variables in equation (1) are a series of indicator variables, so the regression can be viewed as a series of tests of the differences between the risks of the average converting institution and the risks of the average institution in the control group. For any given quarter, this difference is equal to the sum of the intercept and the coefficient estimate for that quarter from equation (1). The difference between the converting institutions and the control group is significant when the sum of the intercept and the coefficient estimate is significantly different from zero.

Equation (1) documents time-series trends in total risk, interest-rate risk, and credit risk, but it does not indicate whether interest-rate risk and credit risk are coordinated. To explicitly test the hypothesis that interest-rate risk decreases are associated with increases in credit risk following conversion *within* each institution, we estimate the following pooled time-series cross-sectional regression:

$$\text{XSNET}_{jt} = \delta_I + \delta_R \text{XSHIGH}_{jt} + \epsilon_{jt}. \quad (2)$$

We predict a positive slope between XSNET and XSHIGH to the extent that our sample of thrifts coordinates the management of these risks because the closer an institution's XSNET is to zero, the better hedged is its balance sheet with respect to interest-rate risk. In other words, higher XSNET (less negative) reflects lower interest-rate risk.

Equation (2) specifies an ordinary least squares estimation of the cross-sectional time-series pooled model where the intercept and the slope term are constant across thrifts and event-time. However, omitted variables may persistently affect the relation between interest-rate risk and credit risk management and induce biases in pooled least-squares estimates of the panel data in equation (2). To mitigate such a possibility, we estimate a fixed-effects model of equation (2) that includes 134 thrift-specific intercepts. In this specification, the value of XSNET for the j th thrift at event-time t is a function of time-variant XSHIGH, where the intercept of this function is allowed to differ across thrifts but not across time.

IV. Empirical Results

A. Univariate Results

Table II presents the mean for each interest-rate risk and credit risk variable for the converting sample and the two control groups over the 1984 to 1988 period. Results for the 134 converting institutions are divided into pre-

conversion and postconversion quarters. Panel A of Table II indicates that even after excluding institutions with total assets (TA) less than \$100 million, stock institutions are larger and nonconverting mutuals are smaller, on average, than the converting institutions. Tangible net worth ratios (CAPITAL) also differ across the three samples. Panel A shows that the capital positions of the converting thrifts improve roughly 70 percent after conversion. The postconversion tangible net worth to total assets ratio for the converting thrifts of 4.8 percent is significantly greater than the corresponding ratios for both the mutual and stock control groups. The immediate increase in capital at conversion gives converting thrifts the ability to grow. Indeed, the asset growth rate for converting thrifts increases significantly postconversion, approaching the average growth levels of established stock institutions. Specifically, converting institutions increase their growth rate of total assets from 1.98 percent per quarter prior to conversion to 2.98 percent after conversion. This compares to growth rates of 1.37 percent for nonconverting mutuals and 3.20 percent for stock institutions.

Panel B of Table II shows that converting institutions significantly decrease their exposure to interest-rate risk from the preconversion period to the postconversion period. Prior to conversion, the converting institutions are similar to nonconverting mutuals with respect to interest-rate risk. During the postconversion period, however, these institutions decrease their interest-rate risk to levels that are lower, on average, than those of stock-chartered institutions. The significant difference in the interest-rate risk of converting thrifts relative to stock thrifts is also reflected in the XSNET measure (see Panel D).

Both pre- and postconversion, the frequency of the use of derivatives (percentage of users) by converting institutions is significantly greater than that of nonconverting institutions and less than that of the stock sample. Considering the growth in size that converting thrifts achieve, these results are consistent with prior research, which finds that larger institutions are significantly more likely to use derivative instruments (Nance, Smith, and Smithson (1993) and Sinkey and Carter (1994)).

With respect to credit risk (Panel C of Table II), we observe that our sample thrift institutions are increasing the riskiness of their loan portfolios, on average, to match that of the established stock-chartered S&Ls. There is a significant decrease in traditional nonconstruction residential mortgage loans from 56 percent of total loans to only 50 percent of total loans. Prior to conversion, converting thrifts are not significantly different from nonconverting mutuals with respect to their holdings of MBS. Postconversion, the converting thrifts increase their holdings of mortgage-backed securities to the point that their investment in MBS is not significantly different from that of the stock institutions. We also observe a significant increase for XSHIGH (Panel D) which indicates that the observed change in investment patterns for the converting thrifts is related to conversion rather than a time-trend in the industry.

An increase in commercial loans can naturally lead to reduced interest-rate risk because these loans have a shorter duration than residential mortgage loans. Hence, an inverse relation between credit risk and interest-rate

Table II
Means of Descriptive Variables and Proxy Variables for Interest-Rate and Credit Risk

Means^a of descriptive variables and proxy variables for interest-rate and credit risk for 134 converting institutions and control samples of 693 nonconverting mutuals with total assets > \$100 million and 48 stock institutions. Descriptive variables include total assets (TA), the ratio of tangible capital/total assets (CAPITAL), the quarterly percent increase in total assets (GROWTH), and the percentage of the sample institutions in each of the five Office of Thrift Supervision regions. Interest-rate risk variables include the excess of assets over liabilities with contractual maturities of twelve months or less/total loans (TL), which includes commercial and residential loans and mortgage-backed securities (GAP/TL); net one-year gap after the impact of off-balance-sheet activities/total loans (NET/TL); the impact of off-balance-sheet activities/total loans (HEDGE/TL); and the percentage of institutions using derivatives (Percentage of users). Credit risk variables include residential mortgages; mortgage-backed securities (MBS); and commercial loans. For the converting institutions, XSVOL, XSNET, and XSHIGH represent the excess of return volatility, NET/TL, and the proportion of commercial loans to total loans, respectively, in calendar quarter *t* for institution *j* measured relative to the means of these variables for all stock-chartered institutions during quarter *t*.

	Converting Institutions (<i>n</i> = 134)		Nonconverting Mutuals (<i>n</i> = 693)	Stock Institutions (<i>n</i> = 48)
	Preconversion	Postconversion		
Panel A: Descriptive Variables				
TA	\$784,477	\$1,304,560 ^{(1)b}	\$372,522 ⁽¹⁾⁽¹⁾	\$3,404,145 ⁽¹⁾⁽¹⁾
CAPITAL	0.0288	0.0480 ⁽¹⁾	0.0219 ⁽⁵⁾⁽¹⁾	0.0213 ⁽⁵⁾⁽¹⁾
GROWTH	0.0198	0.0298 ⁽¹⁾	0.0137 ⁽⁵⁾⁽¹⁾	0.0320 ^{(5)(NS)}
Percentage in region ^c				
West		11.5%	2.2%	36.2%
Central		13.7%	22.9%	4.3%
Northeast		44.6%	35.9%	10.6%
Southeast		27.3%	21.9%	38.3%
Southwest		0	4.0%	8.5%
Panel B: Interest-Rate-Risk Variables				
GAP/TL	-0.6096	-0.5101 ⁽¹⁾	-0.6527 ⁽¹⁰⁾⁽¹⁾	-0.6581 ⁽⁵⁾⁽¹⁾
NET/TL	-0.5975	-0.4831 ⁽¹⁾	-0.6451 ⁽¹⁰⁾⁽¹⁾	-0.6201 ^{(NS)(1)}
HEDGE/TL	0.0082	0.0187 ⁽¹⁾	0.0052 ⁽⁶⁾⁽¹⁾	0.0189 ^{(1)(NS)}
Percentage of users	15.79%	30.50% ⁽¹⁾	9.39% ⁽¹⁾⁽¹⁾	35.88% ⁽¹⁾⁽¹⁰⁾

Panel C: Credit-Risk Variables				
Loans by type/TL:				
Residential	0.5621	0.5038 ⁽¹⁾	0.5650 ^{(NS)(1)}	0.4589 ⁽¹⁾⁽⁵⁾
MBS	0.1016	0.1178 ⁽¹⁾	0.1028 ^{(NS)(1)}	0.1135 ^{(10)(NS)}
Commercial	0.0718	0.0911 ⁽¹⁾	0.0646 ⁽¹⁾⁽¹⁾	0.0986 ⁽¹⁾⁽¹⁰⁾
Panel D: Excess Variables Measured Relative to the Control Group of Stock Institutions				
XSVOL	N/A	-0.0007	—	—
XSNET	0.0228	0.1336 ⁽¹⁾	—	—
XSHIGH	-0.0525	-0.0232 ⁽¹⁾	—	—

^a Means are computed by averaging each variable by quarter for each of the three samples and then averaging the means. Means for both the preconversion and postconversion samples exclude the conversion quarter. This process controls for differences in the number of observations per quarter within each sample.

^b Numbers in brackets indicate the significance level of a Wald test of the equality of the sample mean to that of the (pre) and (post) conversion samples. NS indicates the sample means are not significantly different.

^c *Northeast*: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Washington D.C.; *Southeast*: Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, West Virginia; *Central*: Arkansas, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Wisconsin; *Southwest*: Oklahoma and Texas; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

risk would not be a strategic choice, but rather a direct consequence of the credit risk decision. This argument is most plausible only if our proxy variable for interest-rate risk is duration instead of one-year maturity gap because commercial loans generally have a shorter duration than mortgage loans. Moreover, we use NET maturity gap as a proxy for interest-rate risk, which includes the impact of off-balance-sheet hedging activities. As shown in Table II, Panel B, both the frequency and extent of the use of off-balance-sheet derivative instruments increases postconversion. Prior to conversion 16 percent of thrifts use derivatives; following conversion, there is a significant increase to 30.5 percent. Also, the converting institutions significantly increase the dollar "impact of hedging activities" (as defined by the FHLBB) as a percentage of total loans (HEDGE/TL) from less than 1 percent to 1.9 percent. The attained level of "hedging activities" is consistent with the use of off-balance-sheet derivative instruments by stock institutions. The increased use of derivatives provides evidence that the observed inverse relation between credit risk and interest-rate risk is a strategic decision and not a mechanical phenomenon. Later in this section, we provide additional evidence that the association between interest-rate risk and credit risk is not mechanical.

B. Time Series Evidence

Table III presents the time-series trends in total risk for the converting thrifts following conversion, as well as separate analyses of the time-series trends in interest-rate risk and credit risk. Column (1) reports results for the proxy variable for total risk, XSVOL. The evidence is consistent with an increase in total risk following conversion. In the conversion quarter, the average standard deviation of weekly returns for the converting thrifts is less than that of the established stock thrifts by 1.63 ($-0.0226 + 0.0063$) percent, and this difference is statistically significant. Following conversion, however, we observe a steady increase in the return volatility of the converting institutions relative to changes in return volatility for the control group during the same calendar quarters. The difference between the two groups is insignificant after six quarters.

The remaining columns of Table III indicate how the sample firms separately manage interest-rate risk and credit risk to achieve the observed increase in total risk. With respect to interest-rate risk measured by XSNET, we observe a dramatic change in the net gap positions of the converting thrifts relative to the stock chartered institutions around conversion. From quarter $t - 9$ (9 quarters prior to conversion) to quarter $t - 6$, converting institutions have worse net gap positions than the stock control group. For these quarters, the net gap positions of the converting thrifts are, on average, 3.61, 2.99, 2.40, and 1.53 percent more negative (although not statistically different from zero) than those of the control group, respectively. (These percentages reflect the sum of the intercept and the coefficient of the event-quarter). Beginning in quarter $t - 5$, the converting thrifts have a better net gap position than the stock thrifts, and the difference is significant as of

Table III

Results of Pooled Regressions of Proxies for Total Risk, Interest-Rate Risk, and Credit Risk on Event-Time Variables

Results of pooled regressions of proxies for total risk, interest-rate risk, and investment in commercial loans on event-time variables for 2,630 quarterly observations for 134 conversions between January 1984 and December 1988. $\text{Time}(t + k) = 1$ if quarter t is k quarters from the conversion quarter of institution j ; otherwise $\text{Time}(t + k) = 0$. Total risk (XSVOL) is the excess of the standard deviation of weekly stock returns of converting institution j for quarter t over the average weekly return volatility for all stock-chartered institutions during quarter t . Interest-rate risk (XSNET) is the excess of net one-year gap after the impact of off-balance-sheet activities/total loans (NET/TL) of converting institution j in quarter t over the average NET/TL for all stock-chartered institutions during quarter t . Credit risk (XSHIGH) is the excess of the proportion of commercial loans to total commercial and residential loans and mortgage-backed securities (HIGH/TL) in quarter t for institution j over the average HIGH/TL for all stock-chartered institutions during quarter t . Equation (1) is estimated from nine quarters prior to conversion to fifteen quarters following conversion.

$$\text{RISK}_{jt} = \alpha + \sum_{k=-9}^{15} \beta_k \text{Time}(t + k) + e_{jt}. \quad (1)$$

		Total Risk XSVOL	Interest-Rate Risk XSNET	Credit Risk XSHIGH
	<i>N</i>	(1)	(2)	(3)
Intercept		0.0063	-0.0130	-0.0554††
Quarter				
$t - 9$	90	N/A	-0.0231	-0.0058**
$t - 8$	90	N/A	-0.0169	-0.0099**
$t - 7$	102	N/A	-0.0110	0.0050**
$t - 6$	102	N/A	-0.0023	0.0097**
$t - 5$	103	N/A	0.0148	0.0133**
$t - 4$	109	N/A	0.0354	0.0172**
$t - 3$	110	N/A	0.0545†*	0.0195**
$t - 2$	113	N/A	0.0609††*	0.0213†**
$t - 1$	119	N/A	0.0772††**	0.0247†**
time t	134	-0.0226††**	0.1260††**	0.0243††**
$t + 1$	129	-0.0184††**	0.1188††**	0.0247††**
$t + 2$	124	-0.0153††**	0.1459††**	0.0309††**
$t + 3$	119	-0.0125†	0.1654††**	0.0321††**
$t + 4$	114	-0.0135†*	0.1616††**	0.0283††**
$t + 5$	110	-0.0076	0.1591††**	0.0342††*
$t + 6$	102	-0.0124†	0.1602††**	0.0451††
$t + 7$	88	-0.0092	0.1763††**	0.0545††
$t + 8$	72	-0.0088	0.1791††**	0.0612††
$t + 9$	54	-0.0086	0.2097††**	0.0606††
$t + 10$	46	-0.0001	0.1625††**	0.0667††
$t + 11$	39	-0.0065	0.1565††**	0.0689††
$t + 12$	39	-0.0120	0.1346††**	0.0780††
$t + 13$	29	-0.0001	0.1256††**	0.0739††
$t + 14$	29	0.0079*	0.1223††**	0.0753††
$t + 15$	28	-0.0133	0.1326††**	0.0733††
Adjusted R^2		2.7%	9.0%	4.5%

**(*) The coefficient plus the intercept is significantly different from zero at the 1 percent (5 percent) level, two-tailed test.

††(†) Significantly different from zero at the 1 percent (5 percent) level, two-tailed test.

quarter $t - 3$. Following conversion, the converting institutions continue to manage their interest-rate risk aggressively. At nine quarters after conversion, the net gap ratios of the sample institutions (net gap to total loans) are 19.67 percent higher (closer to zero and less risky) than the net gap ratios of the control group.

Concurrent with the decrease in interest-rate risk, we observe an increase in credit risk by the converting thrifts.²⁵ In quarters $t - 9$ and $t - 8$, the converting thrifts' loan portfolios are composed of significantly fewer commercial loans as a percentage of total loans, and more residential loans and mortgage-backed securities, than the control group. Following quarter $t - 8$, however, we observe a slow but consistent increase in the converting thrifts' holdings of commercial loans as these institutions approach the conversion quarter. By quarter $t + 6$, the converting thrifts' loan portfolio composition becomes indistinguishable from that of the control group. By quarter $t + 15$, the ratio of commercial loans to total loans for the converting thrifts is almost 2 percent greater than that of the stock thrifts. This dramatic increase in credit risk following conversion is consistent with existing empirical evidence that also documents increases in credit risk at converting thrifts (Hadaway and Hadaway (1981), Verbrugge and Goldstein (1981), Simons (1992), and Cordell, MacDonald, and Wohar (1993)).

In dollar terms, the decreases in the net gap positions of the converting thrifts and the increases in their investments in commercial loans during the postconversion period are significant. On average, within the second year following conversion, each sample institution carries \$76.5 million more of its assets as short-term assets (or fewer of its liabilities as short-term liabilities) than in the preconversion period. This is a major change in the maturity structure of thrift institution balance sheets and the sensitivity of these institutions to changes in interest rates. The average increase in the investment in commercial loans during the same period is \$14.6 million per institution, calculated using 72 firms for which we have full data for two years following conversion. This implies that our sample of 134 institutions, which is only a fraction of all conversions, infuses a total of approximately \$2 billion in commercial loans into the economy during the two-year period following their conversions.

Table IV reports the results of the estimation of equation (2) which formally tests the predicted coordination of interest-rate risk and credit risk. We estimate equation (2) for the entire sample period from nine quarters prior to conversion to fifteen quarters following conversion. We also estimate equation (2) separately for the pre- and postconversion quarters.

The results in Panel A indicate that the thrift institutions coordinate the management of their interest-rate risk and credit risk over the entire sam-

²⁵ Although the results are not presented, we also perform these time-series tests using nonconverting mutual institutions as a control group. The results are qualitatively similar in that the converting institutions exhibit a trend toward decreasing their interest-rate risk exposure and increasing their credit risk exposure relative to the control sample in the postconversion period.

Table IV

Tests of the Association between Interest-Rate Risk and Credit Risk

Tests of the coordination of net interest-rate risk (after hedging activities) and credit risk for 134 converting institutions (Panels A–C) and 135 nonconverting mutuals (Panel D). Interest-rate risk (XSNET) is the excess of the net one-year maturity gap scaled by total loans including commercial and residential loans and mortgage-backed securities (NET/TL) in quarter t for institution j over the average NET/TL for all stock-chartered institutions during quarter t . Credit risk (XSHIGH) is the excess of the proportion of commercial loans to total loans (HIGH/TL) in quarter t for institution j over the average HIGH/TL for all stock-chartered institutions during quarter t . For the sample of converting institutions, equation (2) is estimated over the period from nine quarters prior to conversion to fifteen quarters following conversion (Panel A); the preconversion period from nine quarters prior to conversion to conversion (Panel B); and the postconversion period from conversion to fifteen quarters following conversion (Panel C). Regressions are estimated using a fixed-effects model. t -statistics are in parentheses.

$$\text{XSNET}_{jt} = \sum_{l=1}^{134} \delta_l + \delta_R \text{XSHIGH}_{jt} + \epsilon_{jt}. \quad (2)$$

	XSHIGH	Adjusted R^2
Panel A: Data from Nine Quarters prior to Conversion to Fifteen Quarters after Conversion		
Coefficient	0.6097**	62.0%
t -statistic	(9.110)	
Panel B: Data from Nine Quarters Prior to Conversion until Conversion		
Coefficient	0.4942**	73.0%
t -statistic	(5.099)	
Panel C: Data from Conversion to Fifteen Quarters after Conversion		
Coefficient	0.3462**	74.6%
t -statistic	(4.132)	
Panel D: Nonconverting Mutuals (data from 1984–1988)		
Coefficient	0.2339	67.7%
t -statistic	(1.689)	

**(*) Significantly different from zero at the 1 percent (5 percent) level, two-tailed test.

ple period. This coordination is observed in both the pre- and postconversion periods (Panels B and C). For all three sample periods estimated with a fixed-effects model, there is a positive association between XSNET and XSHIGH. Thus, the greater the emphasis on commercial loans within a thrift's loan portfolio, the closer is the institution's net gap position to zero. Given the increase in total risk observed in Table III, these findings suggest that the converting thrifts do not increase total risk by increasing all of the components of risk associated with the loan portfolio. Rather, the converting thrifts that bear more commercial loan risk, which we argue is a positive NPV activity for thrifts *ex ante*, also have the most hedged net gap positions.

The coordination of risks in the postconversion period (Panel C) suggests that the incentives of the converting institutions' managers are aligned with those of the shareholders, and that coordination is an optimal means for

these value-maximizing managers to manage risks. However, we also observe coordination of risks in the preconversion period (Panel B) when these thrift managers are compensated by a fixed salary. One explanation for this result is that managers anticipate conversion and, prior to conversion, begin to coordinate risks to maximize their *expected* investment in the institution.

We test whether anticipation of conversion explains the significant preconversion coordination by comparing the results for the converting thrifts to coordination by nonconverting mutual institutions. Managers of nonconverting mutuals have the same compensation-related incentives as managers of converting institutions in the preconversion period; the only difference between the two groups is the expectation of conversion. We argue that the expectation of conversion is greater for those thrifts that successfully convert, although some nonconverting institutions might have anticipated conversion and failed, or might have converted after our sample period. The expectations of such institutions bias the results against rejecting coordination for the nonconverting mutuals.

For the nonconverting mutual institutions in our sample with total assets greater than \$500 million, we estimate equation (2) over the entire sample period from 1984 through 1988 using a fixed-effects model. We measure the interest-rate risk and credit risk for these institutions relative to the control group of stock-chartered institutions. The results are presented in Panel D of Table IV. In contrast to the results for the converting institutions in the preconversion period, the association between interest-rate risk and credit risk for the nonconverting mutuals is not significantly different from zero. This result suggests that the decision by the converting thrifts to coordinate risks in the preconversion period is related to anticipated changes in incentives, and that the impact of these incentives is internalized by the thrift managers prior to conversion.

The results in Panel D also provide evidence that a mechanical relation between gap, as a measure of interest-rate risk, and commercial lending does not drive the results. If such a relation exists because the contractual maturity of commercial loans is, on average, shorter than that of residential loans, then we should observe a significant relation for the nonconverting mutual sample as well as the sample of converting institutions. However, the association between interest-rate risk and credit risk is insignificant for the nonconverting mutuals, in contrast to the results for the sample of converting institutions.

As further evidence that the decreasing interest-rate risk of converting institutions is deliberate and not an unintended consequence of increasing the commercial loan portfolio, we find that the use of derivatives to hedge interest-rate risk is associated with credit risk decisions for the converting thrifts, but not for the nonconverting mutuals (results not presented). In twelve of the twenty quarters in our sample period, the mean of XSHIGH for the converting thrifts that use derivatives in at least one quarter during the sample period (users) is significantly higher than the mean level of XSHIGH for nonusers. Thus, the converting institutions that hedge interest-rate risk using derivatives also have higher credit risk, on average. For the noncon-

verting mutual institutions, however, the association between the use of derivatives to reduce gap and credit risk is only significant in two of the twenty quarters. Because the use of derivatives clearly has no mechanical relation to the thrift's commercial lending activities, the observed coordination of interest-rate risk and credit risk is not merely a result of the shorter contractual maturity of commercial loans.

C. Cross-Sectional Evidence

To test our prediction that institutions with greater growth opportunities at the time of conversion have the greatest incentives to increase total risk following conversion to avoid underinvestment costs, we develop an *ex ante* measure of the growth opportunities that a thrift has at the time of conversion. Following Maksimovic and Unal (1993), our measure of growth opportunities, THETA, is the chosen issue price of the converting thrift relative to the midpoint of the appraisal range.²⁶ The closer the value of the offer price to the upper limit of the appraisal range (the higher the THETA), the greater is the financial slack created at the time of conversion. Maksimovic and Unal (1993) provide evidence that share-price run-up on the first day of trading following conversion is positively and significantly associated with THETA. This result is consistent with the market attaching value to the creation of financial slack. Furthermore, they provide evidence that *ex post* growth rates are significantly correlated with THETA.

To test our predictions that managerial share ownership is negatively related to increases in total risk following conversion and that option ownership is positively related to increases in total risk following conversion, we use proxy statement data about the thrifts' compensation plans at the time of conversion.²⁷ As a proxy variable for management's share ownership of the thrift, we use the total value of shares purchased by managers at the time of conversion, expressed as a percentage of the conversion proceeds (INSIDE). Option holdings by management (OPTS) are measured as the ratio of the number of options granted to managers at conversion relative to the total number of shares issued at conversion.

Descriptive statistics of THETA, INSIDE, and OPTS are presented in Table V. Data to calculate these partitioning variables are obtained from Maksimovic and Unal (1993). The average choice of THETA is 94 percent of the midpoint of the appraisal range. Many institutions choose an offer price either close to the minimum price (85 percent of the midpoint), close to the maximum price (115 percent of the midpoint), or at the midpoint (1.00). The

²⁶ Prior to conversion, an independent appraiser determines the number of shares to be issued and a range of offer prices with minimum and maximum prices set at 15 percent below and above a midprice. Depending on demand, market conditions, and management's incentives, management chooses an offer price within the appraisal range. For an excellent description of the sale-of-stock approach see Williams et al. (1987).

²⁷ An institution's compensation structure both before and after conversion is a choice variable like interest-rate risk or credit risk. Although there are some regulatory restrictions on managerial share purchases, flexibility remains. The endogeneity of compensation structure and incentives for risk-taking is discussed in Tufano (1996a).

Table V
Descriptive Statistics of THETA, INSIDE, and OPTS

THETA is ex ante growth opportunities measured at conversion as the chosen offer price for the conversion issue relative to the midpoint of the appraisal range (midpoint = 1). INSIDE is the percentage of the initial public offering purchased by insiders at conversion. OPTS is the ratio of the number of options granted to management at conversion relative to the total number of shares issued at conversion.

	Mean	Standard Deviation	Median	Minimum	Maximum
THETA	0.940	0.087	0.928	0.845	1.150
INSIDE	0.070	0.056	0.057	0.003	0.366
OPTS	0.020	0.033	0.000	0.000	0.192

distribution of managerial shareholdings is skewed toward zero with 7.0 percent of the shares held by managers as a group, on average. Approximately one-half of the sample firms have no executive stock options. For those institutions that do include stock options as a component of managerial compensation, the percentage of options granted at conversion relative to the number of shares issued is generally less than 10 percent. One thrift, however, provided its managers with options to buy shares representing 19.2 percent of the total shares issued.

With respect to ex ante growth opportunities, we separately measure the changes in total risk, interest-rate risk, and credit risk for two partitions of the sample firms. "High-THETA" thrifts are those that choose an offer price greater than the midpoint of the appraisal range ($\text{THETA} \geq 1$). This choice creates greater financial slack, and thus greater ex ante opportunities for growth, than that achieved by the "low-THETA" thrifts ($\text{THETA} < 1$).

Table VI indicates that both the high-THETA and low-THETA groups exhibit less stock volatility than the control group of stock institutions in the conversion quarter. The sums of the intercepts and the conversion quarter coefficient estimates show that the stock return volatilities of the low- and high-THETA thrifts are 1.58 percent and 1.89 percent less than that of their stock-chartered counterparts in the quarter of conversion, respectively. However, the return volatility for the low-THETA thrifts remains less than that of the control group over the sample period. In contrast, the lower volatility for the high-THETA institutions is sustained for only six quarters after conversion. After quarter $t + 6$, the high-THETA thrifts have a stock return volatility that is equal to or greater than the volatility of the stock-chartered thrifts.

The increase in total risk that we observe for the high-growth institutions occurs concurrently with better interest-rate risk management than that of the low-THETA sample. Columns (3) and (4) of Table VI show that both the low- and high-THETA thrifts decrease interest-rate risk following conversion. The high-THETA institutions continue to follow a more aggressive interest-rate risk hedging strategy following conversion even though they are more neutral to interest-rate risk exposure than the low-THETA thrifts

Table VI

Results of Pooled Regressions of Proxies for Risk on Event-Time Variables by Growth Opportunities (THETA)

Results of pooled regressions of proxies for total risk, interest-rate risk, and credit risk on event-time variables for 134 conversions between January 1984 and December 1988. Results are presented for 70 LOW-THETA (THETA < 1) and 31 HIGH-THETA (THETA ≥ 1) thrifts with available data. THETA, the chosen issue price of the converting thrift relative to the midpoint of the appraisal range, measures ex ante growth opportunities. Time($t + k$) = 1 if quarter t is k quarters from the conversion quarter of institution j ; otherwise Time($t + k$) = 0. Total risk (XSVOL) is the excess of the standard deviation of weekly stock returns of converting institution j for quarter t over the average weekly return volatility for all stock-chartered institutions during quarter t . Interest-rate risk (XSNET) is the excess of net one-year gap after the impact of off-balance-sheet activities/total loans (NET/TL) of converting institution j in quarter t over the average NET/TL for all stock-chartered institutions during quarter t . Credit risk (XSHIGH) is the excess of the proportion of commercial loans to total commercial and residential loans and mortgage-backed securities (HIGH/TL) in quarter t for institution j over the average HIGH/TL for all stock-chartered institutions during quarter t . Equation (2) is estimated from nine quarters prior to conversion to fifteen quarters following conversion.

$$\text{RISK} = \alpha + \sum_{k=-9}^{15} \beta_k \text{Time}(t+k) + e_{jt}. \quad (2)$$

	RISK = XSVOL		RISK = XSNET		RISK = XSHIGH	
	THETA < 1	THETA ≥ 1	THETA < 1	THETA ≥ 1	THETA < 1	THETA ≥ 1
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0068	-0.0150	0.0001	-0.0536 ^L	-0.0575	-0.0496
Quarter						
$t - 9$	NA	NA	-0.0214	0.0467	-0.0095**	0.0145*
$t - 8$	NA	NA	-0.0207	0.0493	-0.0139**	0.0116*
$t - 7$	NA	NA	-0.0386	0.0734	0.0138**	0.0127**
$t - 6$	NA	NA	-0.0098	0.0410	0.0179**	0.0184*
$t - 5$	NA	NA	0.0077	0.0694	0.0251**	0.0197*
$t - 4$	NA	NA	0.0016	0.0999	0.0336	0.0204*
$t - 3$	NA	NA	0.0567*	0.0911	0.0358	0.0237
$t - 2$	NA	NA	0.0526*	0.1053	0.0357	0.0252
$t - 1$	NA	NA	0.0670**	0.1352*	0.0372	0.0240
time t	-0.0226**	-0.0039**	0.0103**	0.2103**	0.0276**	0.0337
$t + 1$	-0.0186**	0.0077	0.0879**	0.2157**	0.0261**	0.0364
$t + 2$	-0.0113	0.0048	0.1202**	0.2433**	0.0312**	0.0492
$t + 3$	-0.0127	0.0103	0.1268**	0.2986** ^{LL}	0.0348*	0.0481
$t + 4$	-0.0124	0.0033	0.1192**	0.2983** ^{LL}	0.0322	0.0377
$t + 5$	-0.0067	0.0157	0.1237**	0.2985** ^{LL}	0.0389	0.0385
$t + 6$	-0.0114	0.0123	0.1301**	0.2872** ^L	0.0484	0.0448
$t + 7$	-0.0109	0.0159	0.1469**	0.2804**	0.0546	0.0451
$t + 8$	-0.0111	0.0185	0.1578**	0.2487**	0.0601	0.0458
$t + 9$	-0.0147	0.0221	0.1771**	0.2888**	0.0544	0.0576
$t + 10$	-0.0115	0.0468** ^{LL}	0.1340**	0.2520**	0.0489	0.0803
$t + 11$	-0.0062	0.0144	0.1396**	0.2100*	0.0556	0.0613
$t + 12$	-0.0130	0.0062	0.1213**	0.1711	0.0694	0.0624
$t + 13$	0.0036*	0.0045	0.1670**	-0.1377 ^{LL}	0.0656	0.0350
$t + 14$	0.0023	0.0189	0.1691**	-0.1768** ^{LL}	0.0693	0.0354
$t + 15$	-0.0166	—	0.1670**	-0.1832 ^{LL}	0.0728	-0.0106
Adjusted R^2	2.8%	0.2%	7.6%	11.9%	2.6%	-0.0%

**(*) Reject the hypothesis that the coefficient plus the intercept is not significantly different from zero at the 5 percent (10 percent) level, two-tailed test.

^{LL(L)} Reject the hypothesis that the coefficient plus the intercept (or the intercept) for the HIGH partition is significantly different from the coefficient plus the intercept (or the intercept) for the LOW partition at the 5 percent (10 percent) level, two-tailed test.

at conversion. In quarters $t + 3$ through $t + 6$, the high-THETA institutions are significantly better managed than the control group.

With respect to the concurrent management of credit risk, both high- and low-THETA institutions increase holdings of high-risk commercial loans as a percentage of their total loan portfolios (columns (5) and (6)). However, we again observe a difference between the strategies followed by these two groups. The low-THETA institutions have credit risk, on average, that is significantly lower than that of the control group through one year after conversion. By contrast, the high-THETA institutions have significantly lower commercial loan holdings than the control group as of one year prior to conversion, but the difference becomes insignificant in quarter $t - 3$ and continues to be insignificant thereafter.

Taken together, the results suggest that the more aggressive hedging of interest-rate risk by the high-THETA institutions enables them to achieve a higher target level of total risk compared to that of the low-THETA institutions, although the difference in XSVOL between the two groups is not statistically significant. The higher total risk for the high-THETA thrifts, however, is not associated with a significant increase in the risk of their loan portfolios during the sample period relative to the low-THETA institutions.

Related to the cross-sectional predictions about risk-taking and share ownership, we examine the associations between managerial shareholdings and changes in total risk, interest-rate risk, and credit risk for two equal-sized partitions of the sample of converting thrifts. The "high-share-ownership" sample represents institutions with managerial share purchases as a percentage of the initial public offering at the time of conversion that are greater than the median for the entire sample. The "low-share-ownership" sample holds less than the median percentage.

Table VII reports evidence (columns (1) and (2)) that provides some support for the prediction of Smith and Stulz (1985) that risk-averse managers with more wealth at stake are more likely to control total risk, but that the coordination of risks does not differ as a function of share ownership. Although the stock return volatility of the thrifts with low share ownership is a lower percentage than that of the control group by 1.03 percent (0.0035 – 0.0138) at the time of conversion, the low-share-ownership sample is not significantly different from the control group within one quarter after conversion. In contrast, the stock return volatility of the high-share-ownership sample is lower than that of the control group at the time of conversion by 2.01 percent (0.008 – 0.029), and the difference is significant for approximately six quarters following conversion. The low- and high-share-ownership samples are not significantly different in any quarter, however, and the low-share-ownership thrifts show higher stock return volatility in quarter ($t + 14$). The results in the later quarters should be interpreted with caution because the partitioning throughout the sample period depends on managerial share ownership at the time of conversion. By fourteen quarters after conversion, management's share ownership position may have changed.

Columns (3) and (4) of Table VII show that both the low- and high-share-ownership groups decrease interest-rate risk following conversion; columns

Table VII

Results of Pooled Regressions of Proxies for Risk on Event-Time Variables by Managerial Share Ownership

Results of pooled regressions of proxies for total risk, interest-rate risk, and credit risk on event-time variables for 134 conversions between January 1984 and December 1988. Results are presented for 55 LOW-share ownership institutions (share ownership < sample median) and 79 HIGH-share ownership institutions (share ownership > sample median) where share ownership is the percentage of the initial public offering purchased by insiders at conversion. Time($t + k$) = 1 if quarter t is k quarters from the conversion quarter of institution j ; otherwise Time($t + k$) = 0. Total risk (XSVOL) is the excess of the standard deviation of weekly stock returns of converting institution j for quarter t over the average weekly return volatility for all stock-chartered institutions during quarter t . Interest-rate risk (XSNET) is the excess of net one-year gap after the impact of off-balance-sheet activities/total loans (NET/TL) of converting institution j in quarter t over the average NET/TL for all stock-chartered institutions during quarter t . Credit risk (XSHIGH) is the excess of the proportion of commercial loans to total commercial and residential loans and mortgage-backed securities (HIGH/TL) in quarter t for institution j over the average HIGH/TL for all stock-chartered institutions during quarter t . Equation (2) is estimated from nine quarters prior to conversion to fifteen quarters following conversion.

$$\text{RISK} = \alpha + \sum_{k=-9}^{15} \beta_k \text{Time}(t + k) + e_{jt}.$$
 (2)

	RISK = XSVOL		RISK = XSNET		RISK = XSHIGH	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0035	0.0080	-0.0583	0.0123 ^{LL}	-0.0561	-0.0459
Quarter						
$t - 9$	NA	NA	-0.0260**	-0.0131 ^L	0.0011**	-0.0108**
$t - 8$	NA	NA	-0.0180**	-0.0082 ^L	-0.0067**	-0.0122**
$t - 7$	NA	NA	-0.0222**	0.0066 ^{LL}	0.0030**	0.0066**
$t - 6$	NA	NA	-0.0236**	0.0230 ^{LL}	0.0067**	0.0121**
$t - 5$	NA	NA	0.0053	0.0305 ^{LL}	0.0120**	0.0144**
$t - 4$	NA	NA	0.0445	0.0376*	0.0133**	0.0203**
$t - 3$	NA	NA	0.0683	0.0528**	0.0102**	0.0265**
$t - 2$	NA	NA	0.0789	0.0551**	0.0122**	0.0278**
$t - 1$	NA	NA	0.0825	0.0800** ^L	0.0126**	0.0332*
time t	-0.0138**	-0.0290**	0.1490**	0.1162** ^L	0.0126**	0.0326*
$t + 1$	-0.0104*	-0.0239**	0.1618**	0.0951**	0.0112**	0.0345*
$t + 2$	-0.0077	-0.0204**	0.1948**	0.1181**	0.0151**	0.0420
$t + 3$	-0.0049	-0.0178**	0.2135**	0.1382**	0.0174**	0.0428
$t + 4$	-0.0060	-0.0188**	0.2115**	0.1330**	0.0175**	0.0365
$t + 5$	0.0019	-0.0147	0.1998**	0.1376**	0.0224**	0.0439
$t + 6$	-0.0063	-0.0169*	0.2154**	0.1261**	0.0334*	0.0558
$t + 7$	-0.0080	-0.0095	0.2255**	0.1478**	0.0421	0.0650
$t + 8$	-0.0062	-0.0103	0.2557**	0.1314**	0.0491	0.0699
$t + 9$	-0.0087	-0.0079	0.2918**	0.1592**	0.0459	0.0708
$t + 10$	-0.0101	0.0071*	0.2099**	0.1359**	0.0499	0.0776
$t + 11$	-0.0052	-0.0073	0.2179**	0.1212**	0.0569	0.0764
$t + 12$	-0.0089	-0.0138	0.1938**	0.1007**	0.0615	0.0883
$t + 13$	0.0019	-0.0014	0.2430**	0.0679	0.0456	0.0866
$t + 14$	0.0342**	-0.0035 ^{LL}	0.2427**	0.0633	0.0375	0.0922
$t + 15$	-0.0107	-0.0148	0.2624**	0.0673	0.0412	0.0884
Adjusted R^2	3.6%	3.1%	16.3%	4.5%	1.6%	5.1%

**(*) Reject the hypothesis that the coefficient plus the intercept is not significantly different from zero at the 5 percent (10 percent) level, two-tailed test.

^{LL(L)} Reject the hypothesis that the coefficient plus the intercept (or the intercept) for the HIGH partition is significantly different from the coefficient plus the intercept (or the intercept) for the LOW partition at the 5 percent (10 percent) level, two-tailed test.

(5) and (6) show that both groups simultaneously increase their credit risk following conversion by increasing their holdings of commercial loans. The differences between the improvements in interest-rate risk shown in columns (3) and (4) are not significantly different. However, for institutions with high-share managers, the decrease in interest-rate risk exposure begins four quarters prior to the conversion quarter. These institutions exhibit significantly better interest-rate risk management than the low-share ownership thrifts as early as nine quarters prior to conversion. Because a mutual thrift's *preconversion* value becomes a windfall profit to the initial shareholders of a converting institution,²⁸ the association between preconversion interest-rate risk management and share purchase decisions is consistent with a view by managers that interest-rate risk management is a value-maximizing activity.

In sum, the results in Table VII provide some evidence that share ownership affects an institution's target level of total risk. Conditional on choosing a total risk target, however, share ownership at any level induces managers to coordinate risks to achieve the highest return per unit of risk. This coordination for converting institutions at all levels of share ownership contrasts with the absence of an association between interest-rate risk and credit risk that we observe in Table IV (Panel D) for managers of nonconverting mutuals whose compensation is not tied to firm value.

In addition to the share-component of managerial compensation, we consider the relation between executive stock options and total risk, interest-rate risk, and credit risk for the sample thrifts. We partition the sample into two groups based on the number of options granted to management at conversion as a percentage of the total number of shares issued. One group represents institutions whose managers hold no options and the other group holds some options.

Consistent with the predictions of Smith and Stulz (1985), managerial option holdings have a positive association with total risk. Columns (1) and (2) of Table VIII indicate that institutions with managers who hold no options have significantly lower stock return volatility in the conversion quarter and quarter $t + 1$ than the average stock thrift. These excess return volatilities for the no-option thrifts are significantly lower than those of thrifts whose managers are granted options at conversion for five quarters following conversion.

With respect to the management of interest-rate and credit risk, both the no-option and option groups follow similar risk management strategies and reduce interest-rate risk while increasing credit risk following conversion. This finding is similar to the results in Table VII when the institutions are partitioned on the basis of share ownership. Together, the results indicate that compensation structure is related to total risk management, but that all thrift managers with incentives to maximize firm value coordinate the management of bundled risks.

²⁸ Unal (1997) describes how windfall profits accrue to initial shareholders of converting thrifts.

Table VIII

Results of Pooled Regressions of Proxies for Risk on Event-Time Variables by Managerial Option Ownership

Results of pooled regressions of proxies for total risk, interest-rate risk, and credit risk on event-time variables for 134 conversions between January 1984 and December 1988. Results are presented for institutions with no options (NO-OPTS, $n = 62$) and some options (OPTS, $n = 39$). OPTS is the ratio of the number of options granted to management at conversion relative to the total number of shares issued. $\text{Time}(t + k) = 1$ if quarter t is k quarters from the conversion quarter of institution j ; otherwise $\text{Time}(t + k) = 0$. Total risk (XSVOL) is the excess of the standard deviation of weekly stock returns of converting institution j for quarter t over the average weekly return volatility for all stock-chartered institutions during quarter t . Interest-rate risk (XSNET) is the excess of net one-year gap after the impact of off-balance-sheet activities/total loans (NET/TL) of converting institution j in quarter t over the average NET/TL for all stock-chartered institutions during quarter t . Credit risk (XSHIGH) is the excess of the proportion of commercial loans to total commercial and residential loans and mortgage-backed securities (HIGH/TL) in quarter t for institution j over the average HIGH/TL for all stock-chartered institutions during quarter t . Equation (2) is estimated from nine quarters prior to conversion to fifteen quarters following conversion.

$$\text{RISK} = \alpha + \sum_{k=-9}^{15} \beta_k \text{Time}(t + k) + e_{jt}. \quad (2)$$

	RISK = XSVOL		RISK = XSNET		RISK = XSHIGH	
	NO-OPTS	OPTS	NO-OPTS	OPTS	NO-OPTS	OPTS
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0138	-0.0072 ^{NN}	-0.0107	-0.0121	-0.0594	-0.0499
Quarter						
$t - 9$	NA	NA	-0.0050	-0.0056	0.0000**	-0.0022**
$t - 8$	NA	NA	-0.0005	-0.0086	-0.0025**	-0.0081**
$t - 7$	NA	NA	-0.0020	-0.0092	0.0057**	0.0261
$t - 6$	NA	NA	-0.0042	0.0068	0.0093**	0.0323
$t - 5$	NA	NA	0.0233	0.0206	0.0161**	0.0353
$t - 4$	NA	NA	0.0300	0.0511	0.0228**	0.0381
$t - 3$	NA	NA	0.0510	0.0739*	0.0221**	0.0458
$t - 2$	NA	NA	0.0502	0.0813**	0.0269**	0.0399
$t - 1$	NA	NA	0.0775*	0.0920**	0.0256**	0.0448
time t	-0.0328**	-0.0058** ^{NN}	0.1139**	0.1569**	0.0229**	0.0416
$t + 1$	-0.0242**	-0.0032** ^{NN}	0.1119**	0.1390**	0.0261**	0.0364
$t + 2$	-0.0210	0.0024** ^N	0.1410**	0.1739**	0.0319**	0.0470
$t + 3$	-0.0208	0.0044* ^N	0.1600**	0.2007**	0.0343**	0.0485
$t + 4$	-0.0234*	0.0030* ^N	0.1607**	0.1856**	0.0314**	0.0398
$t + 5$	-0.0124	0.0055	0.1601**	0.1946**	0.0384*	0.0412
$t + 6$	-0.0148	-0.0019**	0.1707**	0.1796**	0.0481	0.0478
$t + 7$	-0.0117	-0.0035**	0.2024**	0.1536**	0.0498	0.0572
$t + 8$	-0.0126	-0.0005	0.1969**	0.1487**	0.0575	0.0555
$t + 9$	-0.0151	0.0016	0.2370**	0.1519**	0.0700	0.0314
$t + 10$	-0.0009*	0.0036	0.1863**	0.1244**	0.0771	0.0263
$t + 11$	-0.0129	0.0063	0.1472**	0.1717**	0.0755	0.0264
$t + 12$	-0.0228	0.0034 ^N	0.1253**	0.1428**	0.0850	0.0374
$t + 13$	-0.0039	0.0108	0.1420**	0.0916	0.0838	0.0154
$t + 14$	-0.0089	0.0218* ^N	0.1400**	0.0833	0.0861	0.0204
$t + 15$	-0.0315*	0.0090 ^{NN}	0.1419**	0.1123	0.0829	0.0245
Adjusted R^2	2.6%	0.1%	6.9%	9.3%	5.6%	-0.1%

**(*) Reject the hypothesis that the coefficient plus the intercept is not significantly different from zero at the 5 percent (10 percent) level, two-tailed test.

^{NN(N)} Reject the hypothesis that the coefficient plus the intercept (or the intercept) for the OPTS partition is significantly different from the coefficient plus the intercept (or the intercept) for the NO-OPTS partition at the 5 percent (10 percent) level, two-tailed test.

Options, however, are associated with the *method* of interest-rate risk management that a thrift employs. Further analysis of the interest-rate risk management decisions of the sample thrifts indicates that thrifts with managerial option holdings achieve their interest-rate risk hedging through the use of derivative instruments rather than on-balance-sheet asset/liability matching (results not presented). This behavior is consistent with the conjecture that the relative liquidity of derivatives offers thrifts the opportunity to *selectively* manage their interest-rate exposure based on their expectations of interest-rate changes. In other words, these institutions hold the "option" to become even more risky as a result of their mismatched gap positions simply by liquidating their derivatives positions. Since speculation with derivatives is prohibited, maintaining a more negative gap position is the only way for institutions to speculate on interest rates.

V. Conclusion

This paper proposes an approach to analyzing risk management activities when multiple risks are bundled within a firm's assets or liabilities. We classify potentially bundled risks into two types: core-business risk and homogeneous risk. Firms earn economic rents for bearing core-business risk, such as credit risk, and earn zero economic rents for bearing homogeneous risk, such as interest-rate risk. Given that increases in total risk are costly, the rational strategy is to eliminate homogeneous risks. Because these risks are often bundled with core-business risks, hedging becomes desirable even for risk-neutral or risk-seeking firms as a means of allocating risk. We denote this approach of optimal risk allocation among multiple risks within a firm as *coordinated risk management*.

We test the coordination of risk management activities by examining changes in the interaction between interest-rate risk (homogeneous risk) and credit risk (core-business risk) at thrift institutions following conversion from a mutual to stock form of ownership. Although the concept of coordinated risk management applies to any firm, we use this sample because we predict that the conversion process significantly alters a thrift's risk-taking abilities and incentives. Thus, we can observe concurrent changes in risk-taking across different types of risk and the related changes in the total risk of the institution. Additionally, well-defined homogeneous and core-business risks are bundled in a thrift's loan portfolio. Thus, we have an excellent natural experiment for our analysis of whether hedging one source of risk—interest-rate risk—occurs as a means of achieving an overall increase in total risk.

The time-series tests provide evidence that the converting thrifts do, as we predict, increase total risk following conversion. We argue that the incentives to increase total risk result from changes that occur at conversion in the thrift's ownership structure and growth opportunities. The increase in total risk that we observe is accompanied by an increase in credit risk and a corresponding decrease in interest-rate risk. Prior to conversion, converting thrifts face balance sheets that have significantly more interest-rate risk and less credit risk (commercial loans) than those of stock institutions

on average. The coordinated management of interest-rate risk and credit risk begins as many as nine quarters prior to conversion. In summary, we observe risk-reduction related to interest-rate risk not as a means of reducing total risk but as a means of allocating risk to other activities within the thrift.

Further tests show that nonconverting mutual thrifts do not coordinate interest-rate risk and credit risk like the converting institutions. Because mutual managers do not have incentives to maximize firm value, this observation is consistent with our argument that the coordination of risks maximizes value for firms for which increases in total risk are costly due to market imperfections. Thus, we can observe hedging of certain risks even when firms are trying to increase total firm risk.

We also examine cross-sectional differences in the observed patterns of risk management. We document that the extent of interest-rate risk hedging to achieve an increase in total risk is positively associated with a thrift's ex ante growth opportunities. This result suggests that institutions with higher growth opportunities face higher expected underinvestment costs associated with high cash flow variation. We also provide evidence on the association between managerial security holdings and total firm risk. Consistent with the predictions of Smith and Stulz (1985) and the findings of Tufano (1996a), managers who purchase greater than the median number of shares at conversion reduce total return volatility following conversion. By contrast, managers with low-share ownership do not exhibit the same decreasing pattern, but the differences between the two groups are not significant. Managers with option holdings achieve significantly greater total return volatility than managers who are not granted options at conversion. Regardless of the managers' share and option holdings, however, the sample institutions increase total risk by simultaneously reducing interest-rate risk and increasing credit risk.

REFERENCES

- Allen, James C., 1995, Derivatives dealers offering regionals new diversification tool: Credit swaps, *American Banker*, 1.
- Asquith, Paul, and David W. Mullins, Jr., 1986, Equity issues and offering dilution, *Journal of Financial Economics* 15, 61-89.
- Barth, R. James, Philip F. Bartholomew, and Michael G. Bradley, 1990, Determinants of thrift institution resolution costs, *Journal of Finance* 45, 731-754.
- Bennett, Dennis E., Roger D. Lundstrom, and Donald G. Simonson, 1986, Estimating portfolio net worth values and interest-rate risk in savings institutions, in Federal Reserve Bank of Chicago, ed.: *Proceedings: A Conference on Bank Structure and Competition* (Federal Reserve Bank of Chicago, Chicago, Ill.).
- Bierwag, Gerald O., and George G. Kaufman, 1985, Duration gap for financial institutions, *Financial Analysts Journal* 47, 68-71.
- Campbell, Tim S., and William A. Kracaw, 1990, Corporate risk management and the incentive effects of debt, *Journal of Finance* 45, 1673-1686.
- Carter, Richard B., and Roger D. Stover, 1991, Management ownership and firm compensation policy: Evidence from converting savings and loan associations, *Financial Management* 20, 80-90.
- Chicago Board of Trade, ed., 1977. *Selected Writings of Holbrook Working* (Chicago Board of Trade, Chicago, Ill.).

- Cordell, Lawrence R., Gregor D. MacDonald, and Mark E. Wohar, 1993, Corporate ownership and the thrift crisis, *Journal of Law and Economics* 36, 719-756.
- Culp, Christopher L., and Merton H. Miller, 1995a, Hedging in the theory of corporate finance: A reply to our critics, *Journal of Applied Corporate Finance* 8, 121-127.
- Culp, Christopher L., and Merton H. Miller, 1995b, Metallgesellschaft and the economics of synthetic storage, *Journal of Applied Corporate Finance* 7, 62-76.
- Diamond, Douglas W., 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies* 51, 393-414.
- Diamond, Douglas W., and Robert E. Verrecchia, 1982, Optimal managerial contracts and equilibrium security prices, *Journal of Finance* 37, 275-287.
- Economist*, A survey of corporate risk management, February 10, 1996, 2-22.
- Edwards, Franklin R., 1981, The regulation of futures and forward trading by depository institutions: A legal and economic analysis, *Journal of Futures Markets* 1, 201-218.
- Esty, Ben, Peter Tufano, and Jonathan Headley, 1994, Banc One Corporation: Asset liability management, *Journal of Applied Corporate Finance* 7, 33-51.
- Federal Home Loan Bank Board, 1989, *Thrift Financial Report (TFR) Section H instruction pages*, H-i-H-63.
- Flannery, Mark J., and Christopher M. James, 1984, The effect of interest rate changes on the common stock returns of financial institutions, *Journal of Finance* 39, 1141-1153.
- Fleck, Larry, 1990, Status of conversions, Unpublished memorandum (January 11), Office of Thrift Supervision.
- Froot, Kenneth, David Scharfstein, and Jeremy Stein, 1993, Risk management: Coordinating investment and financing policies, *Journal of Finance* 48, 1629-1658.
- Gorton, Gary, and Richard Rosen, 1995, Banks and derivatives, in Ben S. Bernanke and Julio J. Rotemberg, ed.: *Macroeconomics Annual 1995* (MIT Press, Cambridge, Mass.).
- Hadaway, L. Beverly, and Samuel C. Hadaway, 1981, An analysis of the performance characteristics of converted savings and loan associations, *Journal of Financial Research* 4, 195-206.
- James, Christopher, 1987, Some evidence on the uniqueness of bank loans, *Journal of Financial Economics* 19, 217-235.
- Kane, Edward J., 1985, *The Gathering Crisis in Federal Deposit Insurance* (MIT Press, Cambridge, Mass.).
- Kane, Edward J., 1989, *The S&L Insurance Mess: How Did It Happen?* (Urban Institute Press, Washington, D.C.).
- Lummer, Scott L., and John J. McConnell, 1989, Further evidence on the bank lending process and the capital market response to bank loan agreements, *Journal of Financial Economics* 25, 99-122.
- Maksimovic, Vojislav, and Haluk Unal, 1993, Issue size choice and "underpricing" in thrift mutual-to-stock conversions, *Journal of Finance* 48, 1659-1692.
- Mason, Scott P., 1995, The allocation of risk, Working paper 95-060, Harvard Business School.
- Masulis, W. Ronald, 1987, Changes in ownership structure: Conversions of mutual savings and loans to stock charter, *Journal of Financial Economics* 18, 29-59.
- Masulis, W. Ronald, and Ashok N. Korwar, 1986, Seasoned equity offerings: An empirical investigation, *Journal of Financial Economics* 15, 91-118.
- Mayers, David, and Clifford W. Smith, 1981, Contractual provisions, organizational structure, and conflict control in insurance markets, *Journal of Business* 54, 407-434.
- Mayers, David, and Clifford W. Smith, 1986, Ownership structure and control: The mutualization of stock life insurance companies, *Journal of Financial Economics* 16, 73-98.
- Mayers, David, and Clifford W. Smith, 1987, Corporate insurance and the underinvestment problem, *Journal of Risk and Insurance* 54, 45-54.
- Myers, Stewart C., and Nicholas S. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187-221.
- Nance, Deana R., Clifford W. Smith, Jr., and Charles W. Smithson, 1993, On the determinants of corporate hedging, *Journal of Finance* 48, 267-284.

- O'Hara, Maureen, and Wayne Shaw, 1990, Deposit insurance and wealth effects: The value of being too big to fail, *Journal of Finance* 45, 1587-1600.
- Petzel, Todd E., 1989, *Financial Futures and Options: A Guide to Markets, Applications, and Strategies* (Quorum Books, Westport, Conn.).
- Rasmusen, Eric, 1988, Mutual banks and stock banks, *Journal of Law and Economics* 31, 395-421.
- Schrand, Catherine M., 1997, The association between stock-price interest rate sensitivity and disclosures about derivative instruments, *Accounting Review* 72, 87-109.
- Simons, Katerina, 1992, Mutual-to-stock conversions by New England savings banks: Where has all the money gone?, *New England Economic Review* March/April, 45-53.
- Sinkey, Joseph F., and David Carter, 1994, On the use and determinants of bank derivatives, Working paper, University of Georgia.
- Smith, Clifford, and René Stulz, 1985, The determinants of firms' hedging policies, *Journal of Financial and Quantitative Analysis* 28, 391-405.
- Smith, Clifford W., 1995, Corporate risk management: Theory and practice, *Journal of Derivatives* 2(4), 21-30.
- Stulz, René, 1996, Rethinking risk management, *Journal of Applied Corporate Finance* 9, 8-24.
- Tufano, Peter, 1996a, Who manages risk? An empirical examination of risk management practices in the gold mining industry, *Journal of Finance* 51, 1097-1137.
- Tufano, Peter, 1996b, How financial engineering can advance corporate strategy, *Harvard Business Review* 74, 136-140.
- Unal, Haluk, 1997, Regulatory misconceptions in pricing thrift conversions: A closer look at the appraisal process, *Journal of Financial Services Research* 11, 239-254.
- Verbrugge, A. James, and Steven Goldstein, 1981, Risk return and managerial objectives: Some evidence from the savings and loan industry, *Journal of Financial Research* 4, 45-58.
- Williams, Jeffrey, 1986, *The Economic Function of Futures Markets* (Cambridge University Press, New York).
- Williams, L. Julie, J. Larry Fleck, and V. G. Comizio, 1987, Mutual-to-stock conversions: New capitalization opportunities and post-conversion control developments, *Legal Bulletin of the U.S. League of Savings Institutions* May, 237-317.

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