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RISK MANAGEMENT AND HEDGE ACCOUNTING  
DECISIONS AT FINANCIAL INSTITUTIONS  
DISSERTATION  

Presented in Partial Fulfillment of the Requirements for  
the Degree Doctor of Philosophy in the Graduate  
School of The Ohio State University  

By  

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To My Parents, James and Pat Holifield
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CHAPTER I
INTRODUCTION

This paper examines risk and hedge accounting decisions made at financial institutions. Many factors may affect these decisions, but due to the active regulation of the industry, factors such as federal deposit insurance, minimum capital requirements, and regulatory monitoring are potentially important in the risk and hedge accounting decision processes. For example, deposit insurance provides incentives for institutions to invest in risky assets. Since the downside risk of risky investments is borne by taxpayers, shareholder wealth is maximized by holding risky assets when deposit insurance exists.

To control the incentives created by deposit insurance, regulators introduced minimum capital requirements for institutions and required that the institutions subject themselves to regulatory examinations. The purpose of these requirements is to force shareholders to absorb at least part of any losses incurred from bad investment outcomes with their own wealth and to allow regulators a more direct means of controlling excessive risk-taking through increased monitoring. The capital ratio minima coupled with deposit insurance may only partially eliminate institutions' incentives to take risk. Institutions with capital above the regulatory minimum have incentives to control risk since their shareholders will lose wealth if the institution falls below the minimum capital.
requirement and becomes technically insolvent. However, institutions whose capital is below the minimum requirement still may have incentives to increase risk since the loss to their shareholders from bad outcomes is either a small amount or zero. Monitoring by regulators in addition to the minimum capital ratio requirements provides regulators with a means of controlling the incentives to take risk that exist due to deposit insurance.

It is likely, based on the description of the regulatory characteristics above, that risk and hedging decisions as well as hedge accounting decisions are affected by regulations that exist for banks and savings and loan associations. Since hedging activities relate to risk, institutions with capital below the regulatory minimum may choose to hedge less than they would otherwise to increase their risk, or they may enter into speculative positions. However, institutions with capital just above the regulatory minimum may want to decrease the variance of their returns and may increase their hedging activities.

Also, institutions with capital just above or just below the regulatory minimum may benefit from accrual management techniques which increase capital ratios. Since these institutions have incentives to increase hedging activity in order to reduce risk, the increased hedging activity may provide increased opportunity for the management of hedging accruals. The accounting method chosen for these hedge positions becomes important since it can affect regulatory compliance. It is in the institutions' best interest to maintain capital above minimum regulatory capital levels. However, the interests of regulators may not coincide with the interests of institution managers. Regulators may
not allow an accounting method that allows for the biggest boost (or least decrease) in capital.\(^1\)

The main contribution of this study is to describe the risk and hedge accounting decisions made at savings and loan associations (S&Ls) and commercial banks and the factors, particularly regulation, that affect these decisions. First, the study examines the factors affecting the risk and hedging activities of institutions. Regulatory capital is expected to affect an institution's hedging and risk decisions. Also, hedging decisions should affect an institution's risk. Furthermore, factors including size, tax status, interest rate sensitivity, and liquidity should affect institutions' decisions to hedge. If hedging decisions are related to regulatory capital, then the greatest amount of hedging should occur in institutions just above the regulatory minimum capital requirement. The increased hedging allows these firms to reduce the costs of financial distress which arise due to the regulatory capital constraint.

The expected relationship between risk and regulatory capital is less clear. Risk should be decreasing in capital for institutions below the regulatory minimum and increasing in capital for institutions above the minimum if the institutions are allowed to act in their own best interests. However, regulatory monitoring may dampen or negate this effect for institutions with capital below the minimum in order to protect the interests of the taxpayers.

\(^1\)An example of regulators disallowing the deferral of hedging losses is Franklin Savings of Ottawa, KS. Regulators forced the write-off of large amounts of Franklin's deferred hedging losses, leading to the institution's conservatorship by the OTS. For a discussion of the Franklin Savings case see Holifield, Madaris, and Sackley (1995).
Second, the study attempts to identify the management of hedging accruals at financial institutions and tie this management to regulatory constraints. Evidence of accruals management related to accounting-based capital ratio requirements shows that regulation influences this accounting choice. Specifically, if hedging accruals are largest around the regulatory minimum, then it appears that institutions are managing capital most around the minimum as opposed to above the minimum where management may not be needed or below the minimum where accruals management may not make a difference.

The financial institutions' industry provides a rich setting for the examination of the effects of regulation on risk, hedging activities, and hedging accruals. The industry is actively regulated and its deposits are federally insured. Regulation and deposit insurance naturally interact with an institutions' incentives to manage risk. Also, commercial banks and savings and loan associations engage more extensively in hedging transactions than do many other industries. Since hedging activities are risk-reducing, it seems plausible that hedging incentives may stem from regulation. Also, because of the extensive use of hedging at financial institutions, the opportunities for hedging accrual manipulation are larger than for other industries. Furthermore, financial institutions have incentives to manage accruals since regulatory capital ratio minima are stated in terms of accounting numbers.

Risk decisions at financial institutions are examined using a two-stage analysis. The first stage is a tobit model which examines the relationship between institutions' amount of hedging and their capital, interest rate sensitivity, tax status, size, and liquidity.
The institution's capital is used as a proxy for regulatory costs since regulators impose minimum capital requirements on institutions and may sanction institutions failing to meet the requirements. This first stage captures factors that affect the hedging activities of an institution, which represent a subset of an institution's risk management activities.

The second stage of this model examines the relationship between the portfolio risk of an institution and its capital and hedging activities. This relationship provides evidence as to whether risk is affected by deposit insurance, capital ratio minima, and regulatory monitoring. The second stage also includes the predicted values of hedging from the first stage as an explanatory variable for risk. This two-stage process allows for separation of the effects of regulation on hedging activities from the effects of regulation on other risk activities.

The results provide some evidence that S&Ls increase their hedging around the regulatory capital minimum or slightly above. This is consistent with institutions hedging to reduce regulatory costs of financial distress. Also, institution size and interest rate sensitivity are important factors in S&Ls hedging decisions. Additionally, the results are consistent with S&Ls below the regulatory minimum increasing risk as capital decreases. This implies that, for institutions below the minimum, the risk-taking incentives realized due to deposit insurance outweigh the costs imposed by regulators for taking excessive risk.

The results for banks show that hedging activities for large commercial banks are not related to capital. This indicates that these institutions are hedging for reasons other than to reduce the regulatory costs of financial distress, which is consistent with the fact
that few of these institutions are in financial distress. Commercial banks' hedging decisions are related to their size, liquidity, and interest rate sensitivity. The results for banks do indicate that capital is related to portfolio risk, however. The relationship found in these largely healthy institutions shows higher capital institutions taking on more risk.

Potential management of hedging accruals is tested using a sample selection model. The sample selection model accommodates the endogenous choice of the institutions to either use deferral accounting or mark-to-market accounting for their futures and options transactions. This hedging accrual management model examines the relationship between net deferred hedging losses and regulatory capital adjusted for the effects of the net deferred hedging losses. Management of hedging accruals for regulatory purposes would mean that institutions' defer the largest amount of losses just above or just below the regulatory capital ratio minimum since it is around this point where delaying recognition of the losses would have the most benefit. Above the minimum accrual management is unnecessary, and well below the minimum the accruals to be manipulated may not be large enough to take the institution out of regulatory danger.

Results using the savings and loan association sample indicate some evidence of hedging accrual manipulation. Net deferred hedging losses increase as capital decreases in all sample periods for all levels of the capital ratio. This shows that institutions defer more losses as capital decreases, presumably to keep capital higher than would otherwise be possible. However, the largest amount of deferral does not occur near the regulatory minimum as expected. The results are consistent with institutions continuing to defer
more net hedging losses as capital decreases, even when capital is so low that the accrual manipulation may not make a difference in the extent of institutions' compliance with regulatory minimum capital standards.

The overall results provide some evidence that financial institutions' risk and hedge accounting decisions are affected by regulatory factors. S&Ls' hedging decisions are related to capital in such a way that it appears that they are trying to minimize any regulatory costs of financial distress. Also, S&Ls with capital below the regulatory minimum exhibit increasing risk as capital decreases. This behavior is consistent with risk-taking incentives induced by deposit insurance. Furthermore, commercial banks and, in some years, S&Ls whose capital is above the regulatory minimum exhibit an increasing relationship between risk and capital. This behavior is consistent with the institutions trading off the costs of violating regulatory capital ratio minima with the benefits of increased risk. Finally, S&Ls defer more net hedging losses as capital decreases which is evidence that they attempt to keep reported regulatory capital as high as possible.
2.1 Deposit Insurance and Capital Ratio Regulation

It is widely argued that subsidized deposit insurance creates incentives for excessive risk-taking by financial institutions. Kareken and Wallace (1978), for example, show that under an insurance scheme such as the one used by the Federal Deposit Insurance Corporation (FDIC) banks should hold the riskiest portfolio allowed by regulation. They argue that if bank liabilities are insured at a premium not based on institutions' risk, and if banks are not regulated, then they will hold risky portfolios and numerous bankruptcies will result.

The incentives for increased risk at financial institutions result from the fact that the FDIC's insurance protection acts as a put option on the value of an institution. If an institution becomes insolvent, its insured depositors are paid by the FDIC. Since the explicit cost of this insurance protection is independent of the risk of an institution, the institution has an incentive to increase the variance of its return to maximize the value of its insurance option.\(^2\) As a result of the risk-taking incentives created by deposit

\(^2\)During the sample period examined in this dissertation, FDIC insurance premiums were a flat rate of one-twelfth of one percent of a bank's total domestic deposits per year.
insurance, regulators have created other means designed to curtail excessive risk taking, including setting minimum capital standards and requiring regulatory examinations.

Kareken and Wallace argue that if bankruptcy is costly, then an FDIC-type insurance scheme results in a misallocation of resources. Too many resources are used for post-bankruptcy reorganization. Thus they assert that if deposits are insured under an FDIC-type scheme regulation is a necessary complement to eliminate misallocations. Kareken and Wallace then examine the effects of existing and proposed regulations. They find that a minimum capital requirement by itself is not enough to prevent bankruptcy. However, restrictions on the risk of the institution's portfolio, coupled with a minimum capital requirement, can eliminate the threat of bankruptcy.

Buser, Chen, and Kane (1981) argue that regulatory authority exercised by the FDIC represents an implicit insurance premium. Specifically, they indicate that "regulatory standards for capital adequacy emerge as the critical element in the FDIC's pricing strategy..." They argue that the FDIC deliberately sets explicit insurance premiums below their market value to entice state-chartered, non-Federal Reserve member banks to purchase the insurance and thus submit themselves to federal regulation that otherwise would not apply. This allows financial institutions the opportunity to increase firm value above the maximum value attainable as an uninsured firm. However, this below market value insurance creates incentives for excess risk-taking that must be

However, these premiums were later changed to a risk-based scale with institutions being divided into risk categories. The premiums are increasing across the different risk categories.
eliminated. The FDIC then is forced to create implicit costs for the insurance, and these costs take the form of regulation.

Buser, Chen and Kane then argue that these implicit costs of regulation increase with the bank's portfolio risk. They assume that regulatory interference results in a reduction in firm value that increases with the size of the capital deficiency. They then show that the value of regulatory interference, the implicit premium, varies across different levels of capital adequacy. Also, the net benefit to financial institutions from trading potential losses from costly bankruptcy without insurance for FDIC regulation is favorable at low debt levels and unfavorable at high debt levels. As a result, regulatory capital standards determine the expected net value of deposit insurance to stockholders as a function of leverage, and the combined implicit and explicit premiums charged by the FDIC have the effect of risk adjusted premiums.

Other researchers have questioned whether the capital adequacy standards established through regulation are actually effective in controlling the risk-taking of financial institutions. Mingo (1975) finds that banks' capital decisions are affected by regulators. He finds that banks treat deposit insurance as a substitute for bank capital. However, he argues that this does not necessarily imply ineffective regulation since he finds that institutions with a low ratio of capital to desired regulatory capital are more likely to add capital over the next period than those with a higher ratio of capital to desired capital.

Dietrich and James (1983), however, find that regulatory capital standards are not in general effective. They argue that previous studies neglected to account for the fact
that, when interest payments are limited by interest-rate ceilings, financial institutions have an incentive to increase capital in order to compete for non-insured deposits. They test for the effectiveness of regulation in a period in which ceilings did not exist for most large certificates of deposit. The lack of interest rate ceilings removes an incentive for banks to increase capital, and thus allows for a stronger test of the influence of regulation on banks' capital decisions. Their tests do not find evidence that changes in capital are greater for institutions with lower capital.

2.2 Risk Management Incentives for Financial Institutions

As discussed above, financial institutions with insured deposits have incentives to increase risk to increase the value of the insurance option. However, other forces exist which may create incentives for institutions to either increase or decrease risk. In particular, institutions may realize incentives to decrease their interest rate risk. Flannery and James (1984) show that the equity values of financial institutions are sensitive to movement in interest rates. They also show that the sensitivity of savings and loan stocks to unexpected changes in interest rates is significantly greater than the sensitivity of bank stocks to unexpected changes in interest rates.

Specifically, Flannery and James examine whether the interest rate sensitivity of common stock returns is related to the maturity composition of a financial institution's holdings of assets and liabilities. They find that common stock returns of banks and savings and loan associations are highly correlated with interest rate changes. Furthermore, they find that the correlation between stock returns and interest rate changes
is positively related to the size of the maturity difference between the institution's assets and liabilities. These findings are consistent with the hypothesis that cross-sectional differences in the interest rate sensitivity of financial institutions' common stocks is explained by differences in the maturity composition of the institutions' assets and liabilities. Since the difference in maturity composition of assets and liabilities is generally larger for savings and loan associations than for commercial banks, it follows that the sensitivity of savings and loan stocks to changes in interest rates is greater than the sensitivity of bank stocks to changes interest rates.

Scott and Peterson (1986), in a related paper, examine the effects that unexpected changes in market interest rates have on portfolios of commercial bank, savings and loan, and insurance company stocks. They find that unexpected changes in interest rates have a significant effect on the yields of financial institutions' portfolios. Additionally, they find that the interest rate sensitivity of savings and loan associations' equity shares is twice as large as that of either commercial banks or insurance companies. They attribute this difference in interest rate sensitivity to the fact that commercial banks and insurance are generally better hedged. Commercial banks generally acquire short-term assets and liabilities, and insurance companies generally acquire long-term assets and liabilities. Savings and loan associations, however, generally acquire long-term assets and short-term liabilities and thus are less hedged against movements in interest rates. Their results suggest that the ability of institutions to hedge their portfolios against movements in interest rates can affect the volatility of their equity values.
Equity volatility due to interest rate sensitivity may provide institutions with incentives to reduce risk. Particularly, financial institutions may decide to employ hedging transactions to reduce any interest rate risk not hedged by the nature of their assets and liabilities. Financial institutions may also have other incentives to reduce risk through hedging. Smith and Stulz (1985) develop a positive theory of hedging by value-maximizing corporations with shareholders and bondholders that have the ability to hold diversified portfolios of securities. Modigliani and Miller (1958) show that with no contracting costs or taxes and with an investment policy that is fixed, corporate financing policy is irrelevant. According to Smith and Stulz, the Modigliani and Miller result implies that investors of a firm can simply change their holdings of risky assets to offset any changes a firm makes to its hedging policy. Thus Smith and Stulz assert that hedging policy can only affect the value of a firm through taxes, contracting costs, or the impact of a firm's hedging policy on its investment decisions. They then examine each of these three possible reasons in an attempt to explain the diversity of hedging activity observed among large publicly-traded corporations.

Smith and Stulz argue that hedging can reduce the expected tax payments of a firm. If hedging reduces the variability of pre-tax firm values and if the effective marginal tax rates on corporations are increasing in the corporation's pre-tax value, then hedging reduces the expected tax liability and increases the expected tax value of the firm after taxes. This result holds as long as the cost of the hedge does not exceed the expected tax savings. Smith and Stulz also argue that hedging can increase a firm's value by allowing a firm to reduce the risk imposed on claimholders other than shareholders.
including managers, employees, suppliers, and customers. These other claimholders are often unable to diversify the risks related to their claims on the company and may require more compensation to cover the costs of assuming the risk. A firm can engage in hedging activity to reduce the risk imposed on these claimholders and thus reduce the compensation that is required by these claimholders. Hedging for this purpose can increase the value of the firm as long as the savings in compensation from reduced risk do not exceed the costs of hedging.

Finally, Smith and Stulz argue that hedging can increase firm value by lowering the costs of financial distress as long as the reduction in the expected cost of financial distress exceeds the cost of hedging. Hedging lowers the probability of bankruptcy by reducing the variance of a firm's value. This reduction in expected financial distress costs benefits the shareholders of a firm. Smith and Stulz also indicate that because debt covenants are often stated in terms of accounting numbers, a value-maximizing firm may choose to reduce the variance of accounting earnings even if the variance of economic earnings is increased. Since minimum capital requirements required by regulators act as a debt covenant for financial institutions, they may encourage institutions to reduce risk.

Financial institutions may realize conflicting incentives for risk management. Deposit insurance creates incentives to increase risk so that the firm value is maximized. However, too much interest rate risk can increase equity volatility. Also, institutions may want to decrease risk to reduce the costs of financial distress that exist due to regulatory capital minima and monitoring by regulators.
2.3 Economic Consequences of Accounting Choices at Financial Institutions

Previous research has tied accounting choices at financial institutions to various incentives. Moyer (1990), in a study of commercial banks, tests the hypothesis that managers seek to reduce regulatory costs that are imposed when a bank's capital falls below the minimum amount required by regulators. She also investigates whether the political sensitivity hypothesis which states that managers may seek to reduce political costs that arise when revenue is unusually large applies to her sample of banks. Using the difference between regulatory capital and the required capital minimum as a proxy for regulatory cost and institution size as a proxy for political sensitivity, she examines securities gains and losses, the loan loss provision, and loan charge-offs for evidence that these accounting accruals are adjusted to increase capital and reduce regulatory costs or decrease income and political costs. Her results are consistent with the hypothesis that some managers adopt capital increasing accounting measures as the primary capital adequacy ratio decreases relative to its regulatory minimum. She also finds the results to be strongest when the capital adequacy ratio variables reflect a non-linear regulatory cost structure. She does not, however, find results that are consistent with political sensitivity occurring at commercial banks.

Similarly, Scholes, Wilson, and Wolfson (1990) find that banks with low regulatory capital will adjust earnings to increase regulatory capital. They test to determine whether banks' investment and financing policies can be explained by their tax status. They find evidence that banks changed their holdings of municipal bonds in response to changes in tax laws relating to the deductibility of the interest on municipal
bonds. They also find that banks changed their economic balance sheets when there was a change in their tax status, but that these changes were not instantaneous and they were not made to the extent that they would have been if adjustment costs were not present.

Furthermore, Scholes, Wilson, and Wolfson examine tradeoffs between tax and non-tax costs realized by banks. They find that banks with low regulatory capital will recognize securities gains, even at the expense of higher taxes, in order to increase regulatory capital. They argue that the increase to regulatory capital helps to avoid regulatory intervention in banks' investment and financing strategies and it enhances the ability of banks to attract deposits at a low cost which is possible because of federal deposit insurance. They find that banks make the tradeoff between tax minimization and regulatory capital maximization as predicted given that book value is important to both regulators and shareholders. Thus Scholes, Wilson, and Wolfson find evidence that the importance of regulatory costs outweighs the benefits of lower taxes.

Wyatt (1991) argues that the combination of accounting rules and regulation may have distorted managers decisions at savings and loan associations during the collapse of the industry. Since historical cost accounting was used for securities and the institutions were subject to regulatory restrictions on capital adequacy, managers had incentives to sell securities whose value was above cost and hold securities whose value was below cost. Thus he asserts that accounting choices to manage earnings may be more important for regulated industries than for unregulated industries.

Warfield and Linsmeier (1992), in a study that contradicts earlier findings discussed above, assess whether the securities gains and losses component of earnings is
priced differently depending on the economic conditions faced by a firm. They examine incentives to realize securities gains and losses to minimize taxes and manage earnings. They hypothesize that tax minimization is an important incentive for realizing securities gains and losses and that this should affect the information content of the securities gains and losses component. They then test to determine whether the securities gains and losses component of earnings is priced by investors in a manner consistent with incentives for tax management.

Warfield and Linsmeier find results consistent with tax minimization by banks when examining observations from all four quarters of the years examined. However, they do not find results consistent with the recognition of securities gains and losses for tax planning purposes when they examine fourth quarter observations only. Furthermore, they do not find definite evidence of the management of securities gains and losses for regulatory capital purposes. Their tests reveal that earnings management does not appear to be the predominant motivation for securities gains and losses realization in the fourth quarter. However, they find results that could be consistent with earnings management during the first three quarters of the year. They argue that this is probably not earnings management since earnings management incentives exist primarily in the fourth quarter. However, this is not completely inconsistent with capital ratio management activity since banks are constantly monitored by regulatory agencies and their quarterly data is closely examined. Incentives for capital ratio management through the realization of securities gains may not be limited to the fourth quarter of a given year.
Petroni (1992) finds evidence that financially weak property-casualty insurance companies manage their liabilities for outstanding claim losses. She tests the hypothesis that the incentive to underestimate the liability for outstanding claim losses is a decreasing function of the actual financial position of the insurer. The sample of property-casualty insurers provides an unusual opportunity to test for managerial bias in reporting the estimated liability for outstanding claim losses in that the actual claim losses incurred are reported subsequently. She argues that the difference between the estimated liability and the actual liability provides an estimate of managerial bias. She then examines whether this bias estimate is related to the financial soundness of the insurer.

Petroni finds that financially weak insurers' claim loss reserve estimates are biased downward relative to financially strong insurers, even after controlling for tax rates and exogenous economic factors. She is also able to tie some of the management of accruals to regulation. In particular, she finds that managers of insurers that are close to receiving regulatory attention tend to underestimate the liability for losses to an even greater degree than those in regulatory compliance which suggests that this underestimation is a deliberate strategy taken to avoid or postpone regulatory intervention. She also tests the alternative hypotheses that the underestimation of claim losses by financially weak firms may be due to unintentional overoptimism by management or unpredictable systematic differences in the ultimate settlement of claims. Although she cannot rule out these alternative explanations for the observed behavior, her evidence suggests that these alternate hypotheses are unlikely to be true.
Additionally, there is evidence that S&Ls alter their hedging decisions based on accounting rules. Schrand (1994) argues that S&L managers have incentives to manage both the level and the variance of an institution's accounting earnings. She asserts that managers have incentives to manage the level of earnings to reduce the costs of non-compliance with regulatory capital requirements. She further asserts that S&L managers have incentives to manage the variance of an institution's accounting earnings to reduce the potential concavity of the institution's expected profit function with respect to accounting profits resulting from such market imperfections as bankruptcy costs, taxes, and agency relationships. For institutions with capital above the minimum requirement variance management implies that the institution would want to decrease variance to reduce the expected costs of bankruptcy. For institutions with capital below the minimum requirement variance management implies increasing the variance to reduce the expected costs of bankruptcy by giving an institution the opportunity to reach capital adequacy through a large positive earnings outcome.

Schrand tests whether cross-sectional differences in the futures contract trading behavior of institutions is related to institutions' need to manage earnings and to the effect of SFAS No. 80 on institutions. She finds that thrifts time their futures contract transactions to maximize economic and accounting profit using information about anticipated interest rate changes. Thus it appears that thrifts engage in a form of accrual manipulation related to hedges in that they time their accruals to maximize accounting profit. This may occur because regulatory minima are tied to accounting equity and asset values. She also finds evidence that capital ratios are lower for institutions that do not
hedge than for institutions that hedge. Additionally, she finds that for institutions that hedge, those marking their positions to market have lower capital ratios than those deferring their gains and losses. However, she does not control for the endogenous choice of accounting method used in these tests, and thus the results may be due to variables which are endogenously related to the choice of accounting method.

Other research has found a link between regulatory requirements and accounting choices. Hill and Ingram (1989) examine choices between generally accepted accounting principles (GAAP) and regulatory accounting principles (RAP) made by savings and loan associations. In the early 1980s many S&Ls wanted to sell low-interest loans and use the proceeds to fund new higher-interest loans. However, the losses on the loan sales realized under GAAP would have caused many to violate minimum regulatory capital requirements. Regulators allowed institutions to forego GAAP and amortize the losses over the average remaining life of the loans sold. Hill and Ingram find results that are consistent with the choice by S&Ls to violate GAAP when it conflicted with the economic benefits of turning over the loan portfolio due to minimum regulatory capital constraints.

Blacconiere (1991) examines market reactions to regulatory accounting procedures. He examines three regulations that eased the minimum capital requirements for savings and loan associations. The first regulation examined allowed institutions to consider appraised equity capital as part of regulatory capital. Appraised equity capital is an adjustment to capital for the difference between the book and appraised values of a savings and loan association's premises. The second regulation examined is the deferral
of loan losses on sales of loans. This regulation, also examined by Hill and Ingram, allowed the loss recognition to be spread over several years rather than to be recognized in the period of the loan sale. The third regulation allowed institutions to include net worth certificates as part of regulatory capital. Net worth certificates are demand notes issued by the federal insuring agency to institutions with below minimum capital as a type of non-cash assistance. These certificates are counted as part of regulatory capital.

Blacconiere argues that while these three regulatory procedures do not directly affect cash flows they increase an institution's ability to meet the capital minimum required by regulation. Thus, these procedures decrease the probability that regulators will close the institution or restrict its actions. As a result, these regulatory accounting procedures affect expected future cash flows and should have an associated market reaction. Blacconiere hypothesizes that the announcement of the regulatory accounting procedures should have a positive market reaction based on the assumption that the market interpreted the events leading to the procedures as good news. He finds a significant positive market reaction to the announcement which allowed institutions to use appraised equity capital as a part of regulatory capital, and he finds that the market reaction is more significant for S&Ls with lower net worth. However, he does not find a significant market reaction to the announcements which allowed the deferral of loan losses and the use of net worth certificates.
2.4 Motivation for the Current Study

The literature discussed above provides a background for the purpose of the current study. Financial institutions have an incentive to hold risky assets as a result of deposit insurance. However, regulations and other forces exist which may give financial institutions incentives to hold a less risky portfolio. Previous literature has shown that regulatory monitoring and capital ratio standards as well as market incentives to reduce interest rate sensitivity may provide managers with reasons to reduce risk.

As a means of reducing risk, financial institutions may engage in hedging activity. Thus, we should see more hedging activity when less risk is desired and little or no hedging activity when more risk is desired. This indicates that the hedging activity should be directly linked to the incentives for risk-taking discussed above.

Finally, institutions may have incentives to manage accounting numbers. One purpose of this study is to extend previous work to examine whether thrifts manage hedging accruals by altering the method of accounting for these accruals and to attempt to explicitly link this management of hedging accruals to regulatory constraints. Since risk decisions, and as a result hedging decisions, may be tied to regulation, and since accounting choices may be tied to regulation, then it seems plausible that these factors may interact. However, other factors also exist which may influence hedging accruals. Thus the purpose of this study is to examine the factors, particularly regulation, that affect institutions' risk, hedging, and hedging accrual decisions.
3.1 Regulatory Capital Requirements

Savings and loan associations during the 1987-1989 period were regulated by two different federal agencies--the Federal Home Loan Bank Board (FHLBB) and the Federal Savings and Loan Insurance Corporation (FSLIC). In general, federally chartered S&Ls were regulated by the FHLBB, and the FSLIC regulated all insured S&Ls. The minimum amount of capital required by the FHLBB during this period was at least three percent of total liabilities, and for some institutions this minimum requirement could be slightly higher.\textsuperscript{3} After 1989, S&Ls were regulated by the Office of Thrift Supervision (OTS). In 1990 and 1991 risk-based capital requirements were phased in at thrifts. For these two years, the minimum capital requirement for total capital was 7.25% of risk-weighted assets, and the minimum requirement for core capital was 3.25% of risk-weighted assets.

During the period of testing for commercial banks (1991), they were regulated by three agencies. The Federal Reserve regulated bank holding companies and banks that were members of its the Federal Reserve system. The Office of the Comptroller of the

\textsuperscript{3}The minimum capital requirement may be slightly higher for institutions with a high percentage of troubled loans or real estate.
Currency issued federal charters and regulated federally chartered institutions, and the Federal Deposit Insurance Corporation regulated all insured institutions. During this period, risk-based capital requirements were being phased in for commercial banks. The requirements were that banks must have core capital equal to 3.25% of risk-weighted assets and total capital equal to 7.25% of risk-weighted assets. Core capital includes common stockholders equity, non-cumulative perpetual preferred stock and related surplus, and the minority interest in related companies.

3.2 Accounting for Futures Contracts and Options

The FASB's Statement of Financial Accounting Standards No. 80: Accounting for Futures Contracts establishes two methods of accounting for standardized futures contracts. These methods depend on whether the futures contract is used for hedge or speculative purposes. Gains and losses on futures contracts that meet the criteria for consideration as a hedge may be deferred until gains and losses on the hedged asset, liability, or anticipated transaction are recognized in income. Gains and losses on futures contracts that do not meet the hedge criteria must be recognized immediately in income. In order for a futures contract to qualify for hedge treatment the underlying commodity or financial instrument must have a "clear economic relationship" with the item to be hedged, and changes in the market value of the two items must be highly correlated. It must also be shown that the item to be hedged exposes the firm to risk due to changes in its price.
The accounting for hedges involving options is addressed by AICPA Issues Paper 86-2: Accounting for Options. The criteria to be met in order for an option to qualify for hedge treatment are essentially the same as the criteria that futures contracts must meet. The main difference between the two sets of criteria lies in the level at which risk must be assessed. For an option to qualify for hedge treatment, it must be shown only that the option position reduces the risk of the particular transaction (asset, liability, or anticipated transaction) for which the position was taken. The firm is not required to show that the option reduces the risk of the enterprise as a whole.

Edwards (1981) argues that hedging in futures and forwards markets may allow financial institutions to isolate and hedge interest rate risk. He asserts that financial institutions are best able to bear credit risk due to their informational advantage over other potential lenders. By hedging interest rate risk, these institutions can pass that risk to others in the market instead of having to bear it or pass it to borrowers in the form of credit agreements with less attractive repricing terms.

3.3 Effects of Hedge Accounting on Regulatory Capital Ratios

When hedging losses occur, hedge accounting allows for the deferral of these losses. Assuming a simple capital ratio of capital divided by total assets, this deferral will result in a higher capital ratio than mark-to-market accounting, as shown below.4

4These equations represent the balance sheet effects of an asset hedge. It is straightforward to show that the same results hold for a liability hedge since the denominator of the ratio would be unchanged under either deferral or mark-to-market accounting.
\[
\frac{x}{y} > \frac{x-a}{y-a}
\]

where \( x = \text{equity capital} \)
\( y = \text{total assets} \)
\( a = \text{hedge results--(gain) or loss} \)

In the above equation the left side represents the capital ratio if hedge accounting is employed, and the right side represents the capital ratio if mark-to-market accounting is employed. For hedge accounting, the loss amount, \( a \), will be deferred and added to the asset amount, \( y \), but the margin account required by the broker of the hedging instrument will decrease by the same amount resulting in a net effect on assets of zero. For mark-to-market accounting the loss amount will be subtracted from the equity amount, \( x \), and the margin account (an asset) will decrease by the same amount. This equation reveals that the ratio will be higher under hedge accounting. In a hedging gain situation, it can be shown that mark-to-market accounting yields a higher capital ratio and thus should be preferred by financial institutions. If mark-to-market accounting is preferred then the inequality in equation (1) changes direction.

The above discussion illustrates the important point that using hedge accounting when losses are realized and mark-to-market accounting when gains are realized gives higher capital ratios than using either hedge or mark-to-market accounting only. To the extent that a financial institution wishing to manage its capital ratio can designate and terminate hedge accounting, it is expected to use hedge accounting during periods of anticipated hedging losses and mark-to-market accounting during periods of anticipated...
hedging gains. This can be achieved by tying the hedge either to an asset or a liability. Goodman and Langer (1983) indicate that financial institutions can adjust the method of accounting for economic hedges by simply designating the hedge either a hedge of the value of an asset or the cost of a liability, depending on which is necessary to avoid marking the futures contract to market.

Further concern over the implications of hedge accounting is expressed by Asay, Gonzalez, and Wolkowitz (1981). They argue that the accounting industry's definition of a hedge is neither a necessary nor sufficient condition for reduction in an institution's interest rate risk which they claim may lead to the institutionalization of inaccurate notions of hedging. They also assert that accounting standards may discourage the use of futures contracts by financial institutions, and that the accounting methods may mask the true economics of the situation. In particular, they call attention to the fact that deferral (hedge) accounting may make an institution that is speculating look like it is hedging. Finally, they argue that the mix of mark-to-market accounting for some futures positions coupled with the deferral accounting used for many cash instruments can make an institution attempting to reduce its interest rate risk look as if it has increased its exposure. This can give false signals to regulators and investors and may lead to distorted decision-making by managers.
CHAPTER IV
IMPLICATIONS OF RISK AND HEDGING ACCRUAL MANAGEMENT

4.1 Risk Management

Financial institutions realize incentives to manage investing decisions as a result of capital ratio regulations and federal deposit insurance. As stated above, it is widely argued that subsidized deposit insurance creates incentives for excessive risk-taking by financial institutions. However, regulatory authority exercised by the FDIC may represent an implicit insurance premium. This is due to regulatory capital standards which represent an implicit regulatory cost imposed because of the subsidized insurance in order to control excessive risk-taking. Thus regulation imposes a cost to financial institutions which can be minimized by holding adequate levels of capital. Failure to maintain a minimum capital level increases this regulatory cost in that it leads to regulatory intervention in the form of restrictions on financial institutions' activities and possible regulatory takeover.

As a result of deposit insurance and the implicit cost of regulation, an institution may be more concerned with minimizing regulatory costs than extracting wealth from regulators and taxpayers as long as the institution's capital is above the regulatory minimum. Once an institution's capital falls below the regulatory minimum the
shareholders of an institution are in a position where they will realize any upside potential of investments, but not bear any downside loss. Thus shareholders have incentives to extract rents from regulators and taxpayers.

As capital ratios move below the regulatory minimum, managers have incentives to manage these ratios to get back to the regulatory minimum. However, the steps taken to increase capital ratios by institutions with capital below the minimum may differ from steps taken by institutions with above-minimum capital to maintain or increase capital. Managers of below-minimum capital institutions are faced with potential takeover and may be willing to take high risk projects in the hope of regaining regulatory compliance. However, unlike institutions with capital above the minimum, these institutions' actions may be constrained by regulators.\(^5\) When an institution has less than the regulatory minimum amount of capital a control issue arises between managers who want to increase risk and regulators who want to control risk.

To the extent that regulators do not curtail management's investing activities, institutions with capital below the regulatory minimum are expected to invest heavily in high risk projects with large possible payoffs. Thus we expect to see risk increasing as capital ratios decrease for institutions with capital below the minimum. However, if regulatory control is strong enough to mitigate shareholders' attempts to increase risk then risk may not be increasing for institutions with capital below the minimum.

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\(^5\)Financial institutions whose capital is below the regulatory minimum are sometimes placed under constraints which include control over investing activities, including investments in derivatives, and possible direct control over management.
Furthermore, for institutions with capital above the minimum, risk should be increasing in the capital ratio since institutions whose capital is slightly above the minimum would want to minimize risk in order to reduce the possibility of having their capital fall below the minimum. As capital ratios increase for those institutions above the regulatory minimum, the institutions are more able to tolerate risk since the probability of having their capital fall below the minimum becomes smaller. In fact, for institutions with capital significantly above the regulatory minimum, regulatory concerns may become secondary to other factors since the probability of falling below the minimum is small. The first objective of this paper then is to examine the relationship between risk and the capital ratio to determine whether risk is increasing or decreasing in the capital ratio.

4.2 Hedging Accrual Management

As argued above, managers may have incentives to increase risk when capital ratios are below the regulatory minimum. One of the ways in which risk may be increased is by decreasing hedging activity. However firms whose capital is just above the regulatory minimum may prefer to decrease risk in order to reduce the possibility of having their capital fall below the minimum. These firms may prefer to hedge more to reduce the variance of their returns.

Regulatory capital ratio minima may be thought of as a debt covenant. This debt covenant is stated in terms of an accounting number, the regulatory capital ratio. Consequently, a value maximizing firm may choose to reduce the variance of accounting
earnings even if the variance of economic earnings is increased. Hedging can reduce the likelihood that this debt covenant becomes binding by reducing the variance of the firm's accounting returns. Thus, hedging can increase firm value by lowering the costs of financial distress as long as the reduction in the expected costs of financial distress exceed the costs of hedging. As a result, financial institutions with capital above the minimum may hedge more than financial institutions with capital below the minimum since those with capital just above the minimum have incentives to decrease risk. Also, hedging may decrease for institutions above the minimum as capital increases since the expected costs of financial distress should decrease as capital increases. Thus it is expected that the largest amount of hedging occurs in those institutions with capital just above the minimum capital ratio.

Institutions with capital just above or just below the regulatory minimum are likely to benefit most from the management of accruals to boost capital ratios. This benefit comes from both increased hedging activity in this region and the fact that these institutions are at or near the regulatory minimum so that hedging accruals may significantly impact compliance with capital ratio requirements. If hedging accruals are related to the level of regulatory capital, particularly around the regulatory minimum, then it appears that regulation affects this accounting choice.

In asserting that the timing of gain and loss recognition from hedges can be used to manage capital ratios, several issues must be addressed (Schipper, 1988). First, the discretionary nature of the hedging gains and losses must be established. As argued above, hedge positions can be tied to either assets or liabilities depending on whether
hedge or mark-to-market accounting is optimal. Also, switching from hedge to mark-to-market is possible, although repeated switching would disqualify the hedge position from hedge treatment (Wishon, 1985).

Second, the discretionary amounts involved must be large enough to make a difference in the capital ratio. Descriptive statistics provided in Table 6 indicate that net deferred loss amounts can be quite large. In fact for many institutions the number is large enough to significantly affect the capital ratio. Finally, it must be argued, given the control that regulators exercise over financial institutions, that regulators either cannot or choose not to determine whether accounting numbers have been managed. Scholes, Wilson, and Wolfson (1990) indicate that regulators may be willing to use a subset of all available data in order to lower monitoring costs and discourage institutions from having investing or information-producing incentives related strictly to reducing regulatory intervention.6

The arguments above indicate that the accounting for hedging transactions can be feasibly used to manage capital ratios, and also that managers have incentives to manage capital ratios. The second objective of this paper is to examine hedging accruals to determine whether hedging accrual decisions are related to regulatory capital ratio

6Specifically, Scholes, Wilson, and Wolfson provide four reasons for regulators' use of a subset of available information. The first is that the use of book rather than market value for regulatory assessments may prevent distortions in banks' investment decisions. Second, by using all information, regulators may create incentives for banks to overinvest in information to gain favorable treatment by regulators. Third, allowing regulators too much discretion may result in regulatory capture, and fourth, using a subset of information lowers monitoring costs.
minima. It is expected that any management of accruals will take place primarily in those institutions whose capital ratios are just above or just below the minimum since these institutions may stand to benefit the most from the boost provided by accrual manipulation. Institutions whose capital is well above the minimum have less incentive to manipulate hedging accruals for regulatory purposes since they are not at risk for regulatory action. Institutions whose capital is well below the minimum have less incentive to manipulate hedging accruals for regulatory purposes since they may not realize enough benefit from the manipulation to make a difference or since they may be hedging less to increase risk. These institutions may be far enough away from the capital minimum to make regulatory constraints lose their importance.
CHAPTER V
DATA AND EMPIRICAL METHODS FOR TESTS OF THE SAVINGS AND LOAN ASSOCIATION SAMPLE

5.1 Data Collection

Data for the tests of savings and loan associations are taken from annual Thrift Financial Reports for S&Ls for the years 1987 through 1991. The tests are run separately for each year since interest rate environments changed over the period.\(^7\) Also, the regulatory environment changed in 1989 when the Financial Institutions Reform, Recovery and Enforcement Act (FIRREA) was passed. FIRREA eliminated some of the deregulatory elements of earlier legislation, so the results pre- and post-FIRREA may contain some differences. Because of data limitations, I can examine only the deferral side of accounting for futures and options contracts, not the amounts that were recognized in income during those periods. It is possible that institutions were recognizing gains which cannot be isolated from other amounts in the data.

\(^7\)Tests were conducted to determine whether the data could be pooled across years. The results showed that differences between years exist, so individual year results are reported.
5.2 Risk Management Tests

Risk management is examined using a two-stage polynomial regression. The two-stage regression models the amount of hedging as a function of the previous period's capital ratio, the institution's interest rate gap, the tax status of the institution, the liquidity of the institution, and the institution's size. The predicted values of the hedging amount are then used as an explanatory variable for the second stage of the regression. The second stage models risk as a function of the previous period's capital ratio and the predicted hedging amount. The use of the two-stage analysis allows for consistent estimates of the coefficients in the second stage of the model by capturing the variation in the hedging amount due to the previous period's capital ratio in the first stage of the model.

The first stage of the two-stage regression is a tobit model. The tobit model is used in order to obtain consistent parameter estimates as the amount of hedging is censored (not all institutions choose to hedge). For those institutions choosing to hedge, the relation between the capital ratio and the amount of hedging is expected to change with the capital level. Preliminary results and diagnostics indicate that the relationship between hedging and the capital ratio is non-linear. Therefore, the test models the relationship between hedging and capital as a fourth-order polynomial. The amount of hedging should also be related to the amount of interest rate risk faced by an institution. The twelve-month interest rate gap from the previous period is included in the equation as an ex ante measure of an institution's interest rate risk to control for the effect of this risk on the hedging activity decision.
Nance, Smith, and Smithson (1993) show that a firm's hedging activity is a function of its tax status, size, and liquidity. They argue, as do Smith and Stulz, that a firm with a convex tax function may hedge to reduce its expected tax payments. They add that since tax progressivity causes the tax schedule to be convex that firms in the progressive region of the tax schedule have greater incentives to hedge than other firms.

In order to try to capture ex ante expectations about tax status it is assumed that institutions' income before taxes follows a random walk process. Thus the expectation of this period's income before taxes is last period's income before taxes, and this amount determines whether the institution expects to be in the progressive region of the tax schedule. The tobit model includes an indicator variable which is one if the institution's income before taxes in the previous period falls into the progressive range of the tax scale and zero otherwise.

Nance, Smith, and Smithson also argue that a firm may substitute liquidity for hedging activity. They assert that firms may reduce the expected costs of financial distress by investing in liquid or less risky assets. To control for this influence on the amount of hedging, the sum of cash and treasury securities held by an institution is included in the tobit model as a measure of liquidity. Finally, the size of an institution has been found to be an important factor in whether an institution hedges due to the informational and transaction costs of hedging. To control for this size effect a variable

As a check on the liquidity variable, the model was also run using a different liquidity variable equal to the sum of cash, treasury securities, and the trading account. The results using this broader variable were essentially the same as those for the liquidity variable defined as cash plus treasury securities.
equal to one divided by the institution's total assets is included as a measure of size. The first stage of the regression is as follows.

\[
HAMT_t^* = \alpha_0 + \alpha_1 \text{CAPR}_{t-1} + \alpha_2 \text{CAPR}^2_{t-1} + \alpha_3 \text{CAPR}^3_{t-1} + \alpha_4 \text{CAPR}^4_{t-1} \\
+ \alpha_5 \text{GAP}_{t-1} + \alpha_6 \text{TAX}_{t-1} + \alpha_7 \text{LIQUID}_{t} + \alpha_8 \text{INVSIZE}_{t} + \epsilon_{t-1}
\]

\[
HAMT_t = \begin{cases} 
HAMT_t^* & \text{if } HAMT_t^* > 0 \\
0 & \text{if } HAMT_t^* \leq 0
\end{cases}
\]

(2)

where

- \(HAMT_t^*\) = the latent variable underlying the decision to hedge which represents the net benefit of hedging
- \(HAMT_t\) = the total notional principal amount of long and short positions outstanding at the end of period t scaled by total assets
- \(\text{CAPR}_{t-1}\) = regulatory capital divided by total assets during period t-1
- \(\text{GAP}_{t-1}\) = the institution's twelve-month interest rate gap measured as assets less liabilities repricing within twelve months, scaled by total assets
- \(\text{TAX}_{t-1}\) = an indicator variable which is one if the institution's income before taxes is in the progressive range of the tax schedule in period t-1 and zero otherwise
- \(\text{LIQUID}_{t}\) = the sum of the institution's holdings of cash and treasury securities during period t, scaled by total assets

\(^9\)The size variable used is one divided by total assets since all other continuous variables in the model are scaled by total assets. However, since this variable can be extremely small relative to the others in the equation total assets are stated in hundreds of millions of dollars. This rescales the variable so that is roughly of the same magnitude as the others in the equation.
INVSIZE_t = one divided by the total assets (stated in hundreds of millions of dollars) of the institution during period t

The second stage models risk as a function of the predicted amount of hedging from the first stage, the prior period's capital ratio, and an indicator variable for whether the institution was considered troubled by regulators during the period. The variable for troubled institutions is used to control for institutions whose portfolio risk may be in part determined by regulators. For example, an institution in conservatorship may have a balance sheet that consists of assets that remain after part of the portfolio is sold to another institution. Thus the risk of this institution's portfolio may not represent management's investing decisions. Again, preliminary results and diagnostics indicate that the relationship between risk and the capital ratio is non-linear, so a fourth-order polynomial model is used. The model to be tested is as follows.

\[
RISK_i = \delta_0 + \delta_1 CAPR_{t-1} + \delta_2 CAPR_{t-1}^2 + \delta_3 CAPR_{t-1}^3 \\
+ \delta_4 CAPR_{t-1}^4 + \delta_5 HAMT_{i-1} + \delta_6 T_i + \epsilon_{it}
\]  

(3)

where

\[
RISK_i = \text{a composite measure of an institution's portfolio risk which weights categories of assets by a risk percentage and then sums the risk-weighted assets; the risk-weighted assets are scaled by total assets}^{10}
\]

\[
HAMT_{i-1} = \text{the predicted value of the hedging amount from equation two}
\]

\[
^{10}\text{The risk-weighted assets measure used is similar to the risk-weighted assets measure developed as a basis for capital ratio requirements in 1989. The details of the calculation of the risk measure are discussed in Appendix B.}
\]
\[ T_{1t} = \begin{cases} 
1 & \text{if an institution was in conservatorship or receivership during the period} \\
& \text{or if an institution went into conservatorship or receivership during the following period, or one if an institution} \\
& \text{was placed in a management consignment program in period } t-1, t, \\
& \text{or } t+1, \text{ and zero otherwise.} 
\end{cases} \]

All other variables are defined as above.

The results from equation (3) will provide information about the factors which affect the risk decisions of financial institutions. If a positive relationship is found between risk and capital for those institutions below the regulatory minimum, then it appears that institutions are not able to increase risk presumably due to monitoring and costs imposed by regulators. If a negative relationship is found between risk and capital for those institutions with capital below the regulatory minimum, then it appears that regulatory monitoring and other regulatory costs do not prevent institutions from increasing their risk.

For institutions above the minimum, a positive relationship between risk and capital implies that institutions with capital slightly above the minimum want less risk relative to those with greater amounts of capital since the institutions well above the minimum have a smaller probability of violating capital ratio minima. It is also consistent with institutions with capital well above the minimum behaving as if regulatory capital minima are of lesser importance than other factors which may influence risk. A negative relationship between risk and capital for institutions above the regulatory minimum is not expected. This result would imply that institutions able to bear risk are choosing not to and could be consistent with extreme risk aversion.
The results of the risk model should also show the relationship between risk and the amount of hedging. This relationship is expected to be negative if the positions represented by the HAMT variable are true hedge positions. Furthermore, the coefficient on the troubled institution variable should reflect any risk in the portfolio of institutions under regulatory direction that differs from institutions not under regulatory direction. If this coefficient is negative than it appears that troubled institutions have less risk than non-troubled institutions which implies that the regulatory direction has reduced the risk of the institution. A positive coefficient on this variable implies than regulatory direction on average increases the risk of the institution. This somewhat counterintuitive finding could result from troubled institutions whose portfolios reflect the assets that remain after other, maybe higher quality, assets are sold during the process of the institution's closing.

5.3 Hedging Accrual Management Tests

The test for hedging accrual management correlates the lagged capital ratio, adjusted to remove any effects of hedging, with the net deferred hedging loss amounts reported as of the end of each quarter. The interpretation of this test is that evidence of hedging accrual management for regulatory purposes is shown as an increase.

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11 Adjusted capital is defined as regulatory capital minus the net hedging loss.

12 This amount is defined as the sum of deferred gains and losses on hedged assets and deferred gains and losses on hedged liabilities for each period. Deferred losses are positive amounts, and deferred gains are negative amounts. Thus the net amount is positive if it is a loss and negative if it is a gain. This variable is termed the net deferred hedging loss.
in net hedging losses as adjusted capital ratios decrease to the regulatory minimum, and a
decrease in net hedging losses as adjusted capital ratios decrease below this level.\textsuperscript{13} A
decomposition polynomial model is used to capture this relationship.

Several variables are included to control for other factors affecting the cross-
sectional variation in net losses on hedges involving futures and options. The first control
variable is designed to account for cross-sectional variation in the amount of hedging
across institutions. This variable is defined as the total notional principal amount of both
long and short positions in futures or options outstanding at the end of the quarter, scaled
by total assets.

Second, I control for cross-sectional variation in net interest income across
institutions. Institutions may choose to defer hedging losses or recognize hedging gains
based on fluctuations in their primary operating income source--net interest income. The
control variable used is interest income excluding the amortization of deferred hedging
gains less interest expense excluding the amortization of deferred hedging losses and the
net cost of matched interest rate swaps.

Third, I control for the use of swaps as an alternative hedging instrument. Interest
rate swaps are primarily accounted for at cost (Choi, 1991). Consequently, while interest
rate swaps may be used as a hedging substitute to futures or options they may not offer
the same potential for accrual management as do futures and options. However, they are

\textsuperscript{13}Preliminary results are consistent with a non-linear relationship between net deferred
hedging losses and the adjusted capital ratio.
frequently used hedging instruments since the terms of a swap may be tailored to meet specific risk management needs. The swap variable controls for the cross-sectional variation in net deferred hedging losses that is explained by the variation in the use of swaps across institutions.

Additionally, I control for the institution's status with regulators. If a firm is under regulatory direction (conservatorship, receivership, or management consignment program) then accounting choices may not be made solely by management. Additionally, a troubled institution whose management is allowed to make the accounting method choice may have different incentives for that choice than a firm not under regulatory direction.

Managers' use of discretion in recognizing hedging results is only one way in which they can manage capital ratios. As mentioned previously, Moyer and Scholes, Wilson, and Wolfson find that other measures may be used to manage capital ratios. An institution's use of discretionary hedging accruals to manage its capital ratio may depend on the institution's alternative opportunities for capital ratio management. Therefore, I control for the measures which have been shown by previous studies to be used to manage capital ratios.

The first variable which has been linked to capital ratio management is securities gains and losses. Managers may have incentives to sell securities in order to realize gains if regulatory capital is close to or below the minimum. Both Moyer and Scholes, Wilson, and Wolfson find evidence that banks realize securities gains when capital ratios move toward the minimum.
The second variable which has been linked to capital ratio management is the provision for loan losses. Increasing an institution's loan loss provision leads to an increase in the institution's capital ratio. This is because an institution realizes a tax savings due to the loan loss provision taken in the period, but is allowed to add the entire loan loss allowance, including the current period's provision, to equity in the computation of the regulatory capital ratio\textsuperscript{14}. Thus increasing the loan loss provision above the necessary level allows an institution to increase its regulatory capital.

A sample selection model is used to estimate the relationship between net deferred hedging losses and the adjusted capital ratio. Sample selection models allow for consistent estimates of the relationships between dependent and independent variables in the presence of sample selectivity bias.\textsuperscript{15} The sample used here is truncated in that the choice to use or not to use hedge accounting is endogenous to the institutions. The sample selection model allows estimation of the relationship between NL and the adjusted capital ratio given that the sample of firms chose to use hedge accounting.

The first equation of the sample selection model is a probit equation which represents the factors that affect the choice by all institutions to use or not to use hedge accounting. The probit model estimated is as follows.

\textsuperscript{14}In computing regulatory capital, institutions are allowed to add back the allowance for loan losses. Thus, retained earnings is decreased by the period's provision for loan losses less the tax savings from these losses. Since the allowance for loan losses contains the gross provision for the period, the effect on regulatory capital of the PLL is an increase in regulatory capital.

\textsuperscript{15}For a more thorough discussion of sample selection models see Greene, Chapter 22.
METHOD = \gamma_0 + \gamma_1 ACR_{t-1} + \gamma_2 ACR_{t-1}^2 + \gamma_3 ACR_{t-1}^3 + \gamma_4 ACR_{t-1}^4 + \gamma_5 HAMT_t \\
\cdot \gamma_6 NII_t + \gamma_7 PLL_t + \gamma_8 SGL_t + \gamma_9 SWAP_t + \gamma_{10} TI_t + u_t \tag{4} \\
\]

where

METHOD = one if the institution uses hedge accounting and zero otherwise

ACR_{t-1} = adjusted capital at time t-1 as defined above

NII_t = net interest income for period t excluding any amortization of deferred gains or losses on hedged assets or liabilities

SGL_t = realized gains and losses from the sale of investments during period t

PLL_t = the provision for loan losses during period t

SWAP_t = a binary variable which is one if an institution uses interest rate swaps in period t and zero otherwise

All other variables are defined above, and all variables are scaled by total assets.

The relationship between net deferred hedging losses and the independent variables in the equation is estimated for only those firms using hedge accounting. The relationship to be estimated is the expected value of NL conditional on the independent variables in the equation and on the choice to use hedge accounting.

\[ E \left[ NL \mid X_t, METHOD = 1 \right] - E \left[ NL \mid X_t, \gamma' Z_t - u_t > 0 \right] \tag{5} \]
Here, $Z$ is the vector of independent variables from the probit equation, $\gamma$ is the vector of coefficients from the probit equation, $X$ is the vector of independent variables from the second stage regression equation, $\beta$ is the vector of coefficients from the second stage regression, and $\rho$ is the correlation between the error term in the probit model, $u$, and the error term in the second stage regression, $\epsilon$. $\phi$ and $\Phi$ represent the normal density and cumulative distribution functions, respectively. Thus, in this sample selection model, the selectivity bias occurring from the choice of hedge accounting is corrected using a term equal to the second term in equation (7). This term is $\rho^2 \sigma_u^2$ multiplied by the inverse Mills ratio $(-\phi/\Phi)$. Since $\sigma_u$ is not directly estimable it is assumed to be one. Thus $\rho^2 \sigma_u^2$ serves as the coefficient on the inverse Mills ratio. The sign of this coefficient indicates whether the selectivity bias increases or decreases $NL$ relative to the case where no selectivity bias exists. The two-equation model is estimated using maximum likelihood. Based on the above discussion, the regression model to be estimated for the firms using hedge accounting is as follows.

\[
- \beta'X_i \cdot E [\epsilon_i \mid u_i < \gamma'Z_i]
\] (6)

\[
- \beta'X_i \cdot \left( \frac{\sigma_u}{\sigma_{\epsilon}} \right) \left[ \frac{\phi(\gamma'Z_i)}{\phi(\gamma'Z_i)} \right]
\] (7)

---

\^16 The log-likelihood function to be maximized is the following.

\[
\ln L = \text{METHOD} \times \{-1/2 \ln(2\pi) - \ln(\sigma^2) - 1/2[(NL - \beta'X_i)/\sigma]^2 + \ln \phi((\alpha'Z_i - (\rho/\sigma) (NL - \beta'X_i)) / (1 - \rho^2)^{1/2})\} + (1-\text{METHOD}) \times \ln \phi(-\alpha'Z_i)
\]
where

\[ NL_t = \beta_0 + \beta_1 ACR_{t-1} + \beta_2 ACR_{t-1}^2 + \beta_3 ACR_{t-1}^3 + \beta_4 ACR_{t-1}^4 + \beta_5 HAMT_t, \]

\[ + \beta_6 NII_t + \beta_7 PLL_t + \beta_8 SGL_t + \beta_9 SWAP_t + \beta_{10} TI_t + \epsilon_{t3} \]  

(8)

\[ NL_t = \text{cumulative deferred net hedging losses at time } t, \text{ as defined above} \]

All other variables are defined above, and all continuous variables are scaled by total assets.

The results of the hedging accrual management model reveal whether net deferred hedging losses are related to adjusted capital. If these losses are related to capital in such a way that the largest amounts of net losses are deferred just above or just below the capital ratio minimum, then the results imply that hedging accruals are managed to keep institutions above the capital ratio minimum. The relationship between the amount of hedging and the net deferred hedging losses is expected to be positive since the total amount of net hedging losses is increasing in the amount of hedging.

The coefficients on the remaining control variables should yield information about whether the use of other accounting measures is related to the use of deferral accounting, and whether these measures serve as substitutes or complements to the net deferred hedging loss measure if the measures are used to manage accruals. A positive relationship between an accounting control variable and net hedging losses implies that the institutions use both to manage accruals. A negative relationship between an
accounting control variable and net hedging losses implies that the institutions use one or the other but not both to manage accruals.
CHAPTER VI

SUMMARY OF RESULTS FOR THE SAVINGS AND LOAN ASSOCIATION SAMPLE

6.1 Descriptive Statistics

Descriptive statistics for the savings and loan association sample are presented in Table 1 and Table 6. Table 1 contains general descriptive statistics concerning institution size and descriptive statistics for the dependent variables in the risk tests and for the capital ratio. Table 6 contains a more detailed statistical description of the net deferred hedging losses of the sample to show the significance of this number for some of the institutions.

Based on Panel A of Table 1, the mean institution size is close to or slightly larger than $400 million in all years. However, the standard deviation shows that there is a large amount of variation in institution size in the sample. In addition, the average institution has outstanding hedge positions equal to 1.5% and 1% of its total assets in 1987 and 1988 respectively, and smaller hedge positions of 0.7% and 0.3% of total assets in 1989 and 1990/1991 respectively. Again, the standard deviations indicate a large variation in the amount of hedging at institutions, and the standard deviations are much
higher in 1987 and 1988, the years when the mean hedging amount is large, than in 1989 and 1990/1991 when the mean hedging amount is smaller.

The mean of the risk measure is slightly higher in 1988 and 1989 than in the other two time periods. The standard deviation is similar in all years except 1987, for which the standard deviation is slightly higher than in other years. Finally, the mean capital ratio is 3.2% in 1988 and 1989. It is higher in 1987 and 1990/1991 at 3.96% and 4.4% respectively. The standard deviations for the capital ratio variable are extremely large. The 1987 standard deviation is the smallest at 11.4%, and the 1989 standard deviation is the largest at 28.8%. The 1988 and 1990/1991 standard deviations are similar and are around 16%.

Panel B of Table 1 shows the means of the HAMT, RISK, and CAPR variables by quartile with the quartiles being determined by the institutions' CAPR variable. This panel shows that the largest amount of hedging occurs in the second quartile in 1987 and 1988, and in the first quartile in 1989 and 1990/1991. The first quartile contains institutions whose average capital is negative. The second quartile contains institutions whose average capital is slightly above the regulatory minimum. Panel B also shows that institutions in the lowest capital ratio quartile have RISK measures that are at least as high as the other quartiles, except in 1989. Panel C of Table 1 shows the means of the HAMT and ASSETS variables by quartile with the quartiles determined by the institutions' ASSETS variable. This table shows that the amount of hedging is strictly increasing in the total assets of the institution for all four time periods.
Panel A of Table 6 shows descriptive statistics for net deferred hedging losses for only those institutions using hedge accounting. The mean ranges from 0.22% to 0.32% from 1987 to 1989 and drops to 0.14% in 1990/1991. The median each year is smaller than the mean indicating that the distribution contains some large positive numbers for the net deferred hedging losses. The standard deviations are also large, indicating large variation in the sample. Based on the quartile amounts, it is shown that the net deferred hedging loss amounts are large enough for quite a few institutions to significantly affect the capital ratio. Thus, management of this accrual may be of use to many institutions.

Panel B of Table 6 shows means of the NL and ACR variable for each quartile where the quartiles are determined by the ACR variable. In each period shown, the largest amount of net deferred hedging losses occurs in the lowest ACR quartile. The lowest ACR quartile contains institutions with a negative average adjusted capital ratio.

6.2 Risk Management Results

The hedging amount model used as the first stage regression for the risk tests indicates that the hedging amount is related to the prior period's capital ratio in all four time periods. As shown in Table 2, the second, third, and fourth-order polynomial terms are negative and significant in each time period with the exception of the 1987 period. The linear term is positive and significant in all time periods. From these

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17 The data for 1990 and 1991 are pooled due to three missing quarters of data for the two years as a result of problems with the magnetic tapes from which the data was taken. The 1989 results are computed using only three quarters of data for the same reason.
coefficients and from the Wald test of $a_2 = a_3 = a_4 = 0$, it appears that the relationship between the hedging amount and the prior period's capital ratio is non-linear. Thus, the hedging amount decision appears to be related to the level of an institution's capital.

Table 3 gives the slope of the capital ratio variable in the hedging activity model at seven different points along the capital ratio spectrum. These seven points are chosen since most institutions fall within the -15% to 15% capital ratio range. Table 3 shows that the amount of hedging is an increasing function of the capital ratio up to a point between zero and 5% capital for the 1989 period between 5% and 10% capital in the 1990/1991 time period. As capital ratios move above this peak, the relationship between the hedging amount and the capital ratio becomes negative. These results are consistent with the greatest amount of hedging occurring around the regulatory minimum capital ratio or slightly above the minimum capital ratio.

In 1988, the peak of the hedging amount function occurs between a 10% capital ratio and a 15% capital ratio which indicates a rightward shift in the hedging activity function relative to the 1989 and 1990/1991 time periods. The greatest amount of hedging in 1988 appears to be done by firms that are fairly well capitalized. Also, the relationship between the amount of hedging and the capital ratio in 1987 is positive until at least a 15% capital ratio.

The 1989 and 1990/1991 results are consistent with the expectation that institutions have the greatest incentive to hedge around the regulatory minimum to

\[18\] The estimated relationship between the amount of hedging and the capital ratio in 1987 is positive up to a capital ratio of approximately 34%.
minimize regulatory costs of financial distress. The fact that the 1990/1991 peak is at a higher level of capital than the 1989 peak may be due to the introduction of risk-based capital standards in 1990 that were more stringent than prior period's capital standards and thus a change in the definition of which institutions were well-capitalized. As a result, the higher peak is not inconsistent with the expectations.

The results in 1987 and 1988 are consistent with institutions not in regulatory danger hedging. These results may be due to the interest rate environment during these periods. S&Ls typically have long-term assets and short-term liabilities and are thus hurt by rising interest rates. Interest rates rose more sharply in 1987 than in the other time periods and rose slightly in 1988. As a result, the institutions well above the regulatory minimum may have been hedging to reduce interest rate sensitivity during 1987 and 1988. This is supported by the negative, significant coefficients on the GAP variable in 1987 and 1988. The GAP measure is negative for all but a few of the institutions across all four time periods. Thus the negative coefficient means that the amount of hedging is increasing in the interest rate gap. The coefficient on the GAP variable is only marginally significant in 1989 and is insignificant in 1990/1991, the two time periods when the hedging amount function peaked just above the capital ratio minimum. Consequently, it appears that the well-capitalized institutions hedging in 1987 and 1988 are doing so to reduce interest rate sensitivity.

The results on the remaining control variables are mixed. The tax variable is significant only in 1990/1991, and the sign of the coefficient is the opposite of the expected sign based on prior research. Thus prior results which show that tax status is a
factor in the hedging decision are not supported in this study. The coefficient on the liquidity variable is significant in three of the four time periods. However, it is positive and significant in 1987 and 1988 which is the opposite of the expected result. Prior research has shown that liquidity is a substitute for hedging activity, but the results in 1987 and 1988 imply that the two are complementary. In 1990/1991, however, the sign of the liquidity coefficient is negative and significant. This implies that the higher an institution's liquidity, the less likely it was to hedge during this period. This is consistent with previous findings. Finally, the coefficients on the inverse of size variable are negative and significant as expected. This indicates, as do prior findings, that larger institutions are more likely to hedge than smaller institutions.

Risk appears to be significantly related to the prior period's capital ratio in all periods as shown in Table 4. Most of the capital ratio terms are significant with the exceptions of the linear terms in 1988 and 1989. Also, the 1987 cubic term is only marginally significant. These results as well as the F-test of $\delta_2=\delta_3=\delta_4=0$ support a non-linear relationship between risk and the prior period's capital ratio.

Table 5 indicates that the slopes are negative for institutions in the -15% to 15% range for 1987 and 1990/1991. In 1988, the slopes are decreasingly negative from -15% to zero capital but change to positive from zero capital to a 15% capital ratio. In 1989 the

\[19\] As a robustness check on the risk variable, the model was run using the absolute deviation of net income scaled by total assets a an alternate measure of risk. The results were similar in all years except 1989. The 1989 results using the alternate risk measure yielded a more negative slope than the portfolio risk measure. However, the portfolio risk measure is used as the primary risk measure since it should better capture investing incentives for risk than the income deviation measure.
slope of the function is negative at -15% and -10% capital, but changes to positive between -10% and -5% capital.

The 1988 results are consistent with institutions below the regulatory capital minimum increasing risk as capital decreases to increase firm value since they have already violated the capital ratio requirement. This year is also consistent with institutions with above minimum capital increasing risk as capital ratios increase since the well-capitalized institutions have a low probability of falling below the regulatory minimum, and thus can handle the increased risk. The minimum amount of risk in the 1988 results is just above and just below the capital ratio minimum indicating that these institutions do not want to incur risk that could lead to violation of capital ratio requirements and regulatory action.

The 1989 results are similar to the 1988 results, except that the minimum amount of risk occurs between a -10% and a -5% capital ratio. Institutions between -5% capital and the regulatory minimum should want increased risk if regulatory action is imposed in this region. These results may reflect the fact that regulators were slow in taking control of insolvent institutions.

The 1987 and 1990/1991 results show that institutions below the capital minimum increased risk as capital decreased, which is consistent with institutions maximizing wealth given that they have violated regulatory capital minima. However, the function is also negative for institutions with capital above the regulatory minimum, which is puzzling.
From these results, it appears that regulators are not keeping institutions from increasing risk as capital ratios decrease in 1987 and 1990/1991 for any level of capital. Also, in 1988 and 1989 it appears that regulators are not keeping institutions with negative capital—the ones with the most incentive to increase risk—from increasing their portfolio risk. In 1989, however, it appears that only those institution with very low capital were increasing risk. This may imply that these institutions were constrained from increasing risk above this level. Overall, the results are consistent with the fact that, after controlling for those institutions under regulatory direction, institutions were able to increase risk as capital decreased which implies that regulators were ineffective in controlling the riskiness of institutions.

The coefficient on the predicted amount of hedging from the first stage of the model is negative and significant as expected in three of the four years. In 1990/1991 the coefficient is positive and significant. The 1990/1991 results could be due to the futures and options positions reported being speculative positions rather than true hedges. Changes in these positions from hedges to speculative positions could be a result of the changing interest rate environment from rising to falling rates over the sample period.

Finally, the troubled institution binary variable is significant only in 1987, and has a positive coefficient. This implies that institutions under regulatory direction had higher risk than other institutions in this year only. This may be due to the fact that regulators had not yet begun to control the risk of these institutions effectively, or it could be that the portfolio risk of these institutions reflects the remains of investments after high quality assets had been sold to other institutions in the closing process of the institutions.
6.3 Hedging Accrual Management Results

There is some evidence that deferred net hedging losses are related to the adjusted capital ratio, as shown by the significance of some of the terms in the hedging accrual model results in Table 7. The linear terms are significant in all years. Also, the third and fourth-order terms are significant in 1988, and the fourth-order term is significant in 1987. Wald tests indicate that at least one higher order polynomial term is appropriate in all years. Table 8 gives the slopes of the adjusted capital ratio variable at points ranging from -15% capital to 15% capital. In all years these slopes are negative as capital ratios move from -15% to 15%.

These results are largely consistent with institutions increasing the amount of net deferred hedging losses as the adjusted capital ratio decreases. It does not appear that these deferrals have a peak between around the regulatory minimum as was expected if regulators intervene or if accrual manipulation no longer has a large enough effect to significantly impact capital adequacy. The results indicate that, after controlling for the amount an institution's hedging activity and other variables, institutions defer more net hedging losses as capital ratios decrease. Although this result is consistent with the management of hedging accruals being related to capital, the management may not be a result of capital ratio minima since institutions well below the minimum continue to defer losses.

The coefficient on the inverse Mills ratio, $\rho*\sigma$, is negative in all years except 1988. However, this coefficient is significant only in 1987. The coefficient in 1988 is positive and insignificant. This indicates that a selection bias does exist in the sample in
one of the four years, and that the net deferred hedging losses in that year are higher than if a selection bias did not exist. Also, the coefficient on the hedging amount variable is positive and significant in all years, as expected, which implies that hedging accruals are positively related to the amount of hedging.

The coefficient on the net interest income variable is significant only in 1988 and 1990/1991, and the signs are opposite in these two years. Thus is it difficult to infer any overall relationship between net deferred hedging losses and net interest income. The coefficient on the provision for loan losses variable is negative in all years, and is significant in 1988 and 1990/1991. This evidence is consistent with institutions treating net deferred hedging losses and the provision for loan losses as substitutes for accrual management.

The coefficient on the securities gains and losses variable is significant only in 1987 and is positive. This provides some evidence that institutions deferring hedging losses also recognized greater securities gains, and thus that the two accruals are complements. However, the inconsistent results across the four time periods suggest that the 1987 result is questionable. Similarly, the swap variable is significant only in 1987 and is positive which suggests that institutions using swaps deferred more hedging losses than institutions not using swaps. However, the inconsistency of the results for this variable across years also makes the 1987 swap variable result questionable. Finally, the troubled institution variable is significant only in 1990/1991 and is negative. This suggests that troubled institutions were deferring less hedging accruals than non-troubled institutions. This may imply that troubled institutions were forced to recognize rather than
defer these losses by regulators. However, the inconsistent results across years again leads one to question this result.
CHAPTER VII
DATA AND EMPIRICAL METHODS FOR THE COMMERCIAL BANK SAMPLE

7.1 Data Collection

The data for tests involving commercial banks comes from the commercial bank call reports and was provided by the Federal Reserve Bank of Cleveland. The data includes the variables necessary to replicate the risk management tests discussed above. The hedging accrual management tests are not performed on the commercial bank sample since the net deferred hedging loss amount is not reported as a separate item on the bank call reports as it is on the thrift financial reports. Thus, the amount of this variable cannot be distinguished from other items. The commercial bank sample consists of all institutions with at least one billion dollars in assets, so the size of the institutions varies a great deal from that of the savings and loan association sample. The sample period for the bank data includes the four quarters of 1991.

7.2 Risk Management Tests

As with the savings and loan sample, risk management for the bank sample is examined using a two-stage polynomial regression. The same variables are included in
the hedging activity model, and they include the prior period's capital ratio, the institution's interest rate gap, the tax status of the institution, the liquidity of the institution, and the size of the institution. The predicted values from the first-stage hedging activity model are used as explanatory variables in the second-stage risk management model.

Again, the first stage hedging activity model is a tobit equation since the range of hedging activity is truncated at zero. Additionally, polynomial terms are used for the capital ratio variables since there is evidence from the savings and loan sample that the relationship between hedging and capital is non-linear. The variables used are computed in the same manner as the variables for the savings and loan sample. The first stage hedging activity model is as follows.

\[ HAMT_{t}^* = \alpha_0 + \alpha_1 \text{CAPR}_{t-1} + \alpha_2 \text{CAPR}_{t-1}^2 + \alpha_3 \text{CAPR}_{t-1}^3 + \alpha_4 \text{CAPR}_{t-1}^4 + \alpha_5 \text{GAP}_{t-1} + \alpha_6 \text{TAX}_{t-1} + \alpha_7 \text{LIQUID}_{t} + \alpha_8 \text{INVSIZ}_{t} + \epsilon_{t} \]

\[ HAMT_{t} = \begin{cases} HAMT_{t}^* & \text{if } HAMT_{t}^* > 0 \\ 0 & \text{if } HAMT_{t}^* \leq 0 \end{cases} \quad (9) \]

where

- \( HAMT_{t}^* \) = the latent variable underlying the decision to hedge which represents the net benefit of hedging
- \( HAMT_{t} \) = the total notional principal amount of long and short positions outstanding at the end of period \( t \) scaled by total assets
- \( \text{CAPR}_{t-1} \) = regulatory capital divided by total assets during period \( t-1 \)
GAP\textsubscript{t-1} = the institution's twelve-month interest rate gap measured as assets less liabilities repricing within twelve months, scaled by total assets

\text{TAX}_{t-1} = an indicator variable which is one if the institution's income before taxes is in the progressive range of the tax schedule in period \( t-1 \) and zero otherwise

\text{LIQUID}_t = the sum of the institution's holdings of cash and treasury securities during period \( t \), scaled by total assets

\text{INVSIZE}_t = one divided by the total assets (stated in hundreds of millions of dollars) of the institution during period \( t \)

The second stage models risk as a function of the prior period's capital ratio and the predicted amount of hedging from the first stage. The indicator variable for troubled institutions is not used for the bank sample since the banking industry was not collapsing as was the thrift industry, and since the vast majority of the institutions were solvent. The model employs polynomial terms for the capital ratio variable based on the evidence of a non-linear relationship between risk and capital in the savings and loan sample. As with the savings and loan sample, risk is expected to be inversely related to the capital ratio if management is able to control investments so as to increase risk as capital decreases. The model to be tested is as follows.

\[ RISK_t = \delta_0 + \delta_1 CAPR_{t-1} + \delta_2 CAPR_{t-1}^2 + \delta_3 CAPR_{t-1}^3 + \delta_4 CAPR_{t-1}^4 + \delta_5 HAMT_{t-1} + \epsilon_{t-2} \quad (10) \]
where

\[ \text{RISK}_i = \text{a composite measure of an institution's portfolio risk which weights categories of assets by a risk percentage and then sums the risk-weighted assets; the risk-weighted assets are scaled by total assets}^{29} \]

\[ \text{HAMT}_{1}^{**} = \text{the predicted value of the hedging amount from equation nine} \]

All other variables are defined as above.

The results from equation (10) will provide information about the factors which affect the risk decisions of financial institution. These interpretation of these results is the same for the bank sample as for the savings and loan sample. If a positive relationship is found between risk and capital for those institutions below the regulatory minimum, then it appears that institutions are not able to increase risk presumably due to monitoring and costs imposed by regulators. If a negative relationship is found between risk and capital for those institutions with capital below the regulatory minimum, then it appears that regulatory monitoring and other regulatory costs do not prevent institutions from increasing their risk.

For institutions above the minimum, a positive relationship between risk and capital implies that institutions with capital slightly above the minimum want less risk relative to those with greater amounts of capital since the institutions well above the minimum have a smaller probability of violating capital ratio minima. It is also

\footnote{The risk-weighted assets measure used is the risk-weighted assets measure developed as a basis for capital ratio requirements in 1989. The calculation of this measure is discussed in Appendix B.}
consistent with institutions with capital well above the minimum behaving as if regulatory capital minima are of lesser importance than other factors which may influence risk.
CHAPTER VIII

SUMMARY OF RESULTS FOR THE COMMERCIAL BANK SAMPLE

8.1 Descriptive Statistics

The descriptive statistics for the commercial bank sample given in Table 9 show that the bank sample differs from the savings and loan sample in several ways. First, the average bank in the sample has assets of $6.5 billion, which is much larger than the average S&L. Also, the average outstanding futures and options positions in the bank sample is around 13% of assets, much larger than that of the average S&L. In addition, the portfolio risk of the average bank is greater than that of the average S&L, with the average of risk-weighted assets to total assets being 74%. Finally, the average capital ratio of the bank sample is almost 8%. This is significantly higher than the average capital ratio of the S&L sample.

As a result of the differences between the two samples, the results of the hedging activity and risk management models may be different. The bank sample contains large, well-capitalized institutions whose decisions may not be centered around regulation since most are not in regulatory danger. Thus it is possible that the relationship between regulatory capital and their hedging and risk decisions may not be as strong as for the savings and loan sample.
8.2 Risk Management Results

The results of the hedging activity model show that banks' hedging decisions do not appear to be influenced by their level of capital. None of the capital ratio variables is significant. As expected, the coefficient on the interest rate gap variable is positive and significant in all years. Since most commercial banks have positive interest rate gaps, the positive coefficient means that the larger the interest rate gap of the institution, the larger the amount of hedging. Also, it appears that liquidity is a substitute for hedging in that the amount of hedging is inversely related to the liquidity of the bank. This result is consistent with results found in previous literature.

Furthermore, as expected, the amount of hedging undertaken by banks is increasing in the size of the institutions. However, the tax status of the bank is not significant in explaining the amount of outstanding futures and options positions, as was found in previous literature. Overall, these results indicate that the sample of banks bases its hedging amount decisions on factors other than regulation including interest rate sensitivity, liquidity, and size. These results may reflect the fact that the bank sample is, in general, well-capitalized and that regulatory capital ratio minima are a secondary concern for these institutions.

The results of the risk management model show that banks' portfolio risk is related to the level of regulatory capital.\textsuperscript{21} As shown in Table 12, all of the capital ratio

\textsuperscript{21}As with the savings and loan sample, the alternate risk measure calculated as the absolute deviation in net income from t-1 to t divided by total assets was used as a robustness check on the risk variable for the bank sample. The results using the two different variables are somewhat different. The alternate risk variable yields a function that is negative up to
variables are significant. Table 13 gives the slopes of the function with respect to the capital ratio evaluated from a capital ratio of -5% to 25%. These slopes show that risk appears to be decreasing in the capital ratio up to a capital ratio of slightly less than 15%. Above this point, risk is increasing in the capital ratio. These results are consistent with highly capitalized institutions decreasing their risk as capital increases, which may be consistent with extreme risk aversion in these institutions based on the decreasing risk and high capital. For other institutions, risk is increasing in capital. This result is consistent with institutions above the regulatory minimum wanting to increase risk as capital increases since the probability of falling below the regulatory minimum decreases as capital increases. However, a positive relationship between risk and capital also exists for those few institutions below the regulatory minimum. This result could be due to banking regulators controlling the risk-taking incentives of these institutions effectively.

The risk management results for banks are different from those found in the savings and loan sample for those institutions with capital below the minimum. However, this may be due to differences in the effectiveness of the regulatory bodies that monitor the two industries. The differences may also reflect the fact that the savings and

about zero capital and positive above that. However, this difference may be due to incentives to increase accounting earnings variability without increasing economic earnings variability as discussed in Smith and Stulz and Schrand. The portfolio measure of risk is used as the primary measure since it best captures incentives to increase risk through investing activities which is the measure desired for the tests.

The slopes are computed from capital ratios of -5% to 25% instead of -15% to 15% as with the savings and loan sample because the lowest capital ratio found in the bank sample was approximately -6%.
loan industry was in collapse and the banking industry was not. The S&L sample consists of many moderately or inadequately capitalized institution that may have increased risk as a last effort to regain solvency during a time period in which the industry was collapsing. The bank sample, however, contains institutions that are mostly solvent. Thus the capital levels and state of the industry may explain the differences in behavior.
9.1 Tests of Normality

The empirical methods used in estimating the hedging amount and hedging accrual management models, the tobit and sample selection models respectively, rely heavily on the assumption of normally distributed error terms. As a result, the estimates from the model may be sensitive to departures from normality in the error terms. To determine whether this problem exists in the hedging amount and hedging accrual management tests, diagnostic tests were performed to determine whether there is evidence of non-normality in the error terms of the estimated models.

Pagan and Vella (1989) propose a score test for normality of the errors based on the conditional expectations of the third and fourth moments of the normal density function for the tobit and sample selection models. If the errors are normally distributed then the expectation of the third moment of the error distribution conditional on the dependent variable should be zero. Also, if the errors are normal, then the expectation of the fourth moment of the error distribution conditional on the dependent variables should be equal to three times the variance squared.
Table 14 gives the results of these diagnostic tests for the tobit model, and for both stages of the sample selection model, the probit selection equation and the second stage truncated regression function. Based on the score statistics there is evidence of non-normality of the error terms for both the hedging activity and hedging accrual management models for both the savings and loan and bank samples with the exception of the first stage of the sample selection model in 1989 for the savings and loan sample. Based on the evidence of non-normality, the coefficients estimated from these models may be biased.

9.2 Robustness Checks of the Maximum Likelihood Coefficients

As a robustness check of the model estimates, semiparametric estimates were obtained using a random sample of 1,000 observations from the 1988 savings and loan data. The 1988 period was chosen since it appears to be fairly representative. The random sample of 1,000 observations is used due to the computational intensity of the estimation method used to obtain the semiparametric estimates. Ahn and Powell (1993) propose a semiparametric estimator for sample selection models. This estimator consists of a nonparametric estimator of the first stage selection function and a weighted least squares estimator of the second stage linear regression function. The first stage selection mechanism gives a nonparametric estimation of the correction term for selectivity bias. The nonparametric correction term estimated is not dependent upon the assumption of bivariate normality of the error terms in the first and second stages of the sample
selection model as is the parametric version estimated above, so this correction should yield coefficients that are not sensitive to departures from normality.

Since the Ahn and Powell estimator is developed for semiparametric estimation of sample selection models, it does not exactly fit the tobit specification of the hedging amount model. Furthermore, a suitable semiparametric tobit estimator is not available. However, the hedging amount model may be restated as a sample selection model with a slight change in interpretation. In the tobit specification, the predicted values represent the estimated latent variable underlying the hedging amount decision. However, if the problem is re-specified as a sample selection problem then the predictions may be interpreted as the predicted value of hedging based on the explanatory variables conditional on an institution choosing to hedge.

The maximum likelihood coefficients from the 1988 hedging activity tobit model are presented in Table 15. Also, coefficients obtained using the Ahn and Powell semiparametric sample selection estimator on the hedging activity model data from the 1988 random subsample are presented. Additionally, coefficients from an ordinary least squares regression of the hedging amount on the explanatory variables in the hedging amount model and the predicted nonparametric correction for selectivity bias from the first stage of the Ahn and Powell estimator using the 1988 subsample are presented. The coefficients estimated with this procedure should also be robust to non-normality since the first stage correction term does not depend on the assumption of normality and since ordinary least squares coefficients are not sensitive to departures from normality. Although the maximum likelihood tobit coefficients are not directly comparable to the
two other sets of coefficients to assess the effects of non-normality on the maximum likelihood coefficients, the compared results of the three methods are of interest.

Likewise, Table 16 shows the maximum likelihood coefficients from the hedging accrual sample selection model for the 1988 full data sample. The table also shows the Ahn and Powell semiparametric sample selection coefficients for the 1988 subsample, and the coefficients from an ordinary least squares regression of the net deferred hedging loss on the explanatory variables in the hedging accrual management model and the nonparametric selectivity correction term from the first stage of the Ahn and Powell estimator using the 1988 data subsample. The swap variable used in the earlier parametric estimation is left out of the second stage regression equation of the hedging accrual management model using both the Ahn and Powell weighted least squares estimation and ordinary least squares estimation. Also, the liquidity variable is left out of the second stage of the hedging amount model for the same two estimation methods. This is because it is necessary to have fewer variables in the regression equation (second stage) than in the selection equation (first stage) when using the nonparametric first-stage estimator in order to achieve identification of the model. (Cosslett, 1991)

The results of the robustness checks are for the most part inconclusive. For the hedging activity model, it is impossible to determine whether the potential non-normality of the errors had any effect. The estimation procedure consisting of the nonparametric first stage and the ordinary least squares second stage yields significance for the intercept, the size variable, and the correction term. None of the coefficients estimated using the Ahn and Powell semiparametric estimator are significant. These results are quite
different from the tobit results where all coefficients were significant except the tax variable. It should be noted, however, that the poor results of the results of the Ahn and Powell estimator and the OLS estimation using the Ahn and Powell first stage estimates may be due to the very poor results of the Ahn and Powell first stage estimator. The Ahn and Powell first stage estimator has little or no ability to effectively predict which institutions hedge and which institutions do not, whereas the tobit model appears to fit the data well.

The results of the robustness checks for the hedging accrual management model are similarly inconclusive. The OLS estimates using the Ahn and Powell correction term provide evidence that the HAMT variable is not affected by non-normality since the variable is significant in the same direction as in the maximum likelihood results. However, the NII variable appears to be affected by non-normality since it is significant in different directions under the two estimation methods. The Ahn and Powell correction term is also significant in this set of results. Again, as in the hedging activity model, the Ahn and Powell semiparametric estimation method yields insignificant results for all coefficients. Furthermore, as in the hedging activity model, the Ahn and Powell first stage estimator has very little power to discriminate between those firms that choose hedge accounting and those that do not. In fact, the nonparametric first stage classifies essentially all of the observations as institutions that choose not to use hedge accounting. The maximum likelihood first stage, however, correctly classified more than 99% of the institutions that do not use hedge accounting, and more than 11% of the institutions that do use hedge accounting.
Overall, the robustness checks are inconclusive. It is unclear whether any of the variables in the hedging activity model are affected by non-normality. Additionally, it is unclear whether most of the variables in the hedging accrual management model are affected. However, the hedging amount variable does not appear to be sensitive to departures from normality, and the net interest income variable does appear to be sensitive to departures from normality. Based on the inconclusiveness of the results, it appears that the maximum likelihood estimation results provide the best available estimates of the relationships of interest.
CHAPTER X
CONCLUSION

Financial institutions realize incentives to manage risk and capital as a result of regulatory capital standards and subsidized deposit insurance. However, regulatory monitoring exists to keep institutions from taking too much risk or from misstating their financial positions as a result of accrual management designed to increase capital. This study has attempted to determine whether the incentives created by capital ratio minima and deposit insurance are constrained by regulatory monitoring, or whether managers are able to act in the shareholders' best interests which may include extracting wealth from regulators and taxpayers.

The results from the savings and loan sample show that regulatory capital levels are related to the amount of hedging a thrift undertakes, and the risk of the thrift. The coefficients in the hedging activity model imply that institutions increase hedging activity to a point around the regulatory minimum in two of the four periods. The peak of the hedging function is higher in the other two periods. Thus there is some evidence that hedging transactions are undertaken to reduce regulatory costs of financial distress. In the years where the peak of the hedging function is well above the regulatory minimum, there is evidence to support the fact that institutions' hedging activity may be driven more
by interest rate sensitivity than by regulatory capital minima. The hedging decisions of
thrifts also appear to be related to the size of the thrift. The coefficients of the risk model
imply that thrifts below the regulatory capital minimum increase risk as capital decreases
which is consistent with the extraction of wealth from regulators and taxpayers. This
evidence suggests that regulatory monitoring is ineffective in controlling the risk of these
institutions.

Additionally, the thrift results provide some evidence of management of hedging
accruals. As capital decreases, net deferred hedging losses increase. This indicates that
institutions with low capital may be deferring losses to boost capital ratios as much as
possible. However, the management behavior does not peak around the regulatory capital
minimum as expected, but instead continues to increase as capital ratios become
extremely low.

Tests of the sample of commercial banks yield different results. The hedging
activity of commercial banks does not appear to be related to their level of capital, unlike
the results found for the savings and loan sample. It instead appears to be related more to
their interest rate sensitivity, liquidity, and size. Also, although risk is related to the level
of capital for banks as it is for S&Ls, the relationship between risk and capital is
somewhat different for the bank sample than for the S&L sample. Risk at the sample of
banks appears to be increasing as capital increases, except for those institutions with large
levels of capital. Only a few banks in the sample have capital ratios below the minimum,
but the positive relationship between risk and capital for these institutions is different
from the relationship between the two factors in the S&L sample. The positive
relationship between risk and capital for the banks above the minimum is similar to that of some years of the S&L sample and is consistent with concerns about falling below the minimum diminishing as capital increases, and thus with an increased willingness for these institutions to take risk. Since most of the institutions in the sample are well-capitalized, regulatory concerns may become less important for these institutions, and other factors may become the primary drivers of investing decisions at these institutions.

Diagnostics used to test for the possibility of non-normality of the error terms in the models suggest that the error terms may not be normally distributed. Robustness checks designed to assess the sensitivity of the coefficients to the potential non-normality were generally inconclusive. As a result, the parametric estimates represent the best estimates available to assess the relationships of interest in the study. Based on these parametric estimates, it can be concluded that the investing and accounting decisions of institutions appear to be affected in some ways by deposit insurance and regulatory capital ratio minima, as well as by other factors. The results of this study suggest that regulation may have the largest impact on institutions for which regulatory restrictions are marginally or fully binding.
APPENDIX A

TABLES
### TABLE 1

**DESCRIPTIVE STATISTICS**

**SAVINGS AND LOAN ASSOCIATION SAMPLE**

Panel A: Full Sample Statistics

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=9,536</td>
<td>n=12,195</td>
<td>n=8,628</td>
<td>n=11,962</td>
</tr>
<tr>
<td>ASSETS</td>
<td>398,799</td>
<td>432,188</td>
<td>457,374</td>
<td>432,852</td>
</tr>
<tr>
<td></td>
<td>(1,465,329)</td>
<td>(1,586,638)</td>
<td>(1,725,879)</td>
<td>(1,737,034)</td>
</tr>
<tr>
<td>HAMT</td>
<td>0.01568</td>
<td>0.010595</td>
<td>0.007401</td>
<td>0.003278</td>
</tr>
<tr>
<td></td>
<td>(0.189835)</td>
<td>(0.13476)</td>
<td>(0.078412)</td>
<td>(0.037571)</td>
</tr>
<tr>
<td>RISK</td>
<td>0.493009</td>
<td>0.554516</td>
<td>0.557189</td>
<td>0.488879</td>
</tr>
<tr>
<td></td>
<td>(0.13076)</td>
<td>(0.106505)</td>
<td>(0.09996)</td>
<td>(0.091877)</td>
</tr>
<tr>
<td>CAPR</td>
<td>0.039598</td>
<td>0.032587</td>
<td>0.032381</td>
<td>0.044006</td>
</tr>
<tr>
<td></td>
<td>(0.11389)</td>
<td>(0.163766)</td>
<td>(0.28781)</td>
<td>(0.160484)</td>
</tr>
</tbody>
</table>

The statistics given in the table are the mean (standard deviation) of variables of interest used in the tests of savings and loan associations. The assets variable is stated in thousands of dollars. The variable definitions are as follows.

- **ASSETS** = the total assets of the institution
- **HAMT** = the outstanding positions in futures and options held by an institution divided by the firm's total assets
- **RISK** = a credit risk-weight measure of an institution's asset portfolio divided by the firm's total assets
- **CAPR** = total regulatory capital of the institution divided by the institution's total assets
## TABLE 1 Continued

### DESCRIPTIVE STATISTICS

#### SAVINGS AND LOAN ASSOCIATION SAMPLE

Panel B: Sample Divided into Quartiles Based on CAPR

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HAMT</td>
<td>First</td>
<td>0.01110</td>
<td>0.01334</td>
<td>0.01256</td>
<td>0.00612</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.02922</td>
<td>0.01648</td>
<td>0.00931</td>
<td>0.00324</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>0.01357</td>
<td>0.01078</td>
<td>0.00634</td>
<td>0.00192</td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>0.00884</td>
<td>0.00178</td>
<td>0.00140</td>
<td>0.00183</td>
</tr>
<tr>
<td>RISK</td>
<td>First</td>
<td>0.52046</td>
<td>0.55529</td>
<td>0.55372</td>
<td>0.49802</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.49168</td>
<td>0.54769</td>
<td>0.55618</td>
<td>0.49885</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>0.48680</td>
<td>0.55952</td>
<td>0.56157</td>
<td>0.49283</td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>0.47311</td>
<td>0.55556</td>
<td>0.55727</td>
<td>0.46581</td>
</tr>
<tr>
<td>CAPR</td>
<td>First</td>
<td>-0.06044</td>
<td>-0.09223</td>
<td>-0.10725</td>
<td>-0.06077</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.04600</td>
<td>0.04699</td>
<td>0.05038</td>
<td>0.04843</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>0.06480</td>
<td>0.06614</td>
<td>0.07029</td>
<td>0.06943</td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>0.10804</td>
<td>0.10940</td>
<td>0.00611</td>
<td>0.11893</td>
</tr>
</tbody>
</table>

The statistics given are the mean of each variable within the quartile where the quartiles are created based on the CAPR variable.
### TABLE 1 Continued

**DESCRIPTIVE STATISTICS**

**SAVINGS AND LOAN ASSOCIATION SAMPLE**

Panel C: Sample Divided into Quartiles Based on ASSETS

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HAMT</td>
<td>First</td>
<td>0.00202</td>
<td>0.00083</td>
<td>0.00068</td>
<td>0.00007</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.00798</td>
<td>0.00806</td>
<td>0.00234</td>
<td>0.00154</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>0.01894</td>
<td>0.01422</td>
<td>0.00801</td>
<td>0.00293</td>
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<tr>
<td></td>
<td>Fourth</td>
<td>0.03377</td>
<td>0.01926</td>
<td>0.01852</td>
<td>0.00857</td>
</tr>
<tr>
<td>ASSETS</td>
<td>First</td>
<td>26,535</td>
<td>27,508</td>
<td>27,144</td>
<td>27,598</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>67,995</td>
<td>70,435</td>
<td>69,998</td>
<td>70,272</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>154,612</td>
<td>160,257</td>
<td>162,338</td>
<td>158,937</td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>1,346,051</td>
<td>1,470,420</td>
<td>1,570,014</td>
<td>1,474,812</td>
</tr>
</tbody>
</table>

The statistics given are the mean of the variable within each quartile. The quartiles are created using the ASSETS variable.
TABLE 2
RESULTS OF THE HEDGING ACTIVITY TOBIT MODEL
SAVINGS AND LOAN ASSOCIATION SAMPLE

\[ HAMT_i = \alpha_0 + \alpha_1 \text{CAPR}_{i-1} + \alpha_2 \text{CAPR}^2_{i-1} + \alpha_3 \text{CAPR}^3_{i-1} + \alpha_4 \text{CAPR}^4_{i-1} \]
\[ + \alpha_5 \text{GAP}_{i-1} + \alpha_6 \text{TAX}_{i-1} + \alpha_7 \text{LIQUID}_{i-1} + \alpha_8 \text{INVSIZE}_{i-1} + \epsilon_{i1} \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>1987 (n=9,536)</th>
<th>1988 (n=12,195)</th>
<th>1989 (n=8,628)</th>
<th>1990/1991 (n=11,962)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.12160 (.0000)</td>
<td>-0.71632 (.0000)</td>
<td>-0.54610 (.0000)</td>
<td>-0.36619 (.0000)</td>
</tr>
<tr>
<td>CAPR</td>
<td>1.74110 (.0000)</td>
<td>0.96974 (.0000)</td>
<td>0.52918 (.0170)</td>
<td>0.72475 (.0000)</td>
</tr>
<tr>
<td>CAPR^2</td>
<td>-2.22020 (.1836)</td>
<td>-2.57870 (.0032)</td>
<td>-4.66480 (.0000)</td>
<td>-3.53400 (.0000)</td>
</tr>
<tr>
<td>CAPR^3</td>
<td>-0.93913 (.6851)</td>
<td>-6.18640 (.0000)</td>
<td>-15.9940 (.0000)</td>
<td>-8.93830 (.0000)</td>
</tr>
<tr>
<td>CAPR^4</td>
<td>0.53033 (.8338)</td>
<td>-3.02630 (.0000)</td>
<td>-12.4640 (.0000)</td>
<td>-4.60020 (.0000)</td>
</tr>
<tr>
<td>GAP</td>
<td>-0.25998 (.0117)</td>
<td>-0.15694 (.0178)</td>
<td>-0.11282 (.0629)</td>
<td>-0.03191 (.0871)</td>
</tr>
<tr>
<td>TAX</td>
<td>-0.08715 (.1146)</td>
<td>-0.04691 (.1003)</td>
<td>-0.02803 (.2631)</td>
<td>-0.05445 (.0032)</td>
</tr>
<tr>
<td>LIQUID</td>
<td>1.13130 (.0000)</td>
<td>0.34605 (.0489)</td>
<td>-0.06104 (.7571)</td>
<td>-0.80582 (.0004)</td>
</tr>
<tr>
<td>INVSIZE</td>
<td>-0.30375 (.0000)</td>
<td>-0.27134 (.0000)</td>
<td>-0.19680 (.0000)</td>
<td>-0.15963 (.0000)</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>$a_2=a_3=a_4=0$</td>
<td>n=9,536</td>
<td>n=12,195</td>
<td>n=8,628</td>
<td>n=11,962</td>
</tr>
<tr>
<td>$\chi^2$ Statistic</td>
<td>25.2979</td>
<td>44.5896</td>
<td>464.397</td>
<td>466.149</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
</tbody>
</table>

The statistics given for the variables on the preceding page are the estimated coefficients and the p-values. The statistics given for the Wald test are the chi-squared statistics and the p-values. The variables are defined as follows.

**CAPR** = the institution's total regulatory capital divided by its total assets

**GAP** = the institution's assets maturing within one year less its liabilities maturing within one year divided by total assets

**TAX** = one if the institution's prior period income before taxes fell into the progressive range of the tax schedule and zero otherwise

**LIQUID** = an institution's holdings of cash and treasury securities divided by its total assets

**INVSIZE** = one divided by the total assets of the institution where assets are stated in hundreds of millions of dollars
TABLE 3
SLOPES OF THE CAPITAL RATIO VARIABLE
IN THE HEDGING ACTIVITY MODEL
SAVINGS AND LOAN ASSOCIATION SAMPLE

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.15</td>
<td>2.46339</td>
<td>2.20179</td>
<td>3.17648</td>
<td>2.45039</td>
</tr>
<tr>
<td>-0.10</td>
<td>2.21119</td>
<td>1.68318</td>
<td>1.99182</td>
<td>1.71810</td>
</tr>
<tr>
<td>-0.05</td>
<td>1.96990</td>
<td>1.27550</td>
<td>1.12185</td>
<td>1.14749</td>
</tr>
<tr>
<td>0</td>
<td>1.74110</td>
<td>0.96974</td>
<td>0.52918</td>
<td>0.72475</td>
</tr>
<tr>
<td>0.05</td>
<td>1.51230</td>
<td>0.66396</td>
<td>-0.06349</td>
<td>0.30201</td>
</tr>
<tr>
<td>0.10</td>
<td>1.27100</td>
<td>0.25630</td>
<td>-0.93346</td>
<td>-0.26860</td>
</tr>
<tr>
<td>0.15</td>
<td>1.01881</td>
<td>-0.26231</td>
<td>-2.11812</td>
<td>-1.00089</td>
</tr>
</tbody>
</table>

The slopes in the table are computed as the partial derivative of the hedging amount model with respect to the capital ratio. These derivatives are then evaluated at five different points along the capital ratio spectrum for each time period.
TABLE 4
RESULTS OF THE RISK MANAGEMENT MODEL
SAVINGS AND LOAN ASSOCIATION SAMPLE

\[ RISK_t = \delta_0 + \delta_1 \text{CAPR}_t + \delta_2 \text{CAPR}^2_t + \delta_3 \text{CAPR}^3_t + \delta_4 \text{CAPR}^4_t + \delta_5 \text{HAMT}'' + \delta_6 T_I + \epsilon_{t+1} \]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.51941</td>
<td>0.57407</td>
<td>0.57011</td>
<td>0.48651</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>CAPR</td>
<td>-0.25378</td>
<td>-0.01849</td>
<td>0.01636</td>
<td>-0.14903</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.1119)</td>
<td>(.2708)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>CAPR^2</td>
<td>0.12775</td>
<td>0.29225</td>
<td>0.12448</td>
<td>-0.15135</td>
</tr>
<tr>
<td></td>
<td>(.0067)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>CAPR^3</td>
<td>0.14475</td>
<td>0.12664</td>
<td>0.02024</td>
<td>-0.04976</td>
</tr>
<tr>
<td></td>
<td>(.0764)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>CAPR^4</td>
<td>0.13752</td>
<td>0.01462</td>
<td>0.00069</td>
<td>-0.00247</td>
</tr>
<tr>
<td></td>
<td>(.0338)</td>
<td>(.0001)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>HAMT''</td>
<td>-0.63566</td>
<td>-1.20620</td>
<td>-1.5086</td>
<td>2.5432</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>TI</td>
<td>0.11294</td>
<td>-0.01041</td>
<td>0.00603</td>
<td>0.00868</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.1237)</td>
<td>(.2858)</td>
<td>(.0731)</td>
</tr>
</tbody>
</table>

F-test of \( \delta_2 = \delta_3 = \delta_4 = 0 \)

<table>
<thead>
<tr>
<th>F-Statistic</th>
<th>91.7493</th>
<th>125.5985</th>
<th>87.8932</th>
<th>63.3367</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
</tbody>
</table>

The variables are defined on the following page.
TABLE 4 Continued

RISK = a composite measure of an institution's portfolio risk which weights categories of assets by a risk percentage and then sums the risk-weighted assets; the risk-weighted assets are divided by total assets

CAPR = regulatory capital divided by total assets

HAMT** = the predicted value of the hedging amount from the first stage hedging amount model

TI = a binary variable which is one if an institution was in conservatorship or receivership during the period or if an institution went into conservatorship or receivership during the following period, or one if an institution was placed in a management consignment program in the previous, current, or following period; otherwise the variable is zero
TABLE 5  
SLOPES OF THE CAPITAL RATIO VARIABLE 
IN THE RISK MANAGEMENT MODEL  
SAVINGS AND LOAN ASSOCIATION SAMPLE

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.15</td>
<td>-0.30373</td>
<td>-0.11491</td>
<td>-0.02236</td>
<td>-0.10023</td>
</tr>
<tr>
<td>-0.10</td>
<td>-0.28422</td>
<td>-0.08080</td>
<td>-0.00915</td>
<td>-0.11726</td>
</tr>
<tr>
<td>-0.05</td>
<td>-0.26771</td>
<td>-0.04867</td>
<td>0.00376</td>
<td>-0.13352</td>
</tr>
<tr>
<td>0</td>
<td>-0.25378</td>
<td>-0.01849</td>
<td>0.01636</td>
<td>-0.14903</td>
</tr>
<tr>
<td>0.05</td>
<td>-0.23985</td>
<td>0.01169</td>
<td>0.02896</td>
<td>-0.16454</td>
</tr>
<tr>
<td>0.10</td>
<td>-0.22334</td>
<td>0.04382</td>
<td>0.04187</td>
<td>-0.18080</td>
</tr>
<tr>
<td>0.15</td>
<td>-0.20383</td>
<td>0.07793</td>
<td>0.05508</td>
<td>-0.19783</td>
</tr>
</tbody>
</table>

The slopes in the table are computed as the partial derivative of the risk management model with respect to the capital ratio. These derivatives are then evaluated at five different points along the capital ratio spectrum for each time period.
# TABLE 6

DESCRIPTIVE STATISTICS FOR THE NET DEFERRED HEDGING LOSSES AS A PERCENTAGE OF TOTAL ASSETS

SAVINGS AND LOAN ASSOCIATION SAMPLE

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.00231</td>
<td>0.00323</td>
<td>0.00222</td>
<td>0.00140</td>
</tr>
<tr>
<td>Median</td>
<td>0.00026</td>
<td>0.00045</td>
<td>0.00025</td>
<td>0.00017</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.00637</td>
<td>0.00861</td>
<td>0.00545</td>
<td>0.00447</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.05290</td>
<td>0.08945</td>
<td>0.03775</td>
<td>0.03368</td>
</tr>
<tr>
<td>Third Quartile</td>
<td>0.00204</td>
<td>0.00291</td>
<td>0.00221</td>
<td>0.00116</td>
</tr>
<tr>
<td>First Quartile</td>
<td>-0.00013</td>
<td>-0.00001</td>
<td>-0.00002</td>
<td>-0.00007</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.01752</td>
<td>-0.01417</td>
<td>-0.01023</td>
<td>-0.02207</td>
</tr>
</tbody>
</table>

These statistics are taken from the sample of institutions that used hedge accounting during the sample period.
TABLE 6 Continued

DESCRIPTIVE STATISTICS FOR THE NET DEFERRED HEDGING LOSSES AS A PERCENTAGE OF TOTAL ASSETS

SAVINGS AND LOAN ASSOCIATION SAMPLE

Panel B: Sample Divided into Quartiles Based on ACR

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NL</td>
<td>First</td>
<td>0.00595</td>
<td>0.00800</td>
<td>0.00451</td>
<td>0.00258</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.00266</td>
<td>0.00290</td>
<td>0.00235</td>
<td>0.00096</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>0.00072</td>
<td>0.00145</td>
<td>0.00138</td>
<td>0.00135</td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>-0.00090</td>
<td>0.00057</td>
<td>0.00082</td>
<td>0.00074</td>
</tr>
<tr>
<td>ACR</td>
<td>First</td>
<td>-0.03731</td>
<td>-0.07205</td>
<td>-0.06626</td>
<td>-0.05724</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>0.03448</td>
<td>0.03083</td>
<td>0.03301</td>
<td>0.02605</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>0.05011</td>
<td>0.04721</td>
<td>0.05104</td>
<td>0.04503</td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>0.07948</td>
<td>0.07819</td>
<td>0.08291</td>
<td>0.08853</td>
</tr>
</tbody>
</table>

NL = the cumulative deferred net hedging losses at time t, which is the sum of deferred gains and losses on hedged assets and deferred gains and losses on hedged liabilities, divided by total assets; deferred losses are positive amounts, and deferred gains and negative amounts; thus the net amount is positive if it is a loss and negative if it is a gain.

ACR = the adjusted capital ratio defined as regulatory capital minus the net deferred hedging loss divided by total assets
TABLE 7
RESULTS OF THE HEDGING ACCRUAL MANAGEMENT SAMPLE SELECTION MODEL
SAVINGS AND LOAN ASSOCIATION SAMPLE

\[ NL = \beta_0 + \beta_1 ACR_1 + \beta_2 ACR_1^2 + \beta_3 ACR_1^3 + \beta_4 ACR_1^4 + \beta_5 HAMT, \]
\[ + \beta_6 NII + \beta_7 PLL + \beta_8 SGL + \beta_9 SWAP + B_{10} TI + \epsilon_{ij} \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>1987 (n=9,536)</th>
<th>1988 (n=12,195)</th>
<th>1989 (n=8,628)</th>
<th>1990/1991 (n=11,962)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.00641 (.0000)</td>
<td>0.00548 (.0000)</td>
<td>0.00217 (.2208)</td>
<td>0.00035 (.8221)</td>
</tr>
<tr>
<td>ACR</td>
<td>-0.02403 (.0002)</td>
<td>-0.07955 (.0000)</td>
<td>-0.02387 (.0015)</td>
<td>-0.02040 (.0171)</td>
</tr>
<tr>
<td>ACR^2</td>
<td>-0.05655 (.0639)</td>
<td>0.01073 (.7790)</td>
<td>-0.06753 (.0986)</td>
<td>0.02782 (.2674)</td>
</tr>
<tr>
<td>ACR^3</td>
<td>0.19297 (.0826)</td>
<td>0.53121 (.0012)</td>
<td>-0.02921 (.7695)</td>
<td>0.13610 (.3730)</td>
</tr>
<tr>
<td>ACR^4</td>
<td>0.39246 (.0018)</td>
<td>0.51887 (.0026)</td>
<td>0.00473 (.9449)</td>
<td>0.05488 (.7899)</td>
</tr>
<tr>
<td>HAMT</td>
<td>0.00339 (.0000)</td>
<td>0.00612 (.0000)</td>
<td>0.00569 (.0000)</td>
<td>0.00816 (.0000)</td>
</tr>
<tr>
<td>NII</td>
<td>-0.09303 (.2065)</td>
<td>0.30819 (.0040)</td>
<td>-0.08068 (.4354)</td>
<td>-0.17469 (.0330)</td>
</tr>
<tr>
<td>PLL</td>
<td>-0.01932 (.5325)</td>
<td>-0.03654 (.0290)</td>
<td>-0.02971 (.3340)</td>
<td>-0.06934 (.0632)</td>
</tr>
<tr>
<td>SGL</td>
<td>0.48225 (.0000)</td>
<td>-0.06436 (.5796)</td>
<td>0.02322 (.8115)</td>
<td>-0.04911 (.4481)</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=9,536</td>
<td>n=12,195</td>
<td>n=8,628</td>
<td>n=11,962</td>
</tr>
<tr>
<td>SWAP</td>
<td>0.00217</td>
<td>-0.00057</td>
<td>0.00065</td>
<td>0.00095</td>
</tr>
<tr>
<td></td>
<td>(.0005)</td>
<td>(.5128)</td>
<td>(.4719)</td>
<td>(.2414)</td>
</tr>
<tr>
<td>TI</td>
<td>0.00536</td>
<td>-0.00141</td>
<td>-0.00120</td>
<td>-0.00413</td>
</tr>
<tr>
<td></td>
<td>(.3236)</td>
<td>(.2052)</td>
<td>(.2730)</td>
<td>(.0058)</td>
</tr>
<tr>
<td>Rho</td>
<td>0.80005</td>
<td>-0.08906</td>
<td>0.13831</td>
<td>0.30128</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.2454)</td>
<td>(.5284)</td>
<td>(.1029)</td>
</tr>
<tr>
<td>Sigma_e</td>
<td>0.00696</td>
<td>0.00768</td>
<td>0.00536</td>
<td>0.00441</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
</tbody>
</table>

Wald test of $p*\sigma_v=0$

| $\chi^2$ Statistic | 538.5757 | 1.3352 | 0.3887 | 2.3468 |
|                    | (.0000)  | (.2479) | (.5330) | (.1255) |

Wald test of $\beta_2=\beta_3=\beta_4=0$

| $\chi^2$ Statistic | 29.9891 | 470.021 | 106.718 | 110.974 |
|                    | (.0000) | (.0000) | (.0000) | (.0000) |

The variables are defined on the following page.
TABLE 7 Continued

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>NL =</td>
<td>the cumulative deferred net hedging losses at time t, which is the sum of deferred gains and losses on hedged assets and deferred gains and losses on hedged liabilities, divided by total assets; deferred losses are positive amounts, and deferred gains and negative amounts; thus the net amount is positive if it is a loss and negative if it is a gain</td>
</tr>
<tr>
<td>ACR =</td>
<td>the adjusted capital ratio defined as regulatory capital minus the net deferred hedging loss divided by total assets</td>
</tr>
<tr>
<td>HAMT =</td>
<td>the total notional principal amount of an institution's long and short positions in futures and options contracts outstanding divided by total assets</td>
</tr>
<tr>
<td>NII =</td>
<td>the net interest income for the period excluding any amortization of deferred gains or losses on hedged assets or liabilities divided by total assets</td>
</tr>
<tr>
<td>PLL =</td>
<td>the provision for loan losses during the period divided by total assets</td>
</tr>
<tr>
<td>SWAP =</td>
<td>a binary variable which is one if an institution uses interest rate swaps during the period and zero otherwise</td>
</tr>
<tr>
<td>TI =</td>
<td>a binary variable which is one if an institution was in conservatorship or receivership during the period or if an institution went into conservatorship or receivership during the following period, or one if an institution was placed in a management consignment program in the previous, current, or following period; otherwise the variable is zero</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>-0.15</td>
<td>-0.02539</td>
</tr>
<tr>
<td>-0.10</td>
<td>-0.02008</td>
</tr>
<tr>
<td>-0.05</td>
<td>-0.02002</td>
</tr>
<tr>
<td>0</td>
<td>-0.02403</td>
</tr>
<tr>
<td>0.05</td>
<td>-0.02804</td>
</tr>
<tr>
<td>0.10</td>
<td>-0.02798</td>
</tr>
<tr>
<td>0.15</td>
<td>-0.02267</td>
</tr>
</tbody>
</table>

The slopes in the table are computed as the partial derivative of the hedging accrual management model with respect to the capital ratio. These derivatives are then evaluated at five different points along the capital ratio spectrum for each time period.
TABLE 9

DESCRIPTIVE STATISTICS

COMMERCIAL BANK SAMPLE

\( n=1,432 \)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Assets</th>
<th>HAMT</th>
<th>RISK</th>
<th>CAPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6,580,342</td>
<td>0.13095</td>
<td>0.74475</td>
<td>0.07777</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>13,401,713</td>
<td>0.50767</td>
<td>0.17089</td>
<td>0.03082</td>
</tr>
</tbody>
</table>

The statistics given are for variables of interest used in the tests of commercial banks. The assets variable is stated in thousands of dollars. The variable definitions are as follows.

\textbf{ASSETS} = the total assets of the institution

\textbf{HAMT} = the outstanding positions in futures and options held by an institution divided by the firm's total assets

\textbf{RISK} = a credit risk-weighted measure of an institution's asset portfolio divided by the firm's total assets

\textbf{CAPR} = total core capital of the institution divided by the institution's total assets
**TABLE 10**  
**RESULTS OF THE HEDGING ACTIVITY TOBIT MODEL**  
**COMMERCIAL BANK SAMPLE**  

\[ HAMT_t = \alpha_0 + \alpha_1 CAPR_{t-1} + \alpha_2 CAPR_{t-2}^2 + \alpha_3 CAPR_{t-1}^3 + \alpha_4 CAPR_{t-1}^4 \]
\[ + \alpha_5 GAP_{t-1} + \alpha_6 TAX_{t-1} + \alpha_7 LIQUID_t + \alpha_8 INVSIZE_t + \epsilon_t \]

\[
\begin{array}{lll}
\text{Variable} & \text{Coefficient (p-value)} \\
\hline
\text{Intercept} & 0.34253 (.1695) \\
\text{CAPR} & 5.11960 (.4320) \\
\text{CAPR}^2 & -24.4560 (.6698) \\
\text{CAPR}^3 & 54.9090 (.7286) \\
\text{CAPR}^4 & -46.4070 (.7245) \\
\text{GAP} & 0.74098 (.0000) \\
\text{TAX} & 0.60624 (.2356) \\
\text{LIQUID} & -0.54386 (.0361) \\
\text{INVSIZE} & -19.8360 (.0000) \\
\end{array}
\]
TABLE 10 Continued

RESULTS OF THE HEDGING ACTIVITY TOBIT MODEL

COMMERCIAL BANK SAMPLE

n=1,432

<table>
<thead>
<tr>
<th>Wald test of $\alpha_2=\alpha_3=\alpha_4=0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$ Statistic</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The values given above are for the Wald test are the chi-squared statistic and the associated p-value. The variables used in the model are defined as follows.

CAPR = the institution's core capital divided by its total assets

GAP = the institution's assets maturing within one year less its liabilities maturing within one year divided by total assets

TAX = a binary variable which is one of the institution's prior period income before taxes fell into the progressive rage of the tax schedule and zero otherwise

LIQUID = an institution's holdings of cash and treasury securities divided by its total assets

INVSIZ = one divided by the total assets of the institution where total assets are stated in hundreds of millions of dollars
### TABLE 11
SLOPES OF THE CAPITAL RATIO VARIABLE IN THE HEDGING ACTIVITY MODEL
COMMERCIAL BANK SAMPLE

<table>
<thead>
<tr>
<th>Capital Ratio</th>
<th>Slopes</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.05</td>
<td>7.17659</td>
</tr>
<tr>
<td>0</td>
<td>5.11960</td>
</tr>
<tr>
<td>0.05</td>
<td>3.06261</td>
</tr>
<tr>
<td>0.10</td>
<td>1.69004</td>
</tr>
<tr>
<td>0.15</td>
<td>0.86266</td>
</tr>
<tr>
<td>0.20</td>
<td>0.44126</td>
</tr>
<tr>
<td>0.25</td>
<td>0.28660</td>
</tr>
</tbody>
</table>

The slopes in the table are computed as the partial derivative of the hedging activity model with respect to the capital ratio. These derivatives are then evaluated at five different points along the capital ratio spectrum for each time period.
TABLE 12
RESULTS OF THE RISK MANAGEMENT MODEL
COMMERCIAL BANK SAMPLE

\( n=1,432 \)

\[ RISK_i = \delta_0 + \delta_1 CAPR_{t-1} + \delta_2 CAPR^2_{t-1} + \delta_3 CAPR^3_{t-1} + \delta_4 CAPR^4_{t-1} + \delta_5 HAMT^**_i + e_{i,t} \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>(p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.47810</td>
<td>(.0000)</td>
</tr>
<tr>
<td>CAPR</td>
<td>3.95270</td>
<td>(.0001)</td>
</tr>
<tr>
<td>CAPR^2</td>
<td>-23.2610</td>
<td>(.0069)</td>
</tr>
<tr>
<td>CAPR^3</td>
<td>51.6800</td>
<td>(.0265)</td>
</tr>
<tr>
<td>CAPR^4</td>
<td>-39.4130</td>
<td>(.0339)</td>
</tr>
<tr>
<td>HAMT**</td>
<td>0.43161</td>
<td>(.0000)</td>
</tr>
</tbody>
</table>

F-test of \( \delta_2=\delta_3=\delta_4=0 \)

F-Statistic 11.4255 (.0000)

The variables are defined on the following page.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>RISK</td>
<td>a composite measure of an institution's portfolio risk which weights categories of assets by a</td>
</tr>
<tr>
<td></td>
<td>risk percentage and then sums the risk-weighted assets; the risk-weighting system used for the</td>
</tr>
<tr>
<td></td>
<td>commercial bank sample is the same one used by regulators in determining risk-based capital</td>
</tr>
<tr>
<td></td>
<td>requirements; the risk-weighted assets measure is divided by total assets</td>
</tr>
<tr>
<td>CAPR</td>
<td>core capital divided by total assets</td>
</tr>
<tr>
<td>HAMT**</td>
<td>the predicted value of the hedging amount from the first stage hedging amount model</td>
</tr>
</tbody>
</table>
**TABLE 13**

**SLOPES OF THE CAPITAL RATIO VARIABLE IN THE RISK MANAGEMENT MODEL**

**COMMERCIAL BANK SAMPLE**

<table>
<thead>
<tr>
<th>Capital Ratio</th>
<th>Slopes</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.05</td>
<td>5.91091</td>
</tr>
<tr>
<td>0</td>
<td>3.95270</td>
</tr>
<tr>
<td>0.05</td>
<td>1.99449</td>
</tr>
<tr>
<td>0.10</td>
<td>0.69325</td>
</tr>
<tr>
<td>0.15</td>
<td>-0.06928</td>
</tr>
<tr>
<td>0.20</td>
<td>-0.41132</td>
</tr>
<tr>
<td>0.25</td>
<td>-0.45111</td>
</tr>
</tbody>
</table>

The slopes in the table are computed as the partial derivative of the risk management model with respect to the capital ratio. These derivatives are then evaluated at five different points along the capital ratio spectrum for each time period.
### TABLE 14

**SCORE TESTS FOR NORMALITY OF THE ERROR TERMS IN THE TOBIT AND SAMPLE SELECTION MODELS**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobit</td>
<td>8,226</td>
<td>10,424</td>
<td>6,511</td>
<td>9,346</td>
<td>1,100</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>Sample Selection</td>
<td>26.416</td>
<td>10.207</td>
<td>15.000</td>
<td>1.0982</td>
<td>--</td>
</tr>
<tr>
<td>First Stage</td>
<td>(.0000)</td>
<td>(.0061)</td>
<td>(.0006)</td>
<td>(.5775)</td>
<td></td>
</tr>
<tr>
<td>Sample Selection</td>
<td>126,784</td>
<td>5,279</td>
<td>5,798</td>
<td>13,684</td>
<td>--</td>
</tr>
<tr>
<td>Second Stage</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td>(.0000)</td>
<td></td>
</tr>
</tbody>
</table>

The numbers given in the table are the chi-squared statistics from the score test and the related p-values.
TABLE 15

ROBUSTNESS CHECKS OF THE HEDGING ACTIVITY MODEL

1988 SAVINGS AND LOAN ASSOCIATION DATA SUBSAMPLE

\[ HAMT_i^* = \alpha_0 + \alpha_1 CAPR_{t-1} + \alpha_2 CAPR_{t-1}^2 + \alpha_3 CAPR_{t-1}^3 + \alpha_4 CAPR_{t-1}^4 + \alpha_5 GAP_{t-1} + \alpha_6 TAX_{t-1} + \alpha_7 LIQUID_i + \alpha_8 INVSIZE_i + \epsilon_{i,t} \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Maximum Nonparametric Ahn and Powell Likelihood First Stage</th>
<th>OLS Semiparametric Estimation Second Stage</th>
<th>Ahn and Powell Semiparametric Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Likelihood Estimation n=12,195</td>
<td>Nonparametric First Stage/O LS n=1,000</td>
<td>Ahn and Powell Semiparametric Estimation n=1,000</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.71632 (.0000)</td>
<td>10.6406 (.0001)</td>
<td>--</td>
</tr>
<tr>
<td>CAPR</td>
<td>0.96974 (.0000)</td>
<td>0.06911 (.1489)</td>
<td>1.64109 (.7047)</td>
</tr>
<tr>
<td>CAPR(^2)</td>
<td>-2.57870 (.0032)</td>
<td>-0.07311 (.6933)</td>
<td>-37.8583 (.4743)</td>
</tr>
<tr>
<td>CAPR(^3)</td>
<td>-6.18640 (.0000)</td>
<td>-0.01230 (.9555)</td>
<td>44.3400 (.9653)</td>
</tr>
<tr>
<td>CAPR(^4)</td>
<td>-3.02630 (.0000)</td>
<td>-0.00412 (.9179)</td>
<td>354.815 (.9124)</td>
</tr>
<tr>
<td>GAP</td>
<td>-0.15694 (.0178)</td>
<td>0.00812 (.7784)</td>
<td>-0.22532 (.6212)</td>
</tr>
<tr>
<td>TAX</td>
<td>-0.04691 (.1003)</td>
<td>-0.01894 (.1077)</td>
<td>0.24942 (.3004)</td>
</tr>
<tr>
<td>LIQUID</td>
<td>0.34605 (.0489)</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
### TABLE 15 Continued

<table>
<thead>
<tr>
<th>Variable</th>
<th>Maximum Likelihood Estimation n=12,195</th>
<th>Nonparametric First Stage/OLS Second Stage n=1,000</th>
<th>Ahn and Powell Semiparametric Estimation n=1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVSIZE</td>
<td>-0.27134 (0.0000)</td>
<td>-0.03351 (0.0001)</td>
<td>-5930.96 (0.1104)</td>
</tr>
<tr>
<td>Correction Term</td>
<td>--</td>
<td>-124.805 (0.0001)</td>
<td>--</td>
</tr>
</tbody>
</table>

The variables are defined as follows.

CAPR = the institution's total regulatory capital divided by its total assets

GAP = the institution's assets maturing within one year less its liabilities maturing within one year divided by total assets

TAX = one if the institution's prior period income before taxes fell into the progressive range of the tax schedule and zero otherwise

LIQUID = an institution's holdings of cash and treasury securities divided by its total assets

INVSIZE = one divided by the total assets of the institution, where assets are stated in hundreds of millions of dollars

The correction term is equal to the predicted value from the nonparametric first stage of the Ahn and Powell estimation method for the second and third estimation procedures given. The Ahn and Powell semiparametric estimation method does not estimate a coefficient for the correction term, so no coefficient is reported.

The LIQUID variable was dropped from the second and third estimation procedures shown so that the models are identified.
TABLE 16

ROBUSTNESS CHECKS OF THE HEDGING
ACCRUAL MANAGEMENT MODEL

1988 SAVINGS AND LOAN ASSOCIATION DATA SUBSAMPLE

\[ NL = \beta_0 + \beta_1 ACR_{t-1} + \beta_2 ACR^2_{t-1} + \beta_3 ACR^3_{t-1} + \beta_4 ACR^4_{t-1} + \beta_5 HAMT_t + \beta_p NII_t + \beta_p DLL_t + \beta_p SGL_t + \beta_p SWAP_t + B_{10} T_t + \epsilon_{1t}, \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Maximum Likelihood Estimation</th>
<th>Nonparametric First Stage/ OLS</th>
<th>Ahn and Powell Semiparametric Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=12,195</td>
<td>n=1,000</td>
<td>n=1,000</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.00548 (.0000)</td>
<td>-0.00001 (.9589)</td>
<td>--</td>
</tr>
<tr>
<td>ACR</td>
<td>-0.07955 (.0000)</td>
<td>0.00102 (.2967)</td>
<td>-0.04380 (.9636)</td>
</tr>
<tr>
<td>ACR^2</td>
<td>0.01073 (.7790)</td>
<td>-0.00337 (.0671)</td>
<td>-0.13321 (.9954)</td>
</tr>
<tr>
<td>ACR^3</td>
<td>0.53121 (.0012)</td>
<td>-0.00286 (.2075)</td>
<td>1.94342 (.9864)</td>
</tr>
<tr>
<td>ACR^4</td>
<td>0.51887 (.0026)</td>
<td>-0.00046 (.2677)</td>
<td>2.87094 (.9892)</td>
</tr>
<tr>
<td>HAMT</td>
<td>0.00612 (.0000)</td>
<td>0.00569 (.0001)</td>
<td>0.00239 (.9813)</td>
</tr>
<tr>
<td>NII</td>
<td>0.30819 (.0040)</td>
<td>-0.05337 (.0073)</td>
<td>-0.15496 (.8280)</td>
</tr>
<tr>
<td>PLL</td>
<td>-0.03654 (.0290)</td>
<td>-0.00170 (.5264)</td>
<td>-0.17668 (.6799)</td>
</tr>
</tbody>
</table>
TABLE 16 Continued

RESULTS OF THE HEDGING ACCRUAL MANAGEMENT
SAMPLE SELECTION MODEL

1988 SAVINGS AND LOAN ASSOCIATION SUBSAMPLE

<table>
<thead>
<tr>
<th>Variable</th>
<th>Maximum Likelihood Estimation n=12,195</th>
<th>Nonparametric First Stage/OLS Second Stage n=1,000</th>
<th>Ahn and Powell Semiparametric Estimation n=1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGL</td>
<td>-0.06436</td>
<td>0.04453</td>
<td>0.32216</td>
</tr>
<tr>
<td></td>
<td>(.5796)</td>
<td>(.1719)</td>
<td>(.5838)</td>
</tr>
<tr>
<td>SWAP</td>
<td>-0.00057</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>(.5128)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TI</td>
<td>-0.00141</td>
<td>-0.00015</td>
<td>0.02536</td>
</tr>
<tr>
<td></td>
<td>(.2454)</td>
<td>(.6843)</td>
<td>(.9921)</td>
</tr>
<tr>
<td>Correction term</td>
<td>-0.00068</td>
<td>0.00492</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>(.2479)</td>
<td>(.0106)</td>
<td></td>
</tr>
</tbody>
</table>

NL = the cumulative deferred net hedging losses at time t, which is the sum of deferred gains and losses on hedged assets and deferred gains and losses on hedged liabilities, divided by total assets; deferred losses are positive amounts, and deferred gains are negative amounts; thus the net amount is positive if it is a loss and negative if it is a gain.

ACR = the adjusted capital ratio defined as regulatory capital minus the net deferred hedging loss divided by total assets.

HAMT = the total notional principal amount of an institution's long and short positions in futures and options contracts outstanding divided by total assets.
TABLE 16 Continued

NII = the net interest income for the period excluding any amortization of deferred gains or losses on hedged assets of liabilities, divided by total assets

PLL = the provision for loan losses during the period divided by total assets

SWAP = a binary variable which is one if an institution uses interest rate swaps during the period and zero otherwise

TI = a binary variable which is one if an institution was in conservatorship or receivership during the period or if an institution went into conservatorship or receivership during the following period, or one if an institution was placed in a management consignment program in the previous, current, or following period; otherwise, the variable is zero

The correction term for the maximum likelihood estimates is equal to $\rho^*\sigma_\epsilon$. For the other two methods, the correction term is equal to the predicted values from the nonparametric first stage of the Ahn and Powell semiparametric estimation procedure. The Ahn and Powell semiparametric estimation procedure does not give a coefficient for the correction term, so no coefficient is given in the table.
APPENDIX B

CALCULATION OF THE RISK VARIABLE
The portfolio risk variable used in the risk management model for the banks and savings and loan associations is calculated using the risk weights assigned to various classes of assets in the federal regulators' calculation of risk-based capital. Risk-based capital requirements were phased in at banks and thrifts beginning December 31, 1989. Since all of the bank observations are from 1991, the risk-weighted assets measure is available as calculated by the Federal reserve on the commercial bank call reports. This aggregate measure is collected and used as the RISK variable for the bank sample. Since the S&L sample covers the years 1987 through 1991, risk-based capital measures are not available for all years for these institutions. Therefore, the RISK variable used for these institutions is the sum of specific types of investments multiplied by the risk-weighting assigned by risk-based capital guidelines.

The federal guidelines for risk-based capital for savings associations divide assets into five risk categories. To calculate risk-weighted assets, the total amount of assets in each category is multiplied by the risk percentage. The risk categories and assets within each category are as follows (McElhone, 1989/1990).

<table>
<thead>
<tr>
<th>Weighting</th>
<th>Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% Weighting</td>
<td>Cash, U.S. Treasury securities, and securities guaranteed by the U.S. Treasury (except mortgage securities)</td>
</tr>
<tr>
<td>20% Weighting</td>
<td>FHA-insured, VA-guaranteed mortgage loans, Freddie Mac and Fannie Mae mortgage securities, and high-quality nonagency mortgage securities</td>
</tr>
<tr>
<td>50% Weighting</td>
<td>Mortgage loans secured by one-to-four family homes, mortgage loans on multifamily properties, and other mortgage securities backed by qualifying mortgage loans</td>
</tr>
</tbody>
</table>
100% Weighting  
Delinquent loans (90 days or more) on one-to-four family residential loans, mortgage securities backed by nonqualifying mortgage loans, stripped mortgage securities, residual interests, purchased mortgage servicing, excess mortgage servicing, qualifying supervisory goodwill not excluded from the asset base, equity investments, nonresidential construction loans, land loans, consumer and commercial loans, nonqualifying mortgage loans, and all other assets

200% Weighting  
Real estate owned, and delinquent loans (90 days or more) other than loans on one-to-four family residential property

Since all of the information necessary to determine the exact category of some assets is not available, judgments were made as to which assets belonged in which categories.

The following items were classified into each of the given risk categories.

0% Weighting  
Cash and demand deposits, U.S. government and agency securities

20% Weighting  
Mortgage pool securities insured or guaranteed by an agency or instrument of the U.S., conventional privately-issued mortgage pool securities, state and municipal obligations, interest-earning deposits in Federal Home Loan Banks, and other interest-earning deposits

50% Weighting  
Construction loans and permanent mortgages on one-to-four family dwelling units and multifamily dwelling units, and other mortgage pool securities

100% Weighting  
Nonresidential construction loans and permanent mortgages, land loans, commercial loans, consumer loans, equity securities, mortgage derivative securities, and other investment securities and deposits

200% Weighting  
Real estate held for development, investment, or resale
The above categorizations classify the investment choices of the savings and loan sample into risk categories. The sum of the asset amounts multiplied by the applicable weight should produce a measure which is increasing in an institution's risk and which represents the investment choices made by the institutions' managers.
BIBLIOGRAPHY


