Derivatives and Corporate Risk Management: Participation and Volume Decisions in the Insurance Industry

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Abstract: In this paper we formulate and test a number of hypotheses regarding insurer participation and volume decisions in derivatives markets. Several specific hypotheses are supported by our analysis. We find evidence consistent with the idea that insurers are motivated to use financial derivatives to hedge the costs of financial distress, interest rate, liquidity, and exchange rate risks. We also find some evidence that insurers use these instruments to hedge embedded options and manage their tax bills. We also find evidence of significant economies of scale in the use of derivatives. Interestingly, we often find that the predetermined variables we employ display opposite signs in the participation and volume regressions. We argue that this result is broadly consistent with the hypothesis that there is also a per unit premium associated with hedging and that, conditional on having risk exposures large enough to warrant participation, firms with a larger appetite for risk will be less willing than average to pay this marginal cost.

JEL classification: G2, G3, L2

Key words: financial institutions and services, corporate finance and governance, firm objectives, organization and behavior

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Derivatives and Corporate Risk Management:
Participation and Volume Decisions in the Insurance Industry

This paper examines factors that influence the use of financial derivatives in the U.S. insurance industry. We investigate rationales that might explain both the decision to use derivatives as well as the volume of these transactions. The principal objective is to empirically investigate the general motivations for corporate risk management as well as several more specific hypotheses relating to the insurance industry. In our empirical analysis, we take advantage of the disclosure requirements imposed on insurers by state regulators that provide detailed information on individual holdings and transactions in derivatives markets.

The use of derivatives in corporate risk management has grown rapidly in recent years, fueled in part by the success of the financial industry in creating a variety of over-the-counter and exchange-traded products. A 1995 survey of major non-financial firms revealed that at least 70 percent are using some form of financial engineering to manage interest rate, foreign exchange, or commodity price risk (Wharton-Chase, 1995). Financial firms, including banks (see, for example, Gunther and Siems, 1995, and Shanker, 1996), savings and loans (Brewer, et al., 1996), and insurers (Colquitt and Hoyt, 1995, Cummins, Phillips, and Smith, 1997), also are active in derivatives markets. Although the types of risks confronting managers vary somewhat across industries, there is substantial commonality in the underlying rationale for the use of derivatives and the financial engineering techniques that are employed.

At first glance, modern finance theory provides little motivation for hedging by widely held corporations. According to theory, shares of such corporations are held by diversified investors who, operating in frictionless and complete markets, eliminate non-systematic risk through their portfolio choices. In this context, risk management at the firm level is a dead-weight cost that destroys shareholder value. Although valuable as a starting point, this frictionless theory of finance has given way in recent years to a richer set of hypotheses whereby various market imperfections, incentive conflicts, and information asymmetries create motivations for even value maximizing corporate managers to alter the risk/return profile of the firm.[1] Alternatively, managerial risk aversion, incentive conflicts between managers and owners, and related factors may also lead to a demand for risk management activities that conflict with value maximization.[2]

In the first category, firms, faced with costly frictions, are hypothesized to manage risks to the benefit of shareholders. Examples of these frictions include bankruptcy and bankruptcy related costs, such as legal and court costs. More generally, firms that encounter financial difficulty can experience increased costs of borrowing and reputational loss that can affect relationships with employees, suppliers, and customers. Other examples would include firms whose cash flows are adversely affected by contingencies that, left unhedged, may force managers to forego profitable investment projects for lack of affordable capital. The convexity of the corporate income tax schedule provides another potentially value-increasing motivation for corporate hedging.

Hedging that arises from managerial risk aversion, on the other hand, is likely to reduce firm value. Managers may behave in a risk averse manner, taking less risk than would be optimal for the firm's owners, because their human capital and wealth are poorly diversified. Such lack of diversification can result from managers having, for example, firm-specific human capital that results in a relatively large proportion of the firm's stock being held by managers. These factors are especially likely to have an adverse effect if managerial compensation arrangements are poorly designed. Another managerial motivation for hedging involves the use of risk management to signal managerial skill in the presence of asymmetric information (Breedon and Viswanathan, 1996, DeMarzo and Duffie, 1995).

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[1]For more extensive discussions of the rationale for corporate risk management, see Smith and Stulz (1985), Froot, Scharfstein, and Stein (1993), Stulz (1996), and Tufano (1996).

[2]See Smith and Stulz (1985), Stulz (1996), and Tufano (1996).

Prior research suggests that the factors motivating corporations in general to manage risk are also important in the insurance industry (Cummins and Lamm-Tennant, 1993, Babbel and Santomero, 1997). As financial intermediaries with relatively long-term assets and liabilities, life insurers are subject to significant interest rate risk. They are also subject to liquidity risk due to their heavy investment in illiquid privately placed securities and real estate investments (including mortgages) as well as the embedded options in many insurance policies that permit buyers to withdraw funds in response to interest rate changes and other economic fluctuations. Default risk also has the potential to affect life insurer cash flows. While property liability insurers face some of the same risks as life insurers, they are also subject to extremely volatile cash outflows due to liability lawsuits and property catastrophes such as hurricanes and earthquakes. Both types of insurers face exchange rate risk due to the increasing internationalization of insurance and financial markets. Regulatory intervention, including recently introduced risk based capital requirements, may also provide a motivation for risk management (see Cummins, Harrington, and Niehaus, 1994).

As noted earlier, managerial risk aversion and incentive issues may also be important practical rationales for risk management in the insurance industry. A substantial proportion of the firms in the industry are closely held stocks and mutual companies, where managers are likely to exhibit risk aversion because of suboptimal diversification of personal wealth, organization specific capital, and/or the absence of effective mechanisms for owners to use as disciplining devices.

In this paper, we develop a set of hypotheses regarding the hedging behavior of insurers, specify variables to represent the hypotheses, and then perform tests on a sample of life and property-liability insurers. The sample consists of all U.S. life and property-liability insurers reporting to the National Association of Insurance Commissioners (NAIC). The data on derivatives positions are taken from Schedule DB of the 1994 annual regulatory statements filed by insurers with state regulators. We investigate both the decision to conduct derivatives transactions and the volume of transactions undertaken by firms who enter derivatives markets. Unlike many earlier studies, our data allow us to identify virtually all derivatives transactions across instruments. This, in turn, allows us to observe the portfolio of derivative securities; presumably, the relevant choice variable for optimization purposes. However, we clearly build on earlier theory and econometric techniques that have provided evidence on the determinants of derivative participation by nonfinancial firms (Nance, Smith, and Smithson, 1993, Fenn, Post and Sharpe, 1996, and Tufano, 1996), banks (Sinkey and Carter, 1995, Gunther and Siems, 1995), and insurers (Colquitt and Hoyt, 1995, and Cummins, Phillips, and Smith, 1997).

In this paper, we extend work in the insurance area by explicitly specifying hypotheses about the demand for hedging by insurers, defining a number of new variables to test these hypotheses, and devoting more attention to testing hypotheses related to cross-sectional variation in the volume of derivatives transactions as well as analyzing the participation decision. In particular, we extend the work of Colquitt and Hoyt (CH) (1995) in a number of dimensions. Whereas CH base their analysis on life insurers licensed in Georgia, our sample includes the universe of insurers reporting to the NAIC. Thus, we analyze a more comprehensive sample and study derivatives usage by both life insurers and property-liability insurers. In addition, while CH use a Tobit analysis to analyze the extent of participation of insurers in derivatives markets, we use a generalization of this approach, due to Cragg (1971), that permits the relationship between explanatory variables and the decision to use derivatives to differ from that linking these variables to the volume of derivatives transactions. This is particularly important if there is reason to believe, as we later argue, that there may be specific economic reasons why one would want to allow such flexibility in the estimation technique. We also extend the work in CPS and CH by identifying economic rationales for cross-sectional variation in the volume of derivatives activity across organizations and by investigating some hypotheses concerning the economic relationship between the participation and volume decisions on the part of insurers.

The remainder of the paper is organized as follows: Section I formulates hypotheses and specifies variables to be used in the empirical tests. Section II describes the sample and explains our estimation methodology. The results are presented in section III, and section IV concludes.

I. Hypothesis Formulation

As mentioned above, there are two primary, non-mutually exclusive, classes of theories about the motivations for corporate risk management — maximization of shareholder value and maximization of managerial utility. This section provides a more complete discussion of the theories and specifies variables to test hypotheses concerning rationales for risk management for this sample of insurance firms.

We start by assuming that hedging is not costless, either in terms of fixed or variable costs. In particular, we recognize that, absent any fixed costs of setting up derivatives activities and obtaining expertise in their management, almost all insurers would have some non-zero positions in these additional markets for managing risk. Thus, if the participation decision is driven by these fixed costs, we would argue that only firms with high enough levels of risk exposure, for example, due to a high tolerance for risk per unit of expected return, would find it worthwhile to enter the derivatives market. However, conditional on being active in derivatives, firms/managers with high appetites for risk will demand, ceteris paribus, lower quantities of derivatives positions to the extent that each additional unit imposes additional marginal costs in the form of risk premiums (i.e., hedge less at the margin). It follows, according to this hypothesis, that certain measures of risk may have opposite signs in the participation vs. value regressions. With this general idea in mind, we now turn to specific rationales that have been provided for why insurance corporations may choose to engage in risk management.

Shareholder Value Considerations:

Financial Distress. One important theory of corporate risk management is that firms engage in hedging activities to avoid the costs of financial distress. In addition to the direct costs resulting from bankruptcy e.g., legal fees and court costs, shareholders also face costs arising prior to bankruptcy. These include such factors as reputational loss that may affect the firm's ability to retain its relationships with key employees, customers, or suppliers.

The hypothesis that firms engage in risk management to avoid nontradable costs associated with financial distress seems particularly applicable to the insurance industry. Insurers are subject to stringent solvency regulation by the states that includes detailed reporting requirements, computerized audit ratio tests, extensive site audits, and the recently adopted risk-based capital standards (Klein, 1995). Insurance commissioners can and do sometimes seize control of financially troubled insurers long before the value of assets falls below the value of liabilities. Even prior to seizure, commissioners can impose restrictions on firm growth and on the composition of asset portfolios. Indeed, the risk-based capital laws now in effect in all states require commissioners to take specified actions when a firms risk-based capital ratio, defined as the ratio of actual capital to risk-based capital, falls below certain thresholds. Such actions will reduce the value of the owners' interest in the firm and may ultimately result in the company being seized and liquidated.[3]

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[3]If actual capital falls between 150 and 200 percent of risk-based capital, the commissioner has the obligation to require the insurer to present a business plan indicating actions the firm will take to improve its financial position. If actual capital falls between 150 and 100 percent of risk-based capital, the commissioner must examine the company and institute corrective action if necessary. When actual capital falls between 100 percent and 70 percent of risk-based capital, the commissioner is authorized to rehabilitate or liquidate the company; and when actual capital falls below 70 percent of risk-based capital, the commissioner is required to seize control of the company (see Cummins, Harrington, and Niehaus, 1994).

We specify several variables to capture the effects of potential distress costs on the participation and volume decisions of insurers. The first is the firm's capital-to-asset ratio. The rationale is that firms with high capital-to-asset ratios are less likely to experience financial distress because they hold adequate capital to cushion the firm against adverse loss or investment shocks (Stulz, 1996). In this sense, equity capital serves as a substitute for hedging as a way to avoid the costs of financial distress. We expect an inverse relationship between the capital-to-asset ratio and the decision to engage in derivatives transactions. However, as noted earlier, conditional on having a high enough risk exposure to make derivatives activities worthwhile, firms with a bigger appetite for leverage may find it less appealing to pay the marginal cost of hedging additional units, resulting in a lower than average level of derivatives activity for these firms.

A second variable we specify to measure the effects of distress costs pertains directly to the risk-based capital system. This variable is a dummy variable equal to 1 if the highest risk-based capital threshold is binding, i.e., if a firm's capital is less than 200 percent of its risk-based capital.[4] A continuous version of this variable equal to the insurer's actual risk-based capital ratio also is tested. The expected signs of the risk-based capital variables are ambiguous. The earlier discussion suggests a positive sign on the risk-based capital dummy variable and a negative sign on the risk-based capital ratio. However, opposite signs are also possible, either because the insurer is experiencing financial difficulties, or because it refrains from hedging to avoid additional regulatory costs. The latter effect could arise if insurance regulators are skeptical of the use of derivatives by insurers, believing that derivatives tend to be used for speculation**.**

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[4]We also tested dummy variables for the more stringent (lower) risk-based capital thresholds. These variables did not perform well because few insurers fall below the lower thresholds.

A third financial distress variable that we consider is the ratio of preferred capital stock and surplus notes to total assets.[5] The rationale is that the use of such subordinated claims is a substitute for hedging (Sinkey and Carter, 1994, Dolde, 1996). The predicted sign on this variable is negative since the economic logic is similar to that used in the discussion of the capital/asset ratio.

To test the hypothesis that reputation plays a role in risk management, we specify a dummy variable equal to 1 if the insurer primarily distributes its products through insurance brokers rather than through a tied (exclusive) distribution network. The logic here is that brokers have relationships with more than one insurer and thus can direct business to a variety of sources. Such independent distributors tend to be extremely sensitive to the financial condition of insurers in order to serve their customers and to avoid "errors and omissions" lawsuits. In addition, such distributors are knowledgeable and sophisticated in interpreting information concerning financial conditions. Insurers using the independent distribution channel are thus expected to be more likely to engage in corporate risk management in order to avoid reputational costs, than are insurers using the exclusive distribution channel. We test this hypothesis by including a dummy variable equal to 1 if the insurer uses the brokerage distribution channel and equal to zero otherwise. We expect this variable to be positively related to the use of derivatives.

Interest Rate Risk and Investment Portfolio Structure. Like other financial intermediaries, insurers issue a variety of debt claims and invest the proceeds in financial assets. The data suggest that both life and property-liability insurers tend to have positive equity duration gaps, with the duration of assets exceeding the duration of liabilities (Staking and Babbel, 1995, Cummins and Weiss, 1991). There is also evidence that insurers seek to hedge the resulting duration and convexity risk (Babbel and

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[5]We refer here to the insurer's own preferred stock rather than to preferred stock held as an asset by the insurer. Surplus notes are a financial instrument similar to preferred stock that mutual insurers are permitted to use as capital, subject to advance approval by the regulator.

Santomero, 1997). To capture the effects of hedging activities designed to manage interest rate risk, we specify a proxy for duration gap variable that is equal to the difference between the weighted average maturity of insurer assets and liabilities.[6] We expect a positive relationship between our proxy for the duration gap and the use of derivatives.

Although both life and property-liability insurers invest the majority of their funds in high-grade, publicly-traded bonds, they also invest in assets with higher default risk, return volatilities and/or lower liquidity. Clearly, insurers might desire to hedge part of these default/volatility/liquidity risks. For example, investments in real estate may expose insurers to more price and liquidity risk than they would like to retain. Some life insurers also invest heavily in privately placed bonds and mortgages, which are subject to liquidity risk and often contain embedded options. Moreover, both life and property-liability insurers invest in collateralized mortgage obligations (CMOs), which expose them to similar risks.

To capture hedging activities relating to asset risk, we include in our analysis the proportion of insurer assets invested in relatively risky (in terms of price and/or liquidity measures) classes of assets. Specifically, we include separate variables that measure the proportion of assets invested in stocks, real estate, privately placed bonds, and both private and publicly traded CMOs. These variables are expected to be positively related to the use of derivatives.

With the increasing internationalization of financial markets, insurers have begun to invest more heavily in foreign securities, either as a hedge against foreign liabilities or simply to enhance portfolio diversification and take advantage of attractive yields. Although insurers are sophisticated portfolio managers, we have no reason to believe that they have a comparative advantage in managing exchange

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[6]Maturity is used here as a proxy for duration because the regulatory statements do not provide enough information to calculate duration.

rate risk. Accordingly, they may decide to hedge this component of the risk of investing in foreign securities or holding foreign liabilities.

We use several variables to test the hypothesis that insurers use derivatives to manage exchange rate risk. The first measures the proportions of assets in non-U.S. and non-Canadian stocks and bonds. Other proxies for foreign risk exposure include a dummy variable, set equal to 1 if the insurer has foreign liabilities and equal to zero otherwise, and an interaction variable equal to the product of the foreign liabilities dummy variable and the ratio of foreign bonds and stocks to total assets. A dummy variable set equal to 1 if the insurer has any foreign assets and zero otherwise is also tested along with the interaction between this dummy variable and the dummy variable for exposure to foreign liabilities. We expect a positive relationship between the foreign exposure variables and the use of derivatives. A negative relationship is expected between the asset/liability interaction variables and the use of derivatives since holding both foreign assets and foreign liabilities creates a natural hedge against exchange rate risk that may substitute for hedging through the use of foreign exchange derivatives.

Certain classes of liabilities also potentially expose insurers to abnormal risks. For life insurers, these include group annuities and individual life insurance and annuities. Group annuities are held by sophisticated institutional investors such as corporate pension plans, which are generally believed to be highly sensitive to both yields and insurer financial ratings. Individual life insurance and annuities are relatively long maturity contracts that contain numerous embedded options and are particularly sensitive to changes in interest rates. Property-liability insurers also issue relatively long-maturity liabilities in the commercial casualty lines such as general liability and workers' compensation insurance.

To capture the effects of liability risk on the use of derivatives, we separately include the proportions of reserves in individual life insurance and annuities and in group annuities in the life insurer analysis. These variables are expected to be positively related to the use of derivatives. For property-liability insurers, we include as a variable the proportion of premiums written in commercial liability (except products liability) and workers' compensation insurance and separately include the proportion of premiums written in products liability insurance. Products liability insurance is included separately because losses from this line of business are subject to unusually high volatility. Thus, insurers with a relatively high exposure to products liability may have an especially strong incentive to hedge to the extent they believe that there exist financial securities that can be used to hedge these types of risks. The commercial liability/workers' compensation variable and the products liability variable are expected to be positively related to the use of derivatives if the risk of these lines of business motivates insurers to hedge. On the other hand, because these lines have relatively long payout-tails, they provide a natural hedge against the duration risk of long-term assets held by insurers and thus may reduce somewhat the need to manage interest rate risk through derivatives transactions (Cummins, Phillips, and Smith, 1997).

Life insurers issue another type of debt claim, guaranteed investment contracts (GICs), similar to structured notes, that are purchased primarily by institutional investors. GICs are yield sensitive and contain embedded options that are likely to be exercised in response to changes in interest rates and other economic fluctuations. Insurers are well aware of the risks of issuing GICs,[7] as well as the increasing sensitivity of GIC investors to insurer financial quality (Liscio, 1990). Accordingly, we expect an insurer's GIC exposure to be positively related to the use of derivatives; and we test this hypothesis using the ratio of GIC's to total reserves.

The Underinvestment Problem. The classic underinvestment problem was first identified by Myers (1977). The basic argument is that the presence of debt in the firm's capital structure can lead firms to forego positive net present value projects if the gains primarily augment the value of the firm's

[7]The near-insolvency of Equitable Life following its loss of nearly $1 billion due to unhedged GIC contracts was a clear case in point (Finn, 1988).

debt. The underinvestment problem is more likely to occur in firms that are relatively highly leveraged, providing a motivation for firms to hedge to avoid shocks to equity that result in high leverage ratios. A related problem, identified by Froot, Scharfstein, and Stein (1993) arises if external funds are more costly than internal funds, due to, say, information asymmetries between insiders and outsiders. Firms may hedge to reduce the variability of their income stream and thus help to ensure that adequate internal funds are available to take advantage of attractive projects.

Researchers often use growth rates to proxy for the presence of investment opportunities that might motivate a firm to hedge. However, the growth rate variables we tested (growth in premiums and assets) were not statistically significant. For life insurers, we are able to specify a unique variable to serve as a proxy for growth opportunities (or, rather, the lack thereof). This variable is the proportion of an insurer's new premium volume that arises from the reinvestment of policyholder dividends and coupons from existing policies. The argument is that firms that have a relatively high proportion of revenues from existing policies rather than new policy sales are lacking in growth opportunities. We expect this variable to be inversely related to the use of derivatives. No comparable variable is available for property-liability insurers.

Taxes. Smith and Stulz (1985) argue that the presence of a convex income tax schedule provides a motive for corporate hedging. With a convex tax schedule, firms can minimize taxes and enhance firm value by reducing the volatility of earnings, thus providing a motivation for risk management. The corporate tax schedules affecting both life and property-liability insurers have convex segments, and property-liability insurers, in particular, are known to engage in especially active tax management (Cummins and Grace, 1994).

Because the amount of information insurers disclose to regulators on Federal income taxation is very limited, we are not able to test variables commonly used in the existing literature such as the amount of unused tax loss carryforwards (e.g., Nance, Smith, and Smithson, 1993). However, we are able to specify dummy variables to proxy for insurers' tax positions. We specify a dummy variable equal to 1 if the insurer paid no Federal income tax in 1994 and 0 otherwise; and analogous variables are specified for 1992 and 1993. The expected signs of these variables are ambiguous. On the one hand, not paying taxes may indicate the presence of tax loss carryforwards that the insurer risks losing if it does not generate positive taxable income. This rationale would predict positive signs for the "no tax" dummy variables. On the other hand, if the insurer has been paying little or nothing in taxes, it may indicate that it does not expect to pay taxes in the future and hence does not have a tax motivation for engaging in hedging activities.

A second variable designed to capture the effects of tax-induced hedging is a dummy variable equal to 1 if the insurer's ratio of incurred Federal income taxes to pre-tax income is between zero and 25 percent and equal to zero otherwise. This variable is designed as an indicator for insurers that are in the convex segment of the tax code, between the alternate minimum tax (AMT) rate (20 percent) and the regular corporate tax rate (34 percent).[8] This "AMT" dummy variable is expected to have a positive relationship with the use of derivatives.[9]

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[8]The 25 percent threshold was chosen somewhat arbitrarily because we do not actually know which insurers are paying the AMT and which are paying taxes at the regular rate. Because insurers do not provide information on tax loss carryforwards, insurers paying the regular tax rate could have ratios of incurred taxes to income that are less than 34 percent. Experimentation with a few other reasonable thresholds, such as 20 percent and 15 percent, indicate that the results are not sensitive to the choice of a threshold in the 15 to 25 percent range.

[9]We also tested a continuous tax variable equal to the ratio of taxes incurred to net income before taxes. This variable was never statistically significant and was eliminated from the models reported in the paper.

The Maximization of Managerial Utility

We argue that mutual insurance companies are likely to be more affected by incentive conflicts between managers and owners than are stock companies. The mutual ownership form does not provide effective mechanisms that owners can use to control and discipline managers, such as the alienable claims, voting rights in elections for directors, and the proxy and takeover fights available to the owners of stock companies. Thus, mutual managers are more free to follow their own objectives to a greater degree than the managers of stock firms and are more likely to behave as utility, rather than value, maximizers.[10]

Mutual managers may also be more likely to behave in a risk averse manner precisely because mutuals do not have stock. Thus, the opportunities to structure management compensation systems (such as stock option plans) that reward managers for maximizing value are very limited in the mutual ownership form. If managers of mutuals exhibit utility maximizing behavior, they are likely to engage in derivatives transactions for reasons other than value-maximization. Thus, mutual managers may engage in more derivatives activity than might be desirable from the owners' perspective.

To test for the potential effect of managerial risk aversion on hedging behavior in the insurance industry, we specify a dummy variable equal to 1 if the company is organized as a mutual insurance

[10]For this reason, it is often argued that mutuals are likely to be most successful in lines of insurance which require relatively low managerial discretion in underwriting, pricing, and claims settlement. When little managerial discretion is required to operate the business, the owner-policyholders are better able to monitor the performance of managers and managers have less latitude to pursue their own objectives at the expense of the owners'. Conversely, stocks are expected to be more successful in lines of insurance where more managerial discretion is required because it is easier for owners to monitor and control managers in the stock ownership form. A significant amount of empirical support for this managerial discretion hypothesis has been provided in the prior literature (e.g., Mayers and Smith, 1988, 1990).

company and equal to zero otherwise. We expect this variable to be positively related to the use of derivatives.

Other Variables

We expect firm size to be related to derivatives activity. Size will be positively correlated with derivatives activity if there are significant economies of scale in human capital investment and derivatives trading (Booth, Smith and Stolz, 1984, Hoyt, 1989) and if derivatives operations require significant investments in computer hardware and software (Stulz, 1996). However, these scale economies, if they exist, may be offset by the fact that larger insurers may be more diversified and therefore in less need of derivatives contracts as additional risk management tools. Our overall expectation is that information and transactions cost economies of scale will dominate any built in diversification benefits, resulting in greater usage by larger insurers. The variable used to test for the size effect is the natural logarithm of total assets.

Another scale-related variable included in our analysis is a dummy variable set equal to 1 if the insurer is a member of a group of insurers where at least one other member of the group is active in derivatives trading and to zero otherwise.[11] If one member of the group is involved in derivatives trading, then the marginal cost of other group members taking advantage of these risk/return opportunities is declining to the extent that each member of the group rationally does not duplicate these fixed costs. We expect this dummy variable to be positively related to the use of derivatives.

[11]The reasons for conducting our tests with the company rather than the group as the unit of observation are explained below.

A dummy variable is also included for unaffiliated single companies.[12] Unaffiliated insurers may engage in more risk management through derivatives trading than insurers that are members of groups because unaffiliated companies forfeit a source of diversification by not being organized as a group. An insurance group is similar to a portfolio of options, worth more to the owners than an option on a portfolio. Under corporate law, the creditors of an insolvent subsidiary cannot reach the assets of other members of the group unless they are successful in "piercing the corporate veil," which usually requires a finding of fraud or similar wrong-doing by the group's owners. Thus, we expect the unaffiliated company variable to be positively related to the use of derivatives.

Although derivatives are a recent tool for risk management by most insurers,[13] they have long used reinsurance as a way of hedging underwriting risk. More recently, insurers have used financial reinsurance to hedge their exposure to, for example, interest rate and market risk (Tiller and Tiller, 1995**)**. If there is a significant relationship between underwriting risk and returns in financial markets, then reinsurance designed to reduce underwriting risk might serve as a substitute for derivatives activities. Financial reinsurance is more likely to be a substitute for transactions in financial derivatives, but this type of reinsurance is a relatively recent product that is imperfectly proxied by our reinsurance variable. On the other hand, reinsurance and financial derivatives might be complements if insurers that engage in hedging of underwriting risk are also more likely to hedge financial risk. We account for the

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[12]Thus, the excluded category not represented by the group affiliate dummy and unaffiliated single company dummy variable consists of members of groups where at most one group member is active in derivatives.

[13]Lehman Brothers (1994) reports that some of the more sophisticated insurers have been using derivatives for more than twenty years. However, only a few large insurers fall into this category.

use of reinsurance by including in our regressions the ratio of ceded reinsurance premiums written to direct premiums written plus reinsurance assumed.[14]

II. Data and Methodology

The Data

Our data come from Schedule DB of the 1994 regulatory annual statements filed by insurers with the National Association of Insurance Commissioners. Parts A through D of Schedule DB list individual transactions across four general categories of derivatives; (A) options, caps and floors owned, (B) options, caps and floors written, (C) collar, swap and forward agreements, and (D) futures. In part E of schedule DB, insurers are required to report their year-end counterparty exposure for all the contracts contained in sections A through D. The explanatory variables used in our analysis also are taken from the 1994 NAIC regulatory statements.

The sample of insurers we analyze initially consisted of all life and property-liability companies that filed regulatory annual statements with the National Association of Insurance Commissioners for report-year 1994, a total of 1,760 life insurers and 2,707 PC insurers. Initial screening resulted in the elimination of firms with zero or negative assets, premiums, or surplus (equity) and firms that lack adequate group affiliation identifiers. The screening criteria resulted in the elimination of a large number of very small firms (in the aggregate they account for only 2.2 percent of industry assets). The final sample consists of 1,204 life insurers and 1,664 PC insurers.

Many insurers are members of groups that operate under common ownership. Because members of groups are likely to share common financial strategies and, in many cases, common investment departments, we considered analyzing firms at the group level as well as the individual company level.

[14]This measure of reinsurance is also used by Colquitt and Hoyt (1995) and Mayers and Smith (1990).

However, Cummins, Phillips, and Smith (1997) found that the group level analysis provided virtually no information concerning the participation decision not provided by the company level analysis and, in fact, some interesting information was lost as a result of aggregating individual companies into groups. Consequently, we report only the company-level analysis in this paper.

Methodology

In this paper, we analyze the factors affecting the decision by insurers to enter the market for derivatives as well as the factors affecting the volume of transactions undertaken. We use probit analysis to study the participation decision — the same approach used for this purpose by Colquitt and Hoyt (1994) and Cummins, Phillips, and Smith (1997). The dependent variable is set equal to 1 if an insurer had any derivatives activity during 1994 or reported derivatives holdings at year end 1994 and equal to zero otherwise. The explanatory variables are those formulated above to test our hypotheses. A positive sign on an explanatory variable in the probit analysis implies that the variable is associated with a higher than average propensity for insurers to use derivatives and vice versa if the variable carries a negative sign.

To analyze the volume of derivatives transactions, we adopt two approaches. The first is a Tobit analysis. In Tobit analysis the dependent variable is equal to zero if an insurer does not use derivatives and equal to the volume of derivatives transactions if the insurer does use derivatives. We use notional amounts to measure the volume of derivative transactions.[15] Tobit analysis is a standard procedure for dealing with censored dependent variables, where the variable is continuous for some observations but equal to zero (or some other constant) for others.

[15]We are aware that notional volume is, at best, an imprecise measure of the economic value of these activities. However, to the extent the measurement error is uncorrelated with the explanatory variables, our estimates will remain unbiased.

A criticism of Tobit analysis is that it measures the participation decision and the volume decision simultaneously, i.e., it forces variables to have the same signs with respect to the decision to participate and the volume of transactions, given that participation takes place. To the extent that there are reasons, like those noted earlier, why some variables in the participation and volume regressions should have opposite signs, the Tobit model would be mis-specified. Consequently, we also utilize a generalization of the Tobit model, due to Cragg (1971), that does allow different parameter values for the participation and quantity decisions.

Cragg's framework is quite general and allows a variety of assumptions concerning the underlying probability distributions entering into the participation and quantity decisions. Here we adopt an approach, used previously by Gunther and Siems (1995), that assumes a normal distribution model for the participation decision and a lognormal distribution for the quantity decision, conditional on the fact that the firm is participating in this market. The resulting likelihood function is

$$L = \prod_{i=1}^{N} [1 - \Phi(\beta' X_i)]^{(1-I_i)} [\Phi(\beta' X_i) f(y_i | y_i > 0)]^{I_i}$$

$$\text{where} \quad f(y_i | y_i > 0) = (\sigma y_i)^{-1} (2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}\frac{(\ln y_i - \gamma' X_i)^2}{\sigma^2}}, \quad y_i > 0$$

I_i is an indicator variable equal to 1 if the insurer uses derivatives and zero otherwise, β and γ are parameter vectors, y_i is the volume of derivatives used by insurer i, and X_i is a vector of independent variables for insurer i. The model is equivalent to estimating a probit model for the participation decision and a lognormal regression model for the volume decision. The two parts of the model (parameter vectors) can be estimated separately. It is also possible to conduct a likelihood ratio test of the appropriateness of the Tobit model assumption that the participation and quantity decisions can be modeled using the same coefficients. Results from these tests are reported and discussed in the next section.

III. Estimation Results

Descriptive Statistics

Summary statistics on usage, by asset quartile, are shown in Table 1. Overall, about 9.9 percent of life insurers and 6.7 percent of property-liability insurers use derivatives. However, usage is much more widespread in the largest size quartile, where 31.1 percent of life and 20.1 percent of property-liability insurers are active in derivatives markets.

Summary statistics for the remaining variables appearing in our models are presented in Table 2. The average notional amounts of derivatives transactions during the year by life insurers is $1.7 billion, while the average notional amount of transactions for property-liability insurers is much less, only about $300 million. Clearly, life insurers are, on average, bigger players in derivatives markets than their property-liability counterparts.

Table 2 also contains data on the means of the independent variables for derivatives users and non users, by insurer type, as well as t-tests for the significance of the differences between the means of the variables for users and non-users. Most of the explanatory variables have significantly different means for users and non-users. For example, both life and property-liability insurers that use derivatives are significantly larger than their non-user counterparts.

Life insurers engaged in derivatives activities have significantly higher than average proportions of their assets in stocks, CMOs, privately placed bonds, and foreign securities. Life insurance users also have significantly higher proportions of group annuities and GICs on their balance sheets than do non-users, and users have larger duration gaps than non-users. The direction and significance of these mean differences are consistent with our hypothesis that life insurers are using derivatives to hedge interest rate risk, volatility risk, liquidity risk, and exchange rate risk. Life insurers who are derivatives users have lower capital-to-asset ratios than non-users but are less likely to have risk-based capital ratios less than 200 percent.[16] Life insurance users are significantly less likely than non-users to have incurred a Federal tax liability in 1993 and 1994. Finally, users are more likely to be mutuals, less likely to be unaffiliated companies, and more likely to have another affiliated company that is active in derivatives markets.

Property-liability insurers that use derivatives have higher proportions of their assets in stocks, real estate, and foreign stocks and bonds than non-users. Users write less of their premiums in commercial casualty insurance (other than products liability) but write more of their premiums in the products liability line than do the non-users. As in the case of life insurers, property-liability users have larger duration gaps and lower capital-to-asset ratios than non-users. Property-liability users of derivatives are more likely to be in the AMT range of the tax schedule than non-users. Overall, the descriptive statistics provide suggestive evidence in support of many of our hypotheses; in particular the hypothesis that firms with above average risk exposure, relative to overall population of insurers, will find it beneficial to pay the fixed cost of becoming active participants in the market for derivative securities.

Table 3 provides some descriptive data on the types of derivatives used by life and property-liability insurers during 1994. The table shows statistics on the transactions volume during the year, where, as noted earlier, transactions volume is measured by notional amounts.[17] For life insurers the transactions volume tends to be concentrated in bond and interest rate derivatives, as expected if insurers

[16]The capital-to-asset ratio is known to be negatively related to size. We control for this correlation in our probit, Tobit, and Cragg models by including a measure of size as an exploratory variable.

[17]For further information, including year-end totals and counterparty exposure, see Cummins, Phillips, and Smith (1997).

are using derivatives to hedge the duration and convexity risk inherent in their balance sheets. Life insurers also exhibit considerable activity in foreign exchange derivatives, particularly futures, forwards, collars, and swaps. Property-liability insurers are most active in foreign currency derivatives but also trade substantial amounts of bond, interest rate, and equity derivatives. We now turn to the regression results. In each case, we first discuss the equations capturing the decision to participate in derivatives markets and then turn to the analysis of the volume regressions.

Multi-Variate Results: Life Insurers

The Tobit and Cragg estimation results for life insurers are presented in Table 4. The table shows Tobit results as well as the probit and lognormal regression models estimated as part of the Cragg analysis. Two sets of equations are shown. The second set (presented in the right hand side of the table) differs from the first only in its exclusion of some of the insignificant variables. Because the results in the two sets of runs differ only slightly, we focus on the set with the complete list of explanatory variables, i.e., the set of equations shown in the left hand side of the table.

The Participation Decision. The same variables are statistically significant in the Tobit and probit models, and the signs of the coefficients of the significant variables are the same in every instance. This supports our view that the Tobit model is primarily capturing the participation decision and that Cragg analysis is needed to analyze the volume decision separately. Because of the similarity of the Tobit and probit results, we provide a generic discussion of the results concerning the participation decision.

There are several statistically significant variables in both the Tobit and probit models that support the hypotheses set forth above concerning participation in derivatives markets. Overall, the results provide support for the hypotheses that insurers engage in derivative transactions to reduce the expected costs of financial distress, manage interest rate, exchange rate, and liquidity risk, and minimize expected tax liabilities. The hypothesis that derivatives activities are subject to scale economies is also strongly supported. However, the results provide no support for the hypothesis that the managers of mutual insurers behave differently from managers of stock insurers.

For a more detailed analysis, we consider the Tobit and probit models in Table 4. The capital-to-asset ratio is highly significant and has a negative coefficient, as predicted. This result is consistent with the idea that highly capitalized insurers have less reason to hedge because their probability of incurring distress costs is relatively low. The distress costs hypothesis is also supported by the broker dummy variable, which has a significant positive coefficient, as expected if insurers use derivatives to hedge against potential reputational costs.

The risk-based capital dummy variable has a negative coefficient, suggesting that insurers for which the risk-based capital rules are binding tend to be less likely to use derivatives than those with higher risk-based capital ratios. This result is consistent with the interpretation that insurers that do not hedge are more likely to encounter financial distress or that insurers approaching the risk-based capital threshold tend to avoid transacting in derivatives in an effort to reduce regulatory costs.

The coefficients of the proportions of assets in U.S. stocks, privately placed bonds, CMOs, and foreign stocks all are statistically significant and positive, as predicted if insurers are using derivatives to hedge volatility, liquidity, and exchange rate risk. Moreover, higher proportions of reserves in individual life insurance and annuities and in GICs are also significantly related to a higher than average likelihood of using derivatives. However, our duration gap measure is not statistically significant, perhaps due to the fact that it is only a rough proxy for the duration and convexity risk faced by insurers.

The tax management hypothesis is supported by two significant variables, the dummy variable for not paying taxes in 1992 and the dummy variable for being in the AMT range of the tax schedule in 1994. Both variables are positive and significant. The sign and significance of the former variable is consistent with the hypotheses that insurers engage in tax management to avoid losing tax loss carryforwards, while the result with the latter variable is consistent with tax minimization by insurers operating in the convex segment of the tax schedule. However, some caution is in order in interpreting these particular results in view of the fact that direct data on tax loss carryforwards and taxable income are not available.

The hypothesis of economies of scale in derivatives operations is supported by two significant variables, the logarithm of assets and the dummy variable for firms with at least one affiliate active in derivatives. Both variables have the expected positive coefficients.

The Volume Decision. The lognormal regression part of the Cragg model provides evidence concerning what factors, if any, underlie the volume (quantity) decision. The results from the lognormal regression support the hypothesis that the volume of derivatives transactions is positively related to insurer asset size.

Consistent with the marginal cost hypothesis set forth earlier, the estimation results provide evidence that, conditional on being in derivatives, firms with more tolerance for risk choose to under-hedge. For example, firms with higher leverage (lower capital to assets), tend to have a lower value of derivative activities. The same pattern emerges with other risk measures. The coefficient of the proportion of assets in privately placed bonds is negative and significant in the volume (lognormal) regression, whereas it is positive and significant in the participation (Tobit and probit) regressions. This implies that insurers with high proportions of privately placed bonds are more likely to engage in derivatives transactions, but engage in lower transaction volumes conditional on the decision to participate, consistent with our earlier discussion. Moreover, the coefficients on duration GAP, the proportions of assets in real estate and publicly traded CMOs also are all negative and significant in the lognormal regression, whereas these variables are not statistically significant in the participation models.

An exception to this general pattern is provided by the GIC variable, which is positive and significant in both the participation and the volume regressions. This result may reflect the fact that purchasers of GICs tend to be more sophisticated investors, on average, than the purchasers of other life insurer products. Accordingly, they may engage in more active monitoring of firm risk and hedging decisions than other investors, imposing a market penalty on insurers that under-hedge their GIC exposure.

Finally, the "active affiliate" dummy variable is negative and significant in the lognormal regression, whereas it was positive and significant in the Tobit and probit models. This seems intuitively reasonable, i.e., conditional on size, if a group's derivatives transactions are spread among a larger number of affiliates. The amounts transacted by individual affiliates are likely to be less than if a given affiliate were the only member of the group engaged in derivatives activity.

Multi-Variate Results: Property-Liability Insurers

The Tobit and Cragg estimation results for property-liability insurers are shown in Table 5. As above, we first discuss the Tobit and probit models and then turn to a discussion of the lognormal regression model.

The Participation Decision. The Tobit and probit results for property-liability insurers provide further support for the principal hypotheses discussed above. The capital-to-asset ratio is statistically significant and negative, consistent with the hypothesis that insurers engage in derivatives transactions to reduce the expected costs of financial distress. The ratio of actual capital to risk-based capital is significant and carries a positive coefficient. Consistent with the life insurer results, this variable suggests that insurers are less likely to use derivatives the closer they are to the risk-based capital threshold.

The hypotheses that insurers use derivatives to manage asset volatility and liquidity risk are supported by the significant positive coefficients on the proportions of the asset portfolio is stocks and real estate, respectively. We also find support for the hypothesis that insurers use derivatives to manage foreign exchange rate risk. The dummy variables for exposure to foreign assets and foreign liabilities are both significant with positive coefficients, consistent with hedging of foreign exchange rate risk. The interaction variable defined as the product of the foreign asset and foreign liability dummy variables has a statistically significant negative coefficient. This suggests that insurers with exposures in both foreign assets and foreign liabilities have a natural foreign currency hedge, reducing the need to hedge through derivatives transactions.

The proportion of premiums written in the commercial long-tail lines (other than products liability) has a significantly negative coefficient. This result affirms prior findings in Cummins, Phillips, and Smith (1997) and is consistent with the idea that writing commercial long-tail lines provides a natural hedge for insurers against the duration risk of their intermediate and long-term bonds. The proportion of premiums written in products liability insurance, on the other hand, has a significant positive coefficient, suggesting that insurers who are active writers of products liability insurance feel the need to hedge the volatility inherent in this type of coverage. Such hedges often can be constructed by transacting in derivatives on the stocks of their insured policyholders.[18]

The ceded reinsurance variable is negative and significant for property-liability insurers, whereas it was insignificant in the life insurance equations. The negative sign on this variable is consistent with the hypothesis that firms that hedge their underwriting exposure have lower overall risk levels and therefore have less need to pay the fixed costs of entering the market for financial derivatives. The result

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[18]For example, an insurer writing a products liability policy on a drug manufacturer could hedge the risk of lawsuits by taking a derivatives position in the manufacturer's stock. This might be especially effective in hedging the risk of products liability losses that affect many of the manufacturer's customers simultaneously, such as those resulting from unforeseen side effects of a particular drug.

is also consistent with the finding that insurers appear to hedge products liability risk using derivatives, because reinsurance would be another way to manage the risk of products liability losses.

The results also provide support for the tax management hypothesis. The dummy variable, set equal to 1 if no taxes are incurred in the current year, is statistically significant with a negative coefficient. This implies that insurers that are not paying taxes do not have a motive to hedge in order to avoid higher taxes due to the convexity of the income tax schedule. Although one might think that insurers would hedge to avoid income volatility that might drive their taxable income into the convex segment of the tax schedule, property-liability insurers have been very successful over a long period of time in hitting their taxable income targets through the use of tax favored investments and the manipulation of loss reserves (see Grace, 1990, Cummins and Grace, 1994). Life insurers have less ability to manage their reserves and are taxed under a different section of the tax code than property-liability insurers. As a result, they have been less successful in managing their taxable income through conventional techniques and, therefore, are more likely than property-liability insurers to use derivatives transactions to accomplish this objective.

The property-liability models provide further support for the hypothesis that there are economies of scale in running derivatives operations. The log of total assets has a highly significant positive coefficient, and the "active affiliate" dummy variable is also positive and significant. The unaffiliated single company dummy variable also has a significant positive coefficient, consistent with the hypothesis that such insurers forfeit a source of diversification by not being organized as a group and thus may have a greater need to hedge through the use of derivatives. Because property-liability insurers experience more volatility in their losses and income than do life insurers, diversification through operating as an insurance group is more important in the property-liability insurance industry, leading to the significance of the variable here whereas it was insignificant in the life insurer models.[19]

The broker dummy variable is insignificant in the Tobit and probit models for property-liability insurers. Thus, the hypothesis that insurers enter derivatives markets in part to protect their financial reputations with independent distributors is not supported for this class of insurers. This is perhaps not surprising given that most of the concern about financial reputation and “run on the bank” problems has arisen in the life insurance market.

The Volume Decision. The lognormal regression model is somewhat less informative for property-liability insurers than for life insurers. However, the significant positive coefficient on the log of assets variables provides further support for the hypothesis that larger firms tend to engage in a higher volume of derivatives usage.

The lognormal model for property-liability insurers also provides additional support for our hypothesis that, conditional on being in the derivatives market, firms/managers with higher tolerance for risk will demand, ceteris paribus, lower quantities of derivatives due to the marginal costs of hedging. For example, the foreign liabilities dummy variable is negative and significant in the volume regression whereas it was positive and significant in the participation (Tobit and probit) regressions. Likewise, the real estate variable reverses sign and becomes insignificant in the volume regression and the proportion of assets in stocks becomes insignificant. Several other significant risk variables have opposite signs and/or become insignificant in the volume regressions in comparison with the Tobit and probit models.

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[19]For example, several insurers have set up subsidiaries to write property insurance in Florida and California because of the risk of catastrophic loss due to hurricanes and earthquakes. If a major catastrophe were to wipe out the equity of a subsidiary, the parent insurer would not be required to post additional capital, unlike the case where the parent insurer were to write the property insurance policy.

Thus, although further research is clearly needed into this marginal costs hypothesis, our results provide some preliminary evidence that this hypothesis may help to explain insurer demand for derivative securities, conditional on being participants in this market.

IV. Conclusion

In this paper, we formulate and test a number of hypotheses regarding insurer participation and volume decisions in derivatives markets. We base our hypotheses on the financial theories of corporate risk management that have developed over the past several years. The two primary, and non-mutually exclusive, strands of the theoretical literature hold that corporations are motivated to hedge in order to maximize value and/or to maximize the utility of managers. Our results provide support for the hypothesis that insurers hedge to maximize value. Although we do not find support for the managerial utility maximization hypothesis, this may be due to the limited information in our data set pertaining to this hypothesis. For example, we do not have data on commonly used variables such as the proportion of an insurer's stock that is owned by managers or on the presence of stock options and other incentive features in managerial compensation plans. More definitive tests of managerial utility maximization will be conducted in future work we are undertaking on the derivatives activities of publicly traded insurers.

Several specific hypotheses are supported by our analysis. In terms of participation in derivatives markets, we find evidence that insurers are motivated to use financial derivatives to reduce the expected costs of financial distress — the decision to use derivatives is inversely related to the capital-to-asset ratio for both life and property-liability insurers. We also find evidence that insurers use derivatives to hedge asset volatility, liquidity, and exchange rate risks. Life insurers appear to use derivatives to manage interest rate risk and the risk from embedded options present in their individual life insurance and GIC liabilities. Tax considerations also play an important role in motivating derivatives market participation decisions by insurers. Finally, we provide support for the hypothesis that there are significant economies of scale in running derivatives operations. Thus, only large firms and/or those with higher than average risk exposure would find it worthwhile to pay the fixed cost of setting up a derivatives operation.

Interestingly, however, we often find that, conditional on being a user of derivatives, the relationship between the volume of derivatives activities and these same risk measures often display exactly the opposite result to those found in the usage regression. We argue that this result is broadly consistent with the hypothesis that there is also a per unit risk premium associated with hedging and that, conditional on having risk exposures large enough to warrant participation, firms with a larger appetite for risk will be less willing than average to pay this marginal cost. Such firms therefore have larger than average risk exposure (lower than average derivatives positions) vis a vis the sub-group of insurers that use derivatives, who themselves may be, on average, higher-risk firms than non-users.

Our conclusion that insurers with higher than average asset risk exposures use derivative securities has important public policy implications. State regulators are currently considering the imposition of new restrictions on insurer derivatives transactions. While more work is clearly needed regarding the net effect of derivatives on the risk profile of insurers, it seems premature to deny access to this potentially valuable risk management technique. Restricting derivatives could increase risk for some insurers now participating in derivatives markets and would reduce the ability of other insurers to access this source of risk management. The findings are also relevant in terms of reporting requirements imposed by state insurance regulators, the Financial Accounting Standards Board, and the Securities and Exchange Commission. More detailed and accurate reporting is likely to be beneficial in facilitating market monitoring of insurer derivatives activities. Such monitoring is likely to be much more effective than additional regulation in ensuring that derivatives are used to enhance insurance market efficiency rather than to increase market risk.

References

Babbel, David F. and Anthony Santomero, 1997, "Financial Risk Management By Insurers: An Analysis of the Process," *Journal of Risk and Insurance,* forthcoming.

Booth, James R., Smith, Richard L., Stolz, Richard W., 1984, "Use of Interest Rate Futures by Financial Institutions," *Journal of Bank Research*, 15: 15-20.

Breedon, Douglas, and S. Viswanathan, 1996, "Why Do Firms Hedge? An Asymmetric Information Model," Working paper, Duke University, Durham, N.C.

Brewer, Elijah, William E. Jackson, and James T. Moser, 1996, "Alligators in the Swamp: The Impact of Derivatives on the Financial Performance of Depository Institutions," *Journal of Money, Credit, and Banking* 28: 482-501.

Brewer, Elijah, Bernadette A. Minton, and James T. Moser, 1994, "Interest-Rate Derivatives and Bank Lending," Working paper, Federal Reserve Bank of Chicago, Chicago, IL.

Colquitt, L. Lee and Robert E. Hoyt, 1995, "Determinants of Corporate Hedging Behavior: Evidence from the Life Insurance Industry," Working Paper, University of Georgia, Athens, GA.

Cragg, John G., 1971, "Some Statistical Models for Limited Dependent Variables With Application to the Demand for Durable Goods," *Econometrica* 39: 829-844.

Cummins, J. David and Hélyette Geman, 1995, "Pricing Insurance Catastrophe Futures and Call Spreads: An Arbitrage Approach," *Journal of Fixed Income* 4: 46-57.

Cummins, J. David and Elizabeth Grace, 1994, "Tax Management and Investment Strategies of Property-Liability Insurers," *Journal of Banking and Finance* 18: 43-72.

Cummins, J. David, Scott E. Harrington, and Gregory Niehaus, 1994, "Risk-Based Capital Requirements for Property-Liability Insurers: A Financial Analysis," in Edward Altman and Irwin Vanderhoof, eds., *The Financial Dynamics of the Insurance Industry* (Homewood, IL: Irwin Professional Publishers).

Cummins, J. David and Joan Lamm-Tennant, 1993, *Financial Management of Life Insurance Companies* (Norwell, MA: Kluwer Academic Publishers).

Cummins, J. David, Richard D. Phillips, and Stephen D. Smith, 1997, "Corporate Hedging in the Insurance Industry: The Use of Financial Derivatives by US Insurers." *The North American Actuarial Journal* 1 (January 1997): 13-49.

Cummins, J. David and Mary A. Weiss, 1991, "The Structure, Conduct, and Regulation of the Property-Liability Insurance Industry," in R.W. Kopcke and R.E. Randall, eds., *The Financial Condition and Regulation of Insurance Companies* (Boston: Federal Reserve Bank of Boston).

DeMarzo, Peter and Darrell Duffie, 1995, "Corporate Incentives for Hedging and Hedge Accounting," *Review of Financial Studies* 8: 743-772.

Dolde, Walter, 1996, "Hedging, Leverage, and Primitive Risk," *The Journal of Financial Engineering* 4: 187-216.

Fenn, George W., Mitch Post, and Steven A. Sharpe, 1996, "Why Nonfinancial Firms Use Interest Rate Derivatives," Working Paper, Capital Markets Section, Federal Reserve Board, Washington D.C.

Finn, Edwin A., Jr., 1988, "The Mess at Equitable Life," *Forbes* 142 (September 19): 36-40.

Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein, 1993, "Risk Management: Coordinating Investment and Financing Policies," *Journal of Finance,* 68: 1629-1658.

Grace, Elizabeth, 1990, "Property-Liability Reserve Errors: A Theoretical and Empirical Analysis," *Journal of Risk and Insurance* 63: 28-46.

Greene, William H., 1990, *Econometric Analysis*. New York: Macmillan Publishing Company.

Gunther, Jeffery W., and Thomas F. Siems, 1995, "The Likelihood and Extent of Bank Participation in Derivative Activities," Working Paper, Federal Reserve Bank of Dallas, Dallas TX.

Hoyt, Robert E., 1989, "Use of Financial Futures by Life Insurers," *Journal of Risk and Insurance,* 56:740-749.

Klein, Robert W., 1995, "Insurance Regulation In Transition," *Journal of Risk and Insurance* 62: 363-404.

Lehman Brothers, 1994, "Derivatives Use By Insurers: How Derivatives Are Changing the Way Insurers Operate" (New York).

Liscio, John, 1990, "The GICs Blacklist: Big and Small Insurers Are on It," *Barron's* 70 (February 19): 18,27.

Mayers, David and Clifford W. Smith, Jr., 1990, "On the Corporate Demand for Insurance: Evidence from the Reinsurance Market, *Journal of Business* 63: 19-40.

Mayers, David and Clifford W. Smith, Jr., 1988, "Ownership Structure Across Lines of Property-Liability Insurance," *Journal of Law and Economics* 31: 351-378.

Mayers, David and Clifford W. Smith, Jr., 1987, "Corporate Insurance and the Underinvestment Problem," *Journal of Risk and Insurance* 54: 45-54.

Myers, Stewart C., 1977, "Determinants of Corporate Borrowing," *Journal of Financial Economics* 5: 147-175.

Nance, Deana R., Clifford W. Smith, Jr., and Charles W. Smithson, 1993, "On the Determinants of Corporate Hedging, *Journal of Finance*, 68: 267-284.

Shanker, Latha, 1996, "Derivatives Usage and Interest Rate Risk of Large Banking Firms," *Journal of Futures Markets* 16: 459-474.

Sinkey, Joseph F., and David Carter, 1995, "The Determinants of Hedging and Derivatives Activities by U.S. Commercial Banks," Working Paper, University of Georgia, Athens, GA.

Smith, Clifford W. Jr. and René M. Stulz, 1985, "The Determinants of Firms' Hedging Policies," *Journal of Financial and Quantitative Analysis* 20: 391-405.

Staking, Kim B., and David F. Babbel, 1995, "The Relation Between Capital Structure, Interest Rate Sensitivity, and Market Value in the Property-Liability Insurance Industry," *Journal of Risk and Insurance,* 62: 690-718.

Stulz, René M., 1996, "Rethinking Risk Management," *Journal of Applied Corporate Finance* 9: 8-24.

Stulz, René M., 1990, "Managerial Discretion and Optimal Financing Policies," *Journal of Financial Economics* 26: 3-27.

Tiller, John E., and Denise Fagerberg Tiller, 1995, *Life, Health & Annuity Reinsurance*, ACTEX Publications: Winsted, CT.

Tufano, Peter, 1996, "Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry," *Journal of Finance* 51: 1097-1137.

Venkatachalam, Mohan, 1996, "Value-Relevance of Banks' Derivatives Disclosures," *Journal of Accounting and Economics* 22: 327-355.

The Wharton School and The Chase Manhattan Bank, N.A., 1995, *Survey of Derivatives Usage Among U.S. Non-Financial Firms.* Philadelphia, PA.

Table 1
Proportion of Insurers Active in Derivatives, by Quartile

	Life/Health Insurers	Property/Casualty Insurers
Quartile 1	0.00%	0.24%
Quartile 2	1.00%	3.13%
Quartile 3	7.31%	3.13%
Quartile 4	31.13%	20.14%
All Firms	9.88%	6.67%
Number of Insurers	1,204	1,664

Table 2

Summary Statistics: Derivative Users vs. Non-Users

	Life/Health Insurers					Property/Casualty Insurers				
	Users		Non-Users			Users		Non-Users		
Variable	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Test Statistic: $m_r=m_u$**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Test Statistic: $m_r=m_u$**
Total Notional Amount Transacted During the Year (000000's)	1,711.97	7,311.41				299.254	855.496			
Log(Total Notional Amount Transacted During the Year)	18.6054	2.7519				17.082	2.716			
Log(Total Assets)	21.5961	1.8919	17.5846	2.3763	17.807	20.050	1.756	17.568	1.841	13.769
Percent of Asset Portfolio in Stocks	6.71%	9.79%	7.28%	15.17%	0.397	19.72%	16.17%	9.73%	14.21%	7.090
Percent of Asset Portfolio in Real Estate	9.32%	8.58%	6.07%	11.07%	3.103	2.73%	3.66%	1.42%	3.63%	3.665
Percent of Asset Portfolio in Publicly Traded CMO's	12.51%	11.26%	7.77%	13.91%	3.594					
Percent of Asset Portfolio in Privately Placed Commercial Bonds	8.89%	7.68%	1.97%	5.11%	13.211					
Percent of Asset Portfolio in Privately Placed CMO's	0.37%	0.91%	0.06%	0.34%	7.184					
Percent of Asset Portfolio in CMO's						5.20%	7.76%	3.98%	8.50%	1.471
Foreign Denominated Liabilities Dummy Variable	0.2101	0.4091	0.0313	0.1743	8.832	0.243	0.431	0.035	0.185	10.051
Percent of Asset Portfolio in Non-US and Non-Canadian Bonds	2.81%	7.86%	0.53%	2.53%	6.840	1.01%	1.67%	0.34%	1.96%	3.486
Percent of Asset Portfolio in Non-US and Non-Canadian Stocks	0.30%	1.54%	0.11%	1.37%	1.460	0.57%	1.57%	0.09%	0.69%	6.179
(Foreign Bonds and Stocks) x Foreign Liabilities Interaction Term	0.55%	1.31%	0.09%	1.72%	2.852	0.36%	1.14%	0.03%	0.29%	8.319
Foreign Asset Dummy Variable						0.667	0.474	0.225	0.418	10.672
Foreign Assets Dummy Variable x Foreign Liabilities Interaction Term						0.162	0.370	0.017	0.131	9.301
Percent of LH Reserves in Individual Life and Annuity Reserves	52.63%	31.43%	47.13%	38.08%	1.520					
Percent of Life/Health Reserves in Group Annuities	6.49%	11.28%	1.69%	7.72%	6.098					
Percent of LH Reserves in Guaranteed Investment Contracts	5.95%	13.80%	0.37%	3.57%	10.485					
Percent of LH Premiums Due to Dividends Used to Purchase Paid-up Additions	21.31%	28.60%	18.72%	32.44%	0.835					
Percent of P&C DPW Written in Commercial Long Tail Lines						19.25%	24.82%	29.00%	35.34%	2.857
Percent of P&C DPW in Products Liabiilty						1.35%	6.06%	0.60%	3.58%	2.027
Percent of Premiums Ceded to Reinsurers	13.42%	15.68%	14.27%	21.38%	0.422	31.55%	23.81%	36.82%	28.33%	1.912
Duration Gap	6.8881	3.2654	4.9307	4.4235	4.689	6.379	3.470	4.916	4.101	3.665
Ratio of Preferred Capital Stock + Surplus Notes to Total Assets	0.0052	0.0232	0.0158	0.1129	1.022	0.012	0.041	0.011	0.055	0.144
Capital to Asset Ratio	0.1088	0.0908	0.3343	0.2663	9.182	0.337	0.143	0.420	0.208	4.114
Dummy Variable = 1 if the RBC Ratio is Binding	0.0252	0.1574	0.1051	0.3068	2.800					
Policyholder Surplus to Risk Based Capital						9.022	9.150	14.141	20.385	2.627
No Federal Taxes Incurred Dummy, Current Year	0.1176	0.3236	0.2700	0.4442	3.638	0.270	0.446	0.340	0.474	1.503
No Federal Taxes Incurred Dummy, Previous Year	0.0588	0.2363	0.1889	0.3916	3.554	0.144	0.353	0.209	0.406	1.628
No Federal Taxes Incurred Dummy, Prior 2 Years	0.1681	0.3755	0.2184	0.4134	1.273	0.234	0.425	0.247	0.431	0.293
Incurred Tax Rate < Alternative Minimum Tax Rate Dummy	0.2269	0.4206	0.2765	0.4475	1.155	0.360	0.482	0.243	0.429	2.767
Mutual Organizational Form Dummy Variable	0.1513	0.3598	0.0673	0.2506	3.301	0.234	0.425	0.214	0.410	0.506
"Pure" Stock Organizational Form Dummy Variable	0.7059	0.4576	0.5991	0.4903	2.270	0.622	0.487	0.540	0.499	1.664
Single Unaffliated Company Dummy	0.0924	0.2909	0.2553	0.4362	3.977	0.189	0.393	0.275	0.447	1.969
Direct Writer Dummy Variable	0.0588	0.2363	0.0618	0.2408	0.126	0.279	0.451	0.188	0.391	2.351
Broker Dummy Variable	0.1176	0.3236	0.0802	0.2717	1.399	0.072	0.260	0.091	0.288	0.688
Affliated Member Active in Derivatives Dummy Variable	0.6218	0.4870	0.0774	0.2674	19.020	0.550	0.500	0.109	0.312	13.699

Note - 1085 Life Non-Users, 119 Life Users; 1553 P&C Non-Users, 111 P&C Users

Table 3

Derivatives Use By Insurers

Notional Amounts for Positions Opened During 1994
Life/Health Insurers, By Type of Risk

Underlying Asset/Risk	Number of Users	Total Notional Amounts (000's) Mean	Median	Standard Deviation	Min	Max	Total
Part A Transactions - Call, Put, Cap and Floor Agreements Purchased							
Bonds	26	503,810	168,200	948,490	50	4,611,100	13,099,100
Commodities	1	4,460	4,460	-	4,460	4,460	4,460
Equities	18	130,120	7,830	407,990	0	1,739,320	2,342,300
Foreign Currency	3	133,240	54,840	140,010	50,000	294,890	399,730
Interest Rates	23	895,490	305,000	1,653,330	1,200	6,500,000	20,596,290
Part B Transactions - Call, Put, Cap and Floor Agreements Written							
Bonds	20	528,960	287,150	592,000	10,000	2,000,000	10,579,340
Equities	32	52,290	3,810	204,880	0	1,160,950	1,673,560
Foreign Currency	3	104,780	25,000	150,910	10,500	278,840	314,340
Interest Rates	4	656,000	325,000	843,480	94,000	1,880,010	2,624,010
Part C Transactions - Collar, Swap and Forward Aggreements							
Bonds	2	89,250	89,250	126,200	10	178,500	178,510
Commodities	5	12,260	10,140	15,750	810	39,200	61,300
Equities	3	78,820	75,000	20,990	60,000	101,460	236,460
Foreign Currency	23	1,196,550	80,410	3,598,130	10	16,190,170	27,520,690
Mortgages	2	42,470	42,470	24,360	25,250	59,700	84,950
Interest Rates	57	469,380	162,290	1,166,020	0	8,565,720	26,754,770
Part D Transactions - Futures Contracts							
Bonds	53	1,170,990	212,140	3,467,420	50	24,089,410	62,062,810
Equities	7	73,140	96,610	70,150	1,030	193,090	512,010
Foreign Currency	3	1,351,240	982,090	1,480,880	89,860	2,981,790	4,053,740
Interest Rates	5	6,865,290	50,650	14,162,470	11,960	32,150,780	34,326,470

Notional Amounts for Contracts Opened During 1994
Property/Casualty Insurers, By Type of Risk

Underlying Asset/Risk	Number of Users	Total Notional Amounts (000's) Mean	Median	Standard Deviation	Min	Max	Total
Part A Transactions - Call, Put, Cap and Floor Agreements Purchased							
Bonds	4	124,110	10,600	233,990	240	475,000	496,440
Equities	39	57,870	5,910	100,430	30	423,610	2,257,230
Foreign Currency	2	73,330	73,330	13,030	64,120	82,550	146,670
Interest Rates	1	212,780	212,780		212,780	212,780	212,780
Part B Transactions - Call, Put, Cap and Floor Agreements Written							
Bonds	11	54,580	16,900	90,460	1,000	274,000	600,380
Equities	74	132,400	8,970	755,620	0	6,484,850	9,797,750
Foreign Currency	2	1,857,350	1,857,350	1,005,140	1,146,600	2,568,100	3,714,700
Part C Transactions - Collar, Swap and Forward Aggreements							
Equities	3	87,230	94,240	69,610	14,380	153,080	261,710
Foreign Currency	23	345,120	106,030	536,120	280	2,149,410	7,937,830
Interest Rates	7	44,510	15,250	50,770	7,800	150,000	311,580
Part D Transactions - Futures Contracts							
Bonds	11	311,110	165,630	312,590	10,180	829,610	3,422,220
Equities	14	282,670	114,100	544,240	620	2,139,240	3,957,480
Foreign Currency	4	84,930	40,510	110,420	9,600	249,100	339,730
Interest Rates	4	486,340	473,310	461,960	7,760	990,980	1,945,380

Note - Total notional amount for equity call/put options calculated as No. of Contracts * 100 * Strike Price

- Total notional amount for bond call/put options calculated as par value of underlying bonds
- Total notional amount reported for futures contract calculated as no. of contracts * futures payoff * strike price

Table 4
Cragg and Tobit Regression Results: Life/Health Insurers

Variable	Tobit	Probit	OLS Log(Notional)	Tobit	Probit	OLS Log(Notional)
Intercept	-145.433 ***	-9.218 ***	-3.753	-143.487 ***	-9.100 ***	-3.533
	(6.994)	(6.899)	-(0.918)	(7.067)	(7.003)	-(0.895)
Log(Total Assets)	5.433 ***	0.336 ***	1.167 ***	5.361 ***	0.332 ***	1.142 ***
	(6.097)	(5.712)	(6.623)	(6.162)	(5.792)	(6.765)
Percent of Asset Portfolio in Stocks	40.623 ***	2.546 ***	-2.856	40.209 ***	2.524 ***	-2.766
	(2.954)	(2.782)	-(0.859)	(2.932)	(2.763)	-(0.841)
Percent of Asset Portfolio in Real Estate	-8.609	-0.212	-6.435 **	-8.590	-0.219	-6.326 **
	(0.600)	(0.225)	-(2.052)	(0.604)	(0.236)	-(2.036)
Percent of Asset Portfolio in Publicly Traded CMO's	-1.155	-0.081	-8.243 ***	-0.708	-0.054	-7.918 ***
	(0.124)	(0.134)	-(3.629)	(0.076)	(0.089)	-(3.589)
Percent of Asset Portfolio in Privately Placed Commercial Bonds	37.839 **	2.442 **	-7.740 **	37.592 **	2.421 **	-8.015 **
	(2.250)	(2.228)	-(2.085)	(2.283)	(2.265)	-(2.210)
Percent of Asset Portfolio in Privately Placed CMO's	503.895 ***	36.399 ***	28.251	507.446 ***	36.585 ***	27.282
	(3.209)	(3.079)	(1.166)	(3.232)	(3.094)	(1.138)
Foreign Denominated Liabilities Dummy Variable	-0.444	-0.008	-0.137	-0.355	-0.004	-0.120
	(0.113)	(0.030)	-(0.155)	(0.090)	(0.015)	-(0.137)
Percent of Asset Portfolio in Non-US and Non-Canadian Bonds	26.495	1.819	-3.173	26.718	1.850	-2.665
	(1.361)	(1.208)	-(1.100)	(1.380)	(1.230)	-(0.956)
Percent of Asset Portfolio in Non-US and Non-Canadian Stocks	157.343 ***	9.568 **	-4.979	155.364 ***	9.437 **	-3.670
	(2.657)	(2.501)	-(0.328)	(2.630)	(2.478)	-(0.245)
(Foreign Bonds and Stocks) x Foreign Liabilities Interaction Term	-92.597	-5.734	9.567	-93.161	-5.757	8.561
	(1.347)	(1.391)	(0.330)	(1.351)	(1.400)	(0.299)
Percent of LH Reserves in Individual Life and Annuity Reserves	9.953 **	0.641 **	1.163	9.756 **	0.635 **	1.251
	(2.176)	(2.100)	(1.161)	(2.158)	(2.104)	(1.276)
Percent of Life/Health Reserves in Group Annuities	13.819	0.869	0.936	14.215	0.899	1.016
	(1.298)	(1.241)	(0.437)	(1.335)	(1.290)	(0.479)
Percent of LH Reserves in Guaranteed Investment Contracts	22.480 *	2.169 **	7.219 ***	22.320 *	2.181 **	7.246 ***
	(1.859)	(2.037)	(3.711)	(1.846)	(2.048)	(3.763)
Percent of LH Premiums Due to Dividends Used to Purchase Paic	-6.893 *	-0.434	0.396	-7.078 *	-0.441	0.450
	(1.645)	(1.536)	(0.525)	(1.694)	(1.563)	(0.605)
Percent of Premiums Ceded to Reinsurers	3.479	0.181	-0.322	-	-	-
	(0.521)	(0.408)	-(0.217)			
Duration Gap	0.348	0.025	-0.213 ***	0.338	0.024	-0.211 ***
	(1.040)	(1.112)	-(2.936)	(1.015)	(1.093)	-(2.954)
Ratio of Preferred Capital Stock + Surplus Notes to Total Assets	-24.644	-2.082	3.664	-24.185	-2.062	3.177
	(0.732)	(0.890)	(0.388)	(0.726)	(0.888)	(0.344)
Capital to Asset Ratio	-34.045 **	-1.981 *	7.930 *	-33.956 **	-1.972 *	7.796 *
	(2.134)	(1.866)	(1.800)	(2.133)	(1.860)	(1.784)
Dummy Variable = 1 if the RBC Ratio is Binding	-12.863 *	-0.863 *	1.201	-12.521 *	-0.837 *	1.273
	(1.734)	(1.684)	(0.843)	(1.712)	(1.658)	(0.905)
No Federal Taxes Incurred Dummy, Current Year	0.361	0.085	0.780	0.161	0.075	0.792
	(0.094)	(0.326)	(0.980)	(0.042)	(0.288)	(1.020)
No Federal Taxes Incurred Dummy, Previous Year	-2.191	-0.102	-1.222	-2.049	-0.095	-1.242
	(0.543)	(0.396)	-(1.150)	(0.509)	(0.369)	-(1.185)
No Federal Taxes Incurred Dummy, Prior 2 Years	6.022 *	0.346	-0.662	6.279 **	0.360 *	-0.630
	(1.876)	(1.630)	-(1.023)	(1.980)	(1.720)	-(1.001)
Incurred Tax Rate < Alternative Minimum Tax Rate Dummy	6.196 **	0.459 **	0.830	6.320 **	0.465 **	0.848
	(2.132)	(2.326)	(1.463)	(2.188)	(2.374)	(1.523)
Mutual Organizational Form Dummy Variable	-0.188	-0.027	-0.485	-	-	-
	(0.052)	(0.106)	-(0.741)			
Single Unaffliated Company Dummy	5.644	0.398 *	-1.279	5.480	0.387 *	-1.174
	(1.592)	(1.719)	-(1.521)	(1.561)	(1.694)	-(1.425)
Broker Dummy Variable	9.868 ***	0.695 ***	-0.860	9.959 ***	0.702 ***	-0.829
	(2.641)	(2.808)	-(1.231)	(2.684)	(2.865)	-(1.202)
Affliated Member Active in Derivatives Dummy Variable	21.667 ***	1.429 ***	-1.220 **	21.858 ***	1.440 ***	-1.082 **
	(7.474)	(7.877)	-(2.175)	(7.756)	(8.214)	-(2.116)
Log Likelihood Function	-630.175	-182.501		-630.309	-182.586	
Adjusted R-Squared			42.6%			43.4%

Note: Absolute values of t-statistics shown in parantheses

*Signficant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.

Table 5
Cragg and Tobit Regression Results: Property/Casualty Insurers

Variable	Tobit		Probit		OLS Log(Notional)	
Intercept	-147.830	***	-7.189	***	-2.271	
	(6.625)		(7.114)		-(0.575)	
Log(Total Assets)	5.524	***	0.265	***	1.022	***
	(5.354)		(5.362)		(5.190)	
Percent of Asset Portfolio in Stocks	43.586	***	2.213	***	1.108	
	(4.368)		(4.510)		(0.577)	
Percent of Asset Portfolio in Real Estate	121.293	***	6.141	***	-9.457	
	(4.172)		(4.439)		-(1.509)	
Percent of Asset Portfolio in CMO's	20.381		1.029		-2.074	
	(1.359)		(1.369)		-(0.728)	
Foreign Denominated Liabilities Dummy Variable	18.119	***	0.916	***	-2.229	**
	(3.071)		(3.061)		-(2.387)	
Foreign Asset Dummy Variable	11.054	***	0.546	***	-0.752	
	(3.718)		(3.760)		-(1.408)	
Foreign Assets Dummy Variable x Foreign Liabilities Interaction Term	-17.476	**	-0.800	**	1.351	
	(2.412)		(2.107)		(1.271)	
Percent of P&C DPW Written in Commercial Long Tail Lines	-8.486	*	-0.401	*	-0.726	
	(1.781)		(1.675)		-(0.753)	
Percent of P&C DPW in Products Liabiilty	54.272	***	2.565	***	-1.832	
	(2.684)		(2.594)		-(0.456)	
Percent of Premiums Ceded to Reinsurers	-10.937	**	-0.569	**	0.993	
	(1.986)		(2.028)		(1.013)	
Duration Gap	0.259		0.013		-0.010	
	(0.732)		(0.717)		-(0.140)	
Ratio of Preferred Capital Stock + Surplus Notes to Total Assets	43.044	*	2.274	*	-7.438	
	(1.741)		(1.890)		-(1.434)	
Capital to Asset Ratio	-23.084	**	-1.110	*	-1.216	
	(1.972)		(1.896)		-(0.425)	
Policyholder Surplus to Risk Based Capital	0.165	*	0.008	*	-0.019	
	(1.666)		(1.674)		-(0.466)	
No Federal Taxes Incurred Dummy, Current Year	-6.320	*	-0.288	*	-0.320	
	(1.945)		(1.747)		-(0.574)	
Incurred Tax Rate < Alternative Minimum Tax Rate Dummy	-1.559		-0.077		0.127	
	(0.530)		(0.512)		(0.251)	
Mutual Organizational Form Dummy Variable	-0.647		-0.042		0.510	
	(0.208)		(0.263)		(0.986)	
Single Unaffliated Company Dummy	17.218	***	0.864	***	-0.222	
	(4.486)		(4.645)		-(0.314)	
Broker Dummy Variable	-4.173		-0.263		1.852	*
	(0.921)		(1.143)		(1.911)	
Affliated Member Active in Derivatives Dummy Variable	23.369	***	1.199	***	0.444	
	(6.837)		(7.484)		(0.818)	
Log Likelihood Function	-657.648		-245.114			
Adjusted R-Squared					43.4%	

Note: Absolute values of t-statistics shown in parantheses

*Signficant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.