The Determinants of the Reinsurance Decision by Life Insurance Companies

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Abstract

Risk management is vital to any business including insurance companies, and reinsurance is the major risk management tool available to insurance companies. Insurance companies rely on reinsurance to manage underwriting risk, tax liability, and incentives to invest. This paper extends existing research by considering the decision to reinsure for life insurance companies in two ways. First, we analyze life insurance companies' propensity to reinsure any amount of business. Then, for those companies that do reinsure, we analyze the extent of reinsurance by examining the proportion of reinsurance relative to the total amount of premiums. Using two cross sections of data for U.S. life insurance companies, we find measures of underwriting risk, tax incentives, and incentives to invest are significant determinants of both aspects of the reinsurance decision.

I. Introduction

Risk management is vital to any business including insurance companies, and reinsurance is one of the several risk management tools available to insurance companies. The demand for insurance by insurance companies has been modeled after the corporate insurance decision. The traditional motives for corporate insurance purchases are (i) expected bankruptcy costs, (ii) tax liability, and (iii) conflicts of interest among various claimholders.

This paper empirically examines the usage of reinsurance among life insurance companies. The authors first examine the factors that influence the likelihood that life insurance companies will reinsure a portion of their business. This is followed by an analysis of the factors affecting the extent of reinsurance usage by insurers that decide to reinsure. Unlike previous studies that have focused on the property and liability industry, our study examines the usage of reinsurance among life insurance companies. There are numerous and significant differences between the two industries. For example, in the property and liability industry, contracts are typically short-term especially for property insurance[1], product prices are cyclical, and changes in claims are associated with potentially catastrophic events such as hurricanes and earthquakes. Whereas, in the life and health industry, many contracts tend to be long-term, contracts may involve investments which are influenced by changes in market interest rates, and contract benefits tend to change with demographic trends and revisions of mortality tables. These differences require a separate analysis of the demand for reinsurance in the life insurance industry. Focusing on the life insurance industry will not only allow researchers to examine the use of reinsurance among life insurance companies, but will allow them to determine if the factors that are significant in the reinsurance decision in the property-liability industry are also relevant for life insurance companies' reinsurance decision.

Reinsurance is a contractual agreement under which the primary insurer transfers part or

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1 Some liability insurance contracts may have long tail such as medical malpractice, workers' compensation, and auto liability.

all risks to another insurance company, the reinsurer. The reinsurer can be either another direct insurer or a specialist reinsurance company. Reinsurance arrangements may vary in the distribution of losses or the amount of coverage depending on the source of underwriting risk, the unexpected variation in claims and the amount of coverage; thereby affecting the value of the firm.[2] Doherty and Tinic (1981) were the first to show that the reinsurance decision, as a risk management tool, affects the value of the insurance firm[3]. Their theory provided insights to the broader question of what market imperfections cause companies to engage in risk management activities.

This paper extends the research on risk management activities by considering the decision to reinsure. For those companies that do reinsure, we analyze the firm's aggregate proportion of reinsurance relative to the total amount of premiums. As both decisions are influenced by similar explanatory variables, our discussion of the motivations to reinsure is often described as one process, the decision to reinsure. Several research hypotheses are developed from existing literature on the motives for risk management practices. We find that the decision to reinsure is determined by measures of underwriting risk, tax incentives and underinvestment incentives.

The remainder of the paper is organized as follows. The following section provides a brief review of the extensive literature on the determinants of the reinsurance decision in the property and liability insurance industry and the limited literature on the life insurance sector. The third section provides the theoretical background on demand for reinsurance. The fourth section presents the sample and the variables used in the analysis. The fifth section discusses the empirical results. The last section presents the summary and concluding remarks.

II. Related Literature

Primary insurers provide the mechanism for individuals, families and businesses to share risks so that no single policyholder faces financial ruin if a covered risk occurs; reinsurance provides the same protection for insurance companies.[4] Reinsurance reduces the risk of default of primary insurers, the contracting costs between the different claimholders, and the insurer's tax liability. Existing literature has focused on the determinants of reinsurance proportion by property and liability insurers (Mayers and Smith (1990), Garven and Lamm-Tenant (2003),

[2] Life reinsurance arrangements could be structured either as a proportional or non-proportional agreement. Under proportional reinsurance, the primary underwriter and the reinsurer agree to share premiums and claims proportionately. In contrast, under non-proportional agreements, the reinsurer promises to pay claims that exceed the retention level of the ceding company. Whether the reinsurance agreement is proportional or non-proportional it can be either facultative or a treaty agreement.

[3] To quote, "The reinsurance agreement affects the risk return structure of the insurer's liability portfolio and consequently affects the risk-return characteristics of the insurer's common stock".

[4] Several studies have sought to explain the corporate insurance purchase decision. Among these are: Mayers and Smith (1982), (1987) and (1990), Skogh (1989), Garven and Lamm-Tenant (2003), Cole and McCullough (2006), and Weiss and Chung (2004). These studies contend that corporate insurance purchases are motivated by (i) the comparative advantages of insurance companies by providing real services, (ii) the position of the firm's expected tax liability, (iii) conflict of interest among various claimholders such as between owners and managers and/or shareholders and bondholders, (iv)expected bankruptcy costs and (v) the regulatory status of the firm.

Hoerger, Sloan and Hassan (1990)[5], Adiel (1996), Shortridge and Avila (2004), and Cole and McCullogh (2006)). Garven and Lamm-Tenant (2003) formally analyzes the demand for reinsurance by property and liability insurance companies. In a contingent claims framework, they investigate the valuation effects of the reinsurance decision. Their theory predicts that the demand for reinsurance is determined by the firm's leverage, the correlation between the firm's investment returns and claims costs, the line mix of insurance, and the degree of investment in tax-exempt assets. These predictions are supported by an empirical study of the property and liability insurance industry during the 1980s. Adiel (1996), using panel data for property and liability insurers, finds no support for his hypothesis that insurers adjust their reinsurance as a function of their marginal tax rate. A more recent study by Shortridge and Avila (2004) confirms the Mayers and Smith (1990) finding that reinsurance is negatively related to diversification of the owners' portfolio. Their study uses a small sample of publicly traded property and liability insurers. Finally, Cole and McCullough (2006) while examining the effect of the state of the international reinsurance market on the demand for reinsurance support previous findings on the motives for the demand for reinsurance in property and liability industry.

One of two studies that deal with reinsurance for the life insurance is Lee, Palmer and Skipper (1992). Using 1987 data, the authors analyze the retention level per policy by 97 U.S. insurers. Factor analysis was used to determine the important factors that affect the retention level. The analysis shows that firm size, organizational form, average policy size, proportion of term insurance, and new business are significant determinants of the life insurer retention limits per policy. In particular, size, mutual form and average policy size are associated with a higher retention level. Whereas, companies with higher proportions of term insurance and new business have a lower retention level implying more reinsurance. The second study by Adams, Hardwick, and Zou (2008) for life insurance companies in the United Kingdom in the period from 1992-2001 finds that life insures with low marginal tax rates during the before planning period tend to use more reinsurance, consistent with hypothesis from Adiel (1996).

Our paper adds to this literature by integrating the financial literature on underwriting risk, tax management and agency theory in order to provide a framework of analysis for the decision to reinsure. Further, for companies that choose to reinsure, we analyze the factors that determine the proportion of the business that is reinsured.

III. Theoretical Background on Incentives for Reinsuring

The seminal work of Modigliani and Miller (1958) shows that under perfect market conditions, financial policy decisions are irrelevant. More recent research studies, theoretically and empirically, demonstrate that risk management adds value to the firm.[6] This value added stems from violations of perfect market conditions. The corporate finance literature hypothesizes that corporate risk management programs are motivated by costs of financial distress, tax management and investment incentives. The latter analysis has been extended to the insurance industry in several studies.[7] This paper will demonstrate that the reinsurance decision

[5] Hoerger, Sloan and Hassan (1990) analyze the likelihood to reinsure and the proportion of reinsurance for a sample of primarily medical malpractice underwriters.
[6] See for example Smith and Stulz (1985) and Nance, Smith and Smithson (1993).
[7] See for example Mayers and Smith (1990) and Hoerger, Sloan and Hassan (1990).

by life insurance companies is motivated by similar objectives related to risk management practices.

Reinsurance reduces financial distress from underwriting risk: The traditional role for reinsurance is to protect the ceding company against catastrophic claims and hence reduce the underwriting risk. Life insurance companies provide protection against losses from a variety of personal risks but face mortality risk and morbidity risk which could result in unexpected claims. Life insurance companies buy reinsurance to spread their risk and minimize their losses. The use of reinsurance could help smooth the earnings of the company, enhance its profitability and, therefore, reduce the probability and severity of financial distress.[8] Financial strength is especially important for life insurance companies whose policyholders are mostly buying long-term products.

Reinsurance as a tax management tool: Smith and Stulz (1985) contend that corporate tax schedules are essentially progressive. The federal income tax liability is similar to the value of a call option on the firm's taxable income; therefore, an increase in income volatility will increase the expected tax liability. Companies will actively use investment strategies, accounting practices, and realization of securities gains or losses to reduce expected tax liability by lessening the volatility of their taxable income. In the insurance industry, several studies have shown that property and liability firms engage in similar practices to achieve the same goal.[9] Therefore, insurers have an incentive to use reinsurance to smooth their income and minimize their tax liability.

Reinsurance and Underinvestment Incentives: Conflicts between the main stakeholders in the firm may explain corporate risk management decisions. Myers (1977) argued that equity holders may not undertake certain positive net present value projects since they bear the full costs of the projects while sharing the benefits with debt holders. Consequently, underinvestment arises. Since policyholders, like debt holders, have a fixed claim against the assets of the firm, managers may have incentives to decline positive net present value projects when the potential for unexpected large losses exist. Mayers and Smith (1987) show, that the purchase of insurance may reduce this underinvestment problem if the risk of large unexpected losses is transferred to the insurance company. Furthermore, Myers (1977) explains that the underinvestment problem is amplified within companies with large investment opportunities. For these reasons, we expect that the use of reinsurance by insurance companies may encourage insurance managers to expand their companies' capacity to exploit growth opportunities available to the insurance company.

The purpose of this paper is to use this theoretical framework and apply it to the reinsurance decision within the life insurance industry. This analysis will provide insights into the competing hypotheses and assess the relative importance of each.

IV. Sample, Variable Measurement and Empirical Model

Data and Sample

The study uses financial data from the 1998 and 2000 National Association of Insurance Commissioners (NAIC) Tapes for a cross-section of life insurers. The sample size for the 1998

[8] See for example Mayers and Smith (1990).
[9] See for example Cummins and Grace (1994) and Mayers and Smith (1990).

and 2000 data is 938 and 947 insurers respectively. This sample represents 90 percent of industry assets and 87 percent of insurance in force.[10] The NAIC database includes some companies that either are in financial distress or are non-operating. This may cause some companies to have unusual values such as zero surplus and negative premiums written. These companies were eliminated from the sample. Also, companies that are classified as reinsurers by A.M. Best Company (1999) were not included in the analysis.[11]

Life insurance companies are organized either as groups or unaffiliated companies. Group entities could file a consolidated tax return or an individual tax return. This study uses company level data rather than consolidated group-level data. This gives a more revealing insight into the reinsurance decision at the operational level of insurance companies in our sample.

Definition of the variables

Our empirical approach entails estimating two separate models. The first is a probit model, which estimates the propensity to reinsure for the full sample of insurance companies. For the subset companies with some reinsurance, we estimate a model for the proportion reinsured using ordinary least squares, OLS, regression to determine the factors influencing the reinsurance level. The reported probit and OLS coefficient estimates are not directly comparable.[12] To account for potential selection bias, we performed a Heckman (1979) selectivity adjustment to estimate the equation for the amount reinsured and found evidence of sample selection bias.[13] Though the OLS and the probit models have different dependent variables, we expect both models to yield similar results as we employ the same set of explanatory variables and the hypotheses apply equally to the two models.

The dependent variable in the probit analysis is defined as a binary variable whose value equals one for companies with non-zero reinsurance premiums and zero otherwise. In the OLS model, the dependent variable is defined as the proportion of reinsurance ceded to total volume of direct premiums written plus reinsurance assumed and thus excluding companies with no reinsurance. This measure is consistent with the definitions used in previous studies on reinsurance such as Mayers and Smith (1990). This variable measures the proportion, in aggregate, of reinsurance that life insurance companies contract. The probit model is applied to all companies in the sample and the OLS analysis excludes the companies with no reinsurance.

[10] Industry figures were taken from Life Insurance Fact Book. American Council of Life Insurance (2001).

[11] Best's Key Rating Guide: Life and Health, 1998 and 2000 classify life insurance companies according to their marketing structure as agency, brokerage, direct marketing, mass marketing and reinsurer.

[12] The probit coefficient can be interpreted as a weighted average of two effects: (1) the effect of an increase in an independent variable on the probability that the dependent variable exceeds the limit (greater than zero) and (2) the effect on the expected value of the dependent variable, given that it is above the limit. The magnitude of these effects depends on the values of the independent variables. As these variables grow large, the first effect goes to zero and the second effect converges to the value of the probit coefficient. OLS regression on a sample restricted to observations above the limit provides an estimate of the second effect, but OLS imposes a constant rate of change in the proportion of reinsurance, whereas the probit model implies a nonconstant change in the propensity to reinsure. Moreover, the OLS estimate is biased because the expected value of the truncated error term is positive.

[13] Heckman (1979) developed a method that estimates the Inverse Mills Ratios (LAMBDA) using the predicted probability values from the probit model. The IMR enters the second stage regression as an additional explanatory variable. The null hypothesis of no sample selection bias is rejected if the coefficient on the LAMBDA variable is not significantly different from zero.

Financial Distress from Underwriting Risk Hypothesis: Insurance companies' underwriting experience is closely related to its financial standing. To test for the effect of underwriting risk on the reinsurance decision the following seven variables are used: volatility in claims paid, three measures of business composition, business concentration, the number of states in which companies operate, and policy lapse ratio. The first variable related to the financial distress hypothesis is variability in claims paid, VOLATILITY, calculated as the coefficient of variation in claims paid scaled by total assets paid by the insurer, is used to account for overall risk of the loss distribution. A similar measure is used by Hoerger, Sloan and Hassan (1990) to estimate the risk of the loss distribution for property and liability insurance companies as it affects their reinsurance decision. For the coefficient of variation in claims paid, the mean and the standard deviation of claims paid were calculated using five years of observations ending with the year of analysis. Companies that experience high variability in claims paid are hypothesized to have higher demand for reinsurance to reduce their risk of insolvency.

The next set of variables related to the financial distress hypothesis affecting the underwriting experience of the insurer is measures of business composition. Companies that have lines of business that are potentially more susceptible to wide variations in claims are expected to have a higher proportion of reinsurance. The proportions group insurance (GROUP), accident and health (HEALTH) and annuities (ANNUITY) are included to account for the business composition.[14] We expect group insurance to have a negative impact on the demand for reinsurance. This can be explained by the fact that group insurance claims are lower than under individual life insurance as the risk of adverse selection is controlled through group underwriting standards such as requiring minimum participation by employees and/or having the employer automatically set the amount of coverage.

Baranoff and Sager (2002) argue that in the life insurance industry the most important source of product risk is health insurance writings as it is subject to high uncertainty with regard to benefit payments. Therefore we expect that insurance companies with a high proportion of health insurance premiums will have a higher demand for reinsurance.

Annuity products sold by life insurance companies are mainly interest sensitive. Because owners bear the investment risk, the company's risk exposure is significantly reduced.[15] Therefore, we hypothesize that the demand of reinsurance and the proportion of annuity premiums are negatively related.

The fifth variable related to the financial distress hypothesis is the level of business concentration. A comprehensive measure of concentration that may affect the underwriting results of the insurer through diversification among the different lines of business is the variable HERF. This variable, the Herfindahl index, measures the concentration of an insurer's business calculated as the sum of the squares of premium proportions in each of the different lines of business of direct premiums written. A low value of the Herfindahl index is an indication of

[14] We excluded the proportion of life insurance as the sum of these four proportions adds up to one for most insurance companies included in the sample.

[15] The risk-based capital formula gives zero weight to annuity products signaling no risk to the life insurance companies. See Baranoff and Sager (2002).

low concentration and the insurer's business is spread across several lines of business. The theoretical arguments advanced by Mayers and Smith (1990) on the effect of business concentration, either across lines of business or geographically pertain to two competing hypotheses, the expected bankruptcy costs or the risk of default and the real services incentives for the purchase of reinsurance. The expected bankruptcy costs relates directly to the risk of underwriting. If an insurer's exposures are higher than expected due to a natural or a man-made catastrophe such as a strong hurricane or a terrorist attack resulting in large number of deaths and injuries due to business concentration. On the other hand, as the business of the direct underwriter becomes more dispersed across several lines of business or geographically, the insurer would benefit from the expertise in terms of claim settlement and rate setting that reinsurance companies possess. Consistent with the findings of Mayers and Smith (1990) and Shortridge and Avila (2004) we expect that HERF and the decision to reinsure to be negatively related.

The sixth variable related to the financial distress hypothesis is the number of states in which companies operate. To capture geographic business diversification we include the number of states (NSTATE) the company is licensed to operate. For a company that operates in large number of states, the value of reinsurance services becomes more valuable for the direct writer in terms of skills and technology specific to the area. The geographic diversification is more important in property liability business given the different exposures to natural catastrophes and value of property insured. In life insurance, geographic concentration may reflect differences in the standard of living in terms of income and demographics but no significant differences in mortality and morbidity rates unless there is a high target terrorist attack that could result in a large number of deaths. Like with the variable HERF, we expect the decision to reinsure and the NSTATE to be negatively related.

The next variable related to the financial distress hypothesis is the policy lapse ratio. Lee, Palmer and Skipper (1992) argue that companies that have poor experience with persistency tend to have higher demand for reinsurance. Persistency is measured by the variable LAPSE RATIO, which is the proportion of policies that lapsed to the aggregate number of policies. Policyholders may cancel their policies for a number of reasons such as no need for protection, unemployment, or a substantial increase in cost of life insurance policies. Policies that lapse may result in adverse selection against the company in the sense that low risk policyholders are more likely to cancel and those who really need the coverage, regardless of economic standing, will keep their coverage. This anti-selection bias against the insurance company may result in higher than expected mortality experience for the company and may deteriorate profitability. A high LAPSE RATIO implies that the company has incurred first year expenses without the opportunity to collect enough premiums to make a profit and cover acquisition costs. We predict that companies with a high LAPSE RATIO will have a higher demand for reinsurance.

Tax Management Hypothesis: To test the effect of tax incentives on the reinsurance decision, a proxy for the tax position of the company is calculated. Ideally, net operating loss carryover should be used as a proxy for the company's tax position. This information is not reported on the financial statements of insurance companies. Instead, we use the coefficient of

variation of operating income, TAX, to measure the volatility of earnings.[16] As explained in the theoretical section, the goal of using reinsurance as a tax management tool is to reduce the volatility of earnings. The mean and standard deviation are calculated using previous 5-year observations. We expect a positive relationship between operating income volatility and the demand for reinsurance.

Managerial Incentives to Underinvest Hypothesis: To test for underinvestment hypothesis we use two variables: growth opportunities, and insurance leverage. Myers (1977) suggests that the magnitude of the underinvestment problem is more severe in companies with ample investment opportunities.[17] To test for the underinvestment problem, we include the variable GROWTH as a proxy for investment opportunities available to the company. The variable GROWTH measures the amount of new premiums in proportion to total business. Writing new policies may cause a drain on the capital of the company. Life insurers typically incur high initial expenses in providing long-term policies. Companies hope these expenses will be recovered from subsequent premium revenues. For companies experiencing rapid growth, the returns from valuable marginal opportunities may accrue to new policyholders at the expense of existing policyholders. Without reinsurance, managers may act to protect existing policyholders and forego the valuable opportunities. To mitigate this conflict between different policyholders, rapidly growing companies may use a higher proportion of reinsurance. We anticipate a direct relationship between the demand for reinsurance and the growth variable.

Mayers and Smith (1987) argue that high leverage exacerbates the underinvestment problem. To test the effect of leverage on the reinsurance decision we use the variable, INSLEV. This variable, as used by Hoerger, Sloan and Hassan (1990), is defined as the ratio of direct premiums written to policyholders' surplus. One possible hypothesis regarding the effect of underwriting leverage on the reinsurance decision is that reinsuring the risky claims reduces the probability of financial distress by reducing the risky debt. A lower insurance leverage ratio reduces the variance of firm value and therefore mitigates the underinvestment problem. This reasoning echoes findings in the insurance literature such as Colquitt and Hoyt (1997) that provide evidence that highly leveraged life insurance companies are more likely to use hedging instruments. Therefore, we expect the effect of leverage on the reinsurance decision to be positive.

Control Variables: In addition to the above discussed variables, the purchase of reinsurance can be influenced by other company-specific factors. This study considers the effect of three variables: free cash flow, group affiliation, organization form, and company size.

Free cash flow and reinsurance are compensating sources of capital so that we expect a negative relationship between these two variables. Following Wells et al (1995), internal capital, FREE CASH, is defined as net operating income plus investment income plus additional capital

[16] Other studies such as Cummins, Phillips and Smith (2001) use an indicator variable, equal to one for positive taxable income and zero otherwise, to test tax incentives for hedging. We tried a similar measure in our preliminary tests with no qualitative or quantitative changes in our final results reported in Table 3.

[17] Cummins, Phillips, and Smith (2001) report that researchers use growth rates to approximate growth opportunities.

paid in minus gross interest expenses minus income taxes minus policyholder dividends minus stockholder dividends. We predict that companies with higher undistributed cash flows will have less reinsurance.

The variable AFFILIATION measures group membership and is used to capture the structure of the life insurance industry. Life insurance companies are organized either as single non-affiliated companies or they can be part of a fleet of companies under common management. Groups tend to be larger and more diversified across lines of business, as well as geographically, than single companies. Consequently, companies that are members of a group can share expertise with fellow members on complex insurance problems and can be directly reinsured through group mechanisms. The variable AFFILIATION is an indicator variable equal to one if the company is a member of group and zero otherwise. We expected this variable to have a negative sign as affiliated companies will have a lower demand for reinsurance than independent companies. This argument was made by Lee, Palmer and Skipper (1992).

There are two dominant organizational structures in the life insurance industry, mutual companies and stock companies.[18] Stock companies have conflicts of interest between shareholders and policyholders. The mutual form combines the functions of owners and customers; therefore, for mutual companies, the conflict between shareholders and policyholders is nonexistent.[19] It can be expected that mutual companies would rely less on reinsurance to mitigate the agency problem. However, Garven (1987) argues that reinsurance is a substitute for equity and, as mutual companies do not have direct access to the capital market, these companies will rely more on reinsurance as a source of financing. We include a dummy variable, MUTUAL, which equals one if the company is organized as a mutual and zero otherwise. Because of these opposing effects we cannot a priori predict the sign of the organizational form variable on the demand for reinsurance is an empirical issue.

Another control variable that may have an effect on the reinsurance decision is company size. There are two competing hypotheses with regard to the effect of size on the decision to reinsure. The first hypothesis is that size accounts for informational and scale economies, in the sense that larger companies will cede less of their primary business given their ability to diversify risk across business lines. A large company may safely sustain, to some extent, variations in its underwriting experience without affecting its operating performance. The second hypothesis is that within larger companies agency problems are more significant. In these companies, reinsurance could be used to mitigate the impact of agency costs. A similar argument was made by Mayers and Smith (1990). The variable SIZE is measured as the natural logarithm of admitted assets. The impact of these control variables cannot be predicted on theoretical grounds but may influence the estimation of the demand for reinsurance.

The expected relationships between the explanatory variables and the propensity to reinsure are the same as those to the proportion of reinsurance. Two models are estimated, a probit estimation for the propensity to reinsure and OLS model for the proportion of reinsurance.

[18] There is a third organization form, fraternal societies, which account for only a small proportion of insurance in force.

[19] For a further analysis of the conflict of interest among the different claimholders in an insurance company see for example Pottier and Sommer (1997) and Krishnaswami and Pottier (2001).

Additionally, since the two models are estimated for different firms, the empirical results of the two models may be different in terms of magnitude and/or significance.

V. Empirical Results

Table 1 lists the definition of variables used and their expected relation to the dependent variable. Table 2 reports the descriptive statistics across the years of analysis and tests of significance of the mean and median between reinsurance users and nonusers. Considering the test of the difference in the mean and the median of the independent variables, we find significant differences between users and nonusers.

The results of the probit analysis are presented in Table 3. We report the results for two years to be able to see whether the results we obtain from one year model are consistent with another year. The dependent variable is an indicator variable that equals 1 for reinsurance users and zero otherwise. Our sample shows that 92 and 88 percent of the companies report non-zero reinsurance premiums in 1998 and 2000 respectively. A positive coefficient on a right-hand side variable indicates a positive association between that variable and the probability of being a reinsurance user. The reported results show that several of the independent variables have the predicted effects on the propensity to reinsurance. There is support for the hypotheses of financial distress from underwriting risk, tax incentives and managerial incentives to under invest hypotheses.

Financial Distress from Underwriting Risk Probit Results: One function of the reinsurance decision is to manage future uncertainty and ensure earnings stability which is highly valuable in the life insurance business as many customers are purchasing long term contracts. Our results show that five of the eight variables measuring underwriting risk related to financial distress hypothesis are statistically significant and have the expected sign as follows. The VOLATILITY variable is positive and significant. This provides evidence that life insurance companies with higher risk in the claims distribution are more likely to reinsure to transfer their mortality risk and echoes Shortridge and Avila (2004) and Hoerger, Sloan and Hassan (1990) finding for the property and liability industry. The business composition variables indicate that the proportion of group insurance, GROUP, and the proportion of annuities, ANNUITY, have a negative effect on the propensity to reinsure. As discussed in the previous section, group insurance underwriting standards are used to mitigate adverse selection through minimum required participation and/or allowing the employer to select the amount of coverage. Annuity products are less risky for insurers as the policyholders in many contracts bear the investment risk. The other product line, HEALTH, expected to have a positive impact on the decision to reinsure is significant in the 2000 sample only. The coefficient on HERF is negative and significant indicating that companies whose business line concentration is low are reinsuring a higher proportion of their business. The coefficient of the variable NSTATE is positive and significant indicating that companies whose geographic concentration is low are more likely to reinsure. This result is consistent with Mayers and Smith (1990) and Shortridge and Avila (2004) findings in the property and liability industry that the real-service effect is more important than the reduction in expected bankruptcy costs gained through reinsurance. These empirical results from the probit model indicate that seven variables, VOLATILITY, GROUP, HEALTH, ANNUITY, HERF, NSTATE, and LAPSE RATIO are related to the propensity to reinsure as predicted by the hypothesis that the possibility of financial distress from underwriting risk

influences the reinsurance decision. Most of the statistically significant explanatory variables are consistent across the two samples with the exception of the measures of product proportions. The GROUP measure is significant in the 2000 sample and HEALTH and ANNUITY are significant in the 1998 sample.

Tax Management Probit Result: The coefficient on the TAX variable is significant and positive. This finding indicates that the TAX variable is related to the propensity to reinsure as predicted by the hypothesis that the desire to reduce taxes by smoothing income influences the decision to reinsure.

Incentives to Underinvest Probit Results: the coefficient on the GROWTH variable is significant and positive as predicted supporting the underinvestment hypothesis. This result is in contrast to Cummins, Phillips and Smith (2001) who find no significant impact of growth in assets on the use of derivatives in the life and health industry. Reinsurance has the potential of enhancing firm value by reducing the incentives by managers to underinvest. The coefficient of the INSLEV variable is significant and has a positive sign. Higher leverage is associated with a higher proportion of the direct business being reinsured. This further confirms that highly leveraged companies will benefit more from reinsurance than companies with lower leverage. This result supports the findings by Colquitt and Hoyt (1997) with regard to the use of derivatives in the life insurance industry in reducing the underinvestment problem.

Control Variables Probit Results: We find the variable AFFILIATION to be positive and significant which indicates that life insurance companies that are members of a group are more likely to reinsure. This result may be driven by intra-company transactions. This evidence is consistent with Mayers and Smith (1990) findings that group membership is positive and significant in the property liability industry. The variable SIZE is positive and significant. Large companies are more likely to reinsure than smaller companies. This result supports the agency cost hypothesis as proposed by Mayers and Smith (1990).

The results of the OLS model are reported in Table 4. The model was estimated using Heckman's (1979) two step correction to the OLS regression, which involved the inclusion of the inverse Mills ratio from the probit regression as an additional independent variable. The inverse Mill's ratio, or LAMBDA, is significant indicating that selection bias is present. However, the inclusion of this variable corrects for the selection bias. In this model, the dependent variable is defined as the proportion of reinsurance to total direct premiums written for companies with some reinsurance. The probit model is used to analyze the decision to reinsure while the OLS model is used to analyze the extent of the demand for reinsurance. In the OLS model, we tested the assumption of homoscedasticity of the error term. We found evidence of violation of the latter assumption. The reported t-statistics are adjusted for heteroscedasticity using White's method. Note that the OLS model has more variables that are significant and carry the predicted sign. We focus our attention on these additional variables significant in the OLS model.

The coefficient on the LAPSE RATIO is significant and positive. This result indicates that companies with a high lapse ratio will cede a higher portion of their direct premiums to

mitigate the potential problem of adverse selection and its likely negative impact on the overall performance of the company.

Control Variables OLS Results: One of the purposes of reinsurance is to free up capital and cash. An alternative to external financing is the availability of internal funding from free cash flows. Consistent with prediction, the FREE CASH variable has a negative sign and is significant. This indicates that the existence of excess cash flows decreases the proportion of business to reinsure. In addition, the availability of free cash flow may reduce the probability that the company will experience financial distress in the future. The SIZE variable, in this model, is negative and significant. This finding supports the informational and scale economies hypothesis. Larger companies will cede less of their primary business given their ability to diversify risk across business lines. A large company may safely sustain, to some extent, variations in its underwriting experience without affecting its operating performance.

VI. Summary and Concluding Remarks

Our overall results on the demand for reinsurance by life insurance companies provide support for the hypotheses advanced in the corporate risk management literature. The diversity of explanations reflects the fundamental importance of the risk management program to any corporation. Companies with greater underwriting risk are more likely to reinsure and tend to reinsure a larger proportion of their business. The desire to reduce taxes tends to increase the likelihood of using reinsurance and the proportion of business that is reinsured. Further, this study investigates the effects that reinsurance may have on the incentives for underinvestment in the life insurance industry. The relation between reinsurance and growth opportunities is positive and significant, and shows that reinsurance helps owners to overcome the underinvestment incentive problem. We find consistent results of the analysis of the decision to reinsure using a Probit model of the propensity to reinsure and the analysis of the proportion of business that companies reinsure using a linear regression model.

This study further contributes to our understanding of the demand for reinsurance by life insurance companies. Instead of focusing on underwriting risk reduction as the primary reason to reinsure, our study highlights the role of reinsurance in lessening some of the conflicts between the different stakeholders of an insurance company. Even though recently, there has been a significant rise in the level of securitization of insurance risk, still there are some impediments to a wider use. Some of these include cost savings of reinsurance premiums, lack of expertise among insurance managers and accounting treatment of securitization of risk. As long as there is ample capacity in the reinsurance market, reinsurance will remain the dominant risk management tool for insurance companies along with sound underwriting and pricing. [20]

Further research is needed to incorporate the reinsurance decision within an integrated approach to manage all uncertainties facing a life insurance company from underwriting risk, asset risk and interest rate risk.

[20] Especially during a soft market characterized by abundance of capital, and by and large the reinsurance market is competitive.

Table 1
Variable Definitions and Hypotheses Summary

Dependent Variable

USAGE Indicator variable: 1 for users, 0 for nonusers

$$\text{REINSURANCE} = \frac{\text{Reinsurance Ceded}}{\text{Direct Premiums Written} + \text{Reinsurance Assumed}}$$

Independent Variable	Definition	Expected Sign
	Underwriting Risk	
VOLATILITY	Coefficient of variation of benefits scaled by total assets	+
GROUP	Proportion of group premiums to total direct premiums	-
HEALTH	Proportion of health premiums to total direct premiums	+
ANNUITY	Proportion annuity premiums to total direct premiums	-
HERF	Sum of squared share of each line of business	-
NSTATE	Number of States a company is licensed	-
LAPSE RATIO	Proportion of policies lapsed to total number of policies	+
Tax Incentives		
TAX	Coefficient of variation of operating income	+
Agency Costs		
GROWTH	Direct premiums written of new business to total DPW	+
INSLEV	Insurance premiums to surplus	+
	Control Variables	
FREE CASH	Net operating income + investment income + additional Capital paid in – gross interest expenses – income taxes – Policyholders' dividends –stockholders' dividends.	-
AFFILIATION	Indicator variable =1 if affiliated, 0 otherwise	+
MUTUAL	Indicator variable =1 if mutual, 0 otherwise	+/-
SIZE	Natural logarithm of total assets	+/-

Table 2A Descriptive Statistics

	Users				Non-Users				Difference Mean	
Year	**1998(N=680)**		**2000(N=583)**		**1998(N=154)**		**2000(N=229)**		**1998**	**2000**
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**t-Test**	**t-Test**
VOLATILITY	0.30	0.38	0.56	6.86	0.41	0.99	0.43	1.08	2.27**	0.29
GROUP	0.25	0.36	0.26	0.35	0.17	0.34	0.17	0.33	1.96**	3.25***
HEALTH	0.16	0.27	0.15	0.26	0.12	0.27	0.14	0.28	1.69*	0.73
ANNUITY	0.11	0.23	0.12	0.22	0.15	0.29	0.15	0.29	-1.67*	-1.74*
HERF	0.66	0.23	0.65	0.24	0.77	0.20	0.80	0.28	-5.93***	-7.88***
NSTATE	26.40	20.13	28.40	20.40	14.06	18.1	16.60	19.4	6.97***	7.50***
LAPSE RATIO	0.08	0.19	0.05	0.07	0.06	0.13	0.05	0.11	-0.70	-0.40
TAX	0.63	9.89	0.30	0.47	0.81	9.42	0.21	0.41	0.63	2.65**
GROWTH	0.37	0.33	2.15	19.55	0.33	0.35	0.32	0.34	0.21	1.41
INSLEV	1.90	2.13	2.78	11.57	1.38	1.61	1.64	2.24	1.90*	1.47
FREE CASH	0.03	0.18	0.01	0.13	0.02	0.10	0.05	0.23	1.11	-3.18**
AFFILIATION	0.23	0.42	0.80	0.40	0.51	0.50	0.59	0.49	7.27***	6.40***
MUTUAL	0.10	0.30	0.10	0.31	0.04	0.21	0.05	0.23	2.18**	2.20**
SIZE	18.80	2.56	19.16	2.73	17.04	2.67	17.86	2.70	7.62***	6.10***

Table 2 B Descriptive Statistics

	Users		Nonusers		Difference Median	
Year	**1998**	**2000**	**1998**	**2000**	**1998**	**2000**
Variables	**Median**	**Median**	**Median**	**Median**	**Z-Test**	**Z-Test**
VOLATILITY	0.179	0.191	0.172	0.168	-0.53	0.85
GROUP	0.026	0.053	0.000	0.000	-5.70***	5.84***
HEALTH	0.009	0.009	0.000	0.000	-6.24***	5.06***
ANNUITY	0.002	0.003	0.000	0.000	-3.92***	3.35**
HERF	0.628	0.618	0.793	0.818	3.74***	5.84***
NSTATE	28	36	2	3	-5.56***	6.15***
LAPSE RATIO	0.030	0.024	0.021	0.019	-2.14**	1.01
TAX	0.382	0.162	0.382	0.256	0.00	2.65**
GROWTH	0.276	0.299	0.202	0.215	-0.89	2.26**
INSLEV	1.263	1.321	0.701	0.735	-3.21**	3.03**
FREE CASH	0.002	0.012	0.011	0.013	4.46***	0.23
AFFILIATION	1	1	1	1	7.06***	6.25***
MUTUAL	0	0	0	0	-2.18**	2.19**
SIZE	18.72	19.181	16.562	17.482	-5.88***	5.22***

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

Table 3
Determinants of the Likelihood of Reinsuring, Heckman Model

Dependent Variable **USAGE:** 1 for users, 0 for nonusers

	1998 Sample		2000 Sample	
Explanatory Variable	**Estimates**			**T-Statistics**[a]
INTERCEPT	-2.8386***	-2.8529	-3.4049***	3.6667
Underwriting Risk				
VOLATILITY	0.0660***	2.3975	0.0621***	2.3810
GROUP	-0.0943	-0.3295	-0.7305**	-1.8978
HEALTH	0.5135***	2.0524	-0.3437	-0.6821
ANNUITY	-0.7783**	-1.9937	-0.1617	-0.4061
HERF	-0.8103***	-2.4550	-0.8002***	-2.3512
NSTATE	0.0088**	1.9441	0.0111**	1.7159
LAPSE RATIO	-0.8952	-0.9734	-1.0495	-1.1822
Tax Incentives				
TAX	0.5900***	2.8169	0.5300***	2.6181
Agency Costs				
GROWTH	0.4698***	3.0226	0.4321***	2.8420
INSLEV	0.5631**	1.8363	0.0879**	1.8731
Control Variables				
FREE CASH	-0.4303	-1.0751	-0.3277	-0.7950
AFFILIATION	0.3116**	1.8759	0.2446	1.4810
MUTUAL	0.2633	0.7680	0.3564	1.0082
SIZE	0.2448***	4.5201	0.2644***	5.1480
Number of Observations	812		824	
Pseudo R^2	0.2104		0.2061	
Log Likelihood	-169.7789		-174.1412	

[a] T-statistics adjusted for heteroscedasticity using White's test.

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

Table 4
Second Stage OLS Estimates for Companies Using Reinsurance

Dependent Variable: Proportion of Reinsurance Ceded

Explanatory Variable	**Estimates**			**T-Statistics**[a]
INTERCEPT	0.5583***	5.6329	1.0728***	9.4459
Underwriting Risk				
VOLATILITY	0.0951***	2.5729	0.0039***	2.6058
GROUP	-0.0210	-0.7615	-0.3051***	-2.6628
HEALTH	-0.0552	-1.4036	-0.0806	-1.3869
ANNUITY	-0.1529***	-3.5763	-0.1005***	-2.4379
HERF	-0.0474	-1.3379	0.0290	0.6780
NSTATE	0.0020***	3.3630	0.0026***	3.9319
LAPSE RATIO	0.0805**	2.0370	0.3609***	3.5700
Tax Incentives				
TAX	0.0018***	3.4985	0.0214***	2.1354
Agency Costs				
GROWTH	0.0075***	3.5777	0.0026***	4.9516
INSLEV	0.0075**	1.9631	0.0068**	2.8794
Control Variables				
FREE CASH	-0.4369***	-6.2514	-0.1803***	-2.8061
AFFILIATION	0.0088	0.3109	0.0156	0.6257
MUTUAL	-0.0032	-0.1732	-0.0421	-1.3005
SIZE	-0.0230***	-4.5533	-0.0457***	-7.7690
LAMDA	-0.3386***	-4.4247	-0.2682***	-3.7130
Number of Observations	747		730	
Adjusted R^2	0.1954		0.1731	

[a] T-statistics adjusted for heteroscedasticity using White's test.

*** Significant at the 1% level
** Significant at the 5% level
* Significant at the 10% level

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