Economic and Financial Perspectives on the Demand for Reinsurance

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> "*The ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Practical men, who believe themselves quite exempt from any intellectual influences, are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribblers of a few years back.*"

Quote from John Maynard Keynes
The General Theory of Employment, Interest and Money (1936)

I. Overview

The first section of this book provides a glimpse into the minds of a number of experts involved in setting the reinsurance strategies for leading multinational insurance companies. These authors identify a number of important issues that impact effective reinsurance strategies. Bob Stevenson (Zurich) focuses on the crux of the challenge; that is, setting the reinsurance policy. Policy must be determined prior to setting strategy, and only then can insurers transact as well as benchmark the effectiveness of their reinsurance decisions. Nick Golden (RSA) and Chris Milton (AIG) argue that reinsurance is a capital source intended to either back the risk in the existing book of business or alternatively, back the risk in new ventures. Therefore, the policy guiding reinsurance strategy is essentially a subset of the insurer's capital management policy.

Moving beyond the more philosophical issues addressed by Stevenson, Golden and Milton, both Milton and Sedlmair (Allianz) demonstrate two alternative business models for purchasing reinsurance; one very centralized and the other decentralized. These authors show, among other things, that the appropriate model for a given insurer depends upon various structural and cultural characteristics.

Our preference is to frame the theory of the demand for reinsurance as a "special case" of the more general question concerning how one might design contracts, business organizations, and markets so as to allow for the efficient allocation, pricing, and management of risk. Traditional approaches to risk management typically focus upon the analysis of a specific type of operating or financial risk[1] without considering how such risks interact. Here, we consider more of an integrated approach.[2] The framework for

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[1]Operating risks include uninsurable business risks such as loss of competitive position, product substitution and obsolescence, as well as risks for which private insurance is often available, such as property-liability risks and workplace risks that can adversely affect employee life and health. Financial risks include credit risks as well as risks that result from market fluctuations in the prices of commodities, currencies and financial assets. Insurance and derivatives are commonly used to control the cost of "insurable" operating and financial risks, whereas alternative contract designs and organizational structures are commonly employed as risk control mechanisms for "uninsurable" business risks that are inherently more difficult to quantify and manage.

[2]In recent years, integrated risk management has become increasingly popular in professional as well as academic circles. This change in approach and philosophy has been motivated significantly by the convergence of insurance and financial markets, along with the ever-increasing frequency and severity of natural and man-made catastrophes. Indeed, as noted in a recent *Economist* article, "The

this approach is based in large part upon theoretical advances in finance and economics. In the spirit of the quote by noted economist John Maynard Keynes, by focusing on theory we hope to broaden the reader's perspective beyond the more practical and strategic perspectives that have already been offered in the earlier chapters of this book.

The primary question we wish to address in this chapter is whether risk is costly, and if so, how can reinsurance be used to reduce the cost of risk for insurance companies? The answer to this question is of obvious importance, because insurers who do not manage capital and risk effectively put themselves at a comparative disadvantage in the competition for scarce capital resources. We will address this question by analyzing the economic and financial conditions that are necessary in order for reinsurance to add value to the insurance enterprise. In the next section, we consider the set of conditions under which reinsurance policy may not particularly matter. This model will discipline our analysis by providing a "null hypothesis" against which we can "test" alternative theories that are discussed in subsequent sections. The third section of the chapter will examine the impact that taxes have upon incentives for risk bearing. This will be followed by a section that addresses the effects of direct and indirect costs related to financial distress (e.g., costs of bankruptcy and moral hazard). Section 5 will present a discussion of some implications of adverse selection in reinsurance and financial markets. Section 6 examines the impact that managerial compensation contract design has upon the risk appetite of the insurer. Finally, the chapter concludes with a summary conclusion, including some thoughts concerning how economic and financial insights into the demand for reinsurance help lead to consistency between policy, strategy, reinsurance buying behavior and benchmarking.

II. What if Reinsurance Didn't Matter?

For reasons that will soon become apparent, we prefer to view the reinsurance decision as a risk and capital management decision. This perspective differs significantly from traditional theories of reinsurance markets that were developed in the economics and actuarial science literatures. These literatures typically view insurers as owner-managed underwriters who differ primarily with respect to their appetites for bearing risk. For example, the famous Norwegian actuary and economist Karl Borch (1962) models reinsurance as a market where risk averse insurers participate in a reinsurance pool in which they optimally share insurance risk. What emerges from Borch's model is that reinsurance is demanded and supplied on a proportional, or quota share basis, where the share for any given insurer depends upon the degree to which that insurer is averse to or tolerant of risk. Subsequent authors (including Borch himself (1985)) built upon the Borch model by introducing factors such as the risk of becoming insolvent.

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business of financing companies is converging with the business of insuring them." See "The New Financiers," *The Economist*, September 2, 1999.

While the Borch model is of substantial theoretical interest,[3] the most apparent "deficiency" of his model is that most insurers are not owned and operated by individual entrepreneurs; rather, they comprise a complex set of (implicit and explicit) contracts among various stakeholders, including policyholders, shareholders, managers, regulators, and tax authorities. Consequently, this raises the question of whose welfare should such an insurer look after, and how one might manage conflicts (along with related costs) between these stakeholders.

Under the assumption (to be relaxed later) that the insurer can costlessly enforce its various stakeholder contracts, the optimal decision criterion is for the insurer to maximize the value of its shares.[4] Within this framework, Doherty and Tiniç (1981) show that as a method of reducing the riskiness of returns to the owners of the insurer, the reinsurance policy of the insurer should not matter. The logic behind this result is compelling. Insurers can alter their risk profile by ceding or assuming reinsurance. However, shareholders can also alter their risk profile by trading shares. Suppose the insurer seeks to reduce the risk of its shares by purchasing reinsurance. While some shareholders might approve of such a change, others might have an appetite for more insurance risk that can be satisfied by buying shares in riskier insurers. Thus, shareholder risk management is a close (if not perfect) substitute for insurer risk management. In such a world, reinsurance is a redundant feature of the insurance marketplace.[5]

III. Corporate Income Tax Effects

Now that we have our null hypothesis in place; i.e., that reinsurance is a redundant feature of the insurance marketplace, we are in a position to determine whether it is possible to reject this hypothesis in favor of various alternative hypotheses. The first alternative hypothesis that we will consider is the effect of the corporate income tax. In many countries, corporate income tax rates vary as a function of the level of income and

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[3]It is worthwhile noting that Borch's reinsurance model anticipated the development of the Sharpe (1964)-Lintner (1965)-Mossin (1966) Capital Asset Pricing Model (CAPM) for which Sharpe received the Nobel Prize in 1990. The parallels between Borch's model and the CAPM are striking, since the CAPM posits that investors should hold proportional shares in a "market portfolio" of risky assets. Given that some investors are more risk averse than others, they can satisfy their appetites for risk by varying the proportion invested in the market portfolio and a riskless asset. The development of the CAPM along with the "efficient market theory" helped to popularize indexed mutual fund strategies in which investors passively vary proportions invested in various indexed asset classes.

[4]However, as Fama and Jensen (1983) note, everything changes if we relax the assumption of costless contracting. With costly contracting, the cost of doing business is determined by summing contracting costs along with other costs such as production and distribution costs and the costs related to compliance with external legal and regulatory constraints. Differences in the costs of managing incentive conflicts between stakeholders constitute an important reason why ownership structures in the insurance industry are so diverse, comprising the stock, mutual, reciprocal and Lloyds forms of organization. Although a discussion of ownership structure in the insurance industry is well beyond the scope of our survey, we refer interested readers to Mayers and Smith (2000) for a succinct and lucid discussion of the theory and evidence underlying the industrial organization of the insurance industry.

[5]The reader should note that the above analysis implicitly assumes that there are no transaction costs associated with buying reinsurance (e.g., in the form of premium loadings) and trading shares in capital markets (e.g., in the form of trading costs). However, if the transactions costs are higher for insurers to cede and assume reinsurance than it is for investors to buy and sell shares, then investors would obviously be better off without a reinsurance market.

are typically progressive in nature; i.e., the firm pays a higher marginal rate at higher levels of total income. It is also common for tax authorities to limit the ability of firms to write off the full value of corporate losses.[6] Mathematically, these features imply that firms face nonlinear tax schedules in which varying marginal tax rates introduce a firm-specific source of risk that can be more effectively managed by the firm than by its shareholders.

In order to show how nonlinear taxes create incentives for firms to insure risk, consider the following simple numerical example. Suppose a firm will earn $1,000,000 if no loss occurs and $500,000 if there is a loss. The probability of a loss is 50%, and the firm may purchase an (actuarially fair) insurance policy for $250,000 that fully covers this loss. Also suppose that the firm must pay a 15% tax rate if income is $500,000, 25% if income is $750,000, and 35% if income is $1,000,000. Should the firm purchase the insurance policy? In order to answer this question, we must compare the expected value of after tax income under the two alternatives (risk retention versus risk transfer). In the following two tables, we compute the after-tax income distributions that occur under each possible loss outcome:

Strategy 1: Retain Risk

Loss Outcome	Probability	Taxable Income	Taxes	After-Tax Income
No Loss	50%	$1,000,000	$350,000	$650,000
Loss	50%	$500,000	$75,000	$425,000

Strategy 2: Transfer (Insure) Risk

Loss Outcome	Probability	Taxable Income	Taxes	After-Tax Income
No Loss	50%	$750,000	$187,500	$562,500
Loss	50%	$750,000	$187,500	$562,500

Comparing the two risk management strategies listed above, we find that the effect of insuring risk is to simultaneously reduce the volatility and increase the expected value of after-tax income:

Strategy 1 Expected Taxable Income $= 50\% \times \$1,000,000 + 50\% \times \$500,000 = \$750,000$.
Strategy 1 Expected Taxes $= 50\% \times \$350,000 + 50\% \times \$75,000 = \$212,500$.
Strategy 1 Expected After-Tax Income $= 50\% \times \$650,000 + 50\% \times \$425,000 = \$537,500$.

Strategy 2 Expected Taxable Income $= 50\% \times \$750,000 + 50\% \times \$750,000 = \$750,000$.
Strategy 2 Expected Taxes $= 50\% \times \$187,500 + 50\% \times \$187,500 = \$187,500$.
Strategy 2 Expected After-Tax Income $= 50\% \times \$562,500 + 50\% \times \$562,500 = \$562,500$.

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[6]Although the U.S. tax code mitigates this effect somewhat by allowing for loss carrybacks and carryforwards, the net effect is still one in which corporate gains are effectively taxed at higher rates than losses are rebated. See Doherty (2000, pp. 199-204) for a lucid discussion of these issues.

The reason why insurance raises the expected value of after-tax income by $25,000 is that the firm is able to lock in a certain level of income ($750,000) at which it is favorably taxed relative to the risk retention strategy in which a low tax is paid in the event of a loss but a high tax is paid when there was no loss.[7] The effective tax rate when risk is retained is $212,500/$750,000 = 28.33%, compared with the 25% tax rate that applies when risk is insured. In the academic literature, the problem of nonlinear taxation is commonly referred to as the tax convexity problem. [8]

Interestingly, insurance is irrelevant if the marginal tax rate is constant. Consequently, tax convexity constitutes a sufficient (although not necessary) condition for risk transfer to matter. To illustrate this point, suppose that we replace the progressive tax schedule from the previous numerical example with a tax rate of 25% that applies to all levels of income. Under this assumption, the firm's expected tax liability is unaffected by the volatility of its taxable income; specifically, it will be $187,500 irrespective of whether risk is transferred or retained. Therefore insurance would be irrelevant from a tax perspective.

Now let's consider the problem of tax convexity (and the associated incentive to hedge risk) in the real world in which insurers actually operate. Tax convexity in the real world is quite a bit more complicated than in our numerical example, and it can vary significantly from firm to firm. For any given firm, the degree of tax convexity depends not only upon the schedule of marginal tax rates published by the IRS, but also upon a number of firm-specific characteristics, including past, present and future expected profitability, whether the firm is subject to the alternative minimum tax, and whether the firm has any investment tax credits or net operating loss carrybacks and carryforwards. Graham and Smith (1999) provide empirical evidence of the effect of tax convexity on the incentive to hedge risk by using financial data for a large cross section of U.S. industries over the period 1980-1994. While their study is based on firms drawn from many industries, we have no *a priori* reason to believe that a qualitatively different result would necessarily obtain for the insurance industry. In summary, Graham and Smith find that firms with the greatest tax-based incentives to hedge were small to medium sized, with earnings that were expected to be near zero and frequently shifting between losses and profits. Conversely, firms with weaker tax-based hedging incentives tended to have higher market values, lower leverage, higher levels of income, less frequently reported losses, lower income volatility, more investment tax credits and fewer net operating loss carryforwards. Overall, Graham and Smith found that the average tax savings from a five

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[7]Depending upon the competitive structure of the insurance market, one might expect that the tax benefits associated with insuring risk are likely to be shared between the insurer and the insured, with the insured appropriating most (if not all) of the tax benefits in a competitive insurance market and the insurer wining if insurance markets are not competitively structured.

[8]The definition of tax convexity follows directly from a mathematical theorem known as Jensen's inequality. According to Jensen's inequality, if a function $f(x)$ is convex, then $E(f(x)) > f(E(x))$. In our numerical example, we showed that the tax on insured income $f(E(x))$ is less than the tax on uninsured income $(E(f(x)))$; consequently, we have tax convexity.

percent reduction in the volatility of taxable income represnted 5.4 percent of expected tax liabilities, and in extreme cases, these savings exceeded 40 percent.

Recognizing that reinsurance is a hedging vehicle, the demand for reinsurance will be greater amongst firms facing convex tax functions.[9] Therefore, we may generalize Graham and Smith's findings to suggest firm characteristics amongst insurers who utilize reinsurance more extensively for risk-hedging purposes. Furthermore, reinsurance may be a rational choice even if the contract is priced in excess of the expected loss due to the associated tax savings. Garven and Loubergé (1996) present an analytical model of underwriting capacity and insurance market equilibrium under a convex corporate tax schedule which, among other things, shows this to be the case.[10] In the Garven-Loubergé model, reinsurance markets enable insurers to reallocate tax shields to those firms that have the greatest capacity for utilizing them, in much the same manner as leasing companies share tax shield benefits with lessees in leasing markets. Garven and Loubergé view reinsurance as an efficient mechanism to yield the optimal allocation of tax shield benefits. In this framework, reinsurance markets provide the insurance industry with an important tax arbitrage mechanism. Specifically, reinsurance enables the insurance industry to minimize the aggregate value of tax claims on overall industry income.[11] Finally, Garven and Loubergé extend their model to a consideration of the international reinsurance market, where they note that their model predicts the emergence of "tax clientele" effects that arise when tax rates differ among countries. An empirical implication of the Garven-Loubergé tax clientele hypothesis is that average net retention ratios for insurers should be inversely related to corporate tax rates. Using data from 1988 and 1989, Outreville (1994) provides corroborating empirical evidence, in that he finds that a statistically significant negative relationship exists between retention ratios and corporate tax rates using data from 42 countries. Specifically, net ceded reinsurance tends to be higher on average in countries that have high marginal corporate tax rates.

IV. The Effects of Bankruptcy and Moral Hazard Costs

Recall the assumption underlying the Borch model such that the insurer can "costlessly" enforce its various stakeholders' contracts. Let us now relax this assumption and recognize that the various stakeholders (owners, policyholders, bondholders, shareholders, managers) do, in fact, have contracts that cannot be enforced without the imposition of some costs. For example, firms expend real economic resources in

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[9] A reinsurance contract is a type of hedging contract whereby the ceding company puts the losses on the reinsurer subject to some trigger event.

[10] In Garven and Loubergé, convex taxes are sufficient to cause insurance prices to be actuarially unfair, and the expected return on capital invested in the insurance business reflects the probability of paying taxes. The notion that competitively determined insurance prices must incorporate a corporate tax loading is also a well-known result from the more general insurance pricing literature; e.g., see Fairley (1979), Hill (1979), Doherty and Garven (1986), Hill and Modigliani (1987), and Myers and Cohn (1987).

[11] The parallels between the Garven-Loubergé model and Miller's (1977) capital market equilibrium model are striking, since the Miller model posits that a central role of corporate finance is to perform a similar tax arbitrage function for investors.

upholding the promise to owners by establishing the Board of Directors. Likewise, bankruptcy costs and the costs associated with moral hazard are examples of real costs incurred when firms fail to protect the rights of policyholders and/or bondholders. It is exactly these costs and the recognition of these costs that explain why, in fact, reinsurance does matter. Other owner-creditor agency problems are underinvestment (passing up projects with positive net present value) and asset substitution (replacing safe with risky investments).

Jensen and Meckling (1976) set forth the definition of a firm as being a legal fiction, which serves as a nexus for a set of contracting relationships among individuals. These contracts define a set of agency relationships under which principals engage agents to perform some service on their behalf and subsequently the principals delegate the decision-making authority to the agent. The agent may not always act in the best interest of the principal because it might not be in the agent's self interest to do so. The ownership structure of the insurance company (stock, mutual, reciprocal. Lloyds) determine the relationship between the various stakeholders (also referred to as agents) in an insurance organization. For example, stock insurers separate the functions of the manager, owner and policyholder; whereas the mutual merges the owner with the policyholder and Lloyds merge the owner with the manager. Incentive conflicts exist between these agents and costs (e.g., negotiation, administration, information and litigation costs) are incurred controlling the incentive conflicts. Because these agency costs are real, ownership structure matters when we set out to maximize value for the firm. That is, we must attempt to minimize these agency costs in order to maximize firm value.

In the context of the insurer, we focus primarily upon the following principal-agent relationships: (1) stockholder (principal) – manager (agent), and (2) stockholder (owner) – policyholder (creditor). In accordance with the agency theory of Jensen and Meckling, conflicts occur between shareholders and managers if managers' interests have not been aligned with the value creation demands of the shareholders. One mechanism providing ballast to incentive differences between managers and owners is to compensate managers with options or restrictive stocks. Furthermore, owner/manager conflicts are monitored by establishing a Board of Directors and the costs associated with maintaining a Board, both explicit and implicit, become agency costs.

Under the stock form of ownership structure, the owner (shareholder) function is separate from that of the creditor (policyholder). A conflict exists between stockholders (owners) and policyholders (creditors) in that stockholders would prefer profitability while policyholders would prefer low premium charges. Alternatively, creditors may prefer less risky investments resulting in guarantees that the debt obligations will be met; whereas, shareholders, who claim rights to residual wealth, may prefer more risky investments. Because the stock insurer separates the owner from the customer, the

potential for "ripping off" policyholders by risk shifting does exist. Recognizing that the potential exists such that the owners may abstract value from the policyholders, the policyholders will ask for something in return such as lower premiums, surplus cushion, the purchase of reinsurance or participating policies. When the financial health of the insurer becomes stressed, the costs associated with monitoring the conflict between owners and creditors are worsened. In the case of a mutual organization, these conflicts do not exist because the owners and the creditors are combined in one function – the policyholder.

In the insurance industry, both the mutual and stock form of ownership co-exists. In the mutual organization, owner-creditor conflicts are eliminated and the associated monitoring costs are not incurred. A naïve extension of the theory might suggest that the mutual form of ownership is preferred over the stock form since the structure naturally eliminates one set of conflicts. Mayers and Smith (1981) established the managerial discretion hypothesis suggesting that differences exist in costs of controlling incentive conflicts between shareholders and managers versus policyholders and managers; and these differences influence the choice between stock and mutual form of organization. Mayers and Smith point out those mangers with the greatest decision authority have the greatest potential to operate in self-interest at the expense of the owners. Mutual managers tend to have greater decision authority than do stock managers because of less effective or less intense corporate governance. Mayers and Smith predict that the cost of controlling management is significantly higher for mutual insurers as compared to stock insurers; consequently mutuals should be more prevalent in lines of business where management exercises little discretion. Likewise stock insurers should be more dominate in lines where management discretion is more important.

Lamm-Tennant and Starks (1993) empirically investigate risk differences between the two types of ownership structure in the property-liability insurance industry to better understand why both co-exist. The managerial discretion hypothesis derived from agency theory would suggest that mutuals would be associated with activities that require less managerial discretion. Lamm-Tennant and Starks provide empirical evidence supporting the managerial discretion hypothesis suggesting that stock insurers have more risk than mutuals where the risk inherent in future cash flows is proxied by the variance of the loss ratio. Further evidence suggests that stock insurers write relatively more business than do mutuals in lines and states having higher risk. The risk differences between stocks and mutuals have interesting implications suggesting differences in reinsurance strategy due to ownership structure. If mutuals concentrate in less risky states and less risky lines of business, one might conclude their appetite for hedging may be muted. Likewise, to the extend a mutual holds an exposure in a risky state or risk line of business, the mutual insurer may be more prone to reinsurer or hedge the risk resulting in a net position aligned with their limited risk appetite.

As previously mentioned, two interesting problems occur when owner - creditor conflicts are not controlled; under-investment and risk shifting (also known as asset substitution). Under-investment suggests that insurers in financial distress may fail to exploit positive net present value opportunities since the value creating will not accrue to the shareholders but, instead, will simply prop up the debt otherwise in default. That is, due to agency conflicts between owners (shareholders, in the case of a stock company) and creditors (policyholders, in the case of a stock company), insurers may pass up opportunities in the market that would otherwise provide economic value to the firm. To the extent risk management removes or relaxes the threat of insolvency, agency conflicts are muted. Likewise the absence of agency conflict results in decision makers rendering the optimal economic investment decisions avoiding under investment.

Risk shifting is the propensity of highly levered firms to favor more risky investment choices (post the debt offering) because these choices accrue to the benefit of the shareholders at the expense of the bondholders. Again we see the conflicts between bondholders and owners affecting the risk appetite of the insurer. One might suspect insurers with poor controls between bondholder and owner conflicts would prefer more risk than less and would likewise hold higher nets or avoid reinsurance altogether.

V. Implications of Adverse Selection in Reinsurance and Financial Markets

Groucho Marx's famous comment that he would prefer not to belong to any club that would have him as a member captures the essence of adverse selection. Adverse selection occurs whenever a buyer or seller of a good or service has an informational advantage over her counterparty and tries to profit from this asymmetry in information. If unchecked, adverse selection may lead to market failure. Akerlof (1970) demonstrates how market failure may occur when sellers have an informational advantage over buyers concerning product quality.[12] For example, the seller of a used car knows whether his or her car is a "lemon". Surely, if the car is in pristine condition, the seller would be more likely to transfer ownership to a friend or family member. Consequently, by placing the car on the used car market, the seller inadvertently signals to potential buyers that the product is in all likelihood a lemon. Knowing this, the buyer will offer a lower price for the car in anticipation of it being a lemon. Sellers come to realize that used car prices reflect asymmetric information penalties, so eventually good used cars are crowded out by the lemons in the market for used cars. Akerlof showed that in the absence of adequate mechanisms to assure, verify and enforce contract provisions regarding quality (e.g., via credible third party certification), markets may either fail or do an otherwise

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[12]The 2001 Nobel Prize in Economic Sciences was awarded to George Akerlof (University of California-Berkeley), Michael Spence (Stanford University), and Joseph E. Stiglitz (Columbia University) "for their analyses of markets with asymmetric information." Akerlof (1970) analyzes the role of third party certification in resolving adverse selection, whereas Spence (1973) focuses on the role of signalling. Rothschild and Stiglitz (1976) show that adverse selection in insurance markets can be largely mitigated through contract designs.

poor job of allocating resources. Akerlof's work has important implications for the organization and regulation of any number of markets, including product markets, labor markets and insurance markets.

The adverse selection model that is of more direct relevance for the study of insurance is that offered by Rothschild and Stiglitz (1976). Rothschild and Stiglitz set up an insurance market in which potential insureds are identical in all respects other than their accident probabilities. Although the insurer knows what these accident probabilities are, for whatever reason it is not possible to determine who the bad risks and good risks are, and this creates an obvious dilemma for the insurer.[13] Specifically, how can the insurer offer insurance and avoid adverse selection? Rothschild and Stiglitz's solution to this problem is rather clever. They solve the problem by restricting the menu of available insurance policy choices. The goal of this strategy is to induce self selection, in that one makes it economically attractive for the good risks to purchase the good risk policy and the bad risks to purchase the bad risk policy. In the Rothschild-Stiglitz equilibrium, the good risks will not purchase the bad risk policy because this would lower their economic welfare, and similarly, the bad risks will not purchase the good risk policy for the same reason. The insurer offers a bad risk policy that provides full coverage at a premium that is actuarially fair for bad risks, and she offers a good risk policy that provides partial coverage at a premium that is actuarially fair for good risks. The theory has very practical implications for the demand for insurance. Specifically, if you are a good risk, then you should purchase insurance with a high deductible; to do otherwise would involve overpaying for coverage. This may be an important reason why rates on line in the reinsurance market are lower at higher attachment points; essentially, the reinsurer is anticipating that the worst risks will be those who want low attachment points on their excess of loss reinsurance treaties.

Not only is there adverse selection in insurance and reinsurance markets; adverse selection is also a problem in financial markets, and this also has implications for the insurer's reinsurance policy. The adverse selection problem in financial markets derives from the fact that corporate managers have better information about the firm's future prospects than do outside investors. Consequently, managers are more likely to issue new equity when the firm is overvalued. However, investors are aware of this incentive, so they infer the announcement of a secondary equity offering by a publicly traded firm as a signal that the firm's equity is overvalued. Therefore firms prefer to rely upon internal equity since funds can be raised without conveying adverse signals (and consequently bearing related costs) about the value of the firm. However, if external financing is necessary, then firms prefer to rely upon financing sources such as bank loans, commercial paper, notes, bonds, preferred stock, and convertible securities, and issue

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[13]Although Rothschild and Stiglitz present an extreme case, in the real world there are obvious limits to risk classification that may be due to any number of factors, including technology or legal and regulatory factors.

external equity as a last resort. The logic for this "pecking order" strategy[14] is straightforward; essentially, there is less room for differences in opinion concerning the values of securities whose terms are contractually fixed (e.g., debt), compared with equity which resembles a residual claim on the firm that is paid only after all of the other fixed claims upon the firm are satisfied. Consequently, just as a good risk will gravitate toward higher attachment points in the case of a reinsurance purchase, it is also the case that the "good" firm will manage its risks so that it can minimize the probability of incurring adverse selection costs when it obtains contingent financing. This creates a bias in favor of pre-loss financing strategies (e.g., purchasing reinsurance) in place of post-loss strategies (e.g., retaining risk and issuing equity after the fact). An important benefit of pre-loss versus post-loss financing is that pre-loss financing guarantees liquidity at a future date on favorable terms.[15] Following a loss, the unhedged firm might experience difficulty raising additional capital on favorable terms due to adverse selection costs and also because of the possibility of financial distress.

In the reinsurance markets, the insurer ceding the risk will likely have better information about the underlying risk than does the reinsurer. The asymmetry in information is exacerbated depending on the nature of the underlying risk. For example, we would expect less information asymmetry surrounding high frequency, low severity risk such as automobile physical damage than low frequency, high severity such as commercial liability. The greater the information asymmetry, the greater the imputed charge imposed by the reinsurer on to the insurer when transferring the risk through reinsurance. This imputed charge for information asymmetry may be mitigated though long-standing relationships, joint risk sharing or improved information flows. Therefore, we may expect differences in insurer risk policy and strategy depending on nature of the underlying risk written by the insurer. In a paper entitled "The Design of Private Reinsurance Contracts", Jean-Baptiste and Santomero (2000) demonstrate how information problems affect the efficiency of the allocation of risk between insurers and reinsurers, and how long-term implicit contracts between insurers and reinsurers allow the inclusion of new information in the pricing of both future and past reinsurance coverage. Because of these features (long term relationships and the inclusion of new information in the pricing of future and past coverage), Jean-Baptiste and Santomero show that the ceding company purchases a more efficient quantity of reinsurance and at a more efficient price with long-term implicit contracts or relationships between the insurer and the reinsurer.[16] We (Garven and Lamm-Tennant (2002)) are currently working on an

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[14]The concept of a "pecking order" in terms of preferences for different forms of financing is due to Myers and Majluf (1984). Froot, Scharstein and Stein (1993) apply the pecking order theory as a way to explain corporate risk management decision making. There, risk management represents a device for ensuring the firm's liquidity so that cash is always available for to make value-enhancing investments.

[15]The notion that insurance provides liquidity was recently advanced by Peter Bernstein (see Bernstein (2000)). Bernstein notes that insurance enables investors to reverse the consequences of unfavorable outcomes, and thus reduce the risk of investing in a particular asset that would otherwise be unbuyable and unsellable due to its lack of liquidity.

[16] Garven and Lamm-Tennant (2002) have designed an empirical test of this hypothesis using Schedule F data for all insurers reporting to A.M. Best from 1980 to 2000. While Schedule F does impose numerous data limitation, preliminary results appear

empirical study that we expect will provide empirical support for the Jean-Baptiste and Santomero hypothesis.

VI. Managerial Compensation Contract Design

Until this point in the essay, we have made the implicit assumption that shareholders and managers of insurers have perfectly aligned incentives, such that managers are primarily interested in maximizing shareholder welfare. Next, we consider the implications of relaxing this assumption.

It is reasonable to expect that managers may have different objectives than shareholders. Corporate managers are often not as well diversified as shareholders since they may own disproportionately large firm-specific human capital investments as well as investments in their firm's shares. Consequently, managers have natural incentives to reduce their firm's exposure to risk, even when it may not necessarily be in shareholders' best interests to do so. An important aspect of corporate governance relates to the role of managerial compensation contract design in aligning shareholder and managerial incentives. A substantial literature has developed in the economics and finance literature concerning the relationship between managerial compensation contracts and decision making.[17] Generally, economists have found that compensation contract design is important in the sense that managers tend to respond quite predictably to the incentives that are conveyed by these contracts.

Here, we will consider the impact that very elementary aspects of contract design may have upon risk management decision making. Doherty (2000) develops a simple model based upon the framework provided by Aggarwal and Samwick (1999). In Doherty's model, the firm can select any of three different (mutually exclusive) compensation contracts: 1) flat salary; 2) direct share ownership; and 3) executive stock options. All three of these compensation contracts are competitively priced relative to each other as well as to contracts related to alternative employment opportunities outside the firm. However, they convey different incentives in terms of what might constitute an optimal risk management decision. Specifically, Doherty's model produces the following set of predictions:

- Firms that offer compensation based upon direct share ownership are likely to hedge risk.
- Firms that offer flat salary may still hedge, but the incentives to do so are weaker (since the linkage between managerial welfare and firm risk is less direct).

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consistent with Jean-Baptiste and Santomero. That is, the longer the term of the relationship between the insurer and the reinsurer the greater the reinsurance purchases. Garven and Lamm-Tennant are not capable of testing the pricing implications directly.

[17]For a comprehensive review of the executive compensation literature, see Murphy (1999).

- Firms that offer executive stock options to their managers are not likely to hedge.

Although these contract choices (share ownership, salary and options) are not mutually exclusive in the real world., it is nevertheless interesting to note that the predictions have strong empirical support in papers by Tufano (1996) and Geczy, Minton and Schrand (1997). In Tufano's study of the risk management practices of gold mining firms, he finds that when firms weight compensation more heavily in favor of direct share ownership, there is a greater propensity toward active management of gold price risk. On the other hand, firms that rely more option executive stock options tend to be much less concerned about managing gold price risk. Geczy, Minton and Schrand study foreign exchange risk management by nonfinancial firms, and they obtain results that are qualitatively similar to those of Tufano.

Insurance industry-specific studies of executive compensation have been published by Mayers and Smith (1992, 2001). Mayers and Smith document, among other things, that cross-sectional regularities exist in managerial compensation contract design across organizational forms. For example, stock company CEO compensation tends to be more responsive to firm performance than mutual CEO compensation. This may reflect a number of factors, including the obvious fact that direct share ownership and options on shares are not feasible forms of compensation for a mutual insurer. Although there has yet to be a comprehensive study of the risk incentive effects of insurance industry compensation, we have no *a priori* reason to believe that qualitatively different results from the findings of Tufano and Geczy, Minton and Schrand would necessarily obtain for the insurance industry. However, we are confident that real world reinsurance decision making is quite sensitive not only to the insurer's ownership structure, but also to the nature of its compensation contract designs for management.

VII. Summary and Conclusion

Keynes eloquently wrote, "The ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood". While the work of Karl Borch is eloquent, it clearly fails to explain the role of reinsurance in our markets. Nevertheless, by relaxing the underlying assumptions we do begin to understand why firms reinsure (hedge). Furthermore, we gain insights into the differences in firm characteristics that explain or justify varying reinsurance policies and strategies. And last of all, we begin to appreciate that evaluating the effectiveness of reinsurance may require more financial rigor than merely striking a difference between premium and losses ceded since the very motive for purchasing reinsurance is entangled with both financial and cultural organizational characteristics.

By recognizing taxes, the effects of bankruptcy and moral hazard costs, adverse selection and managerial contract compensation design we begin to understand more clearly the role played by reinsurance when firms seek to maximize value. Furthermore differences amongst firms in terms of these characteristics explain why different reinsurance policy, strategy and buying behavior are appropriate for different firms. The challenge is for firms to recognize how their organization structure both financial and culturally effect taxes, bankruptcy and moral hazard costs, adverse selection and managerial compensation design; and then align reinsurance decisions accordingly.

While we have evaluated each of these influences on reinsurance decision independently, it reality they interact and converge on an optimal choice. Beginning with taxes, we present evidence suggesting that the demand for reinsurance will be the greatest amongst firms facing convex tax functions and that reinsurance may be a rational, value-maximizing choice even if the contract is priced in excess of the expected loss due to the associated tax savings. In the international reinsurance markets the emergence of tax clientele effects suggests that when tax rates differ among countries, the objective is to purchase reinsurance allowing insurers to reallocate tax shields to those entities that have the greatest capacity for utilizing them. Hence we suggest that the average net retention ration for insurers should be inversely related to corporate tax rates.

Organizations may not "costlessly" enforce their various stakeholders' contracts. Agency costs are incurred to monitor conflict between the various stakeholders. A conflict exists between the owner (shareholder) and creditor (policyholder) in a stock insurer which is eliminated though organizational structure amongst mutuals. Because of the owner – creditor friction, we suggest that the policyholders of stock insurers would ask for lower premiums, surplus cushion reinsurance and/or participating policy mechanisms to ballast any incentive by shareholders to expropriate wealth from policyholders. Furthermore, because the cost of controlling management is higher or less effective for mutuals than stock insurers, managers of mutuals may have more discretion. Since traditional managerial control mechanisms are less effective for mutuals, we would expect mutual insurers to concentrate in lines of business and states/countries having less risk. By concentrating in less risky lines, mutual would have less of any need for reinsurance. To the extent that a mutual does have an exposure in a more risky line, albeit small, it would be more prone to reinsure resulting in a net positioned aligned with their limited risk appetite. To the extent that underinvestment and risk shifting occurs due to conflicts between owners and creditors, reinsurance would also provide real economic benefits.

Information asymmetries do exits such that the insurer is more informed that the reinsurer regarding the underlying risk. These information problems affect the efficiency of the allocation of risk between insurers and reinsurers. Also, long-term implicit

contracts between insurers and reinsurers allow the inclusion of new information in the pricing of both future and past reinsurance coverage. We suggest that long term relationships between insurers and reinsurers which allow for the inclusion of new information in the pricing of future and past coverage, will result in the ceding company purchases a more efficient quantity of reinsurance and at a more efficient

Differences in managerial compensation design leads to a set of predictions such that (1) firms offering compensation based upon direct share ownership are likely to hedge risk, (2) firms offering flat salary may still hedge, but the incentives to do so are weaker (since the linkage between managerial welfare and firm risk is less direct), and (3) firms offering executive stock options to their managers are not likely to hedge. Given that mutual insurers are restricted to compensating management with flat salary, we suggest that mutuals are less incented to hedge with reinsurance.

We derive a set of predictions regarding reinsurance, some backed by convincing empirical evidence published in the academic literature, for the reader's consideration.

REFERENCES

Aggarwal, R. K. and A. A. Samwick. 1999. The Other Side of the Trade-off: The Impact of Risk on Executive Compensation. Journal of Political Economy 107, 65-105.

Akerlof, G. A. 1970. The Market for Lemons: Quality Uncertainty and the Market Mechanism. Quarterly Journal of Economics 84(August):488-500.

Bernstein, P. 2000. Risk Management, Financial Markets and Insurance. Contingencies (November/December): 20-26.

Borch K. 1985. Do we need utility theory in insurance? Paper presented at the Annual Seminar of the European Group of Risk and Insurance Economists, Brussels (September).

Doherty, N. A. 2000. Integrated Risk Management: Techniques and Strategies for Managing Corporate Risk. (New York, NY: McGraw-Hill Professional Publishing), ISBN: 0071358617, March.

Doherty N. A. and S. M. Tiniç. 1981. Reinsurance under Conditions of Capital Market Equilibrium: A Note. Journal of Finance 36 (September): 949-953.

Fairley, William B., 1979, Investment Income and Profit Margins in Property Liability Insurance, Bell Journal of Economics, 10: 192-210 (Chapter 1 in Fair Rate of Return in Property-Liability Insurance. Cummins J.D. and S. E. Harrington (Eds.) Kluwer-Nijhof Publishing Company, Boston).

Fama, E. F. and M. C. Jensen, 1983, "Separation of Ownership and Control," Journal of Law and Economics, Vol. 26, pp. 301-325.

Froot, K. A., D. S. Scharfstein, and J. C. Stein. 1993. Risk Management: Coordinating Corporate Investment and Financing Policies. Journal of Finance 48 (December): 1629-1658.

Garven J. R. 1987. On the Application of Finance Theory to the Insurance Firm. Journal of Financial Services Research 1 (September): 57-76.

Garven J. R. 1992. An Exposition of the Implications of Limited-liability and Asymmetric Taxes for Property-Liability Insurance. Journal of Risk and Insurance 59 (Mar.): 34-56.

Garven J.R. and Lamm-Tennant J. 1999.   The Demand for Reinsurance: Theory and Empirical Tests. Working paper, Louisiana State University and Villanova University.

Garven J.R. and Lamm-Tennant J. 2002. Empirical Perspectives on the Demand for Reinsurance. Working paper, Baylor University and GeneralCologne Re.

Garven J. R. and H. Loubergé. 1996. Reinsurance, Taxes and Efficiency: A Contingent-claims Model of Insurance Market Equilibrium. Journal of Financial Intermediation 5 (January): 74-93.

Garven J. R. and S. W. Pottier. 1995. Incentive Contracting and the Role of Participation Rights in Stock Insurance Companies. Journal of Risk and Insurance 62 (June): 253-270.

C. Geczy, B. A. Minton and C. Schrand. 1997. Why Firms Use Currency Derivatives. Journal of Finance 52 (September):1323-1354.

Graham, J. R. and C. W. Smith. 1999. Tax Incentives to Hedge. Journal of Finance 44 (December): 2241-2262.

Jean-Baptiste E. L. and A. M. Santomero. 2000. The Design of Private Reinsurance Contracts. Journal of Financial Intermediation 9, 274-297.

Hill R.D. 1979. Profit regulation in property liability insurance Bell Journal of Economics 10:172-191.

Hill R.D. and Modigliani F. 1987. The Massachusetts model of profit regulation in non-life insurance, in Fair Rate of Return in Property-Liability Insurance. Cummins J.D. and S. E. Harrington (Editors) Kluwer-Nijhof Publishing Company, Boston.

Jensen M. C. and W. H. Meckling. 1976. Theory of the Firm: Managerial Behavior Agency Costs and Ownership Structure. Journal of Financial Economics 3 (October): 305-360.

Keynes, J. M. 1936. The General Theory of Employment, Interest, and Money. New York, NY: Harcourt Brace Jovanovich.

Lamm-Tennant, J. and L. T. Starks. 1993. Stock Versus Mutual Ownership Structures: The Risk Implications. Journal of Business 66 (January):29-46.

Lintner, J. 1965. The Valuation of Risk Assets and the Selection of Risk Investments in Stock Portfolios and Capital Budgets. Review of Economics and Statistics 47:13-37.

Marx, L. M. D. Mayers and C. W. Smith. 2001. Insurer Ownership Structure and Executive Compensation as Complements. Journal of Risk and Insurance, 68 (September): 449-463.

Mayers D. and Smith C.W. 1992. Executive Compensation in the Life Insurance Industry Journal of Business, 65 (January): 51-74.

Mayers D. and Smith C.W. 2000. Organizational Forms Within the Insurance Industry: Theory and Evidence, Chapter 23 in Handbook of Insurance, Georges Dionne, editor (Norwell, MA: Kluwer Academic Publishers), ISBN: 0792378709, December 2000, pp. 689-707.

Mayers D. and C. W. Smith. 1981. Contractual Provisions Organizational Structure and Conflict Control in Insurance Markets. Journal of Business 54 (July): 407-434.

Miller, M.H. 1977. Debt and taxes *J. Finance* 32 261-275.

Mossin, J. 1966), Equilibrium in a Capital Asset Market," Econometrica, Vol. 34, pp. 768-783.

Murphy, K. J. 1999. Executive Compensation. In O. Ashenfelter and D. Card, eds., Handbook of Labor Economics, Volume 3. North-Holland, ISBN: 0444501894.

Myers, Stewart C. and Richard A. Cohn, 1987, Insurance Rate Regulation and the Capital Asset Pricing Model (Chapter 3 in Fair Rate of Return in Property-Liability Insurance. Cummins J.D. and S. E. Harrington (Eds.) Kluwer-Nijhof Publishing Company, Boston).

Myers, S. C. and N. S. Majluf. 1984. Corporate Financing and Investment Decisions when Firms have Information that Investors do not have. Journal of Financial Economics 13: 187-221.

Outreville J.F. 1994. The demand for reinsurance in developing countries UNCTAD WORKING PAPER United Nations Geneva.

Rothschild, M. and J. E. Stiglitz, "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information," Quarterly Journal of Economics, 90(4), November 1976, pp. 629-649.

Sharpe, W. F. 1964. Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. Journal of Finance 19: 425-442.

Spence, A. M. 1973. Job Market Signalling. Quarterly Journal of Economics 87 (August):355-374.

Stiglitz, J. E. 2001. Information and the Change in the Paradigm in Economics. Nobel Prize Lecture, delivered on December 8, 2001 to the Royal Academy of Sciences.

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