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On the Application of Finance Theory to the Insurance Firm

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Abstract

The primary argument set forth in this article is that the theory of finance can and should be rigorously applied to the study of the insurance firm. In order to illustrate this point, we turn our attention to the insurance solvency literature, where the implications of default risk for insurance company decision-making and regulatory policy are widely discussed but not nearly as widely understood. Rather than treat the probability of ruin as an exogenous constraint that is arbitrarily imposed by regulators, the approach taken here is to endogenize the probability of ruin with respect to a complex contracting process undertaken by a variety of self-interested claim holders. This treatment enables us to evaluate regulatory constraints such as minimum capital requirements within a rigorous theoretical framework. Our analysis suggests that even in an unregulated market, insurers would voluntarily limit their premium-capital ratios in an effort to economize on contracting costs. Furthermore, mutual insurers are likely, *ceteris paribus,* to employ less leverage than insurers organized as stock corporations.

"The focal point in the theory of risk . . . has for almost a century been the probability of ruin. It has been assumed that at least a partial objective of the insurance company is to make certain that the probability of ruin does not exceed a given number, say α. *The theory is usually vague, or completely silent about how the number should be determined. The model seems to make most sense if* α *value of* a *is imposed from outside, for instance, by a government inspector."*

—Karl Borch. *The Mathematical Theory of Insurance* (Lexington Books, 1974, p. 107)

Introduction

Traditional risk theory has tended to view the insurance firm too much from within. Although the insurance firm exists in an economic environment within which it must compete with other insurance firms as well as institutions that provide close substitutes to insurance services, this fact of life appears to have largely

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escaped the attention of risk theorists. While the implications of default risk for insurance company decision-making and regulatory policy are widely discussed in the insurance solvency literature, this literature does not provide an internally consistent theoretical framework within which an acceptable ruin probability can be determined. As noted in the above quotation from Karl Borch's well-known and highly regarded book, the literature treats the determination of the appropriate ruin probability as exogenous to the firm. One can only hope that Borch's government inspector is endowed with King Solomon's wisdom.

Unfortunately, the insurance literature in general and the solvency literature in particular have grown in isolation of a plethora of useful studies in the financial economics literature which provide a powerful analytic framework for the study of the firm. Similarly, the finance profession has until recently all but ignored the insurance firm.[1] However, a resurgence of interest has occurred within the past decade in the finance literature regarding the general theory of organizations and its implications for optimal contract structure in a firm. Since there is probably no other industry in existence that features such a diverse set of organizational forms, the insurance industry has provided a nearly ideal laboratory setting for the development of this theory.[2]

The primary argument set forth in this article is that the theory of finance can and should be rigorously applied to the study of the insurance firm. In order to illustrate this point, we apply financial theory to the question of insurance solvency. Rather than treat the probability of ruin as an exogenous constraint that is arbitrarily imposed by regulators, the approach taken here is to endogenize the probability of ruin with respect to a complex contracting process undertaken by a variety of self-interested claim-holders. This treatment enables us to meaningfully evaluate regulatory constraints such as minimum capital requirements within a rigorous theoretical framework.

In what follows, we analyze optimal capital decisions in the context of an unregulated insurance market. The next section of the article provides a relatively general characterization of the traditional theory of the insurance firm, our purpose being to demonstrate what we believe to be some major methodological shortcomings which are substantively resolved by adopting the agency theoretic view of the firm that is prevalent in the financial economics literature. The second section of the article considers the determination of the insurer's optimal capital decision when the writing and enforcement of the various contracts that comprise the insurance firm is costless (costly). Under costless contracting and no taxation, the choice of capital is shown to be an irrelevant consideration. With taxes, the rational insurer will employ as little capital as possible. Only when we explicitly recognize the existence of phenomena such as redundant tax shields, bankruptcy costs, and agency costs are we able to arrive at an optimal capital decision which involves the employment of positive levels of capital. Section 3 of the article provides a brief summary of the results and suggestions for future research.

While the methodology followed in this article represents a fundamental departure from more traditional approaches to the theory of the insurance firm, various

results are shown which are not attainable with the traditional theories. Specifically, our analysis suggests that even in an unregulated market, insurers would voluntarily limit their premium-capital ratios in an effort to economize on contracting costs. Furthermore, mutual insurers are likely, *ceteris paribus,* to be less highly levered than insurers organized as stock corporations.

1. The objectives of the insurance firm

1.1. Collective risk theory and the expected utility hypothesis

Historically, solvency has been emphasized as one of the primary goals of insurance regulation. Munch and Smallwood (1981) attribute this emphasis on solvency regulation to the difficulty allegedly faced by policyholders in establishing the financial soundness of alternative firms.[3] Boyle and Butterworth (1982) note that the trend toward solvency regulation was accelerated by insurance company failures, so that by the beginning of the twentieth century, many Western countries had enacted legislation which heavily emphasized the solvency of insurance companies. Finsinger and Pauly (1984) note that virtually all Western countries regulate the reserves of insurance firms, even when they do not directly regulate the premiums charged.

Given this regulatory emphasis on insurance company solvency, actuaries sought to build quantitative models which would enable insurance company managements to incorporate ruin probabilities into their decision-making. The body of theory that resulted is known as the collective theory of risk. Some of the contributions of the collective risk theorists parallel highly regarded work in the option-pricing area of the financial economics literature. For example, Lundberg (1909) used continuous time processes to model the evolution of an insurance company's liabilities. As Borch (1974) points out, it is natural to compare Lundberg's contribution with that of Bachelier (1900), the only significant difference being that Bachelier's work dealt with a stochastic model for assets rather than liabilities.

In spite of the mathematical elegance and rigor of the collective theory of risk,[4] we believe that it fails to provide an economically meaningful framework for the evaluation of managerial and regulatory policies. Although it is never explicitly stated as such, risk theory essentially treats survival as the goal of the firm.[5] While attempts have been made to reconcile risk theory with paradigms such as the expected utility hypothesis, a number of problems remain:

1. Behavioral models which are based upon survival objectives (e.g., expected utility models that are constrained by ruin probabilities or models which make use of safety-first decision criteria) are likely to yield lower utility rankings than unconstrained models.[6]
2. Most insurance firms are not owned and operated by individual entre-

preneurs; rather, they are comprised of a complex set of contracts among policyholders, shareholders, and managers. Furthermore, substantive disagreements are likely to exist across and even among these classes of claimholders with respect to rates of time preference, risk preferences, and opinions concerning what constitute the "best" corporate policies for the firm to follow. Therefore, even if one can demonstrate that the objections raised in the first point are not generally valid, these considerations cast serious doubt upon the use of the expected utility hypothesis per se, since a collective utility function is likely to be impossible to construct due to the problem of intransitivity (e.g., see Arrow 1950).

3. As we suggested earlier, the risk theory approach to the evaluation of managerial and regulatory policies is deficient because it cannot provide any insight into how "acceptable" ruin probabilities are determined. As we shall see in the next section of the article, a more dynamic theory of the insurance firm is required before this issue can be adequately addressed.

1.2. Agency theory and the market value rule

We believe that the objections we have raised above can be largely resolved by a careful reconsideration of the nature of the insurance firm. Jensen and Meckling (1976, p. 310) note that most organizations, including firms, mutual organizations, nonprofit institutions, and even governmental bodies, are simply *"legal fictions which serve as a nexus for a set of contracting relationships among individuals."* The definition of contracts here is in fact rather broad, including both written and unwritten contracts. These contracts define a set of agency relationships under which principal(s) engage agent(s) to perform some service on their behalf, a decision which invariably involves delegating some decision-making authority to the agent. Agency problems and their attendant costs arise when both parties to the agency relationship are self-interested, and it is costly to write and enforce the contracts that define this relationship. As Fama and Jensen (1983b) have noted, to the extent that contracting is costly, the set of agency relationships which make up the firm is not a trivial consideration, since the resulting contract structure combines with available production technologies and external legal constraints to determine the firm's cost function. The organizational form that delivers output demanded by consumers at the lowest price, while covering costs, survives.[7]

Given our agency theoretic definition of the firm, it is appropriate to give further consideration to the identification of just who the principals and agents are in the context of an insurance operation. Mayers and Smith (1987) note that regardless of whether the firm is organized as a stock or mutual company, it is characterized by three major functions which are allocated across various claimholders: the managerial function, the ownership/risk-bearing function, and the customer/policyholder function. The owner, being the claimant to the *residual* cash flows of the firm,[8] is characterized as the riskbearer, since he/she essentially guarantees the payoffs promised under the firm's contracts with its managers and customers. The

manner in which mutual and stock organizations differ is primarily characterized by the way these functions are allocated across claimholders. In the stock company, the three functions are vested in three distinct claimants: managers, shareholders, and policyholders. The manner in which the literature has treated these three claimants is to view the managers as the agents of the shareholders, while the shareholders are typically viewed as the agents of the policyholders (e.g., see Mayers and Smith, 1981). In the case of the mutual company, the ownership/risk-bearing function and the customer/policyholder function are carried out by policyholders. Therefore, the principal/agent relationship that is of interest is that which exists between policyholders and managers.

Regardless of whether the writing and enforcing of contracts is costly or costless, the agency theoretic perspective of the firm gives rise to a set of logically consistent decision rules. In a recent paper, Fama and Jensen (1985) analyze investment decision rules for different types of business organizations that are distinguished by the characteristics of their residual claims. While their analysis focuses on investment decisions, the rules that are implied are applicable to all decisions. Their analysis indicates that decision rules for publicly traded stock corporations and financial mutuals are most logically modeled by the market value, or maximum wealth rule. For the stock corporation whose residual claimholder is the stockholder, and the financial mutual whose residual claimholder is the customer, this implies that these claimants are best served by decisions that maximize the current market value of their wealth. The proof given by Fama and Jensen for stock corporations is rather simple and intuitively appealing: when prices reflect available information and stocks are traded without transactions costs in a perfectly competitive market, the consumption streams that can be realized in future periods are only constrained by current wealth. In this situation, it is fairly easy to show that shareholders will agree that all decisions, including investments with payoffs in future periods, should be evaluated according to their contribution to the current market value of their residual claims, defined as including all costs, even agency costs and bankruptcy costs. When the stream of payoffs implied by the market value rule does not correspond to any given investor's optimal consumption stream, the capital market can be used to exchange residual claims of one firm for those of another with the same market value but with a stream of payoffs which better match the investor's desired consumption stream.[9] Similarly, Fama and Jensen's analysis demonstrates that since financial mutuals repackage already available securities, the residual claimants of these organizations will also agree that the market value rule best serves their interests.

One can quarrel with the perfect market assumptions that are needed to show that residual claimants of both stock and mutual insurance companies prefer the market value rule as the criterion upon which investment, underwriting, and dividend decisions are to be judged.[10] However, at least the market value rule is logically consistent with the underlying economic relationships that make up the firm. This cannot, for the reasons cited earlier, be claimed for the types of decision rules we often see used in the insurance solvency literature.

2. The optimal capital decision for an insurance firm

2.1. Case 1: Perfect markets, no risk of default

Next, we formalize the arguments advanced in the previous section of the article, our purpose being to demonstrate the determinants of the insurer's capital decision in an unregulated market. To do this, we employ a two-date model in which the activities of the insurance firm can be characterized as follows.[11] At the beginning of the period, the firm is formed for the purpose of maximizing the value of its shares. For simplicity, we assume that the firm underwrites only one line of insurance for which it receives premium income P_0.[12] Paid-in equity capital (S_0) and premium income are allocated to an investment portfolio comprised of financial assets. At the end of the period, the firm's cash flows from its investment and underwriting activities are realized.

Initially, we consider the case of perfect insurance and capital markets in the absence of default risk and taxes. Under the same set of assumptions, Hill (1979), Fairley (1979), and Kraus and Ross (1982) show that the supply curve for insurance is perfectly elastic. Consequently, shareholders receive fair returns on their invested capital, which implies that the market value of equity subsequent to the formation of the firm (V_e) will be the same as its initial paid-in capital: i.e., $V_e = S_0$.

In order to derive an expression for premium income, we must first value the equity of the firm. To do this, we employ the certainty-equivalent formulation of the Sharpe (1964)-Lintner (1965)-Mossin (1966) Capital Asset Pricing Model (CAPM). This allows us to express equity value as simply the discounted value of the certainty-equivalent terminal cash flow:

$$V_e = R_f^{-1} \int_{\infty}^{\infty} \tilde{Y}_e \hat{f}(\tilde{Y}_e) d\tilde{Y}_e$$

$$= R_f^{-1} \hat{E}(\tilde{Y}_e). \tag{1}$$

where:

$\tilde{Y}_e$ = random cash flow accruing to shareholders at the end of the period;
$R_f = 1 + r_f$, where r_f is the riskless interest rate;
$\hat{f}(\tilde{Y}_e)$ = "risk neutral" normal density function;[13]
$\hat{E}(\tilde{Y}_e)$ = the certainty-equivalent expectation of $\tilde{Y}_e$
$= E(\tilde{Y}_e) - \lambda \mathrm{COV}(\tilde{Y}_e, \tilde{r}_m)$;
λ = the market price of risk
$= [E(\tilde{r}_m) - r_f]/\sigma_m^2$;
$E(\tilde{r}_m)$ = the expected return on the market portfolio;
σ_m^2 = the variance of returns on the market portfolio;
$\mathrm{COV}(\cdot)$ = the covariance operator.

The certainty-equivalent expectation of terminal cash flow accruing to shareholders, $\hat{E}(\tilde{Y}_e)$, is given by equation (2):

$$\hat{E}(\tilde{Y}_e) = (S_O + P_O)(1 + \hat{E}(\tilde{r}_p)) - \hat{E}(\tilde{L}). \tag{2}$$

where:

$\hat{E}(\tilde{r}_p)$ = the certainty-equivalent expectation of the rate of return on the insurer's investment portfolio
$= E(\tilde{r}_p) - \lambda \mathrm{COV}(\tilde{r}_p, \tilde{r}_m) = r_f$;
$\hat{E}(\tilde{L})$ = certainty-equivalent expectation of total claims costs
$= E(\tilde{L}) - \lambda \mathrm{COV}(\tilde{L}, \tilde{r}_m)$.

By substituting the right-hand side of equation (2) into equation (1), setting S_O equal to V_e, and simplifying, we derive the following analytic expressions for premium income and the rate of return on underwriting:

$$P_O = \frac{E(\tilde{L})}{(1 - E(\tilde{r}_u))} \tag{3}$$

where:

$$E(\tilde{r}_u) = [P_O - E(\tilde{L})]/P_O$$
$$= -r_f + \lambda \mathrm{COV}(\tilde{r}_u, \tilde{r}_m). \tag{3a}$$

Equation (3) demonstrates that competitively priced insurance policies resemble pure discount bonds with a terminal value of $E(\tilde{L})$ and rate of return of $-E(\tilde{r}_u)$. This rate of return is the same as the so-called "fair" underwriting profit rate derived by Hill and Fairley. Furthermore, competitive insurance premiums are independent of the amount of equity capital employed by the insurer. This result is obvious since the value of equity does not enter anywhere into the formula. Consequently, the insurer's premium-capital ratio is a matter of indifference to both the firm's policyholders and shareholders, since both pay fair, competitively determined prices for their claims. This result is analogous to Modigliani and Miller's (1958) capital structure irrelevance theorem which states that the total market value of the firm is independent of the manner in which its claims are "packaged."

2.2. Case 2: The effect of corporate taxation

Next, we extend our analysis to a consideration of the effect of corporate taxation. The tax treatment of underwriting income (losses) is fairly straightforward; for

every dollar of income (losses), a tax liability (shield) of $\$\tau$ is realized, where τ is the statutory corporate income tax rate. The tax treatment of investment income is more complicated due to the fact that the effective tax rate depends critically upon the composition of the investment portfolio. For simplicity, we assume that every dollar of investment income (loss) generates a tax liabilty (shield) of $\$\theta\tau$.[14] Furthermore, we assume initially that all tax shields generated by investment or underwriting losses are fully utilized. Under these assumptions concerning taxation, the certainty-equivalent expectation of terminal cash flow is given as follows:

$$\hat{E}(\tilde{Y}_e) = S_O + (1 - \theta\tau)\hat{E}(\tilde{r}_p)(S_O + P_O) + (1 - \tau)(P_O - \hat{E}(\tilde{L})). \tag{4}$$

By substituting the right-hand side of equation (4) into equation (1), setting S_O equal to V_e, and simplifying, we derive the following analytic expressions for premium income and the rate of return on underwriting:

$$P_O = \frac{E(\tilde{L})}{(1 - E(\tilde{r}_u^c))} \tag{5}$$

where:

$$\begin{aligned} E(\tilde{r}_u^c) &= [P_O - E(\tilde{L})]/P_O \\ &= -\frac{(1 - \theta\tau)}{(1 - \tau)} r_f + (V_e/P_O)\ \frac{\theta\tau}{(1 - \tau)} r_f + \lambda \mathrm{COV}(\tilde{r}_u, \tilde{r}_m). \end{aligned} \tag{5a}$$

The rate of return on underwriting given in equation (5a), $E(\tilde{r}_u^c)$, is comparable to the expression derived by Hill and Modigliani (1986). This equation demonstrates that corporate taxation has two opposite effects on the underwriting rate of return: (1) to the extent that θ is less than unity, tax shield benefits from the firm's investment and underwriting activities flow through to policyholders in the guise of a higher rate of return on their default-free "loans"; i.e., $[(1 - \theta\tau)/(1 - \tau)]\ r_f > r_f$ if $\theta < 1.0$, and (2) corporate taxation simultaneously imposes an expected tax burden on shareholders of $(V_e/P_O)\ [(\theta\tau)/(1 - \tau)]\ r_f$ per dollar of premiums written which results in a lowering of the overall rate of return. Although equation (5) implies a price for insurance that is greater than its price in a tax-free setting, firms could lower the prices they charge and hence expand their underwritings by employing near zero equity capital. Furthermore, assuming that the tax authorities do not offer rebates for unused tax shields, insurance firms face incentives to invest strictly in fully taxable securities so as to insure that tax shields due to underwriting losses are fully utilized.[15] Hence the equilibrium which would obtain in this setting would feature an effectively tax-exempt insurance industry offering policies at underwriting rates of return that are consistent with equation (3a). However, the analysis also implies that the insurance firm should seek a nearly "all-debt" capital structure by employing a minimal amount of capital. Not sur-

prisingly, this result is analogous to Modigliani and Miller's (1963) "correction" of their original irrelevance theorem, which holds that taxable corporations should adopt nearly all-debt capital structures due to tax incentives.

The propositions derived above have considerable appeal as logical corollaries of the Modigliani and Miller capital structure theorems. Next, we shall consider how robust these results are with respect to changes in the underlying assumptions; i.e., what are the likely effects of phenomena such as redundant tax shields, default risk, bankruptcy costs, and agency costs?

2.3. Case 3: Redundant tax shields

It is well known that insurance firms are typically constrained by regulation to hold minimum levels of capital relative to premiums written, the main justification being that the probability of ruin is thereby decreased, ceteris paribus. However, our model demonstrates a cost associated with minimum capital requirements that is not well known; viz., minimum capital requirements increase the firm's expected tax liability and consequently the premiums it must charge so as to generate a fair return for shareholders. Competitive forces in the insurance market are therefore likely to induce firms to (1) shelter investment income by allocating greater proportions of their portfolios to the purchase of tax-exempt securities,[16] and/or (2) lower prices so as to generate underwriting losses that can be used to shelter taxable investment income. However, such strategies increase the probability that tax shields derived from the firm's investment and underwriting activities will be wasted. There exist a number of private market mechanisms which may provide solutions to the problem of redundant tax shields. One solution would be a merger with a firm that has a higher marginal tax rate. Another solution may possibly involve the purchase of reinsurance; i.e., reinsurance could conceivably be used to allocate tax shields to firms which have the greatest capacity for using them, in much the same manner as leasing companies share tax shield benefits with lessees.[17] In view of the existence of private market mechanisms such as these, tax shield redundancy per se does not constitute a necessary or sufficient condition for rejecting these corollaries to the Modigliani-Miller capital structure theorems.

2.4. Case 4: Default risk and bankruptcy costs

Doherty (1986) has shown that if the insurance market is competitive and information concerning default risk is impounded in insurance prices, then the Modigliani-Miller capital structure theorems hold even when default risk is present, so long as bankruptcy is costless. This result is consistent with results obtained by Stiglitz (1974) and Galai and Masulis (1976) for nonfinancial firms, and is implicit in the comparative statics of Doherty and Garven's (1986) contingent

claims model for pricing property-liability insurance. However, numerous scholars have demonstrated that costly bankruptcy invalidates these theorems. In the insurance literature, Munch and Smallwood and Finsinger and Pauly discuss the impact of bankruptcy-type costs upon capital structure decisions of limited liability insurers. Although not without merit, their results are largely driven by the assumption that insurance prices do not impound information about default risk. In view of the fact that the industry is characterized by a substantial amount of investment in information production activities (e.g., agents and brokers provide consumers with price and quality information, while A.M. Best rates the financial condition of insurance companies), it would be surprising if prices did not impound such information.

To date, there does not exist a complete treatment of insurer capital structure decision-making in a world in which premiums are sensitive to default risk and bankruptcy is costly. However, this is not the case in the capital structure literature for nonfinancial firms and banks. A number of studies (e.g., see Kraus and Litzenberger, 1973; Scott, 1976; Kim, 1978; Turnbull, 1979; DeAngelo and Masulis, 1980) conclude that limited liability nonfinancial firms will employ positive levels of equity so as to balance the marginal benefits of debt-related tax shields against the marginal costs of explicit bankruptcy penalties (e.g., administrative expenses that must be paid to third parties such as lawyers and accountants). Similarly, Buser, Chen, and Kane [1981] show that limited liability banking firms would, in the absence of deposit insurance, select capital structures which match the marginal value of debt (deposit) related tax shields with the marginal value of bankruptcy costs. Although we would expect similar results to obtain in a unregulated insurance market in which prices are default risk-sensitive, we believe that this tax-shield/bankruptcy cost tradeoff theory is largely invalidated in the case of the insurance industry due to the widespread existence of postinsolvency assessment insurance guaranty funds.[18] The existence of these funds eliminates or greatly reduces the risk that claims will not be paid.[19] Furthermore, the funding arrangements upon which these guarantee funds are based ensure that bankruptcy costs are largely borne ex post by surviving firms. Since insurers do not have to bear these costs ex ante, our analysis predicts that firms will employ as much leverage as possible.[20]

Interestingly, casual empirical evidence does not provide very strong support for these predictions. In view of the 3:1 premium-captial ratio standard used by the National Association of Insurance Commissioners (NAIC), we would expect to observe a clustering of premium-capital ratios around this standard. Table 1 records frequency distributions of premium-capital ratios for all A.M. Best rated stock insurance firms and groups having U.S. property-casualty income and complete data on premium-capital ratios during the five-year period beginning in 1981 and ending in 1985.

It appears from these data that while the NAIC 3:1 guideline in fact represents an industry standard for maximum leverage, it is nowhere close to being a binding constraint for most firms. Indeed, with transaction costs we would expect firms to

Table 1. Premium-capital ratios of U.S. stock insurance firms and groups

P_O/S_O range	Percentage of sample having P_O/S_O ratio within range 1985	1981–1985
Less than unity	31.0	33.2
1.0 to 1.5	15.0	17.3
1.5 to 2.0	15.8	18.4
2.0 to 2.5	13.7	13.5
2.5 to 3.0	13.1	9.6
Exceeding 3.0	11.4	8.0
Mean	1.82	1.62
Standard deviation	1.63	1.42

Notes: Sample: All A.M. Best rated stock insurance firms and groups having (1) U.S. property-casualty income, and (2) complete data on premium-capital ratios. Sample size 1040 (1985), 888 (1981–1985).
Source: A.M. Best Key Rating Guide, 1981–1985.

operate within the constraint so as to enable them to absorb fluctuations in premium-capital ratios without violating the constraint and thereby necessitating the frequent issuance of new equity, purchase of reinsurance, or scaling back of the volume of business. However, since (1) both frequency distributions are so significantly skewed toward very low (less than unity) premium-capital ratios, and (2) only a small minority of firms have had premium-capital ratios that exceed the NAIC standard, the facts seem to suggest that there are yet other important factors which need to be taken into account. We believe that a very important missing piece to this puzzle is agency costs.

2.5 Case 5: Agency costs

As we stated earlier, agency costs arise when both parties to the agency relationship are self-interested, and it is costly to write and enforce the contracts that define this relationship. The preceding analysis assumed contracting to be costless; we now relax this assumption and assume that contracting is in fact costly. Enforcement costs include the costs borne by principals to monitor contract compliance and costs borne by agents to bond their behavior. Although principal and agent have divergent interests, they will seek to write and enforce contracts which minimize agency costs, since one or both can thereby be made better off. However, this also implies that it will generally be unlikely that contracts will be perfectly enforced, since the monitoring and bonding expenditures required to ensure perfect compliance may exceed the benefits. Jensen and Meckling (1976) define the opportunity loss that remains when contracts are optimally but imperfectly enforced as the residual loss.

Fama and Jensen (1983b) argue that if contracting is costly, then the firm's con-

tract structure will have an important effect on its cost function. Therefore, the organizational form adopted by any given insurer will be determined endogenously, along with its investment, underwriting, and dividend policies. Indeed, this is the basic theme of the series of papers by Mayers and Smith (1981, 1982b, 1987) which seek to produce an internally consistent, interrelated set of potentially testable hypotheses regarding organizational forms and contractual practices in the insurance industry. Their work suggests that there are incentive conflicts between policyholders and stockholders over investment, underwriting, and dividend decisions and between owners and managers over investment policy. Next, we will summarize their results and attempt to relate these considerations to the relationship between solvency and the choice of an optimal capital structure.

2.5.1 Stockholder/policyholder conflicts. Incentive conflicts exist between principals and agents whenever agents do not bear the full wealth effects of their actions. Furthermore, the mere existence of default risk exacerbates incentive conflicts. This can be easily seen by considering the stockholder/policyholder relationship for a riskless insurer. If the claims held by policy-holders are free of default risk, there will be no incentive conflict, since the value of these claims will not change as a result of investment, underwriting, and dividend decisions made on behalf of stockholders. Next, consider the stockholder/policyholder relationship for a risky insurer. Like lenders in the bond market, the risky insurer's policyholders will experience incentive conflicts with stockholders because stockholders may be able to effect wealth transfers from policyholders by altering the insurer's investment, underwriting, or dividend policies after issuing insurance.[21] However, since policyholders recognize the incentives faced by stockholders, the prices they are willing to pay for the policies will reflect unbiased estimates of the expected behavior of stockholders. Furthermore, the greater the premium-capital ratio employed by the firm, the greater will be the magnitude of agency costs borne by stockholders in the guise of lower premiums.[22] It is therefore in the self-interest of the stockholders to provide policyholders with guarantees against expropriative behavior if such guarantees are less costly than the agency problems. Several mechanisms exist for providing guarantees, such as purchasing reinsurance, employing positive levels of equity, or contractually limiting dividend and investment policies. The use of equity as a bonding mechanism has been suggested by Easterbrook and Fischel (1985), while the use of contractual limitations of dividend and investment policy as bonding mechanisms has been suggested by Mayers and Smith (1981).

Besides the risk incentive effect described above, other explanations exist for why insurers may choose to employ positive levels of capital and/or purchase reinsurance contracts. To see this, consider Mayers and Smith's (1982b) explanations for both the individual and corporate demands for insurance. In the case of the individual demand for insurance, they contend that the most fundamental reason why insurance services are produced is because an unfilled demand for risk reduc-

tion would otherwise exist. A sufficient, although not necessary, condition for the need for further risk reduction is the existence of nonmarketable assets such as human captial. Another important reason for the existence of insurance services which is relevant to both individual and corporate demands relates to the manner in which insurance contracts help to bring about socially efficient levels of investment in monitoring and bonding activities. Finally, they note that insurance contracts are likely to be valuable to both individuals and corporations because insurance companies provide real service efficiencies in the production of claims administration activities. Therefore, to the extent that the bankruptcy of an insurer would impose additional costs upon policyholders due to the cessation of these services, then it would be reasonable to view mechanisms such as the employment of positive levels of capital and/or purchase of reinsurance as rational responses to policyholders' demands for "safe" policies. Following Titman (1984), such mechanisms may provide methods by which insurers can bond, or precommit itself from imposing costs of this nature upon policyholders. Interestingly, these results obtain even in a world where policyholders are otherwise well diversified.

The introduction of insurance guaranty funds eliminates or at least greatly reduces the risk that claims will not be paid and therefore mitigates the incentive conflicts between stockholders and policyholders. Hence consumers will not penalize risky firms by paying lower prices; neither will it be in their interest to produce information regarding the financial viability of the insurer, since they no longer bear the wealth effects associated with failing to engage in such behavior. Furthermore, the decision to guarantee payoffs on insurance policies makes regulatory supervision of insurance firms inevitable. In the case of insurance regulation, the protections that actually exist resemble the kinds of protections that we described above.[23] While the above analysis applies to insurance firms whose liabilities are insured by a guaranty fund, many of the same notions are also applicable to insured banks and thrift institutions.

2.5.2. Owner/manager conflicts. An alternative mechanism for resolving stockholder/policyholder incentive conflicts involves merging the two functions; viz., by imposing a mutual ownership structure. Mayers and Smith's analysis suggests that this advantage of the mutual ownership structure is offset by a worsened incentive problem between owners and managers. While stockholders can rely upon the threat of an unfriendly takeover to discipline managers, the policyholders of the mutual insurer must rely upon a less effective and more expensive mechanism, the proxy fight. Since it is more costly to control managerial behavior in a mutual than it is in a stock firm, the Mayers/Smith and Fama/Jensen analyses predict that the investment and underwriting activities of mutual insurers will be characterized by the placement of substantial limitations upon discretionary managerial behavior. Specifically, mutual insurers will tend to underwrite fewer lines of insurance than stock insurers, and they will tend to be more prevalent than stock companies in lines of insurance for which "good" actuarial tables exist, since this will give managers less discretion in the rate-setting process. Furthermore, mutual

insurers' investments will tend to be more concentrated than stock insurers' investments in assets for which accuratae indices of value are available; i.e., mutuals will hold larger proportions of their investment portfolieos in financial assets and smaller proportions in nonfinancial assets than will stock insurers. Casual empirical evidence provided by Fama and Jensen (1983a) bear this latter prediction out.

While the introduction of insurance guaranty funds is likely to mitigate stockholder/policyholder incentive conflicts, these funds do not provide managers with any contractual guarantees. In fact, depending upon the way management is compensated, the guaranty funds may provide managers with a rather perverse set of incentives. Consider the case of a stock insurer that weights its mangerial compensation schedule rather heavily toward stock options. Since the value of management's claims will increase the greater the premium-captial ratio, we can expect that such a firm will tend to be highly levered, everything else the same. On the other hand, if the compensation schedule is tilted more toward a fixed salary, we would expect managers to select lower premium-capital ratios so as to provide themselves with greater employment security. Since mutual insurers are precluded by virtue of their ownership structure from compensating their executives with stock options, we might expect mutual insurers to employ lower premium-capital ratios than stock insurers, ceteris paribus.[24] However, even if the managers of stock insurance firms receive a substantial proportion of their compensation via stock options, it is not clear whether this prediction would hold either in the absence of a guaranty fund or in the presence of a guaranty fund which charges risk-based premiums.

3. Conclusion

This article has set forth the argument that the theory of finance can and should be rigorously applied to the study of the insurance firm. In order to illustrate this point, we turned our attention to the insurance solvency literature. Perhaps the most important insight provided in this article is the prediction that even in an unregulated market, insurers would voluntarily limit their premium-capital ratios in an effort to economize on contracting costs. Our analysis also suggests that mutual insurers are likely to be less highly levered, ceteris paribus, than insurers organized as stock corporations.

The issue of solvency and how the insurer's captial decision relates to it consititutes a fertile area for future research. Definitive answers are needed for a number of questions. We list some of the more obvious unresolved issues that are related to this topic:

1. Our analysis primarily considered the capital decisions of stock and mutual insurers. Given the diverse set of organizational forms that we observe in the insurance industry, it would be useful to not only sharpen the focus of the present analysis but also to extend it to the cases of reciprocal associations and Lloyd's

associations. Also, empirical work investigating the relationship between capital structure choices and organizational form is very much in order.[25]

2. How managers of insurance firms are compensated is obviously an empirical issue worth investigating. In particular, it would be interesting to investigate (1) whether any cross-sectional regularities exist in managerial compensation contract design across organizational forms, (2) how effective compensations contracts are in controlling owner-manager incentive conflicts, and (3) the extent to which compensation contracts influence insurers' capital decisions.[26]

3. Another important area for further research concerns optimal guaranty fund design. Since most funds are operated on a postassessment basis, firms have incentives under the current system to pursue more risky underwriting and investment strategies than they would otherwise undertake in the absence of such a guaranty fund.[27]

The reader may have noticed that once we strayed from the perfect market models in the second section of the article, the remainder of the analysis was largely nonmathematical. The financial theory of agency constitutes such a radical departure from the perfect market models that a great deal of work remains to be done in terms of defining the dimensionality of the issues discussed here before mathematics can be fruitfully applied.[28] A more robust theory of market equilibrium is clearly needed in which interactions between markets in which the firm competes can be adequately modeled.[29] We believe that the more integrated view of the insurer provided by such a theory would very likely produce sharper insights than the collective risk and expected utility models since it would provide the basis for analyzing insurance company behavior in the context of a much richer economic environment.

Notes

1. Mayers and Smith (1982a, p. 253) note that the topic of insurance is nowhere to be found in virtually all finance textbooks.

2. For example, see the papers by Fama and Jensen (1983a, 1983b, 1985) and Mayers and Smith (1981, 1982a, 1982b, 1987).

3. Stigler (1975, pp. 109–110) goes as far as to suggest that the historical rationale for the regulation of insurance companies was rooted in the belief that consumers of insurance needed protection because they would not, of their own volition, acquire a proper amount of information, even if it were available for sale at its cost of production. According to this view, the problem faced by consumers in making their insurance decisions is not necessarily costly or imperfect information; rather, it is one of irrationality manifested in the form of an underinvestment in information. Of course, such a belief about consumer behavior begs the obvious question: if customers are so irrational, why do they purchase insurance in the first place?

4. In fact, risk theory is perhaps most noted for its important contributions to theoretical statistics. Borch (1974, p. 73) suggests, "These by-products are probably of greater value than the theory itself, which has found few applications in practice."

5. This emphasis on survival pervades the insurance literature. For example, in his critique of the risk management literature, Doherty (1983) notes that the traditional risk management structure is based in part upon the notion that survival is a major corporate objective. As we shall soon see, survival

as a corporate objective is dominated by the market value rule, which treats the probability of ruin as endogenous to the more general problem of maximizing the value of the claims held by the firm's residual claimholders.

6. For examples of such approaches, see Cummins and Nye (1981, pp. 418-419).

7. Of course, all of this is a moot point in a world in which the writing and enforcing of contracts is not costly. In such a world, the firm's contract structure would have no effect on its cost function. Therefore, there would be no reason for one organizational form to dominate any other in the production of goods and services. This result obtains as a logical corollary of Coase's (1960) theorem, which asserts that there can be no misallocation of resources in the absence of transaction costs.

8. Following Fama and Jensen (1983b, p. 302), we define residual claims as claims to the net difference between stochastic inflows of resources and promised payments to agents.

9. For a more detailed elaboration of this proof, see Fama (1978).

10. The assumption of a perfect markets framework does raise an interesting conundrum. Borrowing from Miller (1977, p. 273), if markets are perfect, then financial firms can best be described as "neutral mutations"; viz., while they serve no unique economic function, neither do they do any harm. Therefore, a major challenge facing researchers in the field of financial intermediation relates to producing models of market equilibrium in which the existence of intermediaries is endogenous. An excellent example of this type of research which relates to depository financial intermediaries is the recent paper by Sealey (1983). In the spirit of Sealey's work, Doherty (1986) argues that the issue of insurance policies by an insurance firm is simultaneously an operating and a financing decision. This inherent simultaneity of operating and financing decisions consequently raises questions concerning the applicability of capital structure theories that are based upon perfect market assumptions. Doherty contends that such theories cannot apply to insurance firms unless the insurance market is competitive and information concerning default risk is impounded in insurance prices.

11. The analysis that follows is largely adapted from Doherty and Garven (1986) and Garven (1987). We analyze optimal capital structure decisions of insurance firms in a world characterized by the existence of perfectly competitive markets for the equity and liability claims they issue. As we suggested in note 7, there is no a priori reason to believe that the same basic results would not also generalize to an insurer that is organized as a mutual company, given the nature of the assumed economic environment (i.e., no transaction costs or information costs). If the reader finds such a statement to be rather unsettling, the fact that we observe both stock and mutual firms competing successfully with each other in common insurance lines would seem to suggest that this is a reasonable assertion, even in the presence of transaction costs and information costs.

12. For simplicity of notation, we assume that either there are no transaction costs associated with writing policies, or that premium income P_O is defined net of such expenses.

13. A "risk neutral" density function is a density function whose location parameter is chosen so that the mean of the distribution is its certainty-equivalent.

14. The parameter θ is a factor of proportionality defined over the interval [0, 1]. This parameter is functionally related to the composition of the insurer's investment portfolio. For example, if the investment portfolio is comprised of strictly tax-exempt securities, then $\theta = 0$. Conversely, if only fully taxable claims such as corporate bonds and U.S. Treasury securities are chosen, then $\theta = 1$. If some combination of tax-exempt and taxable claims are chosen, then $0 < \theta < 1$.

15. The above assertions are easily supported. First, we divide equation (5) through by $E(\tilde{L})$ to obtain a price of

$$P_O/E(\tilde{L}) = \left[1 + \frac{(1 - \theta\tau)}{(1 - \tau)} r_f - (V_e/P_O) \frac{\theta\tau}{(1 - \tau)} r_f - \lambda \mathrm{COV}(\tilde{r}_u, \tilde{r}_m) \right]^{-1}$$

per dollar of coverage. Taking the limit of this expression as the market value of equity tends toward zero, we obtain

$$\lim_{V_e \to 0} P_O/E(\tilde{L}) = \left[1 + \frac{(1 - \theta\tau)}{(1 - \tau)} r_f - \lambda \mathrm{COV}(\tilde{r}_u, \tilde{r}_m)\right]^{-1}.$$

However, in the absence of tax rebates from the government or a market for unused tax shields, insurers choose $\theta = 1$; therefore, the insurance price which obtains in a competitive equilibrium is the same as in the no-tax case; viz.,

$$P_O/E(\tilde{L}) = [1 + r_f - \lambda \mathrm{COV}(\tilde{r}_u, \tilde{r}_m)]^{-1}.$$

16. It is well known that apart from households, the principal investors in the market for tax-exempt bonds are commercial banks and property-liability insurance companies. As noted by Hill (p. 181), the fact that tax-exempt bonds typically constitute anywhere from 15 percent to 50 percent of the portfolios of large stock insurers suggests that the tax burden associated with minimum capital requirements is nontrivial.

17. Although reinsurance is not commonly viewed as a leasing arrangement as we have suggested here, Main (1983) has used the leasing analogy to analyze insurance purchases by nonfinancial corporations. Also, a number of other potentially testable hypotheses exist for explaining reinsurance purchases by insurance firms. For example, Doherty and Tinic (1981) note that reinsurance can also be used to release reserve funds which can provide a basis for further premium expansion without violating minimum capital requirements. This may be especially important to mutual insurers who lack direct access to the capital markets. Mayers and Smith (1981) motivate the demand for reinsurance largely on the basis of the so-called costly contracting hypothesis; viz., policyholders may prefer to contract for insurance with one carrier and have the insurer reinsure through established channels rather than hold a diversified portfolio of insurance contracts without reinsurance for the simple reason that such an arrangement economizes on contracting costs.

18. For a comprehensive appraisal of postinsolvency assessment guaranty funds, see the recent paper by Duncan (1984).

19. As Cummins (1986, p. 2, footnote 2) points out, guarantee funds may not in fact accomplish this in practice. For example, the actual payment of claims may be delayed while the liabilities of the insolvent insurer are transferred to the guarantor. Furthermore, most guaranty funds impose maximum limits upon payments per claim; hence policyholders with large claims may not be fully compensated. Similar caveats would also apply to guaranty arrangements such as those found in the banking industry. For example, the FDIC and FSLIC limit guarantees to deposits of $100,000 and less.

20. Although there has (justifiably) been considerable criticism in the banking literature of the flat premium system used by both the FDIC and FSLIC (e.g., see Kane, 1986), at least banks and thrift institutions are required to bear *some* of the cost of the insurance ex ante. For example, the FDIC currently charges a flat, upfront premium of 1/12 percent of the dollar amount of the deposits of insured banks. However, the FDIC guaranty arrangement is not without its similarities to the postinsolvency assessment insurance guaranty arrangements. The similarity comes into play by virtue of the FDIC's ex post rebate policy in which 60 percent of the difference between the FDIC's revenue and expenses is subsequently rebated to member banks.

21. The logic underlying these propositions can be formally demonstrated by invoking the comparative statics of the option pricing model. Black and Scholes (1973) suggest that the equity of a levered firm can be valued as a call option on the terminal value of its assets, with an exercise price equal to the face value of its debt. Galai and Masulis (1976) make use of this insight in order to show how the value of the equity of a nonfinancial firm varies with respect to changes in its asset and liability structures. By analogy, Doherty and Garven (1986) show that the equity of a stock insurance firm can be characterized as a call option on the terminal value of its assets, with an exercise price equal to its terminal claims costs. The value of this call option will increase (accompanied by a corresponding decrease in the value of policyholders' claims) with (1) increases in the riskiness of the insurer's assets, (2) increases

in its dividend payments, and (3) increases (decreases) in the riskiness of its liabilities, assuming that the insurer's claims costs and investment income are positively (negatively) correlated.

22. As Jensen and Meckling (1976) show, the agency costs of debt (and by analogy, insurance policies) are a monotonically increasing function of the firm's leverage (premium-capital) ratio. The reason for this is quite simple: as the total amount of debt financing (premium volume) increases relative to equity financing, it becomes progessively easier for shareholders to expropriate larger amounts of wealth from bondholders (policyholders) by altering the firm's policies after issuing the bonds (insurance policies). The logic of this proposition can also be shown via comparative static relationships derived from the option pricing model.

23. However, we have no guarantee that the regulator will engage in an socially optimal level of monitoring, since as an employee of the state the regulator does not bear the full wealth effects of his or her edicts. Quoting Stigler (1975, p. 113). "We may tell the society to jump out of the market frying pan, but we have no basis for predicting whether it will land in the fire or a luxurious bed."

24. Since mutual insurers lack direct access to the capital markets, we may also expect mutual insurers to hold more surplus as a way to insure that they don't violate the NAIC standard. However, like stock companies, mutuals can use other mechanisms such as reinsurance to accomplish the same objective.

25. Given the diversity of organizational forms within the insurance industry, it may provide empirical researchers as well as theorists with a laboratory setting for testing some fundamental results in capital structure theory. For example, Jensen and Meckling (1976, p. 347) contend that optimal capital structure decisions involve trading off the agency costs of debt against the agency costs associated with outside equity. The fact that Lloyds associations preclude themselves by virtue of their organizational form from issuing outside equity is certain to have significant capital structure implications.

26. A substantial literature has developed in the accounting and finance journals over the three to four years concerning the relationship between managerial compensation contracts and decision-making. Lambert and Larcker (1985) review this literature and conclude that compensation schemes really do "matter" in the sense that executives respond predictably to the incentives built into their compensation contracts. Furthermore, they note that changes in contract design affect executive decision-making in ways consistent with agency theory. Given the diversity of organizational forms within the insurance industry, the use of insurance data may be very helpful in producing useful contributions to this literature as well as the capital structure literature. Obviously, such results may also have potentially important regulatory policy implications.

27. Cummins (1986) has developed a promising approach based upon risk-based premiums. He argues that the likely effects of risk-based premiums would be to (1) eliminate the incentive for insurers to pursue risky strategies by charging them the full market value of the risk they place on the guaranty fund, and (2) reduce regulatory monitoring costs since firms would be less likely to adopt high risk strategies. Similar results are obtained for banking firms by Merton (1977), Kane (1986), and others.

28. Unfortunately, the lack of integration of capital market theory and principal-agent theory makes it difficult to provide formal mathematical analysis of the solvency issue in an equilibrium setting. Instead, one must rely upon intuitive descriptive analysis, since the dimensionality of the problem is so ill-defined. Given the current state of the financial theory of agency, Jensen (1983) suggests that the extensive use of mathematics may even be counterproductive.

29. Some noteworthy examples of this type of research include the papers by Arnott and Gersovitz (1980), Diamond And Verrechia (1982), Ramakrishnan and Thakor (1984), and Titman (1984).

References

Arnott, R.J., and Gersovitz, M. "Corporate Financial Structure and the Funding of Private Pension Plans." *Journal of Public Economics* 13(2) (1980), 231–247.

Arrow, K.J. "A Difficulty in the Concept of Social Welfare." *Journal of Political Economy* 58 (1950), 328–346.

Bachelier, M.L. *Theorie de la Speculation.* Paris: Guthier-Villars, 1900.

Borch, K. *The Mathematical Theory of Insurance.* Lexington, MA: Lexington Books, 1974.

Boyle, P.P., and Butterworth, J.E. "Links Between Modern Finance and Insurance." Paper presented at the *Second Symposium on Money. Banking, and Insurance* in Karlsruhe, Germany, 1982.

Black, F., and Scholes, M. "The Pricing of Options and Corporate Liabilities." *Journal of Political Economy* 81 (1973), 637–659.

Buser, S.A., Chen, A.H., and Kane, E.J. "Federal Deposit Insurance, Regulatory Policy, and Optimal Bank Capital." *Journal of Finance* 35 (1) (1981), 51–60.

Coase, R.H. "The Problem of Social Cost." *Journal of Law and Economics* 3 (1960), 1–44.

Cummins, J.D. "Risk Based Premiums for Insurance Guaranty Funds." Paper presented at the First International Conference of Insurance Solvency, June 1986.

Cummins, J.D., and Nye, D.J. "Portfolio Optimization Models for Property-Liability Insurance Companies: An Analysis and Some Extensions." *Management Science* 27 (4) (1981), 414–430.

DeAngelo, H., and Masulis, R.W. "Optimal Capital Structure under Corporate and Personal Taxation." *Journal of Financial Economics* 8 (1) (1980), 3–29.

Diamond, D., and Verrechia, R. "Optimal Managerial Contracts and Equilibrium Security Prices." *Journal of Finance* 37 (2) (1982), 275–288.

Doherty, N.A. "Risk Management—A Financial Critique and an Alternative Structure." Discussion Paper for the *Geneva Association,* 1983.

_____. "On the Capital Structure of Insurance Firms." Paper presented at the 1986 meetings of the American Finance Association, 1986.

Doherty, N.A., and Garven, J.R. "Price Regulation in Property-Liability Insurance: A Contingent Claims Approach." *Journal of Finance* 41 (5) (1986), 1031–1050.

Doherty, N.A., and Tinic, S.M. "Reinsurance under Conditions of Capital Market Equilibrium: A Note." *Journal of Finance* 36 (4) (1981), 949–952.

Duncan, M. "An Appraisal of Property and Casualty Post-Assessment Guaranty Funds." *Journal of Insurance Regulation* 2 (1984), 289–303.

Easterbrook, F.H., and Fischel, D.R. "Limited Liability and the Corporation." *The University of Chicago Law Review* 52 (1) (1985), 89–117.

Fairley, W. "Investment Income and Profit Margins in Property-Liability Insurance: Theory and Empirical Results." *Bell Journal of Economics* 10 (1) (1979), 172–191.

Fama, E.F. "The Effects of a Firm's Investment and Financing Decisions on the Welfare of its Security Holders." *American Economic Review* 68 (1978), 272–284.

Fama, E.F., and Jensen, M.C. "Agency Problems and Residual Claims." *Journal of Law and Economics* 26 (1983a), 327–349.

_____. "Separation of Ownership and Control." *Journal of Law and Economics* 26 (1983b), 301–325.

_____. "Organizational Forms and Investment Decisions." *Journal of Financial Economics* 14 (1985), 101–119.

Finsinger, J., and Pauly, M. "Reserve Levels and the Reserve Requirements for Profit Maximizing Insurance Firms." In: G. Bamberg and K. Spremann, eds., *Risk and Capital,* Berlin-Heidelberg: Springer-Verlag, 1984.

Galai, D., and Masulis, R.W. "The Option Pricing Model and the Risk Factor of Stock." *Journal of Financial Economics* 3 (1976), 53–81.

Garven, J.R. "Capital Structure and Financial Intermediation: The Case of Reinsurance." Working Paper, The Pennsylvania State University, 1987.

Hill, R. "Profit Regulation in Property-Liability Insurance." *Bell Journal of Economics* 10 (1) (1979), 172–191.

Hill, R., and Modigliani, F. "The Massachusetts Model of Profit Regulation in Non-Life Insurance: An Appraisal and Extensions." In: D. Cummins and S. Harrington, eds., *Fair Rate of Return in Property-Liability Insurance* Hingham, MA: Kluwer-Nijhoff, 1986.

Jensen, M.C. "Organization Theory and Methodology." *The Accounting Review* 58 (1983), 319-339.
Jensen, M.C., and Meckling, W.H. "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure." *Journal of Financial Economics* 3 (4) (1976), 305-360.
Kane, E.J. "Appearance and Reality in Deposit Insurance." *Journal of Banking and Finance* 10 (2) (1986), 175-188.
Kim, E.H. "A Mean-Variance Theory of Optimal Capital Structure and Corporate Debt Capacity." *Journal of Finance* 33 (1978), 45-63.
Kraus, A., and Litzenberger, R. "A State-Preference Model of Optimal Financial Leverage." *Journal of Finance* 28 (1973), 911-922.
Kraus, A., and Ross, S. "The Determination of Fair Profits for the Property-Liability Insurance Firm." *Journal of Finance* 37 (4) (1982), 1015-1028.
Lambert, R.A., and Larcker, D.F. "Executive Compensation, Corporate Decision-Making, and Shareholder Wealth: A Review of the Evidence." *Midland Corporate Finance Journal* 2 (4) (1985), 6-22.
Lintner, J. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." *Review of Economics and Statistics* 47 (1) (1965), 13-37.
Lundberg, F. "Uber die Theorie der Ruckversicherung." *Transactions VI International Congress of Actuaries 1* (1909), 877-955.
Main, B.G.M. "Corporate Insurance Purchases and Taxes." *Journal of Risk and Insurance* 50 (2) (1983), 197-223.
Mayers, D., and Smith, C.W. "Contractual Provisions, Organizational Structure, and Conflict Control in Insurance Markets." *Journal of Business* 54 (3) (1981), 407-434.
_____. "On the Corporate Demand for Insurance." *Journal of Business* 55 (2) (1982a), 281-296.
_____. "Toward a Positive Theory of Insurance," Monograph 1982-1. New York: Salomon Brothers Center for the Study of Financial Institutions, 1982b.
_____. "Ownership Structure Across Lines of Insurance." *Journal of Law and Economics* (forthcoming, 1987).
Merton, R.C. "An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees." *Journal of Banking and Finance* 1 (1977), 3-11.
Miller, M.H. "Debt and Taxes." *Journal of Finance* 32 (2) (1977), 261-275.
Modigliani, F., and Miller, M.H. "The Cost of Capital, Corporation Finance and the Theory of Investment." *American Economic Review* 48 (3) (1958), 261-297.
Modigliani, F., and Miller, M.H. "Corporate Income Taxes and the Cost of Capital: A Correction." *American Economic Review* 53 (3) (1963), 433-443.
Mossin, J. "Equilibrium in a Capital Asset Market." *Econometrica* 34 (4) (1966), 768-783.
Munch, P., and Smallwood, D. "Theory of Solvency Regulation." In: Gary Fromm, ed., *Studies in Public Regulation.* Cambridge, MA: MIT Press, 1981.
Ramakrishnan, R.T.S., and Thakor, A.V. "The Valuation of Assets Under Moral Hazard." *Journal of Finance* 39 (1) (1984), 229-238.
Scott, J. "A Theory of Optimal Capital Structure." *Bell Journal of Economics and Management Science* 7 (1976), 33-54.
Sealey, C.W. "Deposit Rate Setting, Risk Aversion, and the Theory of Depository Financial Intermediaries." *Journal of Finance* 35 (5), 1139-1154.
Sharpe, W.F. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." *Journal of Finance* 19 (3) (1964), 425-442.
Stigler, G.J. *The Citizen and the State.* Chicago: University of Chicago Press, 1975.
Stiglitz, J. "On the Irrelevance of Corporate Financial Policy." *American Economic Review* 64 (1974), 851-866.
Titman, S. "The Effect of Capital Structure on a Firm's Liquidation Decision." *Journal of Financial Economics* 13 (1984), 137-152.
Turnbull, S.M. "Debt Capacity." *Journal of Finance* 34 (1979), 931-940.