

SHORTER ARTICLES

Incentive Conflicts and Portfolio Choice in the Insurance Industry

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ABSTRACT

A model of the relationship between an insurer's strategic decisions and its organization is developed using stochastic dominance theory. Agency costs are shown to arise from the conflicts created by the insurer's organizational form and to be exacerbated by the removal of market forces by guarantee funds. Regulation may not adequately substitute for this lost market discipline. The model provides a means for examining the effects of alternative regulatory policies.

Introduction

This article analyzes the financial incentives of employees and policyholders versus financiers of insurance firms within a stochastic dominance framework. It examines the risk-taking incentives of the insurer with respect to asset portfolio choice, and how the payoffs to each of the firm's claimants depend on the final value of the portfolio. Mayers and Smith (1981), Doherty and Garven (1986), and Cummins (1988) have examined these incentives using an option pricing model paradigm. In this article, we adopt the discrete time, risk-neutral valuation approach previously used by Doherty and Garven (1986). The development of a generalized option valuation model in the discrete time framework, under costly contracting,¹ requires the adoption of one of two sets of assumptions. The first set requires that the return on the insurer's asset portfolio and the claims made on its policies are normally distributed and that individuals have constant absolute risk aversion (Rubinstein, 1976). The second set requires that the return on assets and the cost of claims are lognormally

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¹ Costly contracting is one assumption that can be used to explain the existence of financial intermediaries (Mayers and Smith, 1981).

distributed and that either there is no friction to continuous trading or that investors have constant relative risk aversion (Brennan, 1979; Stapleton and Subrahmanyam, 1984). The advantage of stochastic dominance in analyzing the effects of these conflicts is that it avoids the necessity of imposing restrictions on individual preferences (Levy and Sarnat, 1972; Bawa, 1975). In many cases, conclusions are obtainable without any extensive knowledge about return distributions and/or utility functions. Moreover, this framework has pedagogical value in that many of the incentive conflicts can be demonstrated simply.

This article begins by developing the notion of risky investment portfolios in a stochastic dominance context, followed by an analysis of the incentives of insurer stakeholders. Incentive conflicts between owners and employees and between owners and customers are shown to vary with organizational form.

Two Risky Investment Portfolios

Assume that the insurer has two mutually exclusive investment portfolios from which to choose. One portfolio is riskier than the other in that it is a simple mean-preserving spread of the less risky one (see Figure 1). The expected returns from both portfolios are the same, although the actual returns vary by state of nature. (The figure portrays total end-of-period returns and not rates of return.)

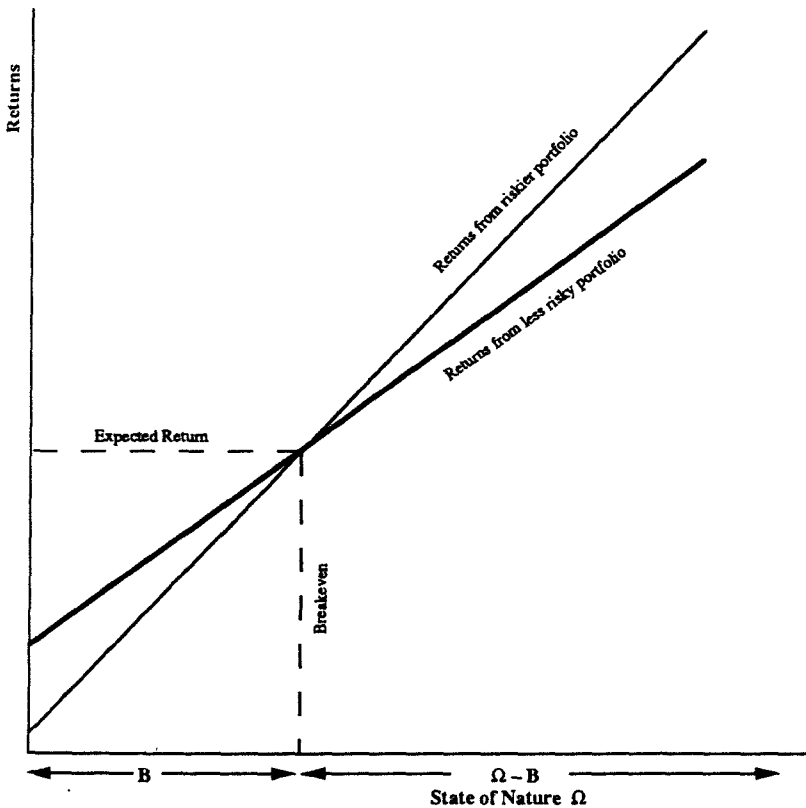
In states with returns below the expected return, the riskier portfolio provides lower returns, whereas in states where returns exceed the expected return, the riskier portfolio outperforms the less risky one. Because the two asset return lines intersect at the point that equates their expected returns, we can be sure that, by way of second-degree stochastic dominance, any risk-averse individual faced with only these two mutually exclusive choices will prefer the less risky portfolio. This is true by construction, regardless of the precise shape of his or her utility function and irrespective of the exact probability distribution of states.

Conflict Between Employees, Policyholders, and Owners

The incentive conflicts among the claimants to a stock insurance firm can be explored using the stochastic dominance paradigm. The simplest case—a single period model—is presented, and employees, policyholders, and financiers are considered.² Labor costs (and other fixed costs) are assumed to be set at levels that reflect the conflicting incentives of owners versus employees. In other words, employees are able to ascertain the firm's incentives to choose an asset portfolio that would be adverse to their interests, and they negotiate for compensating wage levels accordingly. Similarly, policyholders are aware of

² Other claimants to an insurance firm—such as management, sales agents, and tax authorities—are not treated here due to space limitations, but they are easily incorporated in a stochastic dominance framework.

Figure 1



the incentives for the insurer to choose an asset portfolio that would be adverse to their interests, and they demonstrate this awareness by lowering the premiums that they are willing to pay for insurance policies.

We will consider four cases. The first three relate to a stock insurer and the fourth to a mutual insurer.

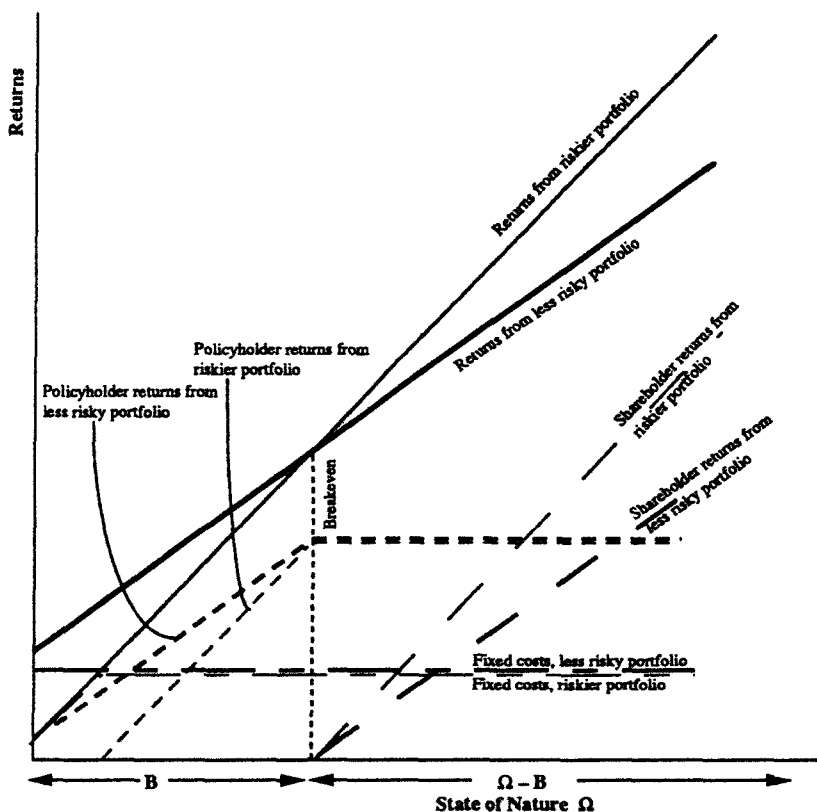
Case A: Expected Return Equals Expected Costs

At the beginning of the period the insurer invests the proceeds from insurance sales, along with any equity, in one of two asset portfolios. The firm is solvent if the returns from these investments cover the end-of-period claims against the firm; if not, the firm is bankrupt. The riskier portfolio has greater losses in bankruptcy states (B) and greater returns in solvency states, where Ω stands for the universe of possible states of nature. Both portfolios are solvent under the same conditions and have the same expected return. Both portfolios are actuarially neutral in the sense that expected returns are equal to fixed costs and expected claims.

At the end of the period, the value of the asset portfolio is used to pay employees (who have priority over policyholders), policyholder claims, and

Figure 2

Stockholder vs. Policyholder Returns When Fixed Costs
and Expected Claims Equal Expected Return on Investments



Note: Where payoff patterns overlap each other, the lines are slightly offset to facilitate their identification. In this figure, portions of the payoff patterns for fixed costs and policyholders have overlapping segments.

stockholders. Policyholders, as a class, receive the appraised value of the losses if the portfolio value, after deducting fixed costs, exceeds the appraised losses; otherwise they receive whatever portfolio value remains after deducting labor costs.³ The smallest return from the company to the cohort of policyholders is zero. The stockholders' end-of-period return is zero if the firm becomes insolvent; otherwise it is the return from investment less labor and claims expenses (see Figure 2).

³ Ignored is the existence of an insurer insolvency guarantee program. Even in the presence of such a program, the caps on claim payments, together with the delays and uncertainties, create a preference by the policyholder for the insurer to pursue the less risky investment strategy, albeit a less compelling preference.

The value of the riskier portfolio to the insurer's stockholders is unambiguously greater than the value of the less risky portfolio, by first-degree stochastic dominance. Figure 2 shows that the cash flows to stockholders are no less for any state, and greater for some, when the firm selects the riskier portfolio. This dominance prevails regardless of the particular probability distribution of returns. This result holds true for sufficiently small stock issues where the firm's expected costs equal the expected returns on the investment portfolio. The same effect can be created by a reduction of insurance rates that reduces or eliminates the insurer's equity. Additionally, if investments provide returns that will only benefit the policyholders, there will be no incentive to make the investments (Mayers and Smith, 1987).

Case B: Expected Return Exceeds Expected Costs

The model is the same as described in Case A except that the company is expected to be profitable. Total return is expected to exceed total costs by a sizable amount (see Figure 3).

Again, employees and policyholders could be hurt if the insurer chooses the riskier asset portfolio, and there is no guarantee that it will not choose it. Therefore, the wage cost and premium levels will reflect these claimants' best estimates of the value of these agency costs. It is no longer a certainty that the stockholders will be better off by selecting the riskier portfolio. The two bankruptcy events are different, and returns from one portfolio are no longer universally dominant.

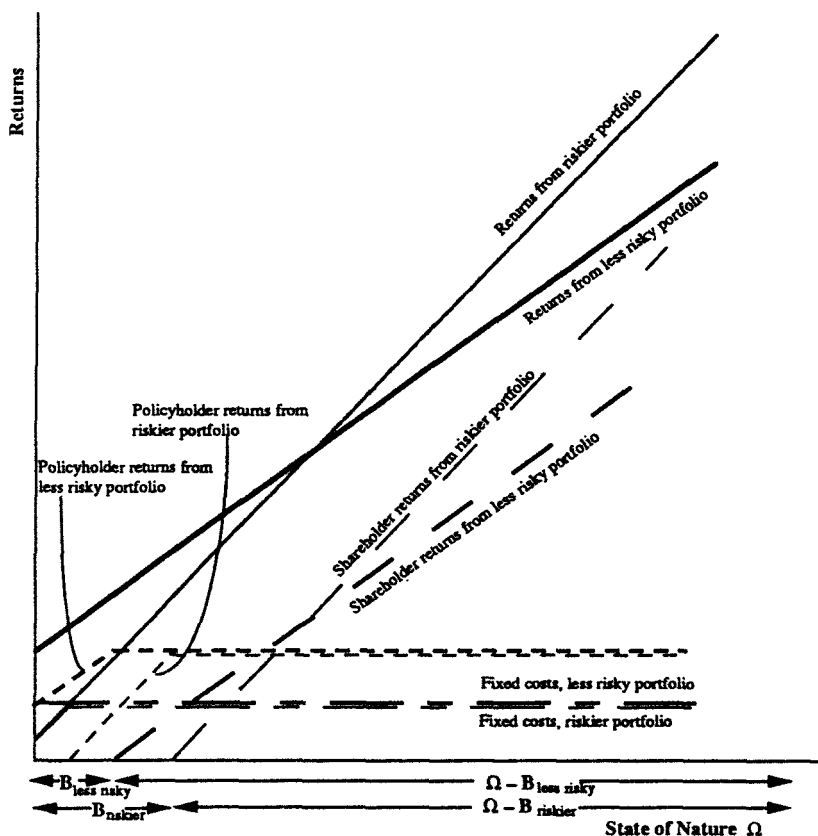
It is clear that the risky portfolio no longer dominates the less risky one by either first- or second-degree stochastic dominance. Indeed, the less risky portfolio will be preferred over the riskier portfolio, in a second-degree stochastic dominance sense, provided that

$$\int_{-\infty}^x [F(t) - G(t)] dt \geq 0$$

for all values of x with a strong inequality holding for at least some x_0 , where x denotes return and F and G denote the (continuous) cumulative probability distributions of returns on the risky and less risky portfolios, respectively. If this is the case, stockholders will have a strong incentive to choose the less risky portfolio. To determine whether this dominance is operative, more information is required about the probability distribution of the asset return states.

This case lies between the first illustration of the mean preserving spread, in which the owners preferred the less risky portfolio by second-degree stochastic dominance, and the previous case, in which the stockholders (owners) preferred the riskier portfolio by first-degree stochastic dominance. Therefore, by continuity we can infer that there exists a capital structure (i.e., initial equity level) where the values to shareholders of the two asset portfolios will be the same. Equity below that level will result in a preference for the riskier portfolio, while equity above that level will result in shareholders'

Figure 3
Stockholder vs. Policyholder Returns
When Expected Net Worth Is Positive



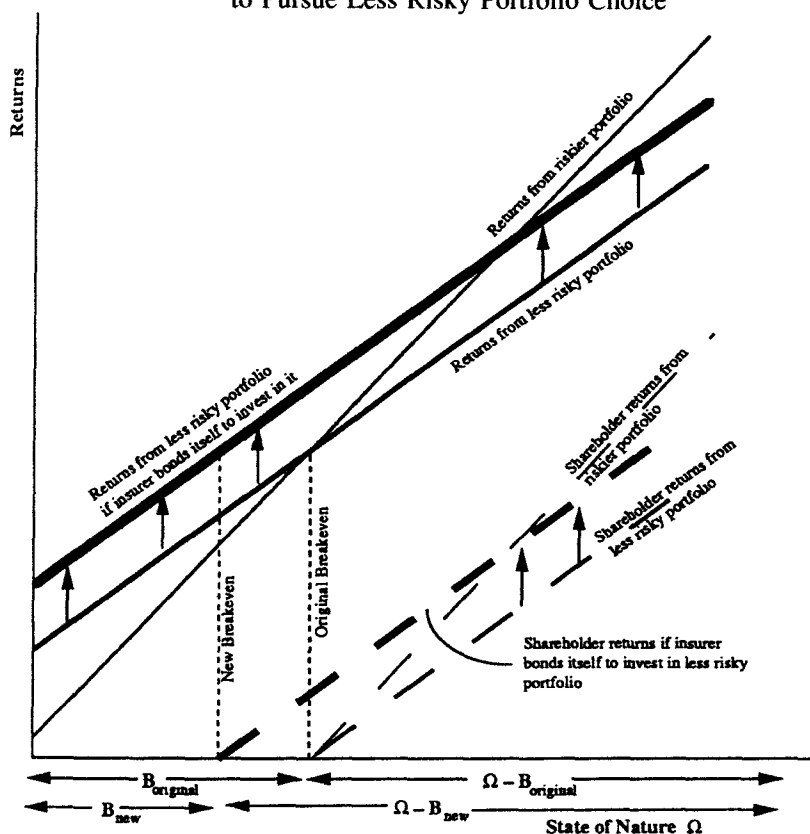
Note: Where payoff patterns overlap each other, the lines are slightly offset to facilitate their identification. In this figure, portions of the payoff patterns for fixed costs and policyholders have overlapping segments.

preference for the less risky portfolio. Determining this indifference point for capital structure would require not only a knowledge of probability distributions of returns, but also a knowledge of the utility functions of investors. Equity can serve as a bonding to pursue the less risky portfolio strategy. Schnabel and Ebrahim (1989), in analyzing the underinvestment problem, find a similar result.

Case C: Insurer Bonds Itself to Choose Less Risky Portfolio

The model is the same as that described in Case B except that the insurer has bonded itself to invest in the less risky portfolio (see Figure 4). To avoid repetition and reduce the density of Figure 4, the returns to employees and policyholders are not shown. However, they are very similar to those shown in the prior figures.

Figure 4
 Stockholder Returns When Insurer Bonds Itself
 to Pursue Less Risky Portfolio Choice

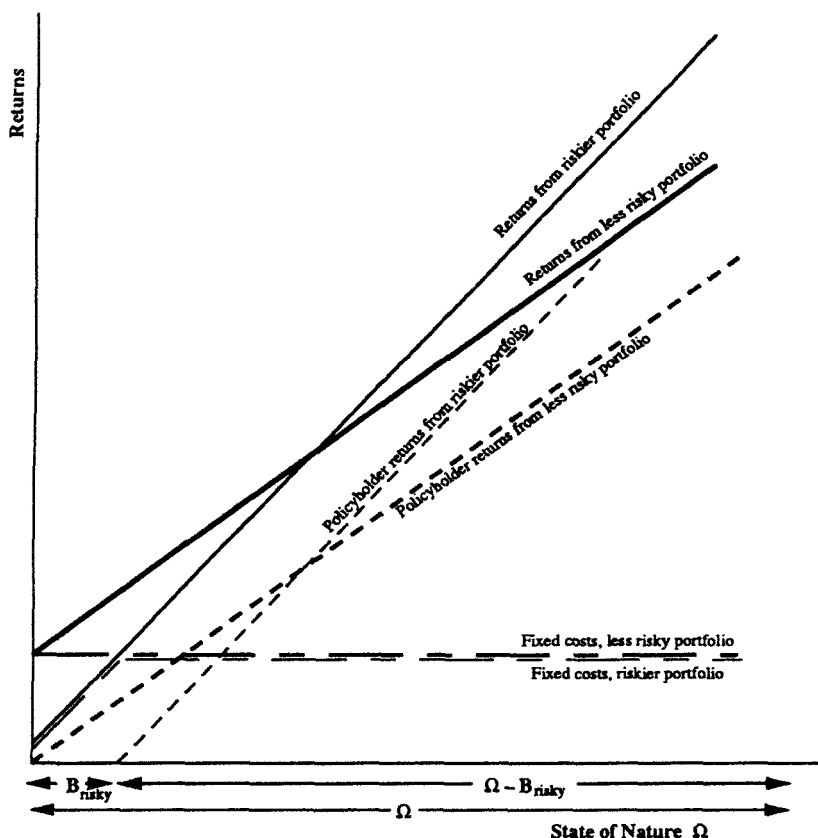


Before the insurer binds itself to invest in the less risky portfolio, assume that the expected portfolio return, for either of the two portfolios, exactly equals the expected fixed costs and insurance claims, as in Case A. In response to the insurer binding itself to pursue the less risky investment strategy, employees will be satisfied with a lower wage, and policyholders will be willing to pay a higher premium for the more secure insurance contract. These responses combine to lower the break-even level of profitability, while increasing the investable assets.

In this case the less risky portfolio may be preferred to the riskier one by second-degree stochastic dominance, depending on the probability distribution of states. However, in no case does the riskier portfolio dominate the less risky one by first- or second-degree stochastic dominance.

At this point it is useful to introduce into our analysis the impact of an insurer insolvency guarantee program on the incentive structure. The insolvency guarantee program will have the effect of making the policyholders less attuned to the solvency prospects of the insurer, and premium levels are unlikely to be

Figure 5
Policyholder Returns from Mutual Insurer



Note: Where payoff patterns overlap each other, the lines are slightly offset to facilitate their identification. In this figure, portions of the payoff patterns for fixed costs coincide.

very responsive to the financial stability of the insurer. Accordingly, the asset return line from the less risky strategy will not shift upward as much as it does in Figure 4, since a guarantee fund is not likely to alter the compensating differential to employees. Thus, the riskier portfolio may dominate the less risky one from the shareholders' perspective. Even if this dominance does not occur, we can say that the less risky portfolio is less likely to dominate the riskier one under these conditions. Perhaps this tendency can be mitigated, to some extent, by having regulatory authorities require the insurer to have a higher equity investment in the firm in order to conduct insurance business.

Case D: Policyholder Participation

The mutual insurance firm has only one class of contingent stakeholders and therefore can be considered entirely equity financed. The mutual case is straightforward in our single-period model.

Figure 5 illustrates the returns to policyholders and employees. All returns above the fixed cost threshold will be distributed to policyholders to indemnify losses and to participate in the profits. (In a multiperiod model, not all returns above the fixed cost threshold would be allocated to policyholders, because mutualism usually entails leaving some equity "on the table" for future policyholders.) The payoff profiles in Figure 5 illustrate the impossibility of a riskier portfolio dominating a less risky one by stochastic dominance. However, it is possible for the less risky portfolio to be preferred over the riskier one by second-degree stochastic dominance. As fixed costs become an insignificant fraction of total costs, it is almost certain that the less risky portfolio will dominate the riskier one, since policyholders must be risk averse (a situation analogous to that depicted in Figure 1). As fixed costs become a more important expense, the dominance can be determined only by interfacing the payoff profiles with the state probabilities.

Conclusion

We developed a model of the insurer under uncertainty and used it to examine the behavior of the stakeholders of the insurance firm. The analytic power of the stochastic dominance framework was illustrated in several cases.

To summarize, a stock insurer with a low equity investment has an incentive to select the riskier portfolio because stockholders benefit more if the firm remains solvent. Employees and policyholders bear greater losses if the firm becomes insolvent, and because they will recognize the incentives of stockholders to invest in the riskier portfolio, the labor cost structure and premiums that the policyholders are willing to pay for insurance will reflect unbiased estimates of stockholders' actions. The lower the equity or surplus in relation to the variability of the cash flows from investment and underwriting of the firm, the greater the magnitude of these agency costs.

Therefore, self-interested stockholders should guarantee policyholders against wealth transfers if the guarantee is less costly than the agency problems. This can be done by limiting investment policies, setting equity levels, limiting dividend policies (which determines capital structure in a multiperiod setting), providing a guarantee fund, or purchasing reinsurance (which also alters leverage, risk, or both).

Mutual insurers were shown to prefer less risky portfolios in some cases. However, it is unclear how strong or universal this preference is without introducing into the analysis probability distributions of returns.

The results extend the analysis of agency problems developed by Mayers and Smith (1981) by relaxing the assumptions imposed by option pricing models. The analysis supplements the option models developed by Cummins (1988) in demonstrating the value of guarantee funds to insurance firms. Together the models provide a complementary framework for considering the economic effects of regulatory changes in minimum capital, pricing, and portfolio restrictions.

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