CHAPTER SEVEN

THEORETICAL PREMIUMS FOR PROPERTY AND CASUALTY INSURANCE COVERAGE - A RISK-SENSITIVE, TOTAL RETURN APPROACH

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OVERVIEW

The purpose of this paper is to present a conceptual paradigm for deriving the premium for a property or casualty insurance policy. The essential idea is that the premium should be sufficient to generate an adequate total return to the investors who supplied necessary capital to the insurance company that issued the policy.

In presenting this approach and some of its implications, the focus will be on the theory and concepts. No real world applications will be demonstrated and no suggestion will be made on how to price any particular coverage. Nor will there be any attempt to debate the merits of this approach versus any other or argue whether it is appropriate for use in any rate hearing or other forum.

THE NEED FOR CAPITAL

An insurance company needs a sufficient supply of capital in order to provide meaningful insurance protection. Without such capital behind it, the company issuing an insurance policy is making a promise of coverage it may be unable to fulfill. If losses are above expectation and if the company has inadequate funds to cover such adverse deviation, it may then have to default on its obligation to pay losses.

Insurance regulators in the United States have recognized the importance of adequate capitalization in ensuring that such defaults occur as infrequently as possible. They have established capital benchmarks and taken action against companies capitalized below minimum standards. In recent years, simple rules of thumb such as the "3-to-1" premium-to-surplus ratio have been replaced by the more sophisticated "Risk-Based Capital" formula as regulators push for more accurate and timely approaches to solvency regulations. Insurance company rating agencies have also focused on adequacy of capitalization as a key factor in determining company ratings.

In addition to establishing benchmarks, regulators have also mandated that companies use a conservative set of accounting rules, Statutory Accounting Principles (SAP), in evaluating their actual capital. The intent of SAP accounting is to make sure that an insurance company has enough cash and easily liquidated assets on hand to pay off all obligations even if the company were shut down the next day. Under the "balance sheet, liquidation" perspective of statutory Accounting, some assets may be understated and

some liabilities may be overstated relative to their values under the "income statement, going-concern" perspective of Generally Accepted Accounting Principles (GAAP) or the true economic approaches used by some financial analysts in evaluating acquisitions and mergers.

An important consequence of the conservative accounting rules is that they keep money in the insurance company that might otherwise be given to investors. In particular, when premiums are paid to an insurance company, the investors of the company do not get their hands on the cash. Rather, most of the funds stay with the company as assets to offset liabilities posted for premiums, claims, and expenses. Not only do they not get the cash, but also investors may find some of their invested capital gets absorbed in keeping the company adequately capitalized under a conservative accounting regimen. For example, under SAP, a significant portion of the expense is declared up-front when a policy is written even though associated premiums will be earned evenly over the policy term. This results in a double-counting of expenses which dissipates as the premium is earned. In GAAP, there is an asset account, the Deferred Acquisition Costs (DAC) balance, which is posted to offset this "equity in the unearned premium reserve". The key point here is that some investor capital does not show up in the SAP valuation of the company's surplus. Because accounting rules tie up money that could go to insurance company investors, they impact the return investors obtain on their investment in the company.

THE INVESTORS' PERSPECTIVE

Consider a hypothetical scenario in which investors are looking at the merits of an investment in a fictitious insurance company formed for the sole purpose of writing a single property or casualty insurance policy. Suppose company management intends to charge a specified premium rate and an actuary has supplied estimates of expected losses and expenses to be paid out. Assume the timing of all payments is forecast as accurately as current methods permit. Suppose interest rates and income taxes are known. Would that be enough for the potential investors to make a decision? Of course not! Because knowing the company's cash flows to and from policyholders, tax collection agencies, agents, employees, and so forth is all very interesting to investors, but not nearly as interesting as the projected flow of funds between the company and the investors themselves. The investors want to know about the moneys they will put in and get out. Also, the investors want to know how risky the deal is.

EQUITY FLOWS

To formalize this, assume investors incorporate a fictitious company set up to write a single insurance policy. Let the term *equity flow* denote movements of cash between a company and its investors. A negative equity flow, denoting the transfer of money into the company by the investors, could take the form of a purchase of company stock by the investors. A positive equity flow might consist of dividends on stock or a repurchase of shares. An initial negative equity flow would occur at policy inception as investors put

up money so that the company has enough capital to write the policy. If the company's books were tabulated just after the policy was written, they would probably show, under the conservative rules of statutory accounting, that the company has less surplus than the capital put in by the investors. At the end of each accounting period, income would be declared and a provisional balance sheet would be computed. Ignoring changes to surplus that do not flow through the income statement (such as unrealized capital gains), the provisional surplus would differ from the surplus at the end of the prior accounting period by the declared income. However, if company management saw that it would have more than sufficient surplus so as to probably stay solvent over the next accounting period, it might decide to pay some money to investors. This would generate a positive equity flow. If the provisional balance sheet looked weak, management might try to get investors to put in more money so that there would be a negative equity flow. After the equity flow, the balance sheet would show a period-to-period change in surplus equal to the sum of income less the equity flow. Rewriting the equation we see that equity flow is equal to income less the change in surplus. Thus, if we had the prospective books for the hypothetical company showing its income and its surplus for each accounting period, we could calculate the prospective flows of money to and from its investors.

IRR ON EQUITY FLOWS

Investors could measure profitability of any projected outcome of a venture by computing the Internal Rate of Return (IRR) on the equity flows. Assuming annual time periods, the IRR is that rate (if it exists and is unique) at which the present value of the equity flows (*EQF*) is zero:

$$IRR = y \text{ if and only if } \sum \mathrm{EQF}_j (1+y)^{-j} = 0$$

The *IRR* on equity flows is a measure of return directly comparable with the interest rate on a bond. For example, if the equity flows are -110, +11, +121, the *IRR* is 10% since $0 = -100 + 11 \cdot (1.1)^{-1} + 121 \cdot (1.1)^{-2}$.

TARGET RETURN

Applying a risk-return paradigm in an insurance context, one could say that a theoretically justified premium should lead to an expected IRR equal to an appropriate risk-sensitive target return. This target return should at least equal the pre-tax risk-free yield otherwise available to investors. However, as will be discussed below, when investors put money in an insurance company, the impact of income taxes and statutory accounting tends to push their return below this floor. Thus, part of the premium is needed merely to raise the expected return to an acceptable non-risk adjusted level.

How much to boost the target return for risk is a question subject to debate. For the sake of argument, suppose the insurance company only invests in risk-free bonds, that it matches the duration of its investment against its liabilities so as to partly immunize itself

from interest rate fluctuation, and further suppose that losses for the policy are entirely uncorrelated with returns on the stock market. Under these assumptions, it follows that, approximately, the IRR to investors will have a zero covariance with the stock market return. If that were true, then one could argue under a strict CAPM approach that the target return ought to be equal to the risk-free return and no higher!

OFFSET FOR INCOME TAXES ON INVESTMENT INCOME

Suppose the company writes no insurance policies, but merely takes the funds invested in it and then reinvests them at the risk-free rate. Because the company must pay income taxes before distributing proceeds to its investors, it will be able to provide investors with a return only equal to the after-tax risk-free yield. Thus, even without consideration of risk, the profit load ought to contain an offset making up for income taxes on the investment income on assets supplied by the equity investors. In effect, the taxes on this investment income have to be passed through to policyholders.

OFFSET FOR CONSERVATISM IN STATUTORY ACCOUNTING

Due the conservative nature of statutory accounting, the investors do not get potential profits as quickly as they otherwise might. Further, they have more invested in the venture than the statutory surplus would indicate. This has implications on their return from the venture. Consider, from a pure cash flow perspective, the surplus of the company might be valued as the difference between the current market value of its assets less the present value of expected subsequent underwriting outflows. However, statutory surplus is the difference between statutory assets and statutory liabilities, and statutory liabilities are usually much greater than the present value of subsequent underwriting outflows. Loss and loss expense reserves are usually supposed to be held at full value. Also, the posting of unearned premium reserves leads in effect to the double-counting of expenses. This is the source of the "equity in the unearned premium reserve" or the balance for Deferred Acquisition Costs recognized in GAAP.

While funds that could, from a strict cash flow perspective, be paid out as profits languish in insurance company vaults offsetting statutory liabilities, they earn investment income. However, here again, income taxes reduce the return on those funds. Thus, to get a sufficiently attractive total return, the premium must implicitly include a charge for the substandard yield on the delayed remission of profits. **The extra protection afforded to policyholders by the discipline of statutory accounting does not come cost-free. One main omission in several pure cash-flow approaches to insurance pricing lies in the failure to reflect the impact of accounting rules on the flow of cash to investors.**

RISK AND SURPLUS

To investors, risk pertains to the possibility they will not get the return they expected on their investment. To policyholders, on the other hand, risk relates to the possibility the

insurance company will run out of money and default on payments of covered loss. Running the company with more surplus does not change the underlying risk of adverse loss experience, but it does decrease the risk to policyholders.

In order to reflect the level of capitalization, consider a "Target Surplus" model in which surplus is capped by pre-set targets that evolve over the life of the policy according to pre-set rules. Investors will put up enough initially so that carried surplus is equal to the target when the policy is written. Subsequently, carried surplus could fall below target if results are less rosy than initially hoped. In that event, future profits will be used to build the carried surplus back up to the target. If results are very poor, the company could run through its surplus and go bankrupt. The odds of this happening are inversely related to the level of target surplus.

A critical point is that the targets on surplus function to cap the surplus and thus ensure that accumulated profits and excess surplus will be returned to investors. If surplus amasses to momentarily exceed the target amount, the company's management will immediately send the extra surplus back to the investors in the form of capital distributions or dividends. Further assume the cap on surplus eventually declines to zero so that no funds that could go to investors are kept from them indefinitely.

THE IRR DISTRIBUTION

Based on a set of surplus targets, loss distribution and payout assumptions, reserving accuracy assumptions, investment and tax assumptions, and so forth, one could in principle derive a distribution of IRR's. This distribution of returns should provide investors with sufficient information to decide if the venture is sufficiently lucrative relative to the risk involved. To simplify matters, assume that the standard deviation of the IRR provides an adequate measure of risk.

PREMIUM AND TARGET SURPLUS IMPACT IRR DISTRIBUTION AND RISK TO POLICYHOLDERS

As a hypothetical example of how changes in premium and target surplus impact the odds of default on obligations to policyholders and on the expected IRR and standard deviation of IRR to investors, consider the following chart of hypothetical results:

TABLE 1

Premium	Target Surplus	Default Odds	Expected IRR	IRR Std Dev
$100	Very High	0.01%	6.00%	4.00%
$100	High	0.10%	7.00%	6.00%
$100	Medium	0.51%	9.00%	9.00%
$100	Low	1.01%	15.00%	15.00%
$105	Very High	0.01%	7.50%	4.00%
$105	High	0.10%	10.50%	6.00%
$105	Medium	0.50%	15.50%	9.00%
$105	Low	1.00%	24.50%	15.00%

Note the amount of premium has a tiny impact on the default odds. Also, observe the amount of premium has no impact on the standard deviation of IRR. The reasoning here is that variations about the average IRR are driven by variations in loss and investment results relative to the surplus and not by the premium level.

It is straightforward that more surplus reduces the risk of default on obligations to policyholders. Target surplus also impacts the expected return. Due to the "leverage" of capital, an increase in surplus moves returns towards the after-tax yield on investments made by the company. In the example above, all returns are apparently above this after-tax yield and so increases in the target surplus lower the return. Increases in target surplus also act to reduce the standard deviation of return. This happens whether or not returns are above or below the after-tax yield, as long as one assumes investment risk is less volatile than the risk of adverse loss experience.

If the risk-free pre-tax yield was 7.2%, the $100 premium would entice no investors if they had to fund the "high" or "very high" surplus targets. However, they could perhaps be enticed by the "medium" or "low" target surplus ventures. Raising the premium to $105 might get some to put up funds to cover the "high" or "very high" surplus targets.

Abstracting from this, it follows that premiums consistent with this model will vary with the level of surplus: the higher the surplus target, the higher the premium. What the policyholder gets for the higher premium is a greater assurance that all claims will be paid.

CONCLUSION

Under the theory expounded here, the premium for an insurance policy is set so as to provide investors with a total return commensurate with the risk they undertake supplying necessary funds to the insurance company. The more funds they supply, the less will be the risk to policyholders that the company will default on its obligations. Since different companies offering identical coverage operate with different levels of default risk, this theory gives no one correct price for an insurance policy. Rather, it posits a curve of

prices that correspond to differing odds of default. These, in turn, are inversely related to the target level of surplus maintained by the company. What price the consumer will pay depends on how much extra the consumer wants to pay in premium now to avoid a potential default later. Since this paper has not attempted to describe consumer willingness to pay an extra price to mitigate odds of default, it is at best incomplete. Nonetheless, it is hoped this presentation of the "supply side" of insurance pricing will provide useful insights and prove a solid foundation for further analysis.