

## **The Relationship to Underwriting, Investment, Leverage, and Exposure to Total Return on Owners' Equity**

Insurance companies operate with a levered capital structure. The leverage is an “insurance leverage,” resulting from the deferred nature of insurance liabilities.

$$\frac{T}{S} = \left(\frac{I}{A}\right) \left(1 + \frac{R}{S}\right) + \frac{U}{P} * \frac{P}{S}$$

Define:

|     |   |                               |
|-----|---|-------------------------------|
| T   | = | Total after-tax return        |
| I   | = | Investment gain (or loss)     |
| U   | = | Underwriting profit (or loss) |
| P   | = | Premium income                |
| A   | = | Total Assets                  |
| R   | = | Reserves & Other Liabilities  |
| S   | = | Stockholders' Equity          |
| T/S | = | Total Return on Equity        |

We see from the formula that the total return to stockholders is:

Investment Return on Assets (I/A)

Multiplied by

Insurance Leverage factor dependent on size of reserves relative to surplus (1+R/S)

Plus

Underwriting Profit on Premiums (U/P)

Multiplied by

Insurance Exposure Term relating premiums to surplus (P/S)

The formula shows the relationship between the return on equity, the return on assets, and the return on sales. These three measures correspond to the investors' viewpoint, society's viewpoint, and the actuaries' viewpoint, respectively.

We can rewrite the formula as

$$\frac{T}{S} = \frac{I}{A} + \frac{R}{S} \left(\frac{I}{A} + \frac{U}{P}\right)$$

To use this formula, we require that “R” be a reserve capital. Reserve capital is the amount of total investable assets that has been supplied by persons other than the investors. In this case, the leverage factor (R/S) is applied separately to interest income on total assets (I/A) and underwriting profit related to the reserve capital contributed by policyholders. This makes the formula analogous to the use of debt capital for financial leverage. Underwriting losses can be considered the “interest” that the insurer has paid, in exchange for the use of R dollars of reserve capital.

This formula indicates that it's to the benefit of the owners to continue to write insurance in the event of underwriting losses, as long as (I/A+U/R) is positive. This indicates the advantage of continuing to write insurance during periods of unprofitability.

This formula is also useful for visualizing the contribution to or subtraction from the total return on equity resulting from the effect of leverage in the insurance companies. Increased variability results from increased leverage. The leverage ratio serves as an indicator (or a partial determinant) of the riskiness of the owner's investment in the firm.

Our goal is to find the optimal combination of liabilities and owners' equity at which the value of the firm will be maximized. Two crucial variables that are generally accepted as firm value determinants are:

- 1) The expected earning stream
- 2) The rate at which that stream is capitalized by the asset.

From our formula, we show that non-equity financing from reserves will add to the income stream, as long as the costs of financing the reserves are less than the returns from invested assets. The central issue in determining optimal structure is the effect of non-equity financing on the quality of the insurer's earnings and on the rate at which earnings are capitalized.

The actuary comes into play in the determination of the impact of insurance obligations on the magnitude and variance of future earnings.

Actuarial determination of the probability of ruin should be extended to include the determination of the probabilities of unfavorable returns to owners, and the subsequent lowering of market valuation from the company, or (at the extreme) a departure of equity capital from the business.

The analysis of reserve capital/insurance leverage is more complicated than analyzing debt capital. The cost of debt capital is fixed, while the cost of reserve capital has an expected cost with a variance. An increase in the relative amount of debt capital generally comes with demands by the creditors for a higher interest rate to reflect increased risk. However, the relative profit of expanding an insurance portfolio is not as predictable.

Actuarial analysis of the optimal capital structure must include an analysis of the quality and the earning capacity of the assets. One major determinant of the amount of non-equity capital that can be undertaken is the degree of variability in the investment earning stream. The greater the variability of earnings, the lower the prescribed debt-equity ratio. The optimum reserve position for an insurer is not independent of the investment policy that is followed.

If the industry has a capacity problem from the public's viewpoint, it may be explained by a capital structure that (from an investor's viewpoint) is optimal at a relatively low reserve to surplus ratio. If the optimal capital structure is at a higher reserve to surplus ratio than is currently maintained in a "typical" company, then a potential conclusion is that the industry is overcapitalized with investor capital.

We could say that, on the basis of our final formula, provided the underwriting results don't fall below a certain standard, the premium volume should be expanded as much as possible. This would increase the total return on owners' equity, but the equity would be exposed to a considerably higher risk. The maximization of the return should be subject to the condition that there is no appreciable increase in the degree of risk to which the owners' equity is exposed.

The formulas herein lend themselves best to describe a static state. The relationships included will not stay constant, and they will change directly as a result of the change in premium volume. This is somewhat included if we realize that there's a possibility of the additional business being of a poorer quality (if P/S increases than U/P may decrease). However, the majority of the companies could avoid this provided they imposed adequate controls over the process of expansion.

Assuming the need to keep the risk to owners' equity unchanged:

- 1) When the premium to surplus ratio (P/S) increases, then the investment gain on assets (I/A) will tend to decrease, because:
  - a. The proportion of uninvested assets originating from the insurance operations will tend to rise
  - b. With a higher P/S, the element of risk to owners' equity becomes greater.
- 2) An insurer can safely write a larger premium volume with the same surplus, if their underwriting results are more favorable (P/S will move in the same direction as U/P)
- 3) U/P and I/A will tend to move in the same direction. If underwriting results are good, the insurer could "indulge" in a more aggressive investment policy