CAS Task Force on Fair Value Liabilities
White Paper on Fair Valuing Property/Casualty Insurance Liabilities

Section K - Appendices

Appendix 1: CAPM Method

This appendix presents an example of computing a risk-adjusted discount rate using CAPM.

In its simplest form, the approach used in Massachusetts assumes that the equity beta for insurance companies is a weighted average of an asset beta and an underwriting beta. The underwriting beta can therefore be backed into from the equity beta and the asset beta.

here
b_e is the equity beta for insurance companies, or alternatively for an individual insurer
b_A is the beta for insurance company assets
b_u is the beta for insurance company underwriting profits
k is the funds generating coefficient, and represents the lag between the receipt of premium and the average payout of losses in a given line
s is a leverage ratio

Since

$$b_e = \frac{\mathrm{Cov}(r_e, r_M)}{\mathrm{Var}(r_M)}$$

or the equity beta is the covariance between the company's stock return and the overall market return divided by the variance of the overall market return. It can be measured by regressing historical P&C insurance company stock returns on a return index such as the S&P 500 Index. Similarly, b_A can be measured by evaluating the mix of investments in insurance company portfolios. The beta for each asset category, such as corporate bonds, stocks, real estate is determined. The overall asset beta is a weighted average of the betas of the individual assets, where the weights are the market values of the assets.

Example:
Assume detailed research using computerized tapes of security returns such as those available from CRISP concluded that β_e for the insurance industry is 1.0 and b_A for the insurance industry is 0.15. By examining company premium and loss cash flow patterns, it has been determined that k is 2. The leverage ratio s is assumed to equal 2. The underwriting Beta is

$$b_u = \frac{b_e - (ks+1)b_A}{s}$$

or $b_U = .5*(1. – (2*2+1).15) = .125$

Once b_U has been determined overall for the P&C industry, an approach to deriving the beta for a particular line is to assume that the only factor affecting the covariance of a given line's losses with the market is the duration of its liabilities:

$$b_L = -k\, b_U$$

So if the average duration in a given line is 2, its beta is -2*.125= -.25

In order to derive the risk-adjusted rate, the risk free rate and the market risk premium are needed. Assume the current risk free rate is 6% and the market risk premium (i.e., the excess of the market return over the risk free return) is 9%. Then the risk-adjusted rate is:

$$r_L = r_f + b_L(r_m - r_f)$$

or $r_L = .06 - .25 * (.09) = .06 - .0225 = .0375$

An alternative approach to computing the underwriting beta is to regress accounting underwriting returns in a line of business on stock market returns. The method suffers from the weakness that the reported underwriting returns often contain values for the liabilities that have been smoothed over the underwriting cycle, thus depressing their variability.