# Section K - Appendices

## Appendix 5: The Tax Effect

More recent work by Butsic (Butsic, 2000) has examined the effect of taxes on the risk adjusted discount rates and insurance premium. Butsic argued that, due to double taxation of corporate income, there is a tax effect from stockholder supplied funds. Stockholder funds are the equity supplied by the stockholder to support the policy. In the formulas above, stockholder supplied funds are denoted by E and taken to be the ratio of *e* to the present value of losses $V = L(1+i_A)^{-T}$ . For a one period policy an amount *E* is invested at the risk free rate *i*, an amount $E_i$ of income is earned, but because it is taxed at the rate *t*, the after tax income is $E_i(1 - t)$. The reduced investment income on equity will be insufficient to supply the amount needed to achieve the target return. In order for the company to earn its target after tax return, the amount lost to taxes must be included in the premium. However, the underwriting profit on this amount will also be taxed. The amount that must be added to premium to compensate for this tax effect is:

$$\frac{Eit}{(1-t)\left[1+i(1-t)\right]}$$

This is the tax effect for a one period policy if the discount rate for taxes is the same as the discount rate for pricing the policy, i.e., the risk adjusted discount rate. Butsic shows that there is an additional tax effect under the current tax law, where losses are discounted at a higher rate than the risk adjusted rate. There is also a premium collection tax effect, due to lags between the writing and collecting of premium. This is because some premium is taxed before it is collected. Butsic developed an approximation for all of these effects taken together, as well as the multiperiod nature of cash flows into the following adjustment to the risk adjusted discount rate:

$i_A' = i - e(1-t)(r_T - i)$ ,where
$i_A$' is the tax and risk adjusted rate,
*e* is a leverage ratio,
*t* is the tax rate,
$r_T$ is the pre tax return on equity.

This is the effective rate used to discount losses to derive economic premium. The tax effect acts like an addition to the pure risk adjustment. Since premiums as stated in aggregate industry data already reflect this tax effect, no adjustment is needed for the risk adjusted discount rate used for pricing. However, for discounting liabilities, it may be desirable to segregate the tax adjustment from the pure risk adjustment, since the tax effect really represents a separate tax liability. Using the formula above, as well as the formula for determining the pure risk adjustment to the discount rate the two effects could be segregated. One would need to have an estimate of the total pre tax return on equity.