EXAM MLC QUESTIONS OF THE WEEK

S. Broverman, 2007

Week of July 30/07

You are given the following information about a fully continuous whole life insurance of 1.

- If the premium is increased by 10% the variance of the issue date loss increases by 4.04%.
- If the premium is increased by .003 the variance of the issue date loss increases by 10.25%.

Find the percentage increase in the variance of the issue date loss if the premium is increased by 20%

The solution can be found below.

Week of July 30/07 - Solution

We denote the annual premium by Q and the force of interest is δ.

The variance of the issue date loss is

- $(1+\frac{Q}{\delta})^2\,Var(Z)$ based on premium Q
- $(1+\frac{1.1Q}{\delta})^2\,Var(Z)$ based on premium $1.1Q$
- $(1+\frac{Q+.003}{\delta})^2\,Var(Z)$ based on premium $Q+.003$

We are given $\frac{(1+\frac{1.1Q}{\delta})^2\,Var(Z)}{(1+\frac{Q}{\delta})^2\,Var(Z)} = \frac{(1+\frac{1.1Q}{\delta})^2}{(1+\frac{Q}{\delta})^2} = 1.0404 \rightarrow \frac{1+\frac{1.1Q}{\delta}}{1+\frac{Q}{\delta}} = \frac{1.1Q+\delta}{Q+\delta} = 1.02$, and

$\frac{(1+\frac{Q+.003}{\delta})^2\,Var(Z)}{(1+\frac{Q}{\delta})^2\,Var(Z)} = \frac{(1+\frac{Q+.003}{\delta})^2}{(1+\frac{Q}{\delta})^2} = 1.1025 \rightarrow \frac{1+\frac{Q+.003}{\delta}}{1+\frac{Q}{\delta}} = \frac{Q+\delta+.003}{Q+\delta} = 1.05$.

We get the following two equations:
$1.1Q+\delta = 1.02(Q+\delta)$ and $Q+\delta+.003 = 1.05(Q+\delta)$.

Solving for Q and δ results in $Q = .012$ and $\delta = .048$.

If the premium is increased by 20%, the issue date variance is increased by a factor of
$\frac{(1+\frac{1.2Q}{\delta})^2\,Var(Z)}{(1+\frac{Q}{\delta})^2\,Var(Z)} = \frac{(1+\frac{1.2Q}{\delta})^2}{(1+\frac{Q}{\delta})^2} = \frac{(1+\frac{1.2(.012)}{.048})^2}{(1+\frac{.012}{.048})^2} = 1.0816$, an increase of 8.16% .