Additional Topics

Additional Mathematics Topics in General insurance

1- Net or Pure Premium

If the loss distribution follows *the normal distribution*, the pure premium P will be calculated as follow:

$P = \bar{x} + \sigma \times z_{\%9.99}$

If the number of insured = 1 then:

$P_1 = x_1 + \sigma 1 \times z_{\%9.99}$ where $z_{\%9.99}$ is the standard value for the confidence degree 99.9% & z = 3.09 (we will approximate it to 3 to facilitate the calculation).

$P_2 = \bar{x}_2 + \sigma 2 \times z_{\%9.99}$

$P_3 = \bar{x}_3 + \sigma 3 \times z_{\%9.99}$

$P_{100} = \bar{x}_{100} + \sigma 100 \times z_{\%9.99}$

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$P_{1000} = \bar{x}_{1000} + \sigma 1000 \times z_{\%9.99}$

$P_{10000} = \bar{x}_{10000} + \sigma 1000 \times z_{\%9.99}$

$P_{1000000} = \bar{x}_{1000000} + \sigma 1000000 \times z_{\%9.99}$

Based on the previous value of $\bar{x}$ =1000 & σ =1500 then

If n = 1 (i.e. if there is only one insured), then the premium for one insured would be:

$P_1 = \bar{x}_1 + \sigma 1 \times z_{\%9.99}$

$P_1 = 1000 + 1500 \times \mathbf{3}$ = 1000 + 4500 =5500

If n = 2 (i.e. if there is only two insureds), then the premium for two insureds would be:

$P_2 = \bar{\mathbf{x}}_2 + \sigma 2 \times \mathbf{z}_{\%9.99}$

$P_2 = 1000 \times 2 + ((1500 \times \sqrt{2}) \times 3)$

$= 2000 + ((1500 \times 1.4142) \times 3)$

$= 2000 + 6363.96 = 8363.96$

Then the premium for each insured = $\frac{p2}{2} = \frac{8363.96}{2} = 4141.98$

If n = 3 (i.e. if there is only three insureds) then the premium for three insureds would be:

$P_3 = \bar{\mathbf{x}}_3 + \sigma 3 \times \mathbf{z}_{\%9.99}$

$P_3 = 1000 \times 3 + ((1500 \times \sqrt{3}) \times 3)$

$= 3000 + ((1500 \times 1.732051) \times 3)$

$= 3000 + 7794.23 = 10794.23$

Then the premium for each insured = = $\frac{p3}{3} = \frac{10794.23}{3} = 3598.08$

If n = 100 (i.e. if there is 100 insureds) then the premium for 100 insureds would be:

$P_{100} = \bar{\mathbf{x}}_{100} + \sigma 100 \times \mathbf{z}_{\%9.99}$

$P_{100} = 1000 \times 100 + ((1500 \times \sqrt{100}) \times 3)$

$= 100000 + ((1500 \times 10) \times 3)$

$= 1000000 + 45000 = 145000$

Then the premium for each insured = $\frac{p100}{100}$ = $\frac{145000}{100}$ = 1450

If n = 10000 (i.e. if there is 10000 insureds), then the premium for 10000 insureds would be:

$P_{10000} = \bar{\mathbf{x}}_{10000} + \sigma 1000 \times \mathbf{z}_{\%9.99}$

$P_{10000} = 1000 \times 10000 + ((1500 \times \sqrt{10000}) \times 3)$

$= 10000000 + ((1500 \times 100) \times 3)$

$= 10000000 + 450000 = 145000 = 10450000$

Then the premium for each insured = $\frac{p10000}{10000}$ = $\frac{10450000}{10000}$ = 1045

If n = 1000000 (i.e. if there is 1000000 insureds), then the premium for 1000000 insureds would be:

$P_{1000000} = \bar{\mathbf{x}}_{1000000} + \sigma 1000000 \times \mathbf{z}_{\%9.99}$

$P_{1000000} = (1000 \times 1000000) + ((1500 \times \sqrt{1000000}) \times 3)$

$= 1000000000 + ((1500 \times 1000) \times 3)$

$= 1000000000 + 4500000 = 145000 = 1004500000$

Then the premium for each insured = $\frac{\boldsymbol{p}\ 1000000}{1000000}$ = $\frac{1004500000}{1000000}$ = 1004.5

And,

The gross premium = $\frac{\text{the pure premium}}{1 - loadings}$

Given $loadings$ = 30 %

So, the gross premium = $\frac{1004.5}{1 - 0.3}$ =1435 (1004.2 pure premium and 430.5 loadings)