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A Proposed Practical Approach for Estimating the Reinsurer Share of Reserve for Deviates in Excess Loss and Stop Loss Reinsurance Treaties

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Abstract

In General Insurance, It's well known that net premium consists of two parts, the first is the risk premium and the second is reserve of deviates.

So, the reinsurer which shares the direct insurer premiums and related risks accordingly has to share the direct insurer the risk premium as well as reserve of deviates and must get one standard deviation at least up the total number of standard of deviations added to the risk premium.

In practice the reinsurers used to multiply the reinsurance risk premium by a loading ratio evaluated 100/65 or 100/70 as a reserve for deviates.

This paper sets focus on how to estimate the reinsurer share of reserve for deviates with the direct insurer in respect of excess loss and stop loss reinsurance treaties.

Introduction

The French Mathematician De Moivre is credited with discovering the importance of adding the reserve for deviations to the risk premium because he proved as early as 1700 that an insurance business would eventually be ruined if it failed to in include a margin in its favor in the price it charged for its contingent payments, in other words, the insurer must include a safety loading in his premium to guard against losses due to random fluctuations [2, p. 238]

The Net Premium = The Risk Premium + Reserve for Deviates [1, P.97]

The reserve for deviates depends upon how many standard deviations must be added, so we can reformulate the equation of the net premium to be:

The Net Premium = Risk Premium + N x Standard Deviation [3, p.26]

We have two kinds of excess of loss treaties:

The first one called open excess of loss reinsurance in which the direct insurer bears an agreed sum called a priority denoted A and any claim over this sum is met by the reinsurer, but it's rare exists in the real world.

The second is prepared on Layer base, in which the direct insurer bears a sum called priority denoted R and the any claim over this sum up to agreed limit called a layer denoted L is met by the reinsurer, noting that a second layer treaty may be held between the direct insurer and his reinsurer.

Each kind has its own calculation as I will propose herein after, but there are systematic steps must be followed in all cases as follows:

As I mentioned before, the net premium consists of two parts, the first is the risk premium and the second is reserve for deviates, so the direct insurer has to follow the following steps to calculate the net premium:

1) Identifying the Yearly Aggregate Losses Function f(x).

2) Calculating the Yearly Aggregate Risk Premiums μ from the following equation:

   $RP = \mu = \int_0^\infty x f(x) dx$ ………. (1)

3) Calculating the Aggregate net premiums which are equal to the MPY (Maximum Yearly Probable Aggregate Losses) at the desired Confidence Interval (IE for example 95%) denoted DP

   $\int_0^{DP} f(x) dx = 0.95$

4) Calculating Reserve for Deviates denoted RD as follows:

   RD= DP – RP

   Then, we have to identify the relationship between Reserve for Deviates and Standard Deviation STDV, to find out how many standard deviation N must be added to the risk premium to get the net premium IE

   N = RD/STDV

   Then we calculate the Net Premium as follows:

   NP = RP X (N x STDV)

5) Calculating the Variation and Standard Deviation of MPY Function:

   $VAR = \mu_2 = \int_0^\infty (x-\mu)^2 f(x) dx$

   $\mu_2 = \int_0^\infty x^2 f(x) dx - \mu^2$

   $STDV = \sqrt{VAR}$

6) Calculating the Net Premium NP

   NP = RP + (N x STDV)

Noting we will recall the equations of Risk Premium and Standard Deviation later.

The Imitative Statistical Protocol for Sharing Risk Premium

We have two types of excess of loss reinsurance treaty, open treaty and layer base treaty, each one has its calculation as follows:

In case of an open excess of loss reinsurance Treaty:

$$\text{Re}\,RP = \int_A^\infty (x-A)\,f(x)dx = \int_A^\infty xf(x)dx - A\int_A^\infty f(x)dx = \int_A^\infty xf(x)dx - A[1-F(A)]$$

$$\text{Re}\,RP = \int_A^\infty xf(x)dx - A[1-F(A)] \;\ldots\ldots\ldots\ldots\ldots\ (2)$$

In Case of a Layer base excess of loss reinsurance treaty:

$$\text{Re}\,LRP = \int_R^\infty (x-R)\,f(x)dx - \int_{R+L}^\infty (x-(R+L)\,f(x)dx$$

$$\text{Re}\,LRP = \int_R^\infty (x-R)\,f(x)dx - \int_{R+L}^\infty ((x-R)-L)\,f(x)dx$$

$$\text{Re}\,LRP = \int_R^\infty (x-R)\,f(x)dx - \int_{R+L}^\infty (x-R)\,f(x)dx + \int_{R+L}^\infty Lf(x)dx$$

$$\text{Re}\,LRP = \int_R^{R+L} (x-R)\,f(x)dx + L\int_{R+L}^\infty f(x)dx$$

$$\text{Re}\,LRP = \int_R^{R+L} (x-R)\,f(x)dx + L(1-F(R+L))$$

$$\text{Re}\,LRP = \int_R^{R+L} xf(x)dx - R\int_R^{R+L} f(x)dx + L(1-F(R+))$$

$$\text{Re}\,LRP = \int_R^{R+L} xf(x)dx - R(F(R+L)-F(R)) + L(1-F(R+L)) \ldots\ldots\ldots\ (3)$$

Proposed practical approach for sharing reserve for Deviates in Excess of Loss Reinsurance and a Stop Loss Treaty

As I mentioned before, we have two main kinds of excess of loss treaties, the first is open treaty and the second is layer base treaty, each one has its approach of calculation

- **Calculating the variation and standard deviation of open excess of loss treaty after a priority A**

$$\text{Re}\,VAR = \int_A^\infty (x - \text{Re}\,RP - A)^2\, f(x)dx$$

$$\text{Re}\,VAR = \int_A^\infty (x - (\text{Re}\,RP + A))^2\, f(x)dx$$

$$Let\ (\text{Re}\,RP + A) = B$$

$$\text{Re}\,VAR = \int_A^\infty (x-B)^2\, f(x)dx$$

$$\text{Re}\,VAR = \int_A^\infty (x^2 - 2BX + B^2)\,f(x)dx$$

$$\operatorname{Re}VAR = \int_A^{\infty} x^2 f(x)dx - 2B\int_A^{\infty} xf(x)dx + B^2\int_A^{\infty} f(x)dx$$

$$\operatorname{Re}VAR = \int_A^{\infty} x^2 f(x)dx - 2B\int_A^{\infty} xf(x)dx + B^2[1-F(A)] \ldots\ldots\ldots\ (4)$$

$$\operatorname{Re}STDV = \sqrt{\operatorname{Re}VAR} \quad \ldots\ldots\ (5)$$

So, the Reinsurer share of one standard deviation in an open excess of loss reinsurance treaty is shown in equation No. 4 and 5, but the Reinsurer share of reserve for deviates must be one standard deviation at least up to the total number of standard of deviations the direct insurer adds to the risk premium

- **Estimation of Reserve for Deviates in a Layer Base Excess of Loss Reinsurance Treaty**

Let's denote the priority of the treaty R and the agreed layer L, So:

$$\mu_R = \int_R^{\infty}(x-R)f(x)dx = \int_R^{\infty} xf(x)dx - R\int_R^{\infty} f(x)dx = \int_R^{\infty} xf(x)dx - R[1-F(R)]$$

$$\mu_R = \int_R^{\infty} xf(x)dx - R[1-f(R)] \ldots\ldots\ldots.6$$

$$\mu_2 R = \int_R^{\infty}(x-\mu_R-R)^2 f(x)dx = \int_0^{\infty}(x-(\mu_R+R))^2$$

$$Let\ \mu_R + R = B_1$$

$$\mu_2 R = \int_R^{\infty}(x-B_1)^2 f(x)dx = \int_R^{\infty} x^2 f(x)dx - 2B_1\int_R^{\infty} xf(x)dx + 2B_1^2\int_R^{\infty} f(x)dx$$

$$\mu_2 R = \int_R^{\infty} x^2 f(x)dx - 2B_1\int_R^{\infty} xf(x)dx + 2B_1^2[1-F(R)] \ldots\ldots\ldots\ldots\ldots.7$$

Likewise, we can proof that:

$$\mu_{R+L} = \int_{R+L}^{\infty}[x-(R+L)]f(x)dx$$

$$\mu_{R+L} = \int_{R+L}^{\infty} xf(x)dx - R[1-F(R+L)] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.8$$

$$\mu_2(R+L) = \int_{R+L}^{\infty}(x-B_2)^2 f(x)dx$$

$$\mu_2(R+L) = \int_{R+L}^{\infty} x^2 f(x)dx - 2B_2\int_{R+L}^{\infty} xf(x)dx + 2B_2^2[1-F(R+L] \ldots\ldots.9$$

Where $B_2 = \mu_{R+L} + (R+L)$

Now we will calculate variation of the layer as follow:

$$\mu_2 L = \mu_2 R - \mu_2(R+L) \quad \ldots\ldots\ldots\ldots10$$

We can calculate standard deviation of the layer as follows:

$$\text{Re}\,LSTDV = \sqrt{\mu_2 L} \;\ldots\ldots\ldots\ldots 11$$

- **Estimation of Reserve for Deviates in a Layer Base Excess of Loss Reinsurance Treaty**

It’s similar to the layer base excess of loss treaty as I show in the following numerical example.

Numerical Examples

Assume that a claim size of an insurance portfolio measured in $ 1000 units follows the Pareto distribution corresponding to parameter values $\alpha = 3, \beta = 2$: [2, p.85]

$$f(x) = \frac{3}{2}\left(\frac{2}{x}\right)^4$$

$$f(x) = 24x^{-4}$$

$$\int_2^\infty f(x)dx = 1$$

$$\mu = \int_2^\infty x f(x)dx = 3$$

Noting that The Risk Premium (RP) is $\mu = 3$

$$\mu_2 = \int_2^\infty (x-\mu)^2 f(x)dx$$

$$\mu_2 = \int_2^\infty (x-3)^2 f(x)dx = 3$$

$$STDV = \sqrt{\mu_2} = \sqrt{3} = 1.732050808$$

$$\int_2^{5.5} f(x)dx \approx 0.95$$

NP at 95% Confidence Interval = 5.5 Units

Reserve for Deviates = 5.5 – 3 = 2.5 Units

Number of STDV added to RP = Reserve for Deviates/ STDV = 2.5/1.732 = 1.4434

NP = 3 + 1.4434 x 1.732 = 5.5 Units

Reinsurer Net premium = ReRP + ReSTDV

The Risk Premium of an open excess of loss treaty after a priority A = 5.5 Units

$$\operatorname{Re} RP = \int_A^\infty (x-A) f(x)dx$$

$$\operatorname{Re} RP = \int_{5.5}^\infty (x-5.5) f(x)dx$$

ReRP = 0.1322314

Noting we can calculate this integration thorough any math software directly without expand because if we expand between brackets we will execute more calculations and more integrations in order to get the same result

$$\mathrm{Re}\,RP = \int_A^\infty xf(x)dx - A[1 - F(A)]$$

ReRP = 0.3966942148760331-5.5[1-0.951915853]

ReRP = 0.3966942148760331 – 5.5 x 0.048084147

ReRP = 0.3966942148760331 - 0.26446281 = 0.132314

So we get the same result through more integrations and calculations using the same math software

ReRP Ratio = ReRP/RP

ReRP Ratio = 0.1322314/3 = 4.4%

The Reinsurer share of Standard deviation can be calculated as follows:

$$\mathrm{Re}VAR = \int_A^\infty (x - A - \mathrm{Re}\,RP)^2 f(x)dx$$

$$\mathrm{Re}VAR = \int_A^\infty (x - (A + \mathrm{Re}\,RP))^2 f(x)dx$$

$$Let\ (\mathrm{Re}\,RP + A) = B$$

B = 5.5+ 0.1322314 = 5.6322314

$$\mathrm{Re}\,VAR = \int_A^\infty (x - B)^2 f(x)dx$$

$$\mathrm{Re}\,VAR = \int_{5.5}^\infty (x - 5.6322314)^2 f(x)dx = 1.4204159$$

If we used equation No. 4 we will get the same result as follows:

$$\mathrm{Re}\,VAR = \int_A^\infty x^2 f(x)dx - 2B\int_A^\infty xf(x)dx + B^2[1 - F(A)]$$

ReVAR = 4.36363636363636 – 2 x 5.6322314 x 0.396694214876033 + 5.6322314^2 [1 - 0.951915852742299]

ReVAR = 4.36363636363636 – 4.68547226 + 31.72203054 x 0.048084147
ReVAR = 1.4204159

ReVAR Ratio to The Total VAR: R = 1.4204159/3 = 0.4734719666666

$\text{Re}\,STDV = \sqrt{3 \times 0.4734719666666} = 1.191812034$

Noting we get the same result directly from taking the square root ReVAR as follow:

$\text{Re}\,STDV = \sqrt{1.4204159} = 1.191812034$

ReSTDV Ratio = ReSTDV/STDV

ReSTDV Ratio = 1.191812034/1.732050808 = 68.8%

The Reinsurer must get at least one standard deviation evaluated 1.19182031 units of money up to 1.72 standard deviations which is 1.19182031 x 1.4434 = 1.72 or 2.5 x 68.8% = 1.72 as well as his share of risk premium evaluated 0.1322314 units of $ 1000.

So the reinsurer share of net premium must be at least 1.32405171units, its ratio to net premium (5.5) is 24.07% up to 0.132314 + 1.72 = 1.852314 units, its ratio to the net premium (5.5) is 1.852314/5.5= 33.678%

This net premium 1.852314 covers reinsurer's maximum probable annual aggregate loss (MPY) at a confidence interval 58.2% that's because:

When we recall Byes theorem which is:

$P(B \mid A) = \frac{P(A \cap B)}{P(A)}$ then

$P(B \mid A) = \int_{5.5}^{7.352314} f(x)dx \,/ \int_{5.5}^{\infty} f(x)dx$

$P(B \mid A) = 0.28 / 0.481 = 0.582$

The Risk Premium of an excess of loss treaty after a priority 5.5 Units and excess of loss layer equals to 24.5 units will be as follows:

Now we have R= 5.5, L= 24.5 and L+R = 30

First we will recall the following equation:

$$\text{Re}\,LRP = \int_{R}^{\infty} (x-R) f(x)dx - \int_{R+L}^{\infty} (x-(R+L) f(x)dx$$

Which lead us the following equation:

$$\text{Re}\,LRP = \int_{R}^{R+L} xf(x)dx - R(F(R+L) - F(R)) + L(1 - F(R+L)) \quad \ldots\ldots\ldots\ldots\ldots(3)$$

$$\text{Re}\,LRP = \int_{5.5}^{\infty} (x-5.5) f(x)dx - \int_{30}^{\infty} (x-30) f(x)dx$$

ReLRP = 0.1322314 - 0.0044444 = 0.127787

Then the risk premium of the layer is 0.127787

Now we are going to calculate the standard deviation of the layer as follows:

1) Calculating the variation from the first bound of layer to infinity as follows:

$$\mu_R = \int_R^\infty (x - R) f(x) dx$$

$$\int_{5.5}^\infty (x - 5.5) f(x) dx = 0.1322314$$

$$B_1 = \mu_R + R$$

B_1=5.5+0.1322314=5.6322314

$$\mu_2 R = \int_R^\infty (x - B_1)^2 f(x) dx$$

$$\mu_{2(5.5)} = \int_{5.5}^\infty (x - 5.6.22314)^2 f(x) dx = 1.4204159$$

2) Calculating the variation from the END bound of THE layer to infinity

$$\mu_{R+L} = \int_{R+L}^\infty [x - (R + L)] f(x) dx$$

$$\mu_{R+L} = \int_{R+L}^\infty x f(x) dx - R[1 - F(R + L)]$$

R=5.5, L= 24.5 then: R+L =30

$$\mu_{30} = \int_{30}^\infty (x - 30) f(x) dx = 0.0044444$$

$$B_2 = \mu_{R+L} + (R + L)$$

B_2 = 0.0044444 + 30 = 30.0044444

$$\mu_2 (R + L) = \int_{R+L}^\infty (x - B_2)^2 f(x) dx$$

$$\mu_2 (30) = \int_{30}^\infty (x - 30.0044444)^2 f(x) dx$$

$$\mu_2 (30) = 0.2666272$$

Estimating the variation of the Layer as follows:

$$\mu_2 L = \mu_2 R - \mu_2 (R + L)$$

$$\mu_2 L = 1.4204159 - 0.2666272 = 1.1537887$$

Then We will estimate the standard deviation of the layer as follows:

$$\text{Re}\,LSTDV = \sqrt{1.1537887} = 1.074145594$$

ReLSTDV = 1.074145594/1.732050808 = 62%

The Reinsurer must get at least one standard deviation evaluated 1.074145594 units of money as well as his share of risk premium evaluated 12.7787%

So the reinsurer share of net premium must be at least 1.20 units which is 0.127787 + 1.074145594 = 1.20, its ratio to net premium (5.5) is 21.82%

And at most 0.127787 + 1.074145594 x 1.4434 = 1.778, its ratio of net premium (5.5) is 1.778/5.5 = 32.33%.

This net premium 1.778 covers reinsurer's maximum probable aggregate loss (MPY) at a confidence interval 57.2% that's because:

When we recall Byes theorem which is:

$$P(B\,|\,A) = \frac{P(A \cap B)}{P(A)} \text{ then}$$

$$P(B\,|\,A) = \int_{5.5}^{7.352314} f(x)dx \,/ \int_{5.5}^{30} f(x)dx$$

$$P(B\,|\,A) = 0.02733244 / 0.047787851 = 0.571953737$$

If the insurance company held a stop loss treaty to cover an 90% of losses range from 80% to 130% of net premium which, then we will use the same approach with slight amend as follows:

Let's assume the following claims aggregate distribution function which follows Pearson family curves type 4:

$$f(x) = 0.02683\left(1 + \frac{(x-48.63)^2}{28.19672927^2}\right)e^{-0.28\tan^{-1}\left(\frac{x-48.63}{28.19672927}\right)}$$

The Risk Premium, Variation and Standard of the portfolio will be estimated as follows:

$$\mu = RP = \int_0^\infty xf(x)dx = 47.213$$

$$\mu_2 = \int_0^\infty (x-\mu)^2 f(x)dx$$

$$\mu_2 = \int_0^\infty (x-47.213)^2 f(x)dx = 313.5136308$$

$$STDV = \sqrt{\mu_2} = \sqrt{313.5136308} = 17.70631613$$

The net premium at significant level 5% or confidence interval 95% is: 75.5 because:

$$\int_0^{75.5} f(x)dx = 0.95$$

The reserve for deviates = 75.5 – 47.213 = 28.287

The Direct Insurer have to add 1.60 standard deviation the risk premium because:

The Reserve for Deviates/ STDV = 28.287/17.70631613 = 1.60

So, we will rewrite the equation of the net premium to be:

The Net Premium = The Risk Premium + (Number of STDV x STDV)

The Net Premium = 47.213 + 1.60 x 17.70631613 = 75.5

First, we have to determine the lower boundaries of the treaty

The lower boundary 0f the treaty = 75.5 x 80%= 60.4 Units

The Upper boundary of the treaty = 75.5 x 130% = 98.15 Units

The size of the Layer 98.15 – 60.4 = 37.75

The cover will be only 90% of 37.75

First: Calculating the risk premium of the stop loss layer:

$$STPRP = 0.90 * \left[\int_{60.4}^{\infty} (x-60.4) f(x)dx - \int_{98.15}^{\infty} (x-98.15) f(x)dx \right]$$

$$STPRP = 0.90 * [2.280158971 - 0.173287204] = 1.89618459$$

Calculating the first variation from beginning of covered layer to end of curve V1

$$STPV_1 = \int_{60.4}^{\infty} (x-60.4-2.280158971)^2 f(x)dx = \int_{60.4}^{\infty} (x-62.680158971)^2 f(x)dx = 56.3975131615$$

Calculating the second variation from end of covered layer to end of curve V2

$$STPV_2 = \int_{98.15}^{\infty} (x-98.15-0.173287204)^2 f(x)dx = \int_{98.15}^{\infty} (x-98.323287204)^2 f(x)dx = 9.54$$

Estimating the variation of the layer as follows:

STPLV = 0.90 * [$STPV_1$ – $STPV_2$]

STPLV = 0.90* (56.39751316147557 – 9.54) = 42.17

Then We will estimate the standard deviation of the layer as follows:

$$\text{Re}\,STDV = \sqrt{STPLV}$$

$$\text{Re}\,STDV = \sqrt{42.17} = 6.493843$$

ReSTDV Share = ReSTDV/STDV

ReSTDV Share = 6.493843/17.70631613 = 36.67529 %

The Reinsurer must get at least one standard deviation evaluated 6.49 units of money as well as his share of risk premium evaluated 1.89618459 units of money

So the reinsurer share of net premium must be at least 8.39 units, its ratio to net premium (75.5) is 11%

On the other hand, the reinsurer share of STDV is at most 6.493843 x 1.60 = 10.39 units therefore its share of net Premium will be 1.497836706 + 10.39 = 11.8878 units, its ratio to net premium (75.50) is 15.74%

This net premium 11.8878 covers reinsurer's maximum probable aggregate loss (MPY) at a confidence interval 67% that's because:

$$P(B|A) = \left[0.90 * \int_{60.4}^{72.2878} f(x)dx / 0.90\int_{60.4}^{98.15} f(x)dx\right] = [0.12/0.18]$$

$$P(B|A) \approx 0.67$$

Summary of the procedure

In this paper I proposed the following procedures to estimate the share of the reinsurer the reserve for deviates in respect of an excess of loss and stop loss treaties and stop loss treaties as follows:

Open excess of loss reinsurance treaty

1) Calculating the risk premium μ of the portfolio form claims aggregate probability distribution function $f(x)$

   $\mu = \int_0^{\infty} x f(x) dx$ ………… (1)

2) Calculating the variation μ_2 and standard deviation of the portfolio form claims aggregate probability distribution function $f(x)$

   $\mu_2 = \int_0^{\infty} (x-\mu)^2 f(x) dx$ ………… (2)

   Noting that we can calculate it immediately through math software

   $STDV = \sqrt{\mu_2}$ ……. (3)

3) Calculating the net premium (NP) at the desired confidence interval for example 95% from the following equation:

$\int_0^{NP} f(x) dx = 0.95$ …….(4)

   So, We have to find out NP which gives rise 0.95%

4) Calculating the reserve for deviates as follows:

   Reserve for Deviates = NP – RP ………(5)

5) Calculating the number of standard of deviations added to the RP to get NP:

   N = Reserve for Deviates/STDV ……(6)

   So, We will reformulate the equation of Net Premium to be:

   NP = RP + N x STDV ……….(7)

6) Calculating the reinsurer share of risk premium for an open excess of loss reinsurance treaty after a priority A $:

   $\text{Re}RP = \int_A^{\infty} (x-A) f(x) dx$ ……….(8)

7) Calculating the reinsurer share of standard of deviation for an open excess of loss reinsurance treaty after a priority A $:

Let B = A + ReRP …….(9)

$\mathrm{Re}VAR = \int_{A}^{\infty} (x - B)^2 f(x)dx$ ….. .…(10)

$\mathrm{Re}STDV = \sqrt{\mathrm{Re}VAR}$ ……………(11)

Noting that the reinsurer share of STDV which is: N x ReSTDV, N is derived from equation No. 6.

A Layer base excess of loss reinsurance treaty

If the direct insurer held an excess of loss treaty covers L $ after a priority R $, then we will calculate the reinsurer's share of reserve for deviates as follows:

1) Using Formulas from 1 to 7 as it is.
2) Calculating the risk premium of the layer

$\mathrm{Re}LRP = \int_{R}^{\infty} (x - R)f(x)dx - \int_{R+L}^{\infty} (x - (R + L))f(x)dx$ ………….(12)

3) Calculating the variation and standard deviation of the layer through the following equations:

$\mu_R = \int_{R}^{\infty} (x - R)f(x)dx$ ………..…(13)

$B_1 = \mu_R + R$ ……………….……..…(14)

$\mu_{2R} = \int_{R}^{\infty} (x - B_1)^2 f(x)dx$ ……....…(15)

$\mu_{R+L} = \int_{R+L}^{\infty} (x - (R + L))f(x)dx$ ….(16)

$\mu_{R+L} = \int_{R+L}^{\infty} (x - (R + L))f(x)dx$ .....(17)

$B_2 = \mu_{R+L} + (R + L)$ …………..……(18)

$\mu_{2(R+L)} = \int_{R+L}^{\infty} (x - B_2)^2 f(x)dx$ ……..(19)

$\mu_{2L} = \mu_{2R} - \mu_{2(R+L)}$ ………….……..(20)

$STDVL = \sqrt{\mu_{2L}}$ …………………..(21)

A Stop Loss Reinsurance Treaty

The treatment here is similar to that of a layer base stop of loss treaty, but according to the wording of the treaty we have to determinate the first and the ratio of treaty cover boundary of the layer R and the second boundary of the treaty and the ratio of treaty cover in order to apply the previous equations from 12 to 21.

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