

Reinsurance

1. The idea:

- Insurance for Insurers
 - Claim X is made, insurer pays Y , reinsurer pays $Z = X - Y$.
 - Increases “effective portfolio size”; insurance “works better”

2. Types of reinsurance:

- Proportional
 - Retention proportion, $p \in [0, 1]$
 - $Y = pX$
 - $Z = (1 - p)X$.
- Excess-of-Loss
 - Retention level, M
 - $Y = \begin{cases} X & \text{if } X \leq M \\ M & \text{if } X > M \end{cases} = XI_{(X \leq M)} + MI_{(X > M)}$
 - $Z = \begin{cases} 0 & \text{if } X \leq M \\ X - M & \text{if } X > M \end{cases} = (X - M)I_{(X > M)}$

Reinsurance

2. Types of reinsurance (*Continued*):

- Proportional Excess-of-Loss

- Retention level, M ; Retention proportion p

- $Y = XI_{(X \leq M)} + \{M + p(X - M)\}I_{(X > M)}$

$$= X - (1 - p)(X - M)I_{(X > M)}$$

- $Z = (1 - p)(X - M)I_{(X > M)}$

- Limited Excess-of-Loss

- Lower retention level, M_1 ; Upper retention level M_2

- $[M_1, M_2] = \text{reinsurance layer}$

- $Y = XI_{(X \leq M_1)} + M_1I_{(M_1 < X \leq M_2)} + \{M_1 + (X - M_2)\}I_{(X > M_2)}$

- $Z = (X - M_1)I_{(M_1 < X \leq M_2)} + (M_2 - M_1)I_{(X > M_2)}$

- Stop-Loss

- Retention level, M

- Let $S_k = \sum_{i=1}^k X_i$, sum of first k claims in policy period

- $Y_k = \begin{cases} X_k & \text{if } S_k \leq M \\ M - S_{k-1} & \text{if } S_{k-1} \leq M \text{ and } S_k > M \\ 0 & \text{if } S_{k-1} > M \end{cases}$

- $Z_k = \begin{cases} 0 & \text{if } S_k \leq M \\ X_k - (M - S_{k-1}) & \text{if } S_{k-1} \leq M \text{ and } S_k > M \\ X_k & \text{if } S_{k-1} > M \end{cases}$