Reinsurance Optimization
The Theoretical and Practical Aspects

Subhash Chandra
Aon Benfield

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“For someone your age, the yearly premium on a $5,000 policy is $8,000.”
Agenda

- What is Reinsurance

- Reinsurance Optimization
  - What is Optimization
  - When to Optimize
  - How to Optimize

- Case Study

- Conclusion
Companies with **Superior ERM** are able to articulate their **risk preferences**, and ensure they align with **stakeholder expectations**. A clear understanding on risk within a company is key to benefit from any potential risk transfer strategies.
Who’s Perspective?

- Better returns on capital
- Reduce volatility of returns
- Reduce risk of insolvency
- Efficient reinsurance purchase
- Increase profitability by line
WHAT IS REINSURANCE
GENERAL COMMENTS
General Comments – Reinsurance

**Insurance**
- **Insurer** (policy limit)
  - Policyholder pays premium to insurer
  - Insurer indemnifies against loss

**Policyholder** (deductible may apply)

**Reinsurance**
- **Reinsurer** (Limit may apply)
  - Insurer “cedes” part of premium to reinsurer
  - Reinsurer “assumes” responsibility for part of loss

**Insurer** (retention* may apply)

**Retrocession**
- **Reinsurer2** (Limit may apply)
  - Reinsurer “cedes” part of premium to another reinsurer
  - Reinsurer “assumes” responsibility for part of loss

**Reinsurer** (deductible may apply)

* retention is defined in other slide
Reinsurance

- Contract of *insurance*
- whereby one insurer agrees for a portion of the premium …
- reinsurer *indemnifies* for losses paid by the reinsured
- under insurance policies issued by the reinsured to its policyholders

Reinsurer

(Limit may apply)

Insurer

(retention may apply)

Reinsurer “assumes” responsibility for part of loss

Insurer “cedes” part of premium to reinsurer

Reinsurance is a cost to transfer the part of uncertainty of losses!!
Why Reinsurance

**Financing**
- Support for additional surplus
- Support new business strain

**Stabilization**
- Reduce the claim volatility
- Reduce uncertainty
- Match the regulatory requirement

**Capacity**
- Provide high limit for a single risk
- Limit insurer’s loss from one risk to a level
- Increase capacity to write larger risks
- Improve the solvency margin

**Catastrophe Protection**
- Limit the adverse effects on balance sheet
- Cover multiple small losses from numerous policies arising from one event

**Services**
- Claims audit
- Underwriting Support
- Product development
- Actuarial Review
- Financial Advice
- Licensing Support

Regulatory Requirement
Types of Reinsurance

**Treaty**
- Similar risks together …

**Facultative**
- Individual risk basis …

**Proportional**
- **Quota Share**
  Reinsurer covers the same percent on each risk

- **Surplus Share**
  Reinsurer’s share based on type or size of risk

**Non-Proportional**

- **Excess per Risk**

- **Excess per Occurrence (Catastrophe)**
  Reinsurer covers over a predetermined amount or limit for all losses arising out of one event or occurrence

- **Aggregate Excess (Stop Loss)**
  Reinsurer covers over a predetermined aggregate limit of loss or loss ratio for a specific period of time

**Per Risk Excess of Loss**
Reinsurer covers excess of a predetermined amount; limits apply separately to each loss

**Per Risk Aggregate Excess of Loss**
Reinsurer covers over aggregate claims for a risk in a specified period of time
Types of Reinsurance continued…

- Some Reinsurance Structures
Retention

Meaning
• Insurer’s limit of liability
• The maximum amount the insurer is willing to pay

Caution
• Different retention for Insurer with similar portfolios but having different corporate aims

Factors Affecting
• Size of insurer,
• Premium income, size of portfolio, profitability
• Financial strength of the insurer
• Type & cost of reinsurance
• Claims experience
• Corporate strategy

Setting retention level needs proper analysis of portfolio/business
Regulation

Regulatory requirement may be different from what a Company aims

Justifying reinsurance structure
REINSURANCE OPTIMISATION
Reinsurance Optimization

- **What to Optimize**
- **When to Optimize**
  - **How to Optimize**
What to optimize

- **Cost** of the reinsurance programme
- **Reduction in volatility** of the programme
- **Capital provided** by the programme

- Objective evaluation of the ceded margin (expected premium less expected recoveries)
- Tail risk and with year-to-year volatility
- Is it cheaper to use your own capital or reinsurer capital to bear the risk?
Reinsurance Optimization continued …

What to optimize

- Reinsurance Spend
- Capital Benefit (Regulatory/Economic)
- Ceded Return on Equity
- Ceded / Reinsurers’ Margin
- Loss Volatility Transferred

Sample Key Matrices

Keeping in mind that Life Reinsurance is also...

- Reinsurers’ underwriting tools & services
- Reinsurers’ market knowledge / product advice / claims expertise
- Reinsurers’ financial strength
Reinsurance Optimization continued …

✔ When to optimize

Any Time
Reinsurance Optimization continued …

 ✓ When to optimize

**In early days / (growth time)**
- Optimize the reinsurance contract as early as its creation
- Free up the capital needed for growth thanks to reinsurance

**After sometime (time to be profitable)**
- Simplify when treaties pile up
- Are the original needs still here?

**In times of M&A (time to restructure)**
- Defining the new reinsurance strategy
- Rationalizing reinsurance programs

**Now (this is the time)**
- Increased reporting and regulatory requirements
- “Emerging” risks
Reinsurance Optimization continued …

✓ How to optimize

- Review Current Reinsurance Treaty (Structure & wording)
  - What is worth optimizing?
  - What can be changed?

- Understanding the risk / Assessing benefits of reinsurance
  - What is the need for reinsurance?
  - How effective is the current reinsurance?

- Finding the best solution / Making the decision
  - Pro's and Con's of alternative reinsurance structures
  - Optimal structure based on different risk-reward criteria

- Identify/test different reinsurance structures
CASE STUDY
“I’ll be performing your surgery on you, but I just got back from tailgating, so I’m a little drunk. Do you have life insurance?”
Case Study

Case Study - Life Reinsurance Optimization

✓ Modelling principles and assumptions
✓ Gross Results Analysis
✓ Testing reinsurance structures
✓ Making the decision
Case Study - Life Reinsurance Optimization

- **Modeling Principles: Modeling Process**

  **Data requirements**
  - Product type
  - Distribution channel
  - Individual policy information / model points
  - Mortality/Morbidity basis
  - Lapse basis
  - Expense charges (acquisition and renewal)
  - Commission terms
  - Reinsurance terms
  - Other factors

  **Assumptions and calibrations**
  - Stochastic variables and distributions – including mortality and lapse variables
  - Interest rate
  - Inflation rate
  - Regulatory requirements

  **DFA TOOL**
  **STOCHASTIC SIMULATIONS**

  **Gross results analysis**

  **Ceded and retained results**

  - Distribution of results allows to:
    - Expected NPV
    - Volatility of results/NPV
    - 1 in 200 year scenario analysis
    - Var or TVar analysis
    - …
Case Study - Life Reinsurance Optimization

- Modeling Portfolio Data
  - Group Credit Life Term Plan
  - Model Point based on
    - 24,000 Policies
    - Reducing Sum Assured
    - Max Term 20 years
    - Max Sum Assured INR 50 Million
Modeling Assumptions

- Model construction
  - Which variables are stochastic? → Mortality
    - Mortality based on Country specific Standard Table
    - Multinomial distributions
    - Claims: 50% of table
  - Lapse, Expenses
  - Reserve Calc
  - Others
Case Study - Life Reinsurance Optimization

- Gross Results – Cumulative 5 Years
  - And we can also view the entire distribution of the results (5,000 simulations):

![Gross Results - NPV - Distribution](image)

- 8.7% of total Simulations
- Threshold Value
Case Study - Life Reinsurance Optimization

- Gross Results – Cumulative 5 Years

✓ And we can also view the entire **distribution** of the results:

![Cumulative Net Benefit 2014-2018](image)
Case Study - Life Reinsurance Optimization

- Gross Results – Cumulative 5 Years
  - And we can also view the entire distribution of the results:
Case Study - Life Reinsurance Optimization

- Gross Results – Cumulative 5 Years

Is Reinsurance Required?
Case Study - Life Reinsurance Optimization

- **Current Reinsurance**
  - *(QS100)* - Quota-Share with cession 100%, profit commission 75% after 10% reins. expenses

![Graph showing NPV distribution and current reinsurance results](image)

- **Current reinsurance: NPV (3%) of Net Benefits 2014-2018**

  - Reduced Volatility but also the Mean
Case Study - Life Reinsurance Optimization

Testing reinsurance structures

- Alternative reinsurance structures:
  - **A.** Surplus Reinsurance with ABC’s retention at INR 500,000
  - **B:** Surplus Reinsurance with ABC’s retention at INR 750,000
  - **C:** Surplus Reinsurance with ABC’s retention at INR 1,250,000
  - **D:** Surplus Reinsurance with ABC’s retention at INR 2,000,000
  - **E:** Surplus Reinsurance with ABC’s retention at INR 2,500,000
  - **F:** Quota Share Reinsurance with 50% cession (i.e. ABC’s retention of 50%)
  - **G:** Quota Share Reinsurance with 70% cession (i.e. ABC’s retention of 30%)
  - **H:** Quota Share Reinsurance with 70% retention subject to maximum of INR 1,250,000 (i.e. ABC’s maximum retention on one life/benefit is INR 1,250,000)
  - **I:** Quota Share Reinsurance with 50% retention subject to maximum of INR 1,250,000 (i.e. ABC’s maximum retention on one life/benefit is INR 1,250,000)
Case Study - Life Reinsurance Optimization

- Testing reinsurance structures
  - Looking at reinsurance impact on Results distribution

![NPV Distribution Graph]

- Gross results
- Current Reinsurance
- Surplus 500,000
Testing reinsurance structures:

- Volatility analysis of the different reinsurance solutions

How to quantify the relationship between mean & volatility?

Bigger bar implies more volatile results

Choosing higher mean generates more volatility

Currency in Millions

- 0.1% to 0.5%
- 0.5% to 1.0%
- 1.0% to 2.0%
- 2.0% to 5.0%
- 5.0% to 10.0%
- 10.0% to Mean
- Mean to 90.0%
- 90.0% to 95.0%
- 95.0% to 98.0%
- 98.0% to 99.0%
- 99.0% to 99.5%
- 99.5% to 99.9%
Case Study - Life Reinsurance Optimization

- Testing reinsurance structures:
  - Risk-Reward analysis of the different reinsurance solutions
Case Study - Life Reinsurance Optimization

- Cumulative Result – 5,000 simulations, Std. Dev. as Risk Measure

Risk - Reward Analysis - Present Value Cumulative Result - 5 years

Increasing Risk / Volatility

Increasing expected Value

Optimal Solutions based on Std. Dev. / Volatility as a measure of risk
Case Study - Life Reinsurance Optimization

- Cumulative Result – **5,000 simulations, VaR 1% as Risk Measure**

**Risk - Reward Analysis - Present Value Cumulative Result - 5 years**

- Gross
- Current - 100%QS - RI2
- RI 1 - A. Surplus 5L
- RI 1 - B. Surplus 7.5L
- RI 1 - C. Surplus 12.5L
- RI 1 - D. Surplus 20L
- RI 1 - E. Surplus 25L
- RI 1 - F. 50%QS
- RI 1 - G. 30%QS
- RI 1 - H. 70%QS subj 12.5L
- RI 1 - I. 50%QS subj 12.5L
- RI 2 - A. Surplus 5L
- RI 2 - B. Surplus 7.5L
- RI 2 - C. Surplus 12.5L
- RI 2 - D. Surplus 20L
- RI 2 - E. Surplus 25L
- RI 2 - F. 50%QS
- RI 2 - G. 30%QS
- RI 2 - H. 70%QS subj 12.5L
- RI 2 - I. 50%QS subj 12.5L
- RI 3 - A. Surplus 5L
- RI 3 - B. Surplus 7.5L
- RI 3 - C. Surplus 12.5L
- RI 3 - D. Surplus 20L
- RI 3 - E. Surplus 25L
- RI 3 - F. 50%QS
- RI 3 - G. 30%QS
- RI 3 - H. 70%QS subj 12.5L
- RI 3 - I. 50%QS subj 12.5L

Increasing Risk / Volatility

Increasing expected Value

**Optimal Solutions based on VaR 1% as a measure of risk**
Case Study - Life Reinsurance Optimization

Testing reinsurance structures:

- Reinsurance impact on solvency requirements and/or economic balance sheet:

Saved Cost of Capital

\[ \text{minus} \]

Cost of Reinsurance

= ECONOMIC VALUE of Reinsurance

Solvency - 1st Year only

with Target Solv Ratio = 150%

- Saved Cost of Capital (targeted ROE) = 25%
- Cost of Reinsurance
- Economic Value of Reinsurance

![Bar chart showing solvency comparison for different options](chart.png)
Case Study - Life Reinsurance Optimization

- Testing reinsurance structures:
  - Reinsurance impact on solvency requirements and/or economic balance sheet:

  \[
  \text{Saved Cost of Capital} \quad \text{minus} \quad \text{Cost of Reinsurance} = \text{ECONOMIC VALUE of Reinsurance}
  \]

![Solvency - 1st Year Only with Target Solv Ratio = 200%](chart.png)
## Making the decision

✅ Identifying optimal solution:

<table>
<thead>
<tr>
<th></th>
<th>Ceded Reinsurance Premium - Present Value - Total over 5 years</th>
<th>Risk Ceded (% of SA /claims)</th>
<th>Present Value of Cumulative Result at the end of Year 5 - @ 3% - (mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Expected Result</td>
</tr>
<tr>
<td>R1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross</td>
<td>0</td>
<td>0%</td>
<td>33</td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QS 100%</td>
<td>124</td>
<td>100%</td>
<td>11</td>
</tr>
<tr>
<td>Solution A</td>
<td>Surplus INR 500,000</td>
<td>64</td>
<td>60%</td>
</tr>
<tr>
<td>Solution B</td>
<td>Surplus INR 750,000</td>
<td>54</td>
<td>51%</td>
</tr>
<tr>
<td>Solution C</td>
<td>Surplus INR 1,250,000</td>
<td>35</td>
<td>35%</td>
</tr>
<tr>
<td>Solution D</td>
<td>Surplus INR 2,000,000</td>
<td>19</td>
<td>18%</td>
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<tr>
<td>Solution E</td>
<td>Surplus INR 2,500,000</td>
<td>10</td>
<td>10%</td>
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<tr>
<td>Solution F</td>
<td>QS 50%</td>
<td>55</td>
<td>50%</td>
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<tr>
<td>Solution G</td>
<td>QS 70%</td>
<td>77</td>
<td>70%</td>
</tr>
<tr>
<td>Solution H</td>
<td>70% retention subj to INR 1,250,000</td>
<td>47</td>
<td>44%</td>
</tr>
<tr>
<td>Solution I</td>
<td>50% retention subj to INR 1,250,000</td>
<td>60</td>
<td>55%</td>
</tr>
</tbody>
</table>
Case Study - Life Reinsurance Optimization

- Making the decision

**Modelling Results**
- Helps to make decisions
- Not a decision itself

**Need to Share & Understand**
- Sensitivity of the results
- Decision framework and criteria (profitability measure, risk appetite, solvency requirement, etc.)
- Feasibility of the suggested reinsurance alternatives according to specific criteria/constraints (financial strength of reinsurers, services expected from reinsurers…).
Conclusion

- Conclusion – Life Reinsurance Optimization

✓ Asking questions:
  - Why reinsurance? (transferring volatility? capital need? services?)
  - Which criteria / which framework?

✓ Getting answers:
  - Understanding risk / Portfolio modeling
  - Testing, comparing structures
Thank you!