Discussion Topics

1. Basic Reinsurance Primer
2. Creating a Reinsurance Structure
   - Understanding Goals
   - Rating Agency Concerns
   - Peer comparison
3. Reinsurance Optimization
   - Verify Gross Modeling
Basic Reinsurance Primer
Types of Reinsurance Agreements

Facultative Reinsurance
An Agreement between the ceding company and the reinsurance company which applies to one individual risk of the ceding company, i.e., a restaurant, building, tournament, etc.

Treaty Reinsurance
An Agreement between the ceding company and the reinsurance company which applies to the ceding company’s entire book of a specific type of business, i.e., Property, Casualty, Auto Physical Damage, Physician’s Malpractice, etc.

Forms of Reinsurance

Pro Rata Reinsurance (Proportional)
- Sharing concept - Ceding company and Reinsurer share premiums and losses in a determined percentage

Excess of Loss Reinsurance (Non-Proportional)
- For a part of the premium, Reinsurers cover losses above a specified retention up to a predetermined limit

- Quota share
- Surplus share
- Per Risk/Per Policy/Per Insured/Per Location
- Per Occurrence (catastrophic)
- Aggregate

GUY CARPENTER
Basic Reinsurance Primer
Non-proportional Reinsurance (Excess of Loss)

Different types of Excess relate to the focus of the loss

<table>
<thead>
<tr>
<th>Per Risk Excess</th>
<th>Per Occurrence Excess</th>
<th>Aggregate Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The focus is on the loss to each risk</td>
<td>• The focus is on the occurrence or event or accident</td>
<td>• The focus is on all losses which occur over a period of time</td>
</tr>
<tr>
<td>Property Per Occur. (Catastrophe) Excess</td>
<td>Casualty Per Occur. Excess</td>
<td></td>
</tr>
</tbody>
</table>

Basic Reinsurance Primer
Some Terms

- **Rate on Line** – Reinsurance premium divided by reinsurance limit
- **Return Period** – Inverse of the probability that the event will be exceeded in any one year. A 100 year hurricane has a 1/100 = 1% chance of being exceeded in any one year
- **VaR** – Value at Risk – The loss amount at a given percentile in a loss distribution. For example, the 95th percentile or 100 year loss
- **TVaR** – Tail Value at Risk – The conditional expected amount for events above a certain percentile
- **XTVaR** – Excess Tail Value at Risk – TVaR less the mean

Basic Reinsurance Primer
Some Terms

- **OEP** – Occurrence Exceedance Probability – Only considers the largest event in a year.
- **AEP** – Aggregate Exceedance Probability – Considers that multiple events can happen in one year. Used to determine annual aggregate loss (i.e., expected loss)
- **PML** – Probable Maximum Loss – In Catastrophe Reinsurance usually stated as a loss at given percentile or return period. For example, the 95th percentile or 100 year loss amount. Usually, equivalent to VaR of the OEP distribution
Section 2
Reinsurance Structure Considerations

• What are the company’s goals?
  – Preserve/create surplus
  – Ensure (analyst expectations of) earnings
  – Manage volatility
  – Maintain/upgrade rating agency rating level
• Which goals are most important?
• How would the goals be weighted?

A company’s risk policy is a key consideration. Need to understand
  – To what return period(s) does the company manage?
  – Risk Tolerance
    - For example, net loss ~5.5% of Equity after-tax
  – For catastrophe risk, Cat modeling and exposure monitoring preferences
    - Cat model vendor and version
    - Perspective (Near-term or long-term)
    - Use of storm surge or demand surge
    - Should multiple models be blended?
Reinsurance Structure Considerations

- Alternatives to traditional excess of loss treaties
  - Aggregate cover
  - Top and Drop cover
  - Top and Aggregate cover
  - Structured options

- Consider alternative sources of capacity and collateralized protection
  - Indexed products (ILW, CWIL)
  - Insurance Link Securities (Cat Bonds)
  - Swaps

- Credit risk (for both long tail and short tail lines)
- Experience

Reinsurance Structure Considerations

Rating Agency Concerns – A.M. Best and Cat Reinsurance

- Cat Reinsurance can affect a rating
  - Directly – BCAR calculation uses the Net PML as a deduction to adjusted surplus
  - The higher the Net PML, the lower the BCAR score
  - The stressed BCAR score could show a greater than allowable drop in baseline score
  - Companies’ risk management practices strongly influence the qualitative review
  - High Net PMLs to Surplus can indicate weaknesses in CAT management
  - Management’s ability to articulate use of models and model blends
  - A.M. Best continues emphasizing catastrophe risk management
  - Review of data quality

Reinsurance Structure Considerations

Rating Agency Concerns – A.M. Best and S&P RBC Models

Natural Catastrophe Risk In A.M. Best and S&P RBC Models

Capital Adjustment in respect of Natural Catastrophe Risk

A.M. Best
Greater of 1/100 wind or 1/250 EQ net PML (OEP)
+ 2nd event stress test: Greater of 1/100 wind or 1/100 EQ
Net of:
- reinsurance and net reinstatement premium
- tax

Standard & Poor’s
Net annual aggregate 1/250 (AEP)
Net of:
- reinsurance and net reinstatement premium
- 70% of annual underlying premium (property business)
- tax

“All boxes ticked” – call for uniform loss assumptions

*Greater of Wind, Earthquake or Terror event for US-domiciled companies

Reinsurance Structure Considerations

Rating Agency Concerns – A.M. Best and Cat Reinsurance

- Credit risk (for both long tail and short tail lines)
- Experience

Reinsurance Structure Considerations

Rating Agency Concerns – A.M. Best and S&P RBC Models

Natural Catastrophe Risk In A.M. Best and S&P RBC Models

Capital Adjustment in respect of Natural Catastrophe Risk

A.M. Best
Greater of 1/100 wind or 1/250 EQ net PML (OEP)
+ 2nd event stress test: Greater of 1/100 wind or 1/100 EQ
Net of:
- reinsurance and net reinstatement premium
- tax

Standard & Poor’s
Net annual aggregate 1/250 (AEP)
Net of:
- reinsurance and net reinstatement premium
- 70% of annual underlying premium (property business)
- tax

“All boxes ticked” – call for uniform loss assumptions

*Greater of Wind, Earthquake or Terror event for US-domiciled companies
Reinsurance Structure Considerations
Protecting Franchise Value

• Earnings surprises destroy franchise value
  – Merrill Lynch (2007)
    • $3.4b (6.0% of market value) surprise on Oct 24
    • $10.6b (18.6%) market value drop through Nov 7
    • $9.3b (16.3%), adjusting for DJI movement
    • Leverage factor of about 2.74
  – Citigroup (2007)
    • Nov 4 $11b (5.3% of market value) surprise
    • Reduced market cap $51b (24.5%)
    • Leverage factor of 4.63
    • Second surprise gets higher leverage
  – Even if earnings positive and surplus untouched

• What is your (levered) Cat limit as a percent of market value of firm?
• Concerns about standing out in a crisis drive requests for peer review
Reinsurance Structure Considerations

- Review retention for optimal combination of
  - Cost
  - Earnings protection
  - Compliance with risk management objectives

- Determine limit for optimal combination of
  - Cost
  - Capital preservation
  - Compliance risk management objectives
Classic Reinsurance Structure Evaluation

Model Structure A
Model Structure B
Model Structure C
Model Structure D

Compare Structures
Selected Structure

Limitations of Classic method
1. Limited number of Options to choose from
2. Difficult to consider multiple goals (constraints) at the same time
3. Subjectively limited to initially selected choice of structures

‘Optimizing’ A Reinsurance Structure

Definition
• op·ti·mize1
verb (used with object)
1. to make as effective, perfect, or useful as possible.
2. to make the best of.
3. Computers – to write or rewrite (the instructions in a program) so as to maximize efficiency and speed in retrieval, storage, or execution.
4. Mathematics – to determine the maximum or minimum values of (a specified function that is subject to certain constraints).

1 from dictionary.com

‘Optimizing’ A Reinsurance Structure
Really Optimal?
• Difficulty in determining a truly optimal solution
  – Combining different treaty types (Per Risk, Excess, Aggregate, Proportional) and non-traditional or alternative capacity
  – Considering different treaty options (e.g., aggregate limits, aggregate deductibles, reinstatements)
  – Understanding market pricing and dynamics for all the above
  - Difficult for less commoditized products and treaty options
  - For some lines, Casualty in particular, the market value for treaty options (e.g., annual aggregate deductible or an extra 50% paid reinstatement) varies significantly by market

• As a result, we “optimize” with constraints around treaty type, coverage and sources of capacity

We can demonstrate material improvement in net results
“Optimizing” A Reinsurance Structure

Issues

• Methods
  – All permutations
  – First in analysis – which individual contract provides the best value
  – Last in analysis – which individual contracts provides the least value
  – Sophisticated optimization techniques

• The optimization can converge to a local minimum. To avoid,
  – Start from multiple initial reinsurance programs with different participation percent starting points (e.g., 0%, 50%, 100%)
  – Assume that current program is a good starting point for optimization

• The method to follow is for illustrative purposes, complexities such as
  - more sophisticated cost of capital models (Tranching, Solvency II)
  - recognizing inter-layer correlations require more sophisticated techniques

What Participations Are Optimal?

Tower 1

Retention $500M

$1.1B
$1.0B
$900M
$800M
$700M
$600M
$500M

50% Placed
50% Placed
70% Placed
70% Placed

Tower 2

Retention $500M

$1.1B
$1.0B
$900M
$800M
$700M
$600M
$500M

45% Placed
50% Placed
80% Placed
80% Placed

An Illustrative Methodology

Phase 1 – Set goals and constraints of the optimization
Phase 2 – Create gross of reinsurance model and validate results
Phase 3 – Create net of reinsurance model, validate results and verify limit and retentions are adequate
Phase 4 – Evaluate current contracts
Phase 5 – Set initial analysis as current structure and determine capital savings
Phase 6 – Determine efficacy of each contract and adjust as needed
Phase 7 – Determine efficacy of the revised structure and adjust as needed
**Optimizing** A Reinsurance Structure

**Phase 1**

Set goals and constraints of the optimization

- As long as the goals and constraints can be expressed as results coming out of the model there is complete flexibility as to the selected measurements.
- If more than one measurement (metric) is used as a goal, then a rank or weighting of the goals needs to be provided. For example,
  - Maximize ROR (Return on Revenue)
  - Maximize ROC (Return on Capital)
  - Minimize the required capital
  - Minimize the probability of an underwriting loss.
  - Surplus loss at the 20 years return period
- To the extent that more than one measurement (metric) is used as a constraint, each constraint is generally thought of as a stand alone metric.
  - Underwriting Loss at the 100 year return period is less than $X$
  - Catastrophe coverage must be purchased up to the Y year return period level.

**Phase 2**

- Set goals and constraints of the optimization

**Phase 3**

- Model Gross Loss and Underwriting Results

- Validate Gross Loss and Underwriting Results?

- Analyze the Gross Capital requirements

- Continue Validation

- Initial Structure Analysis

- Verify Amount of Vertical & Horizontal Limit (Spectral Plot)

- Initial Structure Analysis

- Gross Model Validation

- Model Initial (Current) Net Loss and Underwriting Results

- Validate Net Loss and Underwriting Results?

- Yes

- No
“Optimizing” A Reinsurance Structure
Phase 5
Analyze the Net Capital Savings of the Reinsurance Program
- Use metrics that are consistent with how the company looks at capital
- Calculate the average underwriting profit of the structure and the net capital requirement of the structure.
- The best methods are co-additive:
  - TVaR (Tail Value at Risk) or XTVaR (Excess of Tail Value at Risk)
- The capital required can be measured as a weighted average of various metrics
  - For example, weight all of the following:
    - 50 Year, 100 Year and 250 Year of the XTVaR of loss
    - 50 Year, 100 Year and 250 Year of the TVaR of underwriting loss.
“Optimizing” A Reinsurance Structure

Evaluate Contract Effectiveness

Phase 6

- Effectiveness of each contract is measured by looking at cost of capital for that contract
  - Capital savings is the difference in net required capital w/o & w/ contract
  - Contracts with the lowest cost of capital are deemed effective
  - Contracts with the highest cost of capital are deemed ineffective

Constraint Violated

Constraints Satisfied

Increase Placement up to Maximum allowed for most effective contracts

Decrease Placement down to Minimum allowed for least effective contracts

Structure Analysis

Evaluate Pricing

“Optimizing” A Reinsurance Structure

Evaluate Structure Effectiveness

Phase 7

Constraints Violated

Constraints Satisfied

- Compare benefit of new structure to the current structure based on cost and capital savings
- If new is better than current, replace the current structure with the new one and go to Phase 6
- If new is not measurably better than the current, return to Phase 6 and make fewer or less aggressive changes to the current structure
- Continue until reinsurance optimization is achieved

Increasing/Expanding/Contracting Contracts

- To adjust contracts
  - Proportional - change the placement percentage
  - Excess - 1st change the placement percentage then consider changing contract terms
  - Add/remove whole excess contracts at the top/bottom of a tower
  - Ultimately all contract terms are available to change
    - pricing/repricing will be required
  - Consider the Gross OEP and Spectral Limits plots for guidance on where to set limits and retentions based on company risk appetite
  - Consider any insurance issues

Expanding/Contracting Contracts

Add additional contracts

Decrease Placement up to Minimum allowed

Ultimate all contract terms are available to change
- pricing/repricing will be required
- Consider the Gross OEP and Spectral Limits plots for guidance on where to set limits and retentions based on company risk appetite
- Consider any insurance issues
"Optimizing" A Reinsurance Structure

Efficient Frontiers

- Some programs are suboptimal
- Other are alternative points on efficient frontier
  - Need to understand company preferences, tolerances, etc.
- 2 dimensions of n-dimensional matrix

Underwriting Profit at Select Return Periods

Summary of Methodology

Advantages
1. Every step of the optimization evaluates multiple structure options with each step
2. Process guides you to improvements in the reinsurance structure
3. Allows consideration of multiple goals (constraints) simultaneously

Disadvantages
1. Still requires user judgment
2. Solution is sensitive to the starting point of the optimization
   - A common problem with optimization projects
3. Best protection is to start from multiple starting points
4. Time and computer intensive

More sophisticated methods are available that eliminate most of this methods disadvantages. Caveats still remain:
- Need a deep understanding of market pricing of treaty terms and conditions
- Need to understand constraints and risk appetite

Conclusion

We can demonstrate material improvement in net results

Questions
Important Disclosure

Guy Carpenter & Company, LLC provides this report for general information only. The information and data contained herein is based on sources we believe reliable, but we do not guarantee its accuracy and make no representation or warranty, express or implied, as to its accuracy. Guy Carpenter & Company, LLC assumes no liability for any institutional losses and cannot be held liable as a result of any institutional actions. Guy Carpenter & Company, LLC undertakes no obligation to update or revise publicly any data, or current or forward-looking statements, whether as a result of new information, research, future events or otherwise. The rating agencies referenced herein reserve the right to modify company ratings at any time.

Statements concerning tax, accounting or legal matters should be understood to be general observations based solely on our experience as reinsurance brokers and risk consultants and may not be relied upon as tax, accounting or legal advice, which we are not authorized to provide. All such matters should be reviewed with your own qualified advisors in these areas.

This document or any portion of the information it contains may not be copied or reproduced in any form without the permission of Guy Carpenter & Company, LLC, except that clients of Guy Carpenter & Company, LLC need not obtain such permission when using this report for their internal purposes.

The trademarks and service marks contained herein are the property of their respective owners. © 2011 Guy Carpenter & Company, LLC. All Rights Reserved.