Reinsurance Pricing 101
How Reinsurance Costs Are Created
November 2014

Course Description

Reinsurance Pricing 101: How reinsurance costs are created. This session will cover the basics of pricing reinsurance contracts including proportional quota share, excess of loss, and catastrophe contracts. Included will be examples of calculations, pricing factors, and other considerations.

Learning objectives: Attendees will learn
• The various methods and uses of pricing models
• How pricing interacts with the actuarial function
• How to identify the key pricing drivers to reinsurance contracts.

Introductions

Tim Corley
Tim is a Senior Solutions Executive for Inpoint in the area of Reinsurance Administration and Financial Reporting. Tim has worked in the field of reinsurance since 1989, when he joined an aviation insurance and reinsurance underwriting company serving as a statutory and reinsurance accountant. Tim earned his Bachelor of Business Administration and holds a Certified Public Accounting (CPA) license.
Agenda

- General Characteristics of Reinsurance
- Pro-Rata Reinsurance
- Excess of Loss Reinsurance
- Catastrophe Reinsurance

What Is It?

- A reinsurance program structure is the combination of reinsurance agreements the primary insurer purchases to meet its reinsurance needs and the relationship between various agreements.
- Reinsurance program structures vary widely in their complexity based on the needs of the ceding company.
How Are Program Structures Designed?

- Each form/type of reinsurance that makes up a reinsurance program structure is designed to satisfy a particular need.
- The below table details the reinsurance structure categories and the needs they address:

<table>
<thead>
<tr>
<th>Function</th>
<th>Quota Share</th>
<th>Surplus Share</th>
<th>Working Layer Excess</th>
<th>Catastrophe Per Occurrence &amp; Aggregate Stop Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing – Financial Statement Enhancement</td>
<td>Very Effective</td>
<td>Very Effective</td>
<td>Not Effective</td>
<td>Not Effective</td>
</tr>
<tr>
<td>Increased Risk Capacity</td>
<td>Somewhat Effective</td>
<td>Very Effective</td>
<td>Very Effective</td>
<td>Not Effective</td>
</tr>
<tr>
<td>Increased Premium Capacity</td>
<td>Very Effective</td>
<td>Very Effective</td>
<td>Not Effective</td>
<td>Not Effective</td>
</tr>
<tr>
<td>Catastrophe Protection</td>
<td>Somewhat Effective</td>
<td>Somewhat Effective</td>
<td>Not Effective</td>
<td>Very Effective</td>
</tr>
<tr>
<td>Stabilization</td>
<td>Somewhat Effective - Limited</td>
<td>Somewhat Effective - Limited</td>
<td>Very Effective</td>
<td>Very Effective</td>
</tr>
</tbody>
</table>

Agenda

- General Characteristics of Reinsurance
- Pro-Rata Reinsurance
  - Quota Share
  - Surplus Share
  - Ceding Commission
- Excess of Loss Reinsurance
- Catastrophe Reinsurance

Pro Rata: General Characteristics

- Reinsurer shares a proportion of the ceding company’s liability, premium, and losses and loss adjustment expenses
- True “partnership” of reinsurance
- “First Loss Dollar Coverage”
- Two forms: Quota Share and Surplus Share
Quota Share: Definition and Example

- A form of Pro Rata reinsurance whereby the reinsurer company assumes a predetermined, fixed percentage of all subject business coming within the parameters of the agreement.

- Example: 75% QS, $1M Policy Limit, $100,000 loss.

![Quota Share Diagram]

Surplus Share: Characteristics

- A key to remember is that Surplus Share is essentially a Quota Share on each individual risk.

- Difference lies in the derivation of the cession percentage, which is fixed with the Quota Share and formula-driven with the Surplus Share.

- Surplus Share is typically written on property lines of business.

- In a Surplus Share treaty, the Reinsurer agrees to assume, and the Ceding Company agrees to cede, a pro rata portion of the liability, premium, and losses and loss adjustment expenses.

- This is determined on individual risks falling within the parameters of the agreement:
  - Only individual risks above a certain point are ceded, thus the term “Surplus” is used.

Surplus Share: Characteristics (cont.)

- Surplus Share refers to the concept of ceding the “surplus” amount of liability – the proportion of the policy limit exceeding the retention (of liability).

- A line is equal to the amount retained by the company – the retention of liability.

- Limit of coverage is commonly expressed as a given number of lines above the retention, subject to a maximum cession (dollar amount).

- The retention can be fixed or variable and relates to liability (not loss).

- Risk Definition:
  - Unique to Surplus Share
  - An essential element, since contracts cede on a per-risk basis.
Surplus Share: Fixed Retention Example

- Retention is expressed as a dollar amount – but is a retention of LIABILITY
- Any risk falling below the retention of liability is subject to the treaty, but entirely retained
- **Example:** Fixed retention of $100,000 with a limit of 9 lines
  - Maximum cession of $900,000 (9 Lines x $100,000 = $900,000)
  - Largest risk that could be accommodated is $1,000,000
    ($900,000 limit plus a $100,000 retention)

*As maximum cession is $900,000, the cedent must retain the remainder ($100,000 plus the $500,000 in excess of the maximum cession parameter).

<table>
<thead>
<tr>
<th>Risk Size</th>
<th>Amount Retained ($)</th>
<th>Amount Ceded ($)</th>
<th>Percent Ceded</th>
</tr>
</thead>
<tbody>
<tr>
<td>$400,000</td>
<td>$100,000</td>
<td>$300,000</td>
<td>75.0%</td>
</tr>
<tr>
<td>$300,000</td>
<td>$100,000</td>
<td>$200,000</td>
<td>66.7%</td>
</tr>
<tr>
<td>$75,000</td>
<td>$75,000</td>
<td>$0</td>
<td>0.0%</td>
</tr>
<tr>
<td>$1,500,000</td>
<td>$600,000</td>
<td>$900,000</td>
<td>60.0%</td>
</tr>
</tbody>
</table>

Surplus Share: Variable Retention Dynamics

- As the cedent increases the amount it retains, the reinsurer provides more limit (i.e., capacity)
- Provide a specific number of lines subject to a minimum retention and a maximum cession
- "Ceding to the Max"
  - Suggested Retention formula:
    \[
    \text{Subject Risk Policy Limit} \times \frac{(\text{# of Lines} + 1 \text{ (retention)})}{\text{Suggested Retention}}
    \]
Surplus Share vs. Quota Share

- **Similarities**
  - Both SS and QS are cessions of liability
  - Both offer “first dollar coverage” on all subject risks
  - Premium, losses, and expenses are shared on a proportional basis

- **Differences**
  - Calculation of the cession percentage
    - Fixed with a QS
    - Variable with a SS, based upon risk size
  - SS offers more flexibility, but more administration
  - SS used primarily for property lines, while QS used for both property and casualty

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**Pro Rata: Why Have a Ceding Commission?**

<table>
<thead>
<tr>
<th>Income Statement:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Earned Premiums</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Incurred Losses</td>
<td>$(600,000)</td>
</tr>
<tr>
<td>Expenses</td>
<td>$0</td>
</tr>
<tr>
<td>Profit</td>
<td>$100,000</td>
</tr>
</tbody>
</table>

**Income Statement with a 40% QS and 0% ceding commission:**

<table>
<thead>
<tr>
<th>Reinsurer</th>
<th>Cedent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earned Premium</td>
<td>$400,000</td>
</tr>
<tr>
<td>Incurred Losses</td>
<td>$(240,000)</td>
</tr>
<tr>
<td>Expenses</td>
<td>$0</td>
</tr>
<tr>
<td>Profit</td>
<td>$160,000</td>
</tr>
</tbody>
</table>

Disadvantageous for the Cedent

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**Pro Rata: Ceding Commission Insight**

- Insurance Companies have unique expenses that are not present for Reinsurers
- Unless they are reimbursed for these expenses, the Cedent is placed at a disadvantage – by sharing a pro rata portion of the premium, but retaining 100% of the associated acquisition costs
- A Ceding Commission is an expense reimbursement paid by the reinsurer to the Ceding Company, for expenses such as:
  - Agents’ Commissions
  - Boards
  - Bureaus
  - Taxes (premium taxes, not income taxes)
  - Other Home Office Expense, but not expenses common to both reinsurer and insurer (e.g., rent, electricity, salaries)
- *Acquisition expenses generally range from about 25% to 35% of EP
- Ceding Commissions are the source of surplus relief to a Cedent
Pro Rata: 30% Ceding Commission Added to Earlier Example

- Here is how the income statement looks with a 30% Ceding Commission

<table>
<thead>
<tr>
<th></th>
<th>Reinsurer</th>
<th>Cedent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earned Premium</td>
<td>$400,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Incurred Losses</td>
<td>(240,000)</td>
<td>(360,000)</td>
</tr>
<tr>
<td>Expenses (EP * 30%)</td>
<td>(120,000)</td>
<td>(180,000)</td>
</tr>
<tr>
<td>Profit</td>
<td>$40,000</td>
<td>$60,000</td>
</tr>
</tbody>
</table>

Equitable for the cedent

Pro Rata: Ceding Commissions and the Financing Function

- The Financing effect is the core function of QS Reinsurance
- Reinsurers allow a ceding commission on ceded UEPR
  - Ceding Commission in dollars equal to:
    - (Ceded UEPR ($) x Ceding Commission Percentage)
  - Ceding commissions lead to an increase in PHS/result in surplus relief
  - Surplus Relief created is temporary
    - Only exists as long as there is UEPR
  - Ceding commissions offset the statutory accounting effect of acquisition costs

- Statutory Accounting
  - Views companies on a conservative, liquidated basis
  - Requires the immediate recognition of acquisition costs
    - Causes an immediate decrease in PHS, while the benefits from premium received are realized over time, as the premium is earned
  - Versus GAAP accounting, which views companies as ongoing entities and matches revenues to expenses
    - Deferred Acquisition Costs - acquisition costs are treated as an asset on the balance sheet and amortized over the life of the contract

Pro Rata: Ceding Commission Types

- Flat Ceding Commission
- Sliding Scale Commission
- Contingent Commission
Pro Rata: Flat Ceding Commission Example

- Pre-determined, fixed Ceding Commission taken as a percentage of ceded premium
- 40% Quota Share with a flat 30% Ceding Commission:

<table>
<thead>
<tr>
<th>Subject Written Premium:</th>
<th>$20,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Ceded to Quota Share:</td>
<td>x 40%</td>
</tr>
<tr>
<td>Ceded Written Premium:</td>
<td>$8,000,000</td>
</tr>
<tr>
<td>Ceding Commission %:</td>
<td>x 30%</td>
</tr>
<tr>
<td>Ceding Commission:</td>
<td>$2,400,000</td>
</tr>
</tbody>
</table>

Pro Rata: Flat Ceding Commission Characteristics

- Very common, popular with both cedents and reinsurers
- Easy to administer
- Ceding commission does NOT change – regardless of loss experience
- Ideally, set at cedent’s expenses (acquisition costs)

Pro Rata: Flat Ceding Commissions & RI Margins

- Year 1 (40% QS, with a 30% Flat CC):
  - Ceded EP: $8,000,000
  - Ceded IL: -$4,800,000 (= 60% Ceded LR)
  - Ceding Commission: -$2,400,000 (= 30% of CEP)
  - Reinsurer Margin: $800,000 (= +10%)
- Year 2 (40% QS, with a 30% Flat CC):
  - Ceded EP: $8,000,000
  - Ceded IL: -$3,840,000 (= 48% Ceded LR)
  - Ceding Commission: -$2,400,000 (= 30% of CEP)
  - Reinsurer Margin: $1,760,000 (= 22%)
- Year 3 (40% QS, with a 30% Flat CC):
  - Ceded EP: $8,000,000
  - Ceded IL: -$6,800,000 (= 85% Ceded LR)
  - Ceding Commission: -$2,400,000 (= 30% of CEP)
  - Reinsurer Margin: $1,200,000 (= -15%)

* Note: the Reinsurer Margin is the “cost” of the Quota Share
Pro Rata: Determining the Ceding Commission

- Target is the cedent’s acquisition costs but CCs could also be influenced by:
  - Historical Experience (Loss Ratio)
  - Historical Expenses
  - Override Percentage (Target Profit Margin)
  - Territory of the Business (Catastrophe Exposure)
  - Line of Business / Class of Business
  - Amount of Risk Transfer
  - Cost of Capital (Expected ROE)
  - Other Reinsurance (Insuring Protection)
  - Market Conditions

Pro Rata: Gross Loss Ratio Pick

- A cedent’s historical loss experience is used to generate a loss ratio pick
- Reinsurers need to become comfortable with a loss ratio pick in order to agree upon a ceding commission percentage
- Margins are then developed based on this rate

Pro Rata: Gross Loss Ratio Analysis Example

- Company loss ratios vary over the course of ten years
- Newer years less developed than older ones
- Key is to get reinsurers comfortable with the overall pick and to explain changes to the cedent’s portfolio over time
Pro Rata: Reinsurer’s Margin

- Reinsurers need to make a margin on reinsurance transactions
- Components of the reinsurer’s margin:
  - The amount reinsurers charge for use of their surplus
  - Risk transfer charge
  - Brokerage
  - Charges for reinsurers’ expenses and profits
  - Charges for ECO/XPL and other miscellaneous coverages
  - Charges for catastrophe exposures

Pro Rata: Sliding Scale Commission Characteristics

- The ceding commission fluctuates based upon the ceded experience of the treaty (Ceded Loss Ratio)
  - Higher commission to the ceding company in the event of better than expected experience
    - Incentivize the cedent to keep the loss ratio low
  - Lower commission in the event of worse than anticipated experience
    - Downside protection for the reinsurer
- Components:
  - Provisional Commission
  - Minimum Commission
  - Maximum Commission
  - Slide

Pro Rata: Sliding Scale Commission Components

- Provisional Commission:
  - Provides a starting point for cessions throughout the year
- Minimum Commission:
  - Set so the reinsurer retains some risk
  - Without this, the reinsurer could essentially be guaranteed a profit
- Maximum Commission:
  - Set so there is a cap on the amount of profit the reinsurer is expected to return to the cedent
  - Without this, the reinsurer would be returning 100% of profit above a certain level
### Pro Rata: Sliding Scale Commission

<table>
<thead>
<tr>
<th></th>
<th>Ceding Commission</th>
<th>Loss Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>25%</td>
<td>70%</td>
</tr>
<tr>
<td>Provisional</td>
<td>30%</td>
<td>65%</td>
</tr>
<tr>
<td>Maximum</td>
<td>35%</td>
<td>60%</td>
</tr>
</tbody>
</table>

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### Pro Rata: Contingent Commission Characteristics

- Flat ceding commission with a profit sharing mechanism included
- Contingent commission calculation resembles an income statement
  - Ceded Earned Premium
  - Ceded Incurred Loss
  - Flat Ceding Commission
  - Reinsurer’s Margin Factor
  - Deficit Carry forward

*Net Profit*  
*Apply the Contingent Commission Percentage to Net Profit*

### Pro Rata: Contingent Commission Example

<table>
<thead>
<tr>
<th>Needed Information</th>
<th>Contingent CC Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% Quota Share</td>
<td><strong>Ceded EP [SEP * 60%]</strong> $15,000,000</td>
</tr>
<tr>
<td>32% Flat Commission</td>
<td><strong>Ceded IL [SIL * 60%]</strong> -$6,750,000</td>
</tr>
<tr>
<td>15% RHOE</td>
<td><strong>Flat CC [CEP * 32%]</strong> -$4,800,000</td>
</tr>
<tr>
<td>40% of Net Profit</td>
<td><strong>RHOE Factor [CEP * 15%]</strong> -$2,250,000</td>
</tr>
<tr>
<td>Subject EP $25,000,000</td>
<td><strong>Deficit Carry Forward</strong></td>
</tr>
<tr>
<td>Subject IL $11,250,000</td>
<td><strong>Net Profit</strong> $ 1,200,000</td>
</tr>
<tr>
<td>RHOE is a % of Ceded EP, Net Subject EP</td>
<td><strong>Contingent [NP * 40%]</strong> $ 480,000</td>
</tr>
</tbody>
</table>

Net Profit $ 1,200,000
Agenda

- General Characteristics of Reinsurance
- Pro-Rata Reinsurance
- Excess of Loss Reinsurance
  - Developing Rates
    - Loss Costs
    - Exposure/Experience Rating
    - Flat vs. Retrospective Rates
- Catastrophe Reinsurance

General Characteristics of Excess Reinsurance

- $1,500,000 xs $500,000 UNL Per Risk Per Occurrence:
  - Basis of Coverage: Per Risk, Per Occurrence
  - Triggers coverage (What is a risk, occurrence?)
  - Other bases of coverage include Per Event, Per Person, Per Policy, Per Insured, etc.

Functions of Excess Reinsurance

- Financing
  - Rarely includes a Ceding Commission (except cessions rated contracts), so seldom generates surplus relief necessary for financing function
- Increased Risk Capacity
  - A Company wanting to limit net position can enter into XOL agreements to increase its ability to write higher limits without increasing its net line
  - XOL is very effective at providing this function
- Increased Premium Capacity
  - Relatively modest amount of premium ceded under XOL treaties (compared to Quota Shares)
- Catastrophe Protection
  - Excess coverage applies per risk, and most per risk losses from a catastrophe event are small or partial losses
  - Limited catastrophe protection, due to inclusion of a Per Occurrence limit
- Stabilization of Results
  - Allows Company to keep a limited retention while ceding some of the uncertainty to reinsurers
  - Very effective at providing this function
Functions of Excess Reinsurance – Stabilization

- Excess reinsurance smoothes the impact of large losses on underwriting results
- Overall gross loss ratio lower than net loss ratio (profit ceded to reinsurer)
- Standard deviation over 5 times greater on a gross basis (stabilization provided to primary insurer)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross</th>
<th>Net</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>64.0%</td>
<td>69.0%</td>
<td>5.6%</td>
</tr>
<tr>
<td>2006</td>
<td>75.0%</td>
<td>70.0%</td>
<td>4.9%</td>
</tr>
<tr>
<td>2007</td>
<td>66.0%</td>
<td>66.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td>2008</td>
<td>66.0%</td>
<td>66.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td>2009</td>
<td>66.0%</td>
<td>66.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td>2010</td>
<td>66.0%</td>
<td>66.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td>2011</td>
<td>66.0%</td>
<td>66.0%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

Retentions & Limits

- Factors influencing the determination of retentions and limits:
  - Historical loss frequency / severity
  - Policy limits distribution
  - Company risk appetite
  - Company financial strength and leverage (rating agency implications)
  - Market conditions
  - Price

Retentions & Limits – Loss Frequency / Severity

- Analyze loss frequency and severity to determine predictable losses at various retentions
- Involves calculating the “Loss Cost” for each layer
  - Loss cost is the ratio of Ceded Incurred Loss to Subject Earned Premium for the Contract
- Review changes to underwriting guidelines, claims-handling philosophy, product types, policy limits distribution, and geographic regions for potential impact on historical trends
- Keep the predictable; reinsure the unpredictable

<table>
<thead>
<tr>
<th>Layer</th>
<th>Loss Cost (% of E.P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1M+</td>
<td>5.20% 3.00% 6.00%</td>
</tr>
<tr>
<td>$2M+</td>
<td>5.10% 3.00% 0.00%</td>
</tr>
<tr>
<td>$5M+</td>
<td>5.20% 2.95% 5.00%</td>
</tr>
<tr>
<td>$10M+</td>
<td>5.10% 3.05% 1.00%</td>
</tr>
<tr>
<td>$50M+</td>
<td>5.00% 2.90% 12.00%</td>
</tr>
</tbody>
</table>
Retentions & Limits – Policy Limits Distribution

- Analyze policy limits distribution for natural “breaks” in the limits profiles
  - Particularly important when analyzing casualty lines of business
- Determine maximum required treaty capacity to meet needs of the insured’s policyholders
  - Some automatic capacity is expensive and facultative may be a more cost-effective option
- Track loss patterns vs. policy limits

<table>
<thead>
<tr>
<th>Policy Limit</th>
<th>Policy Count</th>
<th>Written Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Written Count</td>
</tr>
<tr>
<td>100,000</td>
<td>150</td>
<td>40.3%</td>
</tr>
<tr>
<td>150,000</td>
<td>100</td>
<td>26.9%</td>
</tr>
<tr>
<td>250,000</td>
<td>75</td>
<td>20.2%</td>
</tr>
<tr>
<td>500,000</td>
<td>25</td>
<td>6.7%</td>
</tr>
<tr>
<td>1,000,000</td>
<td>20</td>
<td>5.4%</td>
</tr>
<tr>
<td>5,000,000</td>
<td>2</td>
<td>0.5%</td>
</tr>
<tr>
<td>Total</td>
<td>372</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Retentions & Limits – Risk Appetite/Financial Strength

- What is management’s attitude toward risk?
  - Are underwriters well-seasoned or inexperienced?
  - Are there new territories and/or lines of business?
  - Is the composition of the portfolio stable over time?
  - Any concerns about emerging trends (Pollution, Mold, Terrorism, Cyber-Risk)?
  - Is the Company under-or over-leveraged?
- Can the Company withstand earnings volatility?
  - Mutual vs. Stock Companies

Retentions & Limits – Market Conditions/Price

- At times, marketplace may require Companies to accept higher (or lower) retentions or limits
  - Reinsurers limit their offerings to cedents
  - Reinsurer capacity also affected by events (i.e., stock market crash, large catastrophe events) reducing their capital bases
- Price is also a factor
  - Pricing for lower layers may be higher than cedents can afford, forcing them to higher retentions
Quick Review: Subject Premium, Rates and Loss Costs

- Subject Premium is the sum of premium for all lines of business covered under a treaty
  - Earned or Written
  - Extraction factors are utilized for multiple-peril policies (i.e. Homeowners’ 90% for Property; 10% for Casualty
  - Inuring reinsurance, facultative, and government-sponsored entity (i.e. FHCF, coastal pools) premium deducted from subject base of Contract receiving benefit

- Rates are mechanisms determining amount of ceded premium for reinsurers for liability assumed
  - Reinsurer strives to assume adequate amount of premium to cover expected losses in a layer, plus a margin over time
  - Reinsurers use loss costs (Ceded Incurred Losses / Subject Earned Premium) to determine the premium needed to cover historical excess losses to the layer

Subject Premium Calculation Example

<table>
<thead>
<tr>
<th>Line of Business</th>
<th>Direct Earned Premium</th>
<th>Ceded to Quota Share</th>
<th>Subject to PPR</th>
<th>PPR Ceded Premium</th>
<th>Subject to Cat</th>
<th>Cat Ceded Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeowners’</td>
<td>$20,650,000</td>
<td>$1,000,000</td>
<td>$19,650,000</td>
<td>$2,358,000</td>
<td>$17,292,000</td>
<td>$1,815,660</td>
</tr>
<tr>
<td>Allied</td>
<td>$4,560,000</td>
<td>0</td>
<td>$4,560,000</td>
<td>$547,200</td>
<td>$4,012,800</td>
<td>$421,344</td>
</tr>
<tr>
<td>CMP</td>
<td>$8,450,000</td>
<td>0</td>
<td>$8,450,000</td>
<td>$1,014,000</td>
<td>$7,436,000</td>
<td>$780,780</td>
</tr>
<tr>
<td>Total</td>
<td>$33,660,000</td>
<td>$1,000,000</td>
<td>$32,660,000</td>
<td>$3,919,200</td>
<td>$28,740,800</td>
<td>$3,017,784</td>
</tr>
</tbody>
</table>

Rate = 12.00% $1M $500k $500K Retention $1.5M $500K Per Occurrence $1.5M Per Occurrence $1M $1M Property Per Risk Property Cat (Not to Scale)

Excess Reinsurance Rates

- Generally a percentage of subject premium
- Based on written or earned premium
- Excess reinsurance rate development:
  - Actuaries estimate the proportion of the subject premium that the reinsurer feels is necessary to cover the anticipated loss to the layer (loss cost)
  - The loss cost is then loaded for expenses and a profit margin
- Premium rates can be flat or swing rated
  - Rate = Loss Cost + Expenses + Profit
Calculating a Loss Cost

- The loss cost is the result of a combination of two actuarial studies:
  - Experience Analysis
  - Exposure Analysis
- Examines the past loss experience of the ceding company
- Examines the company’s expected book of business and broad, industry-wide data
- The experience and exposure loss costs are then blended to create one Credibility-Weighted Loss Cost

Reinsurance Modeling Process

- Experience Analysis
  - Goal:
    - Predict future reinsurance losses using historical experience
    - Need: Credible comparison of historical subject premium and loss data
    - Result: All data restated in dollar amounts reflective of the future policy period
  - Definition:
    - An Experience Analysis adjusts a Company’s historical experience to reflect current conditions to estimate the expected loss to a reinsurance treaty.
Experience Analysis - Key Data Elements

- Individual large losses
  - Losses in excess of half the lowest retention evaluated
- Historical evaluation of losses
  - Usually 10 years of data
  - Historical subject premium by year
    - Split out by LOB
- Historical rate changes

Projected Loss Cost

What we want:
Projected Loss Cost = Trended Ultimate Losses in Reinsurance layer
                      Trended On Level Subject Premium

What we have:
Burn Cost = Historical Losses in Reinsurance layer
            Historical Subject Premium

Burn Cost to Projected Loss Cost – Three Adjustments

- Trend - Losses are not comparable to losses in other years because they are at different historical cost levels.
  - Example - A house burns down in 2002, the cost to the insurance company was $200,000. If the exact same event were to happen in 2012, the cost would be higher.
- Development - Losses are not comparable because they are in different points of their “claim life cycle” & not at ultimate (final) loss amount. (Development)
  - Example - Losses from 2011 are new and their final amount paid is uncertain, whereas most losses from 2001 are closed and their ultimate loss is certain.
- On-Level - Historical premium paid for a policy has changed over time due to increases/decreases in exposures and rate changes. (“On-Leveling” premium)
  - Example – A company charged $100 per policy in 2001. Over the last 10 years, the company had filed several rate changes and now the company charges $200 per policy.
Burn Cost to Projected Loss Cost

Problem #1

Losses are not comparable because they are at different historical cost levels

Result: Using historical losses will underestimate expected reinsurance losses

Median Price Home Price

<table>
<thead>
<tr>
<th>Median Price Home Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968: $20,100 Median home price - 2004: $185,201</td>
</tr>
</tbody>
</table>

Solution #1 – Determine Loss Trend Assumption

- Loss trend assumption can be based on:
  - Historical experience (above)
  - Industry data (previous slide)

Incurred Claim Average

<table>
<thead>
<tr>
<th>Year</th>
<th>Losses Count</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2,000,000</td>
<td>1,000</td>
</tr>
<tr>
<td>2001</td>
<td>2,053,479</td>
<td>1,005</td>
</tr>
<tr>
<td>2002</td>
<td>2,094,571</td>
<td>1,012</td>
</tr>
<tr>
<td>2003</td>
<td>2,310,300</td>
<td>1,021</td>
</tr>
<tr>
<td>2004</td>
<td>2,525,052</td>
<td>1,030</td>
</tr>
<tr>
<td>2005</td>
<td>2,737,928</td>
<td>1,038</td>
</tr>
<tr>
<td>2006</td>
<td>3,023,483</td>
<td>1,045</td>
</tr>
<tr>
<td>2007</td>
<td>3,090,173</td>
<td>1,050</td>
</tr>
<tr>
<td>2008</td>
<td>3,163,829</td>
<td>1,058</td>
</tr>
<tr>
<td>2009</td>
<td>3,408,113</td>
<td>1,065</td>
</tr>
<tr>
<td>2010</td>
<td>3,736,474</td>
<td>1,071</td>
</tr>
</tbody>
</table>

Cumulative Incurred Loss and ALAE Triangle

<table>
<thead>
<tr>
<th>Year</th>
<th>Incurred Loss and ALAE (000s) as of xx months</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1,000</td>
</tr>
<tr>
<td>2007</td>
<td>750</td>
</tr>
<tr>
<td>2008</td>
<td>1,100</td>
</tr>
<tr>
<td>2009</td>
<td>1,050</td>
</tr>
<tr>
<td>2010</td>
<td>1,500</td>
</tr>
</tbody>
</table>

Age to Age Factors

<table>
<thead>
<tr>
<th>Year</th>
<th>12-24</th>
<th>24-36</th>
<th>36-48</th>
<th>48-60</th>
<th>Tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1.20</td>
<td>1.08</td>
<td>1.04</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>1.33</td>
<td>1.10</td>
<td>1.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>1.18</td>
<td>1.06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>1.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subject Eval. as of Eval. Mos. Age - Ult. Ultimate

<table>
<thead>
<tr>
<th>Year</th>
<th>Premium 12/31/10</th>
<th>Losses</th>
<th>Loss Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>20,000</td>
<td>1,350</td>
<td>6.75%</td>
</tr>
<tr>
<td>2007</td>
<td>21,000</td>
<td>1,150</td>
<td>5.48%</td>
</tr>
<tr>
<td>2008</td>
<td>22,500</td>
<td>1,375</td>
<td>6.37%</td>
</tr>
<tr>
<td>2009</td>
<td>23,250</td>
<td>1,250</td>
<td>6.05%</td>
</tr>
<tr>
<td>2010</td>
<td>25,000</td>
<td>1,500</td>
<td>8.28%</td>
</tr>
</tbody>
</table>

Loss Development Triangle

- After 12 months (as 12/31/06) accident year 2006 had 1,350 incurred losses
- After 24 months (as 12/31/07) accident year 2006 had 1,300 incurred losses
- The 12-24 months age to age factor for accident year 2006 is A/A (12-24) = 1.20
- Apply the same approach for the rest of the evaluations to create the age to age triangle
- Select an average for each age to age period
- Multiply age to age selections to calculate age to ultimate factors

- 12- Ult. = (12-24) * (24-36) * (36-48) * (48-60) * Tail
- 24- Ult. = (24-36) * (36-48) * (48-60) * Tail

- After 12 months (as 12/31/06) accident year 2006 had 1,350 incurred losses
- After 24 months (as 12/31/07) accident year 2006 had 1,300 incurred losses
- The 12-24 months age to age factor for accident year 2006 is A/A (12-24) = 1.20
Loss Development – Several Considerations

More than just averaging the numbers in a triangle. Also considered:

- Changes in claim closure rates
- Changes in average case reserves
- New claims department philosophy
- Selection & implementation of trend factors
- Consistency between adjoining excess layers
- Policy Year vs. Report Year vs. Accident Year
- Tail Estimation
- Coverage Issues: Claims Made vs Occurrence
- Shifting claims between years
- Consistent spacing of evaluation ages
- Various methods can be used (B-F, Cape Cod, Paid vs. Incurred)
- Industry development patterns

Experience Analysis - Example

ABC Insurance Company
Homeowners Large Loss Listing as of 12/31/10

<table>
<thead>
<tr>
<th>Claim No.</th>
<th>Date of Occurrence</th>
<th>Loss Amount</th>
<th>ALAE</th>
<th>Loss %</th>
<th>Case Loss</th>
<th>ALAE Factor</th>
<th>Ultimate Loss</th>
<th>Ultimate Loss Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5/2/2000</td>
<td>750,000</td>
<td>60,000</td>
<td>11.0</td>
<td>1,282,755</td>
<td>1.710</td>
<td>200,629</td>
<td>562,913</td>
</tr>
<tr>
<td>2</td>
<td>11/18/2000</td>
<td>175,000</td>
<td>14,000</td>
<td>11.0</td>
<td>299,309</td>
<td>1.710</td>
<td>23,945</td>
<td>73,254</td>
</tr>
<tr>
<td>3</td>
<td>6/6/2001</td>
<td>3,500,000</td>
<td>280,000</td>
<td>10.0</td>
<td>456,090</td>
<td>1.629</td>
<td>750,000</td>
<td>100,000</td>
</tr>
<tr>
<td>4</td>
<td>12/23/2001</td>
<td>800,000</td>
<td>64,000</td>
<td>10.0</td>
<td>1,303,116</td>
<td>1.710</td>
<td>104,249</td>
<td>28,800</td>
</tr>
<tr>
<td>5</td>
<td>7/11/2002</td>
<td>600,000</td>
<td>48,000</td>
<td>9.0</td>
<td>930,797</td>
<td>1.551</td>
<td>74,464</td>
<td>38,964</td>
</tr>
<tr>
<td>6</td>
<td>1/27/2003</td>
<td>250,000</td>
<td>20,000</td>
<td>8.0</td>
<td>369,364</td>
<td>1.477</td>
<td>29,549</td>
<td>36,853</td>
</tr>
<tr>
<td>7</td>
<td>8/15/2003</td>
<td>175,000</td>
<td>14,000</td>
<td>8.0</td>
<td>258,555</td>
<td>1.477</td>
<td>20,684</td>
<td>29,239</td>
</tr>
<tr>
<td>8</td>
<td>3/2/2004</td>
<td>800,000</td>
<td>64,000</td>
<td>7.0</td>
<td>1,125,680</td>
<td>1.407</td>
<td>90,054</td>
<td>61,400</td>
</tr>
<tr>
<td>9</td>
<td>9/18/2004</td>
<td>125,000</td>
<td>10,000</td>
<td>7.0</td>
<td>175,888</td>
<td>1.407</td>
<td>14,071</td>
<td>17,111</td>
</tr>
<tr>
<td>10</td>
<td>4/6/2005</td>
<td>600,000</td>
<td>48,000</td>
<td>6.0</td>
<td>804,057</td>
<td>1.340</td>
<td>64,325</td>
<td>61,000</td>
</tr>
<tr>
<td>11</td>
<td>10/23/2005</td>
<td>789,000</td>
<td>63,120</td>
<td>6.0</td>
<td>1,057,335</td>
<td>1.340</td>
<td>84,587</td>
<td>90,000</td>
</tr>
<tr>
<td>12</td>
<td>5/11/2006</td>
<td>275,000</td>
<td>22,000</td>
<td>5.0</td>
<td>350,977</td>
<td>1.276</td>
<td>28,074</td>
<td>30,665</td>
</tr>
<tr>
<td>13</td>
<td>11/27/2006</td>
<td>2,500,000</td>
<td>200,000</td>
<td>5.0</td>
<td>3,190,704</td>
<td>1.276</td>
<td>255,256</td>
<td>284,000</td>
</tr>
<tr>
<td>14</td>
<td>6/15/2007</td>
<td>750,000</td>
<td>60,000</td>
<td>4.0</td>
<td>911,630</td>
<td>1.216</td>
<td>72,930</td>
<td>64,300</td>
</tr>
<tr>
<td>15</td>
<td>1/1/2008</td>
<td>300,000</td>
<td>24,000</td>
<td>3.0</td>
<td>347,288</td>
<td>1.158</td>
<td>27,783</td>
<td>25,071</td>
</tr>
<tr>
<td>16</td>
<td>7/19/2008</td>
<td>1,500,000</td>
<td>120,000</td>
<td>3.0</td>
<td>1,736,438</td>
<td>1.158</td>
<td>138,915</td>
<td>158,915</td>
</tr>
<tr>
<td>17</td>
<td>2/4/2009</td>
<td>750,000</td>
<td>60,000</td>
<td>2.0</td>
<td>826,875</td>
<td>1.103</td>
<td>66,150</td>
<td>60,000</td>
</tr>
<tr>
<td>18</td>
<td>8/23/2009</td>
<td>450,000</td>
<td>36,000</td>
<td>2.0</td>
<td>496,125</td>
<td>1.103</td>
<td>39,690</td>
<td>36,853</td>
</tr>
<tr>
<td>19</td>
<td>3/11/2010</td>
<td>4,000,000</td>
<td>320,000</td>
<td>1.0</td>
<td>4,200,000</td>
<td>1.050</td>
<td>336,000</td>
<td>750,000</td>
</tr>
<tr>
<td>20</td>
<td>9/27/2010</td>
<td>350,000</td>
<td>28,000</td>
<td>1.0</td>
<td>367,500</td>
<td>1.050</td>
<td>29,400</td>
<td>28,500</td>
</tr>
</tbody>
</table>

Experience Analysis - Example

ABC Insurance Company
Homeowners Experience Rating - 750,000 as 250,000

<table>
<thead>
<tr>
<th>Year</th>
<th>Accident Premium</th>
<th>On-Level Trended</th>
<th>On-Level Incurred</th>
<th>Ultimate Loss Cost</th>
<th>Ultimate LALAE</th>
<th>Ultimate LDF</th>
<th>Ultimate Loss Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>10,000,000</td>
<td>12,560,000</td>
<td>823,254</td>
<td>6.55%</td>
<td>625,120</td>
<td>1.000</td>
<td>625,120</td>
</tr>
<tr>
<td>2001</td>
<td>10,250,000</td>
<td>12,361,500</td>
<td>850,000</td>
<td>6.44%</td>
<td>730,000</td>
<td>1.000</td>
<td>730,000</td>
</tr>
<tr>
<td>2002</td>
<td>10,500,000</td>
<td>11,655,000</td>
<td>750,000</td>
<td>6.37%</td>
<td>625,000</td>
<td>1.000</td>
<td>625,000</td>
</tr>
<tr>
<td>2003</td>
<td>10,750,000</td>
<td>11,610,000</td>
<td>750,000</td>
<td>6.37%</td>
<td>625,000</td>
<td>1.000</td>
<td>625,000</td>
</tr>
<tr>
<td>2004</td>
<td>16,000,000</td>
<td>12,770,000</td>
<td>750,000</td>
<td>6.37%</td>
<td>625,000</td>
<td>1.000</td>
<td>625,000</td>
</tr>
<tr>
<td>2005</td>
<td>21,000,000</td>
<td>18,837,500</td>
<td>928,840</td>
<td>4.98%</td>
<td>875,071</td>
<td>1.225</td>
<td>1,137,829</td>
</tr>
<tr>
<td>2006</td>
<td>21,250,000</td>
<td>21,743,400</td>
<td>875,071</td>
<td>4.98%</td>
<td>875,071</td>
<td>1.225</td>
<td>1,137,829</td>
</tr>
<tr>
<td>2007</td>
<td>21,500,000</td>
<td>21,721,750</td>
<td>734,860</td>
<td>3.42%</td>
<td>741,906</td>
<td>1.400</td>
<td>1,255,660</td>
</tr>
<tr>
<td>2008</td>
<td>21,750,000</td>
<td>22,037,500</td>
<td>928,840</td>
<td>4.98%</td>
<td>875,071</td>
<td>1.225</td>
<td>1,137,829</td>
</tr>
<tr>
<td>2009</td>
<td>22,000,000</td>
<td>22,000,000</td>
<td>928,840</td>
<td>4.98%</td>
<td>875,071</td>
<td>1.225</td>
<td>1,137,829</td>
</tr>
<tr>
<td>Total</td>
<td>176,000,000</td>
<td>188,265,150</td>
<td>9,684,214</td>
<td>5.47%</td>
<td>10,303,062</td>
<td>1.400</td>
<td>13,912,969</td>
</tr>
<tr>
<td>Last Five</td>
<td>176,000,000</td>
<td>188,265,150</td>
<td>9,684,214</td>
<td>5.47%</td>
<td>10,303,062</td>
<td>1.400</td>
<td>13,912,969</td>
</tr>
</tbody>
</table>

Selected 4.42%
Experience Analysis - When to Use

- When experience rating should be used (in conjunction with exposure analysis):
  - Established book of business
  - No significant changes in the book of business

- When experience rating should NOT be used:
  - The necessary data for experience rating is not available
  - There are not enough claims to credibly estimate the expected losses (experience rating may work in lower layers for an account but not have enough claims in higher layers to use experience rating)
  - There are reasons to believe that the book of business has changed significantly or will change significantly

Exposure Rating - Basics

- An exposure analysis looks at a Company's current policies and industry loss statistics to examine the loss exposure of a reinsurance treaty
- Similar to an experience analysis, the final output of an exposure analysis is a loss cost

Projected Loss Cost = \[ \text{Projected Losses in Reinsurance layer} \div \text{Expected Subject Premium} \]

Exposure Analysis - Key Data Elements

- Current in force policy limit profile with premium
- Projected subject premium by line of business
  - The more detailed, the better
- Industry loss distribution
- Premium by Hazard Group and State (Workers' Compensation only)
- Projected loss ratio
## Exposure Analysis – Projected Loss Ratio Analysis Example

### ABC Insurance Company

### Homeowners Projected Gross Loss Ratio Analysis

<table>
<thead>
<tr>
<th>Year</th>
<th>Premium</th>
<th>Factor</th>
<th>Earned</th>
<th>On-Level</th>
<th>Incurred</th>
<th>Paid</th>
<th>Trended</th>
<th>Ult LDF</th>
<th>Ult LDF</th>
<th>Selected</th>
<th>Ultimate</th>
<th>LDF</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>10,000,000</td>
<td>1.256</td>
<td>12,560,000</td>
<td>6,145,120</td>
<td>6,145,120</td>
<td>8,506,283</td>
<td>8,506,283</td>
<td>1.000</td>
<td>1.000</td>
<td>8,506,283</td>
<td>67.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>10,250,000</td>
<td>1.206</td>
<td>12,361,500</td>
<td>7,828,384</td>
<td>7,828,384</td>
<td>10,520,694</td>
<td>10,520,694</td>
<td>1.000</td>
<td>1.000</td>
<td>10,520,694</td>
<td>85.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>10,500,000</td>
<td>1.110</td>
<td>11,655,000</td>
<td>5,506,939</td>
<td>5,506,939</td>
<td>7,185,306</td>
<td>7,185,306</td>
<td>1.000</td>
<td>1.000</td>
<td>7,185,306</td>
<td>61.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>10,750,000</td>
<td>1.080</td>
<td>11,610,000</td>
<td>7,393,721</td>
<td>7,393,721</td>
<td>9,366,144</td>
<td>9,366,144</td>
<td>1.000</td>
<td>1.000</td>
<td>9,366,144</td>
<td>80.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>11,000,000</td>
<td>1.070</td>
<td>11,770,000</td>
<td>8,361,764</td>
<td>8,361,764</td>
<td>10,283,915</td>
<td>10,283,915</td>
<td>1.000</td>
<td>1.000</td>
<td>10,283,915</td>
<td>87.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>16,000,000</td>
<td>1.045</td>
<td>16,720,000</td>
<td>12,254,274</td>
<td>12,254,274</td>
<td>14,632,244</td>
<td>14,632,244</td>
<td>1.000</td>
<td>1.000</td>
<td>14,632,244</td>
<td>87.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>21,000,000</td>
<td>1.035</td>
<td>21,743,400</td>
<td>10,034,006</td>
<td>10,034,006</td>
<td>11,632,163</td>
<td>11,632,163</td>
<td>1.000</td>
<td>1.000</td>
<td>11,632,163</td>
<td>53.5%</td>
<td></td>
<td></td>
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<tr>
<td>2007</td>
<td>21,250,000</td>
<td>1.022</td>
<td>21,721,750</td>
<td>14,984,421</td>
<td>15,284,110</td>
<td>16,865,098</td>
<td>17,202,400</td>
<td>1.061</td>
<td>1.010</td>
<td>17,629,930</td>
<td>81.2%</td>
<td></td>
<td></td>
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<tr>
<td>2008</td>
<td>21,500,000</td>
<td>1.080</td>
<td>23,220,000</td>
<td>12,479,712</td>
<td>12,978,900</td>
<td>13,636,918</td>
<td>14,182,395</td>
<td>1.103</td>
<td>1.050</td>
<td>14,963,108</td>
<td>64.4%</td>
<td></td>
<td></td>
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<tr>
<td>2009</td>
<td>21,750,000</td>
<td>1.050</td>
<td>22,837,500</td>
<td>8,502,649</td>
<td>8,842,755</td>
<td>9,020,460</td>
<td>9,381,279</td>
<td>1.286</td>
<td>1.225</td>
<td>11,547,317</td>
<td>50.6%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Total
|       | 176,000,000 | 188,265,150 | 102,770,840 | 104,559,412 | 121,207,471 | 123,120,145 | 130,451,541 | 69.3% |

### Last 5
|       | 107,500,000 | 111,588,650 | 55,280,638 | 57,069,211 | 60,712,885 | 62,625,559 | 69,956,955 | 62.7% |

### Selected

63.0%

## Developing Final Rates

- Using experience and exposure analysis, and considering credibility of analyses, an expected loss cost is generated.
- Other factors need to be considered before generating a “final” reinsurance rate:
  - **Discount** (time value of money)
    - Payout patterns vary by line of business
    - Excess generally pays out later and may take time for payments to reach that layer
  - **Risk Load**
    - If volatile loss history, more premium may be necessary to bear that risk, even if expected losses are the same
    - Risk load reflects really bad outcomes in the excess layer
  - **Profit and expenses**
    - Reinsurer incurs costs (Contracts, administrative, premium tax)
    - Reinsurer needs to make a profit over time

## Flat Rates

- Developed by applying a Load times a loss cost:
  - Nominal Loss Costs – Unloaded
  - Trended and Developed – Actuarially-derived
- Loads can vary by line of business, experience, and current market conditions
- Examples of loads:
  - 100/65ths or 1.540 (likely a sign of a hard market)
  - 100/75ths or 1.333
  - 100/80ths or 1.250
  - 100/90ths or 1.111 (likely a sign of a soft market)
- Loads take into account a reinsurer’s expenses, profit targets, etc.
Flat Rates and Accounting

- The rate is applied to subject premium for the Contract term and cash is paid
- The Contract term is generally 12 months
- Reinsurer position is easy to calculate:
  - Ceded premium less ceded losses
  - Easy for which to account by Ceding Company and reinsurers
- There is no Contractual provision to deal with any deficit under the reinsurance Contract
  - A deficit here could simply be when ceded losses exceed ceded premium
- There are minimal risk transfer issues as loss mitigating features like AADs, limited reinstatements (excluding cats) etc., are rarely included
- When would a ceding Company’s annual statement benefit from this kind (or any kind) of reinsurance?

Flat Rates and Accounting Example

- The following method is used to calculate results under a flat-rated reinsurance Contract:
  - Subject Earned Premium: $15,000,000
  - Rate: 7.00%
  - Developed Premium: $1,050,000 (SEP x Rate)
  - Ceded Incurred Loss: $500,000
  - Reinsurer Margin: $550,000

Flat Rates and Accounting

- Flat rated excess Contracts generally cede premiums on either:
  - Deposit basis
  - Report/Remit basis
- Deposit premiums are typically:
  - Set at 100% of expected developed premium (rounded)
  - Paid proportionately on specified dates (often quarterly), either:
    - In advance or
    - In arrears
  - Later adjusted to equal the actual premium
- Minimum premium is typically a percentage of the deposit premium (often 80%)
  - Provides a minimum amount of premium to the reinsurer
- Report/Remit basis:
  - Typically on a monthly or quarterly basis
  - Report and remittance delayed 30 to 60 days
  - Ex: Monthly within 45 days
Swing Rates – Losses Loaded

- Losses Loaded Rate Calculations
  - Minimum = Lowest Lost Cost * Load
  - Provisional = Expected Lost Cost * Load
  - Maximum = Expected Loss Cost * Factor * Load
  - Developed = Ceded incurred losses loaded subject to the minimum and maximum rates

- Reinsurer Margin under a losses loaded Contract is a function of ceded incurred losses.
- As the ceded incurred losses increase the load times the ceded incurred losses results in a higher developed premium until the maximum rate is reached.

Swing Rates – Losses Loaded - Accounting

- Swing rates may need to use cumulative accounting if the accounting period is more than 12 months long and the rating formula and reinsurer participations remain the same year over year.
- As long as the minimum, maximum, or load factors do not change in a swing rated contract, subject premiums and losses from multiple years are combined prior to applying the rating formula.
- Since most contracts experience a change in reinsurer participation percentages or and/or a change in the rating formula from one year to the next, most contracts do not use cumulative accounting.

Swing/Retrospective Rating Mechanisms

- Swing Rates have issues
  - They might have trouble passing risk transfer tests, due to:
    - Deficit carry forward provisions
    - Cumulative accounting treatment
  - More difficult to administrate than flat rates
  - Accounting regulations require insurers to “book to the developed” premium
  - May or may not address IBNR in the developed premium calculation
- Common in professional lines and Europe but not so common in “main street” lines of business
- They are used at the “bottom portion” (i.e., working layers) of a reinsurance program, not “top portions” (i.e., Cat Contracts)
Other Rating Approaches – Cession Rates

- Cession rated Contracts seek to give the reinsurer the appropriate part of the primary rate for the exposure the reinsurer assumes
  - Increased Limit Factor (ILF) based rating approach
  - Requires agreement by reinsurer to Company’s base premium and ILFs
- Cession rated issues
  - While technique may be sound, dollars generated may be too low to attract reinsurer capacity
  - ILFs don’t contemplate multiple losses
  - Poor experience can de-stabilize this rating approach
- Often found in professional liability contracts for Lawyers, D&O, E&O, Medical Malpractice, etc.

Agenda

- General Characteristics of Reinsurance
- Pro-Rata Reinsurance
- Excess of Loss Reinsurance
- Catastrophe Reinsurance
  - Types of Catastrophe Reinsurance
  - Catastrophe Modeling & Effect on Pricing
  - Pure Premium & Pricing

Types of Catastrophe Reinsurance

- Per Occurrence
  - Responds to the accumulation of smaller losses from one event, such as hurricanes and tornadoes
  - These losses could be net of per risk or other insuring reinsurance Contracts
- Aggregate Excess
  - Responds to the total amount (hence the name “aggregate”) of losses suffered by an insurer over a period of time
  - Usually, these losses are net of the insurer’s Per Occurrence Catastrophe coverage
- Aggregate Stop Loss
  - Responds to the total amount of losses suffered by an insurer over a period of one year
  - Coverage is net of any Per Occurrence or Aggregate Excess coverage and responds on a loss ratio basis
  - Aggregate Stop Loss treaties respond to both cat and non-cat losses
- What function does Excess Catastrophe reinsurance serve?
Per Occurrence Catastrophe

- General Characteristics:
  - Flat dollar retention and limit
  - Severity coverage, not frequency
  - Coverage is generally "layered"
  - May or may not include a company-participation (Co-Par)
  - Some treaties offer 100% coverage, but are 95% placed with reinsurers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Retention</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>$60M</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>$40M xs $60M</td>
<td>$30M</td>
</tr>
<tr>
<td>3rd</td>
<td>$15M xs $15M</td>
<td>$15M</td>
</tr>
<tr>
<td>4th</td>
<td>$15M</td>
<td>$15M</td>
</tr>
<tr>
<td>5th</td>
<td>$15M Retention</td>
<td>$15M</td>
</tr>
</tbody>
</table>

Excess Catastrophe Reinsurance – Premium

- Subject Premium is the sum of premium for all lines of business covered under a treaty
  - Earned or written
  - Extraction factors used for multiple-peril policies
  - i.e., Homeowners’ premium is usually split 90% for Property, 10% for Casualty
  - Inuring reinsurance premium deducted from subject base of Contract receiving benefit
    - Facultative
    - Government-sponsored entity (i.e., FHCF)
- Subject Premium used in many treaties to calculate the premium rate for the treaty
- Cost of catastrophe-reinsurance is usually quoted as a rate on line (ROL)

Excess Catastrophe Reinsurance – Losses

- Definition of Loss Occurrence:
  - Accumulation of losses from various policies/risk arising from a single occurrence/event
    - Hurricanes, Tornadoes, Nat. Brush Fire, Winter Freeze, Wind, Riot
  - Hours limitation clauses – may differ by peril and treaty
    - 96 hours for wind (4 Days)
    - 168 hours for earthquake (7 Days)
  - Company judgment on inception of event/occurrence
  - Contiguous states
- Reinstatement in the same event depends on the peril and treaty
Reinstatements

- Cat layers do not provide unlimited coverage
- Original premium pays for only the original limit
- Usually, each layer provides the original limit PLUS one additional limit (reinstatement)
- However, the reinstatement limit is available at an additional cost

Excess Catastrophe Reinstatement Terminology

- Definition of Reinstatement
  - Restoration of a reinsurance limit after a loss has been paid
- Reinstatements are simultaneous and mandatory
- Additional reinstatement premium based on three elements:
  - Annual premium
  - Time element
  - Limit being reinstated
- Possible options for reinstatement provisions:
  - Free (included in original cost as a "pre-paid" reinstatement)
  - Fixed percentage (i.e., 100%, 80%, etc.) for the time element
  - Pro rata as to time element (proportion of the year remaining)
- Additional reinstatement premium calculation:
  - (% of limit reinstated) * (time element) * (annual premium)

Aggregate Catastrophe Basics

- General Characteristics
  - Flat dollar retention and limit
  - Retentions set at level requiring multiple losses to recover
  - Coverage for loss frequency, not severity
  - May or may not include co-participation
  - Usually not (afford) of any Per Occurrence Cat reinsurance
Aggregate Catastrophe Terminology

- Responds to a frequency of “smaller” catastrophe events
- Includes a limit, retention and a trigger
- Trigger: Subject Excess Loss (SEL)
  - Cedent’s ultimate net losses within a defined range
- Cannot be reinstated

Example:
- Annual Aggregate Catastrophe Cover
  - $20M vs $20M of SEL for Contract Year
  - SEL $10M vs $5M UNL

<table>
<thead>
<tr>
<th>Layer</th>
<th>UNL</th>
<th>Per Occurrence Deductible</th>
<th>Aggregate Accumulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>$14M</td>
<td>$5M</td>
<td>$9M</td>
</tr>
<tr>
<td>#2</td>
<td>$3.5M</td>
<td>$3.5M</td>
<td>$0</td>
</tr>
<tr>
<td>#3</td>
<td>$15M</td>
<td>$5M</td>
<td>$10M</td>
</tr>
<tr>
<td>#4</td>
<td>$13M</td>
<td>$5M</td>
<td>$8M</td>
</tr>
<tr>
<td>Total</td>
<td>$45.5M</td>
<td>$18.5M</td>
<td>$27M</td>
</tr>
</tbody>
</table>

$27M - $20M (retention) = $7M Cat Agg recovery

Cat Pricing vs. Excess of Loss Pricing

- Excess of Loss pricing is largely an exercise in examining past history
  - Analysis of a Company’s loss history to make assumptions and predict future results
  - Apply loads to historical average loss costs to determine rates
- History alone cannot predict future results
  - Cat reinsurance protects against large single events
  - Little credibility in experience due to so few events
  - Company’s past cat loss history has less bearing than standard XOL pricing
- Cat pricing relies on three models:
  - Applied Insurance Research (AIR)
  - Risk Management Solutions (RMS)
  - EQUECAT

What is an ELT (Event Loss Table)?

- List of modeled stochastic events typically including event rate, loss, standard deviation, & exposed value
- From these events/losses an exceedance probability curve can be created and average annual loss can be calculated
- Used as an input for reinsurance pricing tools (CatMetrica/CatRAM)
Model Output: Exceedance Probability

- AKA "EP", formerly known as "PML"
- ELTs create EP Curves as well as EP Summaries
- Annual probability that a certain loss threshold is exceeded
  - Example: "100-year Gross EP loss is $212M"
    - Probability of exceeding $212M in one year is 1%
    - Return Periods are for a one-year perspective
    - It does not mean that there is a 100% probability of exceeding $212M over the next 100 years
    - It does not mean that 1 year of the next 100 will have loss > $212M
    - It does not mean that there is no chance of having 2 losses > $212M over the next 100 years
- Used for reinsurance purchasing decisions and portfolio management

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 yr</td>
<td>418,200</td>
<td>211,940</td>
<td>206,077</td>
<td></td>
</tr>
<tr>
<td>500 yr</td>
<td>304,040</td>
<td>146,206</td>
<td>142,312</td>
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</tr>
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<td>250 yr</td>
<td>220,040</td>
<td>89,065</td>
<td>86,852</td>
<td></td>
</tr>
<tr>
<td>200 yr</td>
<td>214,080</td>
<td>84,852</td>
<td>82,639</td>
<td></td>
</tr>
<tr>
<td>100 yr</td>
<td>158,100</td>
<td>65,639</td>
<td>62,427</td>
<td></td>
</tr>
<tr>
<td>50 yr</td>
<td>117,040</td>
<td>46,852</td>
<td>44,639</td>
<td></td>
</tr>
<tr>
<td>25 yr</td>
<td>65,100</td>
<td>26,852</td>
<td>24,639</td>
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<tr>
<td>Annual avg</td>
<td>39,000</td>
<td>19,000</td>
<td>18,000</td>
<td></td>
</tr>
<tr>
<td>Std dev</td>
<td>304,000</td>
<td>304,000</td>
<td>304,000</td>
<td></td>
</tr>
</tbody>
</table>

Model Output: Occurrence vs. Aggregate

<table>
<thead>
<tr>
<th>Hurric.</th>
<th>HU</th>
<th>%</th>
<th>SCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 yr</td>
<td>39,000</td>
<td>1%</td>
<td>19,000</td>
</tr>
<tr>
<td>200 yr</td>
<td>39,000</td>
<td>1%</td>
<td>39,000</td>
</tr>
</tbody>
</table>

Model Output: Exceedance Probability

<table>
<thead>
<tr>
<th>Hurricane</th>
<th>Probability of</th>
<th>Exceedance</th>
<th>Loss Event</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max Loss (Loss)</td>
<td>v9</td>
<td>v9</td>
</tr>
<tr>
<td>100 yr</td>
<td>1,028</td>
<td>211,940</td>
<td>206,077</td>
</tr>
<tr>
<td>500 yr</td>
<td>304,040</td>
<td>211,940</td>
<td>146,206</td>
</tr>
<tr>
<td>250 yr</td>
<td>220,040</td>
<td>89,065</td>
<td>86,852</td>
</tr>
<tr>
<td>200 yr</td>
<td>214,080</td>
<td>84,852</td>
<td>82,639</td>
</tr>
<tr>
<td>100 yr</td>
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<td>65,639</td>
<td>62,427</td>
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<tr>
<td>50 yr</td>
<td>117,040</td>
<td>46,852</td>
<td>44,639</td>
</tr>
<tr>
<td>25 yr</td>
<td>65,100</td>
<td>26,852</td>
<td>24,639</td>
</tr>
</tbody>
</table>

There is a 1% chance this company will experience a hurricane loss that will exceed $722M in a year.
Regional EP Summaries
- Florida Region: Higher Frequency and Severity
- Northeast Region: Lower Frequency, Higher Severity
- Gulf Region: Higher Frequency, Lower Severity

In Millions Unless Otherwise Noted

Model Output: Exceedance Probability Frequency vs. Severity

- Florida Region: Higher Frequency and Severity
- Northeast Region: Lower Frequency, Higher Severity
- Gulf Region: Higher Frequency, Lower Severity

Model Output: Average Annual Loss

- Average Annual Loss = Mean Loss * Rate
  - Rate = Probability of occurring
  - Model's estimate of average loss that can be expected each year
  - Reflects combined impact of frequency and severity of events

Sample AAL by State

Florida 45.1%
MA 10.9%
CT 10.7%
TX 9.3%
RI 8.9%
Others 15.1%

This company should expect $61M in hurricane losses each year
Portion of the Average Annual Loss falling into a specific reinsurance Contract

- AKA “Expected Loss”
- NOT the reinsurance premium
- Akin to an exposure loss cost
- Needs to be “grossed-up” for a reinsurer’s margin / expenses
- May not include all perils (i.e., straight line winds, demand surge, storm surge)

Pure Premiums

Standard Deviation & Coefficient of Variation

- Standard Deviation
  - Measure of volatility around the mean
  - Higher layers have greater standard deviations than lower frequency layers, given measure of uncertainty
  - A percentage of the standard deviation is added to pure premium to generate the price of the layer
  - Commonly referred to as “Risk Load” or “MSD”
  - Cannot compare the SD of one analysis to the SD of another

- Coefficient of Variation (CV)
  - Standard Deviation / Mean
  - The larger the CV, the greater the relative variability around the mean loss
  - CV has no “units” (better than using SD for comparison purposes)

Origin of Standard Deviation: Uncertainty

- Primary Uncertainty
  - “Uncertainty around whether or not an event will occur, and if an event does occur, which event it will be.”

Payout is either $0 or $100. The uncertainty in the payout is considered primary uncertainty

- Secondary Uncertainty
  - “Uncertainty in the size of the loss, given that a specific event has occurred.”

Payout is $0 or a range between $80 and $120. The uncertainty in how much will be paid given that there is a payout is the secondary uncertainty. If there is a payout, avg payout is $100 – as with the final example
Making Pure Premiums into Deposit Premiums

- Pure Premium = (Standard Deviation * Load %) + Deposit Premium
  - Each reinsurer has a different approach
  - Market pricing trends support this approach most often
  - Geography (Midwest vs. Southeast) and peril (Wind vs. Earthquake) cause variations to this approach
  - Research shows somewhere between 30% and 50% of the Standard deviation added to the pure premium gives a close approximation to the range of quotes.

### Pricing Example

#### Estimated Deposit Premiums using 50% load on Standard Deviation.

<table>
<thead>
<tr>
<th>Limit Retention</th>
<th>Pure Premium</th>
<th>Standard Deviation</th>
<th>Deposit Premium</th>
<th>Rate on Line</th>
<th>Margin $</th>
<th>Margin %</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10,000,000</td>
<td>$15,000,000</td>
<td>$680,141</td>
<td>$2,956,025</td>
<td>14.39%</td>
<td>$1,478,012</td>
<td>68.49%</td>
</tr>
<tr>
<td>$30,000,000</td>
<td>$30,000,000</td>
<td>$532,272</td>
<td>$3,630,175</td>
<td>7.82%</td>
<td>$1,815,088</td>
<td>77.32%</td>
</tr>
<tr>
<td>$40,000,000</td>
<td>$60,000,000</td>
<td>$247,655</td>
<td>$2,850,656</td>
<td>4.18%</td>
<td>$1,425,328</td>
<td>85.20%</td>
</tr>
</tbody>
</table>

#### Actual Deposit Premiums based on Market Feedback.

<table>
<thead>
<tr>
<th>Limit Retention</th>
<th>Pure Premium</th>
<th>Standard Deviation</th>
<th>Deposit Premium</th>
<th>Rate on Line</th>
<th>Margin $</th>
<th>Margin %</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10,000,000</td>
<td>$15,000,000</td>
<td>$680,141</td>
<td>$2,956,025</td>
<td>15.00%</td>
<td>$1,569,859</td>
<td>69.77%</td>
</tr>
<tr>
<td>$30,000,000</td>
<td>$30,000,000</td>
<td>$532,272</td>
<td>$3,630,175</td>
<td>9.50%</td>
<td>$2,317,728</td>
<td>81.32%</td>
</tr>
<tr>
<td>$40,000,000</td>
<td>$60,000,000</td>
<td>$247,655</td>
<td>$2,850,656</td>
<td>5.50%</td>
<td>$1,952,345</td>
<td>88.72%</td>
</tr>
</tbody>
</table>

### Pricing Mechanisms: Rate on Line and Payback

- Cat pricing is often done on a Rate on Line or Payback basis
- Rate on Line (ROL) is stated as a function of what percentage of the treaty (or layer) limit is funded by the reinsurance premium collected for that year
  - Reinsurance premium / layer limit
  - Premium of $2.25M and a reinsurance layer limit of $15M generates a 15% rate on line
- Payback is stated as the number of years a reinsurer would need to collect premium in order to be "paid back" in the event of a total loss
  - Layer limit / reinsurance premium
  - A layer limit of $15M and a reinsurance premium of $2.25M translates to a payback of 6.7 years
  - In the event of a total loss, it would take a reinsurer 6.7 years to be paid back if the layer limit and reinsurance premium were to stay constant.
Agenda

- General Characteristics of Reinsurance
- Pro-Rata Reinsurance
- Excess of Loss Reinsurance
- Catastrophe Reinsurance

Thank you for your time and attention!

Any questions?

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timothy.corley@inpoint.com