
Sessional Meeting of the Institute and Faculty of Actuaries, Staple Inn, London

20 February 2017

Overview by: Dr Ana Mata, ACAS, MatBlas and Dr Enrico Biffis, Imperial College
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In October 2016 at the GIRO conference of general insurance actuaries, the IFoA-CAS International Reinsurance Pricing Working Party was awarded the prestigious Brian Hey prize for their research paper on Analyzing the Disconnect Between the Reinsurance Submission and Global Underwriter's Needs - Property Per Risk.

This research paper fills the literary void related to information required by the primary and reinsurance pricing practitioner, but often lacking when pricing property per risk coverages worldwide. Results from surveys of members in the UK, European and US actuarial communities, as well as others in the related insuring communities, clearly indicated a disconnect between the desired information and the information commonly available for pricing. This paper presents the broad ranging results of this research. Much of this information is also appropriate for usage in other property and casualty lines of business.

Aimed at all stakeholders in GI pricing, this event is suitable for those at the most junior levels right up to board members. Suitable for actuaries and underwriters at primary companies, intermediaries, and reinsurance companies.
Agenda

1. Motivation of the paper
2. Results of survey
3. Overview of key points of the paper
4. Conclusions
5. Q&A
Working party formation

- Joint effort between IFoA-GIRO and CAS-CARe 2014-2016
- Initially focus on Property Per Risk Reinsurance
- Goals of WP:
  - Analyse gaps between data and information presented in a standard reinsurance submission and data required by reinsurance actuaries and underwriters to thoroughly price a treaty
  - Improve understanding across all parties (cedant, broker and reinsurer) of impact of incomplete submissions on pricing throughout a number of examples.
  - Create a reference framework for future property primary data collection and reinsurance submissions.
Members of the working party

• John Buchanan – Chair of the working party
• 16 participants:

Mohamed S. Afify
Chris Boggs
Eric Greenhill
Mandy Kisala
Eoin O'Baoighill
Bei Zhou
Shayne Andrews
Lawrence Cheng
Yin Hang
Xiao-Xuan (Sherwin) Li
Josiah Ogungbesan

Enrico E Biffis
Paul Gates
Kevin Hilferty
Ana J. Mata
Adam P. Shrubshall
Impetus for working party

• Focus: Property per risk insurance and reinsurance
• Insurance companies provide limited data in reinsurance submissions
• Reinsurance underwriters make more conservative assumptions – higher price
• Higher insurance premiums for commercial property insureds
• Better data from insured to insurer to reinsurers could benefit all parties – even brokers!
Working party steps

• Identified an ideal submission vs. most common submission.
  – A survey was prepared and circulated among reinsurance practitioners (actuaries and underwriters)
  – Results of the survey were presented at the annual CARe meeting in June 2015 in Philadelphia, USA and CAE in London in September 2015.

• Preparation of a white paper delivered in March 2016 with detailed examples showing illustrative price differences driven by lack of data

• Preparation of paper to be submitted to the BAJ for Publication in 2017
  – Includes additional reviewer comments regarding market interactions
Survey overview

• 44 responses
  – 86% actuaries and 14% from other areas;
  – 25 members of CAS, 16 members of IFoA, 13 members of other organisations (some members of multiple organisations);
  – Representation from France, China and New Zealand.

• Risks priced in a wide variety of territories.
Respondent demographics

Which territories do you mainly price?

Europe 35%  
Middle East/Asia 10%  
Latin/South America 5%  
Worldwide 50%  
Other (please specify) 0%

How many years have you been pricing insurance?

- 0-2
- 2-5
- 5-10
- 10-20
- 20+
- Other (please specify)
Respondent demographics

- Colour palette for PowerPoint presentations
  - Dark blue: R17 G52 B88
  - Gold: R217 G171 B22
  - Mid blue: R64 G150 B184
- Secondary colour palette
  - Light grey: R220 G221 B217
  - Pea green: R121 G163 B42
  - Forest green: R0 G132 B82
  - Bottle green: R17 G179 B162
  - Cyan: R0 G156 B200
  - Light blue: R124 G179 B225
  - Violet: R128 G118 B207
  - Purple: R143 G70 B147
  - Fuchsia: R233 G69 B140
  - Red: R200 G30 B69
  - Orange: R238 G116 B29
  - Dark grey: R63 G69 B72
How does a poor quality submission impact price?

- Other (please specify)
- More pessimistic assumptions (non-explicit loadings)
- Explicit loadings within pricing
- No effect on pricing
How does an excellent quality submission impact price?

![Chart showing the impact of excellent quality submissions on pricing for different categories: All, CAS, IFOA, and Other. The chart includes categories such as More optimistic assumptions (non-explicit benefits to price), Below normal margin requirements, and No effect on pricing.]

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How much does quality of submission impact your price?

![Quality of Submission Impact on Price Chart]

- **All**: 100%
  - Unknown: 0%
  - Very High: 0%
  - High: 0%
  - Medium: 0%
  - Low: 0%
  - None: 0%
- **CAS**: 100%
  - Unknown: 0%
  - Very High: 0%
  - High: 0%
  - Medium: 0%
  - Low: 0%
  - None: 0%
- **IFOA**: 100%
  - Unknown: 0%
  - Very High: 0%
  - High: 0%
  - Medium: 0%
  - Low: 0%
  - None: 0%
- **Other**: 100%
  - Unknown: 0%
  - Very High: 0%
  - High: 0%
  - Medium: 0%
  - Low: 0%
  - None: 0%
## Exposure rating

<table>
<thead>
<tr>
<th>Category</th>
<th>All</th>
<th>CAS</th>
<th>IFOA</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Receiving</td>
<td>Rank</td>
<td>% Receiving</td>
<td>Rank</td>
<td>% Receiving</td>
</tr>
<tr>
<td>a. In-force risk profile (banded)</td>
<td>93%</td>
<td>1</td>
<td>92%</td>
<td>1</td>
</tr>
<tr>
<td>b. Historic risk profiles (banded)</td>
<td>23%</td>
<td>5</td>
<td>8%</td>
<td>6</td>
</tr>
<tr>
<td>c. Individual risk listing (all cat/non-cat exposures)</td>
<td>30%</td>
<td>3</td>
<td>24%</td>
<td>2</td>
</tr>
<tr>
<td>d. Individual risk listing (above certain threshold)</td>
<td>48%</td>
<td>7</td>
<td>48%</td>
<td>7</td>
</tr>
<tr>
<td>e. Historic from ground up loss ratios (cat and non-cat)</td>
<td>57%</td>
<td>2</td>
<td>68%</td>
<td>3</td>
</tr>
<tr>
<td>f. Written explanation of risk profile</td>
<td>25%</td>
<td>4</td>
<td>20%</td>
<td>5</td>
</tr>
<tr>
<td>g. Risk profile detail</td>
<td>34%</td>
<td>6</td>
<td>32%</td>
<td>4</td>
</tr>
<tr>
<td>h. Link of claims to risk profiles</td>
<td>7%</td>
<td>8</td>
<td>4%</td>
<td>8</td>
</tr>
</tbody>
</table>

20 February 2017
## Experience rating

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>CAS</th>
<th>IFOA</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Receiving</td>
<td>Rank</td>
<td>% Receiving</td>
<td>Rank</td>
</tr>
<tr>
<td>a. Large loss listing (no triangle)</td>
<td>100%</td>
<td>1</td>
<td>100%</td>
<td>1</td>
</tr>
<tr>
<td>b. Historic large loss listing (triangle)</td>
<td>30%</td>
<td>3</td>
<td>24%</td>
<td>3</td>
</tr>
<tr>
<td>. Large loss claim description including cat/non-cat indicator</td>
<td>82%</td>
<td>4</td>
<td>96%</td>
<td>4</td>
</tr>
<tr>
<td>d. Historic premium</td>
<td>93%</td>
<td>2</td>
<td>96%</td>
<td>2</td>
</tr>
<tr>
<td>e. Historic exposures (# of risks, # of exposures / risk)</td>
<td>30%</td>
<td>6</td>
<td>20%</td>
<td>6</td>
</tr>
<tr>
<td>f. Projected rate change</td>
<td>43%</td>
<td>7</td>
<td>56%</td>
<td>6</td>
</tr>
<tr>
<td>g. Historic rate change</td>
<td>59%</td>
<td>5</td>
<td>84%</td>
<td>5</td>
</tr>
<tr>
<td>h. Rate monitor (renewal policies)</td>
<td>18%</td>
<td>8</td>
<td>24%</td>
<td>8</td>
</tr>
</tbody>
</table>
Chapter 3: Insurance company’s considerations (Cedant)

• Process starts when risk/policy is presented to the insurance underwriter
  – Proposal form relevant questions (PDF or printed format).
  – List of individual locations with insured values vs. Total amount of insurance under the policy (Excel vs. PDF format).
  – Risk factors per location: construction, occupancy, presence of sprinklers, etc.
  – Brokers and agents benefit from faster response, more refined and consistent pricing.

• Data collection depends on insurance company’s rating models and databases
  – Rating models often in Microsoft Excel not linked to a database.
  – Policy premium not always allocated to individual locations.
  – Limited information is systematically collected in a database (amount of insurance, limits, excess, main territory and policy premium).
Chapter 3: Insurance company’s considerations (Cedant)

• Benefits to the insurance company
  – Insurance company’s pricing actuaries would benefit from having a robust database for ratemaking (GLMs) and portfolio segmentation.
  – Primary underwriters would have more granular data to analyse and manage their portfolio and make decisions.
  – Facilitates preparation of reinsurance submission.
  – Reinsurers would have more data to work with; hence fewer assumptions.
  – Potentially better more consistent reinsurance pricing results in better pricing for the buyer of insurance

• Understanding what information the reinsurer needs benefits all parties involved in the property insurance transaction
Chapter 4: Reinsurance company’s considerations

- Reinsurers have sets of benchmarks based on market data
  - Exposure curves
  - Gross loss ratios
  - Rate changes
  - Claims development patterns
  - Claims inflation

- Benchmarks (often conservative) are used to price in the absence of credible data from cedant

- ‘Fair Price’ and ‘Smooth Price’
  - Demonstrable that price is directly based on data; fewer loadings.
  - Stable pricing even after a loss
Chapter 4: Reinsurance company’s considerations

• **New vs. Renewal treaties**
  – Maximize opportunity vs trying to avoid mistakes

• **Reinsurance brokers**
  – Clean and complete submission leads to faster response
  – Have a check list – same questions and requests each year

• **Long term relationships and consistent pricing**
  – Reinsurance actuaries reconciliation with prior year’s pricing
  – Easier to measure changes in risk and reinsurance programme
  – Facilitates internal decision making and referrals/sign off

• **Other market considerations**
  – Winner’s curse
  – Submission bias
  – Overconfidence
Chapter 5: Data elements

Exposure rating

• Historical and prospective loss ratios
  – Gross of THIS treaty
  – Cat vs. non-cat (definition of cat loss)
  – Accident Year vs. UW Year

• In-force risk profile (banded) – what is a risk?

• Individual in-force risk listing
  – Amount of insurance
  – Excess/deductible
  – Premium allocated to each risk

Experience rating

• Large losses preferable with development
  – Amount of insurance and excess
  – Loss description
  – Date of loss vs. policy date

• Historical premium (earned vs. written)

• Historical and prospective rate changes
  – Basis of calculation
Chapter 6: Amount of insurance (AOI) definition

• How does the treaty respond to a loss?
  – Usually risk excess treaties respond per location/building

• What is the amount of insurance?
  – Policy limit is maximum loss an insurer would pay in the vent of a loss.
  – The amount of information contained in that one single value is extremely limited.
  – Is it building only or does it include other coverages, e.g. business interruption?

• What is a risk?*
  – A policy covering multiple locations
  – The location with highest amount of insurance (top location)
  – A single location (building)

Chapter 6: Amount of insurance

- **Common presentations**
  - Total insured value (TIV)
  - Maximum probable loss (MPL)
  - Possible maximum loss (PML)
  - Maximum feasible loss (MFL)
  - Average TIV across all locations in the policy
  - Largest/top location or key location

- **Subscription market policies**
  - Common presentation: one policy with lowest attachment and total programme participation.
  - Cedant’s participation per layer: % share, limit and attachment with stack code

Could be per location or aggregated for the policy.
Chapter 7: Types of risk profile submissions

- Banded profile with TIV, Premium and number of risks per band
  - normally received by 93%, ranked 1 in exposure rating importance

<table>
<thead>
<tr>
<th>TIV Band</th>
<th>%TIV</th>
<th>TIV in band</th>
<th>Avg TIV</th>
<th>No Risks</th>
<th>% Prem</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>35%</td>
<td>437,500,000</td>
<td>759,549</td>
<td>576</td>
<td>44.12%</td>
<td>6,562,500</td>
</tr>
<tr>
<td>1,000,001</td>
<td>25%</td>
<td>312,500,000</td>
<td>1,554,726</td>
<td>201</td>
<td>24.16%</td>
<td>3,593,750</td>
</tr>
<tr>
<td>2,000,001</td>
<td>20%</td>
<td>250,000,000</td>
<td>2,688,172</td>
<td>93</td>
<td>16.47%</td>
<td>2,450,000</td>
</tr>
<tr>
<td>3,000,001</td>
<td>15%</td>
<td>187,500,000</td>
<td>3,232,759</td>
<td>58</td>
<td>11.60%</td>
<td>1,725,000</td>
</tr>
<tr>
<td>4,000,001</td>
<td>5%</td>
<td>62,500,000</td>
<td>4,166,667</td>
<td>15</td>
<td>3.66%</td>
<td>543,750</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>1,250,000,000</td>
<td></td>
<td>943</td>
<td>100.00%</td>
<td>14,875,000</td>
</tr>
</tbody>
</table>

- What is a risk? A policy or a single location?
  - Significant impact on exposure rating results

Risks exposing a $4m xs $1m layer
Chapter 7: Types of risk profile submissions

- In-force risk profile banded by TIV/MPL and Attachment
  - normally received by 93%, ranked 1 in exposure rating importance

<table>
<thead>
<tr>
<th>Limits</th>
<th>0 - 1,000,000</th>
<th>1,000,001 - 2,000,000</th>
<th>2,000,001 - 3,000,000</th>
<th>3,000,001 - 4,000,001</th>
<th>4,000,001 - 5,000,001</th>
<th>5,000,001 - 7,500,000</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREMIUM</td>
<td>100,000</td>
<td>200,000</td>
<td>300,000</td>
<td>400,000</td>
<td>500,000</td>
<td>600,000</td>
<td>2,100,000</td>
</tr>
<tr>
<td>0 - 1,000,000</td>
<td>0</td>
<td>50,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50,000</td>
</tr>
<tr>
<td>1,000,001 - 2,000,000</td>
<td>0</td>
<td>50,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50,000</td>
</tr>
<tr>
<td>2,000,001 - 3,000,000</td>
<td>0</td>
<td>50,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50,000</td>
</tr>
<tr>
<td>3,000,001 - 4,000,001</td>
<td>0</td>
<td>50,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50,000</td>
</tr>
<tr>
<td>4,000,001 - 5,000,001</td>
<td>0</td>
<td>0</td>
<td>100,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100,000</td>
</tr>
<tr>
<td>5,000,001 - 7,500,000</td>
<td>0</td>
<td>0</td>
<td>150,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>150,000</td>
</tr>
<tr>
<td>7,500,001 - 10,000,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>200,000</td>
<td>0</td>
<td>0</td>
<td>200,000</td>
</tr>
<tr>
<td>10,000,001 - 15,000,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>400,000</td>
<td>0</td>
<td>400,000</td>
</tr>
<tr>
<td>15,000,001 - 20,000,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>160,000</td>
<td>160,000</td>
</tr>
<tr>
<td>20,000,001 - 30,000,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>80,000</td>
<td>80,000</td>
</tr>
<tr>
<td>30,000,001 - 60,000,000</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100,000</td>
<td>300,000</td>
<td>350,000</td>
<td>650,000</td>
<td>1,100,000</td>
<td>880,000</td>
<td>3,380,000</td>
</tr>
</tbody>
</table>
Chapter 7: Types of risk profile submissions

• Shared and layered programmes with ventilation
  – Standard practice: aggregate cedant’s participation (limit) with lowest attachment for the cedant.

In a banded profile the total premium of $249,500 for this risk will be counted in the band with 0 attachment and $25M limit.

Stack code | Participation | Policy Limit | Attachment | Cedant’s premium
--- | --- | --- | --- | ---
A | 30% | 10,000,000 | xs | 0 | 145,000
A | 50% | 10,000,000 | xs | 10,000,000 | 72,000
A | 34% | 50,000,000 | xs | 50,000,000 | 32,500

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Chapter 7: Types of risk profile submissions

• Individual risk listing (all cat / non-cat exposures)
  – normally received by 30%, ranked 3
## Chapter 7: Types of risk profile submissions

- **Impact on pricing:** using exposure curve of the “Swiss Re” type with parameter c=5 (approximation to Lloyd’s industrial curve)*

<table>
<thead>
<tr>
<th>Policy limit</th>
<th>Attachment</th>
<th>TIV</th>
<th>Share of Premium</th>
<th>Ceded premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>$25,000,000$</td>
<td>$0$</td>
<td>$25,000,000$</td>
<td>$249,500$</td>
<td>$26,435$</td>
</tr>
<tr>
<td>$25,000,000$</td>
<td>$0$</td>
<td>$25,000,000$</td>
<td>$249,500$</td>
<td>$26,435$</td>
</tr>
<tr>
<td>$10,000,000$</td>
<td>$0$</td>
<td>$100,000,000$</td>
<td>$145,000$</td>
<td>$33,765$</td>
</tr>
<tr>
<td>$10,000,000$</td>
<td>$0$</td>
<td>$100,000,000$</td>
<td>$145,000$</td>
<td>$33,765$</td>
</tr>
<tr>
<td>$50,000,000$</td>
<td>$0$</td>
<td>$100,000,000$</td>
<td>$32,500$</td>
<td>$26,317$</td>
</tr>
<tr>
<td>$50,000,000$</td>
<td>$0$</td>
<td>$100,000,000$</td>
<td>$32,500$</td>
<td>$26,317$</td>
</tr>
<tr>
<td>$60,082$</td>
<td>$6,183$</td>
<td>$6,183$</td>
<td>$6,183$</td>
<td>$6,183$</td>
</tr>
</tbody>
</table>

Chapter 8: How is the gross loss ratio used?

• **Exposure rating method**
  – What % of the gross loss cost is allocated to the reinsurance layer based on TIV profile and selected exposure curve.

• **The gross loss cost**
  – Gross loss ratio for the treaty year x gross premium – most commonly used
  – Extended exposures - allocate a loss cost to each location based on risk profile

• **Cat vs. non-cat**
  – Non-cat loss ratio to exposure rate using non-cat curves (typically fire)
  – Cat exposures from cat models if covered by risk excess treaty
Chapter 8: Loss ratio information

• Historical gross premium and losses
  – Accident year vs. underwriting year;
  – Split non-cat and cat (definition of cat)

• Actuarial analysis
  – Premiums adjusted for rate changes and inflation;
  – Claims adjusted for inflation.

• Reconcile with cedant’s business plan gross loss ratio.

• If not provided benchmarks are used.
# Chapter 8: Loss ratio example

<table>
<thead>
<tr>
<th>Year of Account</th>
<th>Ultimate Written Premium</th>
<th>Cedant's ULRs</th>
<th>Ultimate losses</th>
<th>Rate Changes</th>
<th>Premium On-Level Factor</th>
<th>Trend Factor @ 3% p.a.</th>
<th>On-level premium</th>
<th>Trended ultimate losses</th>
<th>&quot;As-if&quot; ULR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>20,455,785</td>
<td>48.63%</td>
<td>9,947,648</td>
<td>-3.50%</td>
<td>0.804</td>
<td>1.344</td>
<td>16,448,368</td>
<td>13,368,807</td>
<td>81.28%</td>
</tr>
<tr>
<td>2008</td>
<td>22,547,855</td>
<td>65.48%</td>
<td>14,764,335</td>
<td>-2.00%</td>
<td>0.821</td>
<td>1.305</td>
<td>18,500,600</td>
<td>19,264,109</td>
<td>104.13%</td>
</tr>
<tr>
<td>2009</td>
<td>27,856,963</td>
<td>85.56%</td>
<td>23,834,418</td>
<td>3.50%</td>
<td>0.793</td>
<td>1.267</td>
<td>22,083,810</td>
<td>30,192,727</td>
<td>136.72%</td>
</tr>
<tr>
<td>2010</td>
<td>31,772,519</td>
<td>45.23%</td>
<td>14,370,710</td>
<td>-7.50%</td>
<td>0.857</td>
<td>1.230</td>
<td>27,230,158</td>
<td>17,674,161</td>
<td>64.91%</td>
</tr>
<tr>
<td>2011</td>
<td>45,265,489</td>
<td>53.26%</td>
<td>24,108,399</td>
<td>-3.50%</td>
<td>0.888</td>
<td>1.194</td>
<td>40,201,144</td>
<td>28,786,690</td>
<td>71.61%</td>
</tr>
<tr>
<td>2012</td>
<td>65,789,632</td>
<td>68.45%</td>
<td>45,033,003</td>
<td>-2.00%</td>
<td>0.906</td>
<td>1.159</td>
<td>59,621,456</td>
<td>52,205,593</td>
<td>87.56%</td>
</tr>
<tr>
<td>2013</td>
<td>72,145,223</td>
<td>72.37%</td>
<td>52,211,498</td>
<td>2.50%</td>
<td>0.884</td>
<td>1.126</td>
<td>63,786,509</td>
<td>58,764,501</td>
<td>92.13%</td>
</tr>
<tr>
<td>2014</td>
<td>75,214,665</td>
<td>70.31%</td>
<td>52,883,431</td>
<td>-1.50%</td>
<td>0.898</td>
<td>1.093</td>
<td>67,513,022</td>
<td>57,787,153</td>
<td>85.59%</td>
</tr>
<tr>
<td>2015</td>
<td>78,415,223</td>
<td>71.00%</td>
<td>55,674,808</td>
<td>-3.60%</td>
<td>0.931</td>
<td>1.061</td>
<td>73,014,375</td>
<td>59,065,404</td>
<td>80.90%</td>
</tr>
<tr>
<td>2016</td>
<td>76,245,145</td>
<td>72.00%</td>
<td>54,896,504</td>
<td>-4.50%</td>
<td>0.975</td>
<td>1.030</td>
<td>74,339,016</td>
<td>56,543,400</td>
<td>76.06%</td>
</tr>
</tbody>
</table>

2017* 74.00% -2.50%

* 2017 are business plan figures

10-year wgt average 85.07%

• Need to reconcile 85% estimated ULR for 2017 with 74% business plan.
Chapter 8: Loss ratio considerations

- Cedant’s claims inflation assumptions
- What is included in the rate change and how is calculated?
  - Does it include new business premium or only renewals?
- Natural catastrophe losses by year of account
- Treatment of large non-cat losses above a certain threshold
- Changes in mix of business and geographical spread over time
- How is the business plan loss ratio calculated?
  - Key assumptions
Chapter 9: Historical AOI Profiles

• Increase TIVs over time main reason experience lacks credibility.
• Layer more exposed than prior years
• Traditional approach is to apply exposure adjustment based on total sum insured or premium
• Chapter shows how the use of historic TIV profile could help refine experience rating results compared to standard exposure adjustment
## Adjusting experience for changes in historical profile

### 2007

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
<th>% TIV</th>
<th>TIV in band</th>
<th>Avg TIV</th>
<th>No Risks</th>
<th>% Prem</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1,000,000</td>
<td>100%</td>
<td>35%</td>
<td>437,500,000</td>
<td>759,549</td>
<td>576</td>
<td>44.12%</td>
<td>6,562,500</td>
</tr>
<tr>
<td>1,000,001</td>
<td>2,000,000</td>
<td>25%</td>
<td>312,500,000</td>
<td>1,554,726</td>
<td>201</td>
<td>24.16%</td>
<td>3,593,750</td>
<td></td>
</tr>
<tr>
<td>2,000,001</td>
<td>3,000,000</td>
<td>20%</td>
<td>250,000,000</td>
<td>2,688,172</td>
<td>93</td>
<td>16.47%</td>
<td>2,450,000</td>
<td></td>
</tr>
<tr>
<td>3,000,001</td>
<td>4,000,000</td>
<td>15%</td>
<td>187,500,000</td>
<td>3,232,759</td>
<td>58</td>
<td>11.60%</td>
<td>1,725,000</td>
<td></td>
</tr>
<tr>
<td>4,000,001</td>
<td>5,000,000</td>
<td>5%</td>
<td>62,500,000</td>
<td>4,166,667</td>
<td>15</td>
<td>3.66%</td>
<td>543,750</td>
<td></td>
</tr>
</tbody>
</table>

**Total**: 100% 1,250,000,000 | 943 100.00% 14,875,000

### 2009

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
<th>% TIV</th>
<th>TIV in band</th>
<th>Avg TIV</th>
<th>No Risks</th>
<th>% Prem</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1,000,000</td>
<td>100%</td>
<td>30%</td>
<td>487,500,000</td>
<td>755,814</td>
<td>645</td>
<td>39.32%</td>
<td>7,215,000</td>
</tr>
<tr>
<td>1,000,001</td>
<td>2,000,000</td>
<td>22%</td>
<td>357,500,000</td>
<td>1,588,889</td>
<td>225</td>
<td>21.82%</td>
<td>4,004,000</td>
<td></td>
</tr>
<tr>
<td>2,000,001</td>
<td>3,000,000</td>
<td>24%</td>
<td>390,000,000</td>
<td>2,635,135</td>
<td>148</td>
<td>20.19%</td>
<td>3,705,000</td>
<td></td>
</tr>
<tr>
<td>3,000,001</td>
<td>4,000,000</td>
<td>17%</td>
<td>276,250,000</td>
<td>3,410,494</td>
<td>81</td>
<td>13.40%</td>
<td>2,458,625</td>
<td></td>
</tr>
<tr>
<td>4,000,001</td>
<td>5,000,000</td>
<td>7%</td>
<td>113,750,000</td>
<td>4,375,000</td>
<td>26</td>
<td>5.27%</td>
<td>966,875</td>
<td></td>
</tr>
</tbody>
</table>

**Total**: 100% 1,625,000,000 | 1,125 100.00% 18,349,500

### 2016

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
<th>% TIV</th>
<th>TIV in band</th>
<th>Avg TIV</th>
<th>No Risks</th>
<th>% Prem</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1,000,000</td>
<td>100%</td>
<td>27%</td>
<td>607,500,000</td>
<td>778,846</td>
<td>780</td>
<td>35.90%</td>
<td>8,808,750</td>
</tr>
<tr>
<td>1,000,001</td>
<td>2,000,000</td>
<td>22%</td>
<td>495,000,000</td>
<td>1,661,074</td>
<td>298</td>
<td>22.79%</td>
<td>5,593,500</td>
<td></td>
</tr>
<tr>
<td>2,000,001</td>
<td>3,000,000</td>
<td>23%</td>
<td>517,500,000</td>
<td>2,640,306</td>
<td>196</td>
<td>19.82%</td>
<td>4,864,500</td>
<td></td>
</tr>
<tr>
<td>3,000,001</td>
<td>4,000,000</td>
<td>15%</td>
<td>337,500,000</td>
<td>3,515,625</td>
<td>96</td>
<td>11.83%</td>
<td>2,902,500</td>
<td></td>
</tr>
<tr>
<td>4,000,001</td>
<td>5,000,000</td>
<td>13%</td>
<td>292,500,000</td>
<td>4,642,857</td>
<td>63</td>
<td>9.66%</td>
<td>2,369,250</td>
<td></td>
</tr>
</tbody>
</table>

**Total**: 100% 2,250,000,000 | 1,433 100.00% 24,538,500

---

*Exposure rating $3m xs $2m layer: growth is not uniform across bands*
## Adjusting experience for changes in historical profile

<table>
<thead>
<tr>
<th>Policy year</th>
<th>On-level premium</th>
<th>Inflation adjusted TIV</th>
<th>Exposure rate using historical profiles</th>
<th>Trended ultimate losses in layer</th>
<th>Burn cost</th>
<th>With OL Premium</th>
<th>With adjusted TIV</th>
<th>Exposure adjusted losses with exposure rate in layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>14,427,641</td>
<td>1,380,777,657</td>
<td>1.327%</td>
<td>1,015,706</td>
<td>7.040%</td>
<td>1,865,600</td>
<td>1,839,011</td>
<td>1,621,911</td>
</tr>
<tr>
<td>2008</td>
<td>13,509,518</td>
<td>1,725,835,360</td>
<td>1.327%</td>
<td>0</td>
<td>0.000%</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>16,343,110</td>
<td>1,759,642,147</td>
<td>1.731%</td>
<td>0</td>
<td>0.000%</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>17,100,229</td>
<td>1,801,187,392</td>
<td>1.731%</td>
<td>646,389</td>
<td>3.780%</td>
<td>1,001,700</td>
<td>897,170</td>
<td>791,663</td>
</tr>
<tr>
<td>2011</td>
<td>18,733,394</td>
<td>1,857,660,264</td>
<td>1.935%</td>
<td>0</td>
<td>0.000%</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>18,592,448</td>
<td>2,049,469,598</td>
<td>1.935%</td>
<td>736,261</td>
<td>3.960%</td>
<td>1,049,400</td>
<td>898,112</td>
<td>806,487</td>
</tr>
<tr>
<td>2013</td>
<td>21,119,854</td>
<td>2,133,238,221</td>
<td>1.943%</td>
<td>1,926,131</td>
<td>9.120%</td>
<td>2,416,800</td>
<td>2,257,285</td>
<td>2,101,777</td>
</tr>
<tr>
<td>2014</td>
<td>22,383,158</td>
<td>2,215,147,150</td>
<td>1.943%</td>
<td>957,999</td>
<td>4.280%</td>
<td>1,134,200</td>
<td>1,081,191</td>
<td>1,045,360</td>
</tr>
<tr>
<td>2015</td>
<td>23,943,359</td>
<td>2,295,225,000</td>
<td>1.943%</td>
<td>0</td>
<td>0.000%</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>25,274,655</td>
<td>2,444,200,000</td>
<td>2.120%</td>
<td>0</td>
<td>0.000%</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2017 (proj)</td>
<td>26,500,000</td>
<td>2,500,000,000</td>
<td>2.120%</td>
<td>842,513</td>
<td>3.179%</td>
<td>829,744</td>
<td>774,752</td>
<td>707,466</td>
</tr>
<tr>
<td>2017 Projected average loss cost excludes 2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>3.179%</strong></td>
<td><strong>3.131%</strong></td>
<td><strong>2.924%</strong></td>
</tr>
</tbody>
</table>

---

- **Burn cost method**: take straight average and multiply by subject premium for 2017
- **Exposure adjusted with OL premium**: adjust trended ultimate losses with relative growth in on-level premium to 2017
- **Exposure adjusted with TIV**: adjust trended ultimate losses with relative growth in inflation adjusted TIV to 2017
- **Exposure adjusted with exposure rate in layer**: adjust trended ultimate losses with relative growth exposure rate to 2017
## Chapter 10: Traditional COPE and portfolio extensions

### COPE Assessment Matrix (for illustration only)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>C</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Occupancy</td>
<td>O</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Protection</td>
<td>P</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Exposure (e.g. industrial facilities)</td>
<td>E</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Amount of Insurance</td>
<td>A</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Replacement Costs</td>
<td>R</td>
<td>M</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Total Indicated (before validation)</td>
<td></td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td></td>
</tr>
</tbody>
</table>

### Impact Key (compared to US)

- **Direction**
  - Worse
  - Better
  - No difference

- **Magnitude**
  - H = High
  - M = Moderate
  - L = Low

1. With US as base, compare each COPE+ attribute
2. Tally up expected impacts and qualitatively weigh them by COPE+ attribute
3. See how compares to actual large loss experience
4. Use same procedure for Ground-up Loss Costs, but include Frequency component – COPE+FARM
Chapter 11: Large claim information and link to AOI

• Claims and exposures are notoriously difficult to link
  – but are required for any kind of reliable size-of-loss analysis

• Data collection
  – Data sourcing is complicated by the fact that different departments within a company may store different information

• Data quality and granularity
  – An important proxy for the exposure would be the TIV at location, however, this is often not available

• Small sample issues

• Integration of data sources:
  – there is very limited availability of public data sources
Chapter 11: Large claims information and links to AOI

• **(Re) insurers**
  – FGU loss available through a variety of sources, but often in no systematic way
  – Data sourcing / validation can be a long and costly process

• **London market**
  – FGU loss typically **not** available via Xchanging

• **Illustration:** Asia-Pacific FGU loss data sources across anonymous contributors
Chapter 11: Example - Occupancy classification

- **IICI data snapshot (anonymized figures)**
  - Claims and exposures inflated to 2014 levels to ensure comparability
  - USD as reference currency, but original currency (Ocy) info available
  - Data validated across contributors (London market overlap rate clearly high)

- **Refinements**
  - FGU split into PD, BI, TPL, fees often available
  - TIV information still a challenge (both sourcing and anonymization): band, average, median, min/max, top location, etc.
Chapter 11: Some recent data projects

- **London market large commercial risks dataset**
  - Lloyd’s syndicates, Insurance Intellectual Capital Initiative (IICI), and Imperial College London
- **Asia-Pacific large commercial risks dataset**
  - SCOR, Hiscox, Liberty, Nanyang Business School, and Imperial College London
- **Fire Protection Agencies**
  - Verisk/ISO and Imperial College London
- **LMA Loss & Exposure Data Working Group**
  - Property & Energy, Cargo & Hull data enrichment strategies

- Limited claims data for some geographical regions
- Linking claims and exposures is a challenge
- Significant heterogeneity by occupancy type & location
Chapter 12: Price monitoring (Rate changes)

- Property reinsurance submissions provide limited information about rate changes
- Cedants do not provide examples or explanations of how they calculate rate changes
- Rate changes may not be aligned with historical premium presented (written vs. earned)
- Paper presents detailed examples of how rate changes should be calculated according to Lloyd’s Minimum Underwriting Standards
Chapter 12: Price monitoring (Rate changes)

• Premium rate change
  – Changes in premium rate
  – Changes in exposure (TIV), coverage and limit/attachment

• Risk Adjusted Rate Change
  – Also includes elements of experience
    • Changes in view of risk: better/worse than expected experience
    • Claims inflation
    • View as the change in expected loss ratio
Chapter 12: Price monitoring
(Rate changes)

Premium rate change
• 5% reduction in rate
• No changes in exposure, coverage of limits/attachment
• Rate change = -5%

Risk adjusted rate change
• Assume average claims inflation is 3% p.a.
• Apart from -5% rate reduction, expected loss cost is adjusted by 3% from previous year
• Renewal IELR = Expiring IELR*1.03/0.95 = 1.0842 x Exp. ILER
• RARC = -7.77%
Chapter 12: Price monitoring (Rate changes)

• Rate change is key assumption in experience rating
  – Gross loss ratio for exposure rating
  – Burning cost for excess of loss layers

• If RARC takes into account inflation could be double counting
  – Previous example RARC -7.77 including 3% claims inflation
  – For experience rating no need to further adjust claims for inflation
  – Explicit explanation to reinsurers
Rate monitoring at Lloyd’s (Underwriting Minimum Standards)

• Monthly report (PMDR)

• Breakdown overall rate change in key components
  • Change in limits, deductibles, attachments (L/D/A)
  • Change in coverage
  • Change in other factors (everything else)

• Convention
  • (+ %) means more coverage or exposure
  • (- %) means less coverage or exposure

• Prescriptive approach but not consistently followed
Rate change example

Rate change should be done on ultimate premium on a 100% basis, not including your share of the policy.

<table>
<thead>
<tr>
<th>Expiring premium</th>
<th>£100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change due to L/D/A</td>
<td>120%</td>
</tr>
<tr>
<td>Change due to coverage</td>
<td>110%</td>
</tr>
<tr>
<td><strong>Other factors</strong></td>
<td></td>
</tr>
<tr>
<td>Change due to exposure</td>
<td>130%</td>
</tr>
<tr>
<td>Change due to mix</td>
<td>x 90%</td>
</tr>
<tr>
<td>Change due to other factors</td>
<td>117%</td>
</tr>
<tr>
<td><strong>Risk Adjusted Expiring premium</strong></td>
<td></td>
</tr>
<tr>
<td>£100,000 x 1.2 x 1.1 x 1.17 =</td>
<td>£154,440</td>
</tr>
<tr>
<td><strong>RARC = (Renewal Premium / RA Expiring Premium)</strong></td>
<td>£125,000/£154,440 = 80.94% (19.06% rate reduction)</td>
</tr>
<tr>
<td>Renewal premium</td>
<td>£125,000</td>
</tr>
</tbody>
</table>
Chapter 13: Winner’s curse – Competitive bidding - 1 company

Assumptions: Company A has superior pricing model with model results = actual losses
Winner takes all and a 50% illustrative loss ratio
## Winner’s curse – Competitive bidding - 4 companies

### Scenario 2

<table>
<thead>
<tr>
<th></th>
<th>Pillow Manufacturer w/sprinkler</th>
<th>Pillow Manufacturer w/o sprinkler</th>
<th>Pillow &amp; Dynamite Manufacturer w/sprinkler</th>
<th>Dynamite Manufacturer w/sprinkler</th>
<th>Dynamite Manufacturer w/o sprinkler</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>0.50</td>
<td>0.75</td>
<td>1.25</td>
<td>2.50</td>
<td>5.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Company B</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>12.50</td>
</tr>
<tr>
<td>Company C</td>
<td>0.55</td>
<td>0.68</td>
<td>1.38</td>
<td>2.75</td>
<td>5.50</td>
<td>10.85</td>
</tr>
<tr>
<td>Company D</td>
<td>0.60</td>
<td>0.90</td>
<td>1.50</td>
<td>2.00</td>
<td>4.00</td>
<td>9.00</td>
</tr>
<tr>
<td>Actual Premium</td>
<td>1.00</td>
<td>1.35</td>
<td>2.50</td>
<td>4.00</td>
<td>5.00</td>
<td>13.85</td>
</tr>
</tbody>
</table>

### Assumptions:
- Company B uses one rate for all Manufacturing, with no adjustments for COPE characteristics.
- Companies C and D have somewhat inferior pricing models compared to Company A.
- Winner takes all and a 50% illustrative loss ratio.

---

20 February 2017
The insurer with the superior pricing model and benchmarking data has a significantly better loss ratio. However…

Winner’s curse illustration – Loss of market share

- By getting the price more accurate, the insurer with the superior model loses business to competitors with inferior models.
- The insurers with inferior models will underprice sufficiently enough to win the business on a more frequent basis.

Bias in data provision

- **Cedants incentives**
  - Better data may lead to more accurate risk assessment (expected loss cost)
  - Would only better risks provide such data?
  - Would risks with insufficient data be assumed to be worse risks?
  - Hard vs. soft market incentives

- **Reinsurers incentives**
  - Not all reinsurers request same information
  - Internal referral processes greatly drive request for information
  - Detailed modelling vs. timeliness – first one to quote
Chapter 14: Link risk excess submission to cat programme submission

- Cat submissions contain an immense amount of detail
- Cat submissions can supplement, augment or inform the basic limit profiles that often accompany property risk submissions
- If premium is allocated to location and a non-cat limit is coded, exposure rating calculations on an individual location basis are possible
- Things to check to avoid a distorted view of the business:
  - Does the cat file represent ALL or only PART of the business?
  - Is the file coded with the proper limits and deductibles?
Chapter 15: Country specific issues

• Issues related to specific countries, as well as the quality of information available, varies greatly by geographic region.

• In the US, valued policy statutes alter the application of indemnification, total insurable value, and the concept of or limit assignable to a specific property’s Probable Maximum Loss (PML). Twenty US states currently maintain valued policy statutes.

• The submission in Japan reinsurance market is very unique because the PML estimation is very common.

• Emerging markets have issues such as: rate change not available, large loss threshold amounts not provided, only the diagonal of a triangle is available, cat exposures not provided, etc.

• In emerging markets, many insurers grow very quickly and the structure of their reinsurance arrangement is often changed every few years.
Closing remarks

• Considerable gap between information provided in submission and requirements for thorough reinsurance pricing

• Problem builds up from insurance company’s rating models

• Key data items significant impact on pricing

• Commercial considerations
  – Incentives: hard vs. soft market
  – Winner’s curse
  – Bias in data
QUESTIONS?