The latest issues surrounding catastrophe modelling
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Lloyd’s Catastrophe Modelling
29 March 2011

Agenda

• RDS a critical part of catastrophe modelling
• Lloyd's Catastrophe Model
• Emerging risks
RDS
A critical aspect of catastrophe modelling

The role of exposure management

- Exposure Management is responsible for managing the aggregation, or potential accumulation of risks and reinsurance within individual syndicates and across the Lloyd’s market, and alerting the market to emerging risks

- Principal activities include:
  - Assessing managing agent exposure management competencies
  - Operating the Realistic Disaster Scenario framework
  - Monitoring reinsurance performance and trends
  - Researching and raising awareness of emerging risk issues
  - Quantifying cat risk contribution in capital model
The RDS process

- 17 structured scenario-based questions
- Mixture of Natural & Man-made catastrophes
- Tests syndicate and market resilience to thematic major disasters
- Deterministic framework
- Reported January and July

The scenarios

<table>
<thead>
<tr>
<th>Generic Scenarios</th>
<th>Compulsory Scenarios</th>
<th>Industry loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Marine Event</td>
<td>8 Two Event (Northeast US windstorm followed by Caribbean windstorms)</td>
<td>$76bn + $36bn</td>
</tr>
<tr>
<td>2 Loss of Major Complex</td>
<td>9 Florida Windstorm</td>
<td>$125bn</td>
</tr>
<tr>
<td>3 Aviation Collision</td>
<td>10 Gulf of Mexico Windstorm</td>
<td>$111.5bn*</td>
</tr>
<tr>
<td>4 Satellite Risks</td>
<td>11 European Windstorm</td>
<td>€23bn</td>
</tr>
<tr>
<td>5 Liability Risks</td>
<td>12 Japanese Typhoon</td>
<td>¥1.5tn</td>
</tr>
<tr>
<td>6 Political Risks</td>
<td>13 California Earthquake</td>
<td>$78bn</td>
</tr>
<tr>
<td>7 Alternative RDS: A/B</td>
<td>14 New Madrid Earthquake</td>
<td>$47bn</td>
</tr>
<tr>
<td></td>
<td>15 Japanese Earthquake</td>
<td>¥8trn</td>
</tr>
<tr>
<td></td>
<td>16 UK Flood</td>
<td>£0.2bn</td>
</tr>
<tr>
<td></td>
<td>17 Terrorism</td>
<td>N/A</td>
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</table>
Benefits of RDS

- A standardised framework for assessing syndicate and market cat risk over time
  - Open and transparent, very easy to explain to non-specialists
- Encourages a disciplined approach to monitoring and managing risk
  - Company specified Alternatives drives good behaviours
- Business planning tool for future exposure levels
- Understanding reinsurance counterparty concentration risk
- Standard stress tests for Capital setting
- Useful to assess losses in actual catastrophes
- Widely used beyond Lloyd’s, both in London and globally
- Publicly available: www.lloyds.com/rds

How RDSs are used at Lloyd’s

- Syndicate cat and large loss potential
- Lloyd’s market risk => NCF adequacy
- Benchmark exposure management process
- Supports Rating process
- Stress & scenario testing of capital setting
- US Trust Fund implications
- Understand Reinsurer concentration\credit risk
Overview

- Scenarios miss things and have probability zero
- Lloyd's has some unique challenges
- Following reflects current thinking; may change
Model flow diagram

In-force view
Creating RMS years

Create peril/model/version groups

© Lloyd's
Peril copula

- Captures dependency between offshore and onshore energy
- Allows for teleconnection modelling in future (if any)

<table>
<thead>
<tr>
<th>Rank/Year</th>
<th>WM, WS</th>
<th>US, WS</th>
<th>US, EQ</th>
<th>EU, WS</th>
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<tbody>
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<td>2</td>
<td>5</td>
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</tbody>
</table>

Random rank alignment

Rank dependency based on AIR model

Rank matching
Allocating to year of account etc

Business profiles
Multiple years of account and calendar years

Each line in the graphic above can be expressed as a function, B:

\[ B(month, \text{calendar year}, \text{YOA}) \]

Creating a volume index

\[ l(month, \text{calYear}, \text{YOA}) = \frac{B(month, \text{calYear}, \text{YOA})}{\sum_{\text{YOA}} B(\text{in-force date, calYear, YOA})} \]

- Splitting in-force into YOA
- Allowing for growth

\[ \sum_{\text{YOA}} l(\text{in-force date, calYear, YOA}) = 1 \]
Peril profiles

$\sum_{\text{month}} P(\text{month}, \text{peril}, \text{region}) = 1$

Creating a combined index

$\text{combinedIndex} = \sum_{\text{month}} P(\text{region}, \text{peril}, \text{month}) \times I(\text{month, calYear, YOA, region, peril, COB, synd})$

Combined index = area
Augmented in-force data – YoA and Cal Year

\[ GL(\text{year, synd, region, peril, COB, YOA, CalYear}) = GL(\text{year, synd, region, peril, COB}) \times \text{combinedIndex(..., YOA, CalYear)} \]

Augment classes of business
Emerging risks

Don’t forget…
Don’t forget…
Help is available!

- Emerging risks team
- LRN and KTN
  - Links to research councils
  - Universities
- Lloyd’s special interests group
- Lobbying
  - Responsible innovation
  - Avoiding liability catastrophes

In summary…

- Scenario tests augment models – they’ll always have a role
- But scenarios miss things, stochastic modelling is valuable if suitably interpreted
- Lloyd’s catastrophe modelling takes high quality syndicate modelling and augments it to form a Lloyd’s view
- Models always leave things out…. ….keep thinking about emerging risks too.
Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.
The views expressed in this presentation are those of the presenter.