32nd ANNUAL GIRO CONVENTION

The Imperial Hotel, Blackpool
Focusing the effort on improving the accuracy of reserving

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Focusing the effort on improving the accuracy of reserving

- This workshop discusses certain key decisions that need to be taken when providing a central estimate and a range around it which a Board of Directors can use as input into their decision as to the level of reserves to be established in a balance sheet.
- The guiding philosophy is to narrow the areas of major uncertainty and then focus on those areas.
- The particular aspect to be discussed is, inside a category, the manner in which the data should be split, eg subdivided by size of claim or capped, and the levels at which this should take place.
Objective

- Example analysis: UK motor injury claims
- For different capping levels: to calculate probability distribution for gross reserve when:
  - There are potentially very large open and IBNR claims
  - Data on paid development of individual claims are available
  - Case estimates are highly uncertain on large claims
Overview of method

- Data adjusted for inflation by accident year
- Individual claim cap selected (e.g., £100k)
- Separate analysis of capped paid claims and excess amounts
- Results of capped and excess analyses combined to give final result
# Data

<table>
<thead>
<tr>
<th>Bands</th>
<th>Numbers of Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Claims</td>
<td>33,815</td>
</tr>
<tr>
<td>&gt; £50k</td>
<td>2,228</td>
</tr>
<tr>
<td>&gt; £100k</td>
<td>851</td>
</tr>
<tr>
<td>&gt; £250k</td>
<td>289</td>
</tr>
<tr>
<td>&gt; £500k</td>
<td>116</td>
</tr>
<tr>
<td>&gt; £1m</td>
<td>52</td>
</tr>
</tbody>
</table>
Capped £50k – Qtr 16: 84% - 91%
Capped £100k – Qtr 16: 78% - 88%
Capped £1m – Qtr 16: 59% - 74%
Fitted Paid Curves for different capping levels

Cumulative Amount as % of Estimated Ultimate

Development Quarter

%
Data needed for the analysis

- Capped Paid Triangle
- List of Claims for which the paid has exceeded the capping level
  - d-quarter
  - Inflated Excess Paid Amount to Date
  - Flag if Claim is closed
Overview of method

- Data adjusted for inflation by accident year
- Individual claim cap selected (eg £100k)
- Separate analysis of capped paid claims and excess amounts
- Results of capped and excess analyses combined to give final result
Analysis of capped claims

- Stochastic projection of aggregate capped paid amounts triangle
- Capped amounts of large claims included in capped triangle (to preserve development pattern)
- For the example analysis, we used basic chain ladder with Mack’s standard errors
- Produces best estimate and standard error of aggregate capped reserve (OS+IBNR)
Analysis of large claims (excess amounts) – step (a)

(a) Stochastic projection of future number of claims exceeding cap:

- gives best estimate and standard error of number that will exceed cap in future
- for the example analysis, we used Mack’s method on paid numbers exceeding cap
- use of incurred numbers and/or exposure-based stochastic method would be better for later accident years
Analysis of large claims (excess amounts) – step (b)

(b) Loss distribution analysis of individual claim amounts in excess of cap

- uses open (right-censored) and closed claims
- gives loss distribution of ultimate individual amounts in excess of cap
- ultimate loss distribution may depend on when a claim first exceeds cap
Analysis of large claims (excess amounts) – step (c)

(c) Combine (a) stochastic projection of number of claims that will exceed cap in future with (b) loss distribution for individual ultimate excess amounts

- gives aggregate excess probability distribution for ‘IBNR’ reserve (i.e., large claims that have not yet exceeded the cap)
- for the example analysis, we used Panjer’s method
Analysis of large claims (excess amounts) – step (d)

(d) For outstanding amounts on open claims that have already exceeded cap

- left-truncate appropriate loss distribution from step (b) at the amount paid to date: gives conditional distribution for the amount outstanding on each claim
- calculate convolution over all open claims of these conditional distributions
- gives aggregate probability distribution for amount outstanding on all open large claims
Diagram to illustrate step (d)
Example analysis – Step (a) ‘IBNR’

- Stochastic projection of future number of claims exceeding cap (‘IBNR’)

<table>
<thead>
<tr>
<th>Cap</th>
<th>£100k</th>
<th>£1m</th>
</tr>
</thead>
<tbody>
<tr>
<td>To date</td>
<td>851</td>
<td>52</td>
</tr>
<tr>
<td>“IBNR”</td>
<td>158</td>
<td>50</td>
</tr>
<tr>
<td>Std Error</td>
<td>31.3</td>
<td>28.2</td>
</tr>
</tbody>
</table>
Example analysis – step (b)

- Excess loss distributions analysed by development quarter when cap was exceeded
- Closed and open (right-censored) claims included in analysis
- Kaplan-Meier plots show non-parametric estimates of ultimate excess loss distributions
- MLE used to fit analytic curves to excess loss data for open and closed claims
- At all capping levels tried, there is evidence that ultimate amount tends to be higher for claims that exceed the cap earlier
Kaplan-Meier plots (cap = £100k)
Kaplan-Meier plots (cap = £1m)
Use of industry benchmarks

- For £100k cap, K-M plots and statistical tests show ultimate amounts higher if cap exceeded in first 10 development quarters
- Dataset of such claims comprises 45 open and 182 closed amounts excess of £100k
- Curves fitted by MLE subject to constraint on mean
- Mean ultimate amount excess of £100k derived from IUA data
Components of total reserve (£100k cap)

- Excess - OS d<=10
- Excess - OS d>10
- Excess - IBNR
- Capped
Components of total reserve (£100k cap)
Components of total reserve (£1m cap)
Components of total reserve (£1m cap)

pdf(x)

- Excess - OS
- Capped
- Excess - IBNR
Combining components

- Probability distribution for gross reserve by numerical convolution of the distributions for capped, excess-IBNR, excess-OS
- For capped component, used Log-Normal distribution fitted to moments give by Mack’s method
- Components approximated as independent (not quite true because capped claims used in all components)
- Could use judgemental correlations between components
### Example analysis – final results (£m)

<table>
<thead>
<tr>
<th>Cap</th>
<th>£100k</th>
<th>£1m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>St Error</td>
</tr>
<tr>
<td>Capped</td>
<td>48.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Excess-IBNR</td>
<td>50.4</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>(158 x £0.32m)</td>
<td>(50 x £2.0m)</td>
</tr>
<tr>
<td>Excess-OS</td>
<td>154.2</td>
<td>34.9</td>
</tr>
<tr>
<td></td>
<td>(167 x £0.92m)</td>
<td>(11 x £2.4m)</td>
</tr>
<tr>
<td>Combined</td>
<td>252.8</td>
<td>37.6</td>
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If number of ‘IBNR’ claims were known with certainty:

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<td>St Error</td>
<td>Mean</td>
<td>St Error</td>
</tr>
<tr>
<td>Capped</td>
<td>48.3</td>
<td>3.1</td>
<td>122.0</td>
<td>10.3</td>
</tr>
<tr>
<td>Excess-IBNR</td>
<td>50.4</td>
<td>9.1</td>
<td>100.8</td>
<td>19.4</td>
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Questions?