Individual claim loss reserving conditioned by case estimates

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The project

• Work carried out by Taylor Fry personnel
• Data (Medical Liability) provided by a large specialist insurer
• Supported by research grant of £15,000 from Institute of Actuaries for Stochastic Reserving

Why individual claim loss reserving?

• What is meant by individual claim loss reserving?
  • Or let’s call it micro-reserving
Why individual claim loss reserving?

- What is meant by individual claim loss reserving?
- Or let’s call it micro-reserving

Conventionally

Why micro-reserving (cont’d)

Raw data

<table>
<thead>
<tr>
<th>Claim 1</th>
<th>Claim 2</th>
<th>Claim 3</th>
<th>...</th>
<th>Claim n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of accident</td>
<td>Date of notification</td>
<td>Age</td>
<td>Gender</td>
<td>Income</td>
</tr>
</tbody>
</table>

Data Forecast
Forecast
Why micro-reserving (cont’d)

Raw data

Summary data

Accident period

Development period

Information lost

Why does quantity of data matter?

Volume of data

1 2

Data set

Out of reserve

1 2

Data set

Capital employed

1 2

Data set
One form of micro-reserving model

Raw data

<table>
<thead>
<tr>
<th>Claim 1</th>
<th>Claim 2</th>
<th>Claim 3</th>
<th>Claim n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>etc</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date of accident
Date of notification
Age
Gender
Income
etc

Data vector $X_i$ for claim $i$
One form of micro-reserving model

Raw data (finalised claims)

Date of accident
Date of notification
Age
Gender
Income
e tc

Data vector
Xi for
claim i

Parameter vector
Stochastic error

Yi = Xi β + ei

Why case estimates?

1. Simply more information
   • So more efficient prediction

Why case estimates?

1. Simply more information
   • So more efficient prediction
2. Tail data
   • Few finalised claims
   • Claim sizes often at their largest
   • So extrapolating heavy tail from few data points
   • But usually plenty of case estimate data

In “old” triangle terms

Data

Few data points
Factoring case estimates into model

• Natural to think in terms of modelling a development ratio:
  - **Finalised claim size**
  - **Current estimate of incurred cost**

• But what about nil claims? either
  - Nil finalised cost; OR
  - Nil current estimate of incurred cost

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Factoring case estimates into model (cont’d)

<table>
<thead>
<tr>
<th>Current estimate of incurred cost</th>
<th>Finalised claim size</th>
<th>Model required</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
<td>Severity</td>
</tr>
<tr>
<td>+</td>
<td>0</td>
<td>Frequency</td>
</tr>
<tr>
<td>0</td>
<td>+</td>
<td>Frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severity</td>
</tr>
</tbody>
</table>

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Final estimate of liability

• Possibilities are
  - Adopt the “paids” estimate
  - Adopt the “incurred” estimate
  - Adopt some mixture of the two

• There are two versions of the last
  - “**Blended**” estimate: weighted average of the two estimates for each accident year with weights dependent on accident year
  - “**Unified**” estimate: fit a generalised model that includes “paids” and “incurred” models as special cases
Some (very brief) results

<table>
<thead>
<tr>
<th>Model</th>
<th>Forecast</th>
<th>Predictive CoV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mack (chain ladder)</td>
<td>$808M</td>
<td>10.5%</td>
</tr>
<tr>
<td>Paid</td>
<td>$1,000M</td>
<td>5.3%</td>
</tr>
<tr>
<td>Incurred</td>
<td>$1,040M</td>
<td>5.3%</td>
</tr>
<tr>
<td>Blended</td>
<td>$1,021M</td>
<td>3.8%</td>
</tr>
<tr>
<td>Unified</td>
<td>$1,071M</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

Bootstrap distribution of unified forecast of loss reserve

Conclusion

- Micro-reserving useful as a means of reducing prediction error associated with liability estimates
- Can be carried out by means of a “paid” model
- Significant further reduction may be achievable by extension of the model to include case estimates