Allowing for Qualitative Risk: Reserving and capital collide...

MUQ Working Party

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The Measuring Uncertainty Qualitatively (MUQ) Working Party

- After developing a Reserve Uncertainty Framework, we now seek to enable practitioners to be more confident in allowing for qualitative risks in day-to-day reserving activities including risk assessments.

1. Review Qualitative Methods
   - Started in 2015
   - Found two good leads:
     1. A company’s framework
     2. Australia’s framework

2. Develop Output
   - 2016: Created Reserve Uncertainty Framework
   - Wider view of uncertainty
   - Tailored to UK reserving actuaries’ needs

3. Publish output
   - 2017: Presenting at many events
   - Gathering feedback
   - Allowing for new TASs
   - Publishing refined framework in 2018

4. Uses in Capital...
   - How could we help reserve risk assessments?
   - Also looking at Israeli regulations
   - And IFRS 17...
Bootstrapping – Quick Recap

- Why Uncertainty?
- Reality != Expectation
- Could be due to,
  - Expectation not accurate
    - Model not suitable (Model uncertainty)
    - Parameters not accurate (Parameter uncertainty)
  - Reality never matches expectation (Process uncertainty)
- Does history entirely line up with expectations? NO!
- The future could behave in the same manner!
- Get something extra out of existing historical data.
Expectation vs Reality

- Differences feed into residuals
- Some assumptions:
  - Paid/Notified, Gross/Net
  - Inflate data?
  - Data points to include/exclude
  - Pattern (All, Last 5, etc.), Tail or not?
More Choices along the way…

- Method (Mack / ODP)
- Derived from residuals
  - Scale factor (ODP) / Alpha (Mack)
  - Process uncertainty distribution
  - Parameter uncertainty distribution
- Scaling (additive / multiplicative / others)
- Adjustments for tail
- Heteroscedasticity
- Other variants of bootstrapping
- Further loading for uncertainty
Scenario 1: Two insurers merge

- *Onwards and upwards insurance* (A) acquires *Can’t be too careful insurance* (B) which is about half the size and also a motor insurer
  - The acquisition’s due diligence notes that pooling of risk should reduce the uncertainty

- During the merger, some employees unfortunately lose their jobs to realise expense savings and the claims are now handled by one team
  - The teams had two different ways of handling claims: *Onwards & Upwards* reserve on a known facts basis and *Can’t be too careful* are open about the benefits of their very prudent estimating philosophy

- It is 18 months later and the reserving actuary is doing their first risk assessment after some interesting reviews…
Bootstrapping of Scenario 1

- As noted in the due diligence, having the two portfolios should reduce capital requirements from the pooling of risk, however the reserve reviews haven’t been predictable from the pattern changes…

- Could we allow for the uncertainty in the bootstrapping parameters?
Initial bootstrap model runs (all years, reserves)

- As the pattern has changed, and we need to allow for the pooling of risk, a potential starting point could be the combined triangles (merger) run on paid claims.
- This is less like to be affected by the changes to claims teams and better reflect the inherent uncertainty compared to incurred with case estimates.

<table>
<thead>
<tr>
<th>Model Run (£k)</th>
<th>Mean</th>
<th>SD</th>
<th>1 in 4</th>
<th>1 in 10</th>
<th>1 in 20</th>
<th>1 in 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onwards and Upwards - Notified</td>
<td>4,302</td>
<td>1,432</td>
<td>5,066</td>
<td>5,977</td>
<td>6,598</td>
<td>8,615</td>
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<tr>
<td>Onwards and Upwards - Paid</td>
<td>3,912</td>
<td>2,543</td>
<td>5,528</td>
<td>7,428</td>
<td>8,491</td>
<td>10,789</td>
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<tr>
<td>Careful - Notified</td>
<td>-561</td>
<td>2,103</td>
<td>-26</td>
<td>660</td>
<td>1,162</td>
<td>7,546</td>
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<tr>
<td>Careful - Paid</td>
<td>-527</td>
<td>1,704</td>
<td>572</td>
<td>1,614</td>
<td>2,352</td>
<td>4,021</td>
</tr>
<tr>
<td>Merger - Notified</td>
<td>4,705</td>
<td>933</td>
<td>5,301</td>
<td>5,902</td>
<td>6,322</td>
<td>7,092</td>
</tr>
<tr>
<td>Merger - Paid</td>
<td>2,555</td>
<td>2,989</td>
<td>4,439</td>
<td>6,414</td>
<td>7,534</td>
<td>10,294</td>
</tr>
</tbody>
</table>
Bootstrapping adjusted

- When we know there is uncertainty beyond what we see, paid combined (merger-paid) may not be the place to stop...

<table>
<thead>
<tr>
<th>Step</th>
<th>Model Run (£k)</th>
<th>Mean</th>
<th>SD</th>
<th>1 in 4</th>
<th>1 in 10</th>
<th>1 in 20</th>
<th>1 in 200</th>
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<tr>
<td>Step 1 Merger - Notified</td>
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<td>4,705</td>
<td>933</td>
<td>5,301</td>
<td>5,902</td>
<td>6,322</td>
<td>7,092</td>
</tr>
<tr>
<td>Step 2 Merger - Paid</td>
<td></td>
<td>2,555</td>
<td>2,989</td>
<td>4,439</td>
<td>6,414</td>
<td>7,534</td>
<td>10,294</td>
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<tr>
<td>Step 3a Scaling Paid to Notified - Additive</td>
<td></td>
<td>4,705</td>
<td>2,989</td>
<td>6,589</td>
<td>8,564</td>
<td>9,684</td>
<td>12,443</td>
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<td>Step 3b Scaling Paid to Notified - Multiplicative</td>
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<td>4,705</td>
<td>5,504</td>
<td>8,174</td>
<td>11,810</td>
<td>13,873</td>
<td>18,953</td>
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<tr>
<td>Step 3c Scaling None</td>
<td></td>
<td>2,555</td>
<td>2,989</td>
<td>4,439</td>
<td>6,414</td>
<td>7,534</td>
<td>10,294</td>
</tr>
<tr>
<td>Step 4 Increase parameter uncertainty (10% increase in residuals)</td>
<td></td>
<td>4,705</td>
<td>3,246</td>
<td>6,754</td>
<td>8,836</td>
<td>10,137</td>
<td>13,157</td>
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<tr>
<td>Step 5 Increase process uncertainty (ODP to Lognormal)</td>
<td></td>
<td>4,705</td>
<td>3,312</td>
<td>6,781</td>
<td>8,834</td>
<td>10,113</td>
<td>13,706</td>
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<td>Step 6 External Loading (5% for ENIDs)</td>
<td></td>
<td>4,940</td>
<td>3,478</td>
<td>7,120</td>
<td>9,275</td>
<td>10,618</td>
<td>14,391</td>
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</table>
Bootstrapping adjusted – plots

Standard Deviation

1 in 200
Scenario analysis of the merger – a new pattern?

- The reserving team used a number of methods and much effort to come up with their neutral central estimate.
- There is some uncertainty on Careful but due to the larger size and sudden flatter development there is a greater magnitude of uncertainty on Upwards.
- Is it possible Upwards is now being more careful?

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Scenario analysis of the merger – the results

• The reserving team performed sensitivity analysis on the current-year results to demonstrate the uncertainty
  – For *Careful*, the low estimate considered a more recent set of development factors and the high estimate assumed this only affected the first development factor, giving ultimates from £7.2m to £8.6m
  – For *Upwards*, the possibility of two blocks of development factors before and after the merger is more evident and the low estimate places full reliance on them and the high no reliance, giving a range of £13.1m to £16.8m

• The reserving actuary spoke to members of the claims team to help estimate the likelihood of each current-year projection become a reality
  – *Upwards*’ pattern giving a total ultimate of £25.5m with a 10% chance of being as high or higher
  – Neutral central estimate £23.6m
  – *Careful*’s pattern £20.3m, 30% chance of being this low or lower
Comparing the current year results

- We can now compare the judgement-adjusted bootstrap result to the reserving actuary’s and operation’s estimates.

<table>
<thead>
<tr>
<th>Measure (£m)</th>
<th>Scenario</th>
<th>Raw bootstrap</th>
<th>Adjusted bootstrap</th>
<th>Actual*</th>
</tr>
</thead>
<tbody>
<tr>
<td>90th percentile</td>
<td>25.5</td>
<td>22.3</td>
<td>26.2</td>
<td>n/a</td>
</tr>
<tr>
<td>Mean</td>
<td>23.6</td>
<td>19.2</td>
<td>22.9</td>
<td>21.9</td>
</tr>
<tr>
<td>30th percentile</td>
<td>20.3</td>
<td>18.1</td>
<td>21.8</td>
<td>n/a</td>
</tr>
</tbody>
</table>

- Comparing the two methods of expert judgement gives some validation to results, but also gives rise to some questions…

- The scenario also allows a common sense explanation that can be challenged by subject-matter experts.

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Scenario 2 – Writing business in a new geography

• Able Explorers Insurance write casualty business and expanded into a new geographic territory called Utopia 3 years ago

• The insurance policy sold in Utopia is the same as in their current territory: The Doldrums

• However the actuary undertaking the reserve risk assessment has just been to a market conference in Utopia. Not everything is as similar as they thought. Whereas the statute of limitations is two years in The Doldrums, it is five years in Utopia and it’s no dreamland - a late rush of claims is common in Utopia!

• Obviously they have not seen this yet in the development curves and now need to assess their reserving ultimates and risk assessments
Scenario analysis of the potential late notified claims

- The reserving team undertook further research and discussed this with Utopia’s claim team (with some being experts in Utopia’s legal system)
- They believe that there is a possibility of 5% additional late claims that up to 15% could come through, although they note this is very unlikely. Allowing also for uncertainty on average cost of claims give the following scenarios

<table>
<thead>
<tr>
<th></th>
<th>Current year</th>
<th>Low</th>
<th>Central</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late claims</td>
<td>0%</td>
<td>5%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Claim numbers</td>
<td>23,483</td>
<td>24,979</td>
<td>26,273</td>
<td></td>
</tr>
<tr>
<td>Average cost</td>
<td>13,602</td>
<td>13,964</td>
<td>14,793</td>
<td></td>
</tr>
<tr>
<td>Ultimate (m)</td>
<td>319</td>
<td>349</td>
<td>389</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>-29</td>
<td>n/a</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
Scenario analysis – getting ready to compare

- The reserving team then sat down again with a number of colleagues from across the business to estimate their likelihood

- This gave a number of percentiles that can then be sense-checked to the adjusted bootstrapping and vice-versa to understand the potential uncertainty to advise the capital and reserving committees of Able Explorers Insurance

<table>
<thead>
<tr>
<th>Reference</th>
<th>Current-year Ultimate</th>
<th>All-year reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>33rd percentile</td>
<td>319m</td>
<td>319m</td>
</tr>
<tr>
<td>Mean</td>
<td>349m</td>
<td>358m</td>
</tr>
<tr>
<td>75th percentile</td>
<td>389m</td>
<td>403m</td>
</tr>
</tbody>
</table>
Unadjusted bootstrapping results

- The IBNR calculated is 346m versus 358m in reserving (the former not allowing for future claims and the later does)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Incurred</th>
<th>Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>346m</td>
<td>259m</td>
</tr>
<tr>
<td>75\textsuperscript{th} percentile</td>
<td>358m</td>
<td>283m</td>
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Bootstrapping adjustments

• Should we make use of the reserving scenarios and how could we do this?
• What external benchmarks could we use and could we combine with our own claims’ experience?
• Should we just use the reserving numbers and fit it to a lognormal?
Plans for the future

• Explore different models for impact of qualitative factors
• One such - **Individual Claims Reserving (ICR)**
  – Detailed methodology and increased number of assumptions
  – Increased flexibility in allowing for qualitative factors
  – Methodology diagram currently developed and is being reviewed
  – Intend to develop a prototype in R
  – Expected to help assess the impact of qualitative factors
• Intended for GIRO 2020
Conclusion

- Bootstrapping can give more meaningful results with a more careful consideration of model choice and in some circumstances adjusting for increased parameter and process uncertainty
- Scenarios are vital – percentiles can be misleading to ourselves and others
- Scenarios allow for sense checking, could be used to set expert adjustments and make the whole exercise much less of a black box
- Comparisons between scenarios and stochastic models add value in both directions
- This will be vital for risk margins in IFRS 17, where decisions around reserve uncertainty now also affect the profit and loss directly, as well as the regulatory balance sheet
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Chair required for the Measuring Uncertainty Qualitatively Working Party

• The current chair of the working party is stepping down to devote more time to leading GIROC (MUQ is a GIROC working party, so support will be available in the transition)

• This leaves a vacancy for others to develop their leadership skills whilst learning more about the art of allowing for uncertainty without needing to rely solely on percentiles from turn-the-handle bootstrapping. To apply, visit the link below

Reserve Uncertainty Framework