A Framework For Estimating Uncertainty in Insurance Claims Cost

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Agenda

• Why do we need a framework?

• Proposed Framework
  – Individual product group
  – Inter-product group dependencies

• Insights & Lessons Learned
### Why a Framework?

**Current Approaches have Limitations:**

<table>
<thead>
<tr>
<th></th>
<th>Implied Need</th>
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</thead>
<tbody>
<tr>
<td>Separate approaches to mean, variance, covariance</td>
<td>• Consistent approach based on the underlying distributional form</td>
</tr>
<tr>
<td>Bottom up approach – little work done on risk aggregation (diversification benefit)</td>
<td>• Portfolio approach based on estimating key uncertainties</td>
</tr>
<tr>
<td>Quantitative techniques for CoVs are costly, inconclusive and “backward-looking”</td>
<td>• An approach that looks at all sources of variability in estimates</td>
</tr>
<tr>
<td>No acknowledgement of subjective elements of the valuation basis</td>
<td>• A means of controlling and bringing accountability to</td>
</tr>
<tr>
<td>– Business information provided to the actuary</td>
<td>– Qualitative information provided to the actuary</td>
</tr>
<tr>
<td>– Assumptions made by the actuary</td>
<td>– the use of subjective judgement by the actuary</td>
</tr>
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</table>
The Framework in General

• Top-down approach to identifying key risks
  – Identification
  – Assessment
  – Quantification

• Goal is to make sure all sources of risk are identified and key risks quantified

• To this end, hierarchical risk categories are used (this also enables identification of dependence relationships between risks)

• Has broad similarities with approaches being developed for operational risk quantification (eg. Basel II AMA)
## Components of Risk

<table>
<thead>
<tr>
<th>Source of Risk</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Risk</strong></td>
<td></td>
<td></td>
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<tr>
<td>Independent Parameter Error</td>
<td>Process error in past data results in volatility in calibrating the model</td>
<td>Volatility in past results even if the process does not change</td>
</tr>
<tr>
<td>Process Error</td>
<td>Future insurance process has volatile outcomes relative to expected</td>
<td>Tossing of an unbiased coin 100 times will not always give 50 tails</td>
</tr>
<tr>
<td><strong>Systemic Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model Specification Risk</td>
<td>Model is an imperfect representation of complex real-life processes - includes &quot;systemic parameter error&quot;</td>
<td>Actuarial model assumes payments related to simplistic predictor (finalised claims) while process is more complex</td>
</tr>
<tr>
<td>Future Systemic Risk</td>
<td>Trends move systemically away from current realistic outcomes</td>
<td>Trends in inflation</td>
</tr>
</tbody>
</table>
Independent Risk

Risk Identification

• Quantitative techniques
• Formal modelling (eg. Bootstrapping), informal modelling (eg. Sensitivity analysis) and historic reserving variance

Risk Assessment

• Adjust results for major known systemic episodes
Model Specification Risk

Risk Identification

- Mainly qualitative techniques used to compare valuation methods
- Consistency of approach across product groups

Risk Assessment

- Balanced scorecard approach and use of risk indicators
- Calibration of model based on:
  - Actuarial model differences
  - Black box model outputs
  - Actuarial judgement!!!
Future Systemic Risk

Risk Identification

• Forward looking method
• Identify key risks by mapping business processes and interviews with business experts

Risk Assessment

• Key risks categorised into independent “risk buckets”
• Quantification using mix of qualitative and quantitative techniques
Inter-product Group Dependencies

- Risk categories identified gives power to measuring dependencies across different product groups

- Explicitly model root cause of dependencies
  - For example event risk, inflation risk, data risk
  - Explicit tail correlations can be separately identified and modelled
  - If you can’t identify dependencies then they probably don’t exist

- Stochastic simulation techniques can be used to model resulting dependencies
Practical Application of Framework

• Asbestos portfolio:
  – Qualitative investigations
    • Interviews with business experts (medical, legal, actuarial etc)
  – Sensitivity / scenario analysis under a probabilistic framework

• LMI portfolio:
  – Mainly quantitative methods used
  – Stochastic economic modelling
  – E Kelly, K Smith (2005)
Practical Application of Framework

Insurer with multiple lines of business:

- Mixture of quantitative and qualitative methods:
  - Quantitative approach to independent risk and event risk
  - Qualitative approach for model specification risk and other components of future systemic risk

- Consistency of assumptions across product groups:
  - Economic risk effects related to the mean term of liabilities
  - Model specification risk consistent method / quantification across product groups

- Root cause of dependencies identified and explicitly modelled
Insights & Lessons Learned

• Top few risks in a class often comprise over 90% of uncertainty
• Difficult to justify high correlations unless key risks or processes are shared
• “Multiplier” approach to premium liabilities is inherently flawed
• Some risks do not fall easily under commonly used distributions (eg events)
• Model specification risk is still a significant challenge requiring further work
Advantages of Proposed Framework

• A robust and forward looking framework
• Auditable, replicable and transparent process
• Consistency in:
  – approach to moment estimation
  – methods used between product groups and over time
• Premium liabilities treated appropriately
• No distributional limitations on risks or results
• Identification of key risks and control of subjectivity
• Dependencies explicitly identified and quantified