Pragmatic Stochastic Reserving

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Outline

- Context and motivation

- Working Party objectives

- Process for 'Reserve Variability Assessment'

- Methods, models and maths

- Practicalities

- Initial findings

- Next steps

Context and motivation

Reserve Variability Assessment (RVA)

- quantification of uncertainty
  - required by TAS R and in SAOs

- Australian 'Risk Margin'
  - 75% percentile, to ultimate

- UK ICAS regime
  - 99.5% percentile, to ultimate

- Solvency II regime
  - Solvency Capital Requirement
    - 99.5% percentile over one year
  - 'Risk Margin' ≡ cost of capital
    - similar to Swiss Solvency Test

Challenges

- reserving 'Best Estimate' (BE)
  - typically with manual adjustments
  - based on 'actuarial judgement'

- how is RVA related to BE process?
  - established theoretical models…
  - …don't accommodate adjustments

- practical questions
  - how to allow for data limitations?
  - is RVA consistent with BE?
  - what level of granularity?
  - how to aggregate lines of business?

The 'Generation Challenge'

- RVA is a detailed technical exercise
  - the models are sophisticated
  - the practical process is detailed and specific
  - so, RVA is delegated to more technical, relatively junior, staff

- but, senior actuaries tend to be less experienced in RVA
  - they won't have an intuitive feel for likely results
  - with consequences for the quality of oversight and peer review

- how do we educate senior actuaries in RVA?
  - how do we support newcomers to RVA more generally?

The Pragmatic Stochastic Reserving Working Party

- Objectives
  - sharing RVA practice amongst experts and newcomers
  - sharing RVA Excel tools based on common methods
  - testing these tools on data sets in the public domain
  - capturing 'minimum' and 'good' practice
  - developing 'RVA Practitioner Guides'
  - writing up our finding in a working party paper
  - reporting back to GIRO

Scope

- Three methods, in common practice

    1. Mack – analytic and Bootstrap variants

    2. Over-dispersed Poisson (ODP) - analytic and Bootstrap variants

    3. Stochastic Bornhuetter-Ferguson

- Focus

    – gross of reinsurance

    – line of business (Solvency II) level

    – limited adjustment for business knowledge

        • results primarily driven by numbers

    – 'Ultimate' view of risk

        • one-year view (Solvency II) for later

Systemic risk / model error

Step 1: Assessment of nature, scale and complexity of risks

SCR.1.19 The insurer should assess the **nature**, **scale** and **complexity** of the risks […]

Step 2: Assessment of the model error

SCR.1.21 Where simplified approaches are used to calculate the SCR, this could introduce **additional estimation uncertainty** (or **model error**) […]

SCR.1.23 Undertaking **are not required to quantify** the degree of **model error** in **quantitative terms** […] Instead, it is sufficient **if there is reasonable assurance that the model error included in the simplifications is immaterial**

One of the objectives of the working party is to give some guidelines on how to assess model error

Reserving and RVA Process Overview

Reserving

$LoB_1 \rightarrow BE_1$
$LoB_2 \rightarrow BE_2$
…
$LoB_n \rightarrow BE_n$
$\Sigma LoB_i \rightarrow BE_{Agg}$

Plus Held Margins
set by senior mgt

Reserve Variability Assessment

CoV_1
CoV_2
…
CoV_n

Plus Systemic Risk
additional uplifts to CoVs for variability not reflected in data

Aggregation

Correlation Matrix $\{\rho_{ij}\}$
…

Overall Results
75% Percentile →Risk Margin (Aus)
Cost of Capital →Risk Margin (EU)
99.5% Percentile →SCR (EU)
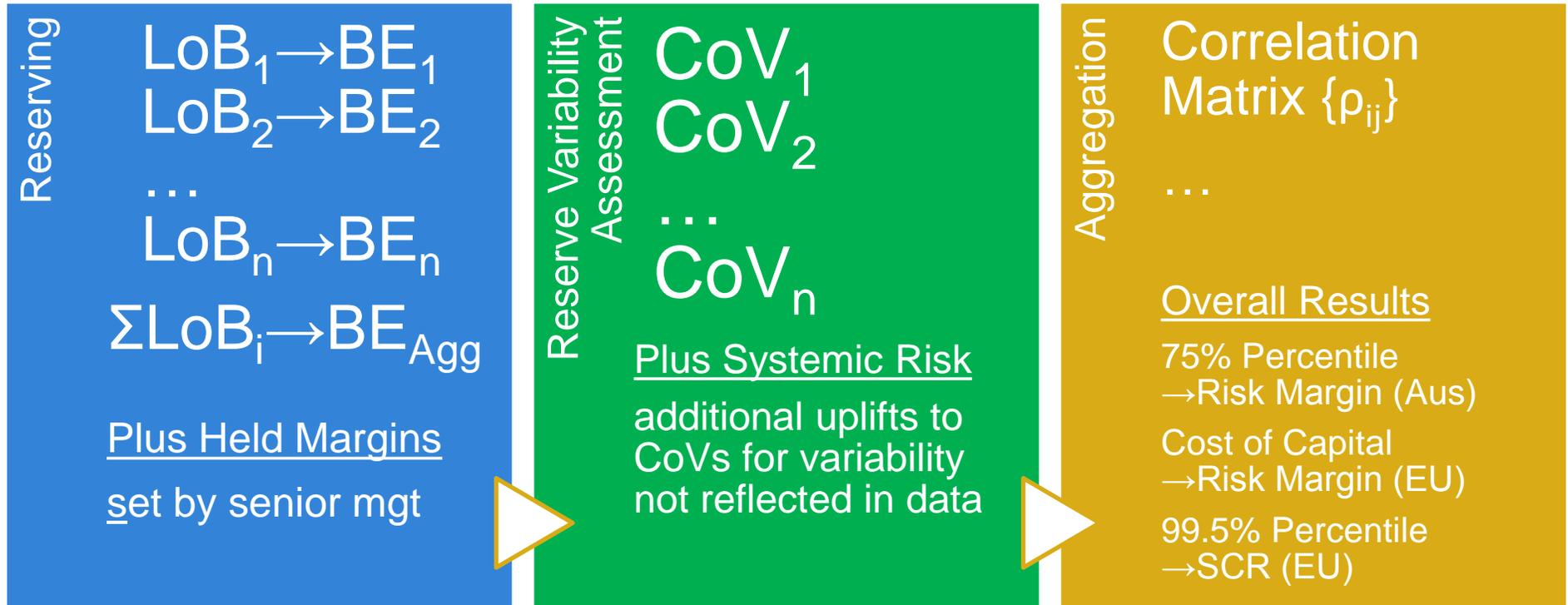
LoB: Line of Business
BE: Best Estimate

CoV: Coefficient of Variation
= standard deviation / mean

SCR:
Solvency Capital Requirement

Broader RVA Considerations

- Is data sufficient?

  - often 5 to 10 years, or more?

  - is there enough data for RVA model(s) to work?

  - as a limited sample, in time and scope, what is likely 'systemic' risk?

  - what systemic events are included and excluded?

- How should data be organised?

  - segmentation as for 'BE' exercise?

  - larger data sets (aggregating reserving LoBs)?

  - use Solvency II classes?

Methods, models and maths

- ## MACK

  - Mack (1993) – Distribution-Free Calculation of the Standard Error of Chain Ladder Reserve Estimates

  - England, Verral (2002) – Stochastic Claims Reserving

  - England, Verrall (2006) – Predictive Distributions of Outstanding Liabilities in General Insurance

Assumptions

- **Normal distribution** of observed link ratios $f_{i,j}$, with

$$E[f_{i,j}|C_{i,j-1}] = \lambda_j \text{ and } Var[f_{i,j}|C_{i,j-1}] = \frac{(\sigma_j)^2}{C_{i,j-1}}, j \geq 2$$

- **Log-link** function

Best estimate same as (Volume All) Chain Ladder model

Methods, models and maths

- **ODP**
  - Renshaw, Verrall (1998) – A Stochastic Model Underlying the Chain Ladder Technique
  - England, Verrall (2006) – Predictive Distributions of Outstanding Liabilities in General Insurance

Assumptions

- **ODP distribution** of incremental claims $P_{i,j}$, with $E[P_{i,j}] = m_{i,j}$ and $Var[P_{i,j}] = \phi m_{i,j}, j \geq 2$

- **Log-link** function

Best estimate same as (Volume All) Chain Ladder model

Methods, models and maths

- ## Stochastic BF

  – Mack (2008) – The Prediction Error of BF

  – Alai, Merz, Wuthrich (2008) – MSEP in the BF Claims Reserving Method: Revisited

Assumptions

- ## ODP assumptions

- ## A-priori estimates of ultimate costs are independent between AY, besides their uncertainty is estimated exogenously

- ## Incremental paid and a-priori estimates

> **Best estimate same as a BF model with underlying a Chain Ladder model (for development pattern)**

Practicalities

- Role of expert judgement

- Benchmarks

  – other data and industry studies

  – Australian Institute of Actuaries

- Treatment of outliers

- Treatment of catastrophes and large losses

- Accident year and underwriting year

Initial findings

- Difficult to define processes
  - overall 'flow diagram'
  - instructions and guidelines

- Technical and complexity barriers

- There is some data out there!
  - CAS and FSA/PRA returns

- RVA practitioners lack opportunities for comparing notes
  - but many are keen to share…

Next steps

- Review of commonly shared implementation models
  - e.g. CAS 'Downloadable Programs, Spreadsheets and Workbooks'

- Also, of public domain databases
  - e.g. CAS Loss Reserving Data from NAIC Schedule P

- Test RVA on sample lines of business
  - e.g. short, medium and long tail

- Capturing 'minimum' and 'good' practice from practitioners
  - beginning to draft 'Practitioners Guides'

Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.