Actuaries Institute.

GI reserving: Robust statistical process or artisanal cottage industry?

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Context

- Professional background
- Focus: techniques for setting OCL
- Basis for this discussion:
 - Experience in designing, implementing, operating and reviewing reserving processes (*views our own*).
 - Survey and structured discussions with senior reserving actuaries.
- Australian GI context: relative sophistication historically, e.g. use of PP methods and splits by payment type.
- BUT what is substantially different from 20 (or 30+!) years ago?



Current Practice





State of play | views from the industry



Participants

Large GIs, injury schemes, consulting firms, a reinsurer.

Portfolios of various sizes – statutory, short tail and specialty classes including cat-exposed and seasonal.

Some audit work.

Methodologies

Prevalence of traditional aggregate triangle techniques.

Stochastic approaches largely limited to parameterising risk margin.

Parameterisation

Some instances of automation or more sophisticated parameterisation for traditional methods.

For examples, claims-level analysis and ML within chain ladder framework.



State of play | views from the industry



Automation

Various examples of more automated processes using proprietary application-specific software or open source scripting languages

Benefits such as more frequent reserving and better governance.

Granular modelling

Some specific use cases of granular modelling for particular classes/portfolios (e.g. reported latent claims).

Largely deterministic approaches.

Other approaches

Some examples of aggregate (triangle) GLMs.

Used for central estimate and risk margin, as well as broader applications.



Reserving as statistical forecasting





Perspectives

- Is there any reason that loss reserving should not be viewed as an exercise in statistical forecasting?
 - Our broad view is that the answer is no (ie there is no reason).
 - It's partly a definitional question? What is statistical forecasting?
 - GLMs are the archetypal stochastic reserving models
- Historical perspective
 - 1972: Nelder, J.A. and Wedderburn, R.W.M. GLMs. Journal of the RSS; Invention of GLMs.
 - 1976: Coutts, Baxter & Ross. JIA First paper using GLM for pricing.
 - 1986: Taylor, G: *Claims reserving in non-life insurance*
 - **1989: McCullagh and Nelder**: *Generalized Linear Models* (2nd edition)
 - 1990: Wright, T. S. JIA; First large-scale use of GLMs in reserving.
 - 1995: Ferris, S, D et al; TIAA, *Pricing: Theory Practice & Control*
 - 2008: Wüthrich, M. V., and M. Merz, *Stochastic Claim Reserving Methods in Insurance*.
 - 2016: Taylor & McGuire: Stochastic loss reserving using Generalized Linear Models; CAS Monograph
- Implementation Pricing vs Reserving
 - Pricing widespread since early 1990s
 - Reserving not yet (widespread)



Approaches

- Statistical approach
 - Data review
 - Model definition/structure
 - Model implementation
 - Review results
 - Suite of standard model diagnostics
 - Redefine/respecify model?
 - It is not sufficient to decide, a priori, that, for example, "class X will be quarterly PPAC"
 - Are suitable information criteria reviewed to assess the predictor set?
 - Sounds a bit like control cycle?
- Chain Ladder-based methods can be constructed as statistical estimates
 - > CL mostly implemented
 - without statistical rigour;
 - without review of the underlying assumptions of the (implied) statistical model;
 - with unsystematic parameterisation;
 - by users unaware of the underlying statistical model;
 - without rigorous diagnostics
 - > They are treated as heuristic "models" to which "actuarial judgment" is applied.
 - How does "actuarial judgment" differ from data science?

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Machine learning (ML)

- Is ML a form of statistical modelling?
 - > Not in the sense that we use it in this paper.
 - We may refer to stochastic modelling (which would normally be some form of GLM)
 - LLMs are characterised as producing the next most probable token (word)
- If ML is not "statistical", it nevertheless shares many characteristics of the approach we advocate
 - Code/script based
 - Version control
 - > Data not entangled with model structure and implementation
 - ➤ The ML train is already here for reserving will we wave it by?



Better reserving: benefits & barriers





An illustrative example | *introduction*

- Scripting language (Python, R) log file (searchable)
 - Each note is sequentially added with a timestamp and user ID
 - Most notes are automated for example for a GLM:
 - model statement;
 - data summary;
 - output summary;
 - address of detailed output (may or may not vary; incl diagnostic charts);
 - user commentary;
- Model diagnostics
 - Consistent suite of standardized deviance residual (and other) plots quickly identify problems or model quality.
- Examples to come deviance residual heat map before and after change of model structure which would take ages with a spreadsheet.



An illustrative example | testing inclusion of a predictor



glm_anal(['OT2','EP2'],'PPCS ~ OT2:Seg + EP2',PPs,heat_axes,'OES2','S')



An illustrative example | GLM vs. traditional





mod_form = 'PPAC~ -1 + DP_grp + AP_grp + Seg', wts='A'



'Better' reserving * | some examples



Benefits

Speed & efficiency	Risk	Team engagement
Better use of actuarial time – focussing on the (material) judgements and strategic contributions.	Better process control, reduced frequency of operational risk incidents, confidence to stakeholders.	Relieve time pressure. New transferable skills, more engaging work.
Wider business benefits	Compliance & profession	Appropriateness
Opportunities for better monitoring, earlier detection of trends, strategic insights. Better monitoring, more frequent insights.	Easier ways to meet CPS320, GPS340, PG1, PS302 Credibility – rigorous mathematical and statistical underpinnings.	Adequately model trends in data – e.g. calendar period effects. Avoid over-specified models. Reduce bias and variance.

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Barriers | views from the industry

Upskilling & teams

- Skills to implement and operate more sophisticated approaches seen as a challenge (more so at corporates).
- Ability to interrogate and understand data will remain.
- Emerging role of dedicated modelling team – brings challenges as well as benefits.
- Challenge in upskilling analysts/actuaries to understand models in a more automated process.

Communication

- Education needed if changing methodologies. E.g. ResCom / Board familiarity with current approaches and exhibits.
- Buy-in from stakeholders such as auditors and EPR - a general reticent around change.
- Conversely, should be able to focus on the positives; e.g. identifying trends which may otherwise be overlooked, more easily breaking down drivers, supporting assumption setting and providing more narrative.

Budget & capacity

- Time for actuaries to invest in the process itself can be limited (particularly at some corporates).
- Benefits can be difficult to quantify.
- Impacts on audit budgets.

Barriers | ideas in response

Upskilling & teams

- Skills to implement and operate more sophisticated approaches seen as a
- Many free resources available. Draw on skills in other teams.
- Appetite from juniors to use 'modern' techniques.
- Consider retention and engagement.
 brings
 challenges as well as benefits.
- Challenge in upskilling analysts/actuaries to understand models in a more automated process.

Communication

- Education needed if changing methodologies. E.g. ResCom / Board familiarity with current
- Existing exhibits and MI are likely to be enhanced rather than compromised.
- More time for ad hoc investigations.
 - focus on the positives; e.g. identifying trends which may otherwise be overlooked, more easily breaking down drivers, supporting

providing more narrative.

Budget & capacity

- Time for actuaries to invest in the process itself can be limited (particularly at some
- There are means of quantifying the efficiency benefits.
- Other benefits can provide a competitive advantage.
- Investment in "AI" is topical!
- Potentially strong support from auditors for standardised outputs and better governed process.

Barriers | views from the industry

- Most cited barrier, although some variation by insurer.
- Consulting: a perennial issue for clients big and small – "masses of poor-quality data".
- Some note the difference to pricing – can't pick and choose datasets – and that upfront investment required for delayed benefits.
- Concern around over-reliance on data (lagging indicator).
- Some acknowledge as an easy excuse.

Judgemen

- Ease of overlaying judgement

 there will always be a need
 for this.
- One respondent noted that deterministic, aggregate methods can handle rapid changes in environment quite well.
- The more automated processes still face the challenges of volatility, and an ongoing need for human intervention.

Risk

- Risk profile of reserving is a problem - pricing you can fix on the fly if you have an issue; heavier repercussions for reserving.
- Aggregate models can do better at picking up systemic trends – could be dismissed as noise/insignificant at a more granular level.
- Concern about a lack of industry consensus on where to push things – stakeholders underscore this conservatism.



Barriers | ideas in response

Data	Judgement	Risk
 Most cited barrier, although some variation by insurer. Consulting: a perennial issue 	 Ease of overlaying judgement there will always be a need for this. 	 Risk profile of reserving is a problem - pricing you can fix on the fly if you have an issue;
 Quality affects all algorithms / models – unlikely to (uniquely) preclude a GLM, for example. Model specification can incorporate forward-looking indicators and judgement. 	 The mechanisms to overlay still exist (may look different). Argument for overlaying judgement <i>sparingly</i> – bias. Judgements can be more explicit and better supported. 	 Can move slowly – e.g. incremental changes and/or parallel runs to iron out kinks. Retain aggregate modelling in parallel with granular (low cost).
 Concern around over-reliance on data (lagging indicator). Some acknowledge as an easy excuse. 	challenges of volatility, and an ongoing need for human intervention.	 Concern about a lack of industry consensus on where to push things – stakeholders underscore this conservatism.



Achieving change: individuals & teams





Action plan | bringing challenge to the status quo

Build the business case

- Measure current process quantify time spent on each aspect, categorise and analyse.
- Identify and articulate the risks inherent (but perhaps hidden) in the current process potential or realised operational risk incidents (e.g. hard-coded overrides, old links, formula errors), delayed identification of trends in data and whether the process is defensible to auditors and regulator.
- Identify and articulate strategic value e.g. insights, early warning, team capacity for other contributions.
- Consider team engagement.

Plan a pathway

- Map out the end state then prioritise ruthlessly; consider platform/tools, data, methodologies, reporting.
- Focus on the changes needed to achieve appropriate rigour and governance, given the available data and broader nature of the portfolio.

Get your team involved and upskilling

- Designing and prototyping
- e.g., have an analyst build a simple reserving GLM based on the (quite accessible) CAS Monograph*



Achieving change: the profession





Avenues for change

- We believe significant changes would benefit the profession.
- But GIPC/GIRWG may decide otherwise.
- Survey
- University/early training
- Formal institute training
- CPD
- Professional standards/information notes
- Commercial imperatives



Views from the industry

- Need for change:
 - Those who have implemented modern methods generally don't look back.
 - > Those without direct experience are less likely to think change is necessary.
- Avenues for change:
 - General preference for education program and CPD rather than professional guidance/standards.
 - Some potential risks with the trend towards more principles-based and less prescriptive guidance (leaving too much room for maneuver?)
 - Education
 - Mixed views (and some ideas) on Fellowship program content.
 - Readiness of newly qualified actuaries and progression to sign-off responsibility? Training actuaries to 'act and think like actuaries' (theoretical grounding less of an issue than practical application).
 - Some see universities as playing a role.
 - > CPD
 - Should support those that don't get exposure to ML through their work (and bring the more experienced/senior actuaries along).



University

- Are we a scientific institute?
 - ➢ If we are, we need strong technical skills.
 - > This implies strong mathematics.
 - > Do all actuaries need to be technical (?)
 - Course streaming?
 - More pathways for mathematicians/physicists etc into the profession?
 - Perhaps not so much mathematics but more "practical" statistics?
 - More emphasis on machine learning?
 - Go back to actuarial qualification as post graduate?



Professional courses & CPD

- Fundamental review of professional courses (iro reserving)?
 - More data science for GI? (If not covered at university.)
 - Practical implementations of stochastic reserving in GI course?
 - ➤ GIPC (GIRWG) to take lead with education committee.

• CPD

- > Is this necessary?
- > If you need to learn to code and do statistical analysis, you need to do get your hands dirty and do it.
- > There is no shortage of training material. My preferences (noted earlier):
 - McCullagh & Nelder
 - Taylor & McGuire
- What CPD for senior actuaries?
 - Do senior actuaries need to know all the details?
 - If the results, presented by the statistician/actuary do not "make sense", would a senior actuary see this?



Professional standards

- Is more needed?
 - > APRA CPS320: requirement to document key risks or limitations of methodologies in the AVR
 - > APRA GPS340:
 - Consideration given to, among other things, the robustness of the valuation models;
 - Comprehensive actuarial analysis and modelling techniques should be employed, subject to considerations of materiality
 - > PG1 requires the actuary to :
 - consider appropriateness of methodologies that have a known significant bias;
 - consider inconsistencies between methodologies used for different components of the work;
 - set model governance requirements, including a 'fit for purpose' requirement;
 - > PS302: "methods that incorporate actuarial principles which... are reasonable in the circumstances."
- Above implies, to me, requirement for more rigorous methods and hence no need for specific PS
- A practice note, on the other hand, may be prudent/helpful.



Wrapping up

- 'Traditional' triangle reserving algorithms remain dominant in Australian GI reserving.
- Those who have taken steps (be they small or large) towards more automation and/or more advanced approaches do see genuine benefits.
- We contend that the profession should be supporting and encouraging such steps through avenues such as university curricula, the Education Program and CPD.





Thank you

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