The Actuarial Profession
making financial sense of the future

General Insurance Reserving Seminar, 28 June 2010
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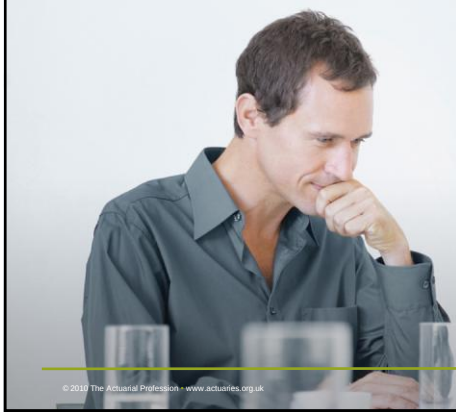


Performance Testing: Are you using the best reserving methods?

Today's agenda

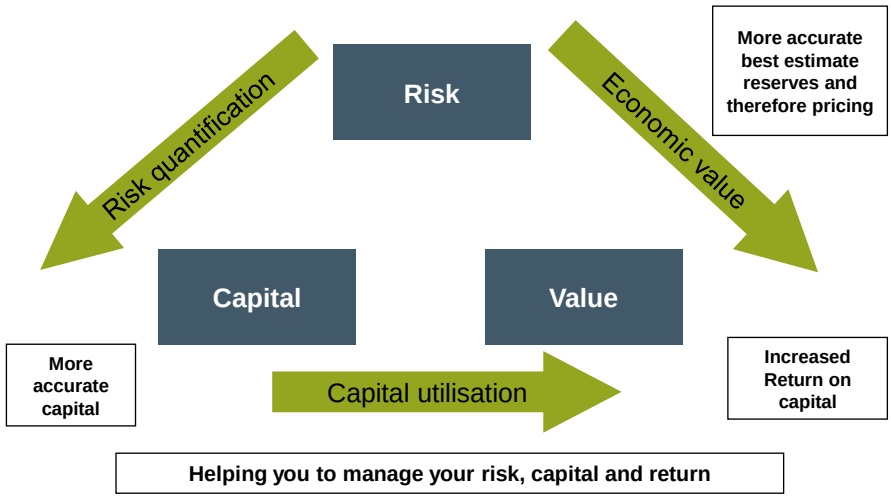
- Benefits of performance testing
- Defining the problem
- Performance testing — in general and in the context of reserves
- Embedding the reserving control cycle
- Case studies
- Conclusion

- This presentation is based on the paper "Loss Reserving: Performance Testing and the Control Cycle", authored by Yi Jing, Joseph Lebens, and Stephen Lowe, that was published in *Variance.* It is available at www.variancejournal.org

What do we mean by the best reserving methods?

Whatever method gets you closer to the actual outcome, on average, over time

Benefits of Performance Testing



How will you answer Article 47 of the Solvency II Directive: Actuarial Function and reserving?

1. Insurance and reinsurance undertakings shall provide for an effective actuarial function to undertake the following:
   a) to coordinate the calculation of technical provisions;
   b) to ensure the appropriateness of the methodologies and underlying models used as well as the assumptions made in the calculation of technical provisions;
   c) to assess the sufficiency and quality of the data used in the calculation of technical provisions;
   d) to compare best estimates against experience;
   e) to inform the administrative or management body of the reliability and adequacy of the calculation of technical provisions;
   f) to oversee the calculation of technical provisions in the cases set out in Article 81;
   g) to express an opinion on the overall underwriting policy;
   h) to express an opinion on the adequacy of reinsurance arrangements;
   i) to contribute to the effective implementation of the risk management system referred to in Article 43, in particular with respect to the risk modelling underlying the calculation of the capital requirements set out in Chapter VI, Sections 4 and 5 and the assessment referred to in Article 44.

Questions for the reserving actuary

- **How do you know that the methods you are currently using are the "best"?**
  - What evidence supports your selection of methods?
  - What are the optimal weights for combining the results of the methods?
  - How do you decide when to change methods?
  - What is the confidence range around estimates?
  - Cost/benefit of developing new data sources or implementing more complex methods?
  - How do you manage over-confidence?

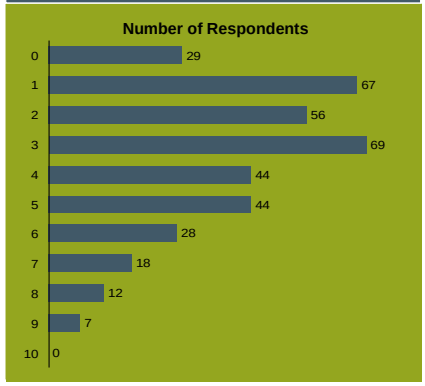
The results of our research illustrate the prevalence of overconfidence

Tillinghast Confidence Quiz

The Quiz

- Objective: To test respondents understanding of the **limits** of their knowledge
- Respondents were asked to answer ten questions related to their general knowledge of the global property/casualty industry
- For each answer, respondents were asked to provide a range that offered a 90% confidence interval that they would answer correctly
- Ideally (i.e., if "well calibrated"), respondents should have gotten nine out of ten questions correct

Raw Scores of Respondents



Note: based on 374 respondents as of 4/5/04.
Profile of respondents: 86% work in P/C industry; 73% are actuaries.

Using Performance Testing to improve results

An actuarial method consists of
- An algorithm
- A data set
- A set of intervention points

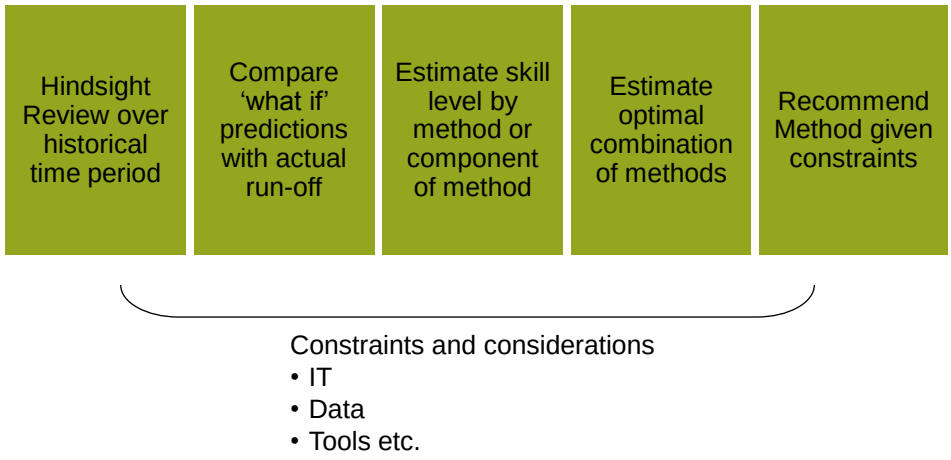
Without Performance Testing
Choose a combination of methods using 'actuarial judgment'

Result:
Subjective best estimate

With Performance Testing
Choose a combination of methods that optimises the formal measure of 'skill' in a rigorous manner

Result:
More accurate best estimate; validated

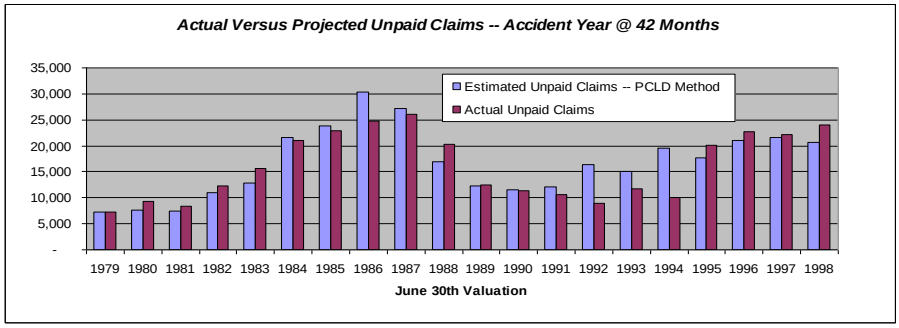
The Approach



Background to company data used in paper

- Commercial Auto BI Liability with heavy environmental influences that add difficulty to estimation
  - Economic and social inflation
  - Operational changes in claim department
  - Changes in underwriting posture

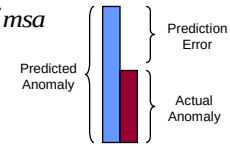
Performance testing is a formal analysis of prediction errors



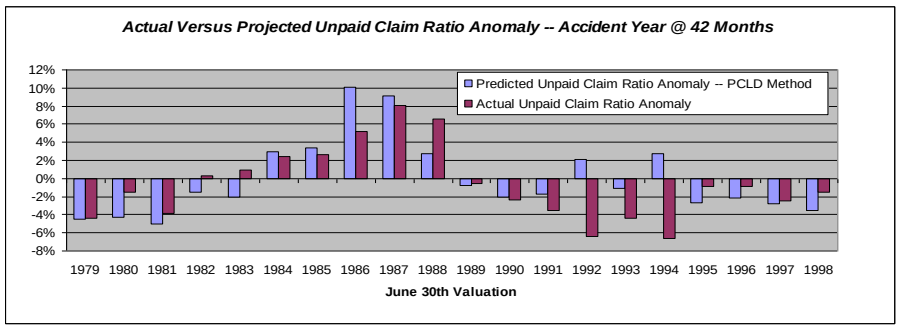
- Test a particular method by looking at historical performance – comparing estimates from the method with actual run-off
- Giving us insights into the most accurate method to use

Performance testing yields a formal measure of skill

$$Skill_m = 1 - mse_m / msa$$



- The skill of a method is measured by:
  - *mse* = mean squared error
  - *msa* = mean squared anomaly
- Skill is the proportion of variance "explained" by the method

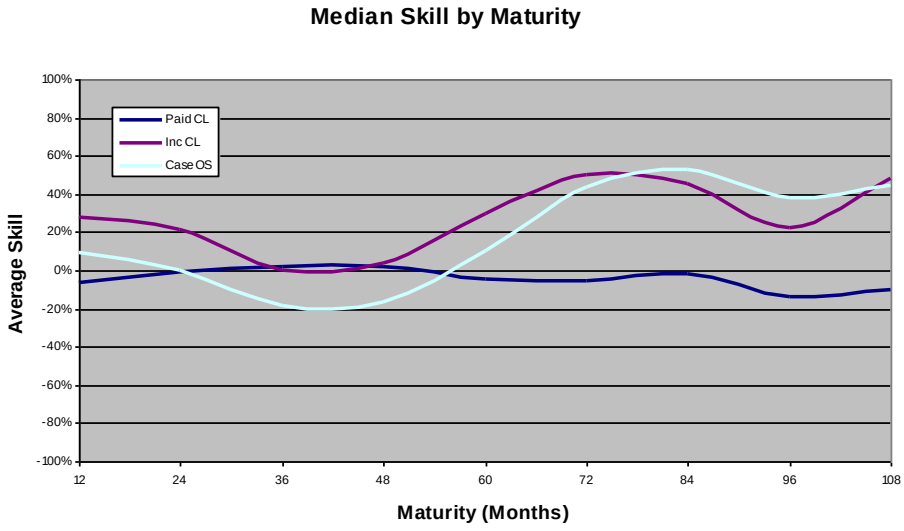


Actuarial methods subjected to performance testing

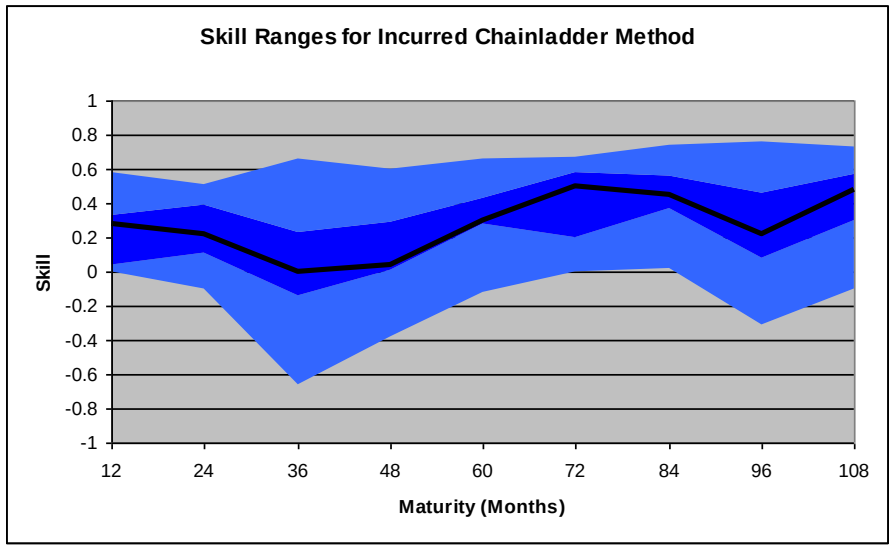
Actuarial Projection Method	Skill for Accident Year @ 42 Months	Overall Skill – for Latest Ten Accident Years
Paid Chain-Ladder	23%	13%
Incurred Chain-Ladder	52%	32%
Case Reserve Development	60%	22%
Reported Count Chain-Ladder	99%	99%
Case Adequacy Adjusted Incurred Chain-Ladder	52%	52%

- Note that absolute level of skill results are low due to changing case reserve adequacy and claim settlement patterns

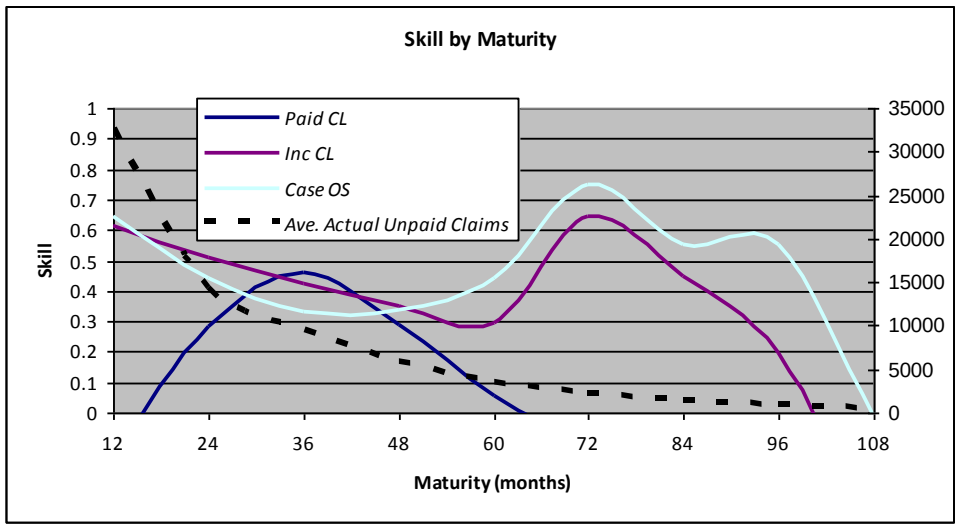
Case Study 1 - UK Private Motor: Median Skill scores by method and maturity



Case Study 1 - Distribution of Skill Scores by company

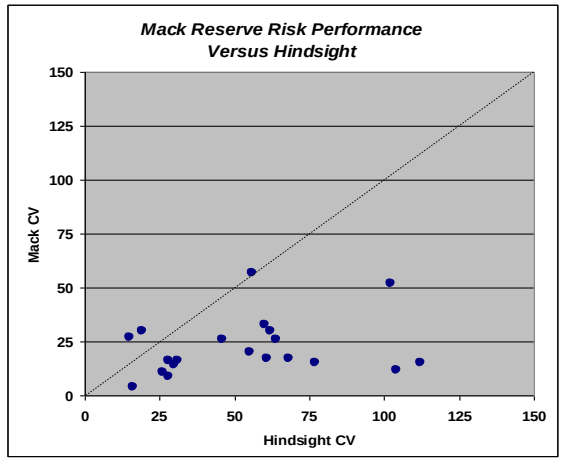


Case Study 1 - Company D Skill scores by method and maturity

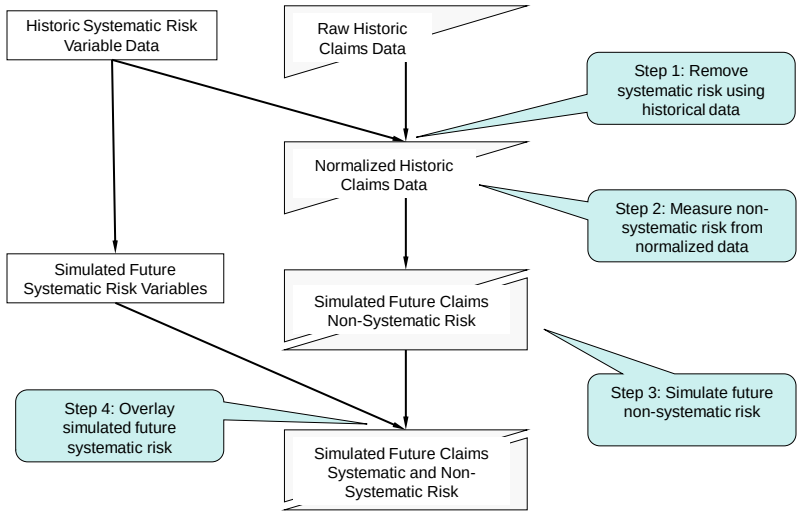


Case study 2 - Empirical hindsight performance test data indicates that Mack may understate reserve risk

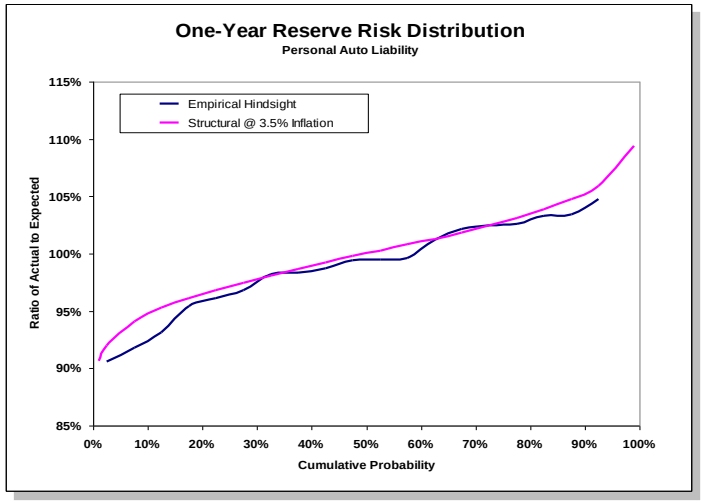
- Sample of 20 lines of business, “more difficult” US casualty lines
- Experience over a 15-20 year period
  - Historical best estimate reserve errors
- Mack based on most recent development triangle
  - includes parameter risk and tail factor volatility



Overview of structural stochastic claim liability simulation model

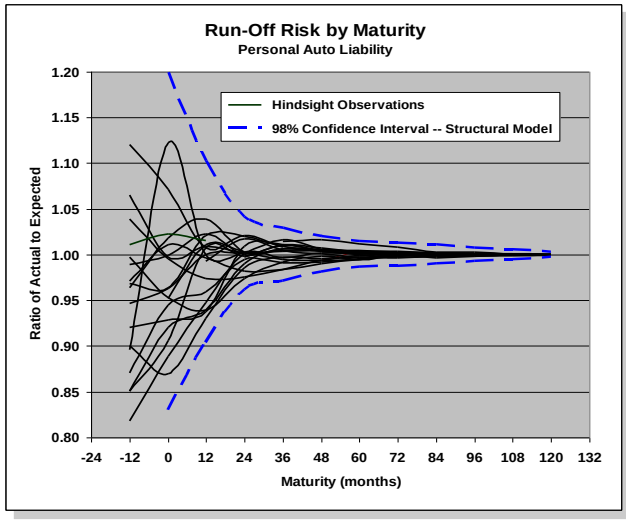


Validation results of the structural model look good!



- One can also validate the one-year model, by comparing the risk distribution generated by the model to historical one-year changes in estimates

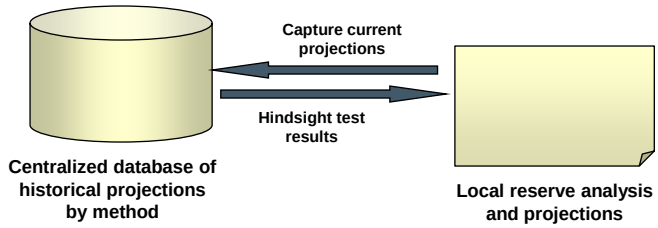
Validation can be performed by maturity



- Estimates of individual accident years at each maturity, expressed as a ratio to ultimate
- Collectively the historical data generates an empirical funnel of doubt
- The model's funnel should encompass most of the empirical

Case study 3 - Installing performance testing and a control cycle

- Corporate Actuary responsible for reserves set by decentralized organization of actuaries within each business unit
- Standard templates and database used to capture quarterly projections on an ongoing basis
- Actuaries review performance test results prior to each quarterly reserve-setting exercise; perform more detailed analysis annually

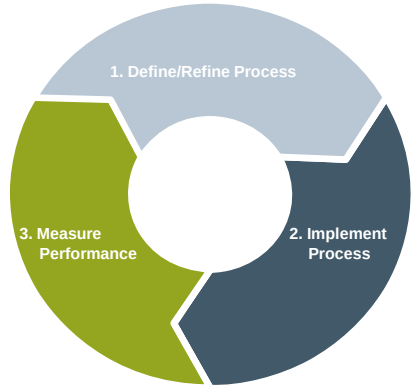


Embedding Performance Testing into Business Operations

The Actuarial Control Cycle for the Reserving Process
- Embedding Reserve Risk Management

Formal Performance Testing

- Are the current methods appropriate? Would changes to methods improve estimation skill?
- Are the data and other input accurate and sufficient? Would improvements or expansion of data improve estimation skill?
- Are there opportunities to improve process flow?
- Are emerging estimation errors within tolerance?



Reserving Process Elements

- Data used
- Actuarial methods employed
- Operational input
- Judgments and intervention points
- Process flow and timeline
- Quality assurance process

Ensuring the reserving approach is continually monitored and adapted as required

The best place to start is with a pilot project

- Test a few lines of business to gain some initial learnings
  - Lines where there is a ready data history
  - Cross-section of lines with varying degrees of difficulty
  - Test current methods and new methods
    - Stochastic methods versus traditional
    - Man versus machine
- Use learnings to educate staff and demonstrate value
- Develop plan for further implementation

Benefits of Performance Testing

- Supports Solvency II
  - Formal validation of best estimates and ranges
- Embeds reserving control cycle
  - Improve accuracy of estimates
    - Inflation risk
    - Reserving cycle
  - Manage over-confidence
  - Cost / benefit of enhancements to data and systems

Discussion

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