



The Actuarial Profession

making financial sense of the future

Performance Testing: Are you using the best reserving methods?

GIRO 2009, Edinburgh

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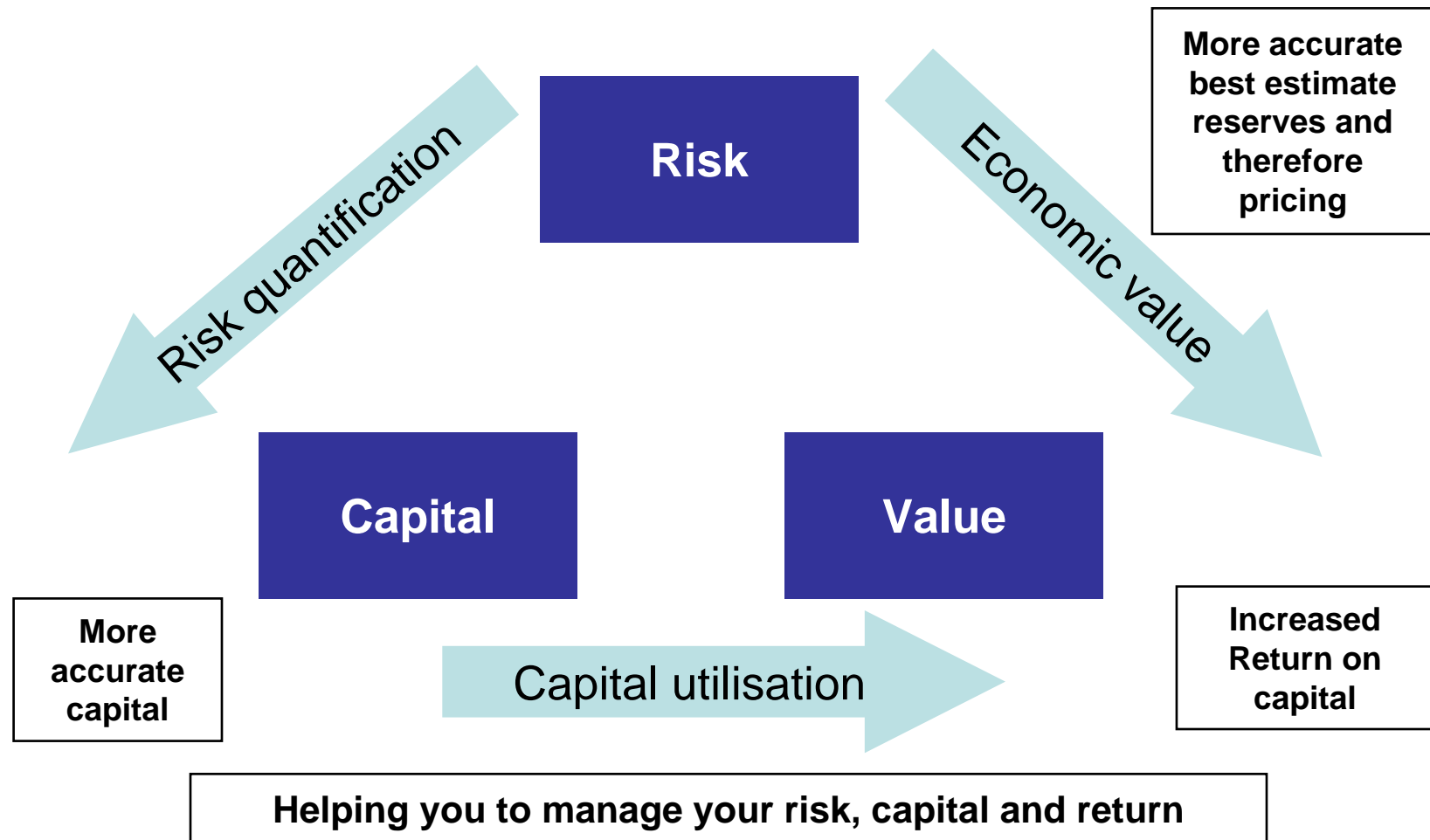
Today's agenda

- 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
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- 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 has recently been accepted for publication in *Variance*. It will be 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



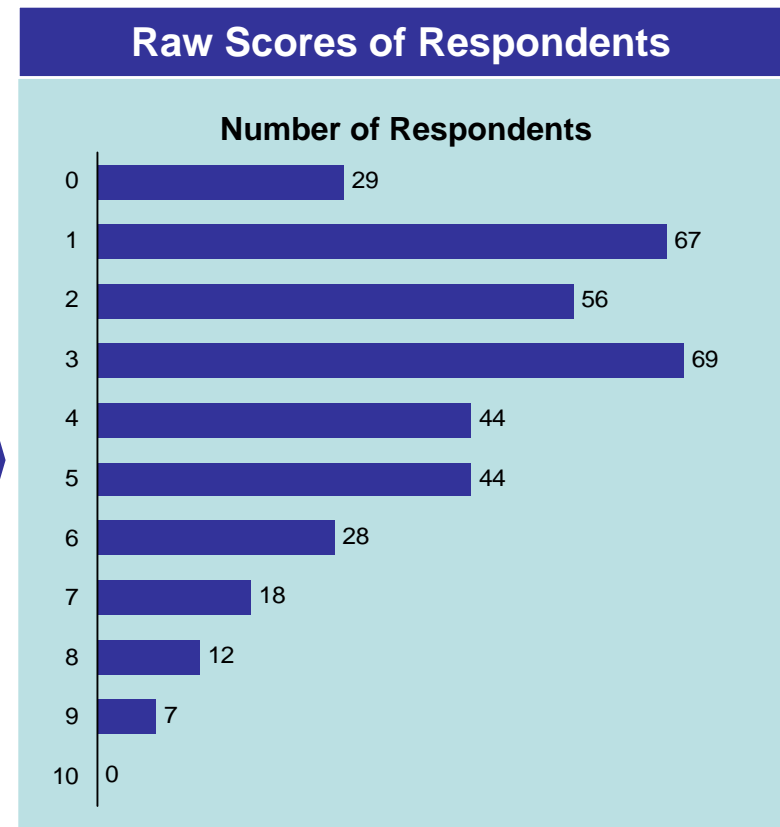
Questions for the reserving actuary

- **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



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

Hindsight
Review over
historical
time period

Compare
'what if'
predictions
with actual
run-off

Estimate
skill level by
method or
component
of method

Estimate
optimal
combination
of methods

Recommend
Method
given
constraints

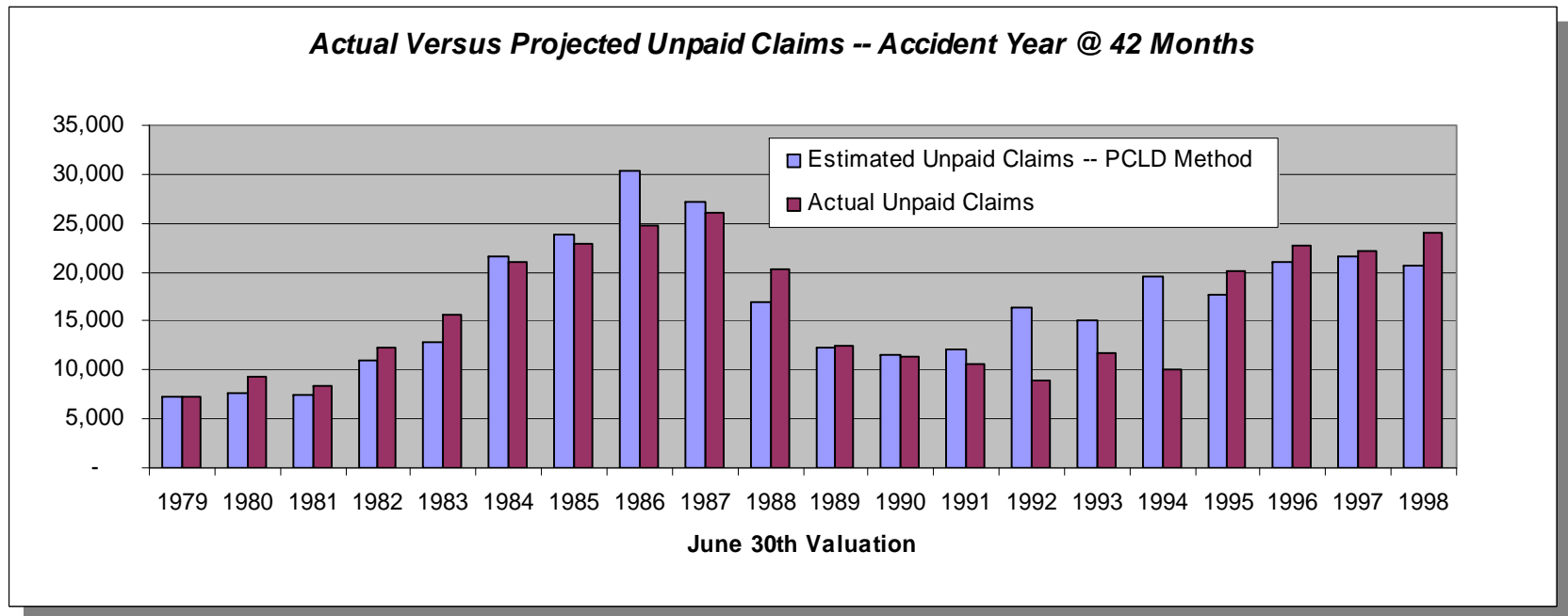
Constraints and considerations

- IT
- Data
- Tools etc.

Background to company data used in paper

- Commercial Auto BI Liability with heavy environmental influences
- Estimates of claim liabilities from 1979 to 1998
- Environmental influences during the period add difficulty to estimation
 - Economic and social inflation
 - Operational changes in claim department
 - Changes in underwriting posture

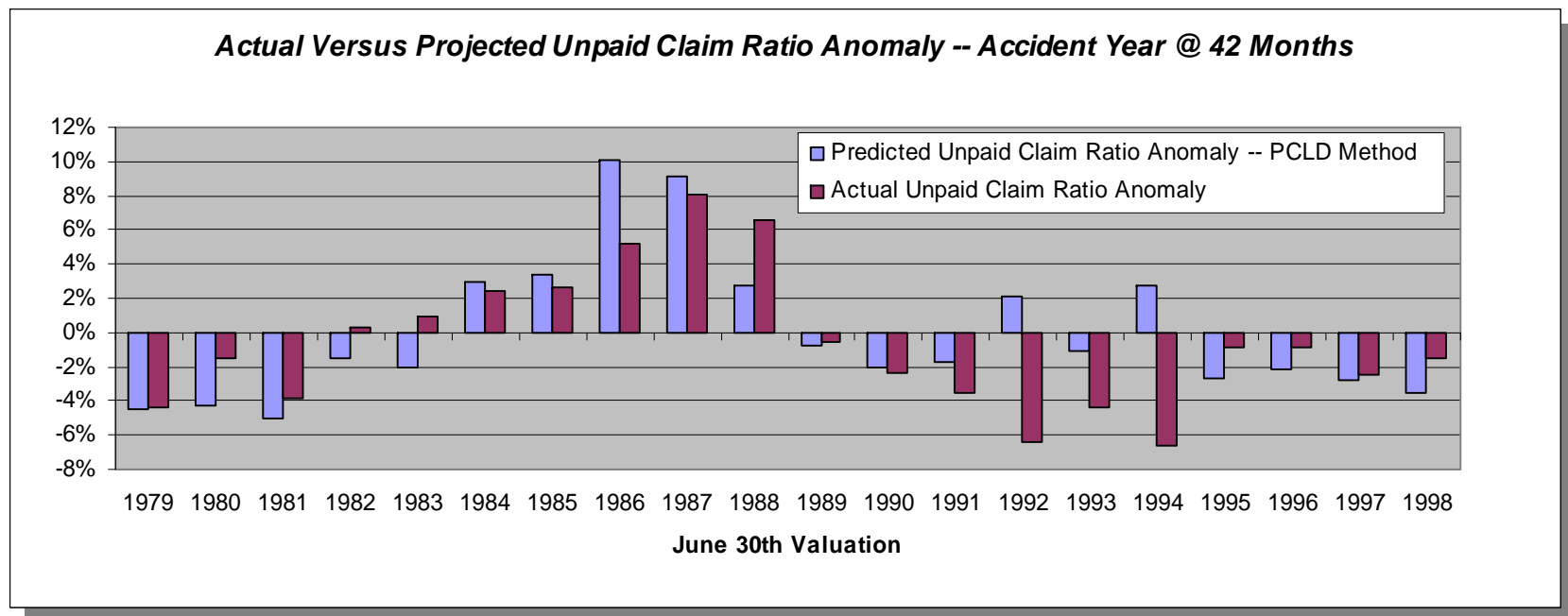
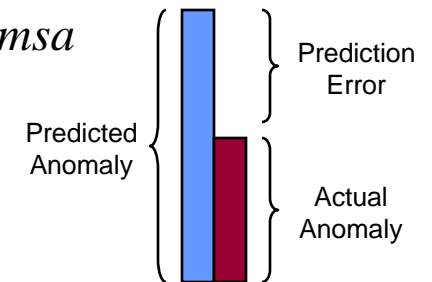
Performance testing is a formal analysis of prediction errors



- 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

- The skill of a method is measured by: $Skill_m = 1 - mse_m / msa$
 - mse = mean squared error
 - msa = mean squared anomaly
- Skill is the proportion of variance “explained” by the method



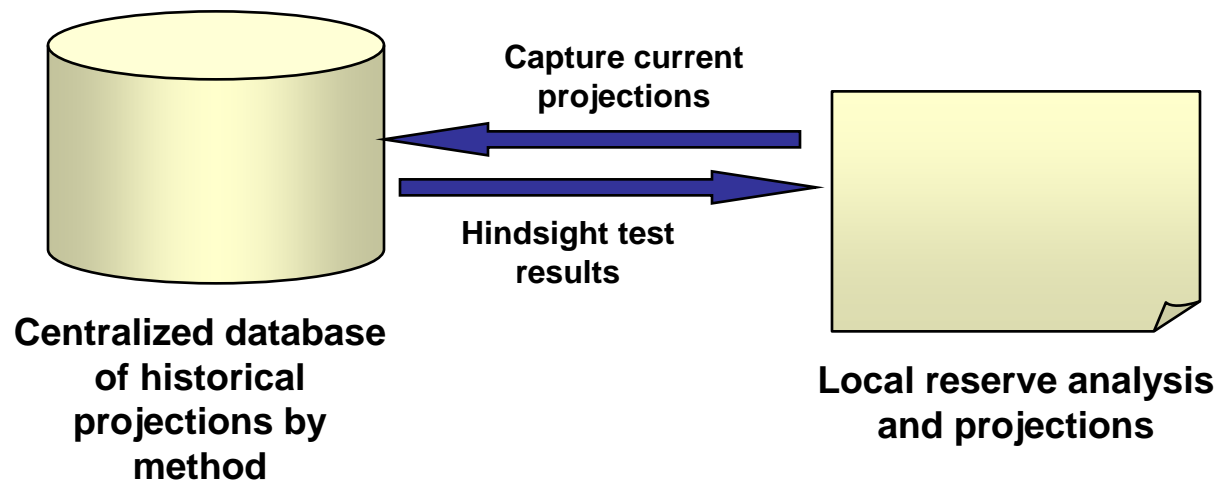
Actuarial methods subjected to performance testing

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- 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

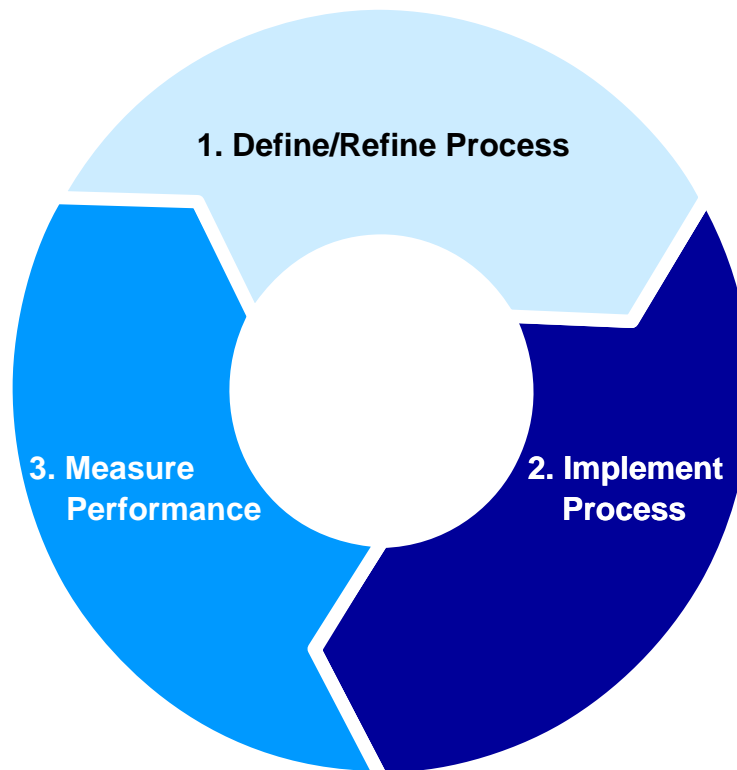


Embedding Performance Testing into Business Operations

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 tolerances?



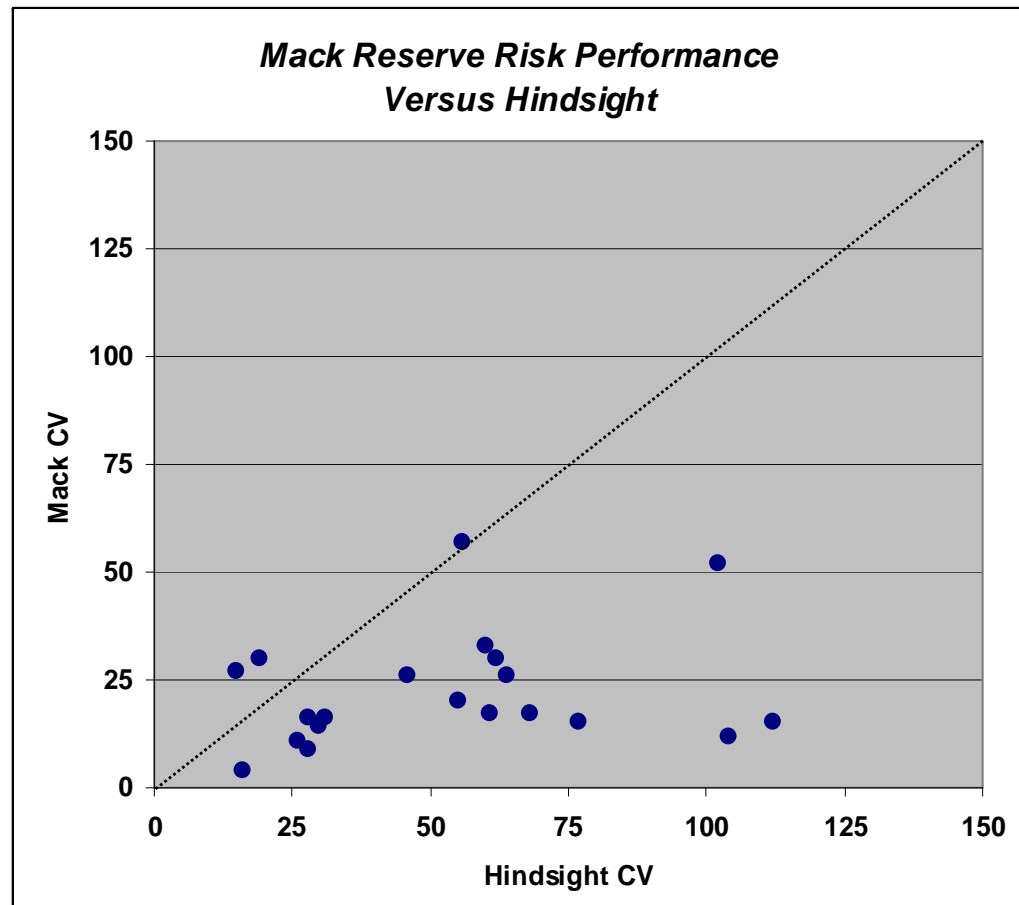
Reserving Process Elements

- 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

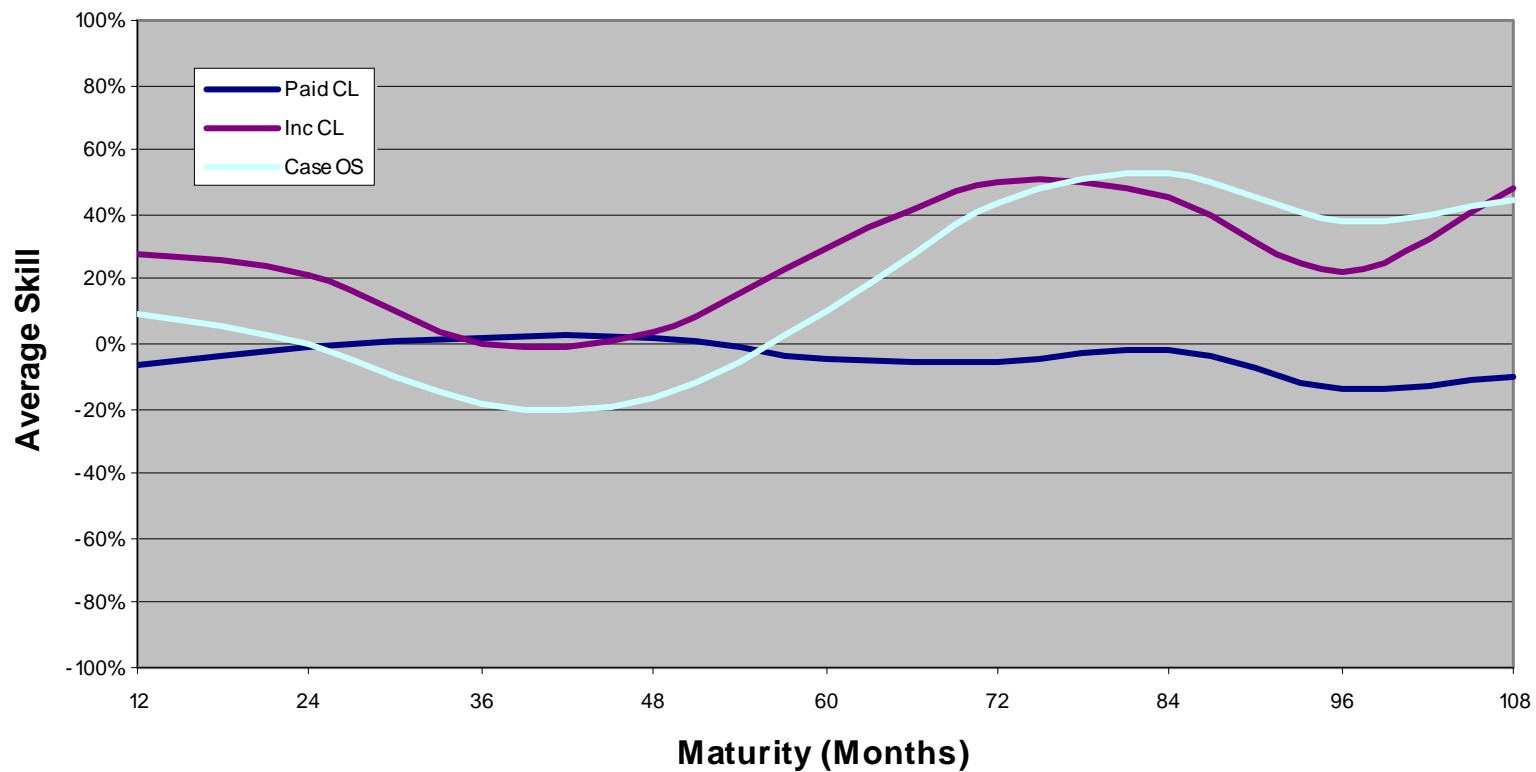
Case study 2 - Empirical hindsight performance test data indicates that Mack may understate reserve risk

- 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

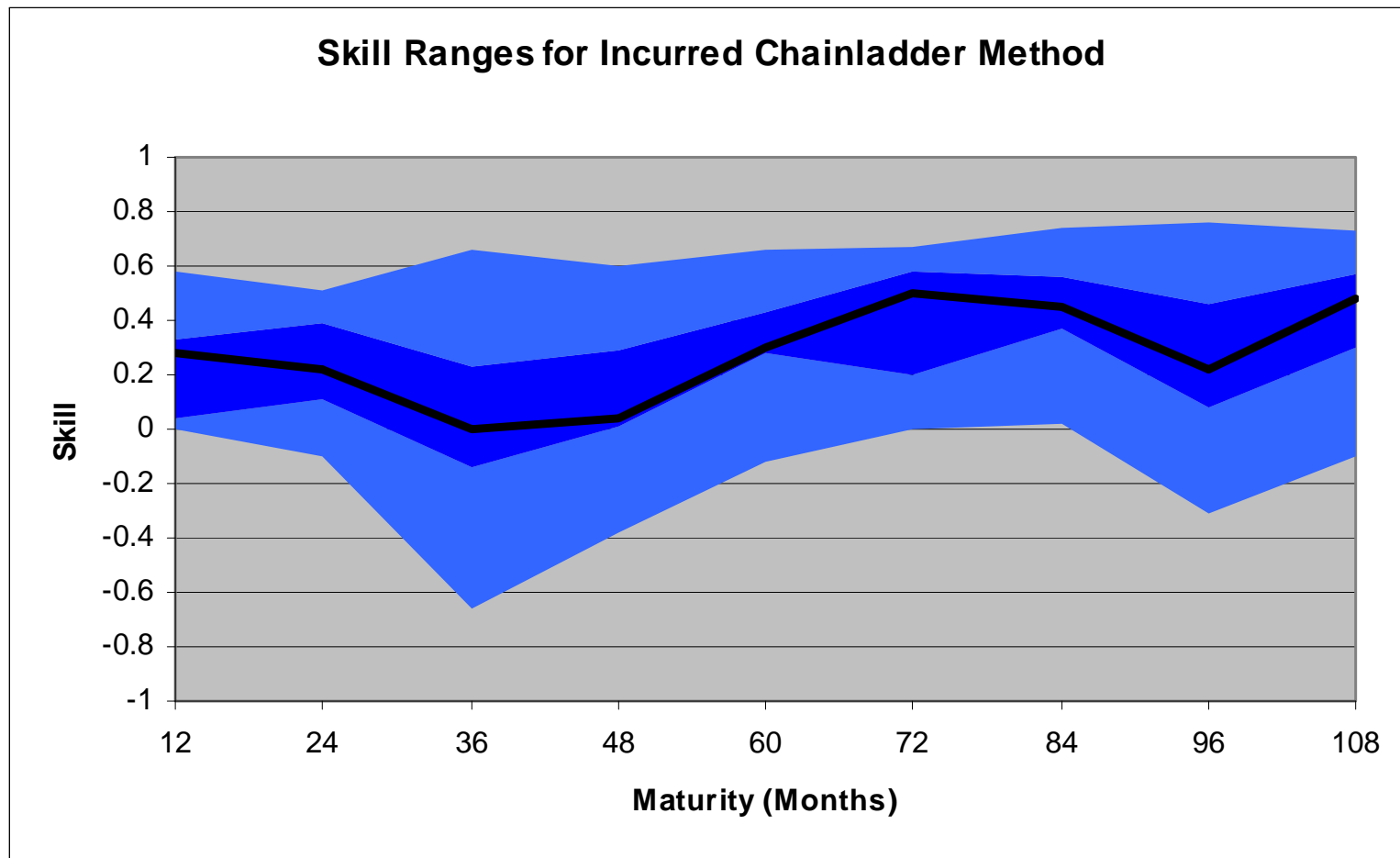


Case Study 3 - UK Private Motor: Median Skill scores by method and maturity

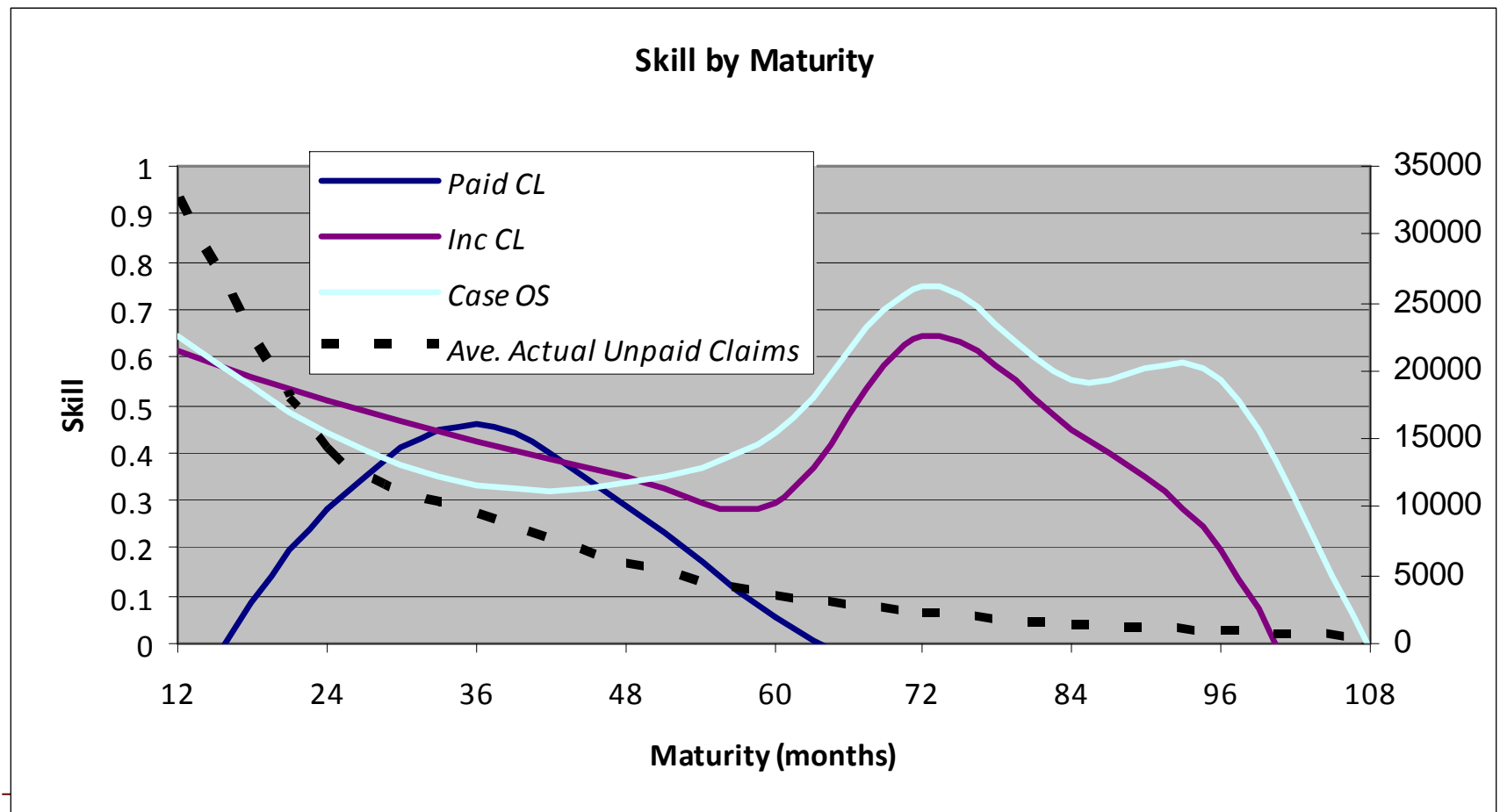
Median Skill by Maturity



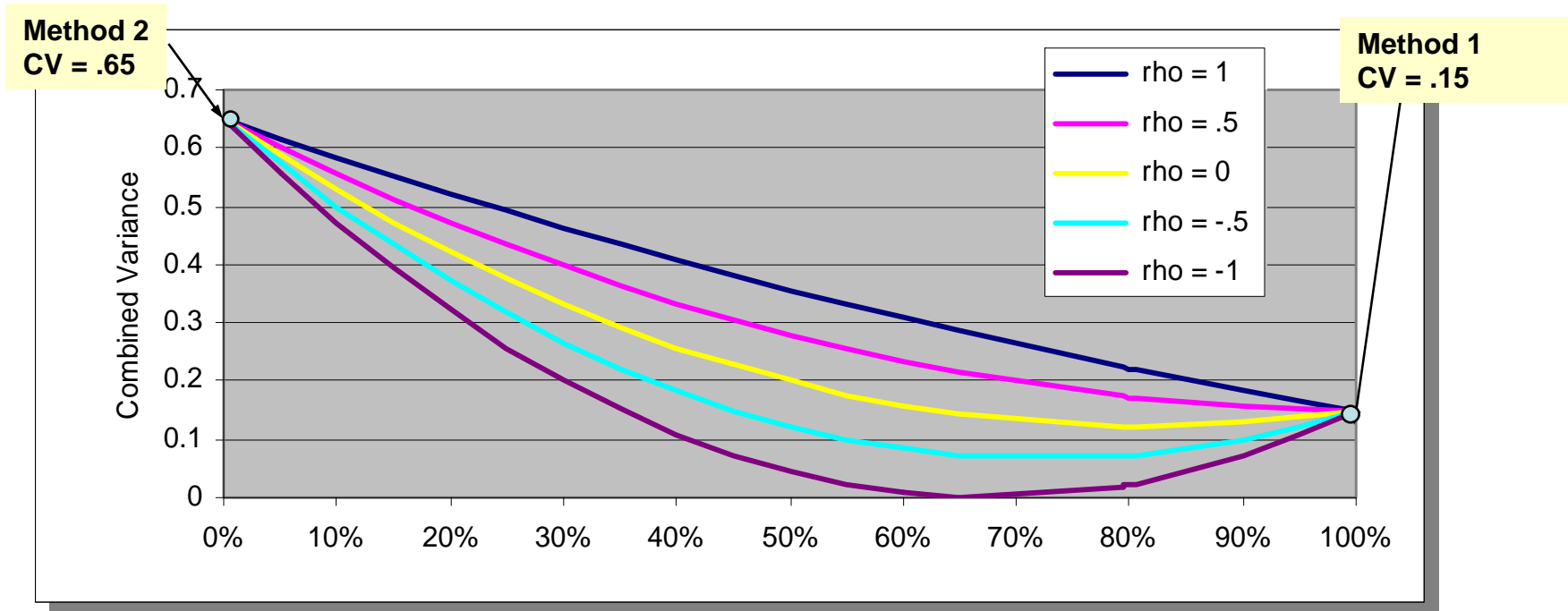
Case Study 3 - Distribution of Skill Scores by company



Case Study 3 - Company D Skill scores by method and maturity



The minimum-variance weighting of methods depends on their variances and their correlation



- For a given correlation, the optimal weights are those with the minimum combined variance
 - Minimum starts at the very right, when correlation is 100%
 - Minimum gradually shifts leftward as correlation decreases

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



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Discussion