



Strategic Reserving

Reserve Variability and Hindsight Testing

A presentation to Casualty Loss Reserving Seminar

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September 17, 2013

TOWERS WATSON 

Agenda

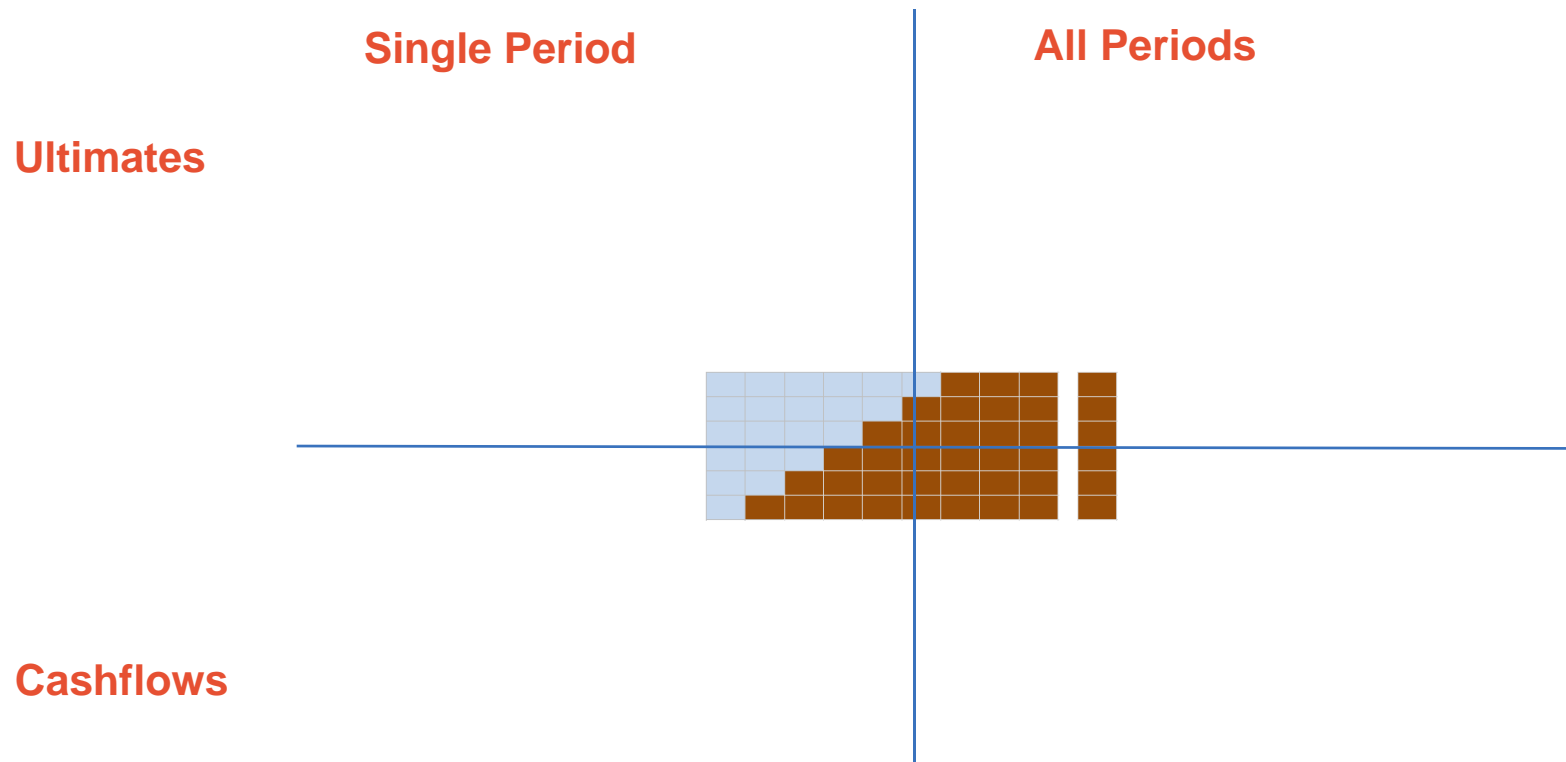
Segments covered in this portion of the presentation:

- **Reserve Variability**
 - Including uses for assessing of appropriateness of the reinsurance purchase
- **Hindsight testing**
 - Identification of appropriate reserving methodologies

Reserve Variability

Outputs

- In this session, we are going to explore a number of uses for the outputs available from an uncertainty analysis and some potential practical uses of these outputs which can directly impact your business
- For the purposes of simplification, the output from a variability analysis can be thought of as grouped along the following characteristics:



Reserve Variability Process

There are a number of potential uses from a variability study that will help business decisions and improve the quality of your estimates.

	Single Period	All Periods
Ultimates	<ul style="list-style-type: none"> • Reserve evaluation: Comparison of Methods • Reinsurance • Reserve Evaluation: Changes in Ultimates 	<ul style="list-style-type: none"> • Companywide Range • Financial Reporting • Reserve Opinion • Mergers & Acquisition • Adverse Development Cover Case Study
Cashflows	<ul style="list-style-type: none"> • Reserve Evaluation: Actual vs Expected analysis 	<ul style="list-style-type: none"> • Inflation / Discounting scenario testing • Asset / liability matching • ERM

Using the Results

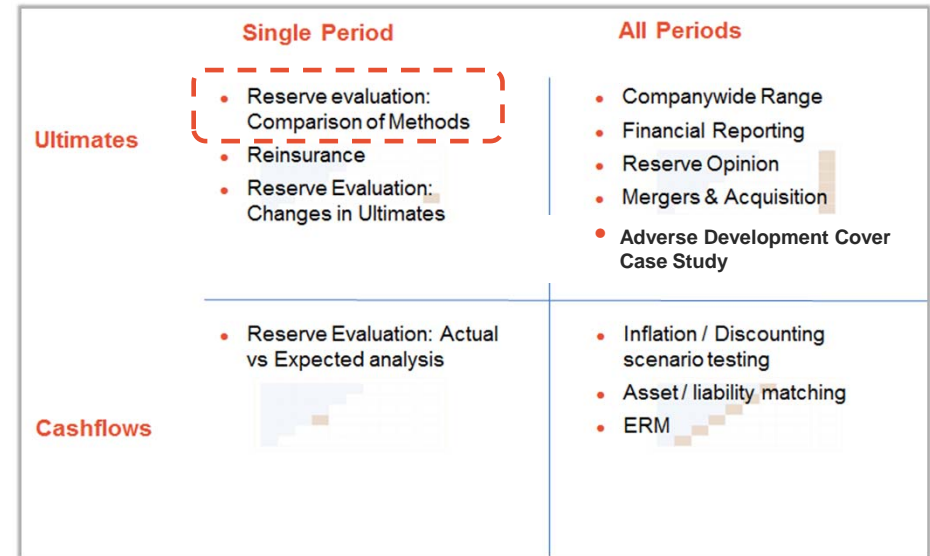
Ultimates – Single Period

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Using the Results

Reserve Evaluation: Comparison of Methods

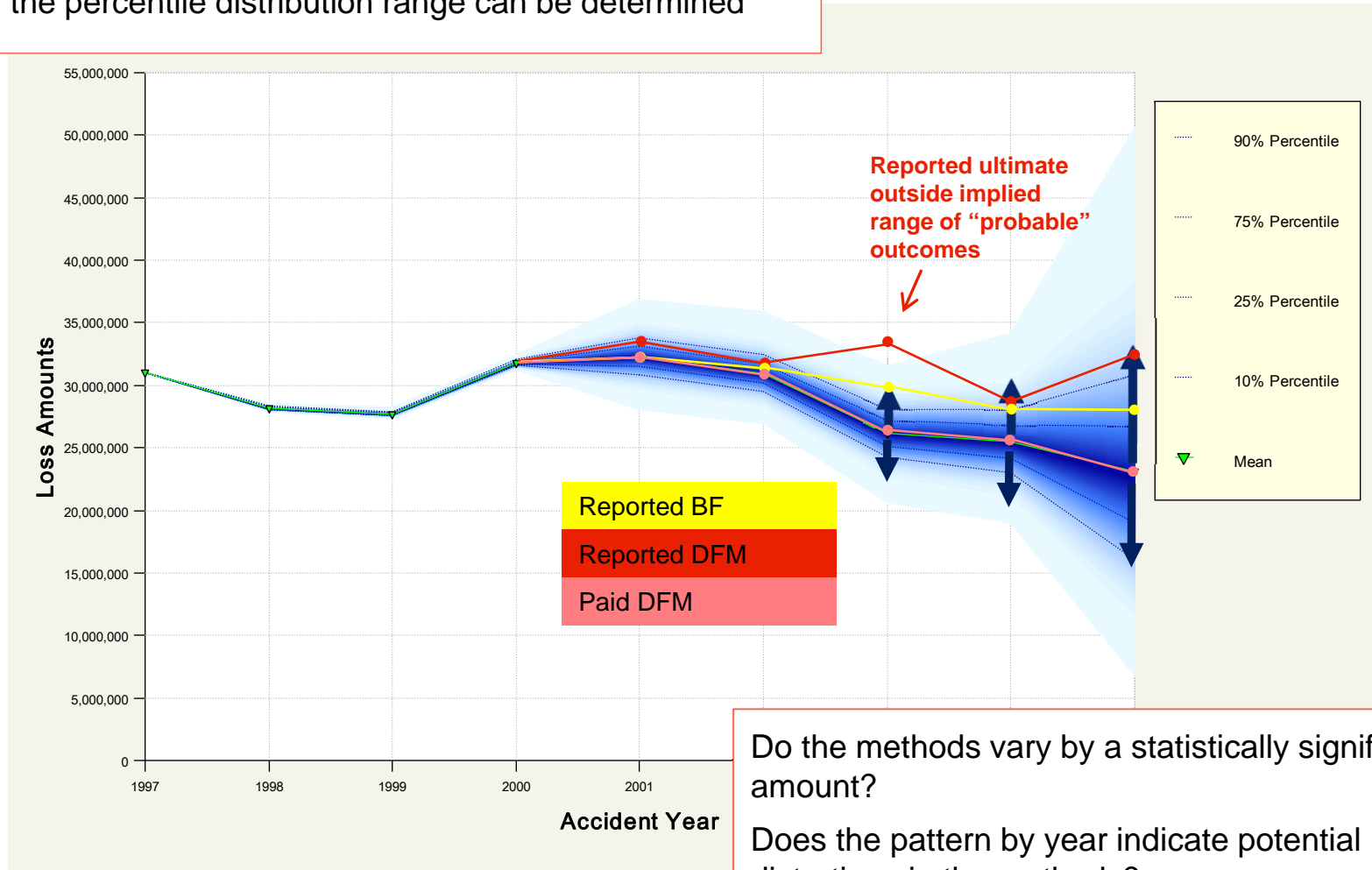
- Predictive distribution allows the actuary to evaluate the reasonableness of their respective methods for a book of business
- As the main focus is the total reserve, it is the variability around the **ultimate** position projected by the various methodologies that is of chief concern, not necessarily *how* they get there
- Generally, a review is most informative on an **origin-period by origin-period basis** as looking at the projected reserves in total may conceal underlying points of interest



Using the Results

Reserve Evaluation: Comparison of Methods

For each accident period, the position of different methods within the percentile distribution range can be determined



Do the methods vary by a statistically significant amount?

Does the pattern by year indicate potential distortions in the methods?

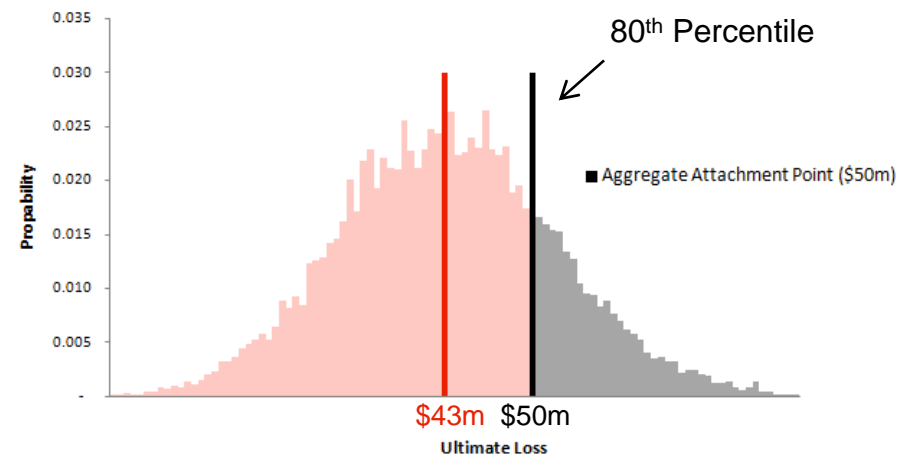
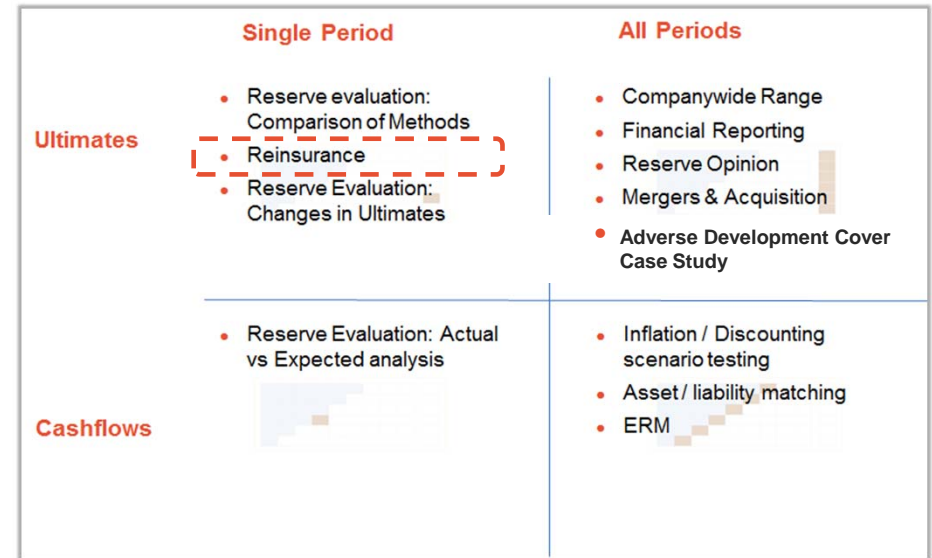
Using the Results

Reinsurance

- Just as a primary insurers will be concerned with the variability about their booked reserves, reinsurers will also be interested in potential future amounts ceded

Example:

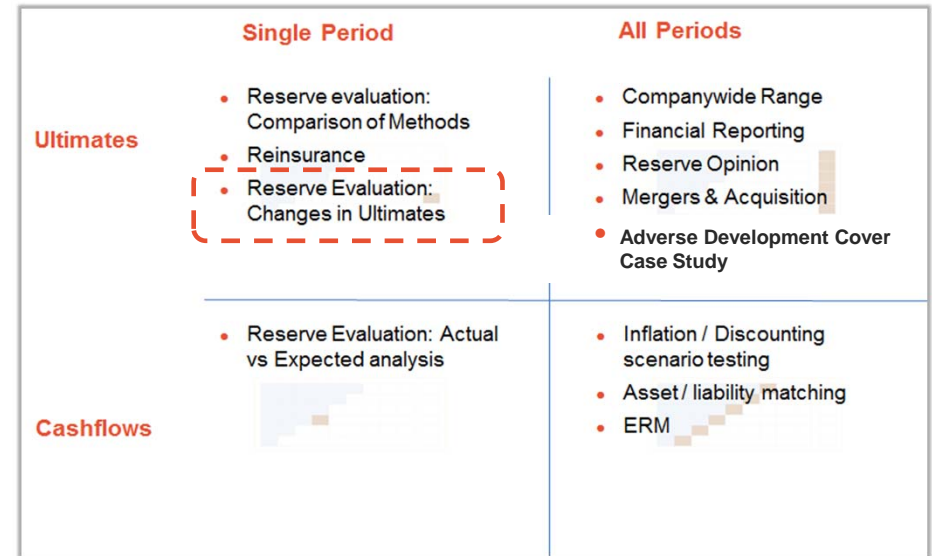
- Consider an aggregate reinsurance arrangement with an attachment point of \$50m
- The actuary's best estimate of the total ultimate loss is \$43m
- However, this information alone does not communicate to the reinsurer the full picture concerning the uncertainty in this estimate
- From the range of probable outcomes of a variability model, we can deduct that there is a 20% chance that the total reserves will breach the aggregate layer
- A similar approach can be applied to loss portfolio transfers and commutations



Using the Results

Reserve Evaluation: Changes in Ultimates

- A common question that actuaries are asked when presenting results to management or when booking the reserves is ‘how much have the estimates changed since the last review and is this movement material?’
- Quantifying the degree of uncertainty surrounding the selected overall reserve estimate helps in communicating whether the changes observed are material or significant



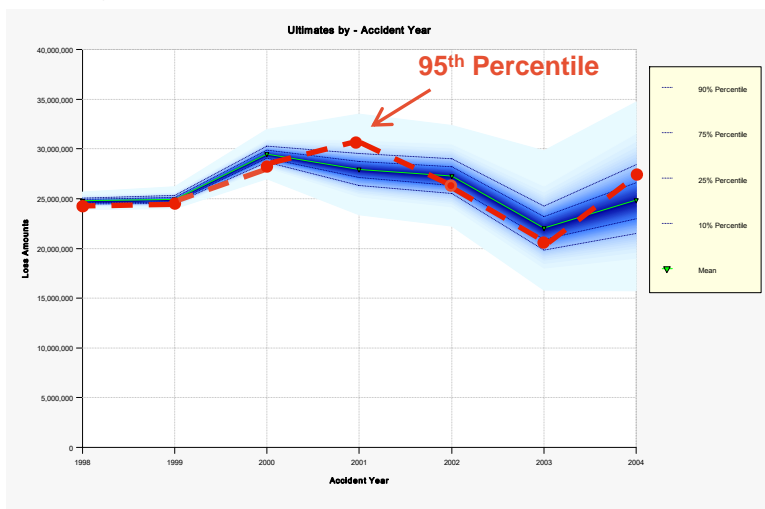
- Comparing how the magnitude of uncertainty changes as the origin periods mature (or as the book changes in volume/mix) helps set expectations about future changes in estimates
- The degree of materiality will also vary by book of business. Where a \$2m movement in reserves held for a liability book may not raise a concern, a similar movement on an auto account of comparable size may be cause for further investigation and explanation
- Though many factors will drive results, an important aspect conveyed is that they are, after all, an *estimate*. Providing the degree of uncertainty within these estimates will help set expectations

Using the Results

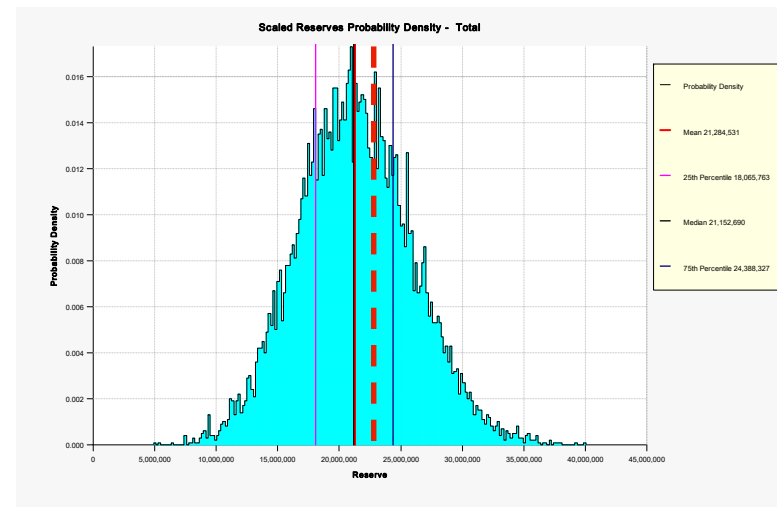
Reserve Evaluation: Changes in Ultimates

- The graph below shows the distribution fan provided from a December 2004 uncertainty review
- Imposed on the graph (shown with a red, dotted line) are the selected results from a December 2005 review
- The graph below shows the probability density cone around the total reserve based on the same 2004 analysis as above
- Again, the total reserve estimated from the following years review is shown as a red, dotted line

By Origin Period:



Across all Origin Periods:



- Communicating this change in estimated reserve in percentile terms will help focus concerns on those differences that could be considered material based on the result of a detailed uncertainty study

Using the Results

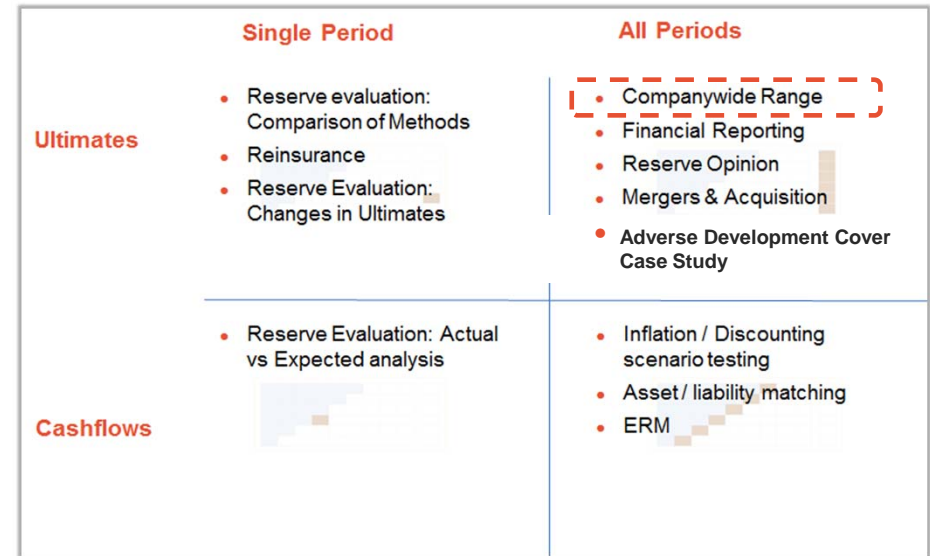
Ultimates - All Periods

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Using the Results

Companywide Range / Consolidation of Results

- Estimates of uncertainty surrounding a company's total reserve across all business segments allow for an apples-to-apples comparison to the company's balance sheet



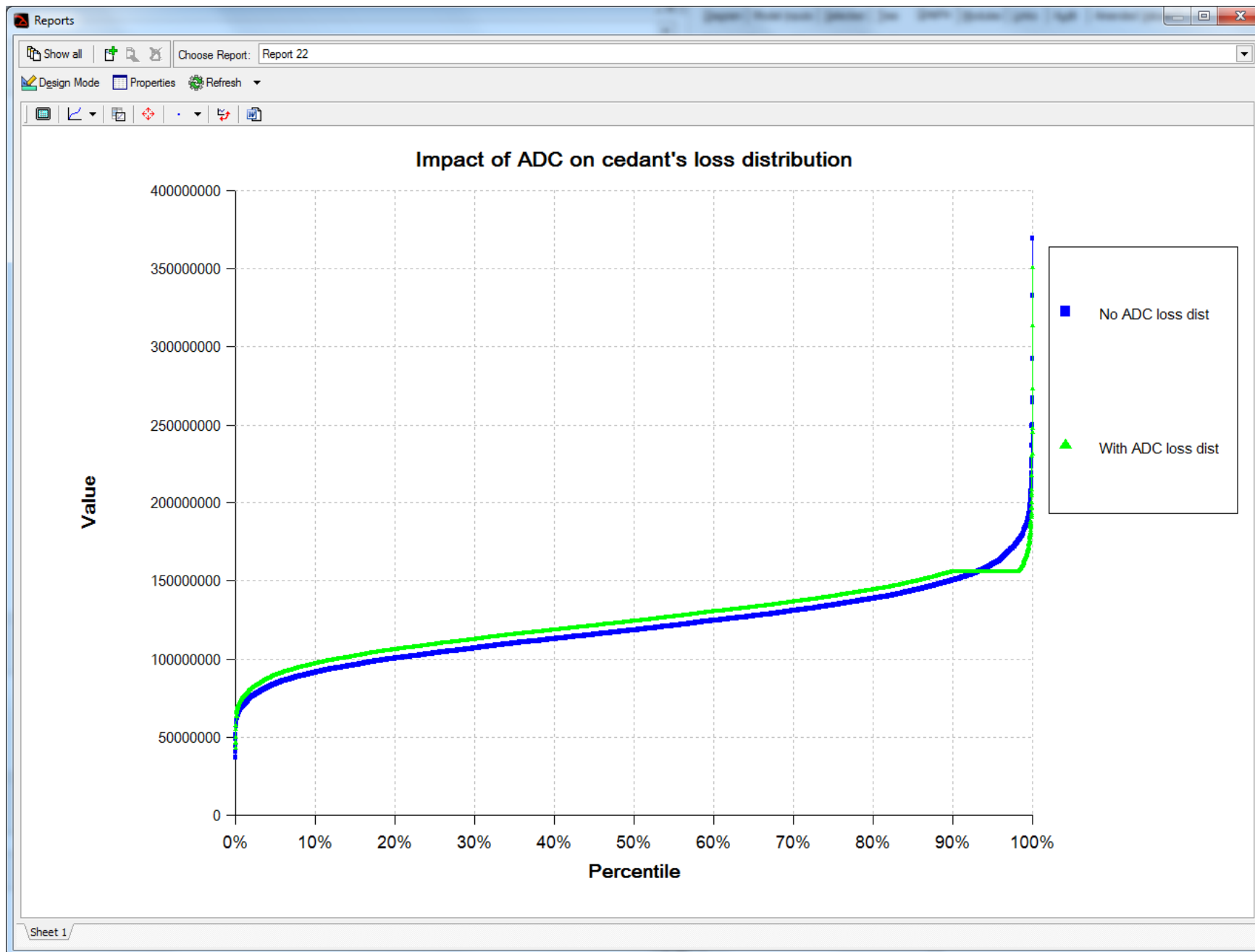
- When evaluating the company's consolidated results, two general questions arise:
 1. Are there significant risks that could result in a material adverse deviation?
 2. What is the range of reasonable estimates and are the company's booked reserves reasonable?
- Analyzing the variability of reserves can help to answer those questions

ADC coverage details

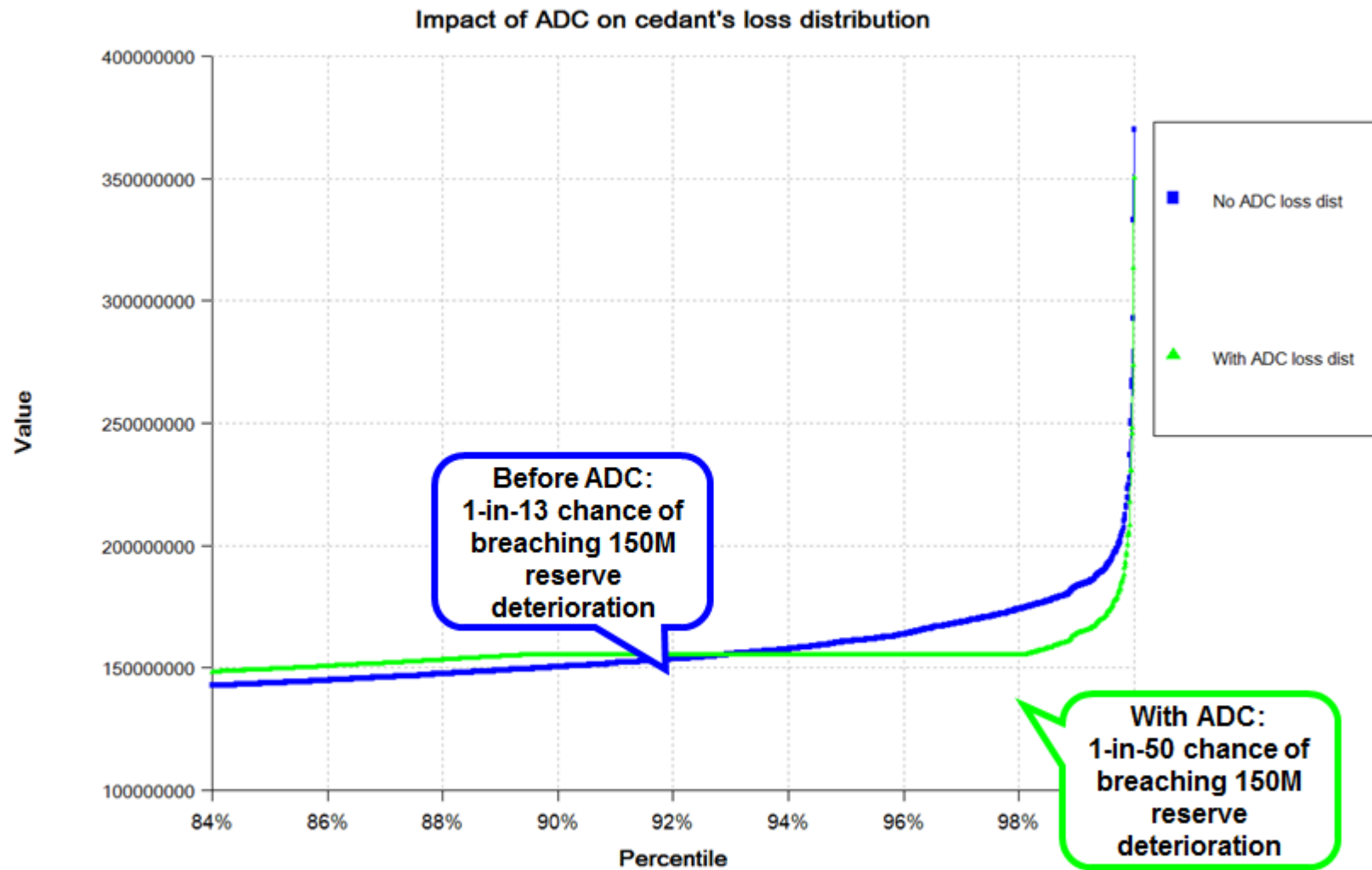
- Various long-tailed casualty lines of business
- Interest in ADC for underwriting years 2000-2008
- Net claims reserves of £120m
 - Seeking ADC
 - Attaching at £150m
 - Limit of £25m
 - 100% order

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ADC helps reserves align with corporate risk tolerance



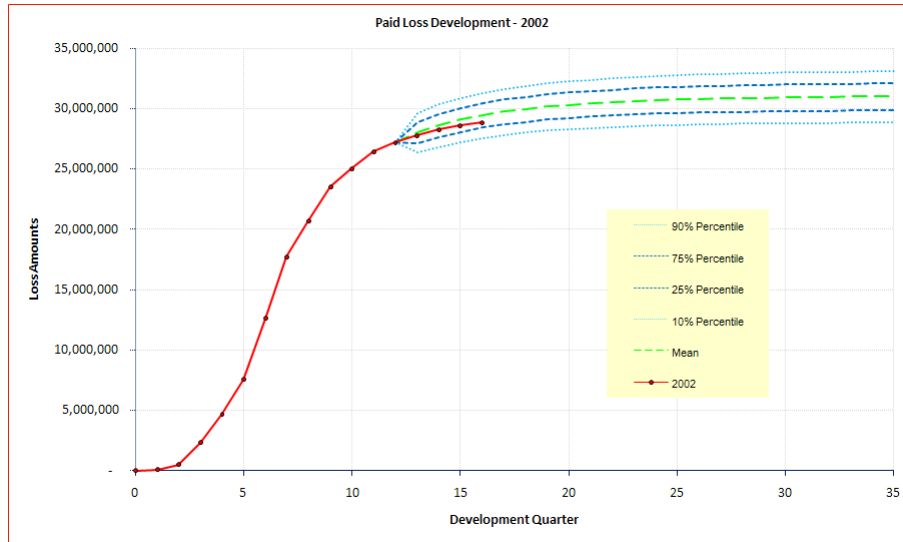
Using the Results

Cashflows – Single Period

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Using the Results

Reserve Evaluation: Actual vs. Expected


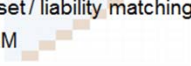


- Simulation techniques allow the actuary to not only determine the uncertainty around the final estimate, but also in the cashflows that take the payments to ultimate
- Predicted cashflows, output from a variability analysis, will assist the actuary in determining the materiality of differences in actual cashflows over given periods when compared to the expected cashflows from a previous analysis

Origin Year	Paid Losses as at 2004	Estimated Ultimate Losses as at 2004	Expected Paid Losses 2004 to 2005	Actual Paid Losses 2004 to 2005	Actual - Expected 2004 to 2005	Cashflow Percentile
2001	30,378,231	32,047,216	936,357	608,703	(327,654)	4%
2002	27,214,233	31,214,646	2,385,788	1,640,305	(745,483)	27%
2003	16,758,431	25,785,079	5,677,598	5,757,792	80,194	53%
2004	2,385,508	16,162,641	8,107,330	9,004,136	896,806	69%
2005				3,241,443		

Using the Results

Cashflows – All Periods

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Using the Results

ERM

- Up until now, we have considered in isolation a number of uses of different outputs from an analysis of uncertainty, such as:
 - Consolidation across multiple lines
 - Inflationary/other systemic effects
 - Asset liability matching
- Within a capital modeling environment consideration of all of these aspects is required
- Main benefit of using a simulated approach to reserve uncertainty are the detailed cashflows and reserve outputs which allow for direct integration of the reserve element of uncertainty into the wider ERM framework:
 - Capital Setting
 - Capital Allocations
 - Asset-liability linking
- Focus is generally on a specified time horizon (e.g. one-year) and the impacts on financials (income statement and balance sheet)

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Hindsight testing

Hindsight testing is the retrospective review of the performance of a variety of reserving methodologies on a class of business

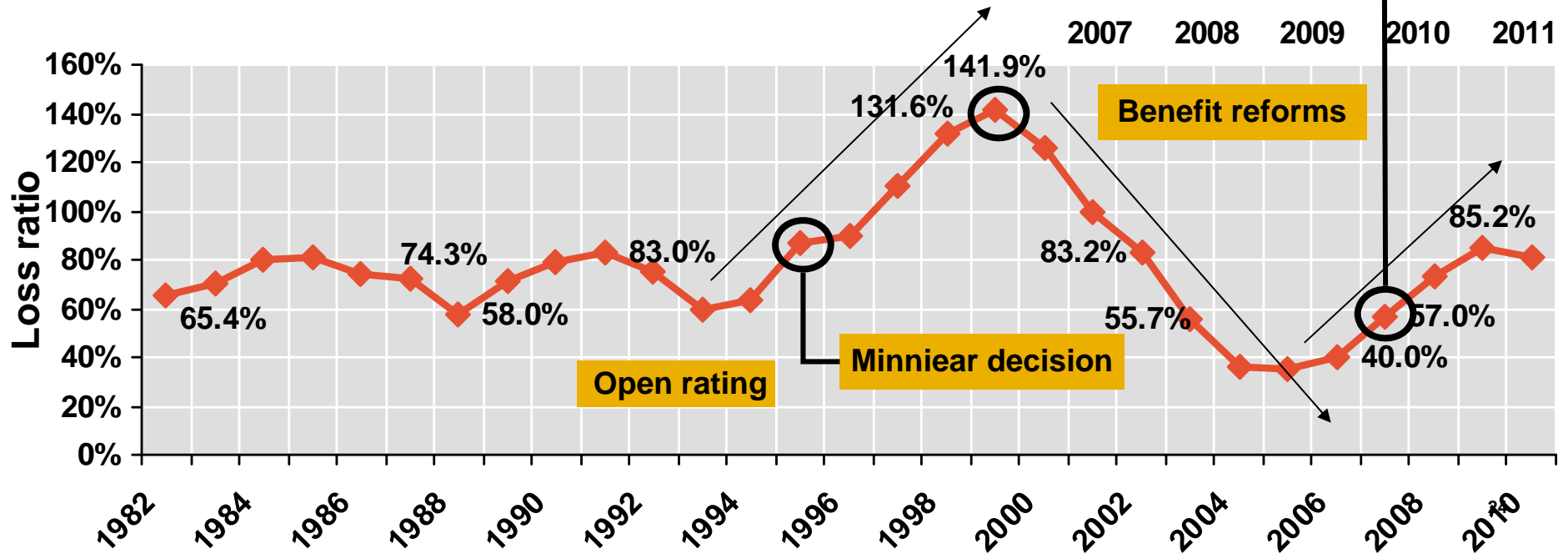
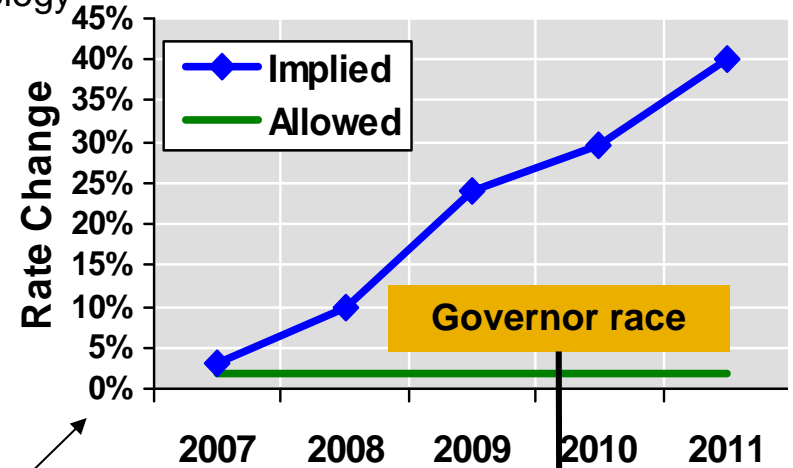
- We will cover this through the review of a California Workers' Compensation case study
- The case study assessed how well different reserving methodologies performed under a variety of conditions
 - We can adopt similar approaches to understand which methodologies have historically performed well

The goal of the case study is to identify the most (and least) accurate methods under a variety of environments

- We tested 27 methods (with several parameterizations) under 8 sets of environmental conditions
- Environmental changes include:
 - Bubble in calendar year inflation – covered today
 - Increase in frequency of serious claims (i.e., shift in claim types)
 - Increase in case reserve adequacy
 - Acceleration in claim settlement rates
 - Economic downturn – covered today
 - Combinations of the above

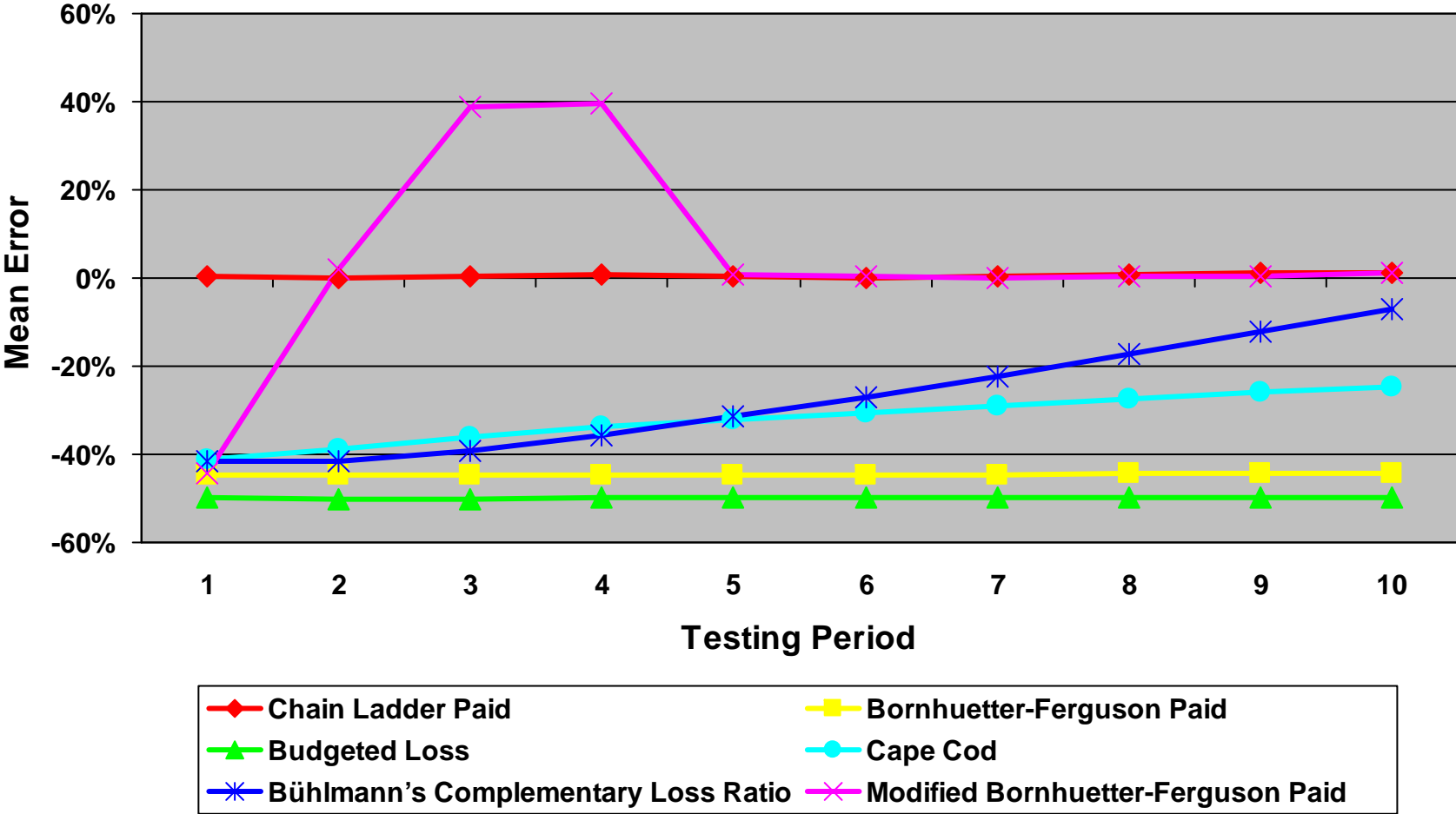
A short history of California Workers' Compensation

- WCIRB comprised of all WC writers in California
- Requested by CDI to evaluate appropriateness of their methodology
- Methodology
 - Current – chain-ladder on paid using the latest diagonal
 - Result – modified Berquist-Sherman adjustment for reserve adequacy
- The full results can be found in paper...
 - Tapio Boles and Andy Staudt, "On the Accuracy of Loss Reserving Methodology," CAS *E-Forum*, 2010, 1-62.
 - 2010 Ronald Bornhuetter Loss Reserve Prize



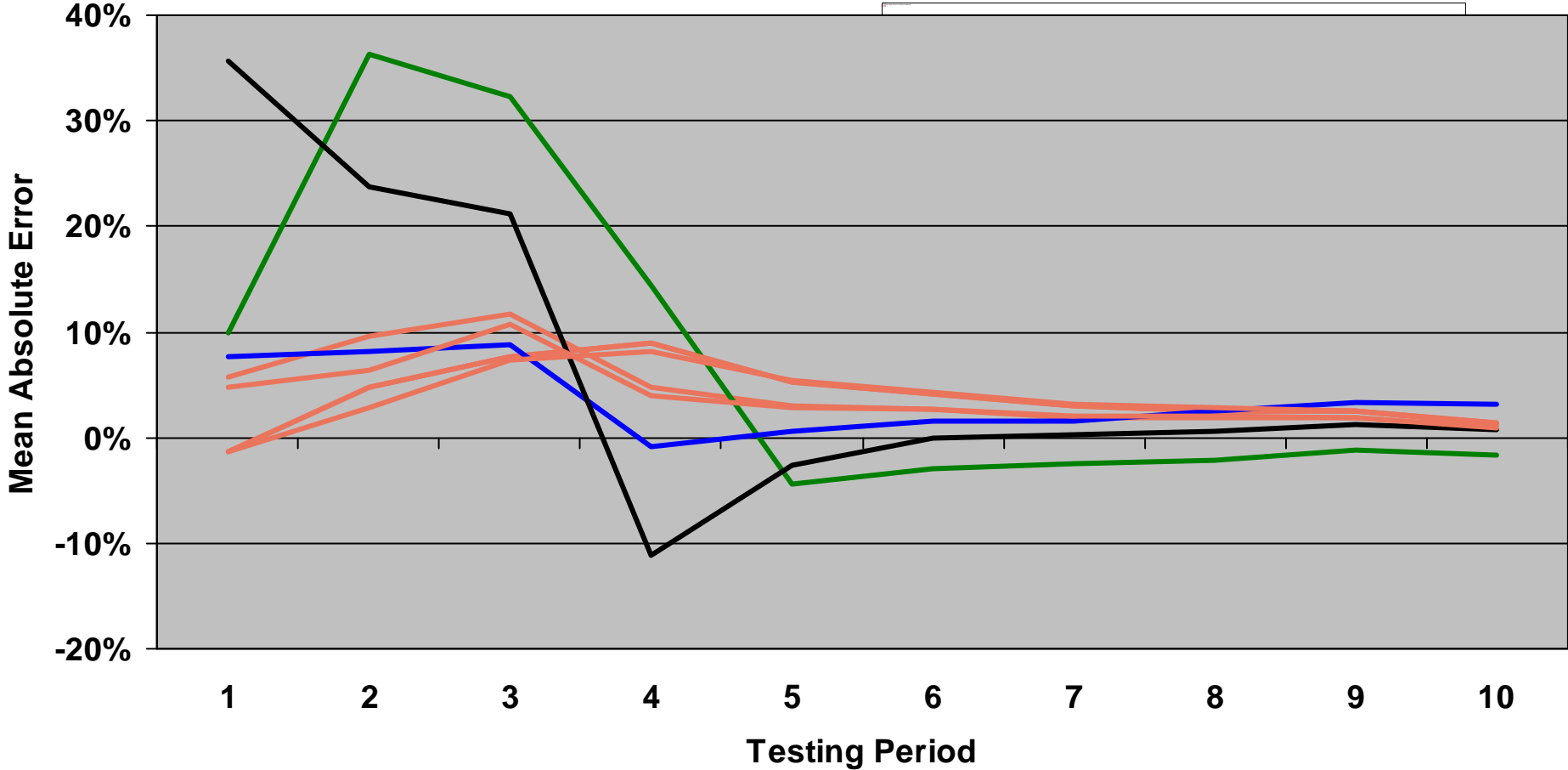
Some methods learn, others don't

Environment: Sudden doubling of loss exposure without recognition



Note: Where applicable, parameters based on latest 3 years

Economic downturn



- Cumulative Multiplicative on Paid
- Incremental Multiplicative on Paid
- Berquist-Sherman with Reserve Adequacy Adj. on Incurred
- Hybrid Method w/ Paid/Case/OpenCC on Paid
- Cumulative Multiplicative on Incurred
- Incremental Additive on Paid
- Berquist-Sherman with Claims Settlement Adj. on Paid
- Hybrid Method w/ Paid/Case/OpenCC on Incurred

Closing comments

- **Strategic reserving can improve the quality of your estimates**
- **Additional value can be gained through the process**
 - Gain greater understanding of the variability around the best reserves and the potential drain this could be on your capital
 - Gain greater understanding of the appropriateness of your reinsurance structure
 - Gain greater understanding of the most appropriate reserve methodologies to use in different situations