Applications of Reserve Ranges and Variability in Practice

Casualty Actuarial Society
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Ground-Rules for our Discussion
Including disclaimers

- This presentation is prepared and intended for general educational and discussion purposes only.
- It should not be used as a substitute for consultation with professional advisors.
- The views and opinions expressed by the panelists may or may not be reflective of their own personal views and opinions; the views and opinions are not expressions of position by their employers.
- Enjoy the exchange of information and ideas.
- Contribute.

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The Authors (Your Panelists)

- Christopher Walker, FCAS, MAAA
  - Principal, PwC-Chicago
- Mark Littmann, FCAS, MAAA
  - Principal, PwC-Hartford

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Outline for our Discussion

- Business Applications
- Concepts in the Literature
- Approaches in Practice
- Illustrations
- Aggregate Ranges
- Take-Away's

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Business Applications of Variability Concepts

- Statements of Actuarial Opinion and Actuarial Opinion Summary
  Discussions of the business and its qualities that may introduce variability; assessment of RMAD; optional in AOS
- Securities and Exchange Commission filings
  Discussion of analysis that developed the carried reserve and variability in that estimate; recently expanded disclosure by registrants.
- Financial Audits
  Even for non-insurance entities, "how much of a difference is too much" is a constant question in assessing self-insurance estimates
- Mergers and Acquisitions
  May affect subsequent year "true ups" or the decision to purchase third-party reinsurance, and how much.
- Internal Revenue Service Considerations
  Supportable "reasonable ranges" may factor into on-going or future IRS actions.

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Variability Concepts in the Literature

- Thomas Mack Method

  "Distribution free" technique using loss development; no guidance on what constitutes "reasonable range"

- Boot-Strapping

  Simulation process with observed development being one "observation"

- Sensitivity Testing

  Not explicitly described in literature, though widely used reflecting alternative high/low assumptions

Approaches in Practice

- Judgment

  Includes "rule of thumb"; lacks substantive analytical or qualitative evidence; increasingly ignored by regulators and other third parties

- Sensitivity-Testing

  Some commonalities, such as adjustment of tail factors; changes in severity assumptions; inflation; or inclusion/exclusive of large single events

Sensitivity Testing

- Evaluate the dispersion of indications from one or more methods applied to one or more types of data. An actuary might elect to evaluate the dispersion of indications for all accident years combined, or for each accident year, or deviation from "actuarial central estimate."
- Evaluate the effect of alternate judgments for the key elements of the methods as applied to the various sets of data, and generally keep the same judgment about relative preferences among the methods.

We consider the second approach to be preferred.

Illustration: Sensitivity Testing

AY	Estimated Ultimate		Unpaid Claims Estimate	
	Baseline	Alternate (High)	Baseline	Alternate (High)
2003	1,147	1,147	20	20
2004	1,188	1,188	11	11
2005	1,109	1,109	23	23
2006	1,155	1,155	35	35
2007	1,626	1,628	41	44
2008	1,451	1,457	92	99
2009	1,453	1,467	162	176
2010	1,464	1,487	286	309
2011	1,778	1,824	580	626
2012	1,570	1,646	1,000	1,076
Sum	13,940	14,108	2,250	2,418
			Difference	168
	Difference as % Baseline Unpaid Claims Estimate			7%

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Illustration: Stochastic Approach – Thomas Mack Technique

AY	Estimated Standard Error	
	Paid Data	Reported Data
2003		
2004	1	1
2005	1	1
2006	1	2
2007	2	2
2008	21	23
2009	30	33
2010	31	33
2011	109	76
2012	166	132
All Years	219	175

Choose ESE of $197

The chosen ESE of $197 is 9% of the mean unpaid claim estimate of $2,250.

Based on the assumed distribution, the High estimate (from sensitivity testing) of $2,418 corresponds with the 80th percentile of the distribution.

Percentiles of Distribution		Unpaid Claim Estimate	
Low	High	Low	High
20%	**80%**	2,082	2,418

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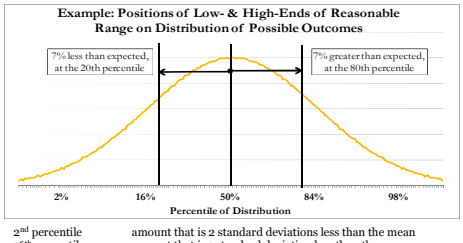
Illustration: Building a Bridge

Overlaying the Reasonable Range on the Distribution of Outcomes



2nd percentile	amount that is 2 standard deviations less than the mean
16th percentile	amount that is 1 standard deviation less than the mean
50th percentile	the mean amount
84th percentile	amount that is 1 standard deviation greater than the mean
98th percentile	amount that is 2 standard deviations greater than the mean

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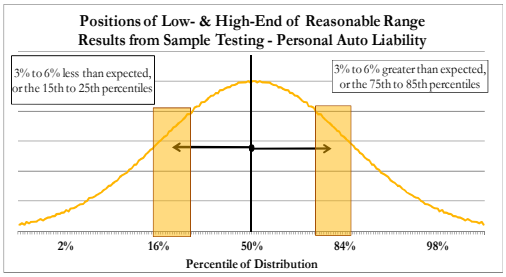
Sample Testing: Personal Auto Liability



See accompanying commentary on the sample testing in Section 5.3 of the paper.

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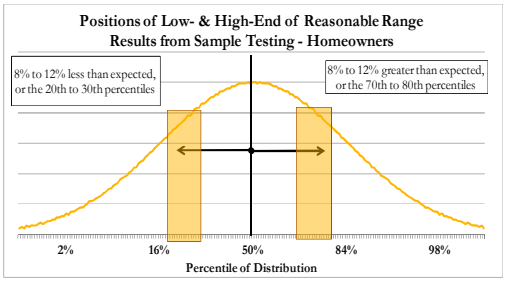
Sample Testing: Homeowners



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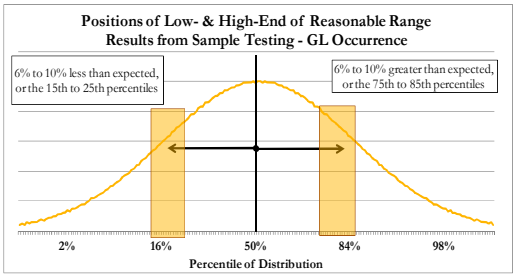
Sample Testing: GL Occurrence



See accompanying commentary on the sample testing in Section 5.3 of the paper.

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Summary of Sample Testing

	High-End of Reasonable Range as % Reserves	Percentiles of Distribution aligning with High-End of Reasonable Range	# Std Dev's from Mean to High-End of Reasonable Range	Estimated Standard Deviation of Distribution as % Mean Reserve Estimate
Personal Auto Liability	3% to 6%	75th to 85th	0.7 to 1.0	3% to 7%
Homeowners	8% to 12%	70th to 80th	0.6 to 0.9	12% to 16%
GL Occurrence	6% to 10%	75th to 85th	0.7 to 1.0	6% to 12%

See accompanying commentary on the sample testing in Section 5.3 of the paper.

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Consideration of Ranges on an Aggregate Basis

Bottom-Up Approach

- Evaluate individual segments
- Aggregate segment results, considering correlations
- Aggregations at 0% correlation and at 100% correlation may be helpful
- In practice, actuaries often sum the low and high ends to develop a range of unpaid claim estimates in the aggregate.

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Consideration of Ranges on an Aggregate Basis

Top-Down Approach

- Evaluate range at an aggregate level, by applying a technique (for instance, sensitivity testing or the Mack approach) to the aggregated data*
- A primary advantage is to implicitly address correlation among individual segments.

* We do not generally advocate an analysis of aggregated data for evaluating a point estimate, but consider it potentially useful to perform sensitivity testing or stochastic analysis in order to assess an aggregate range of reasonable estimates. The mix of underlying coverages should be relatively stable over the experience period for such an analysis of aggregate data; to the extent that there are substantial shifts of the mix of business (for instance, relative proportion of long and short tail business), we would caution against this approach.

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Take-Away's

- Applications of variability of unpaid claim estimates arise in a variety of business settings; the approach must reflect the situation with appropriate disclosure regarding the type of finding being expressed.
- We believe that the days of expressions of reasonable ranges based solely on judgment or rules of thumb are over, as stakeholders seek a more-reasoned response to questions regarding the basis of a stated range.
- We believe the framework described herein is practical and can be reasonably explained to the variety of stakeholders who seek insights and opinions from actuaries on point-estimates and the associated uncertainty.
- We identified an apparent relationship that the sample ranges of reasonable estimates for the three reviewed lines tended to align with portions of the distribution of outcomes that extend up to one standard deviation above and below the mean. This may be an area of further research.

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Thank you