How Much Is Enough?

An Empirical Testing of the Relationship between the Variability of Reserve Estimates and the Volume of Data

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Agenda

- Two Questions
- Qualitative Responses
- Empirical Testing Approach
- Empirical Answers
- Observations, Issues, & Conclusions

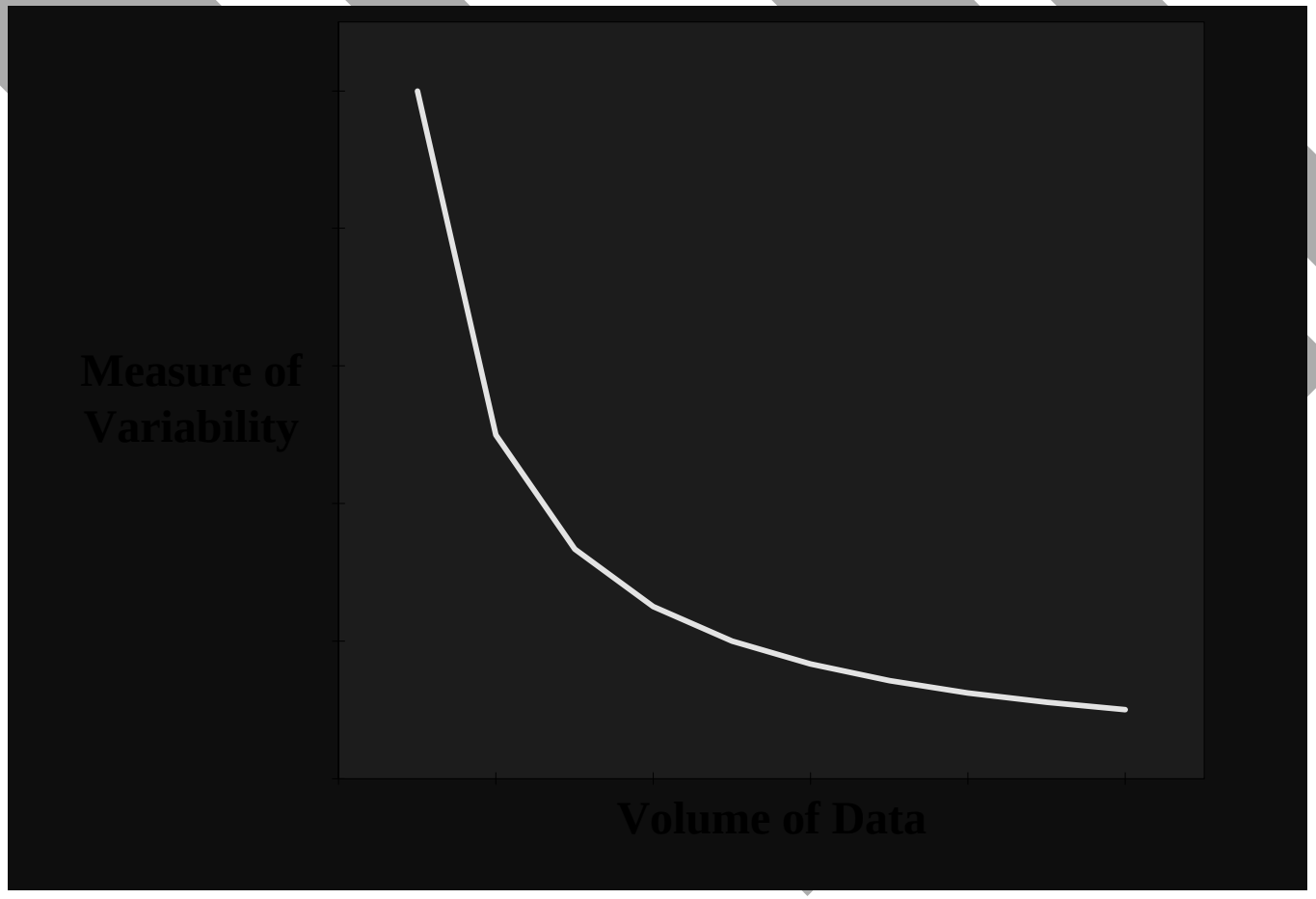
Two Questions

1. How does the volume of data influence the performance of a reserving method?
2. How much data may be required to achieve certain tolerance levels in estimates of reserves?

Qualitative Response to Question 1

- If we view performance of a method in terms of the variability inherent in the estimate generated by the application of the method to a set of data,
- Then we might expect the variability of estimates to be inversely related to volume of underlying data

Expected Relationship between Variability and Volume



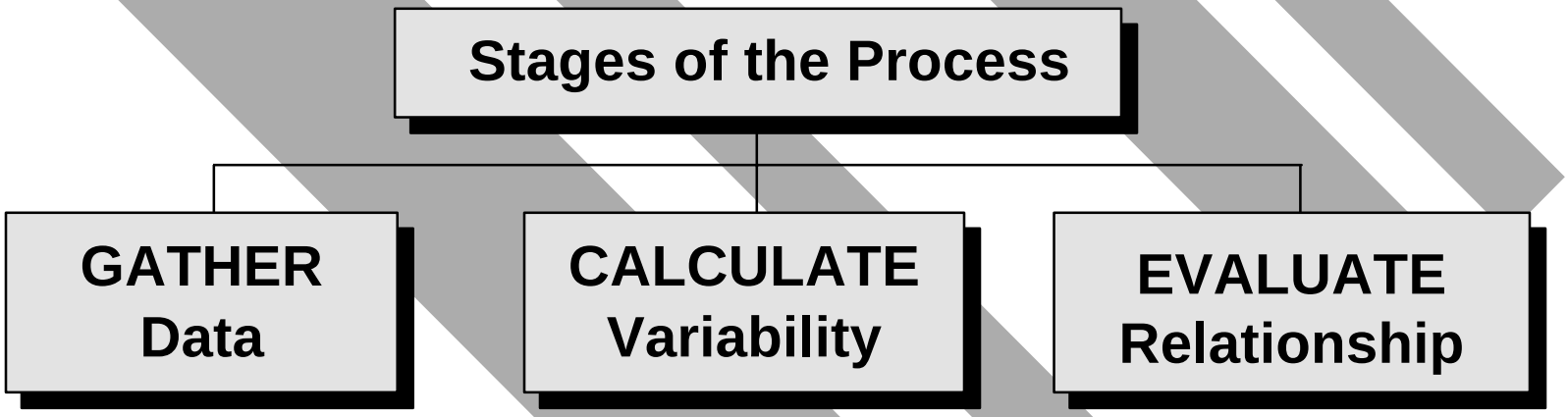
Thoughts regarding Question 2

- Absence of credibility standards for reserving
- Credibility standards for ratemaking tend to specify the volume of data to achieve N-% confidence of being within T-% of ultimate.

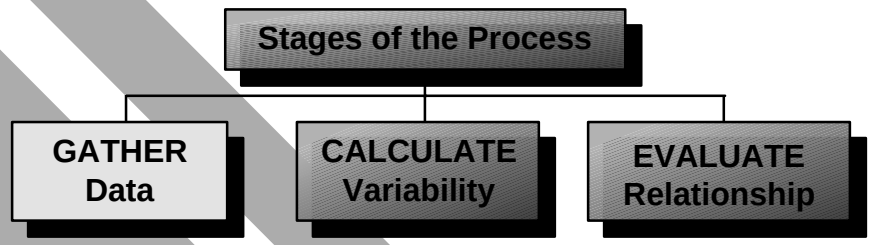
Empirical Testing Approach

- Perform calculations on many sets of data
- Use aggregate earned premium for experience period as the measure of volume
- Use estimated standard error of reserve estimate, expressed as percent of reserve estimate, as the measure of variability
- Evaluate relationship between the measures

The Testing Process

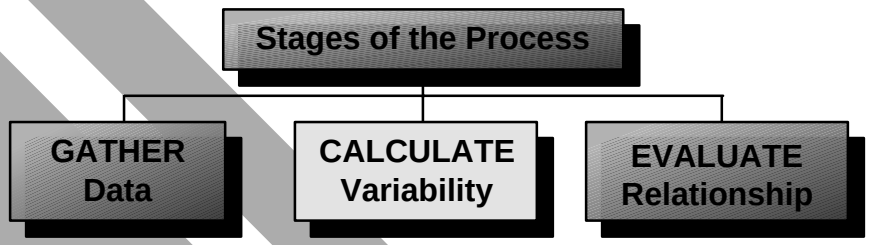


Gather Data



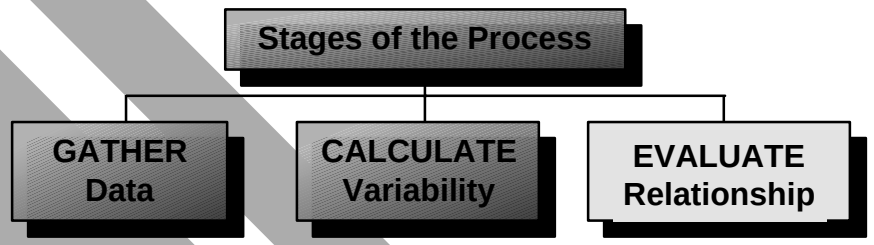
- OneSource CD ROM of Schedule P data
  - Paid and reported loss development data
  - Earned premiums
- 4 Lines of Business:
  - Commercial Auto Liability, CMP, Homeowners, and Personal Auto Liability
- Size of Sample: 125 companies/groups
- Store in Corporate Affinity database of actuarial objects

Calculate Variability



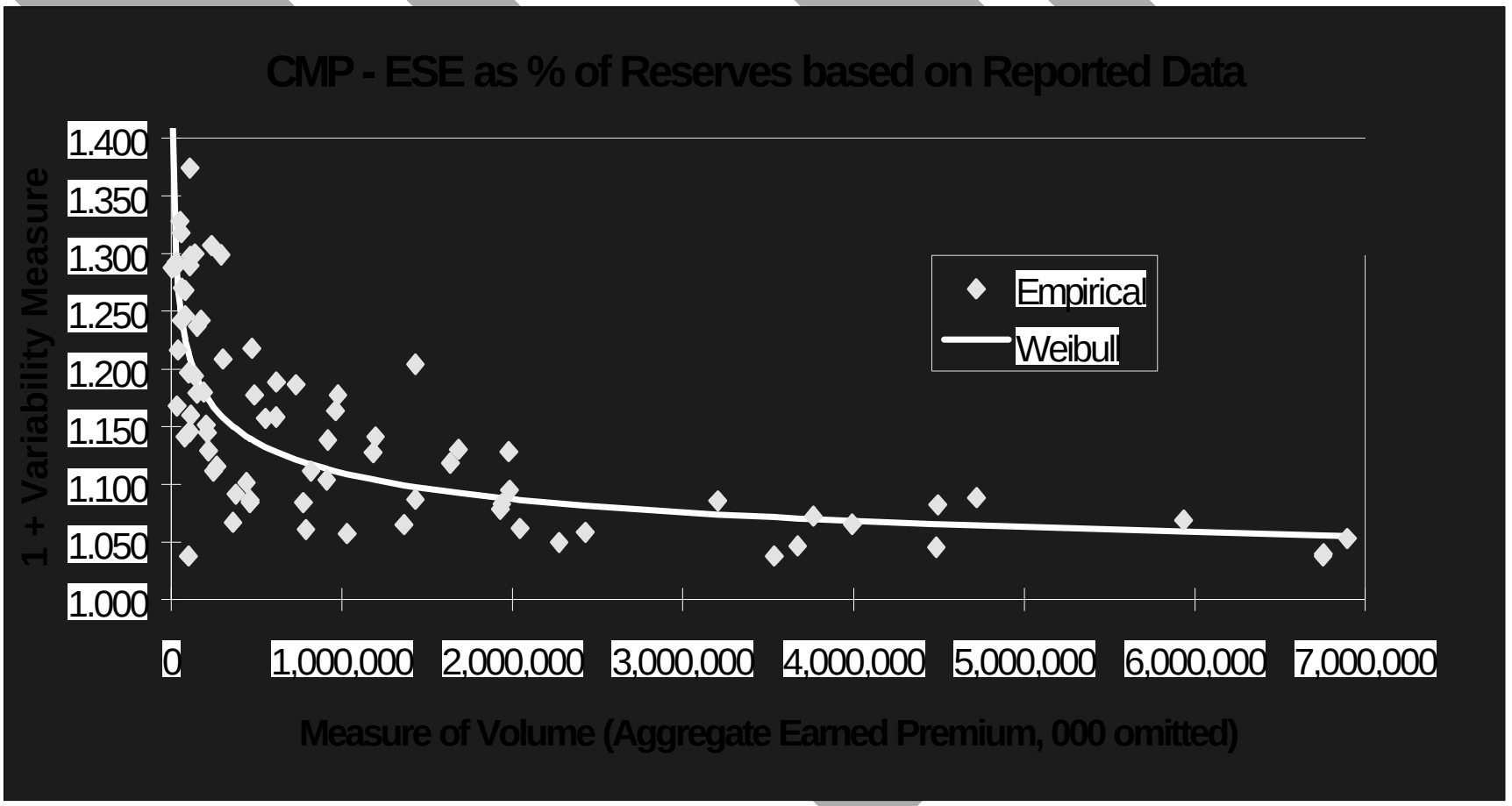
- Apply Mack algorithm (CAS 1993) as extension of the chain ladder method
- Calculate estimated standard error (ESE) of total reserve estimate for all accident years combined
- Express ESE as percentage to estimated total reserve
- Store results in the Affinity database

Evaluate Relationship



- Fit the empirical results to four curves
- Evaluate statistics for goodness of fit
- Pick the best curve
- Evaluate implications for volume based on selected values for estimated standard error

What did the Results Look Like?



How Significant?

	R^2 - Statistic		F-Statistic	
	Paid	**Reported**	**Paid**	**Reported**
CAL	**53%**	**58%**	**88**	**108**
CMP	**60%**	**63%**	**119**	**138**
HO	**57%**	**54%**	**115**	**104**
PAL	**51%**	**55%**	**101**	**119**

How Much* to Achieve 5% Relative Standard Error to Reserves?

	Paid Basis	Reported Basis
CAL	$ 6 b	3 b
CMP	10 b	9 b
HO	23 b	13 b
PAL	5 b	5 b

***Aggregate Earned Premium, based on empirical testing.**

How Did Industry Data Fare?

		ESE as % Total Reserves	
	AEP	Paid	Reported
CAL	$ 116b	2.7%	1.6%
CMP	169b	2.7%	3.1%
HO	197b	9.3%	4.6%
PAL	483b	2.7%	2.4%

In Relation to Ultimates, How Did Industry Data Fare?

		ESE as % Est. Ultimate	
	EP	Paid	Reported
CAL	$ 116b	0.7%	0.4%
CMP	169b	0.6%	0.7%
HO	197b	0.6%	0.3%
PAL	483b	0.5%	0.4%

In Relation to Ultimates, How Much to Achieve 5% Relative ESE?

	Paid Basis	Reported Basis
CAL	$ 6 m	4 m
CMP	27 m	35 m
HO	300 k	450 k
PAL	15 m	5 m

Aggregate Earned Premium, based on empirical testing.

Why the Difference?

- Assume 100 ultimate, 50 paid, 50 reserve
- A standard error of 5 is 5% of ultimate
- But 10% of reserve

Implied Tolerances for Reserves Based on 5% Tolerance of Ultimate

	# Acc Years to Meet Requirement		
	1	3	10
CAL	6%	9%	20%
CMP	8%	11%	22%
HO	16%	32%	80%
PAL	8%	13%	32%

Using payment patterns based on industry data.

Relationship between Credibility for Ratemaking & Reserving ??

- Implications of the Historic Credibility Formula for Ratemaking on Reserving
  - Requirement = (t-stat / tolerance) ^{2}
  - GL: 7.5% ultimate tolerance --> 2% reserves means requirement increases 14x
  - Auto: 5.0% ultimate tolerance --> 1% reserves means requirement increases 25x

Areas for Further Research

- Increased sample
- “Scrubbing” procedure for unusual data
- Aggregating results for many lines
- Sources of “appropriate” external reference when subject data are not reliable
- Extension of credibility standards for ratemaking to reserving

Conclusions

- Bigger data generally means smaller variability, but not always
- Apparently small tolerances in relation to ultimate may be equivalent to large tolerances in relation to reserves
- Reserving exercises should include:
  - evaluation of variability of the historical data
  - assessment of implications for realistic tolerances
  - consideration of external references

Discussion