AN EASY WAY TO BUILD RESERVE RANGES

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Research

- Paper: Quantifying uncertainty in reserve estimates
- Authors: Zia Rehman, Stuart Klugman
- Published Forum 2009: http://www.casact.org/pubs/forum/09spforum/07Rehman.pdf

Model Validation

- Tested 50 companies from using Schedule P part 2 on Homeowners data
- Calculated different reserve confidence intervals and tested against actual reserve 10 years later
- Performed Chi-square test to test if the ranges were sound: 95% confidence interval implies 5% (2.5 companies) of the time the actual is outside the range etc.

Goal

- To determine the distribution of actuary's true but unknown reserve
- The indicated reserve and complete history of loss selections is known
- Provide estimate of
  - Indicated Reserve ranges
  - Equal percentile margin allocation
  - Reserving capital
  - Loss portfolio transfer
  - Ranges around ultimate loss selections (or loss ratios)
  - Percentile of held reserves.

Data

- Recent reserve review data segments
- AY historical triangles of ultimate loss selections
- Resulting errors = log (link ratios) of ultimate loss triangle
- Cumulative paid or incurred loss data by AY

How This Model Differs From Other Models?

- Reserving risk pertains to errors in ultimate loss selections and not paid or incurred link ratios

- Due to historical changing conditions such as speed of settlement, case reserve adequacy, reserve practices and modeling, the reserve adequacy shifts over time.

How This Model Differs From Other Models?

- Cannot assume that present reserves have no bias.
- Volatility must capture error correlation by development interval and by AY. It should relate to errors in actual selected ultimate losses.
- Ties to the regulatory framework of Schedule P Part 2

Why Use This Model?

- True AY ultimate loss has lognormal distribution by the central limit theorem - Easy to test this assumption
- Taylor series approximation: True but unknown reserves have lognormal distribution. Simulation usually unnecessary but can be done.
- All calculations can be done easily in excel. Analytically very tractable.

Why Use This Model?

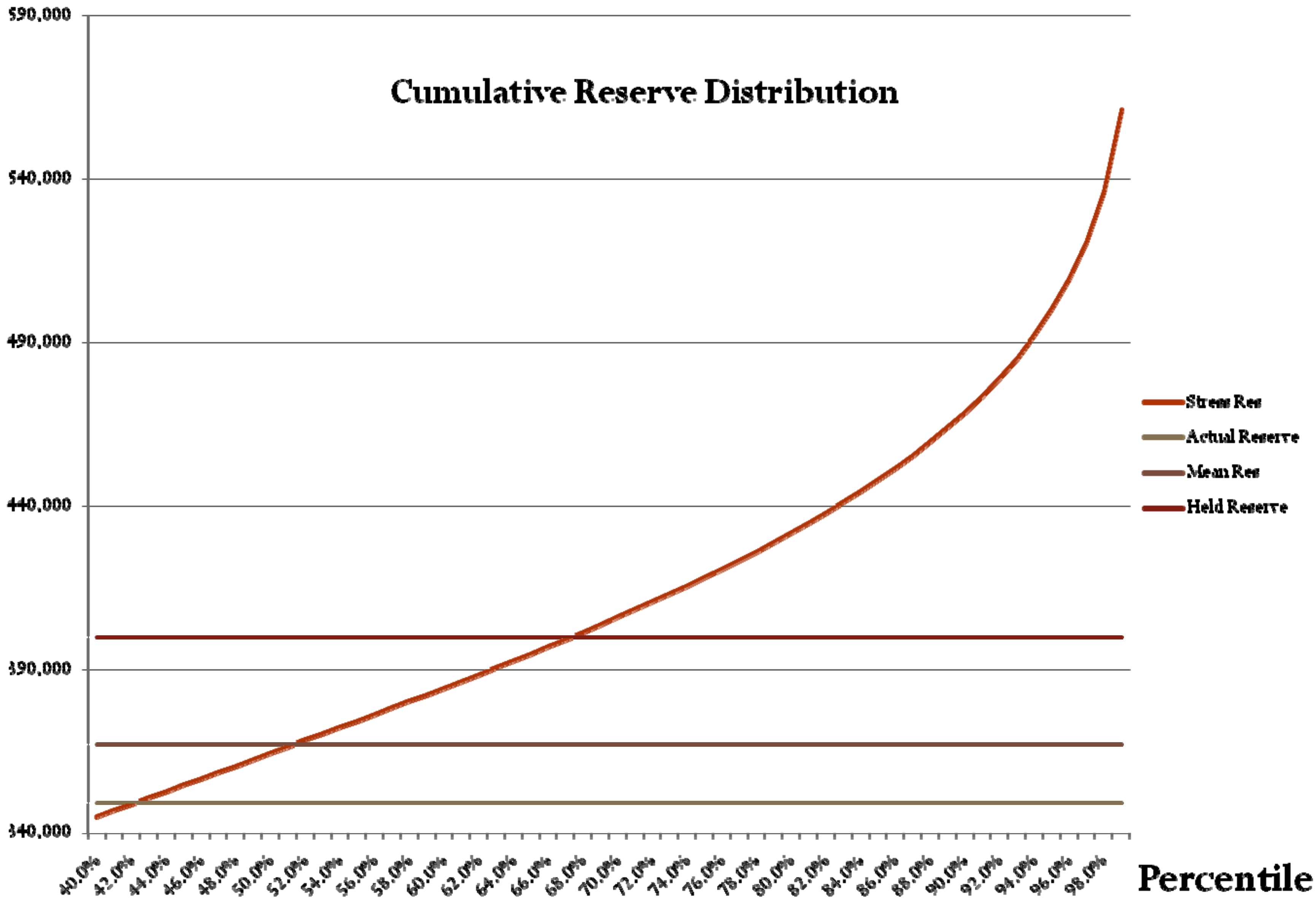
- Ties to the actual reserve review, data segments and ultimate loss selections
- Not abstract: Data of errors provides insight into the accuracy and variability of loss selection process.
- Provides a new way to project ultimate losses if paid or incurred data is used instead of ultimate loss selections.

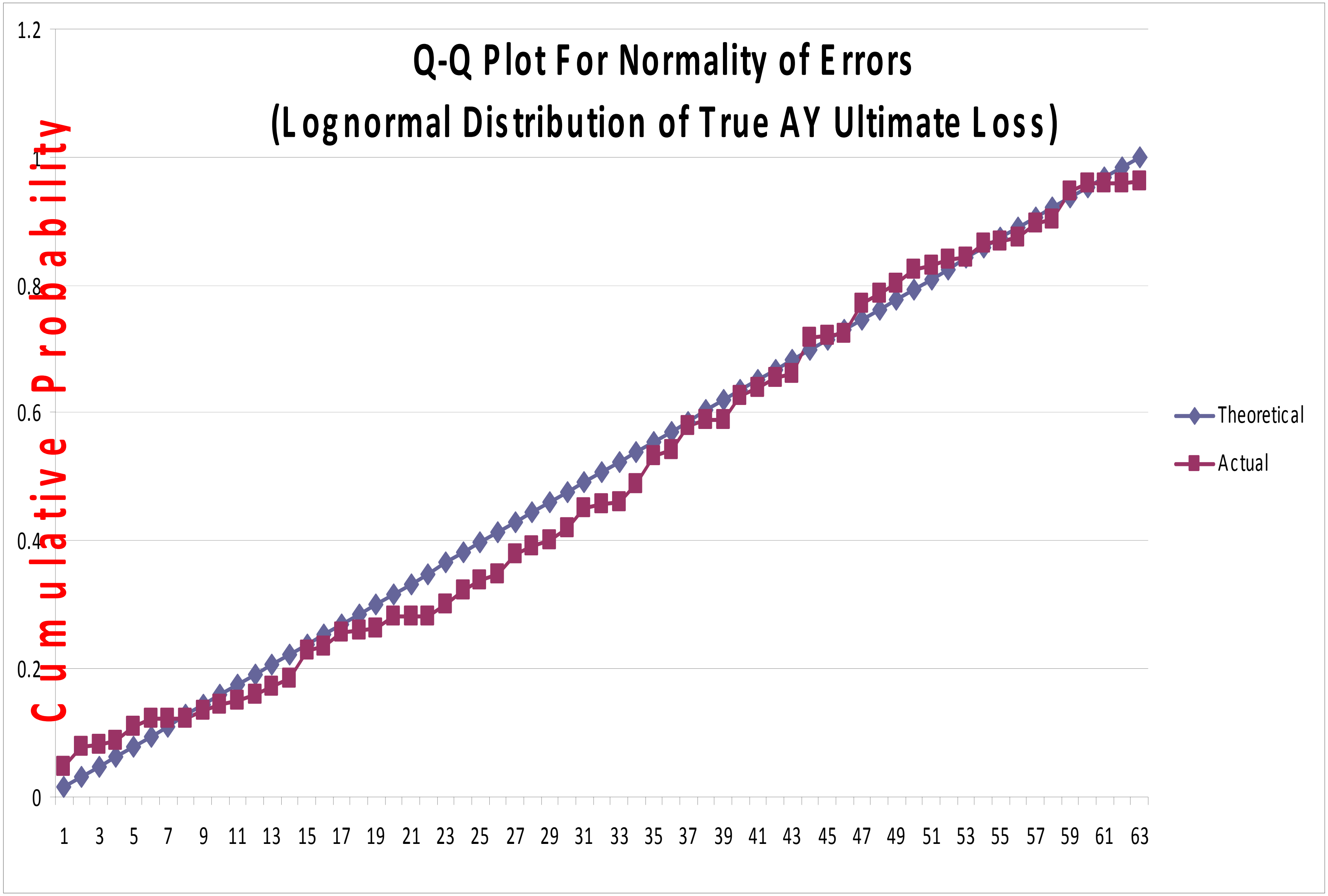
Bias and Variability

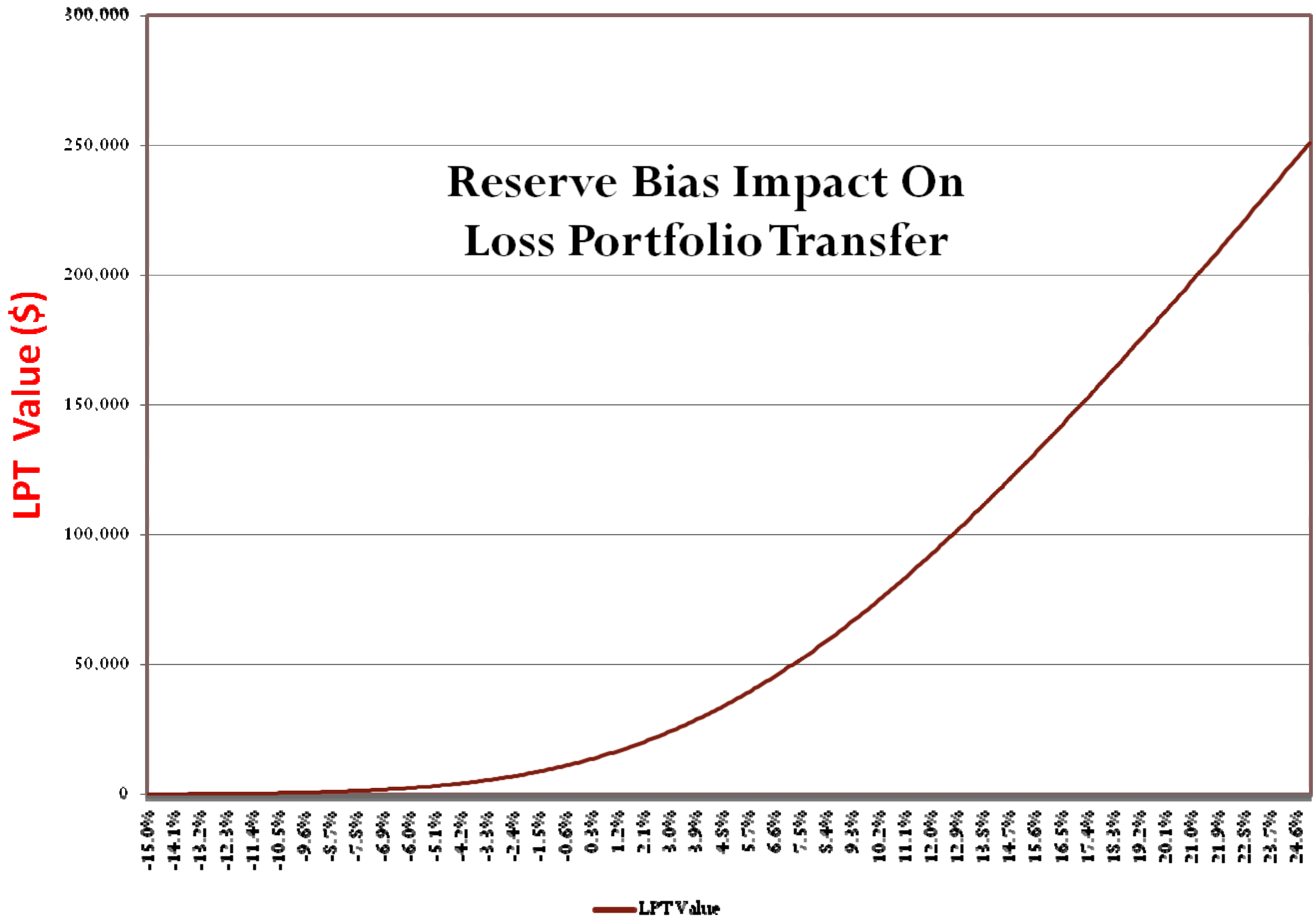
- Variability of errors (σ Parameter for Lognormal)
- Process risk in underlying link ratios – actual ultimate will always be different than selected (even if model is unbiased)
- Parameter risk in loss selections (and modeling) involves finding the unbiased estimate (mean)
- Correlation of errors by development interval
- Bias (μ Parameter for Lognormal) : A second look at the current reserve review for selection biases using error triangles.

Easy Formulas

- V = sum of selected ultimate loss in current reserve review (all AY)
- Log (True Ultimate) ~ Normal (μ + log V, σ)
- Unbiased Ultimate = V*exp(μ + σ ^2/2)
- Stress True Ultimate = V*exp(μ + Normal Cutoff * σ)
- Unbiased Reserve = Unbiased Ultimate– Paid (or Incurred)


Cumulative Reserve Distribution
590,000
540,000
490,000
440,000
390,000
340,000
Stress Res
Actual Reserve
Mean Res
Held Reserve
40.0%
42.0%
44.0%
46.0%
48.0%
50.0%
52.0%
54.0%
56.0%
58.0%
60.0%
62.0%
64.0%
66.0%
68.0%
70.0%
72.0%
74.0%
76.0%
78.0%
80.0%
82.0%
84.0%
86.0%
88.0%
90.0%
92.0%
94.0%
96.0%
98.0%
Percentile


Q-Q Plot For Normality of Errors
(Lognormal Distribution of True AY Ultimate Loss)
Cumulative Probability
1.2
1
0.8
0.6
0.4
0.2
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63
Theoretical
Actual


Reserve Bias Impact On
Loss Portfolio Transfer
LPT Value ($)
300,000
250,000
200,000
150,000
100,000
50,000
0
-15.0%
-14.1%
-13.2%
-12.3%
-11.4%
-10.5%
-9.6%
-8.7%
-7.8%
-6.9%
-6.0%
-5.1%
-4.2%
-3.3%
-2.4%
-1.5%
-0.6%
0.3%
1.2%
2.1%
3.0%
3.9%
4.8%
5.7%
6.6%
7.5%
8.4%
9.3%
10.2%
11.1%
12.0%
12.9%
13.8%
14.7%
15.6%
16.5%
17.4%
18.3%
19.2%
20.1%
21.0%
21.9%
22.8%
23.7%
24.6%
LPT Value