Dependency and Calibration Working Party (DCWP) Research Results

Risk Based Capital ("RBC") Reserve Risk Charges – Standard Formula vs. Individual Company Assessments

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Objective

We compare the results of measuring reserve risk factors (RRFs) from:

(a) the standard formula approach described in DCWP Report 7

(b) three types of individual company stochastic reserve risk assessments

1. Stochastic loss development
2. Mack
3. Correlated Chain ladder method

Stochastic models are internal models that usually vary from company to company.

Authors and Disclaimer

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- The analysis and opinions expressed in this report are solely those of the authors, and in particular are not those of the members' employers, the CAS, or the American Academy of Actuaries

Two Approaches for Reserve Risk Factors

- Hindsight/Industry calibrations
  - Use industry data (Schedule P), i.e., all companies across all years
  - Compares the carried reserves at the initial reserve date to a hindsight value
- Inherent variability/individual company calibrations
  - Use individual company data rather than industry data
  - Calibration is based on variation inherent in the data, rather than a hindsight test
  - Aka “stochastic” methods

Improved Calibration Method (ICM)

- Hindsight/Industry calibration
- Uses the runoff ratios (change in reserve over initial reserve) of LOB specific 1997-2010 Schedule P data from thousands of companies
- Lines of data consist of Company/LOB/Reserve Year
- Banded by reserve size
- RRF is 87.5th percentile of reserve runoff ratio over time and across companies
- Includes reserve runoff development from “all prior” line

Data Underlying Stochastic Methods

- 1997- 2010 Schedule P Data
- 126 Companies
- 167 Company-LOBS
- Short-tail lines not considered
- AYs 1988 – 2010 considered
- Companies with negative reserves or negative paids not considered

Data Underlying Stochastic Methods

- Selection Criteria
  - Attempted to have 19 Companies for each LOB spread over size by premium although all greater than $1 million NEP
  - Selected companies with 23 AY of Schedule P data
  - Preferred more stable sized companies
  - Typical levels of ceded reinsurance for the LOB
  - Used pooled companies only when necessary (large premium)

Stochastic Models

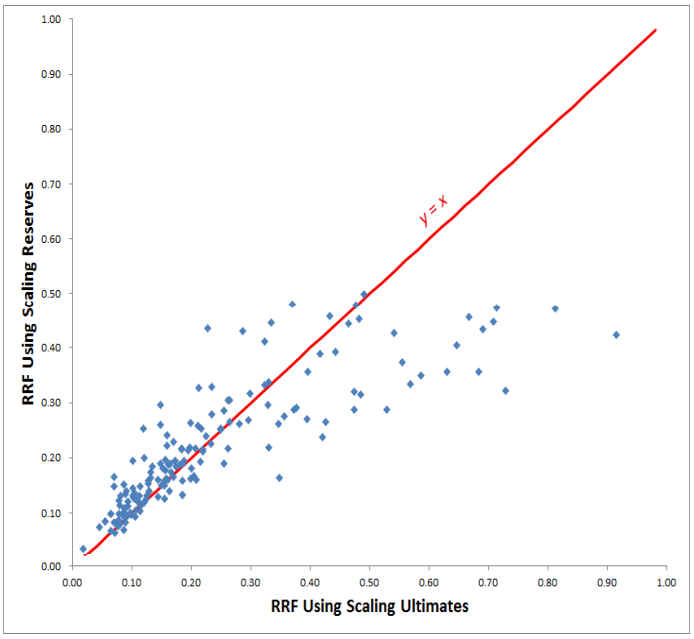
- Three Monte-Carlo simulation methods (Feldblum Reserve Models)
  - Chain Ladder using normal distribution of development factors
  - Borhnuetter-Ferguson (BF) using normal distribution
  - Chain Ladder using lognormal distribution
- Mack model
  - Assumes an error structure where uncertainty is proportional to square root of losses at prior age
- Correlated Chain Ladder (CCL)
  - Bayesian Markov-Chain Monte Carlo simulation method

Stochastic Reserve Risk Factor

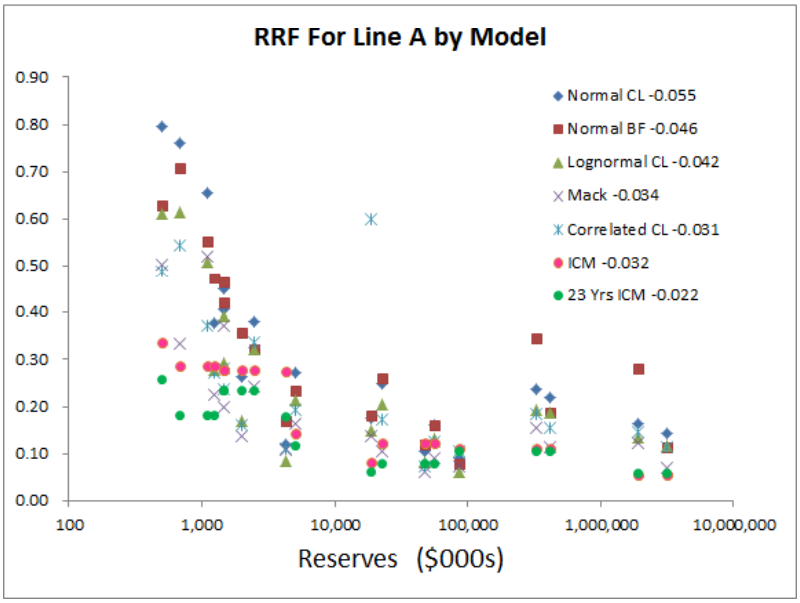
- Model output is the unpaid claim liability distribution
  - Felblum and Meyers produce an empirical distribution
  - Mack assumes a distributional format, i.e., log-normal
- Add paid to date to calculate a distribution of ultimate
- Scale the 87.5th percentile of stochastic distribution around the booked ultimate
- Risk Factor is calculated as follows:

$$\frac{87.5^{th}\text{ percentile around the Booked Ultimate} - \text{Booked Ultimate}}{\text{Booked Reserve}}$$

Scaling reserves versus ultimates does not seem to have a large effect

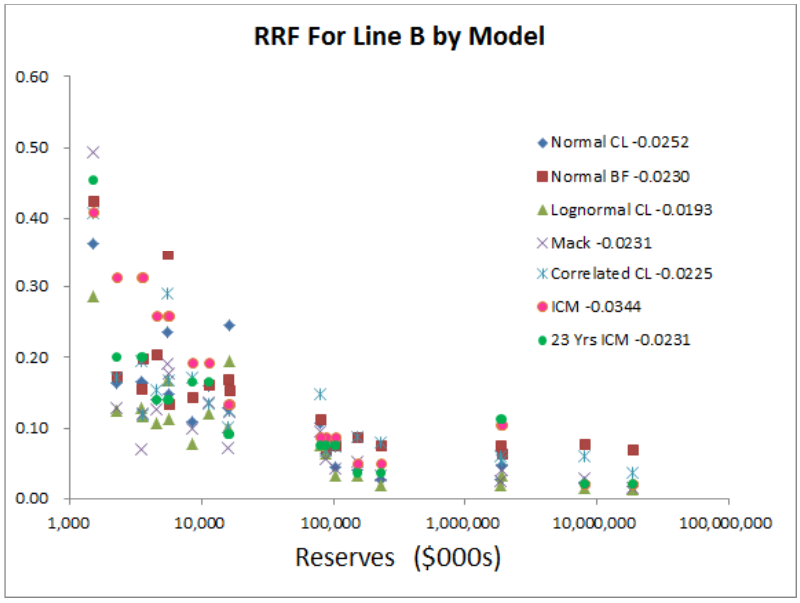


In Homeowners/Farmowners the RRFs from ICM are less than the stochastic methods for large companies



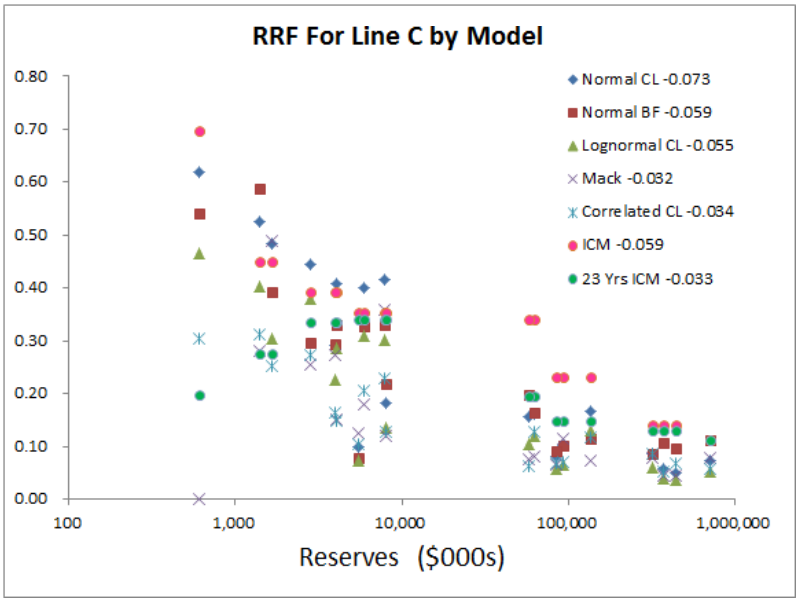
- ICM RRFs are generally less than those from the stochastic methods
- 23-year ICM RRFs are generally less than the baseline ICM RRFs for smaller reserve sizes
- For larger reserve sizes the two ICM RRFs results tend to converge below those from the stochastic methods
- Normal BF and CCL show some outliers

Private Passenger Auto shows declining RRF



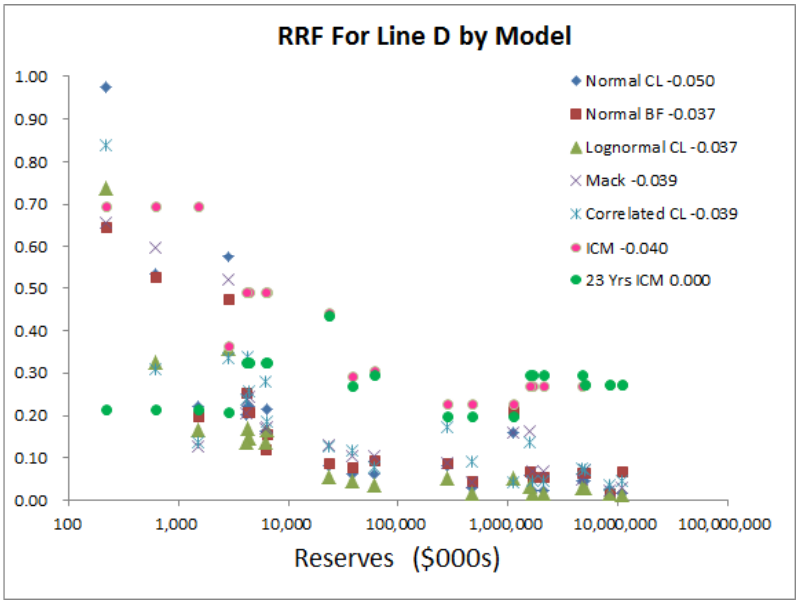
- ICM RRFs are generally within the range of stochastic methods

ICM RRFs for Commercial Auto are greater than stochastic methods



- The stochastic Mack and CCL methods do not measure tail risk
- The ICM on the other hand incorporates run-off from the prior year row and therefore does reflect development beyond 120 months

Workers Comp RRFs decrease with size



- RRFs for workers comp are generally lower than corresponding RRFs from other long tail lines due to less uncertain statutory indemnity benefits
- Flattening for larger companies might reflect more risky exposures

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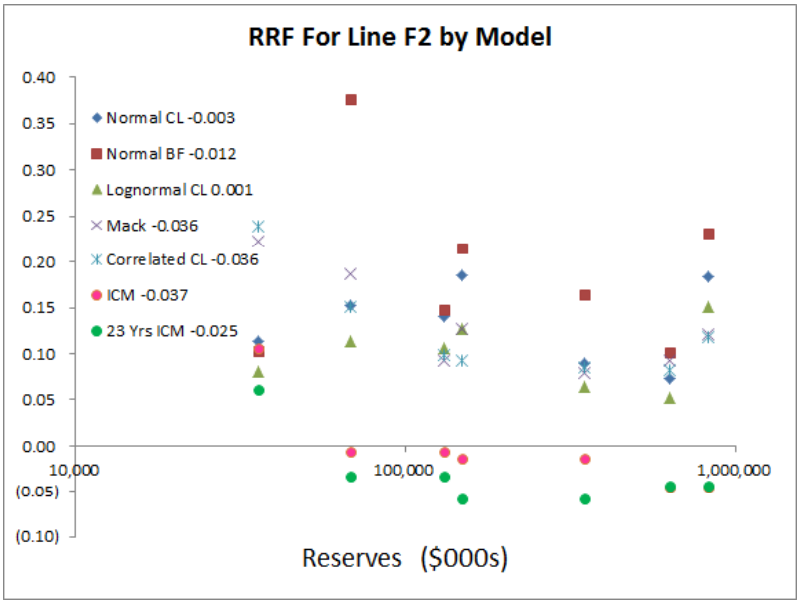
Claims Made Physicians Professional Liability ICM is negative



- Negative ICM RRFs reflect favorable reserve development for the medical malpractice industry as a whole

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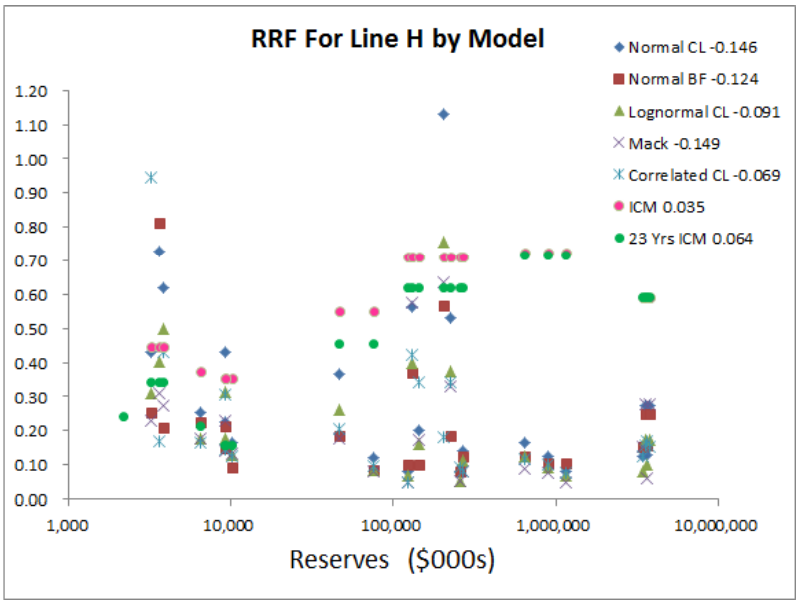
Other liability ICM RRFs behave quite differently from stochastic methods RRFs



- Upward trend for ICM RRFs maybe due to the fact that the "all prior experience" reflects A&E development for larger companies

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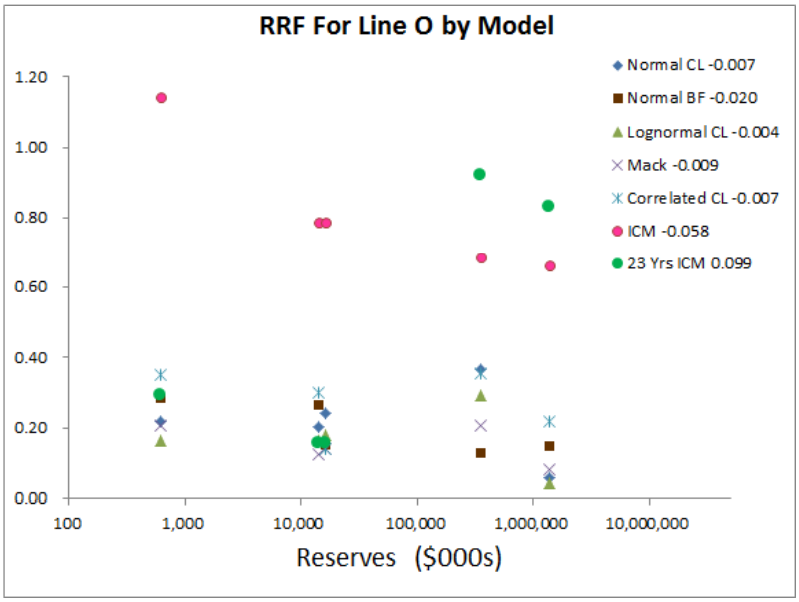
Reinsurance lines tend to have volatile RRFs

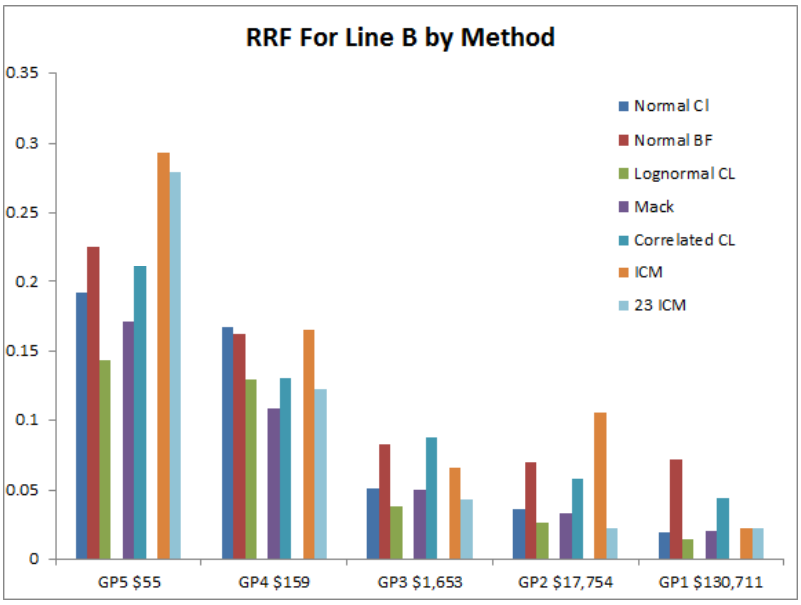


- The lower RRFs for stochastic methods might be reflective of more stable companies selected for the stochastic analysis

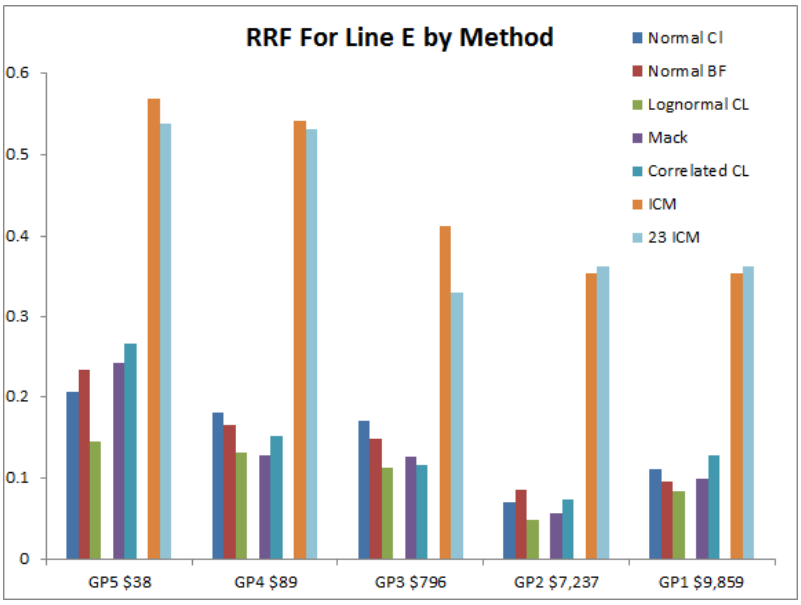
Summary of Findings

- The RRFs decrease as the LOB-premium increases
- For personal lines, the ICM RRF is comparable to the company modeled RRFs
- For many of the commercial lines and especially for large commercial lines, the ICM RRFs are noticeably larger than the stochastic RRFs
- Normal CL and Normal BF tend to produce higher RRFs than lognormal CL, Mack and CCL methods
- Mack tends to produce the lowest RRFs among the methods

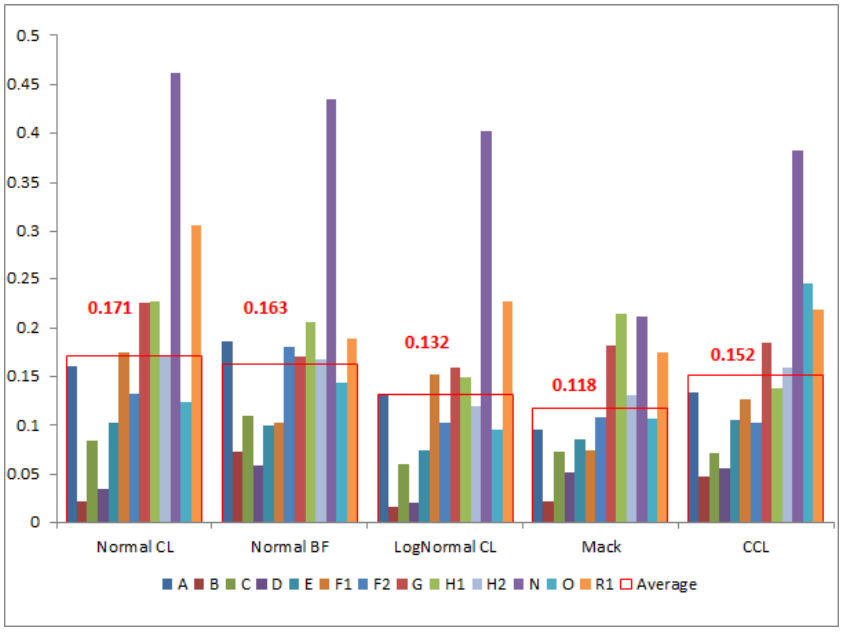
Personal Auto shows inverse relationship between RRFs and premium



In large commercial lines ICM RRFs are significantly greater than stochastic RRFs

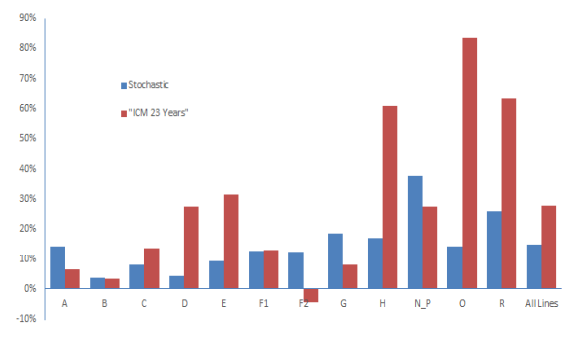


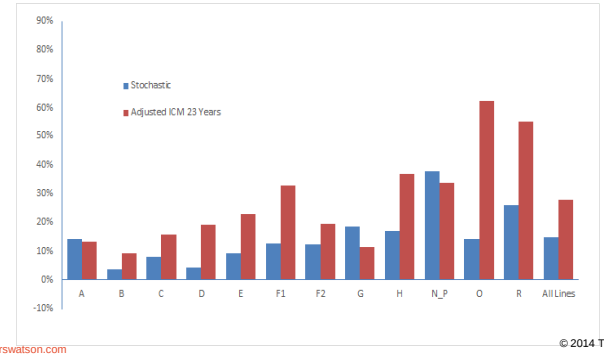
Reserve weighted average RRFs by LOB and method



- Monte-Carlo simulation methods are customarily more sensitive to outliers
- The Normal CL and Normal BF methods incorporate process and parameter risk while the LogNormal CL method incorporates only process risk
- The Mack model is an analytical approach not very sensitive to outliers

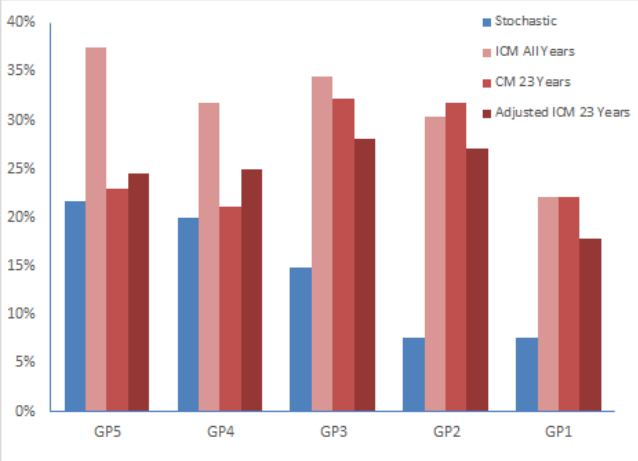
The effect of normalizing ICM to a zero average redundancy/deficiency





- Adjusting the 23 year ICM for observed redundancy/deficiency brings the RRF closer to the average of the stochastic methods
- For workers compensation we remove the adverse development due to the emergence of tabular reserves
- For products and other liability we remove the adverse A&E development
- For medical malpractice the negative ICM RRF becomes positive

RRF by LOB size average stochastic vs. ICM's



- Moving from ICM to ICM 23-years has a larger effect on smaller companies since volatility decreases with more years of experience
- Moving from ICM to ICM 23-years has less effect on larger companies
- The ICM-adjusted method reduces the difference from stochastic ICM for larger companies only

Questions… Comments?

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