MAI-3: The Biggest Problem with Your Pricing Model is Your Reserving Model

RPM Conference

March 16th, 2016

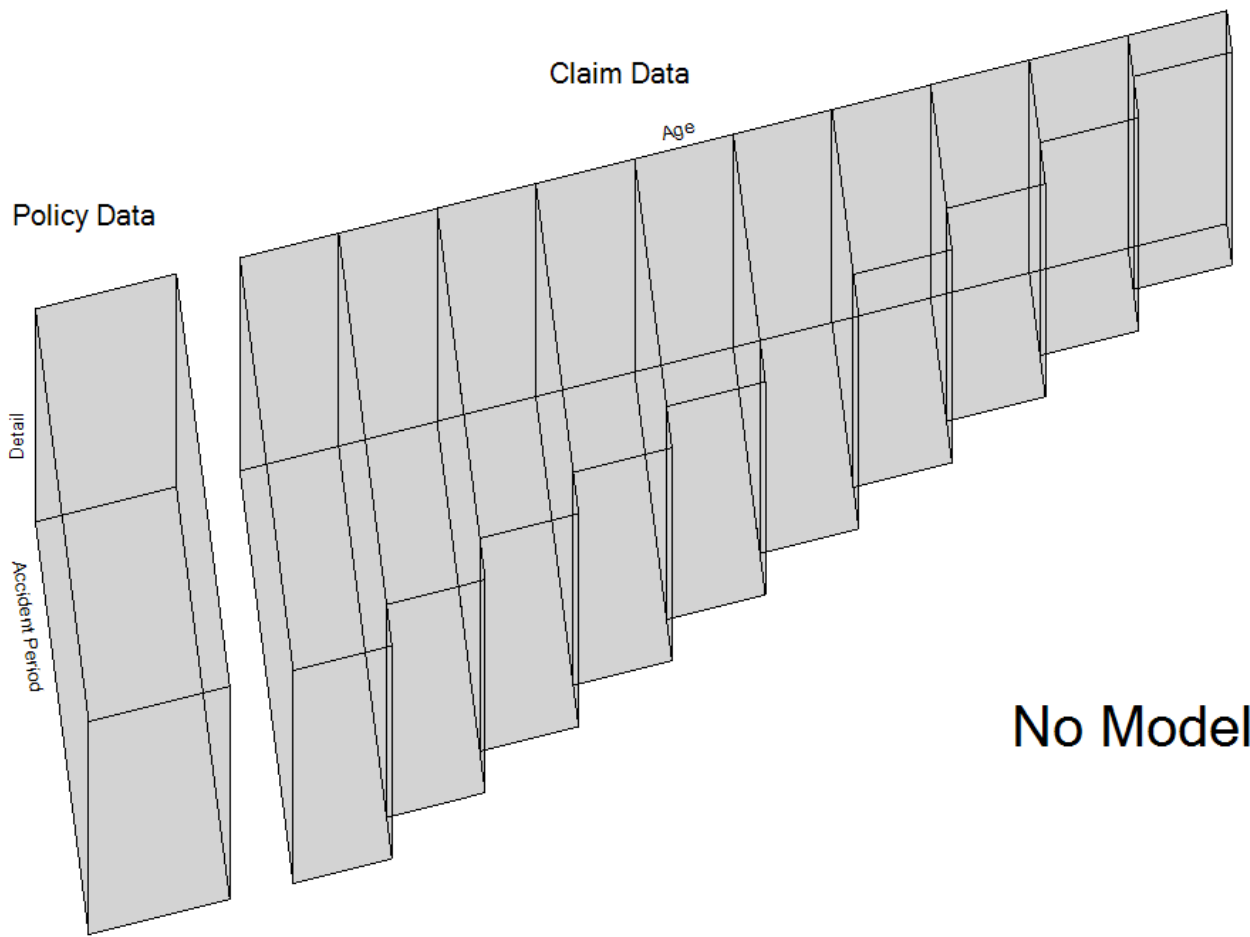Presenter: Chris Gross

The Pricing Problem

- Estimate discounted value of ultimate claim costs and expenses

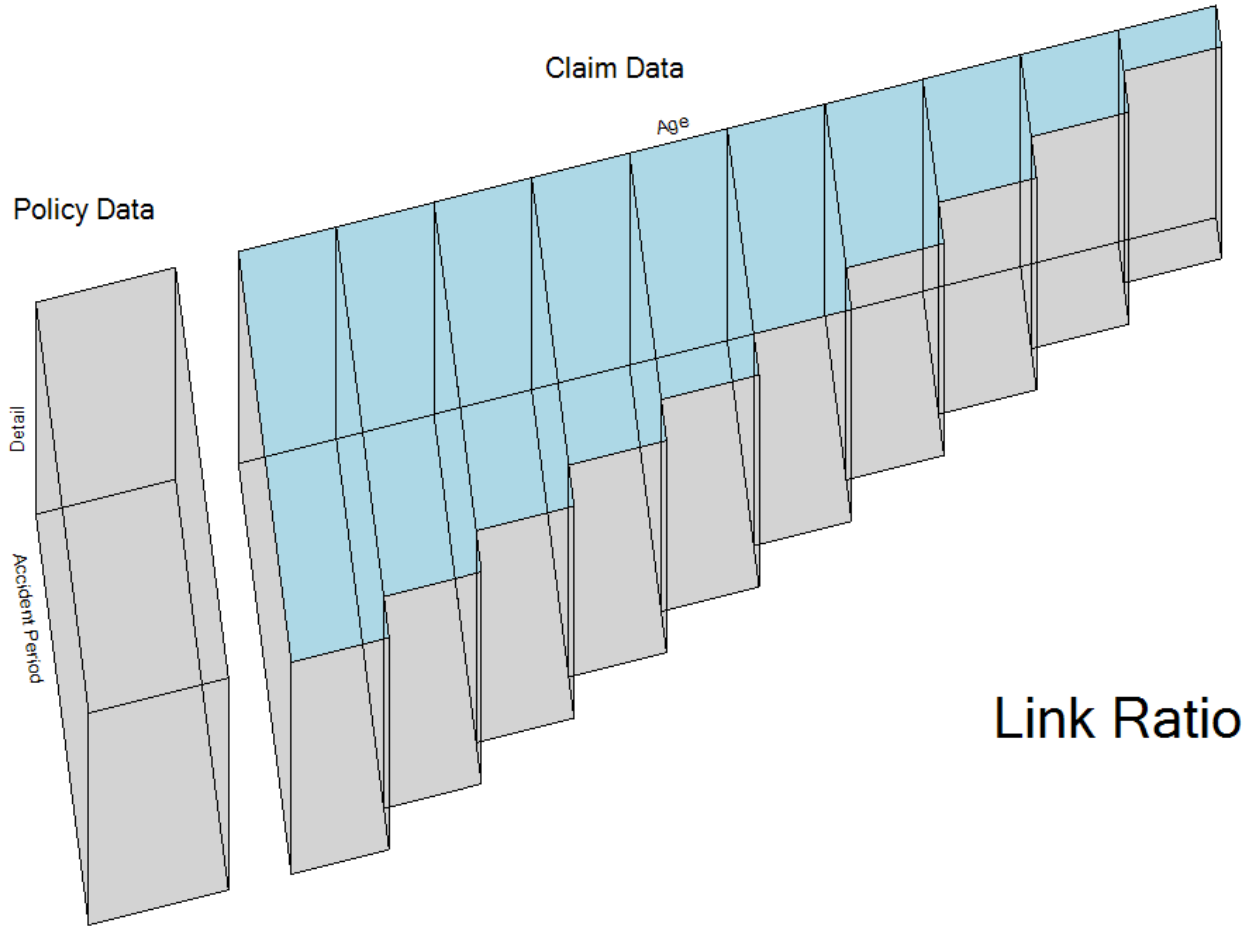- Estimate differences across available rating characteristics
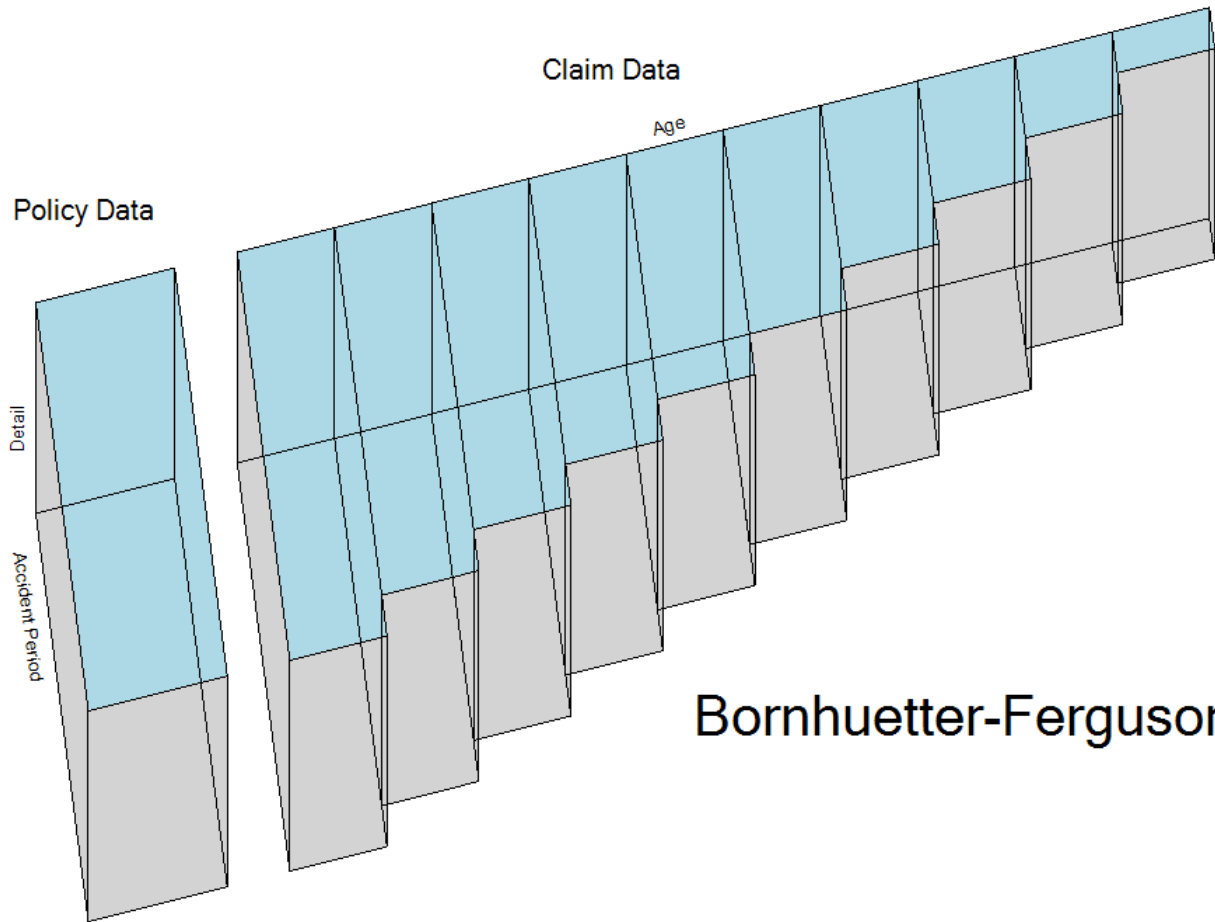
The (incomplete) Solution

- Build models based on the current diagonal only

- Build models based on a common age of development

(incomplete) Treatment of Loss Development

- Develop all losses with a factors based on age
- Reduce premium/exposure based on age
- Include policy effective date as a variable
- Only use the process to rank policies
- **Generally assumes all development is the same (wrong!)**

Policy Data

Claim Data

Age

Detail

Accident Period

No Model

Gross Consulting

Policy Data

Claim Data

Age

Detail

Accident Period

Link Ratio

Policy Data

Claim Data

Age

Detail

Accident Period

Bornhuetter-Ferguson

Gross Consulting

The Mix Problem… An Example

- Two classes of business
  - Class 1.
    - Faster developing
    - Lower ultimate loss ratio (60%)
  - Class 2
    - Slower developing
    - Higher ultimate loss ratio (90%)
- Class 2 has always been there, but only recently started growing significantly

Different Development
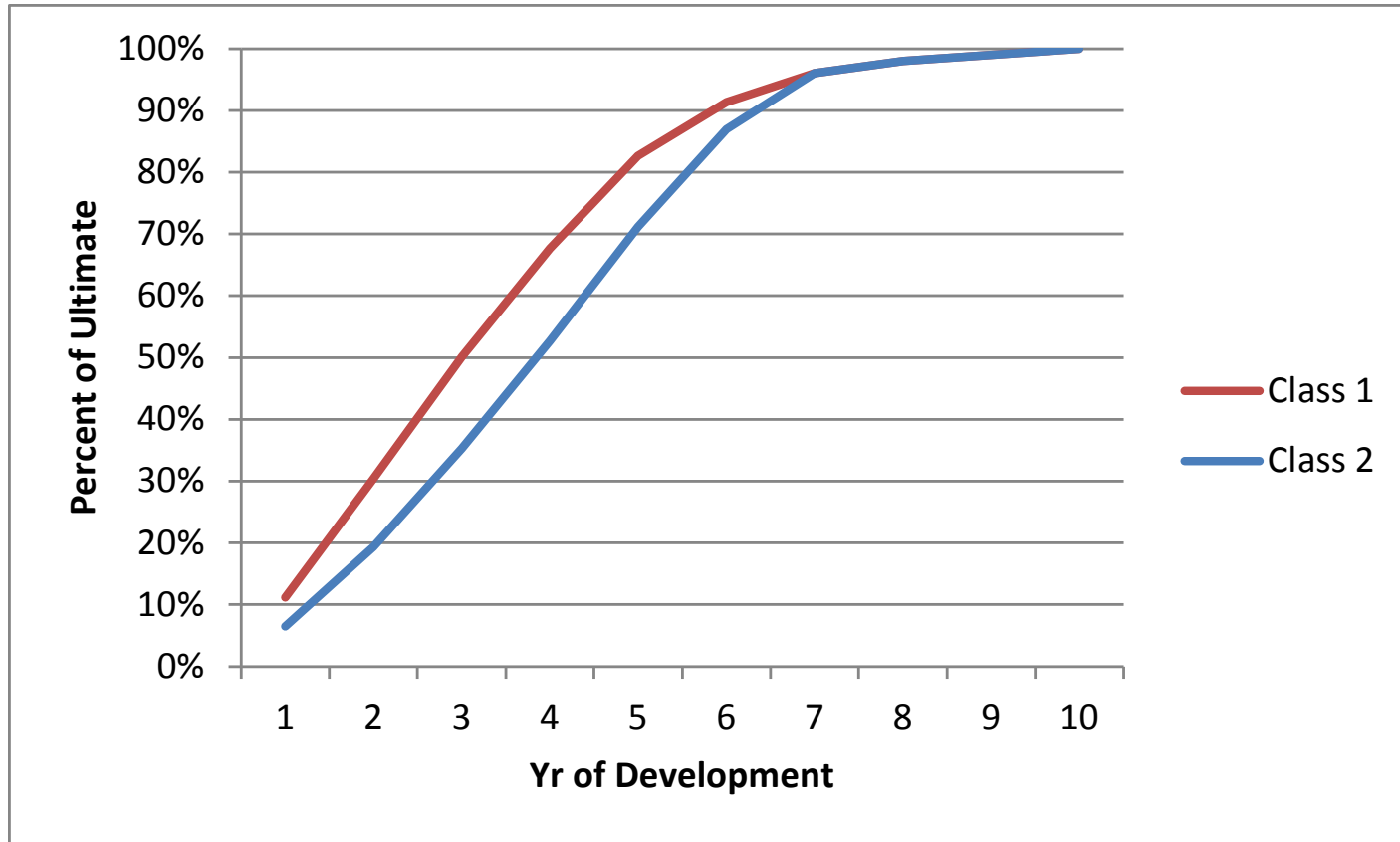
The Triangle

Year	Premium	Loss as of:									
		Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
2006	105	7.53	20.40	32.67	43.49	52.72	58.08	61.20	62.36	63.28	64.50
2007	105	8.06	20.72	32.65	43.52	54.68	60.16	63.87	64.15	63.71	
2008	105	6.48	19.23	30.80	42.47	52.70	58.32	60.99	62.91		
2009	105	7.21	19.21	30.81	42.44	52.93	59.64	61.78			
2010	105	7.43	21.88	34.36	43.89	53.76	59.81				
2011	105	6.76	19.19	33.07	43.90	54.42					
2012	105	7.11	18.49	30.01	40.40						
2013	120	8.44	22.18	37.25							
2014	140	8.65	25.87								
2015	160	9.81									

Development Factors

2006	2.709	1.602	1.331	1.212	1.102	1.054	1.019	1.015	1.019
2007	2.571	1.576	1.333	1.256	1.100	1.062	1.005	0.993	
2008	2.967	1.602	1.379	1.241	1.107	1.046	1.031		
2009	2.666	1.604	1.378	1.247	1.127	1.036			
2010	2.944	1.570	1.277	1.225	1.113				
2011	2.840	1.724	1.327	1.239					
2012	2.602	1.622	1.346						
2013	2.630	1.679							
2014	2.990								
Last 3	2.740	1.675	1.317	1.237	1.115	1.048	1.018	1.004	1.019
Cumulative	9.108	3.324	1.984	1.506	1.218	1.092	1.042	1.023	1.019

True Loss Ratio vs Estimate
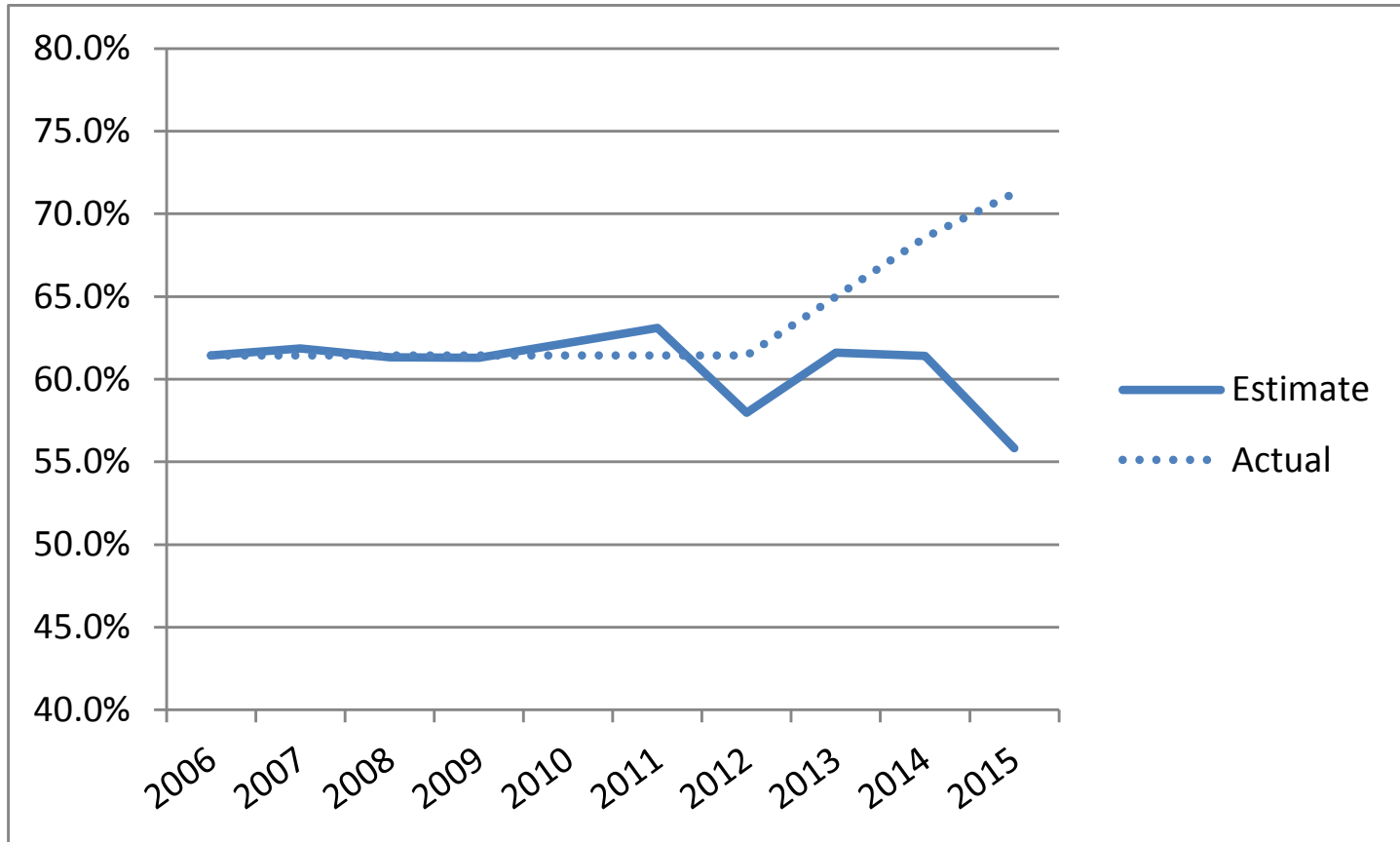
Potential Differences

- Industry classification

- Geography

- Deductible/Limit Profile

- Size of account

- Type of Claims

- Etc.

Policy Data

Claim Data

Age

Detail

Accident Period

Rate Indication

Predictive Model - Pricing

Predictive Model - Pricing 2

Policy Data

Claim Data

Age

Detail

Accident Period

Gross Consulting
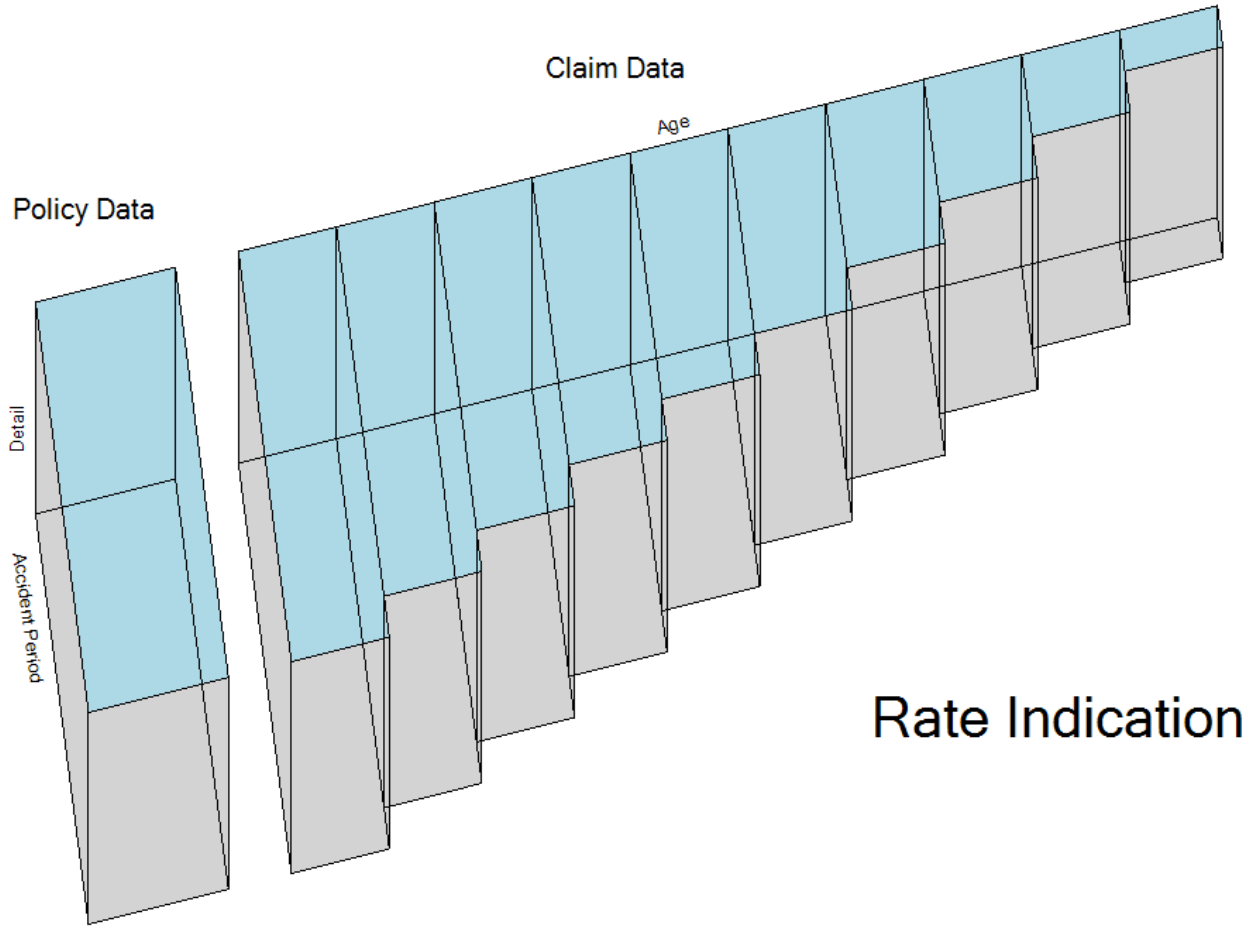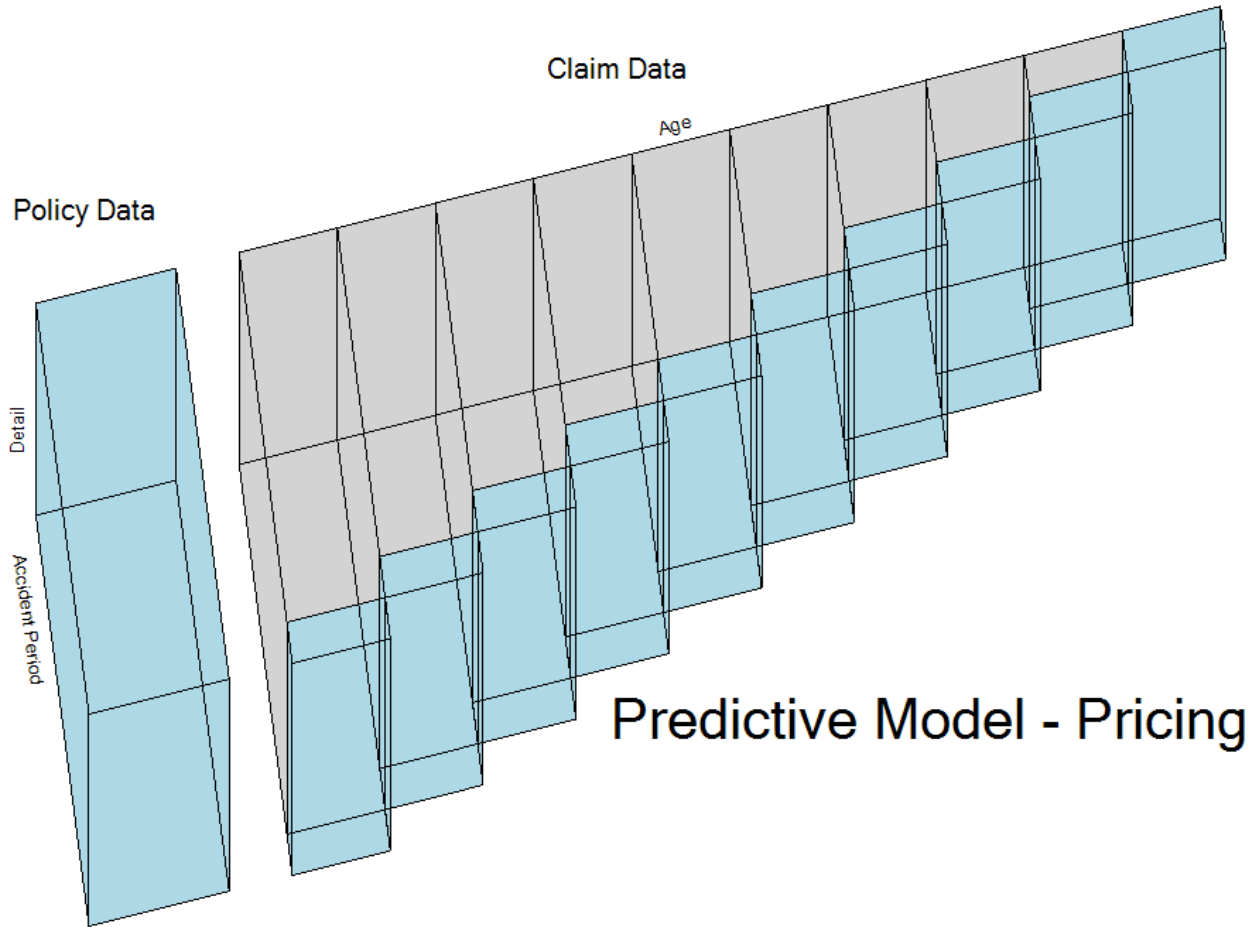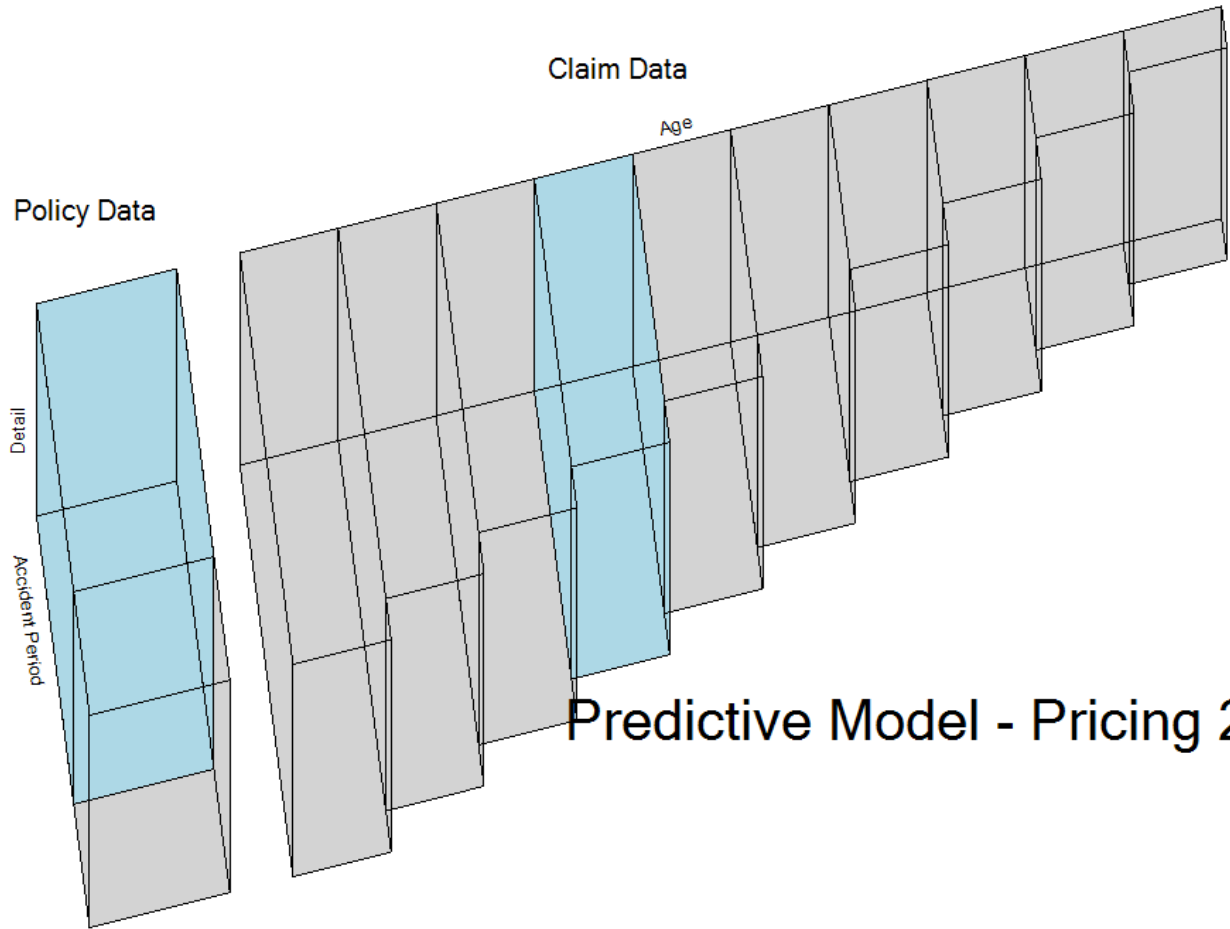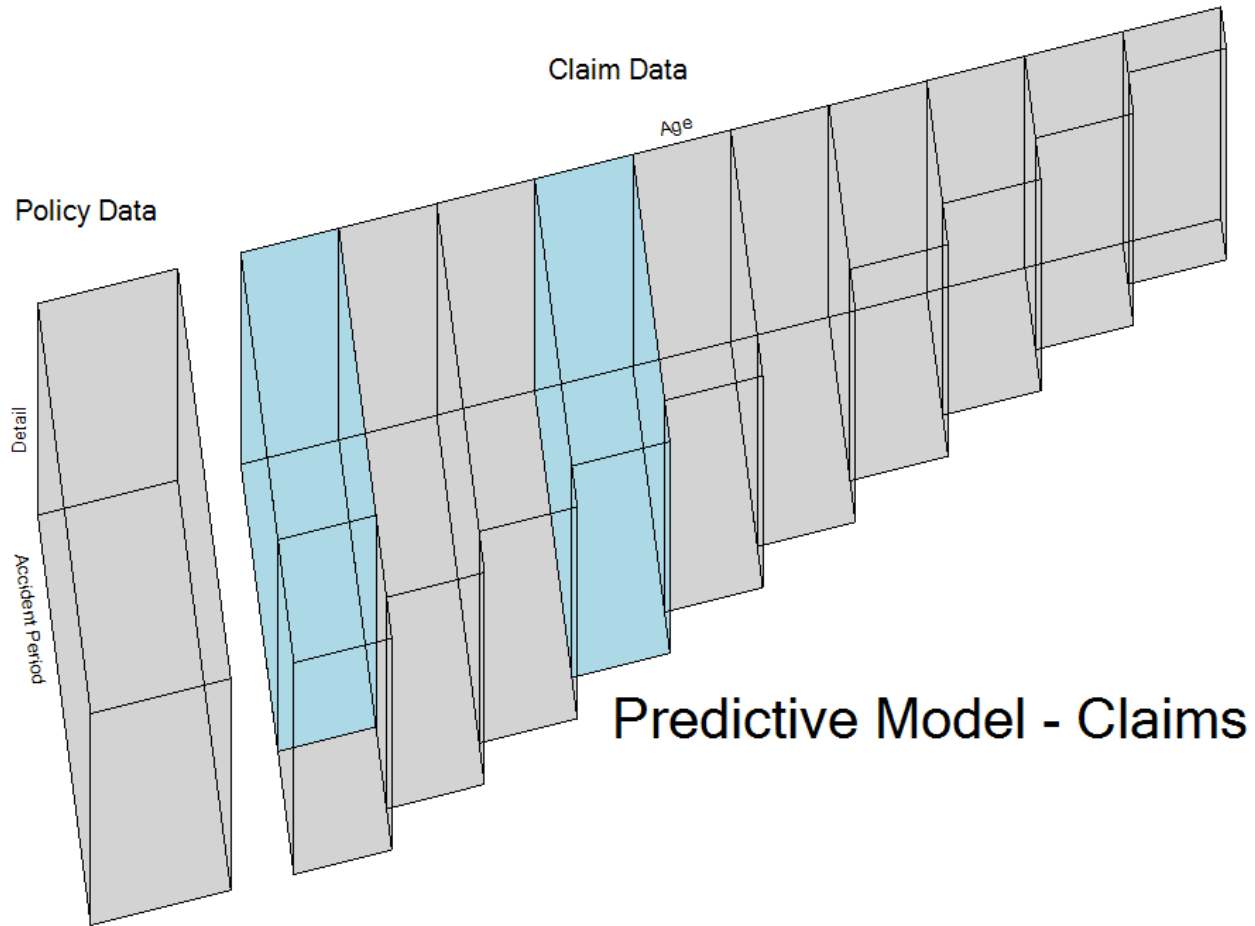
Predictive Model - Claims
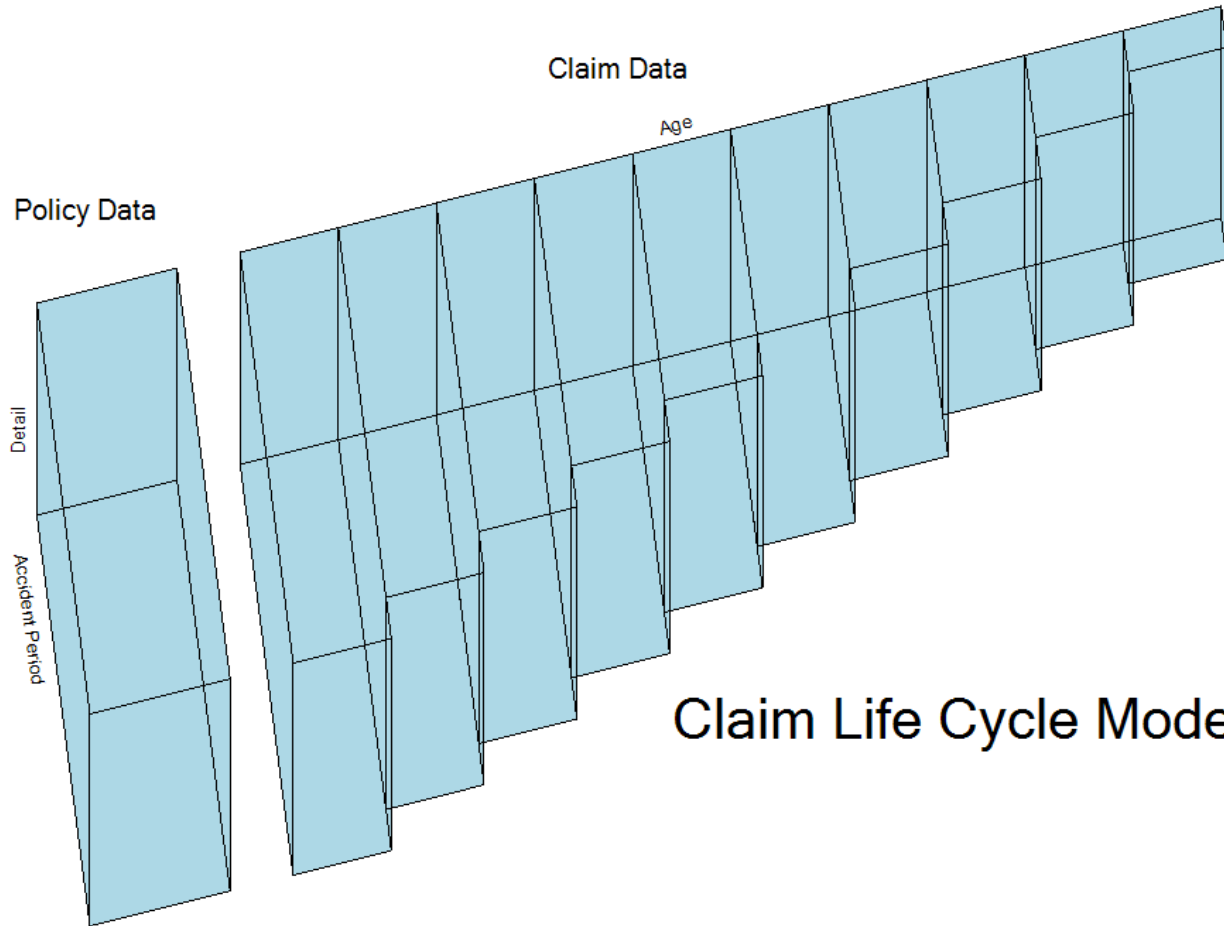
Claim Life Cycle Model

Challenges to Building a Complete Model

- An age old problem
  - Loss development occurs over time, mature periods are old
  - Immature claims contain information
- Many facets of loss development
- Helpful to concentrate on a single time-step (e.g. beginning of quarter to end of quarter)

Data

Financial Data

    Beginning Case Reserve

    Ending Case Reserve

    Payment in Period

Timing Data

    Accident Quarter

    Report Quarter

    Valuation Quarter

Exposure Characteristics

    Type

    Product

    ZIP Code

Claim Characteristics

    Loss Cause

    Loss Cause - Detail

Claim activity from the beginning of the quarter to the end of the quarter

Did the Claim Close?

Does the Claim Have a New Value?

What is the New Value?

Is there a Payment?

How much is the Payment?

Arrows indicate dependency on other results
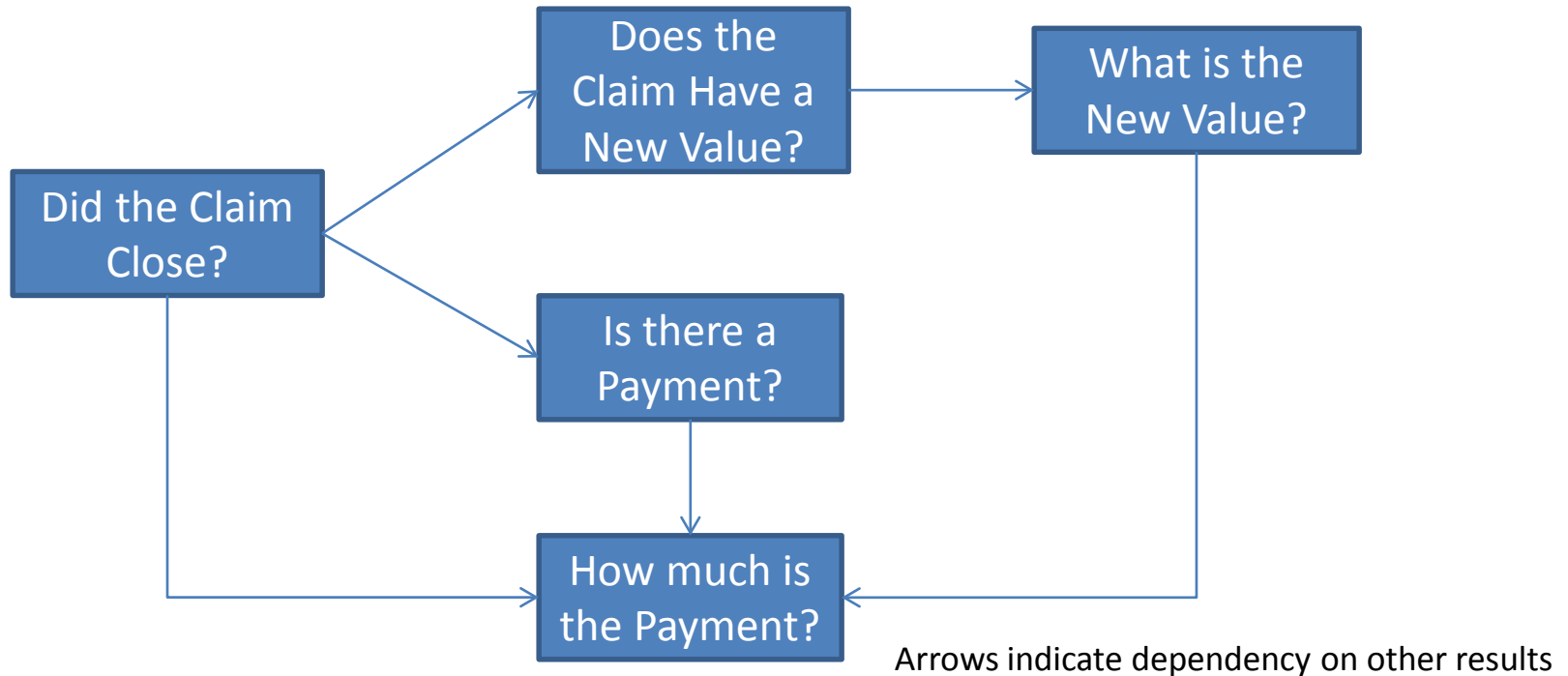
A number of available claim or exposure characteristics may have predictive value for any of these questions.

Probability of a Claim Closing

- Base probability of 71%

- Modification of this probability by various claim characteristic values that were found to have predictive value
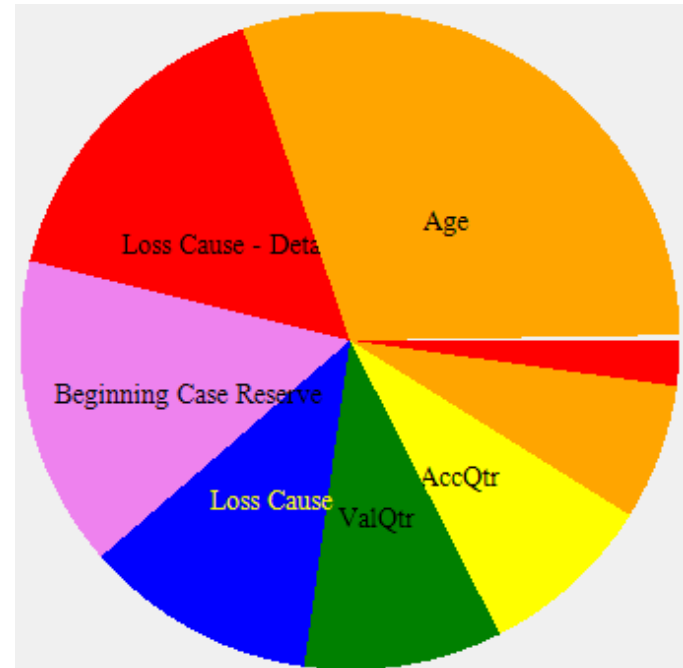
Close Probability – Claim Age
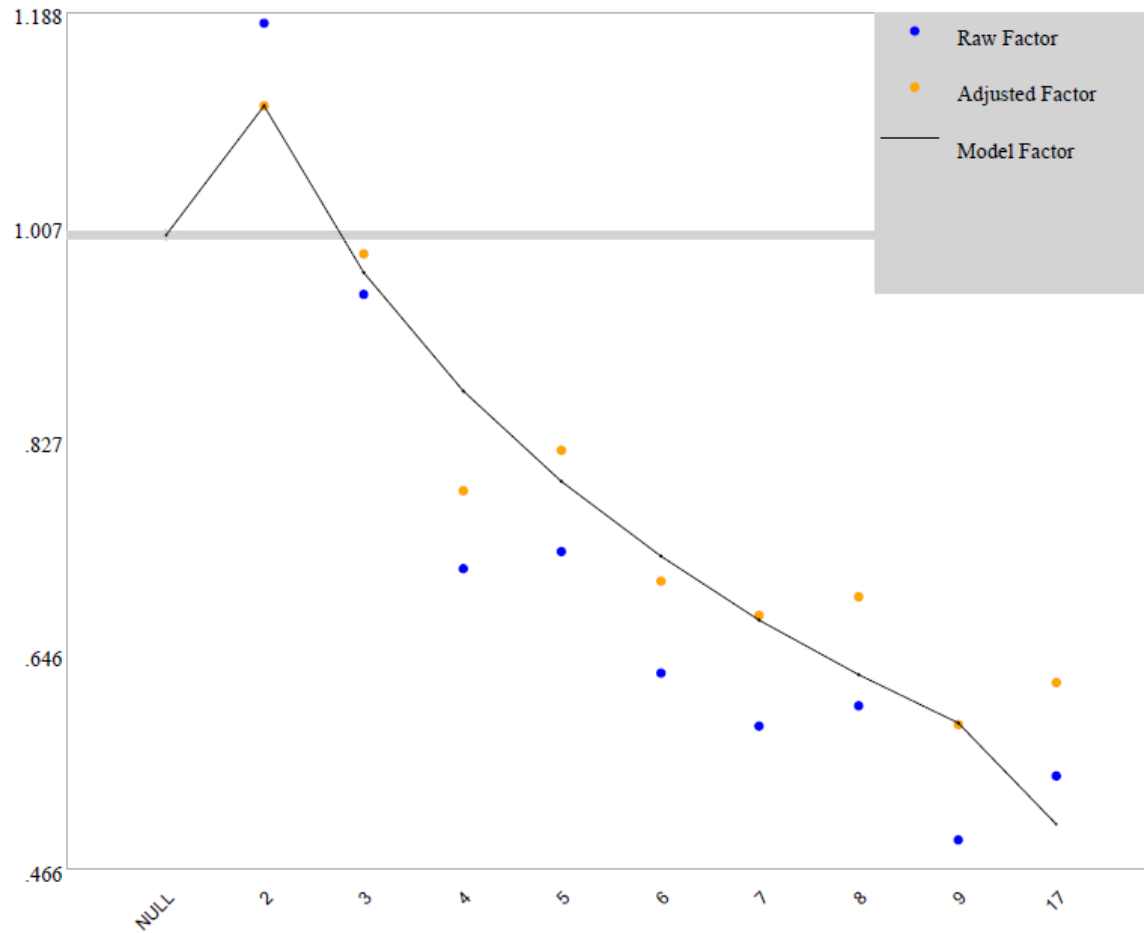
Close Probability – Loss Cause (detailed)
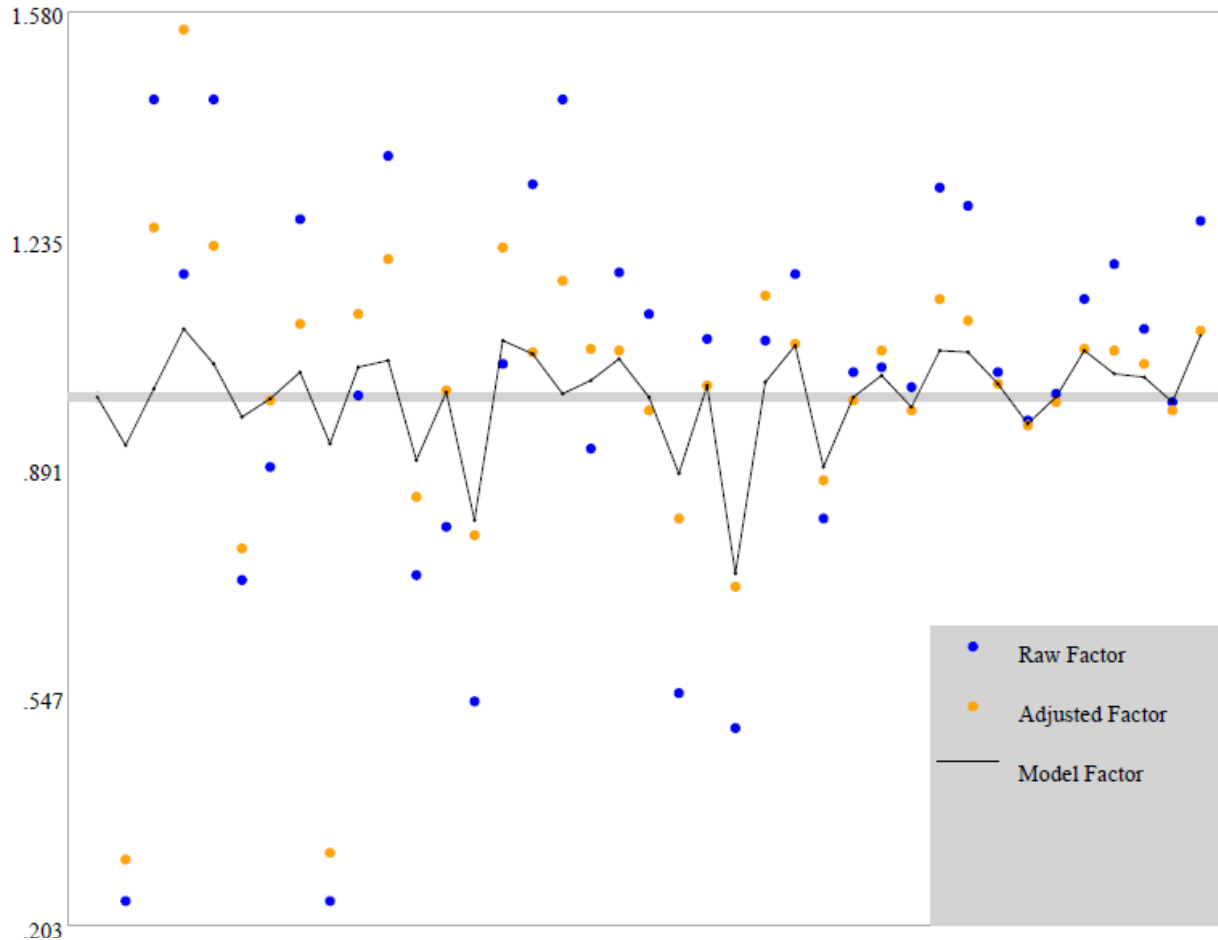
Close Probability – Loss Cause
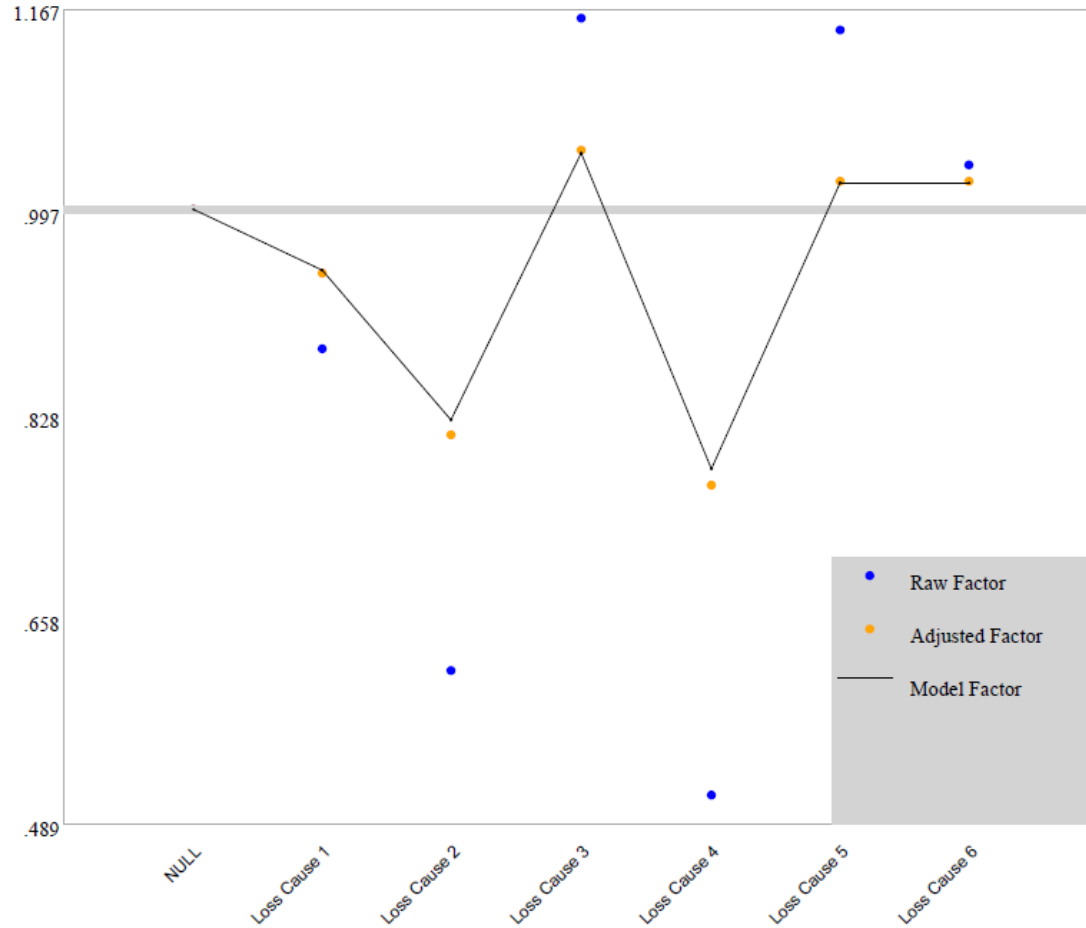
Close Probability – Accident Quarter
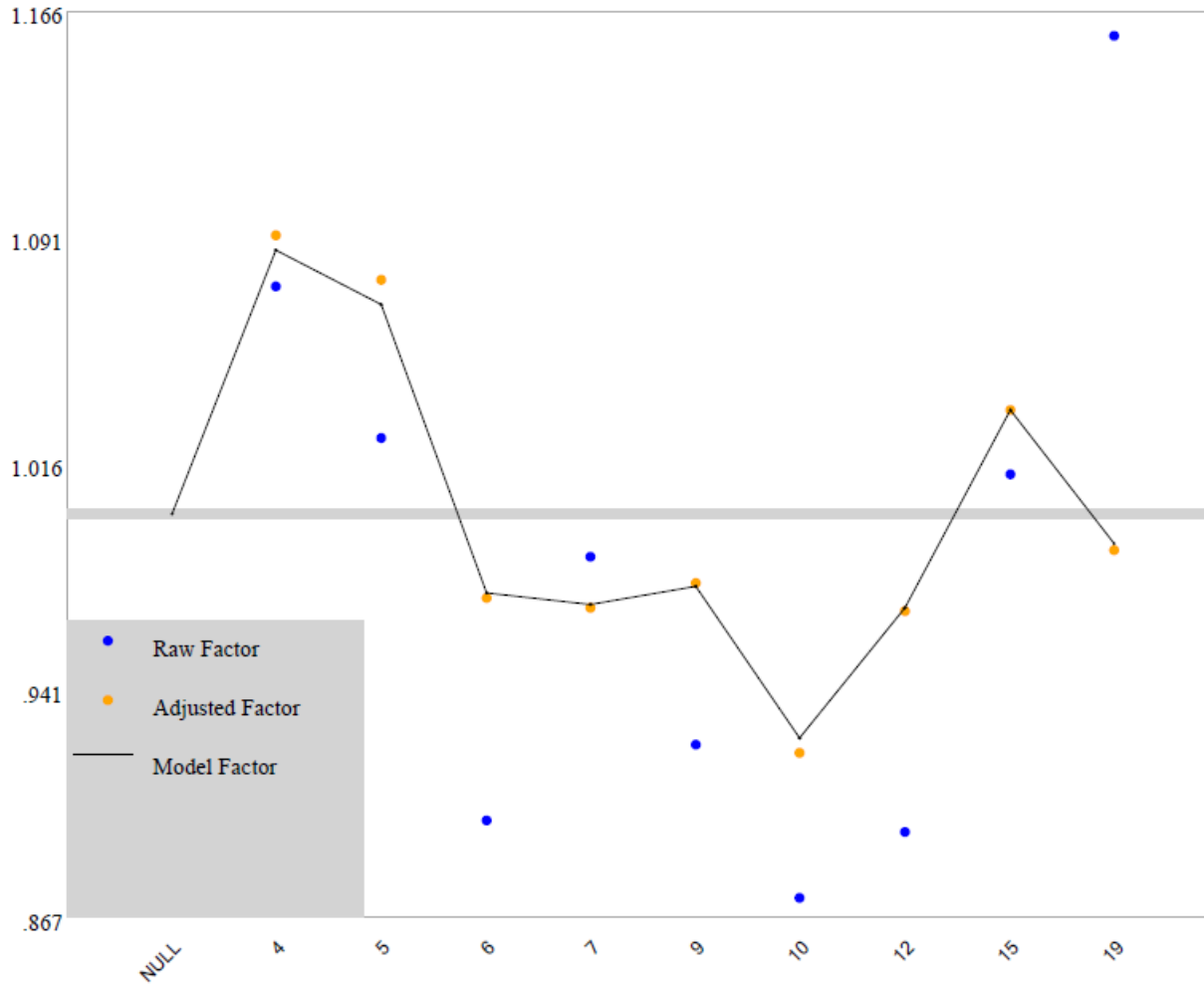
Close Probability - Product
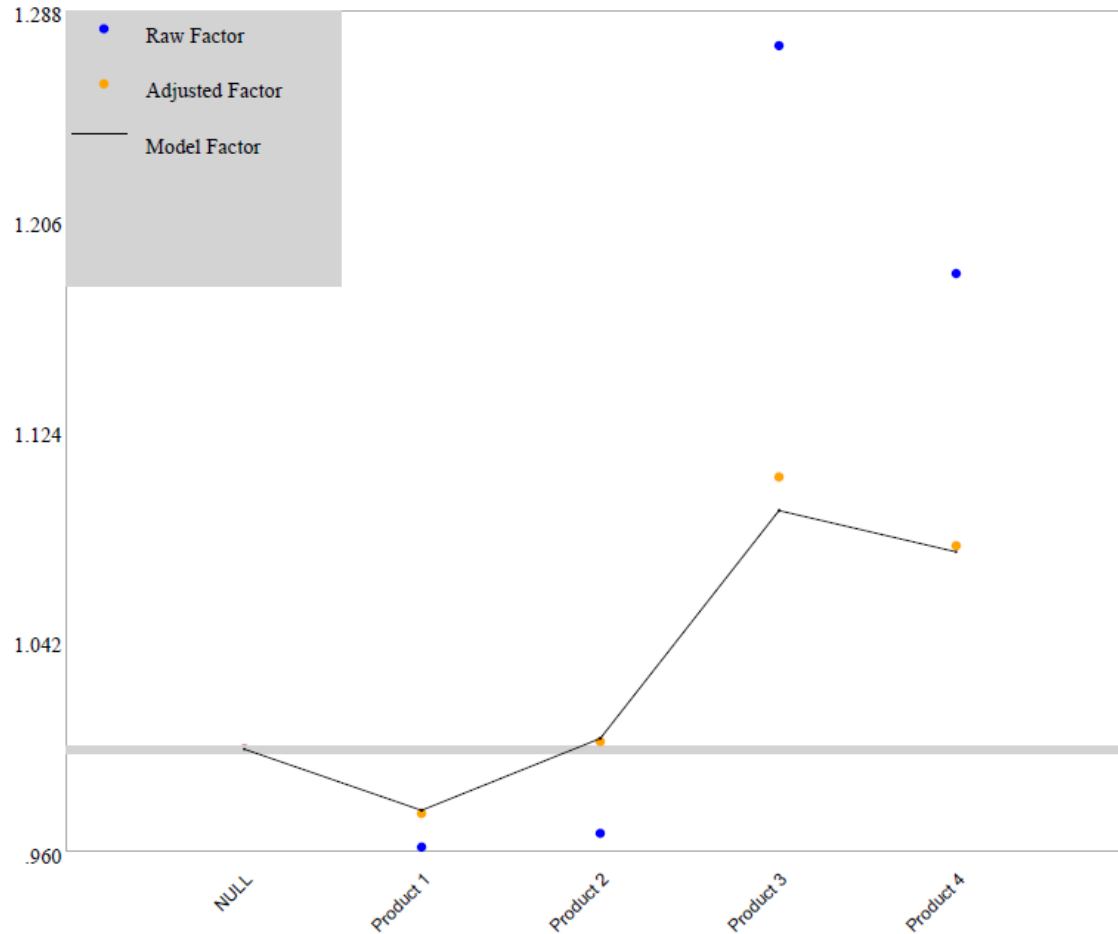
Close Probability - Type
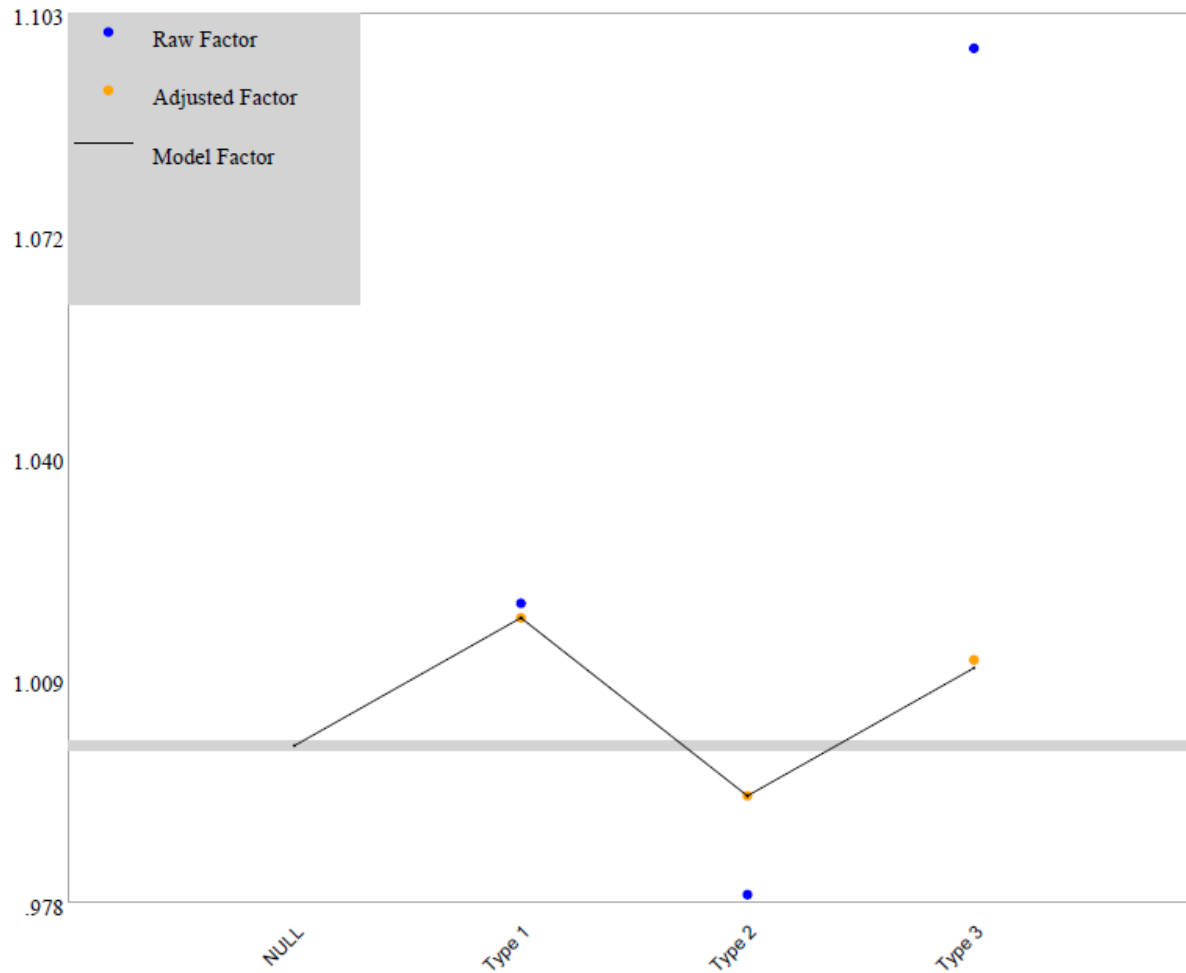
Probability of Change in Value (Given Not Closed)

- Base probability of 37%

- 4 characteristics found to be predictive
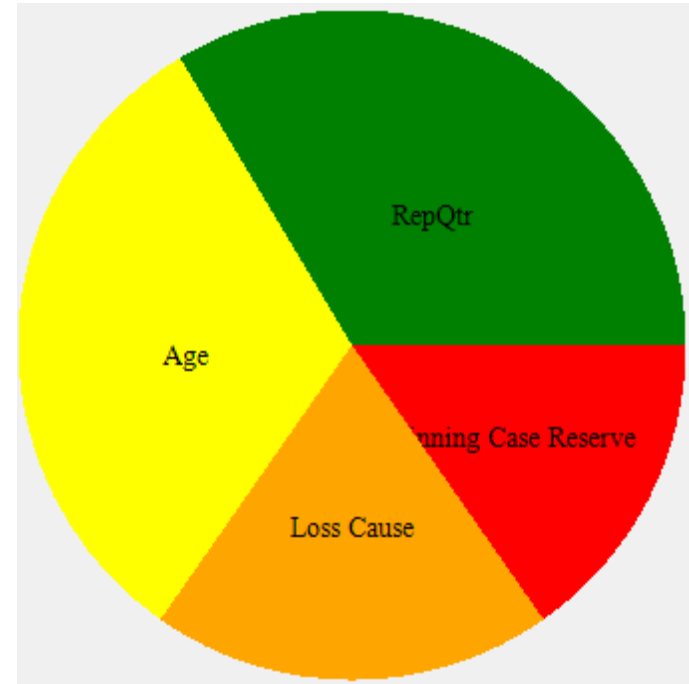
Change Probability – Claim Age
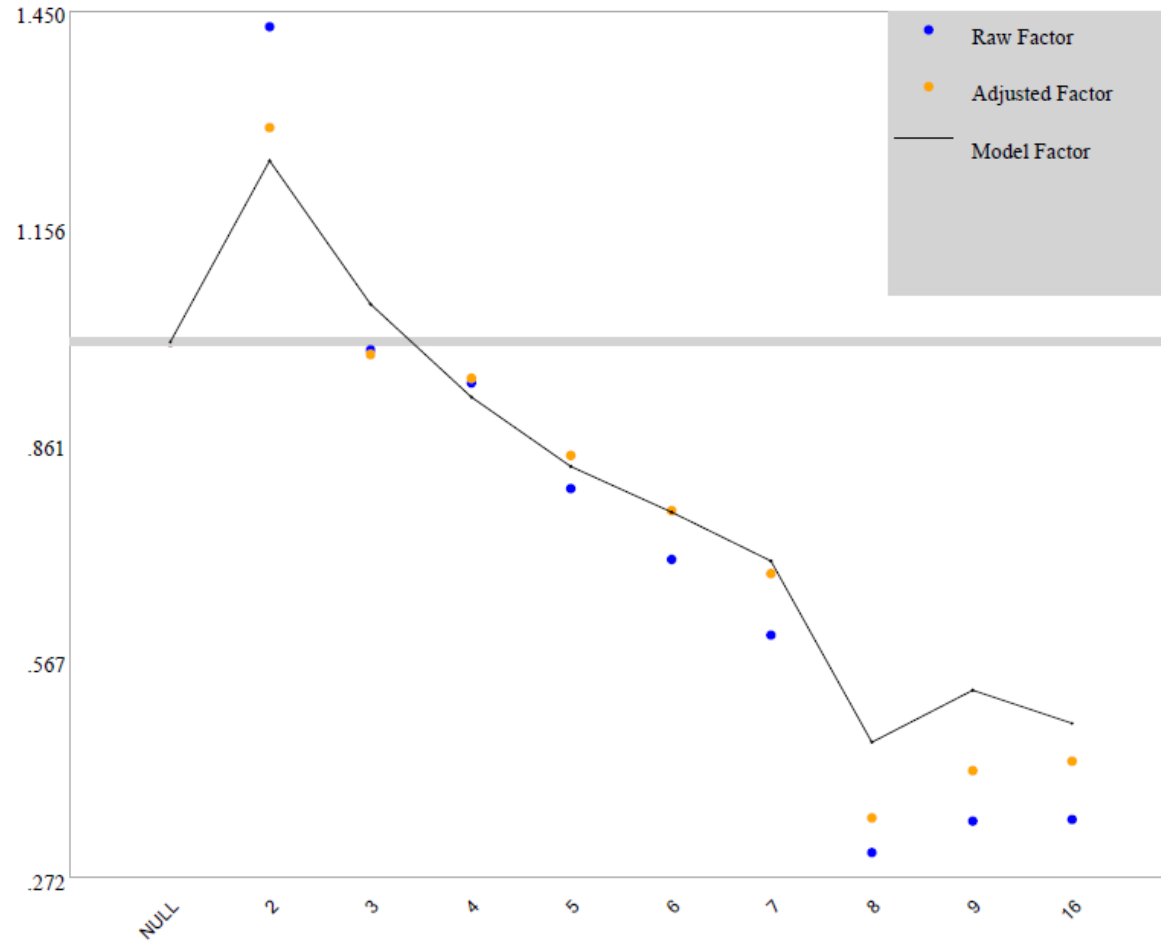
Change Probability – Loss Cause
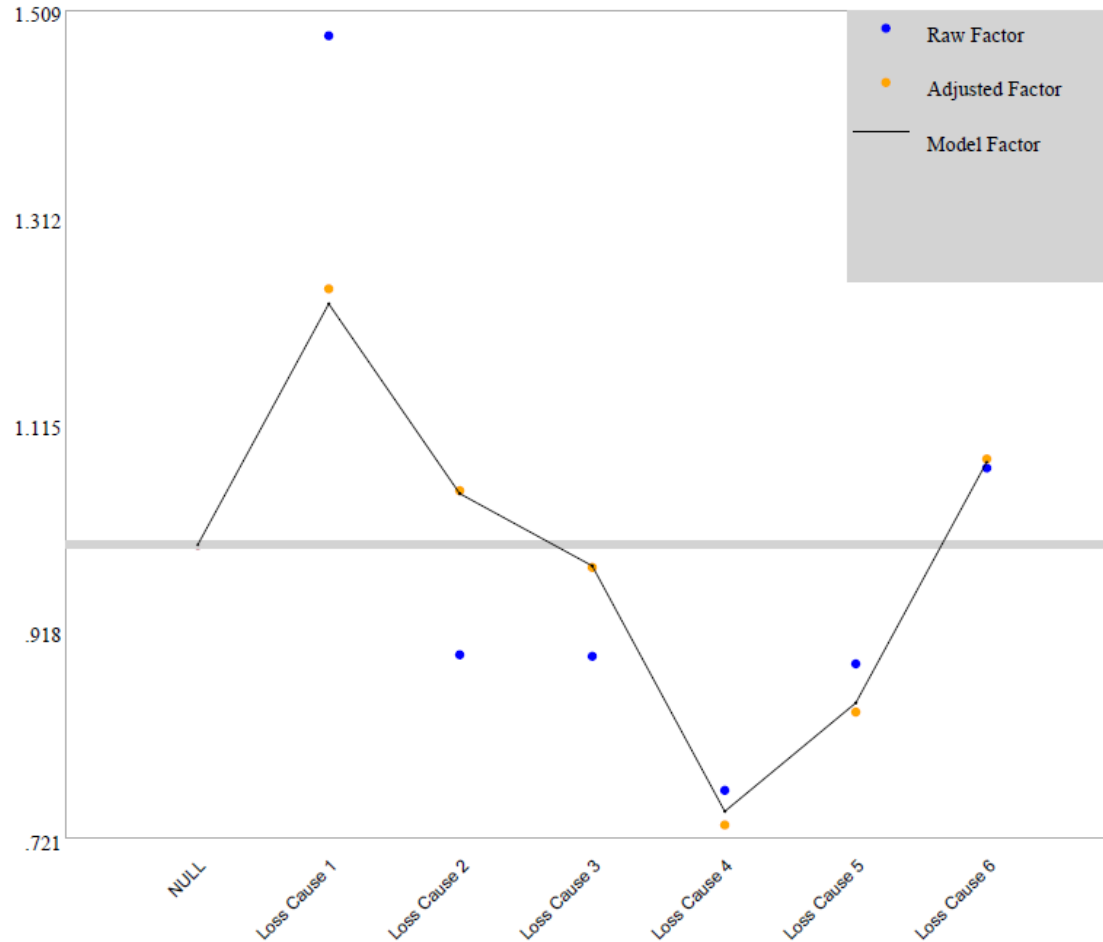
New Claim Value (Given Changed but Not Closed)

- Base factor of 1.98 to beginning case reserve

- Modification to this linear relationship, as well as five additional predictive characteristics
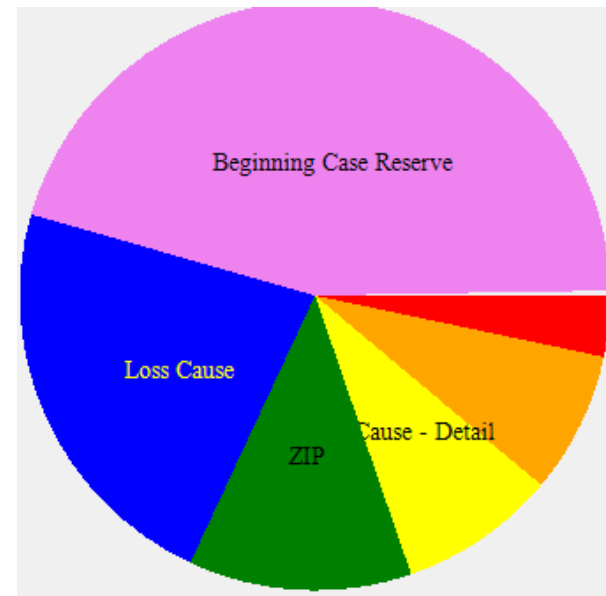
New Claim Value - Case Reserve
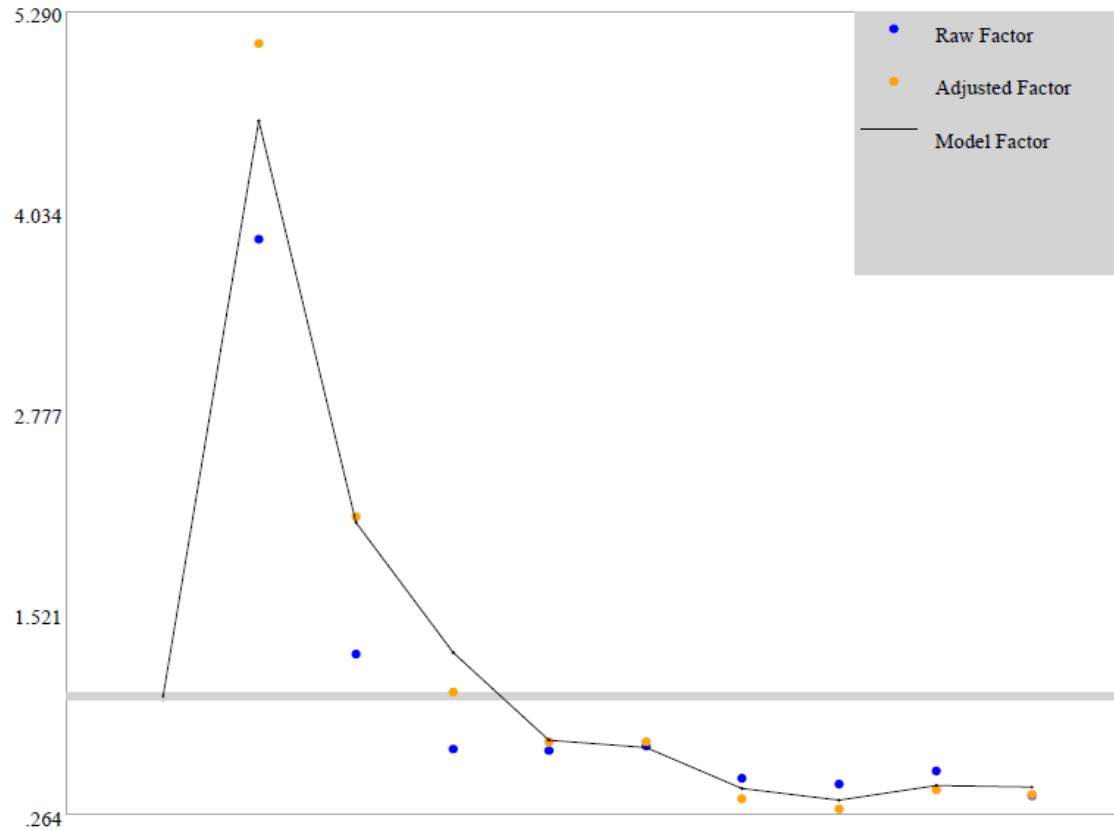
New Claim Value – Loss Cause
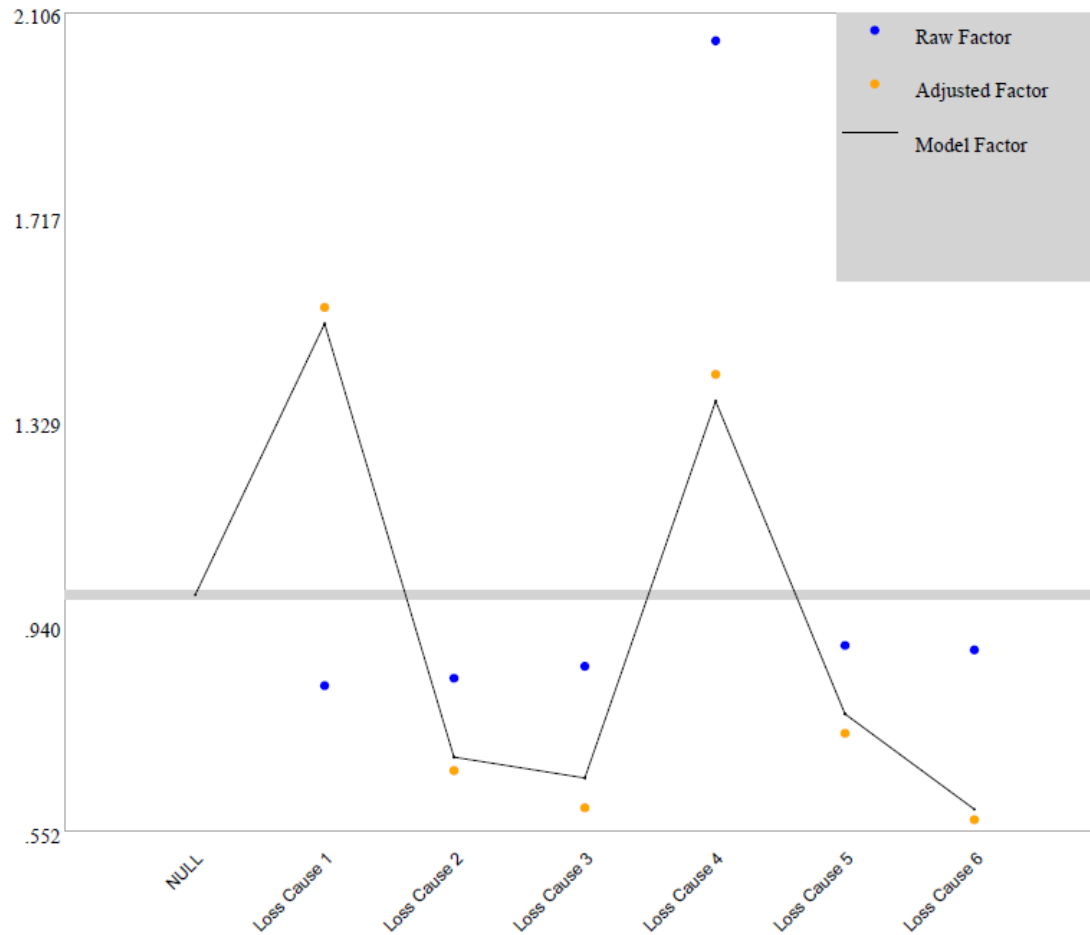
New Claim Value – ZIP Code
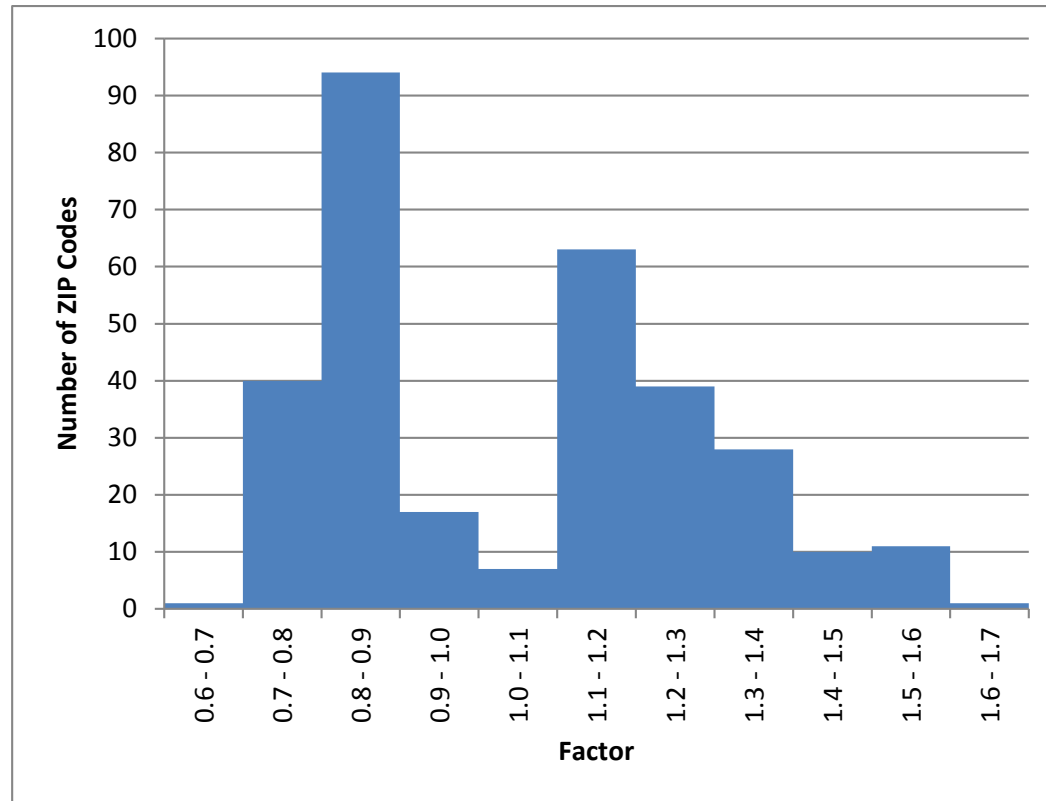
New Claim Value- Loss Cause (Detail)
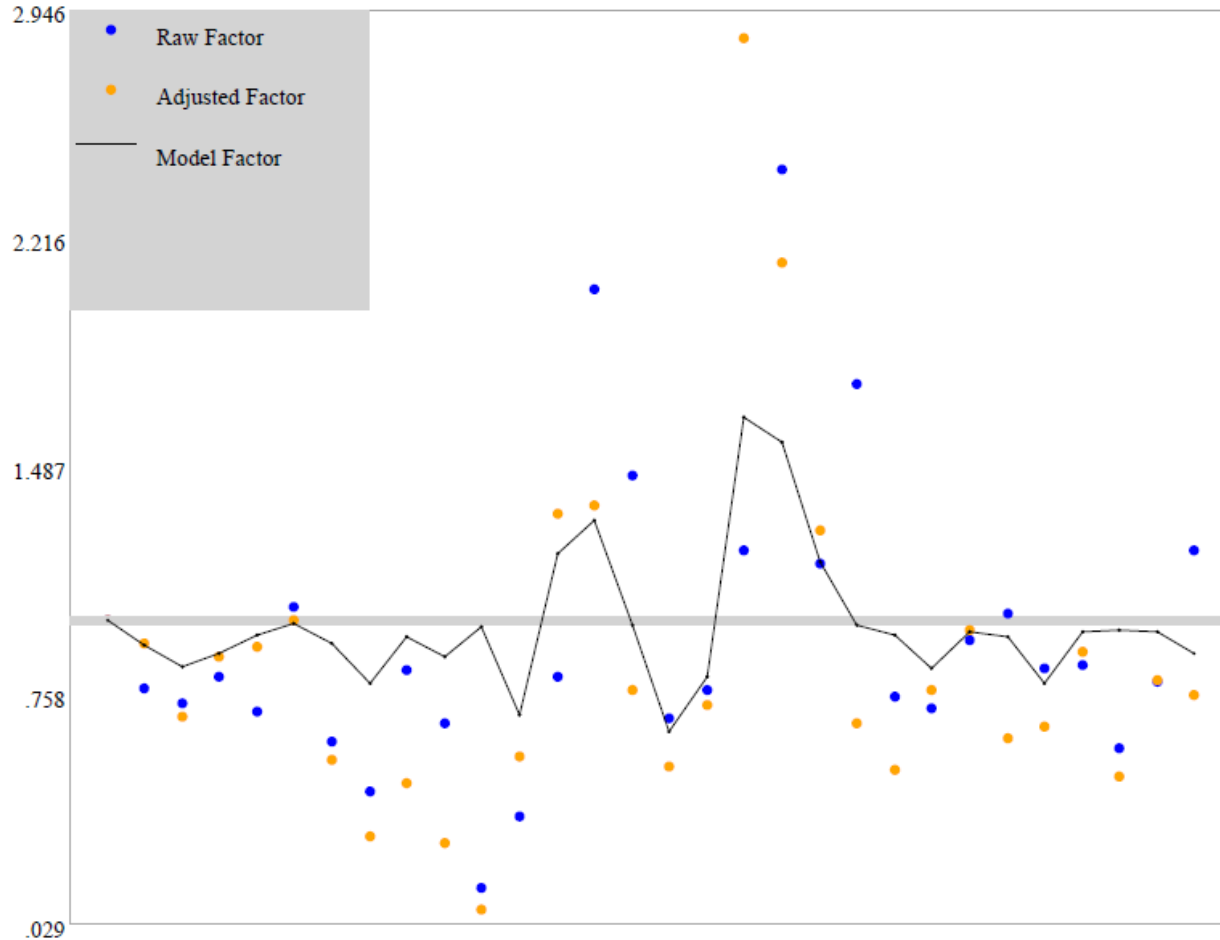
New Claim Value - Product
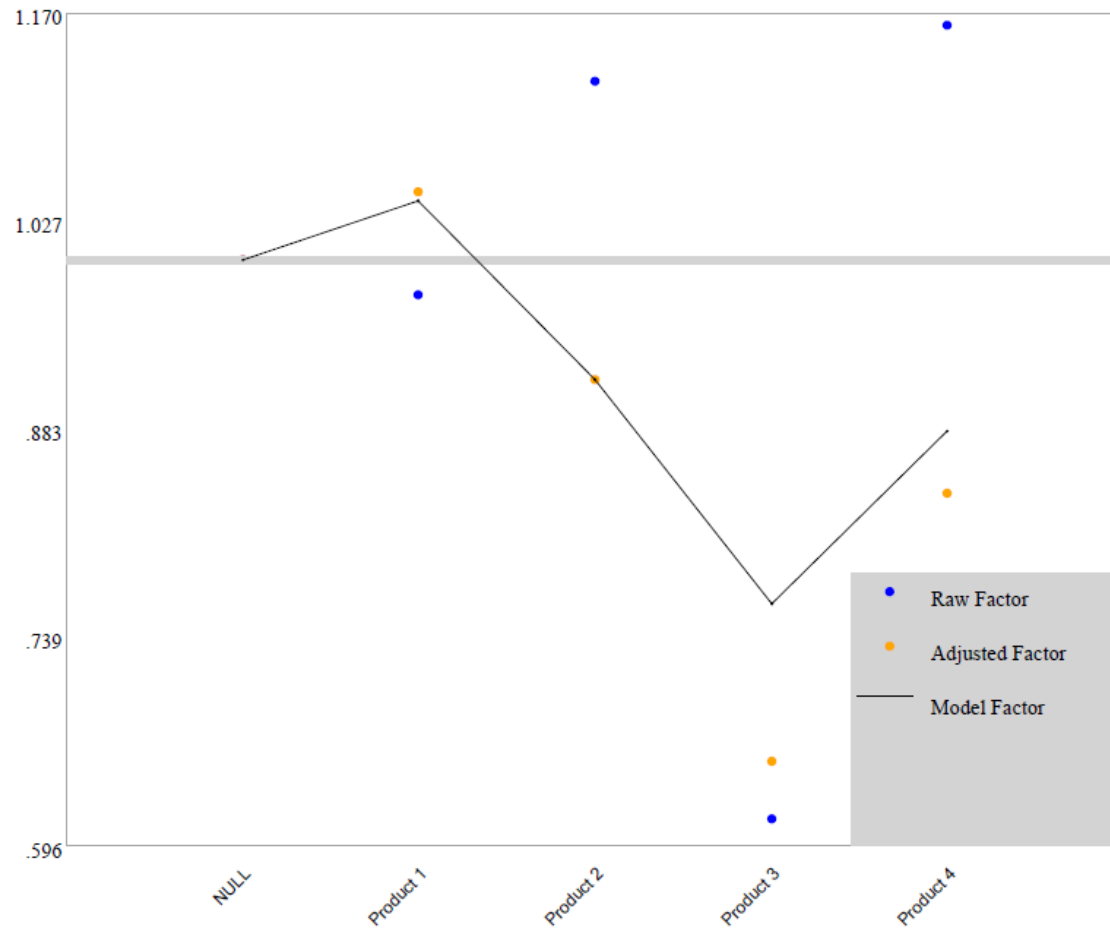
Bringing it together

- Simulation can be used to project activity in the next quarter

- It is necessary to project not only the predictive relationships, but also the residual error term.

- Chain through quarters using information from the previous simulated quarter.

- Store results, preferably at the claim level.

Simulate Going Forward

- Claim Development
  - Start with current inventory of open claims
  - For each open claim simulate a number of potential outcomes for the next time-step (using the claims' characteristics)
  - For those simulated claim-paths that are still open simulate forward another time-step.
  - Continue until all simulated claim-paths are closed

Claim 1

Claim 2

Claim 3

Grand Total

Probability distribution of total payments

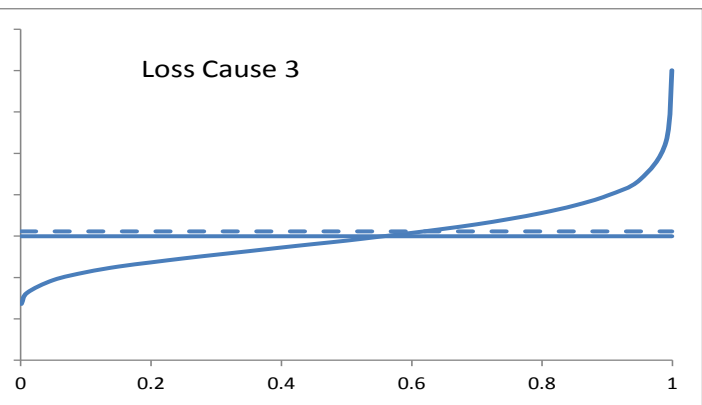Grand Total
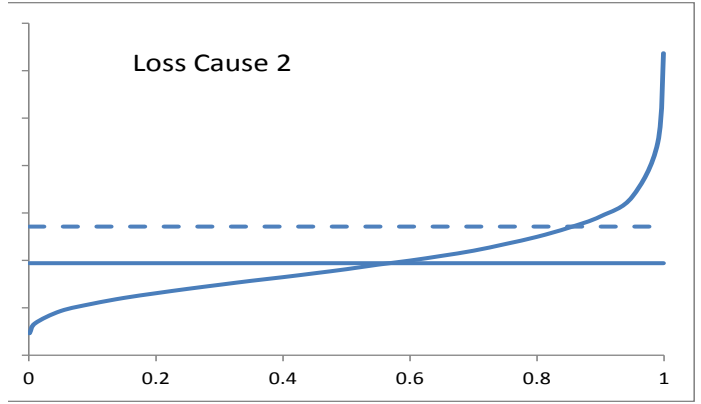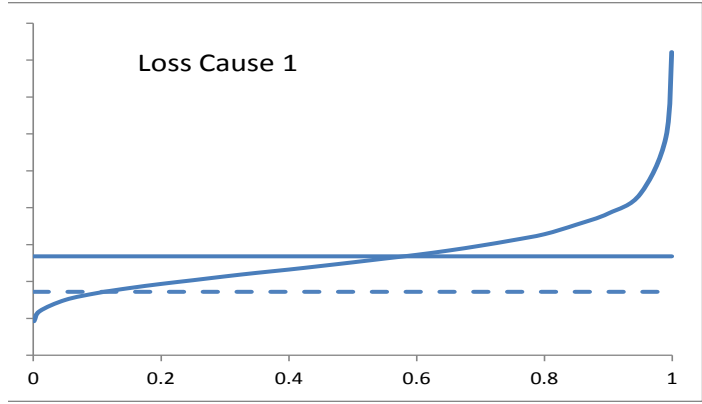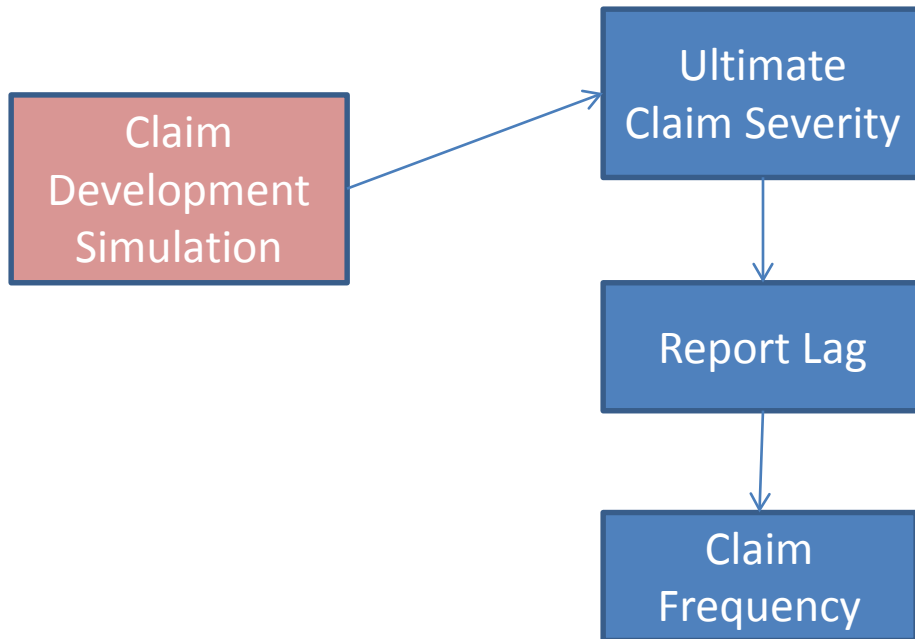
Mean of total payments

Grand Total

Current case reserves
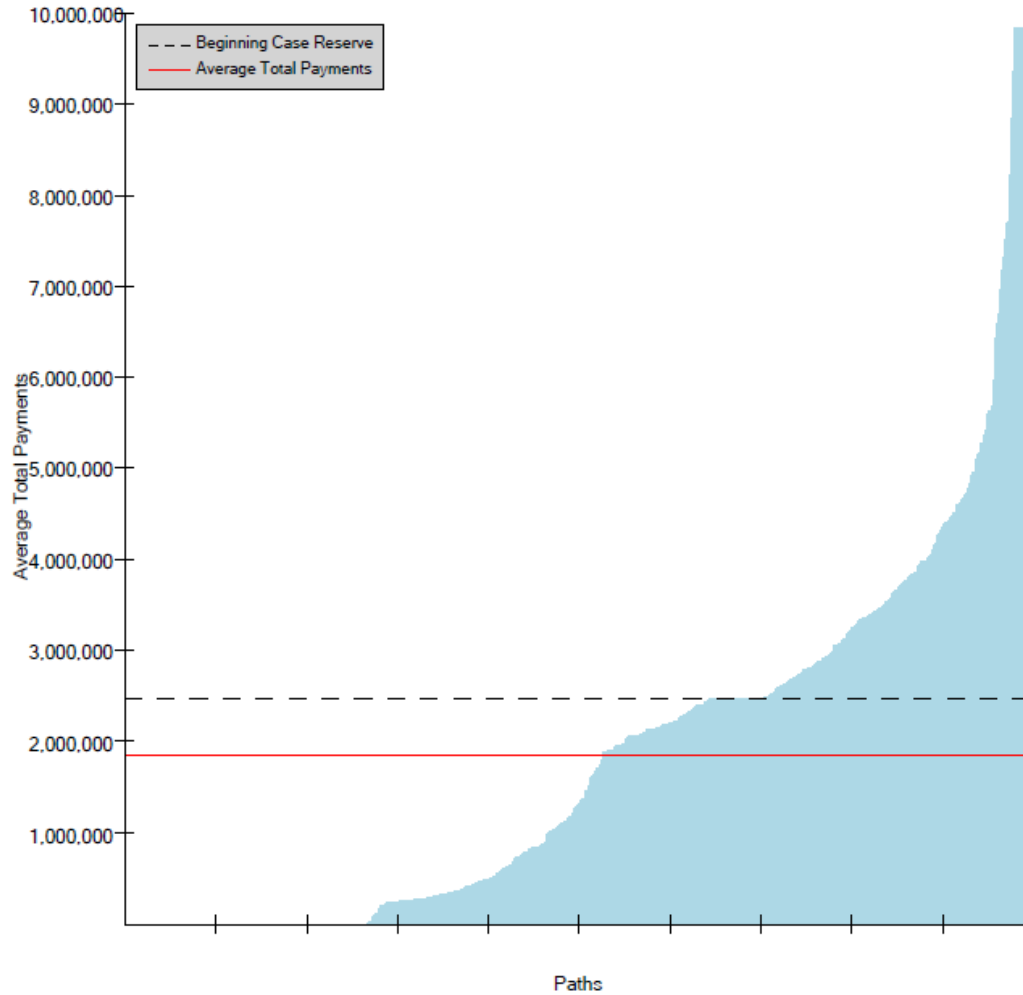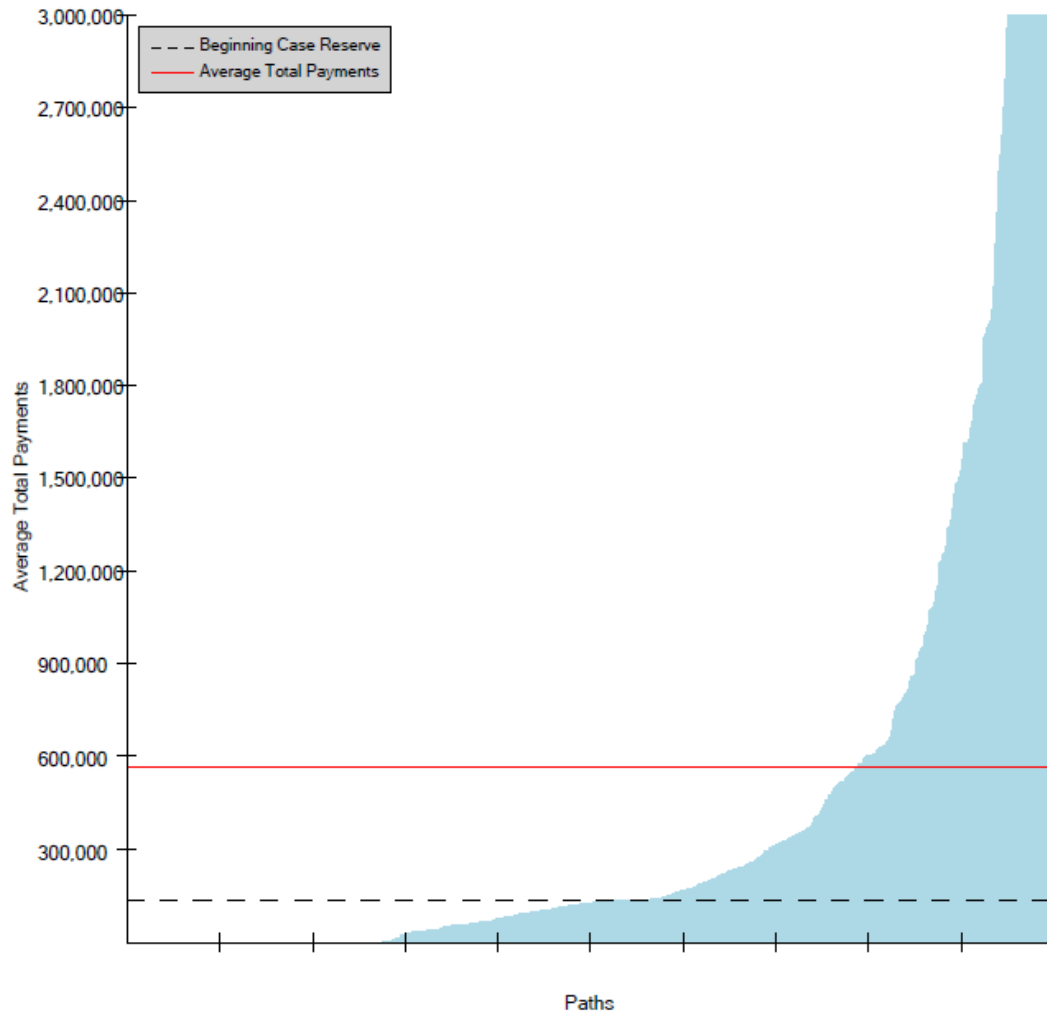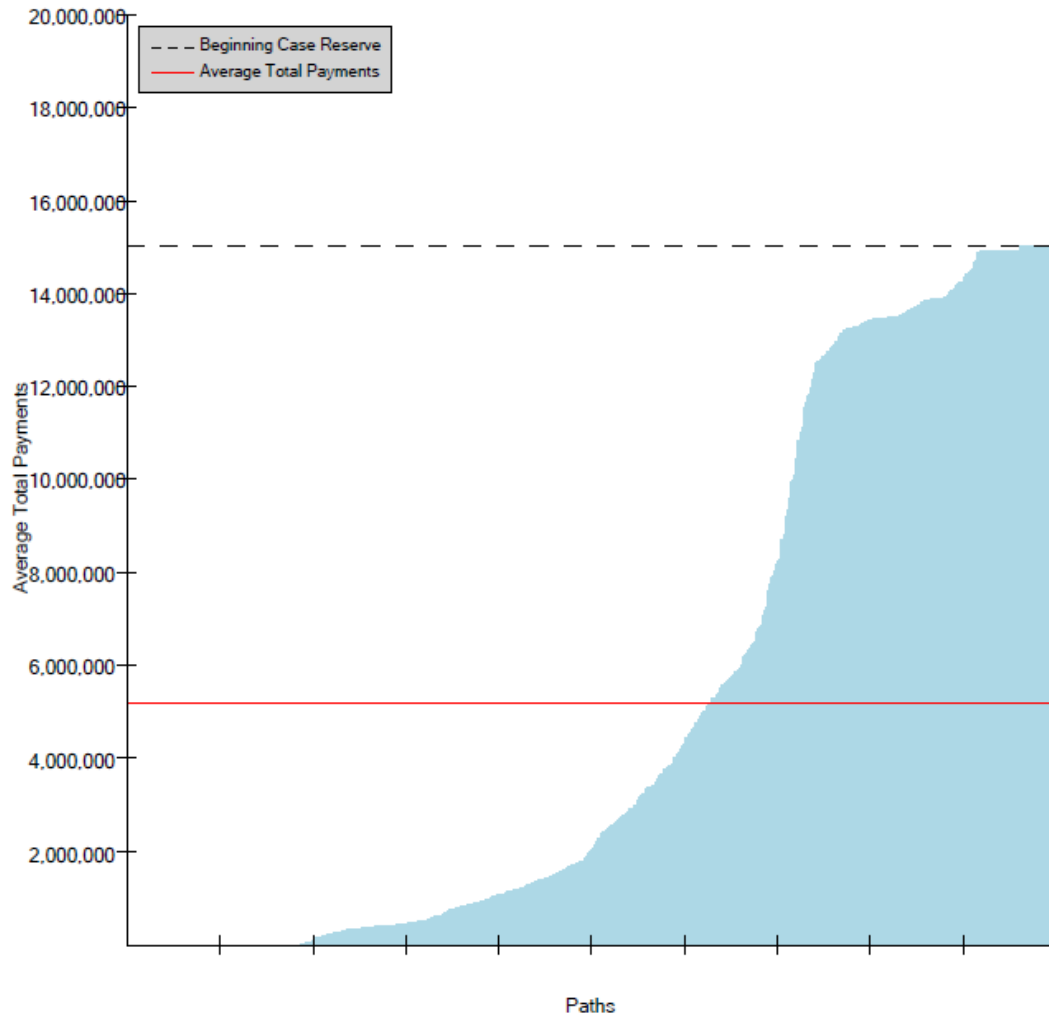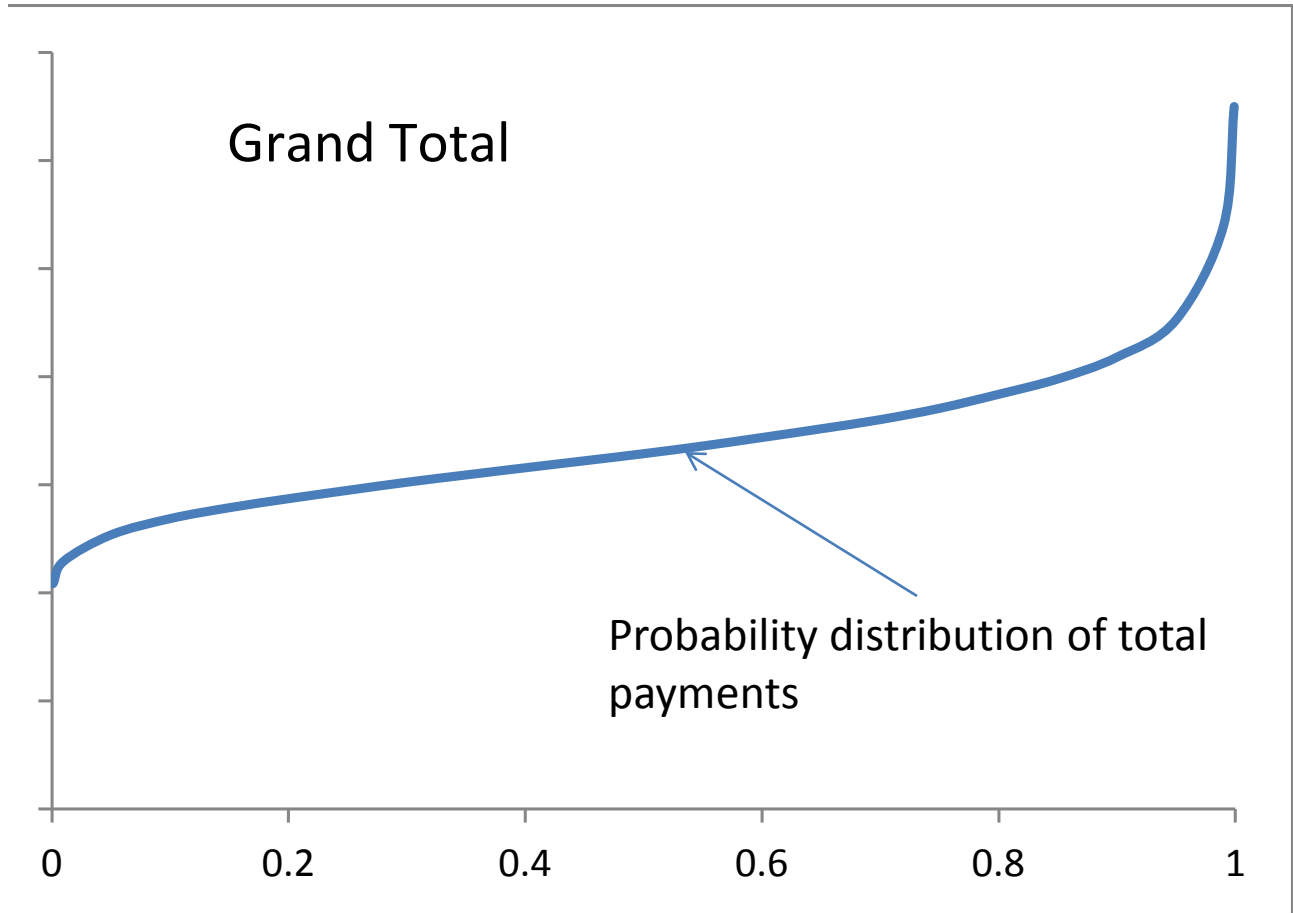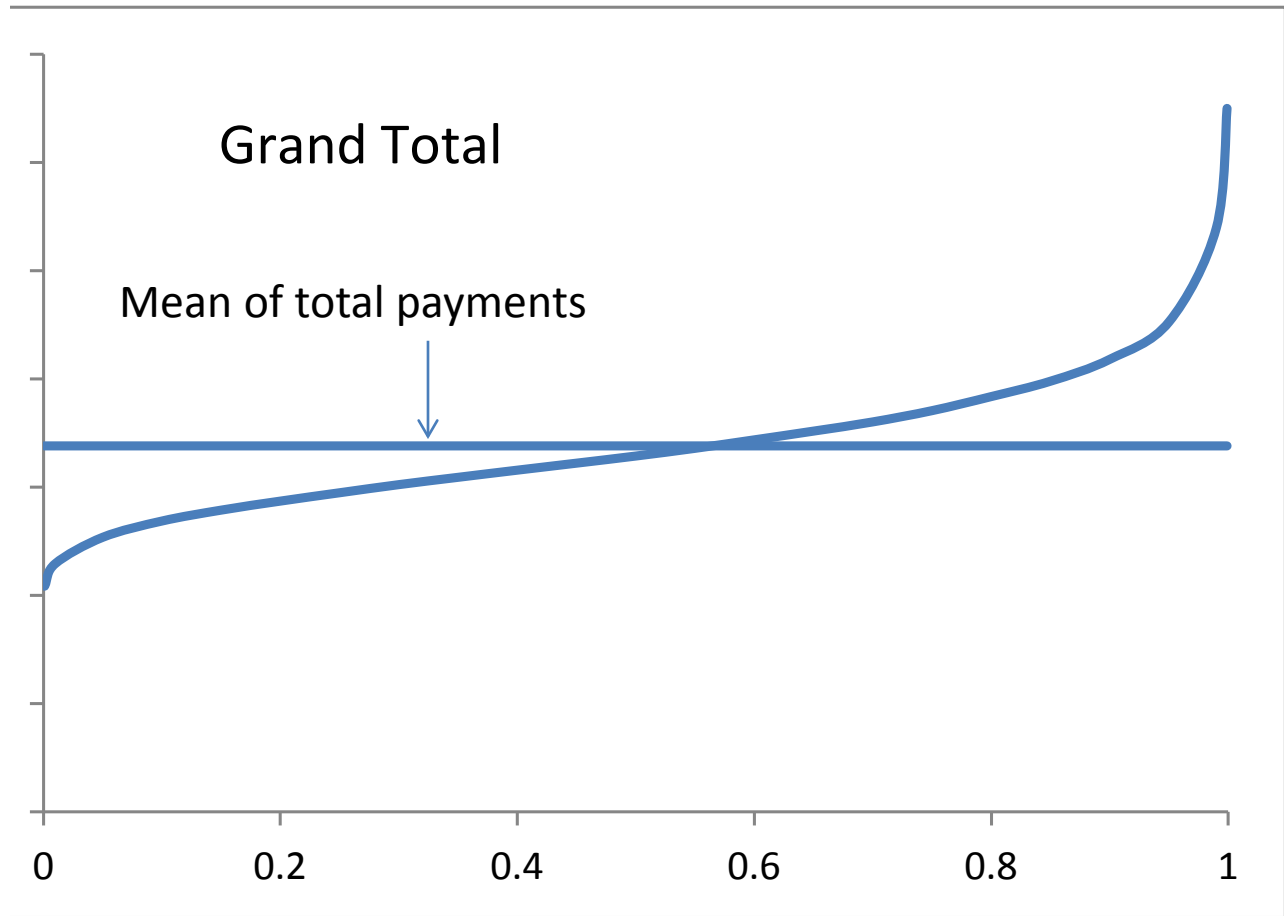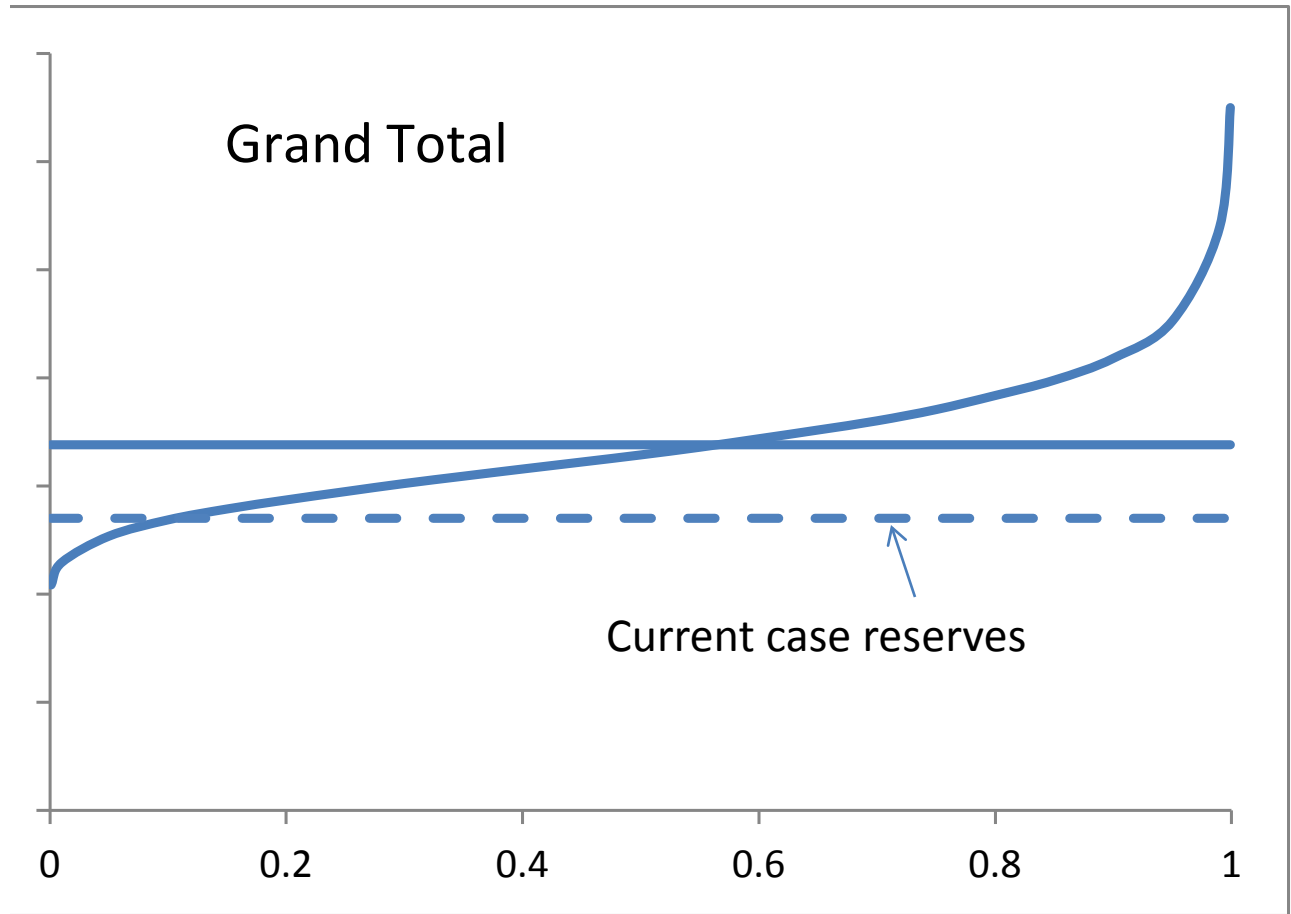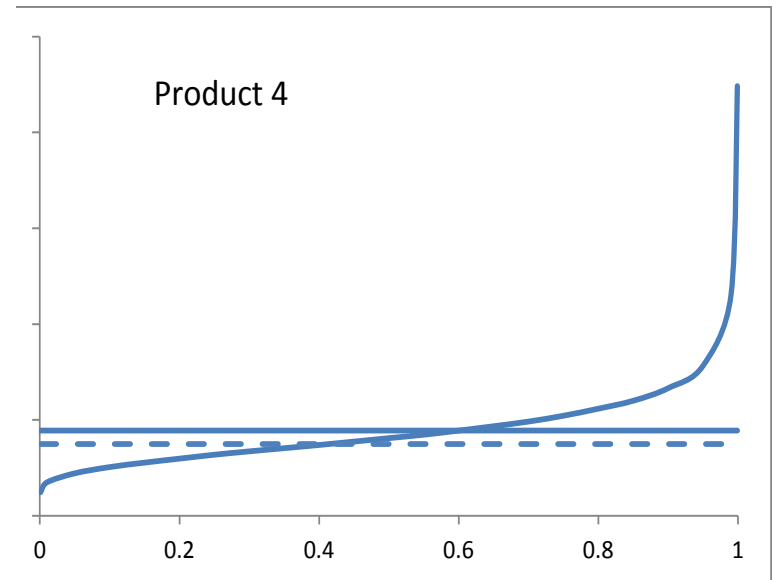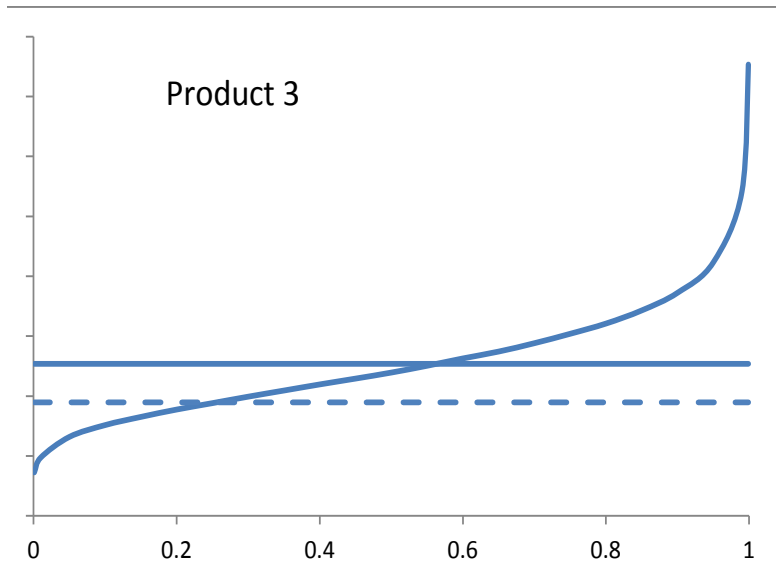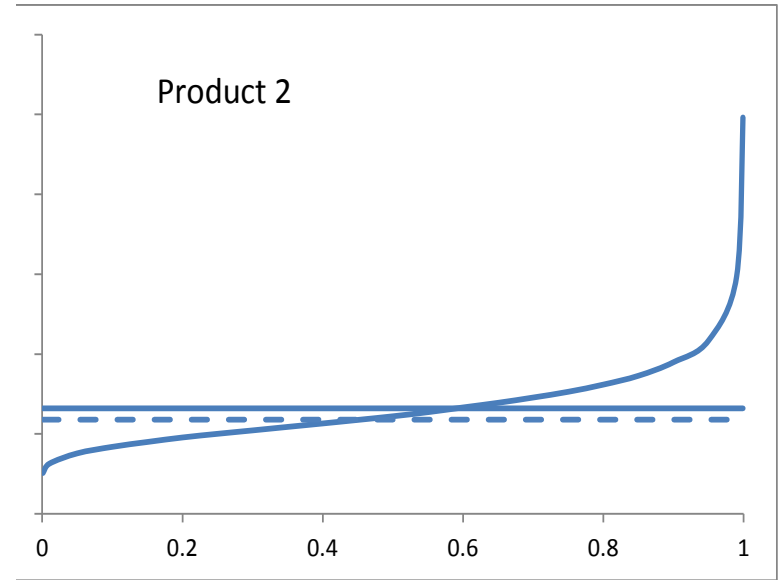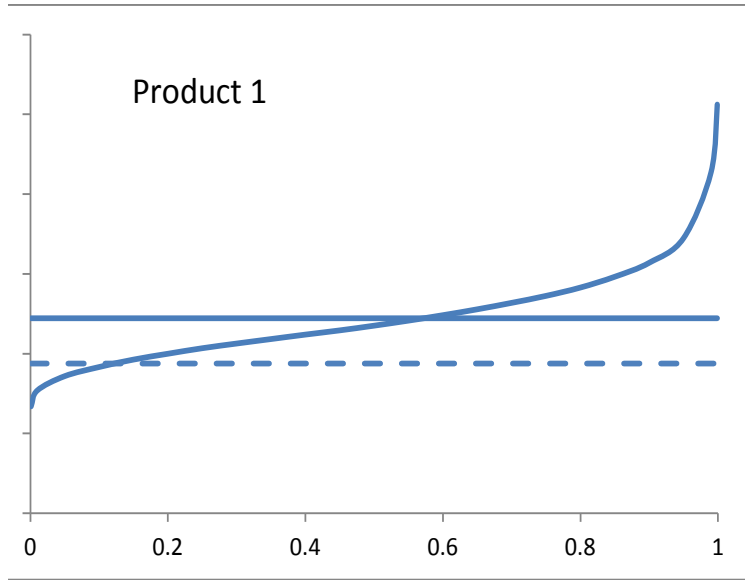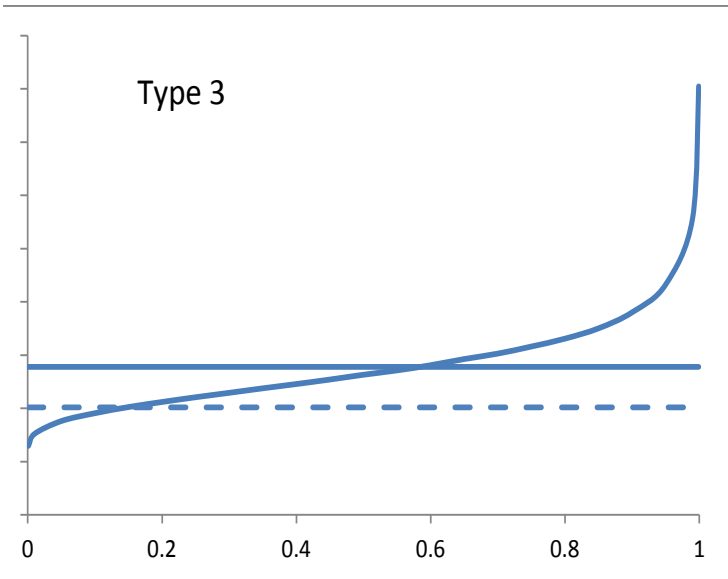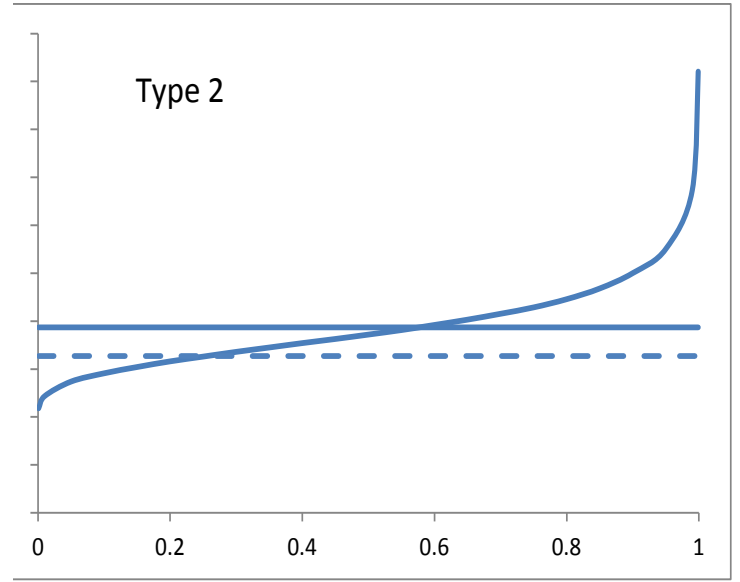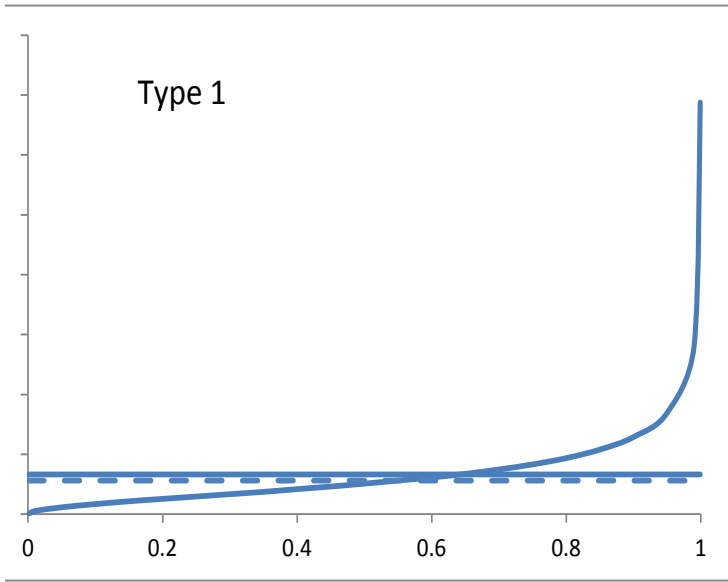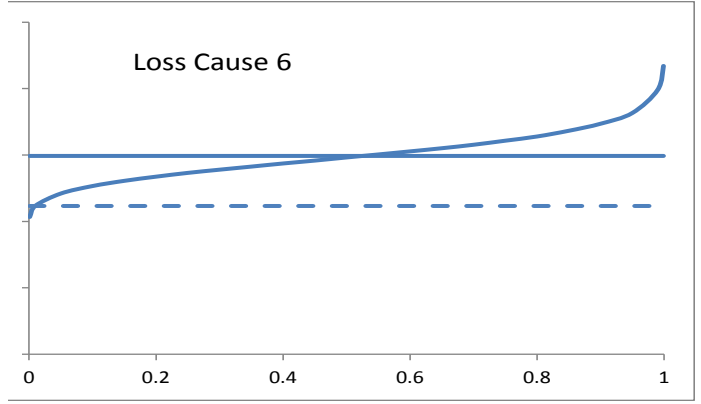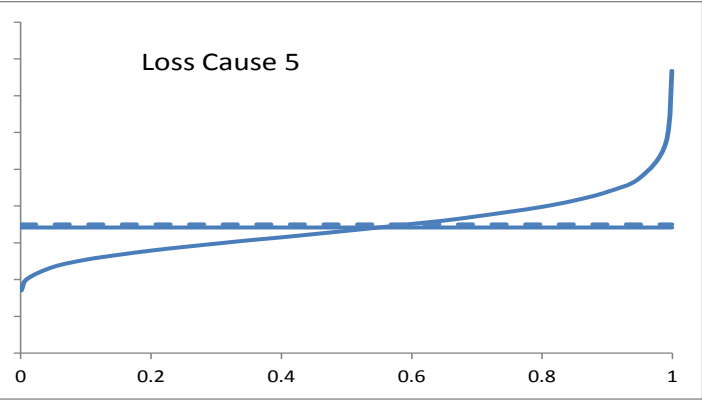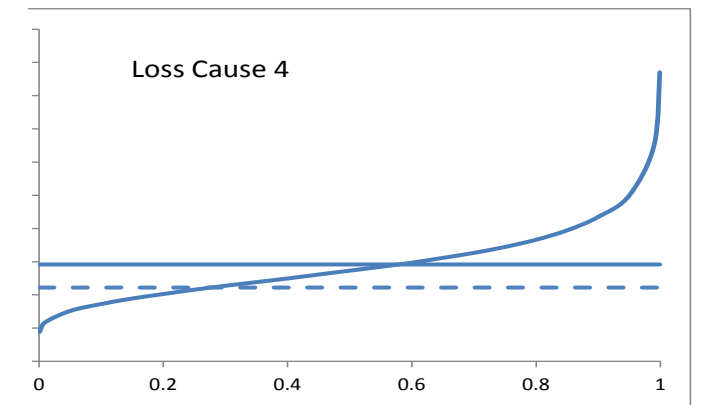
Emergence

- After simulating claim development to ultimate, model emergence

- Frequency

- Severity

- Report Lag

Claim Emergence

A number of exposure characteristics may have predictive value for any of these questions.

Emergence Simulation

- Use <u>written</u> policies (w/ characteristics) simulate remaining emergence.

- Generating loss date within this process allows accident period calculations

- Also get losses associated with unearned premium

- Inforce loss ratio distribution.

Comparison of "Traditional" Predictive Modeling for Pricing vs. Claim Life Cycle Model

- Real examples

- Using the same rating variables

- Only difference is use of CLCM ultimate vs Case-Incurred.

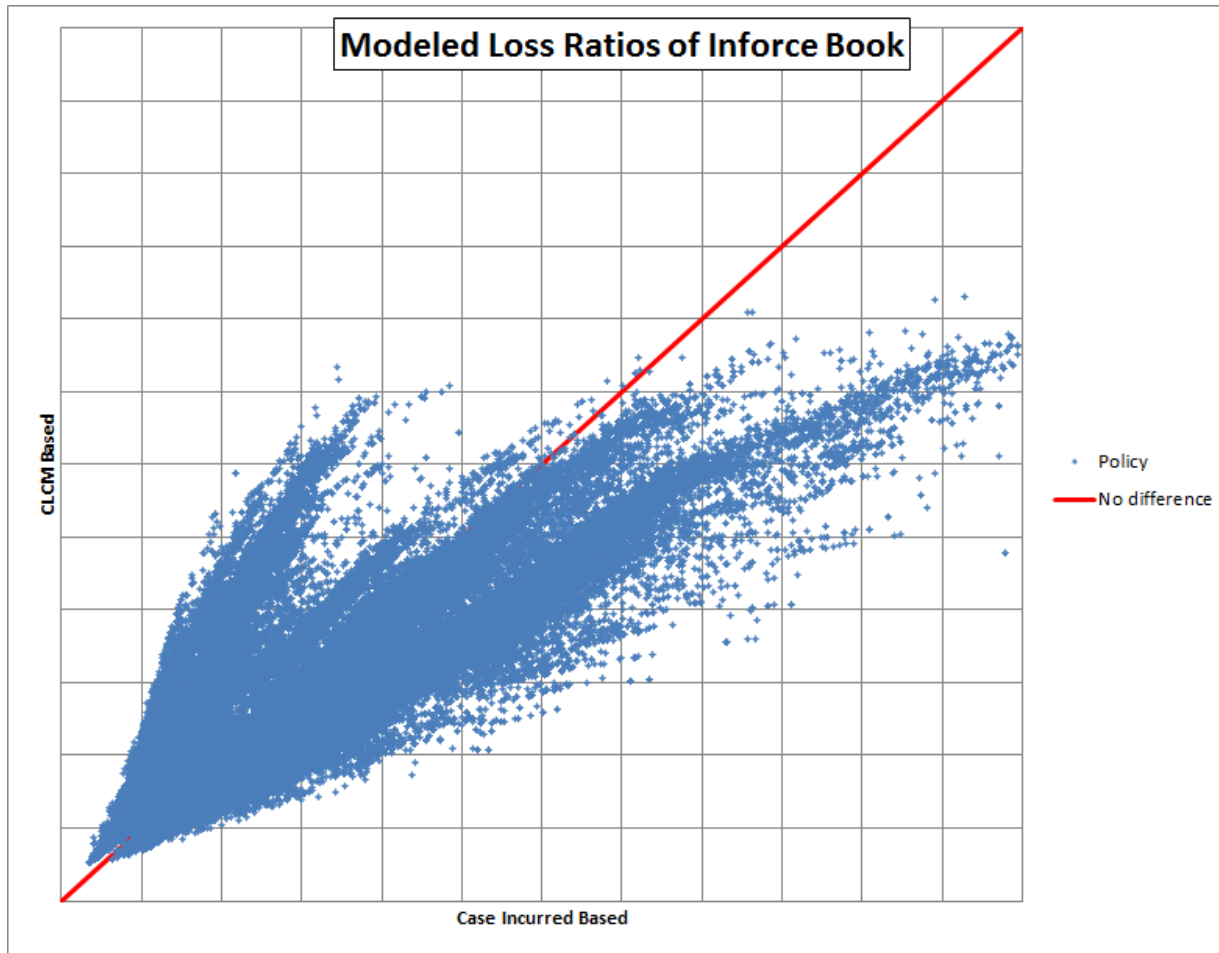- Compared modeled loss ratio by policy from the current inforce book.

Example 1

Example 2

Modeled Loss Ratios of Inforce Book

Example 3

Modeled Loss Ratios of Inforce Book
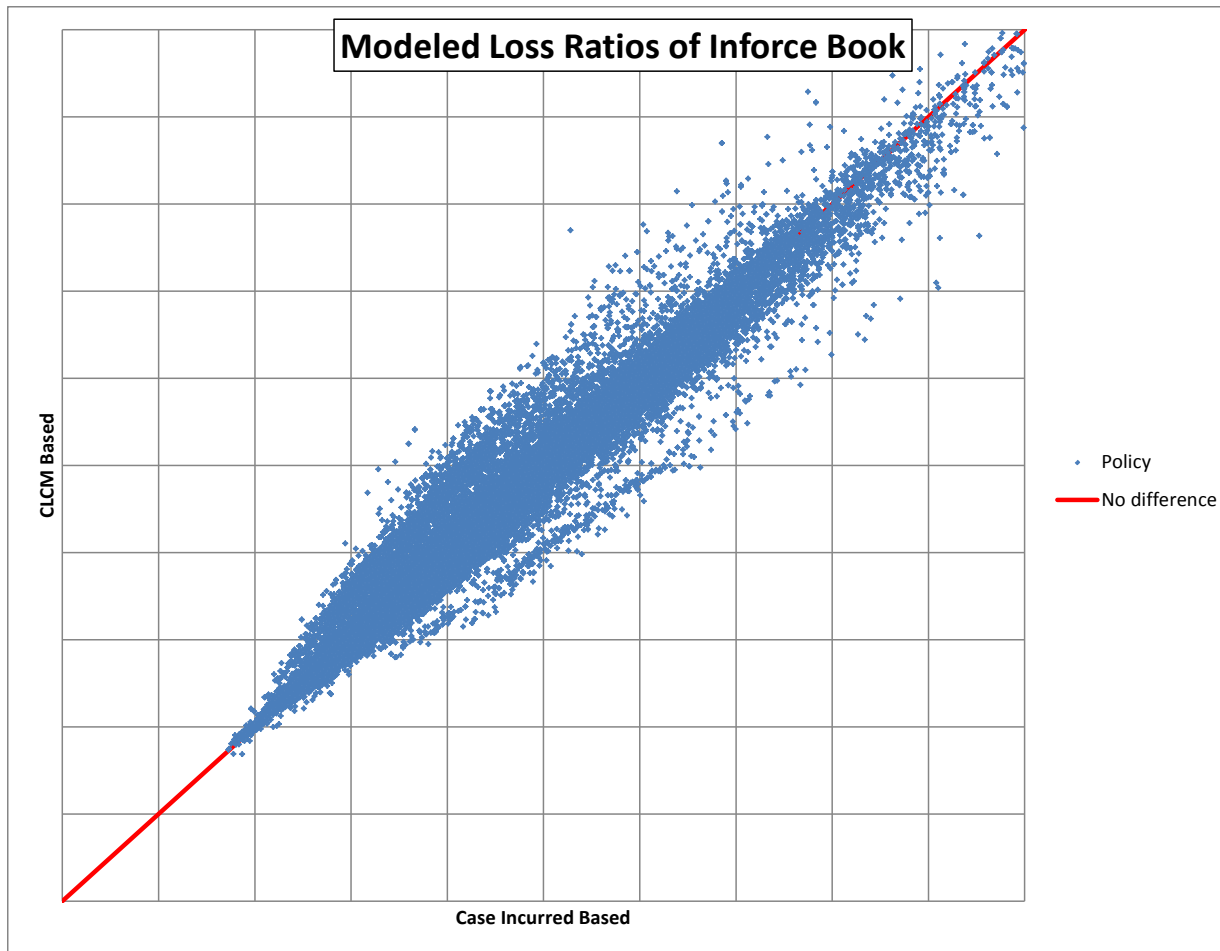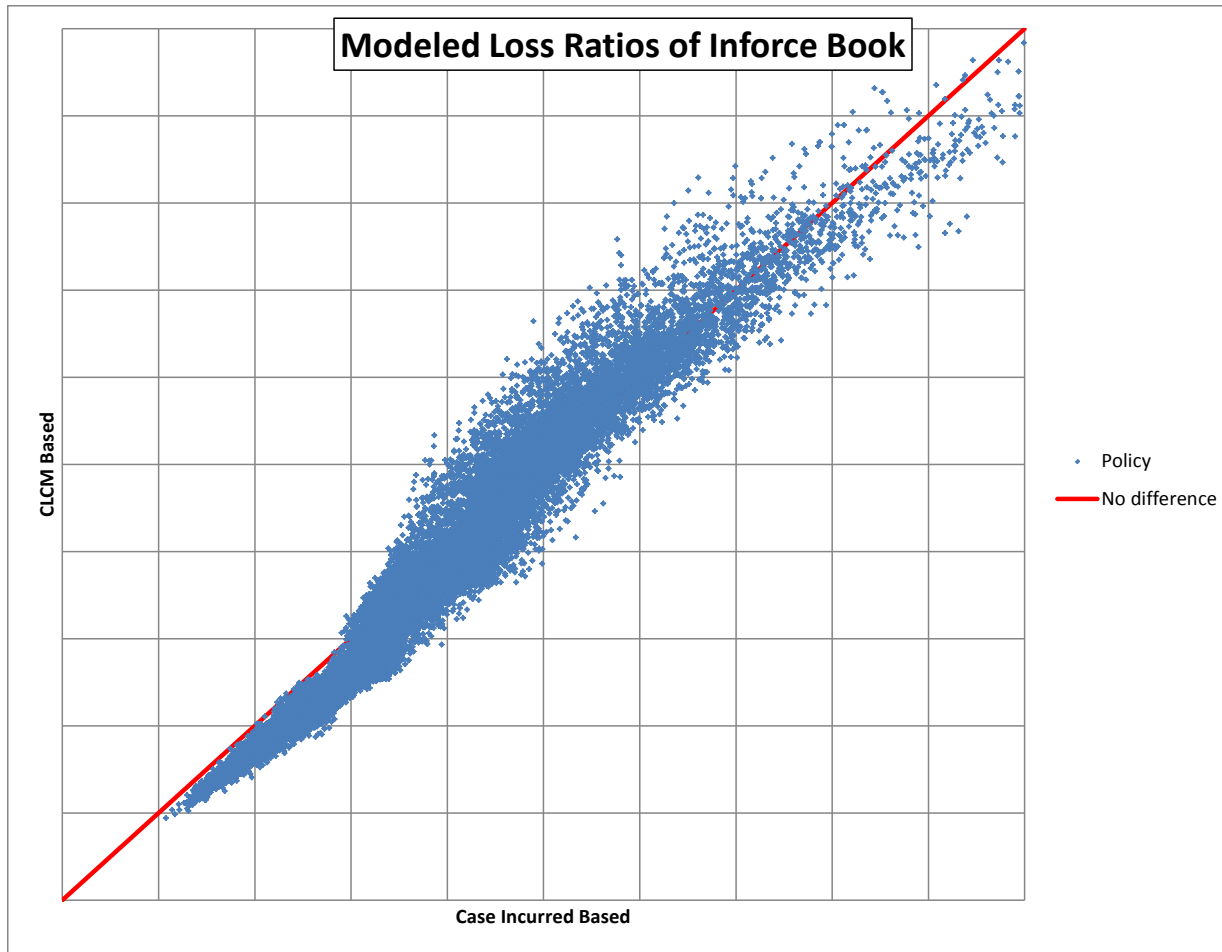
Some Observed Differences

- Geography

- Industry Classification

- Size of Account

- Agency

- Deductible/Limit

- Year Built

Conclusion

- Reserve development matters for pricing!

- Different exposures develop differently!

- Models that do not reflect these differences will be inferior!