Predictive Modeling with Healthcare Reserves

2014 Casualty Loss Reserve Seminar

September 16th, 2014

GROSS CONSULTING

Healthcare Reserves

- Claims-made nature focuses attention on development as opposed to emergence
- Wealth of data available
  - Claim allegation
  - Nature of the procedure
  - Patient information
  - Doctor information
  - Hospital information
  - Etc.

Uses

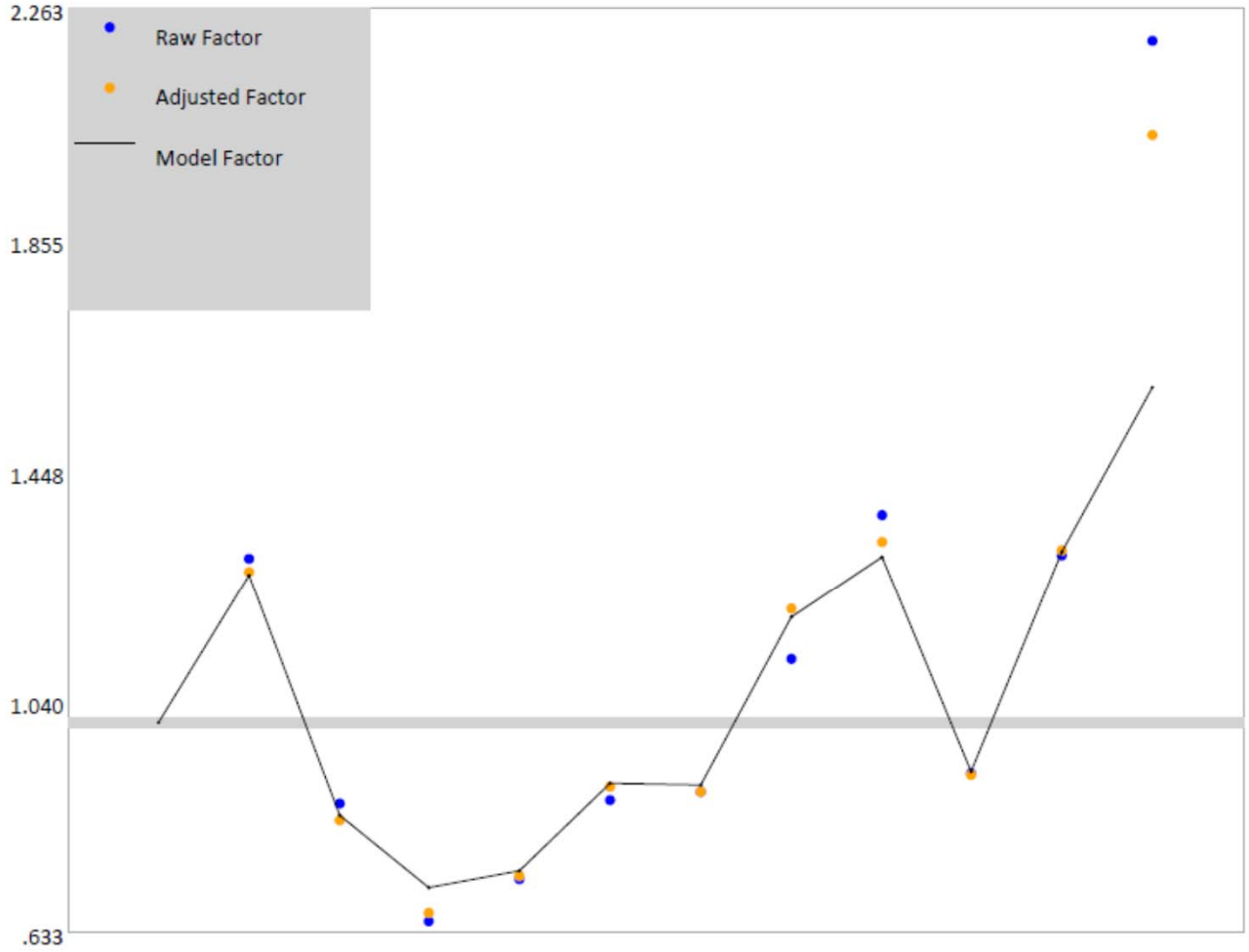
- Claim management
- Reserve Analysis
- Pricing Analysis
- Underwriting Management
- Risk Management
- Reinsurance

Managing the data

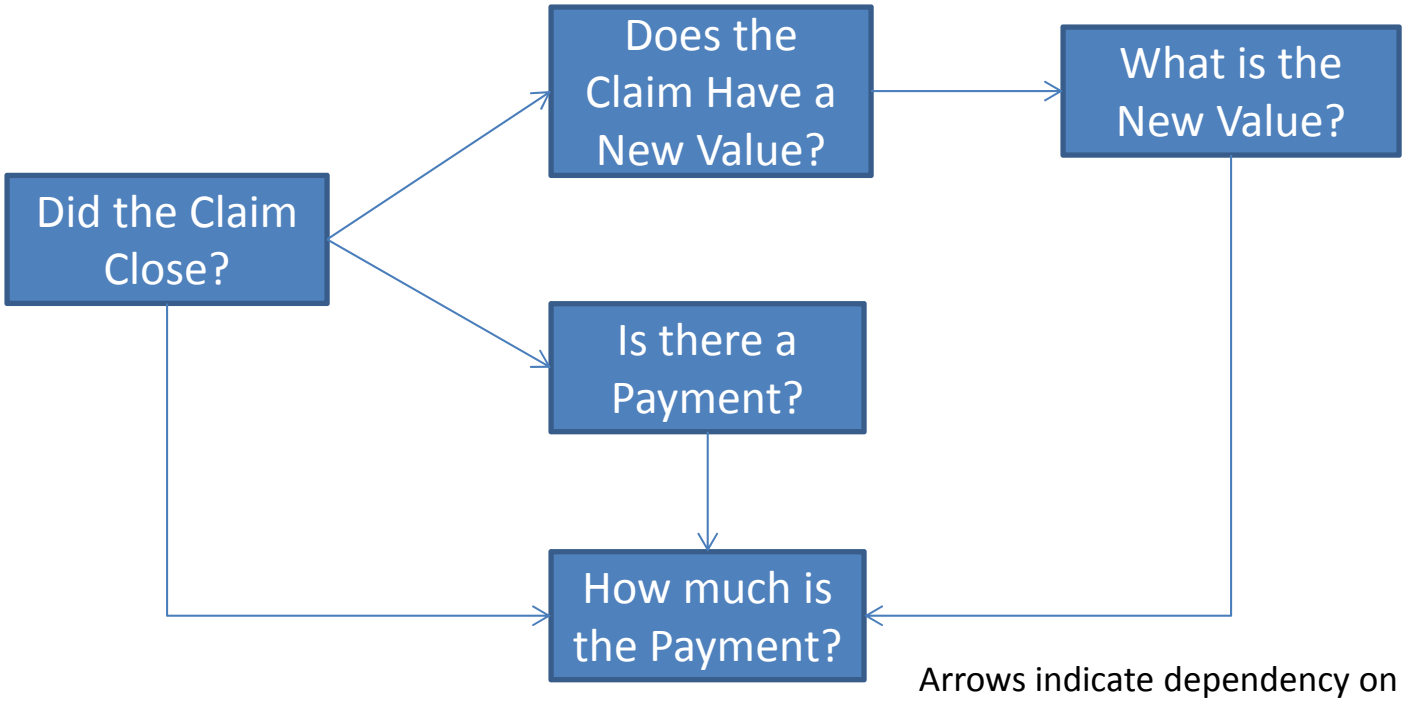
- Useful to think about a single calendar period
  - Claims closing
  - Changing in value
  - Payments
  - Nothing
- All of these can be modeled as a function of case reserves, age of claim, and all of the available characteristics

Characteristic: SeverityDescription

Closure Probability



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

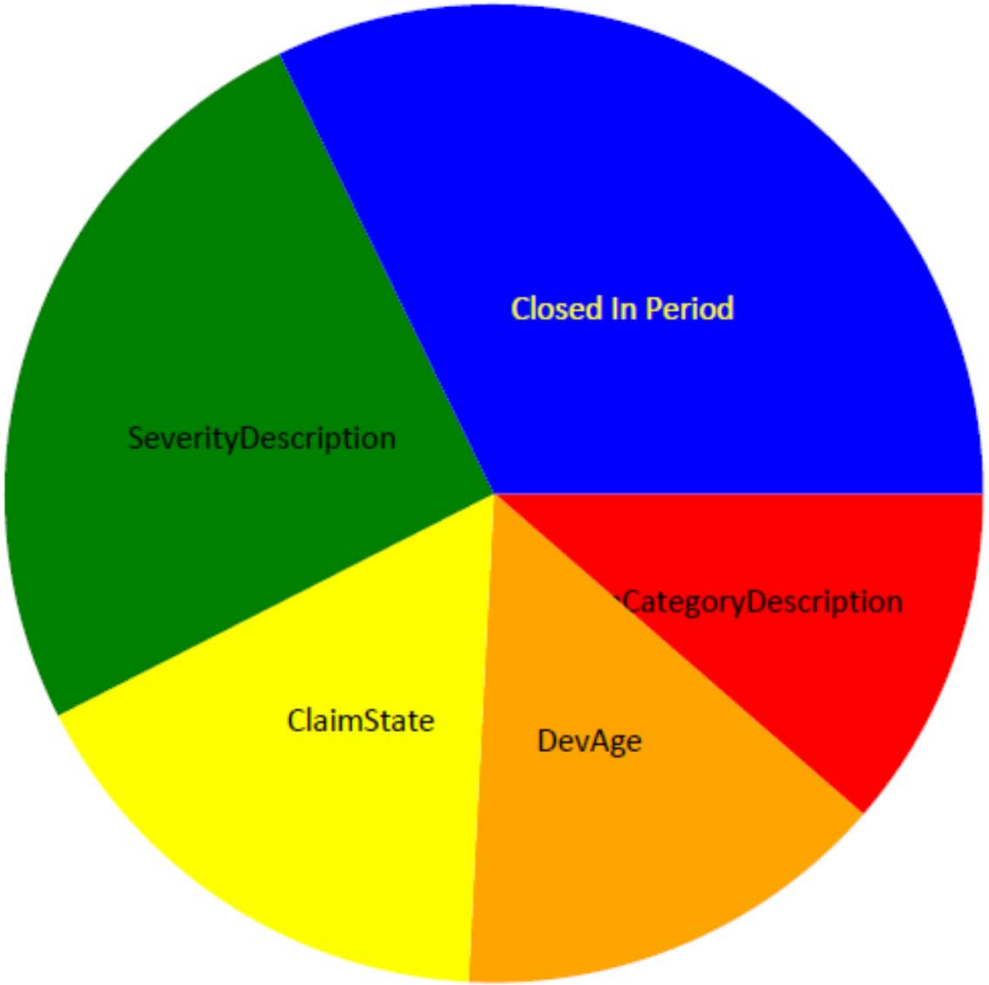


Arrows indicate dependency on other results

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

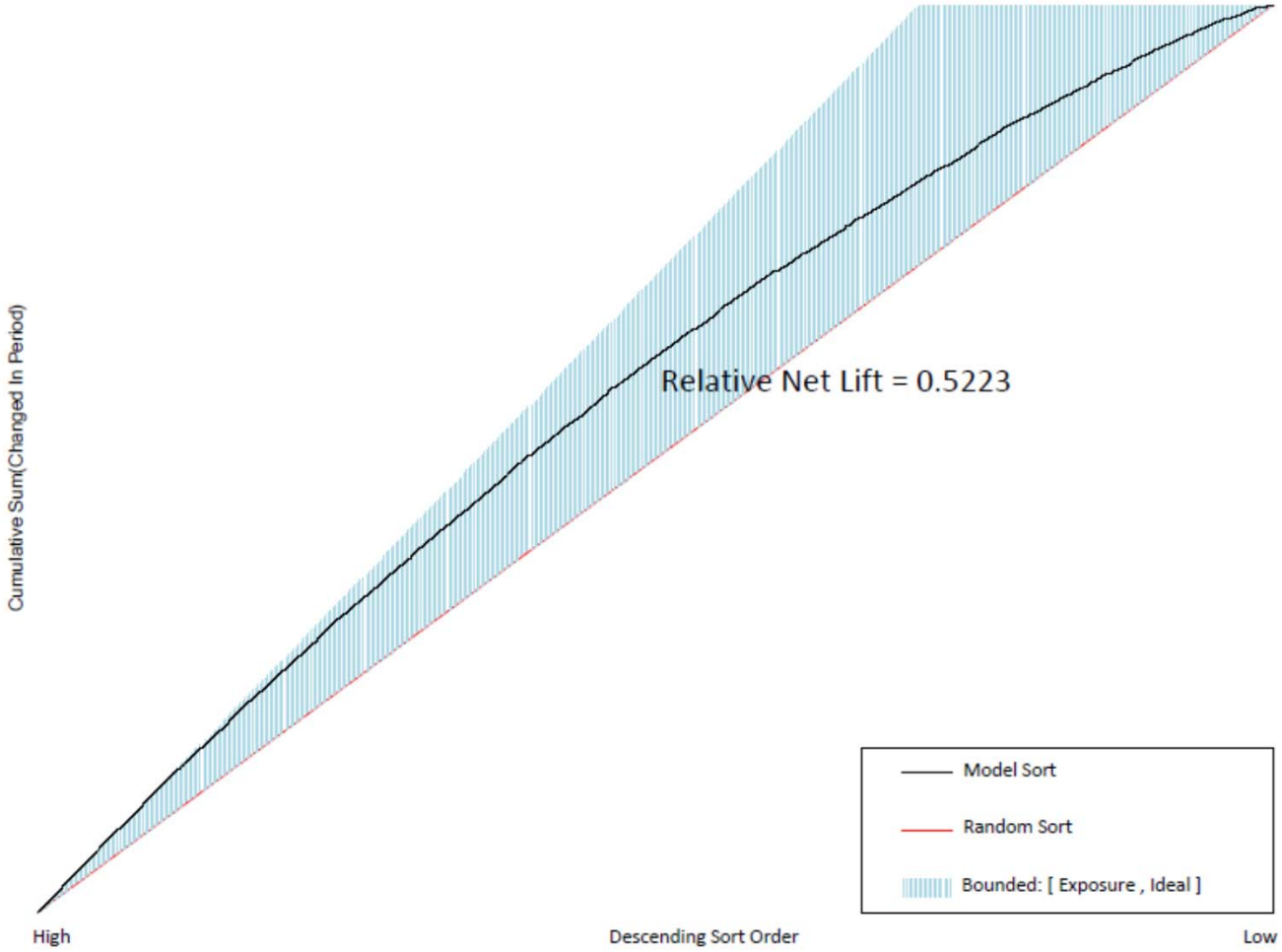
Change Probability

Predictive Significance



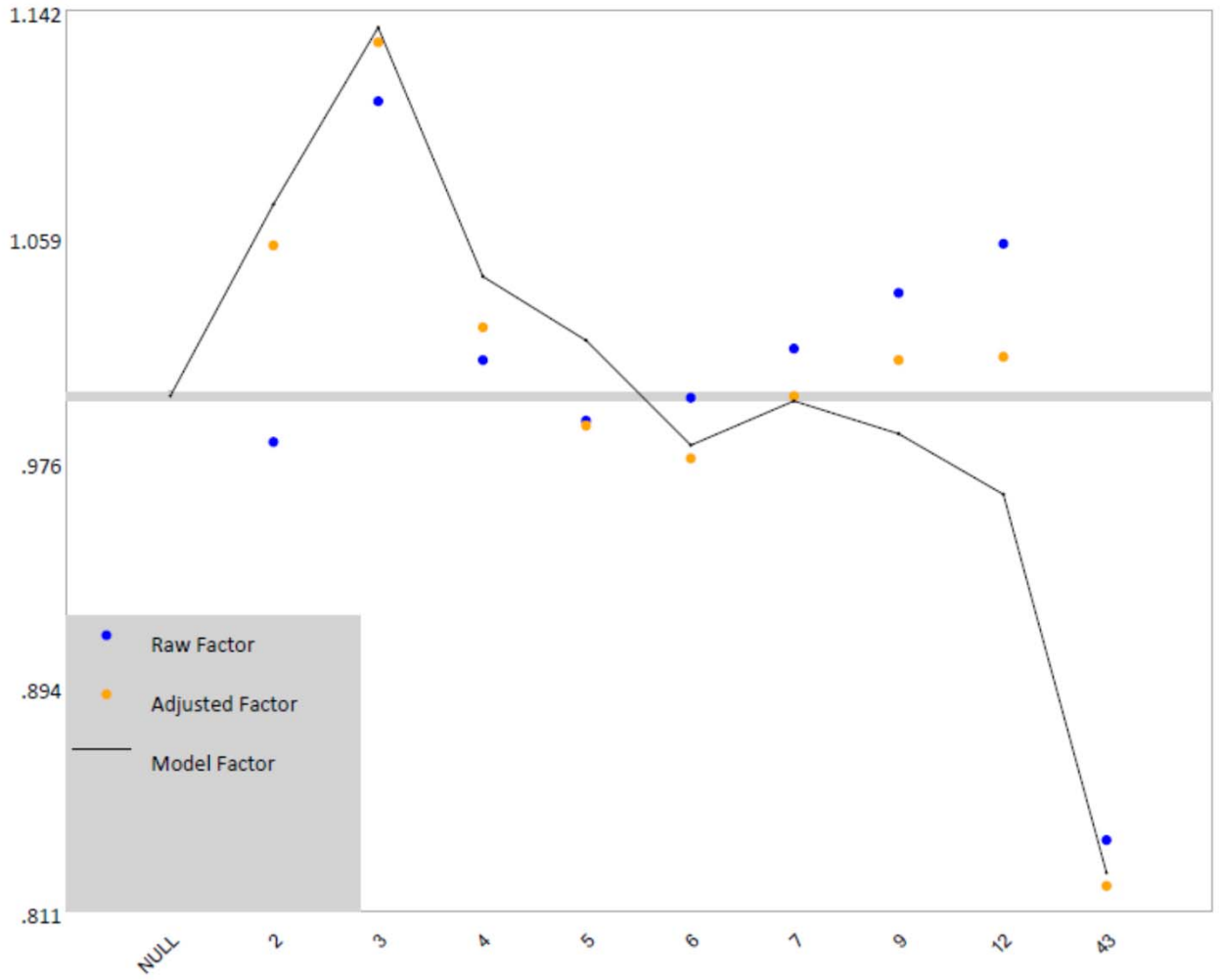
Change Probability

Test Data Lift Chart - with Curve Modification



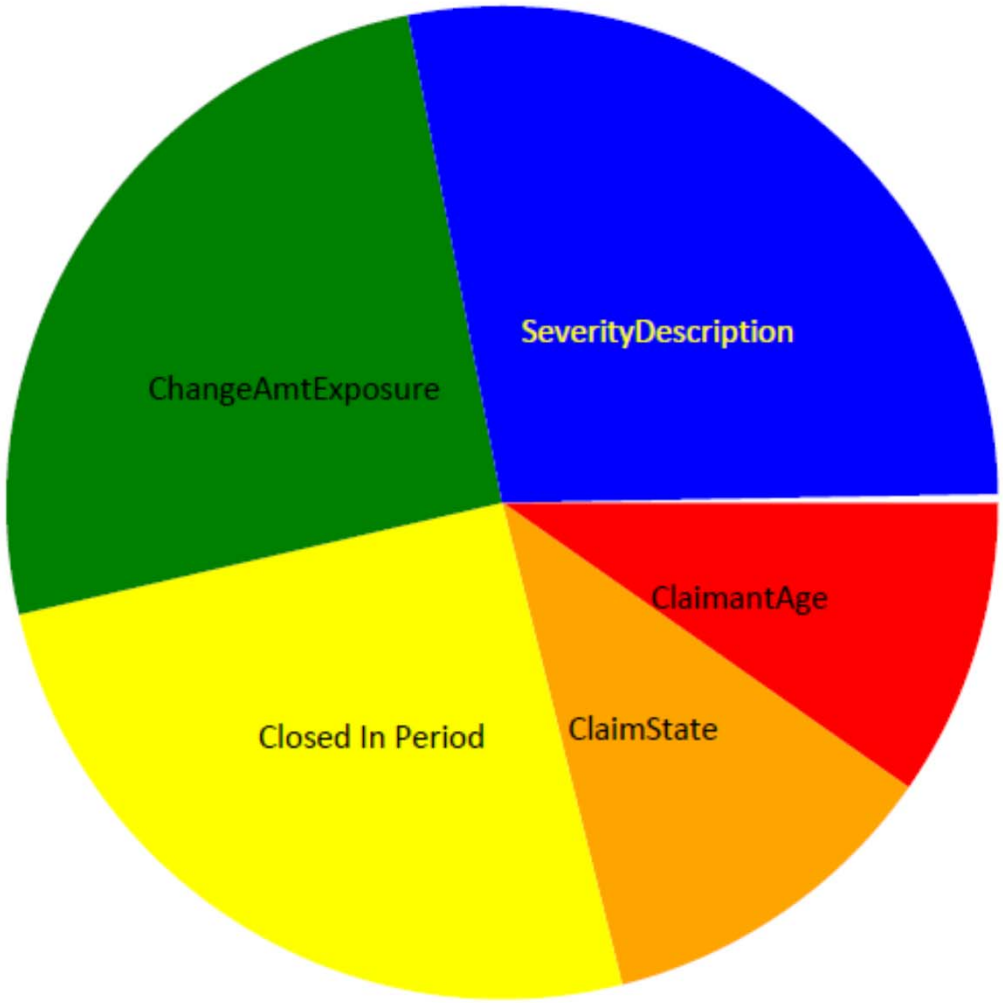
Characteristic: DevAge

Change Probability



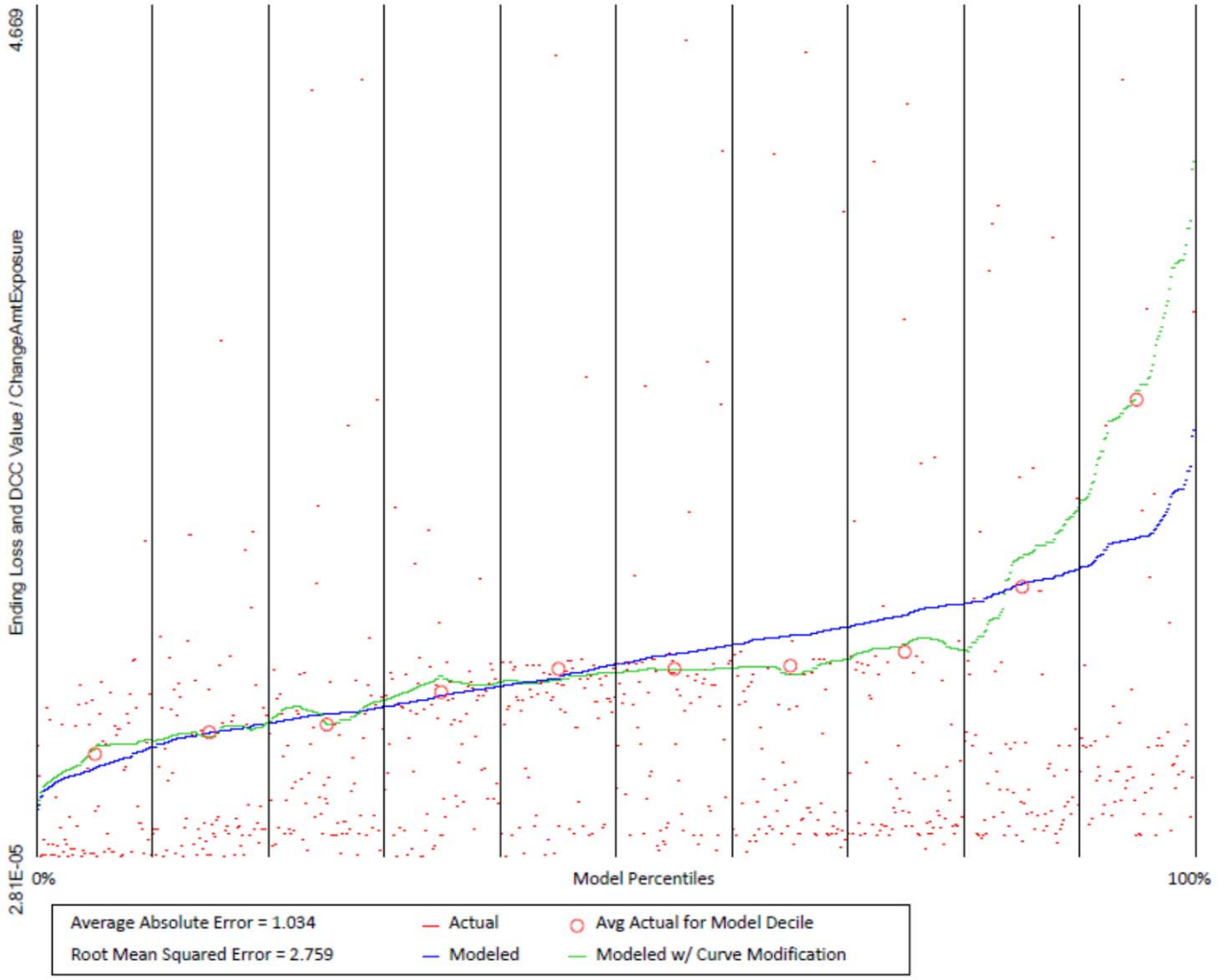
Change in Value

Predictive Significance



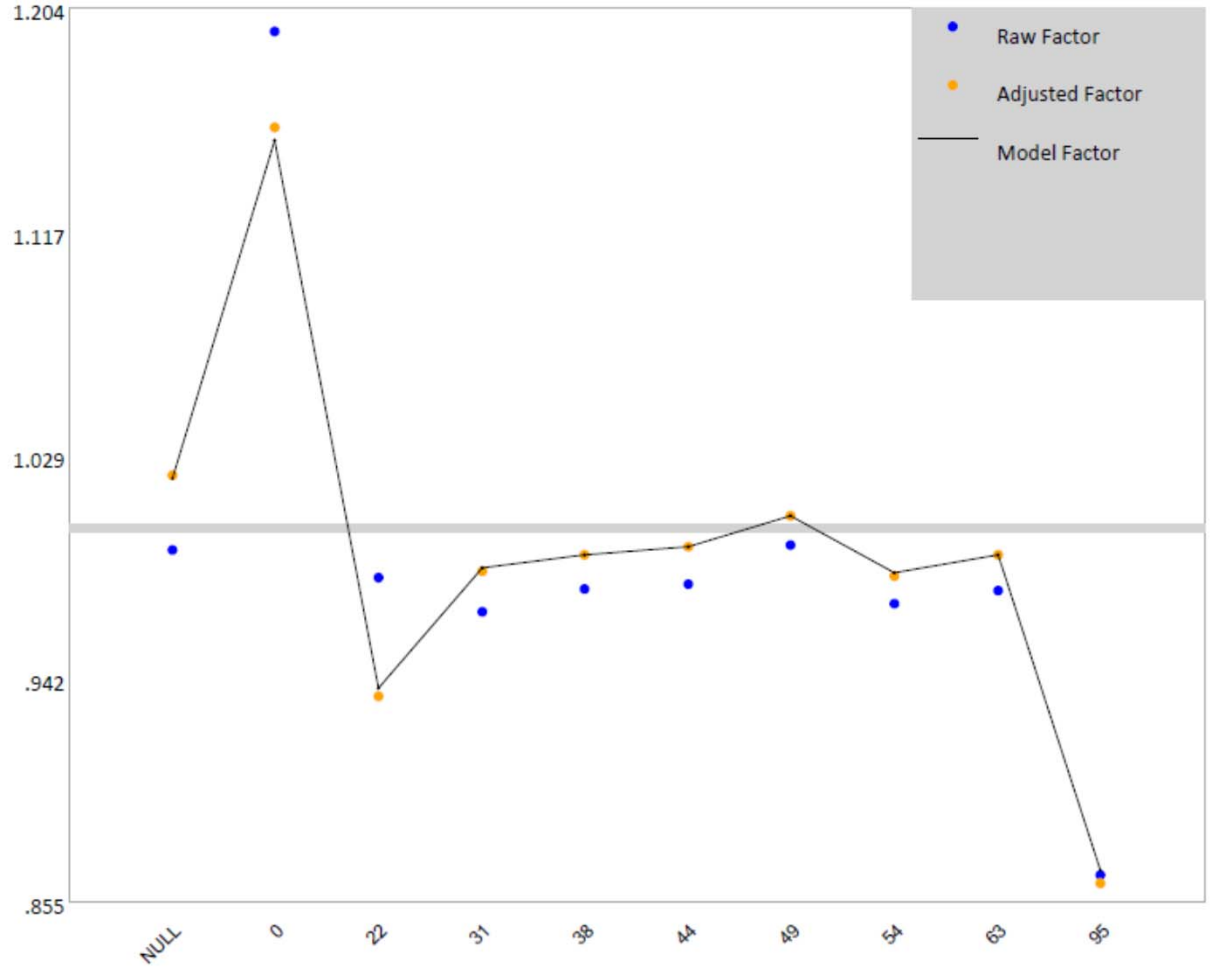
Change in Value

Test Data Fit by Model Deciles



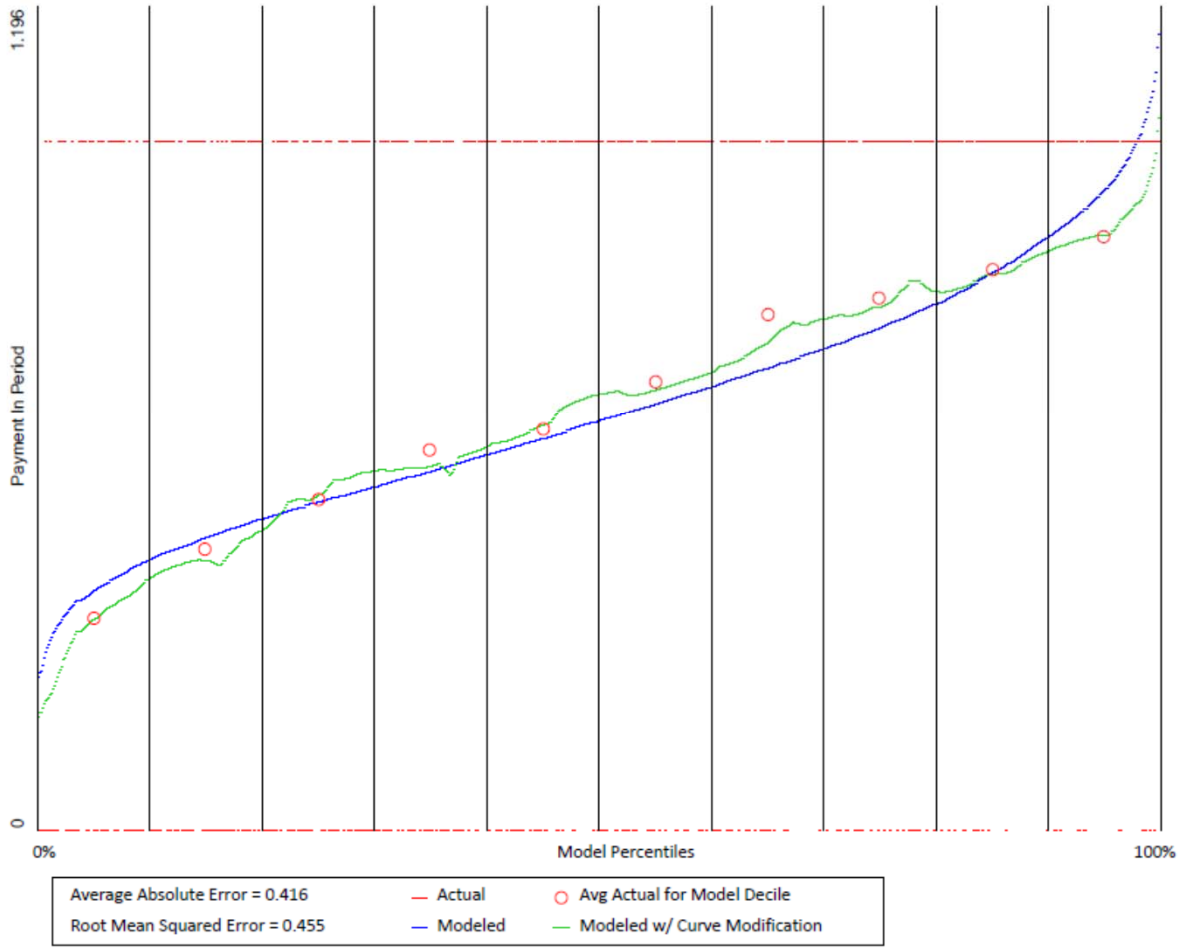
Characteristic: ClaimantAge

Change in Value



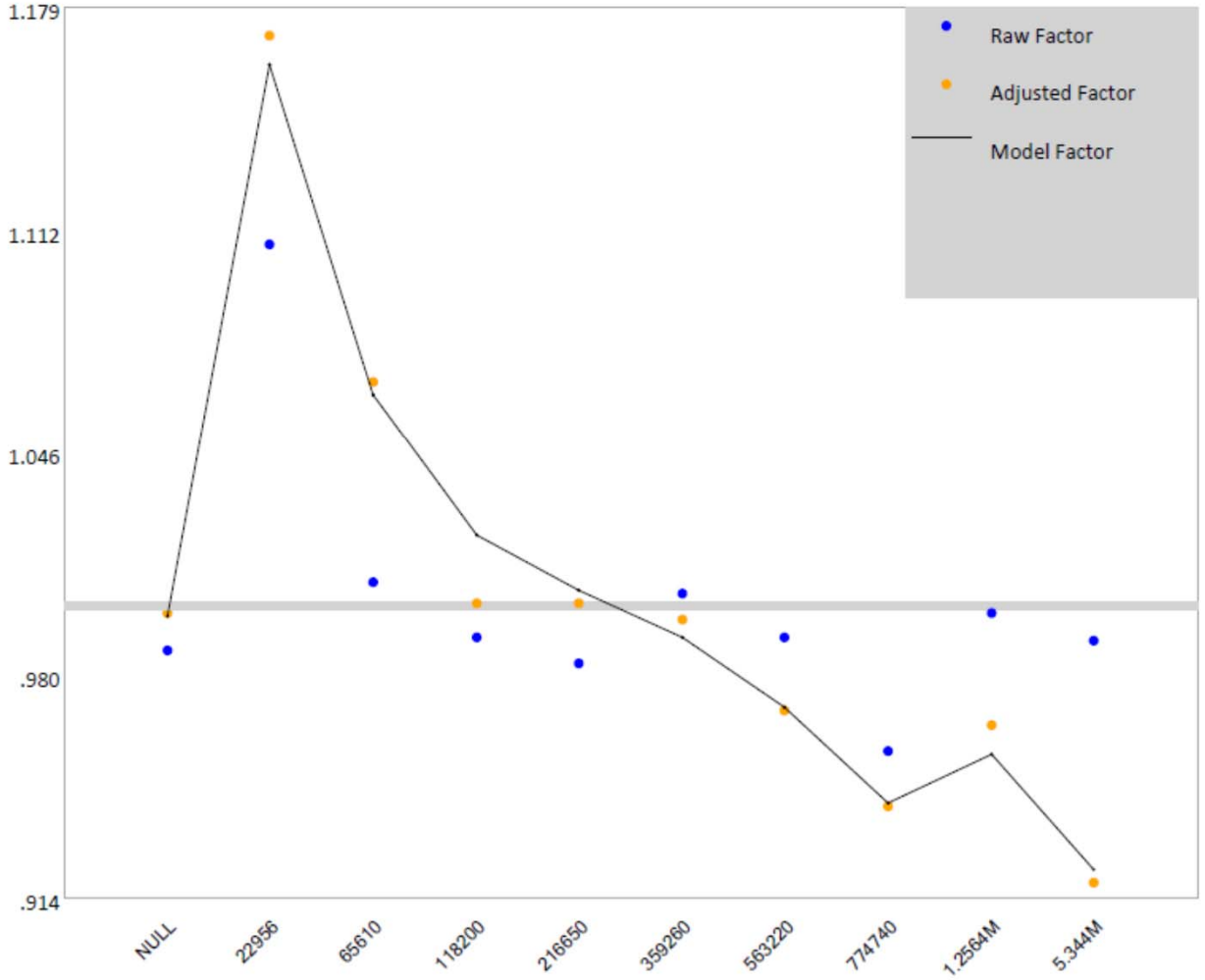
Payment Probability

Test Data Fit by Model Deciles



Characteristic: Written Premium

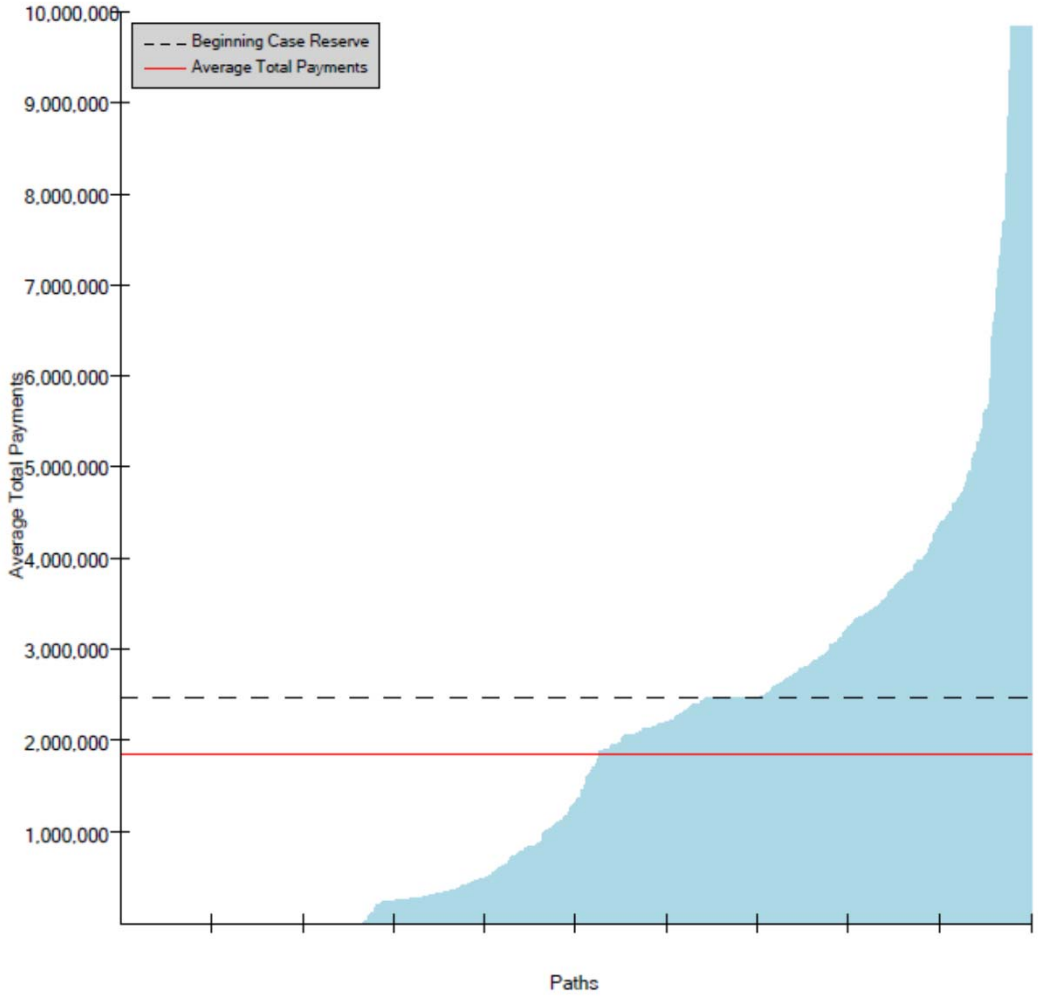
Payment Probability



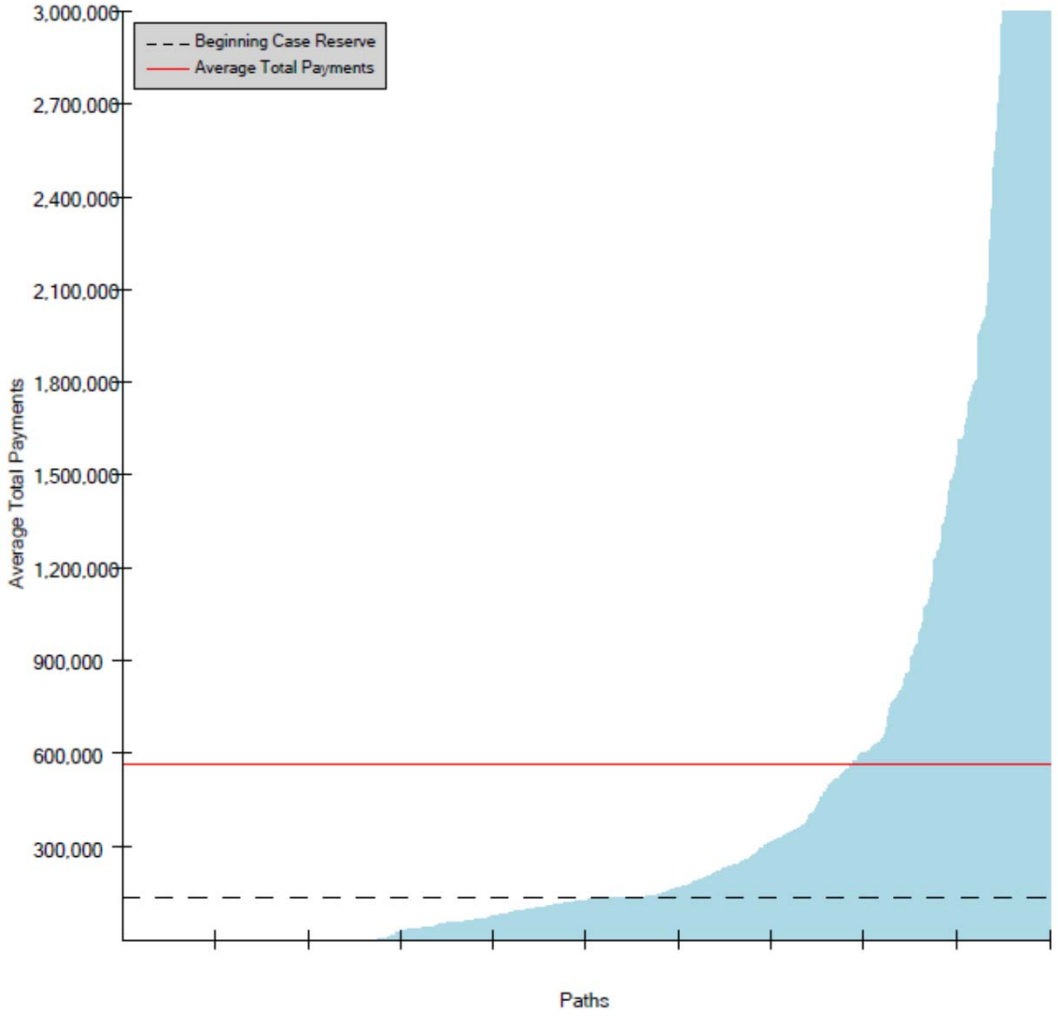
Simulate Going Forward

- 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

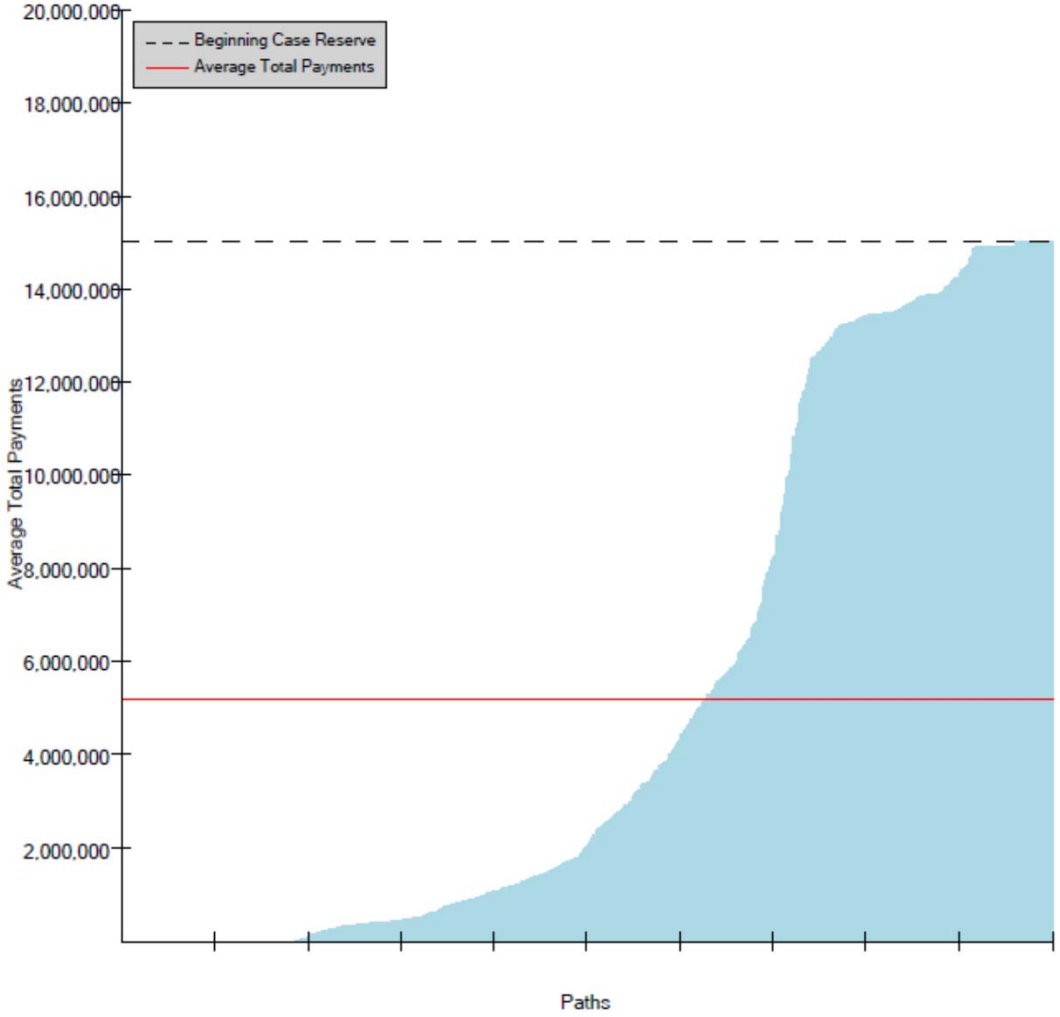
Claim 1


Beginning Case Reserve
Average Total Payments
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
Average Total Payments
Paths

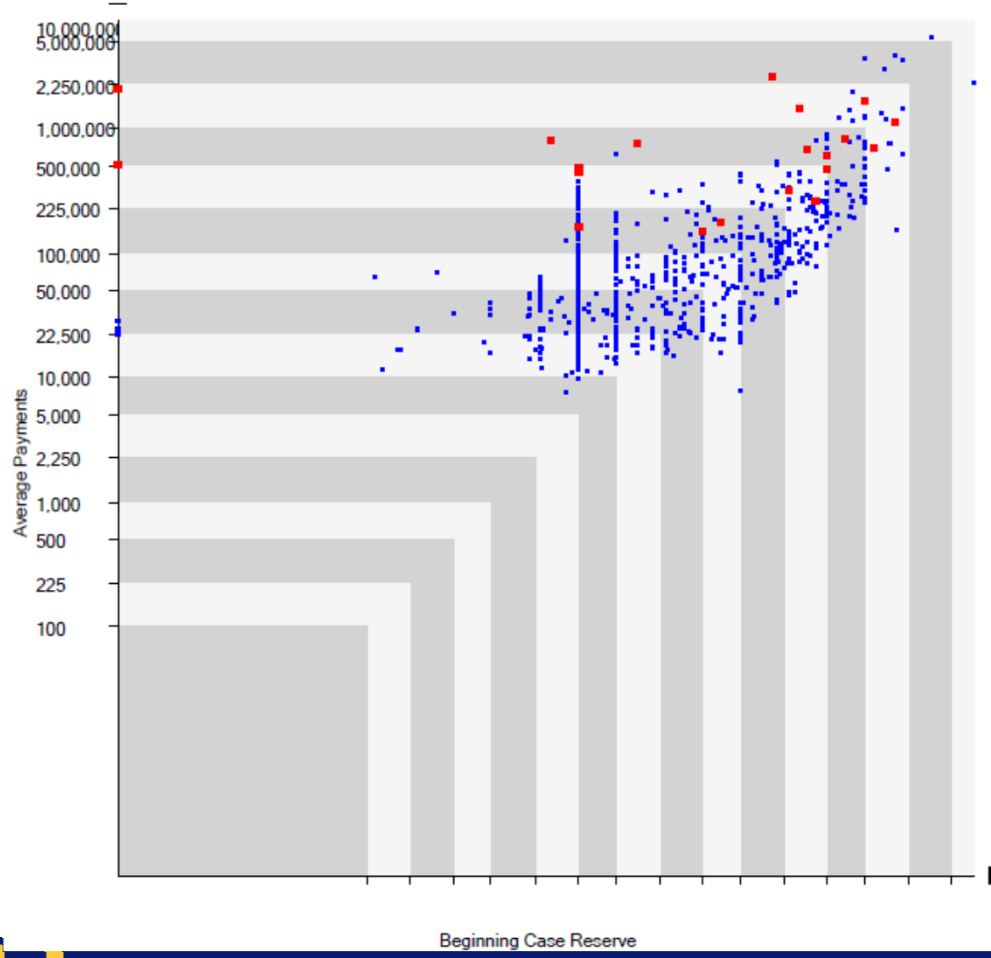
Claim 2


Beginning Case Reserve
Average Total Payments
3,000,000
2,700,000
2,400,000
2,100,000
1,800,000
1,500,000
1,200,000
900,000
600,000
300,000
Average Total Payments
Paths

Claim 3


Beginning Case Reserve
Average Total Payments
20,000,000
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
Average Total Payments
Paths

Severity Description 1



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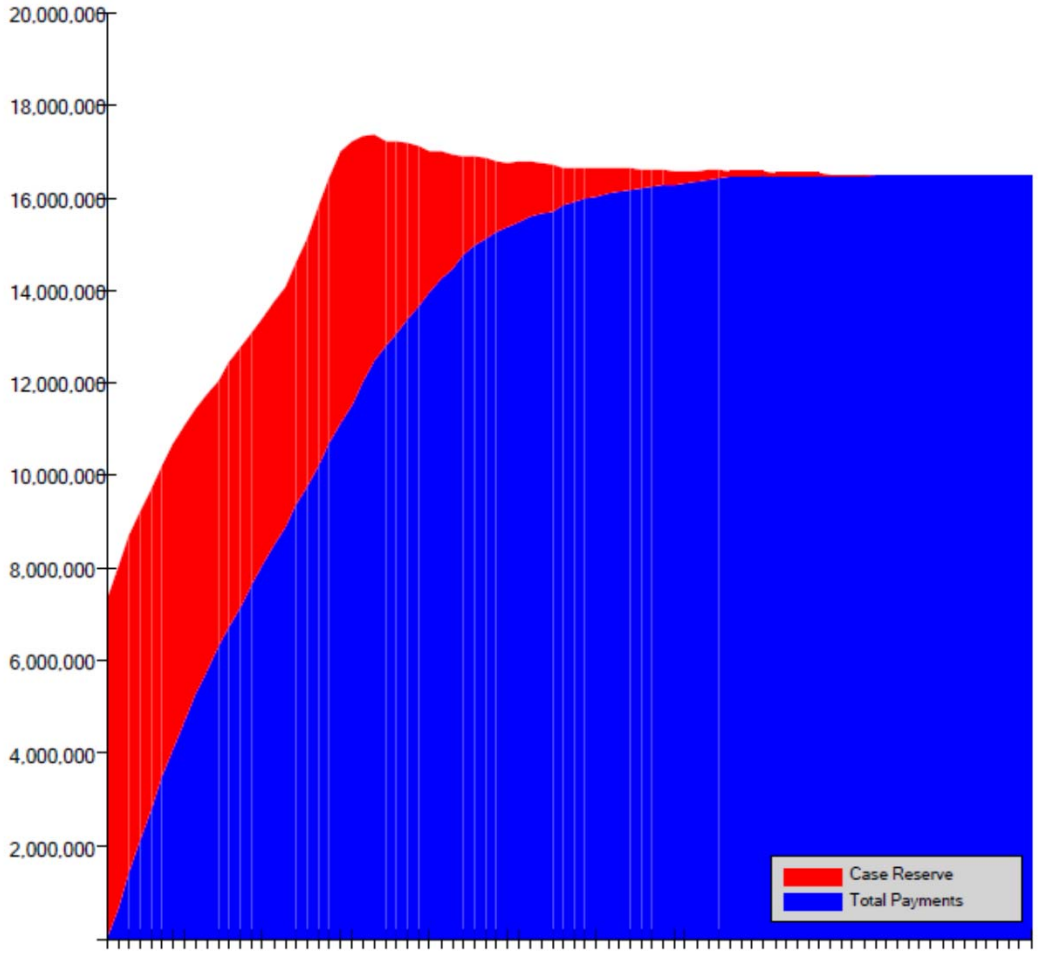

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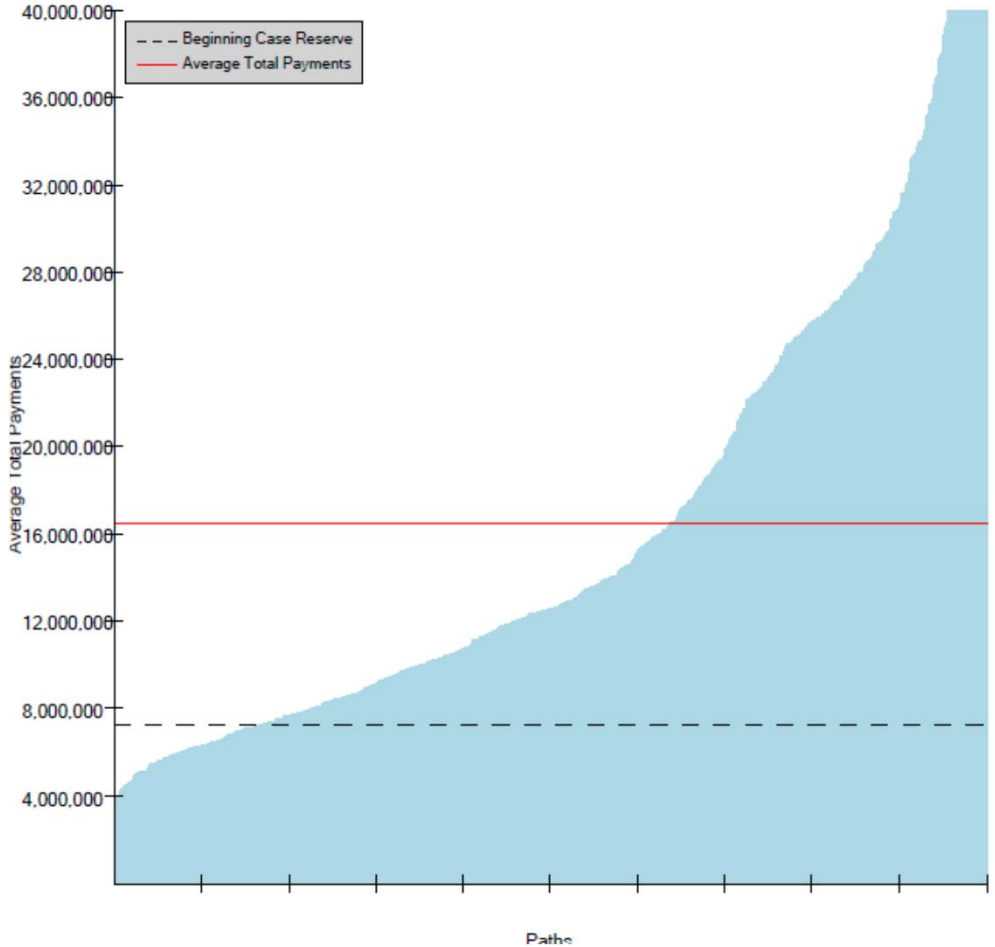
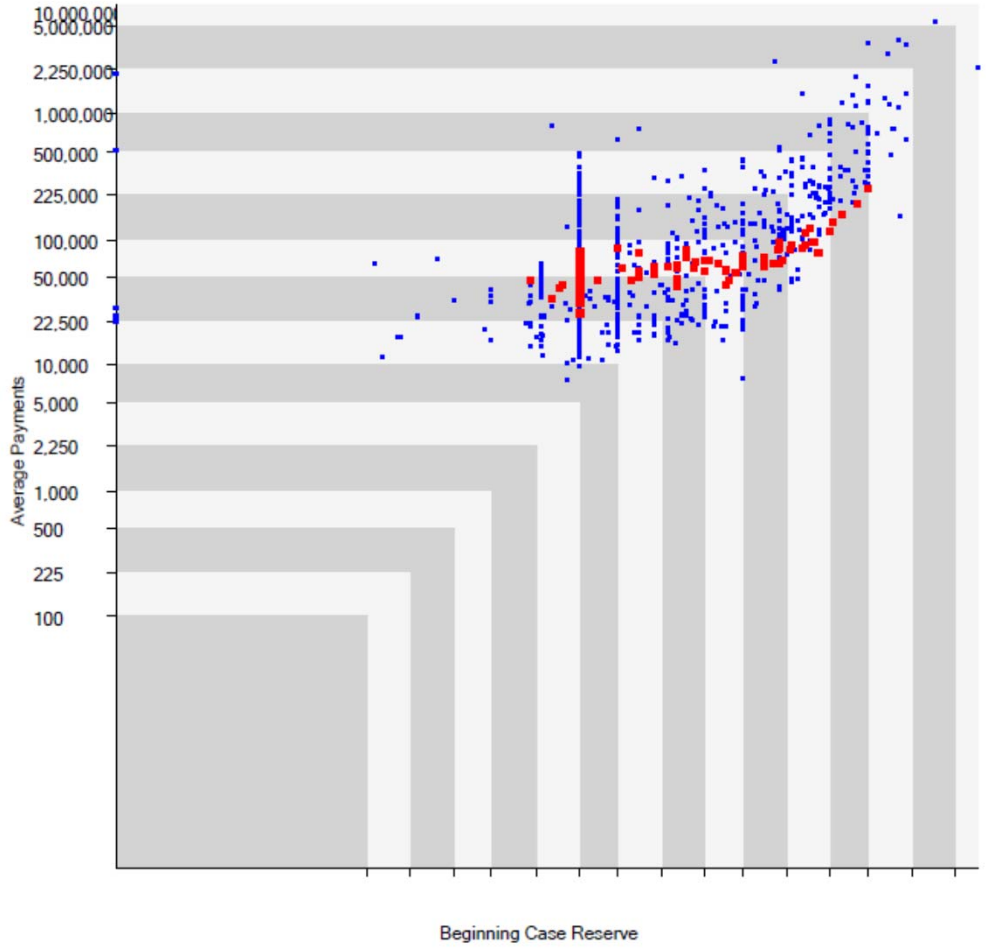


Severity Description 2



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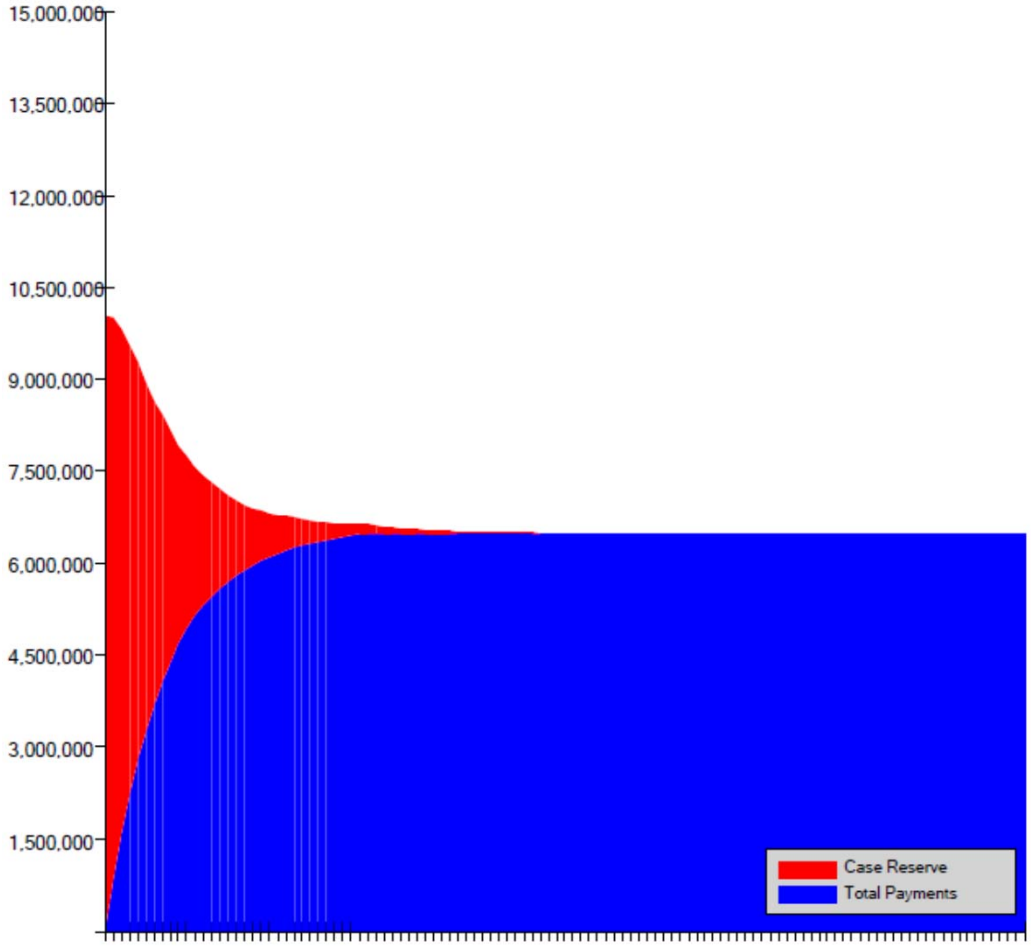

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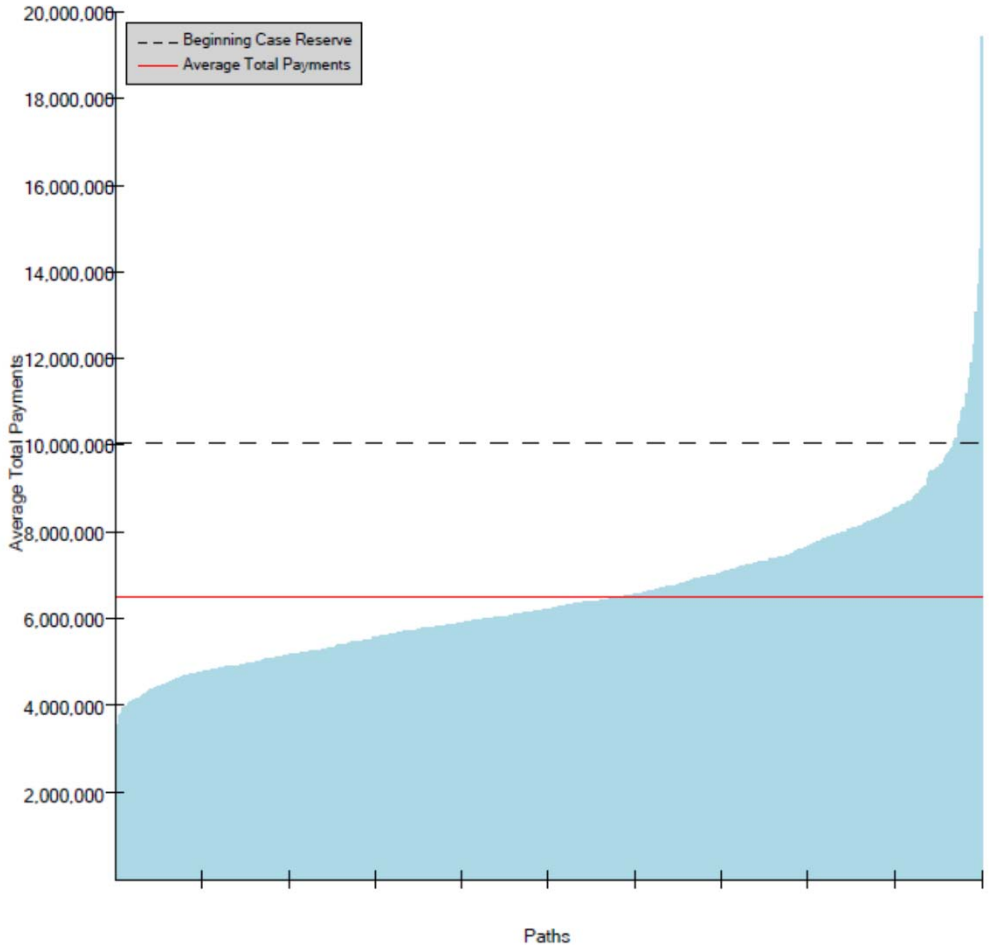
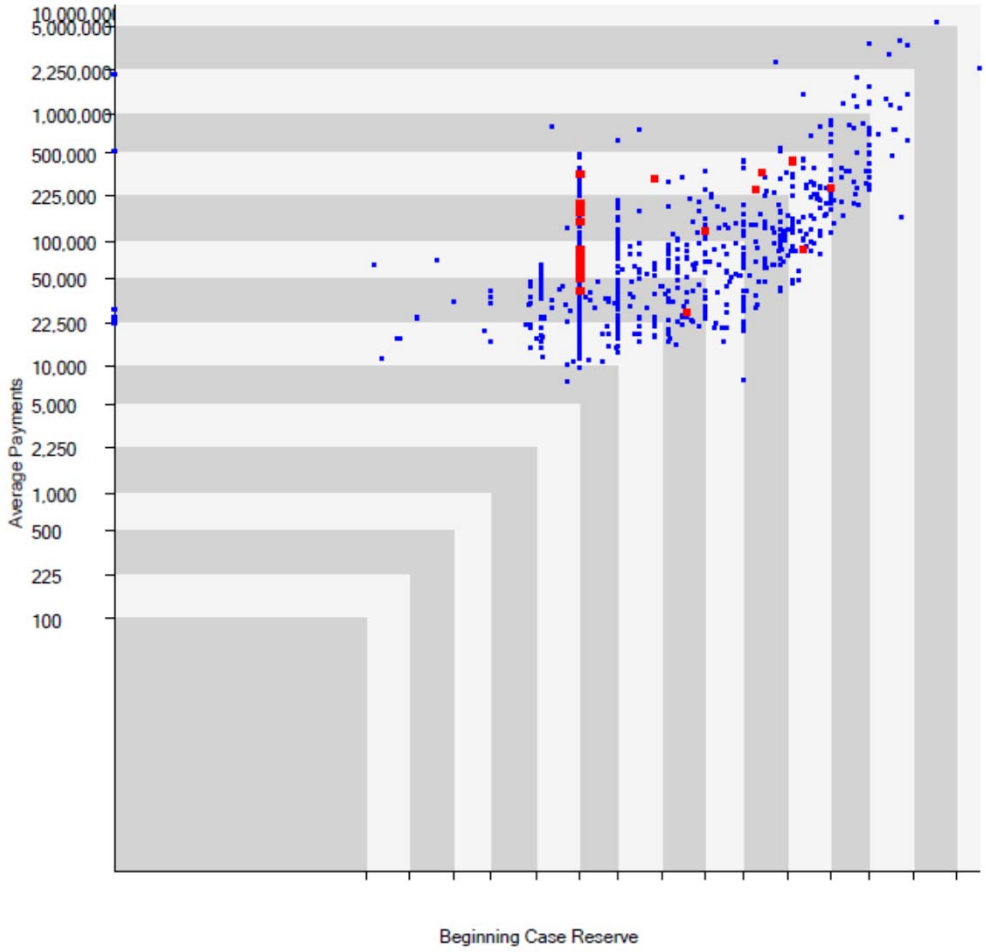


Claim Category 1



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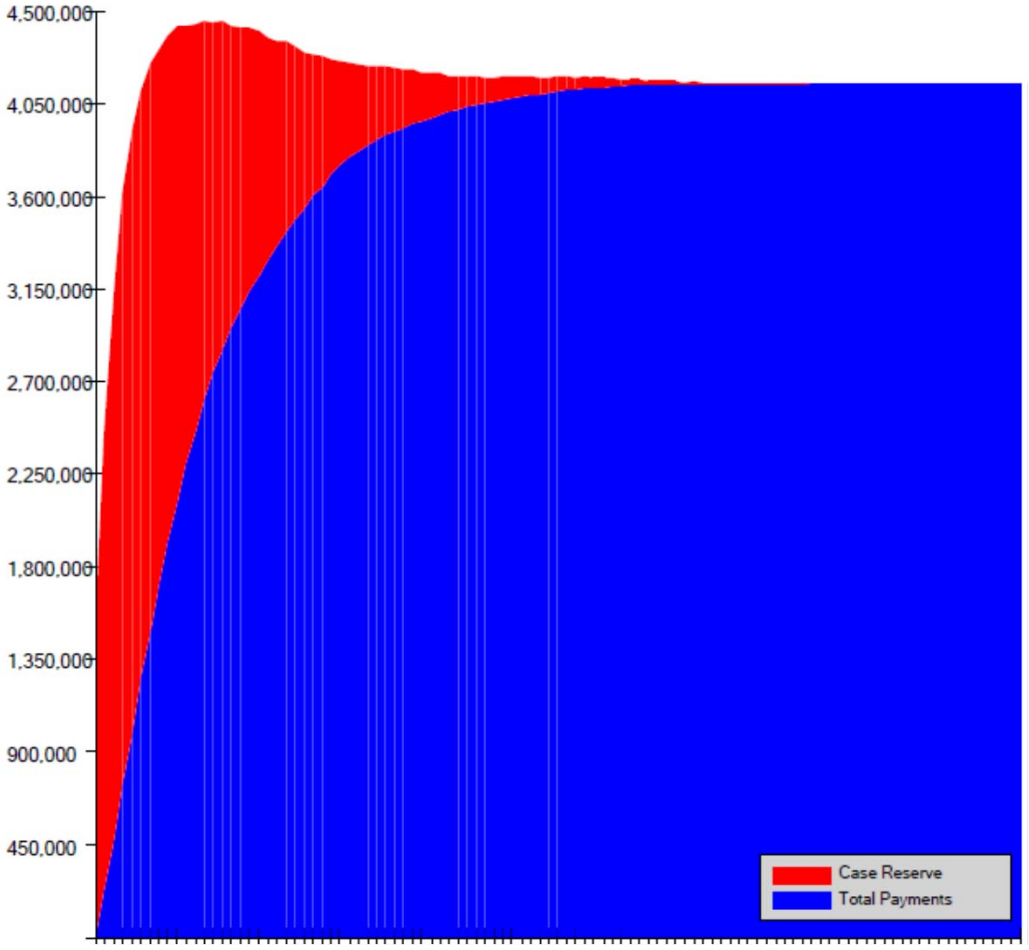

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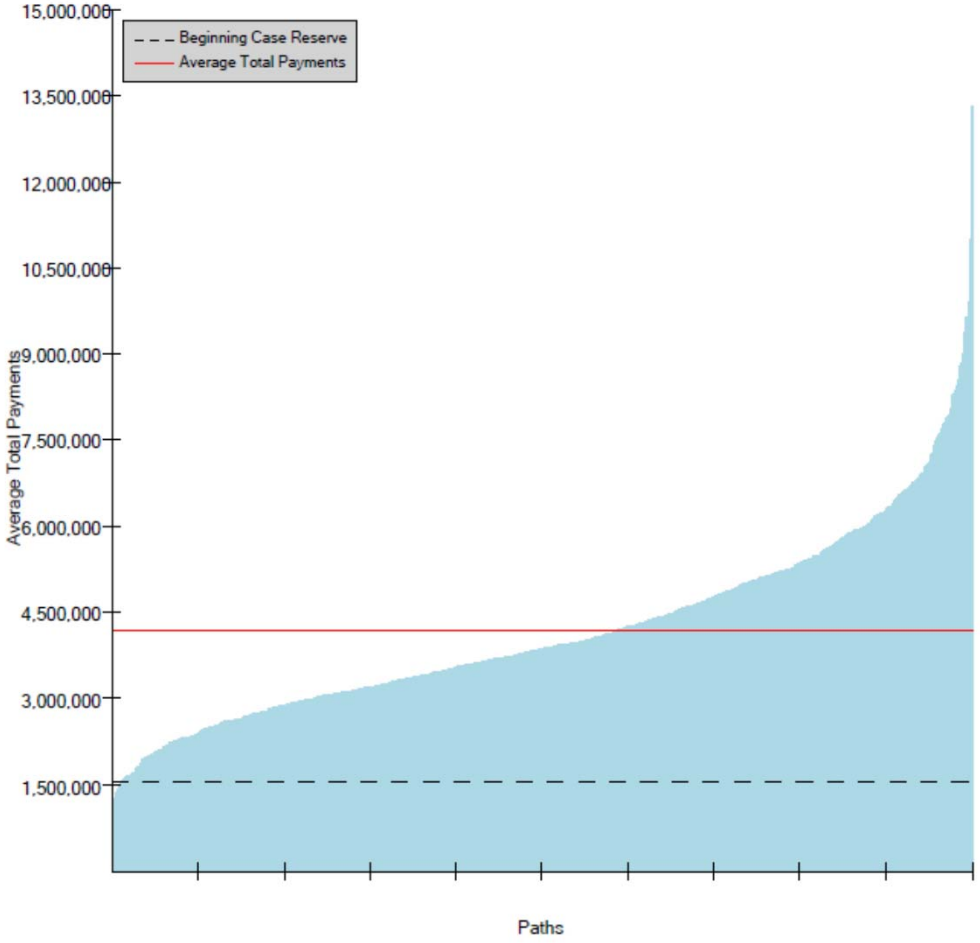

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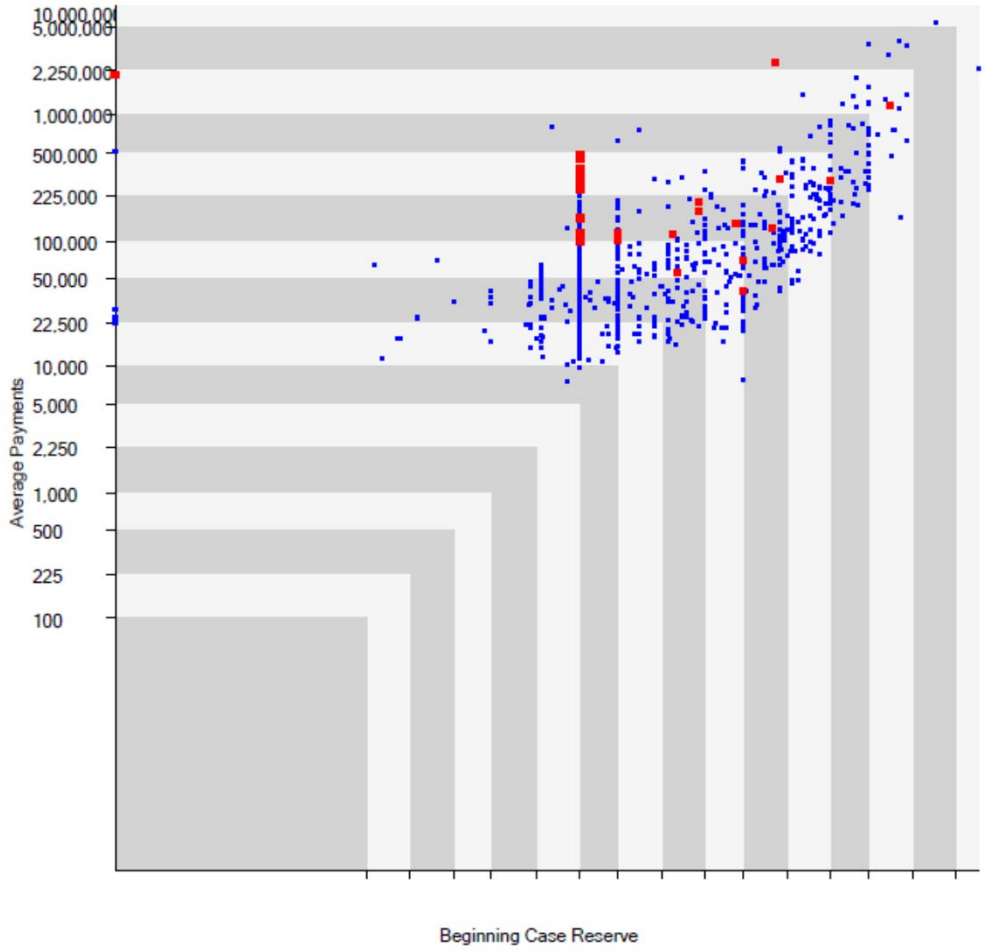

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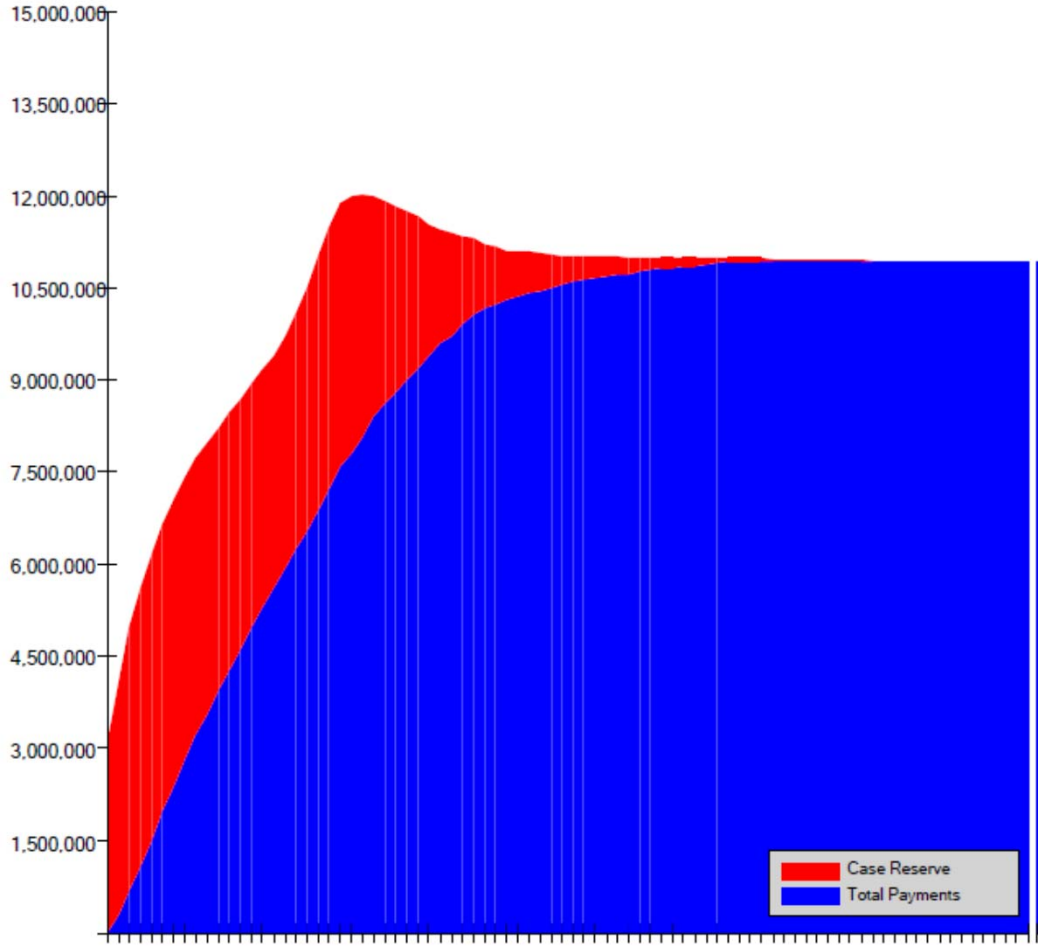

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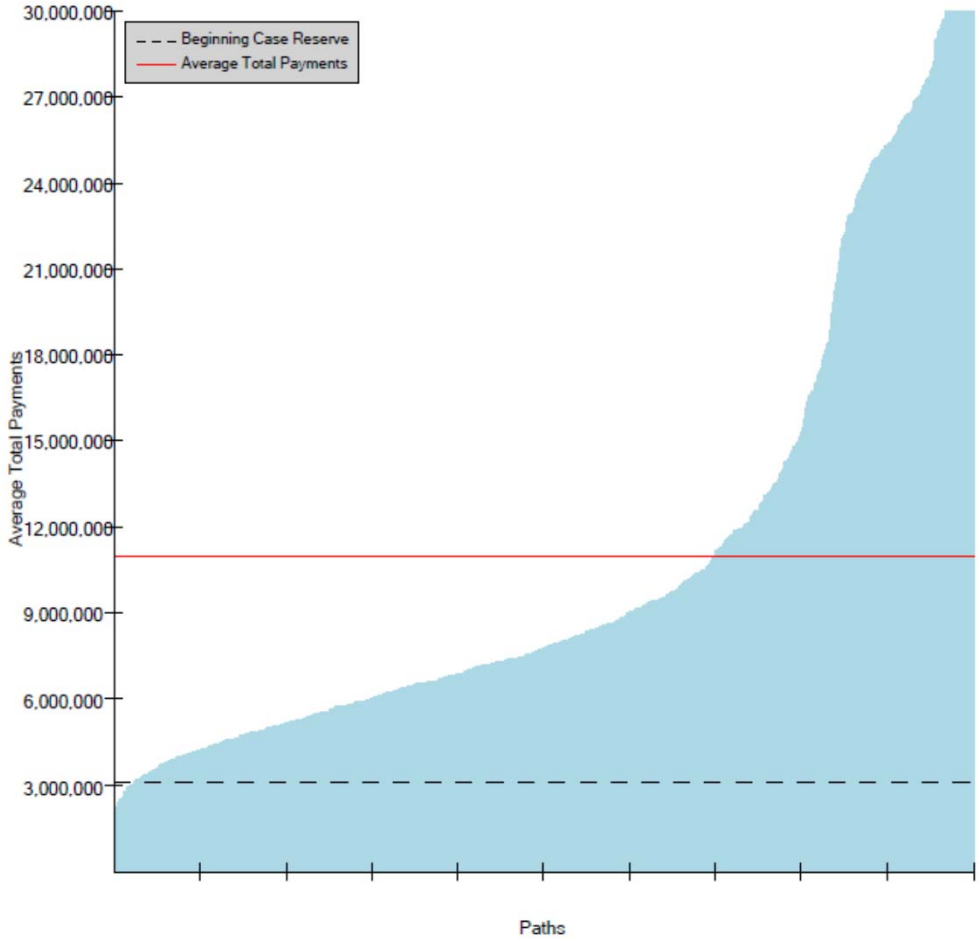
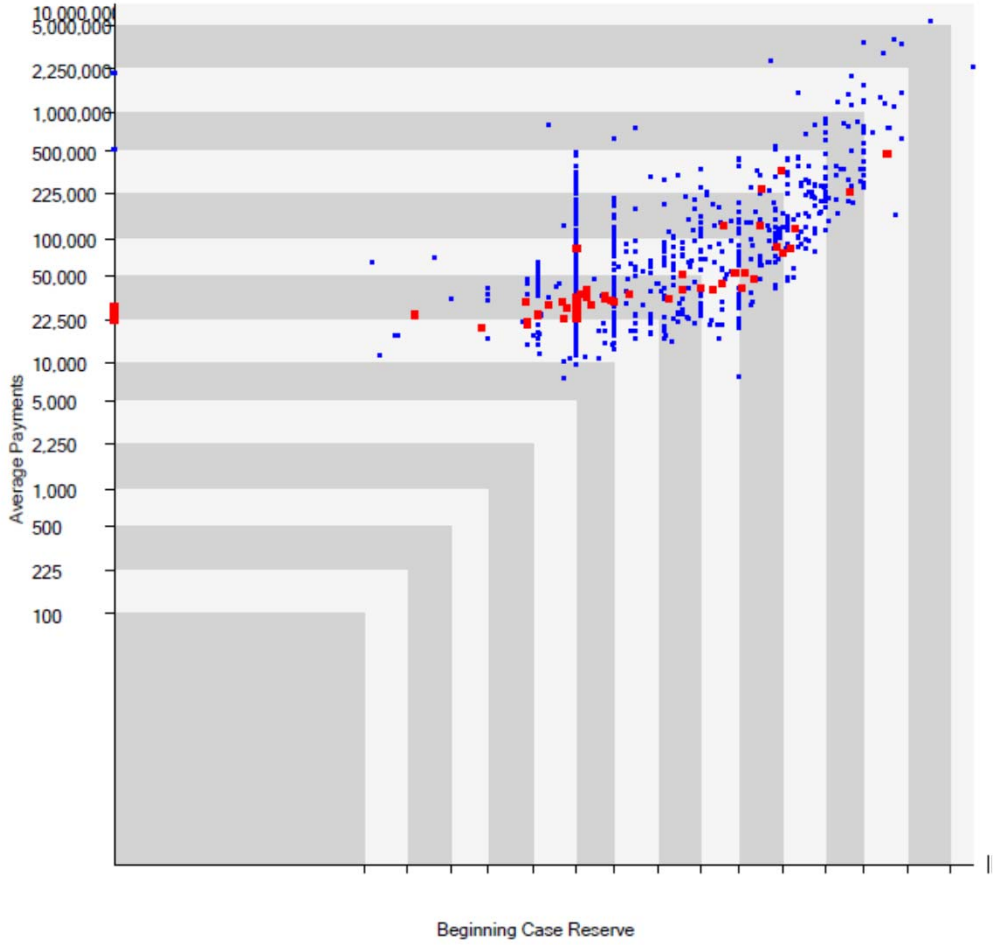


Claim Category 3



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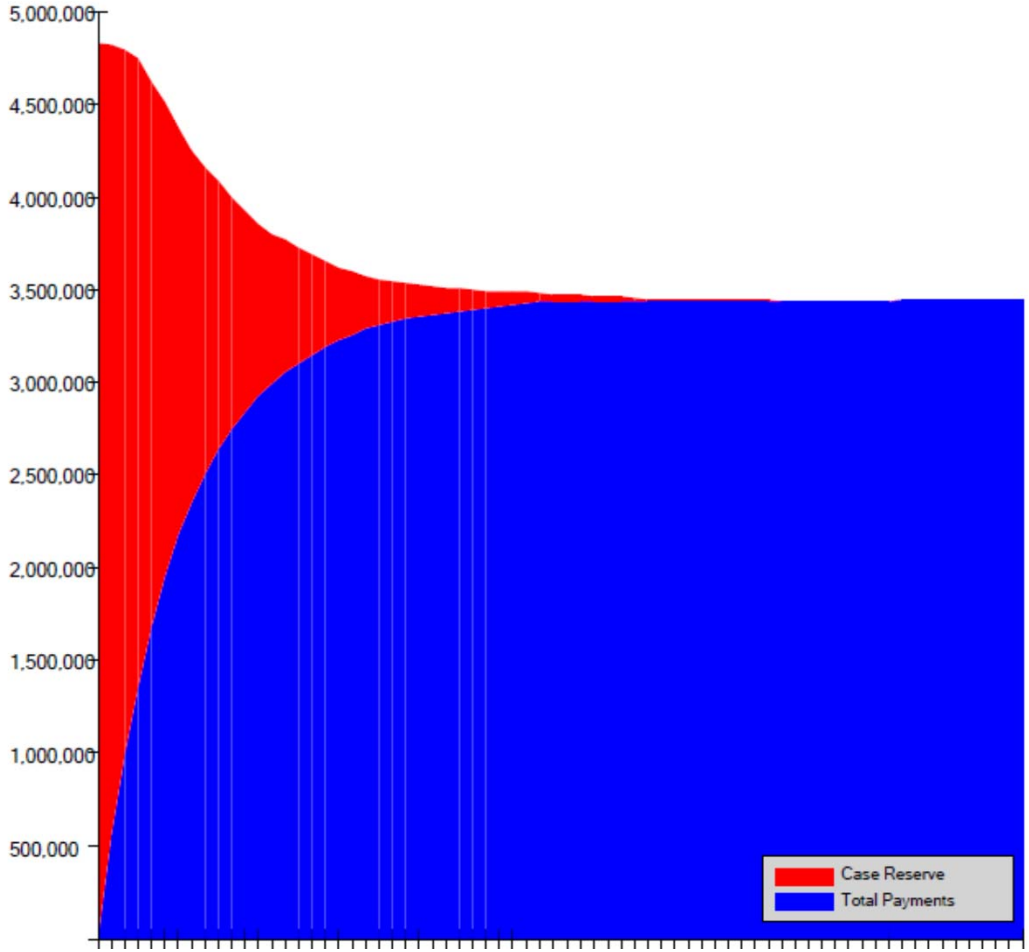

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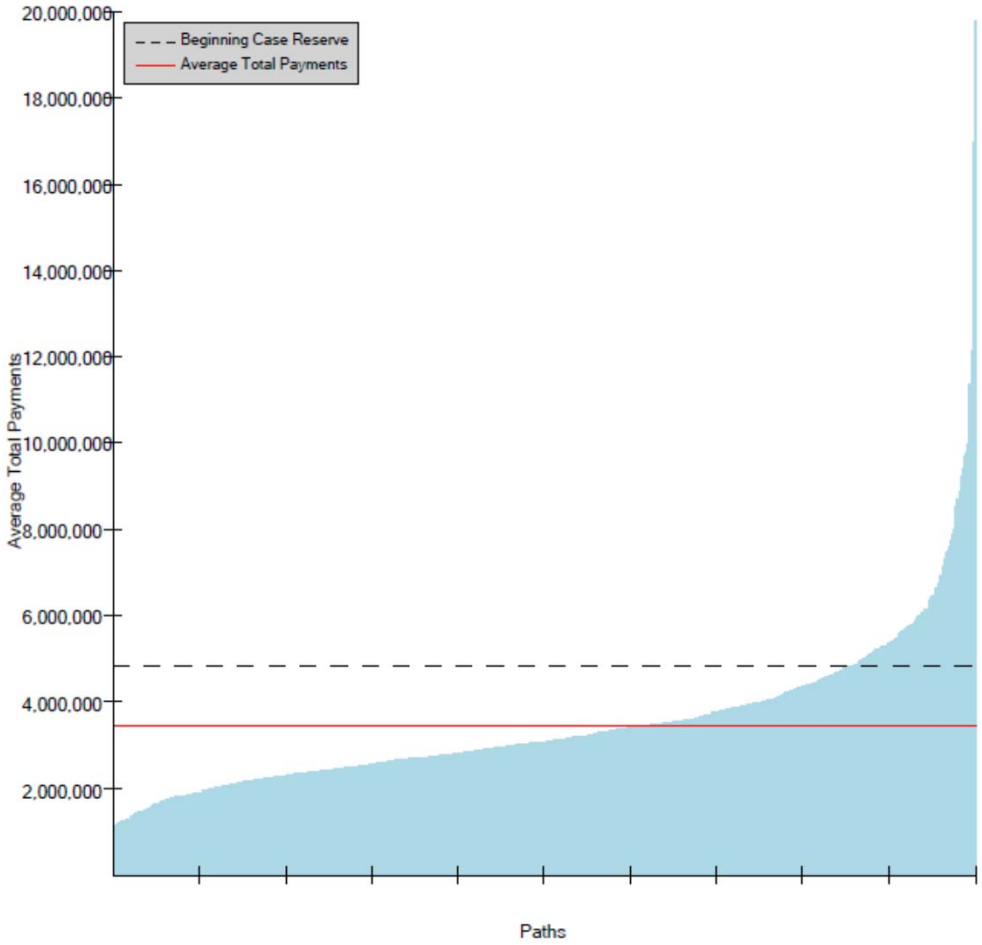

Uses

- Claim management
- Reserve Analysis
- Pricing Analysis
- Underwriting Management
- Risk Management
- Reinsurance

Summary

- Healthcare claims contain a wealth of data for the reserving actuary
- Multivariate predictive modeling techniques can help turn this data into **information**
- By focusing on a calendar period time-step, simulation can be used to build a more complete understanding of the reserves
- Many actuarial questions besides reserving are addressed through the use of this approach

Questions?