Actuarial Case Reserves

2019 Casualty Loss Reserve Seminar

Concurrent Session AR-16

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What is the ideal case reserve from an actuary's perspective?

One that optimizes the actuary's ability to perform.

Actuarial uses of case reserves

- Development in loss triangles
- Allocation of total reserve estimate
- Input for pricing analysis

Qualities of an Ideal Actuarial Case Reserve

- Stability (constant adequacy over time)

Impact of change in mix on stability

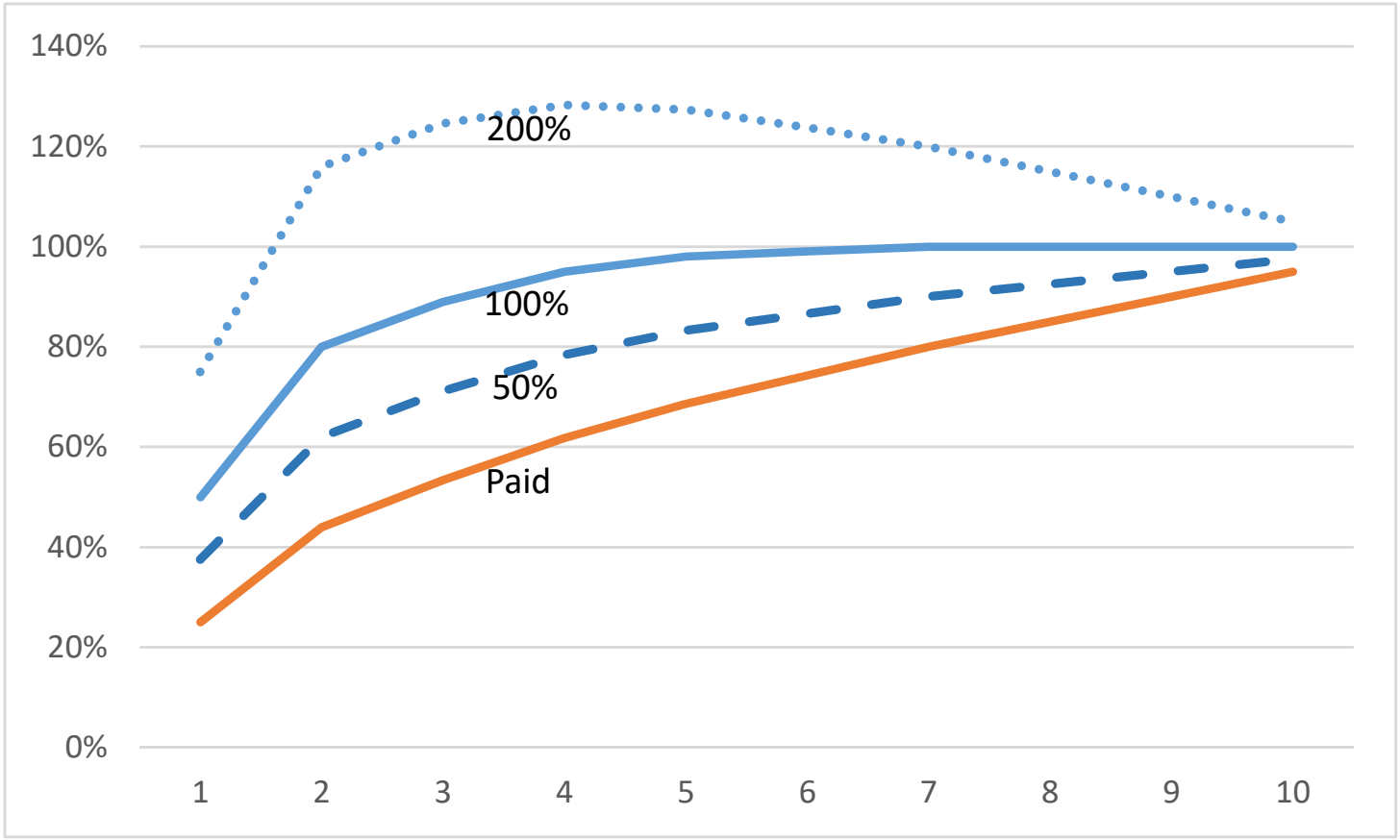
- Rarely true that types of claims are equally adequate. Differences usually exist by deductible, geography, industry classification, size of account, cause of loss, injury type, etc..
- Change in Mix => Change in Adequacy.
- It is rarely true that there is NO change in mix is occurring along any particular dimension.
- Therefore case adequacy is constantly changing.

Qualities of an Ideal Actuarial Case Reserve

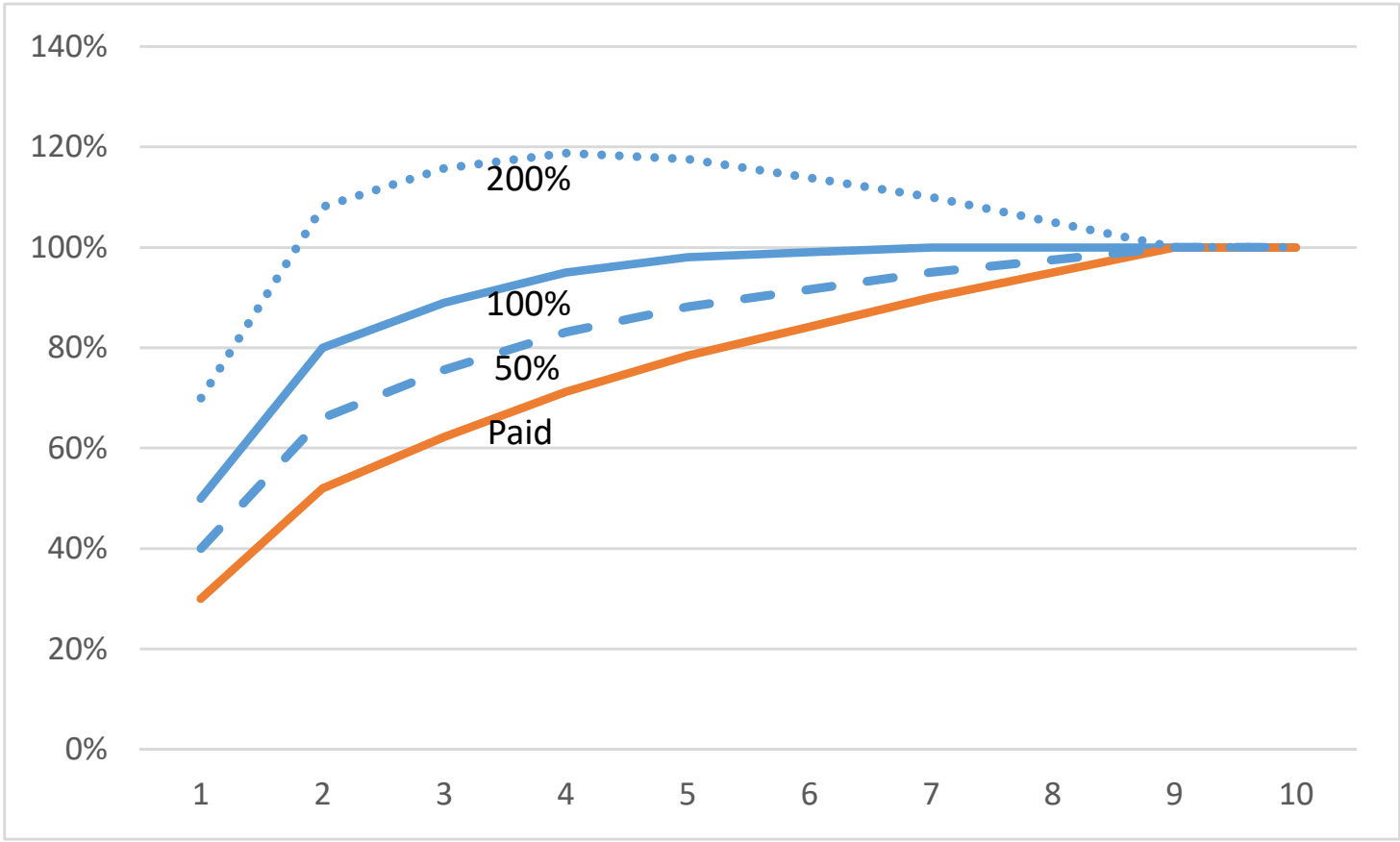
- Stability (constant adequacy over time)
- Uniformity (constant adequacy across population)

When we talk about the above two are we talking about case reserves by themselves or in conjunction with payments?

Impact of claim payment speed up



Impact of speed up



Qualities of an Ideal Actuarial Case Reserve

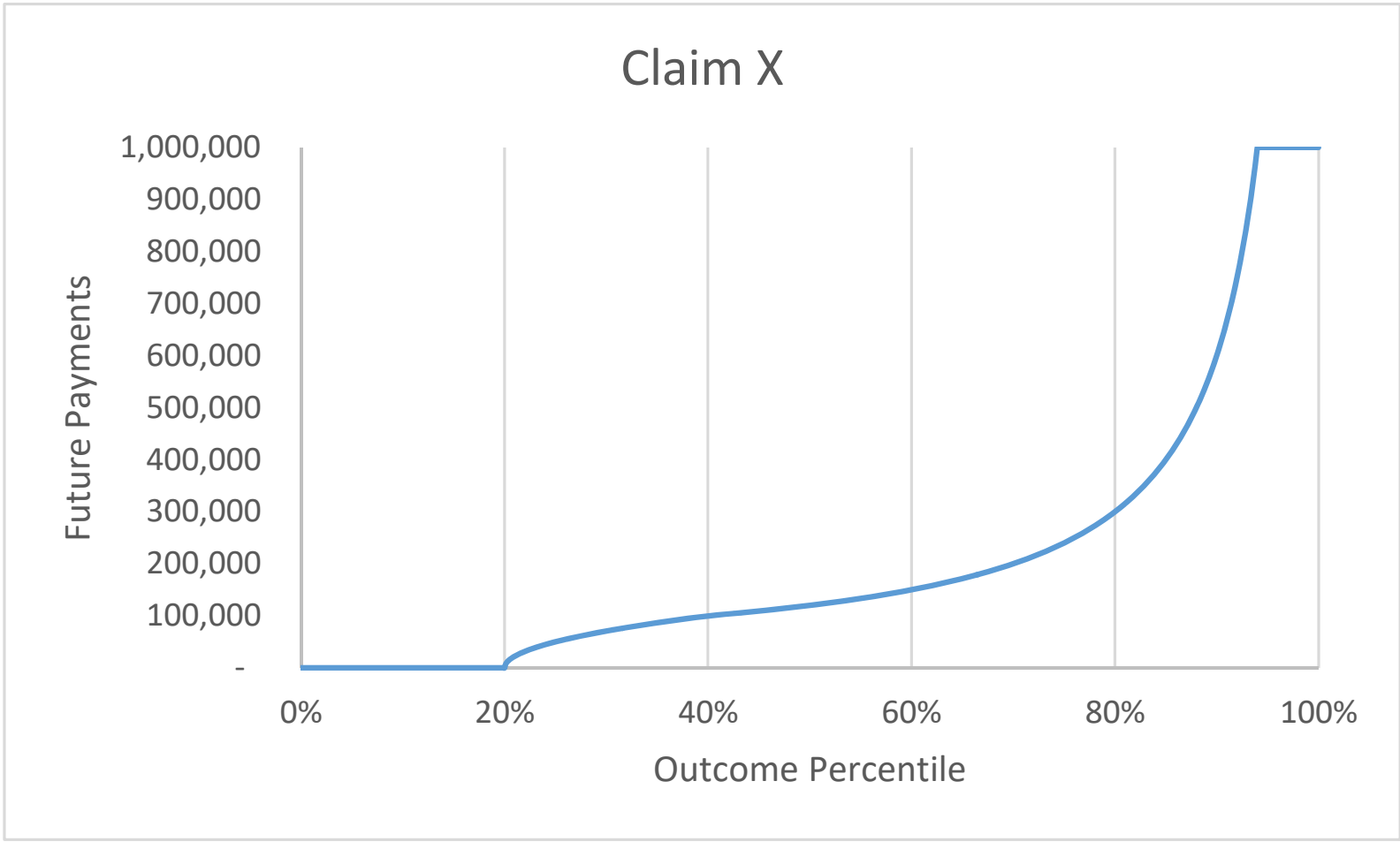
- Case Res = E(future payments | available information), i.e. adequate
- Consistent determination over time
- Objective

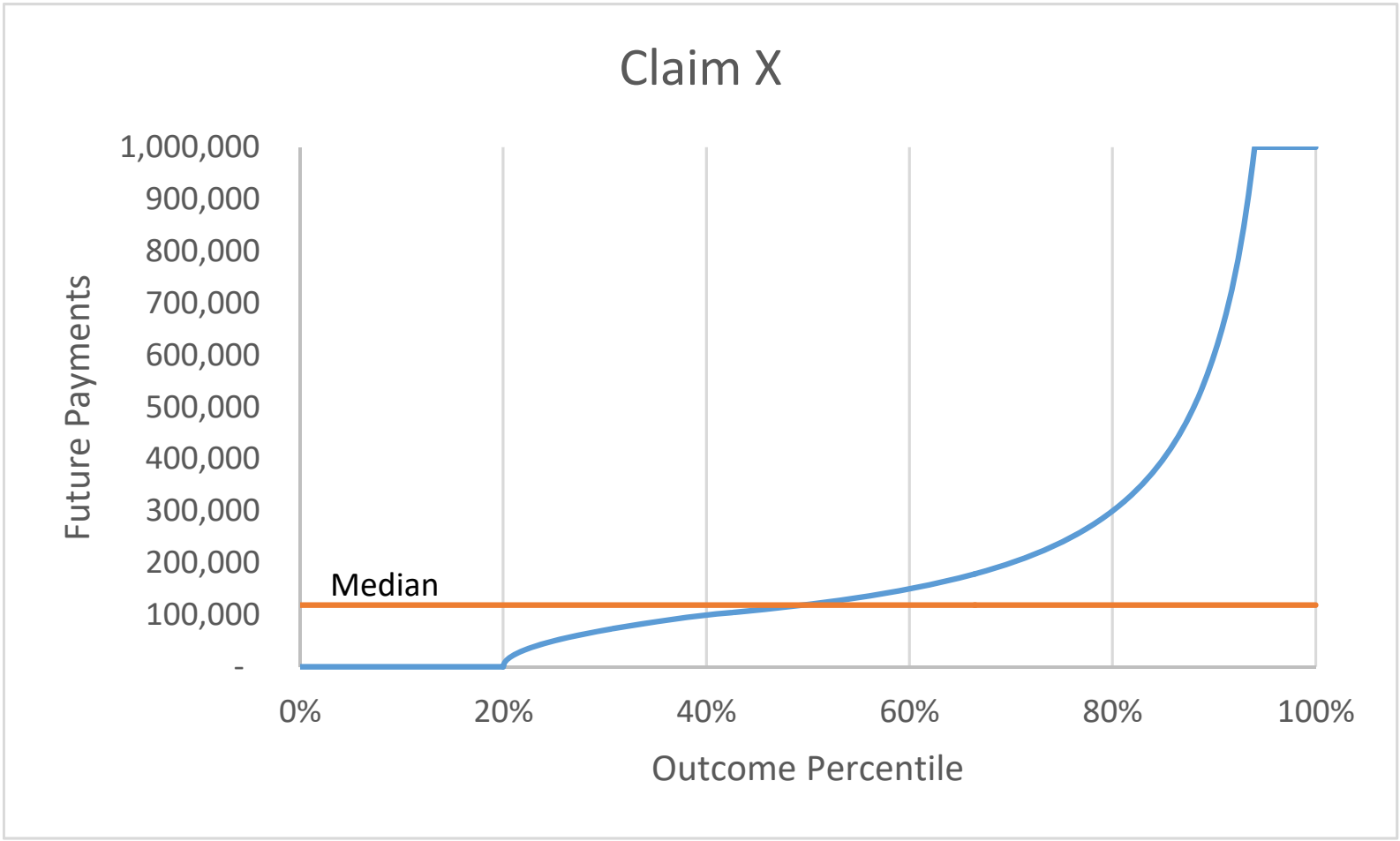
What is the ideal case reserve from a claim department's perspective?

One that optimizes the claim department's ability to perform.

Claim Department Uses of Case Reserves

- Communicate their opinion
- Benchmark for negotiation
- Benchmark for performance


Claim X
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
Future Payments
0%
20%
40%
60%
80%
100%
Outcome Percentile


Claim X
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
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100,000
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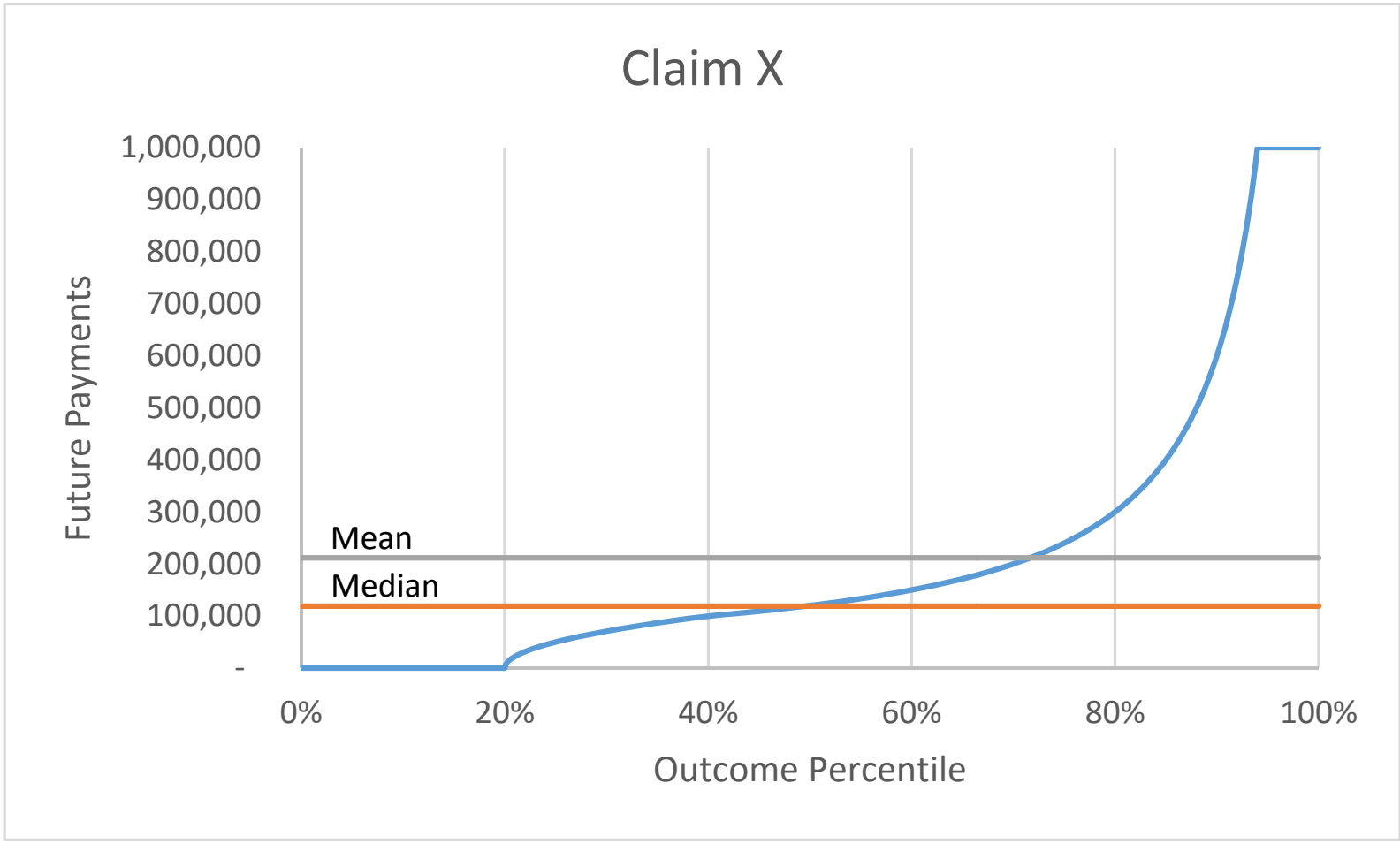
Future Payments
Median
0%
20%
40%
60%
80%
100%
Outcome Percentile


Claim X
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
Future Payments
Mean
Median
0%
20%
40%
60%
80%
100%
Outcome Percentile

Historical plea from actuary to claim department

- Don’t change things!
- Unrealistic
- Suboptimal with regard to outcomes

The solution

- Two separate case reserve estimates
  - One controlled by the claim department for their purposes
  - One controlled by the actuarial department for their purposes
  - Comparison and discussion where appropriate

Use of Actuarial Case Reserves -General Process

- Build an actuarial algorithm for case reserves
- Apply to every open claim at each triangle point
- Replace historical case reserves
- Organize into triangle
- Generalization of Berquist-Sherman

Variables to include as predictors

- Age of claim
- Payments to date
- Recent payments
- Claim variables
- Exposure variables
- Limit Remaining
- Time component?
- NOT the current case reserve

Predictive Modeling

- Test/Validation with out-of-sample data
- Seek parsimony
- Consider timing/consistency of predictive variables

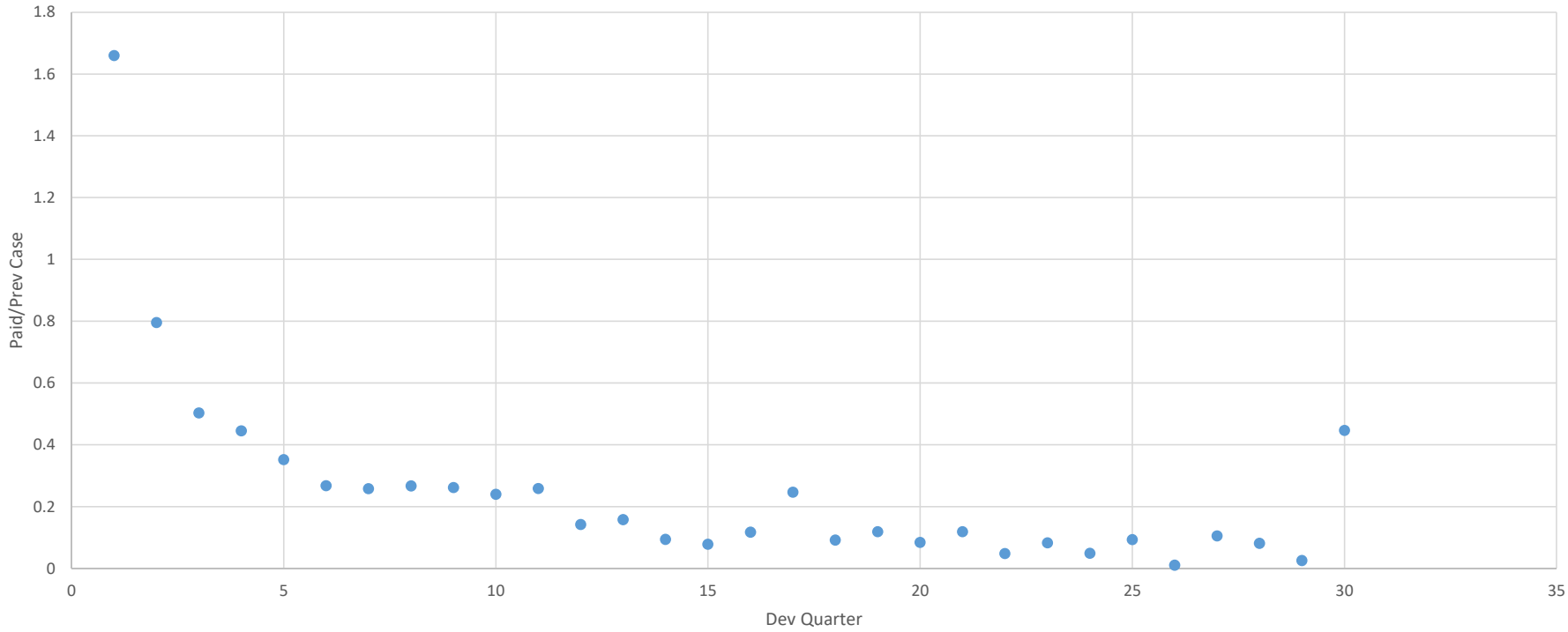
Data to include

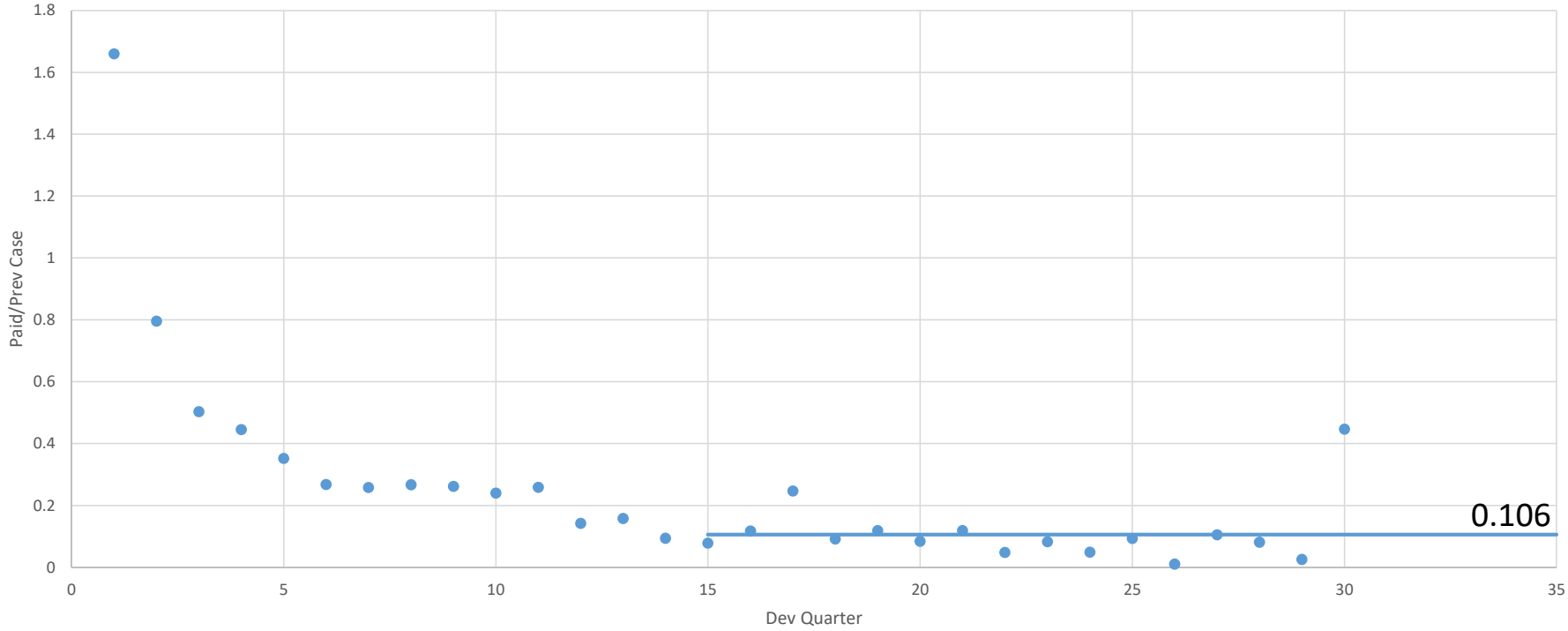
- Closed Claims
  - Advantage of being complete
  - Disadvantage of being biased toward simpler claims
  - Could use a cutoff point of where substantially ALL claims are closed, but relevance will likely suffer.
- Open Claims
  - Payments to date on these claims are known
  - There is information in the case reserves
  - Need to remove known biases

Claim ID	Age	Characteristic 1	Characteristic 2	Characteristic 3	...	Paid as of Age	Case Reserve as of Age	Paid as of Now	Case Reserve Now	Adjustment Factor	Current Est Ultimate	Future Payments as of Age
10001	1					700,000	1,060,000	1,910,000	-	1.07	1,910,000	1,210,000
10001	2					1,500,000	580,000	1,910,000	-	1.07	1,910,000	410,000
10001	3					1,900,000	120,000	1,910,000	-	1.07	1,910,000	10,000
10001	4					1,900,000	30,000	1,910,000	-	1.07	1,910,000	10,000
10001	5					1,905,000	10,000	1,910,000	-	1.07	1,910,000	5,000
10002	1					-	50,000	247,000	29,000	1.34	285,860	285,860
10002	2					220,000	35,000	247,000	29,000	1.34	285,860	65,860
10002	3					247,000	29,000	247,000	29,000	1.34	285,860	38,860
10003	1					500	60,000	37,000	12,000	1.34	53,080	52,580
10003	2					37,000	12,000	37,000	12,000	1.34	53,080	16,080

Adjustment to Current Case

- It is likely that some known biases are already understood – general or specific
- In the specific case, individual development models may have been built to study the behavior of case reserves
- In the general case, IBNER might already be expected.
- In either case, adjustment is appropriate before building the actuarial case algorithm
- Marker-Mohl backwards-recursive approach, applied to “report-period by age” triangles is an easy starting point (develops factors that are applied to case reserves as of a certain age)


1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Paid/Prev Case
0
5
10
15
20
25
30
35
Dev Quarter


1.8
1.6
1.4
1.2
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0.8
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0
Paid/Prev Case
0
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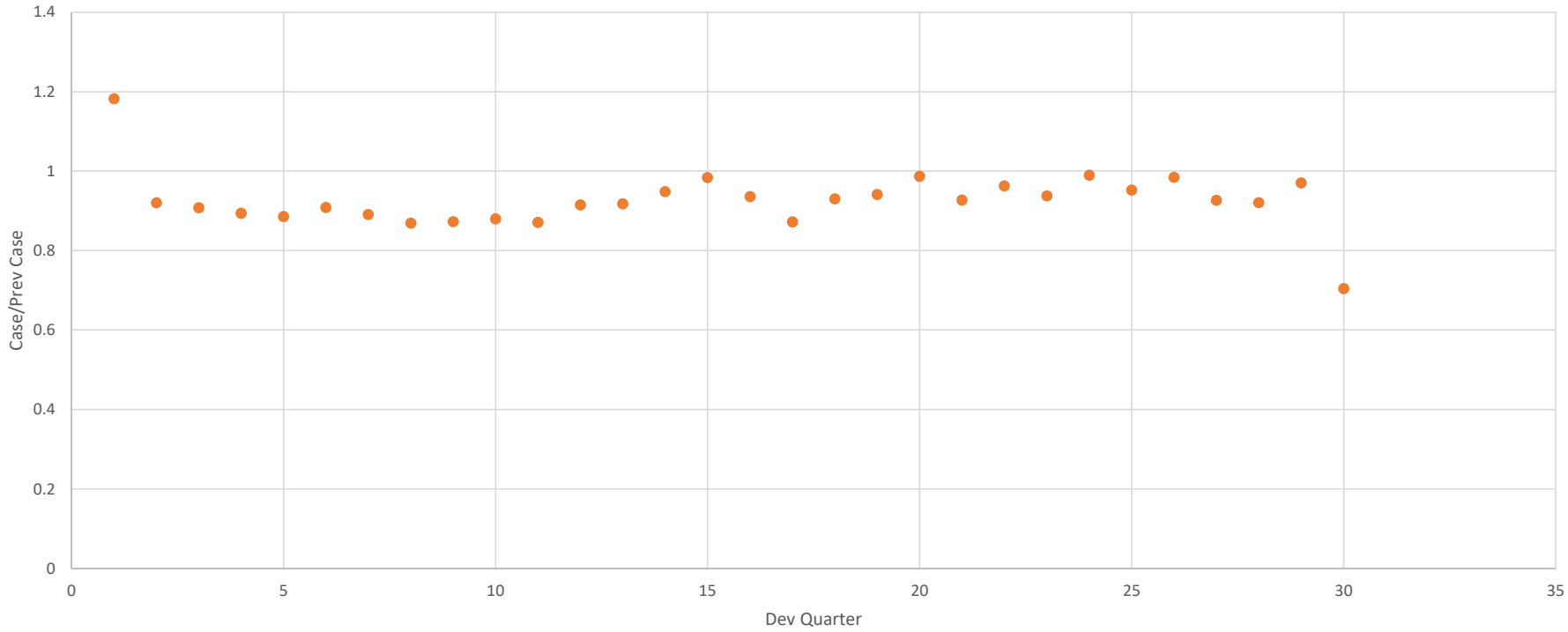
10
15
20
25
30
35
Dev Quarter
0.106


1.4
1.2
1
0.8
0.6
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Case/Prev Case
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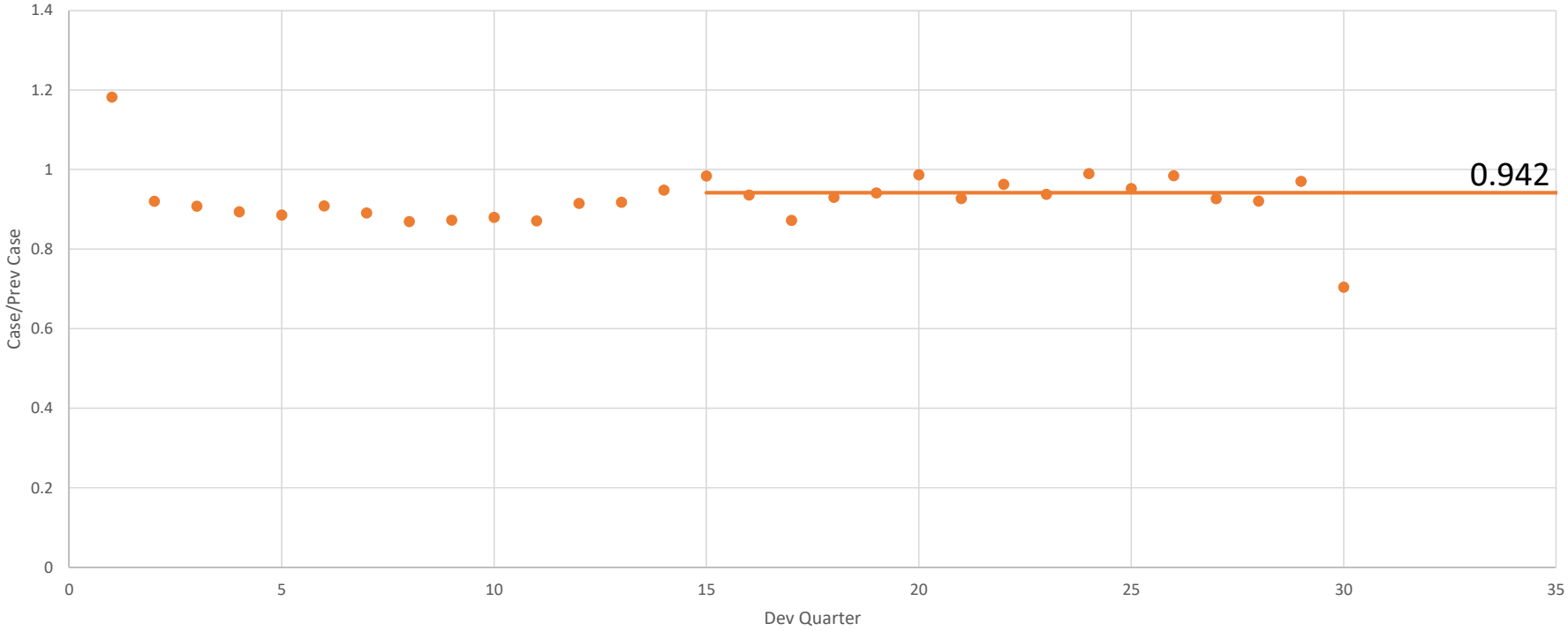
35
Dev Quarter

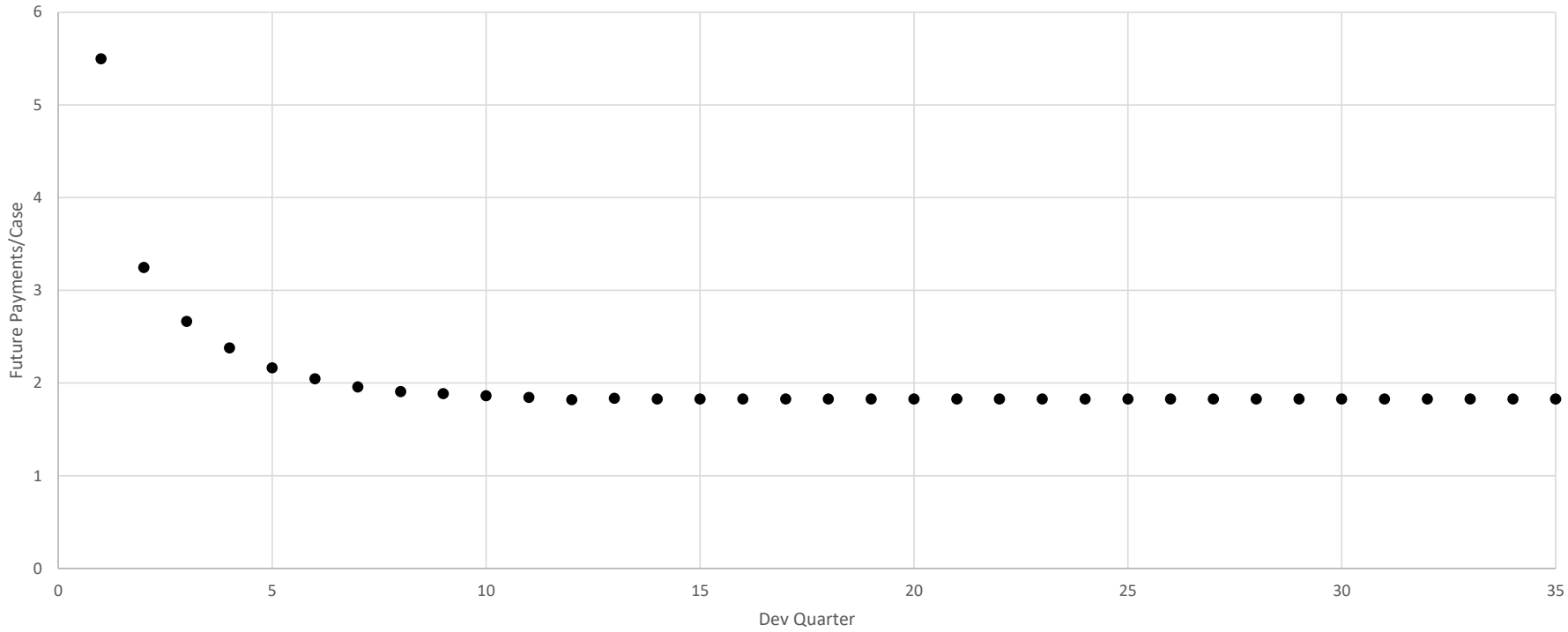

1.4
1.2
1
0.8
0.6
0.4
0.2
0
Case/Prev Case
0
5
10
15
20
25
30
35
Dev Quarter
0.942

Stationary Case Settlement (Tail development)

- Incremental paid/ previous case of 0.106
- case/ previous case of 0.942
- Translates to future paid/ current case = 0.106/(1 – 0.942) = 1.828

The backwards recursive formula

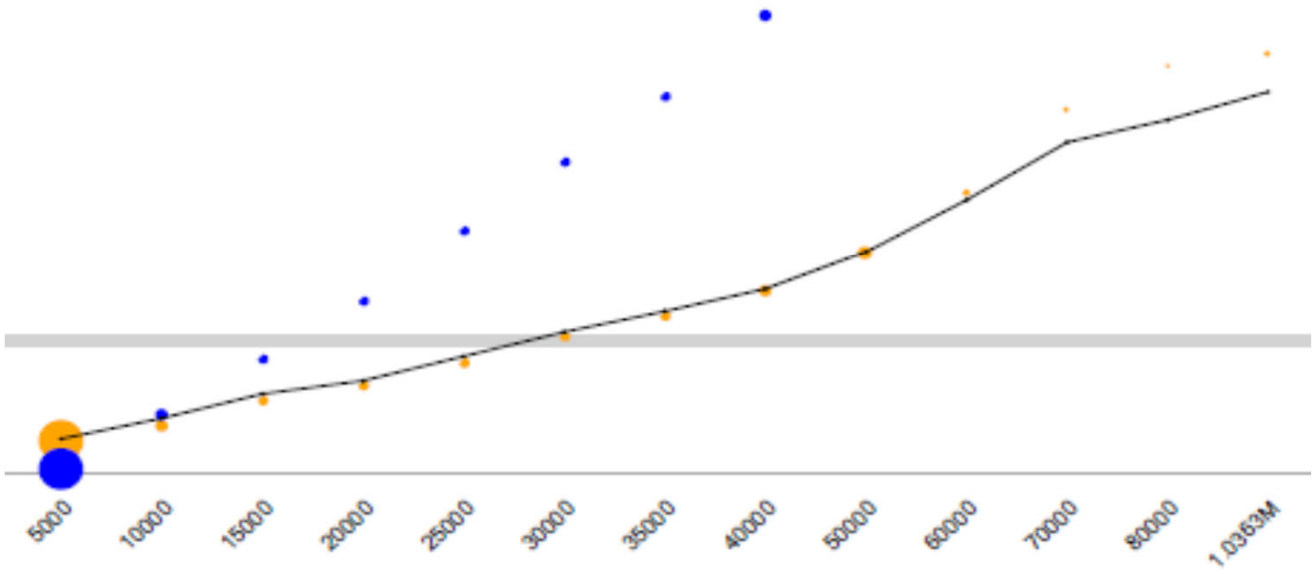
$$\text{CaseToUltFactor}_{age} = \text{PaidToCaseFactor}_{age} + \text{CaseToCaseFactor}_{age} * \text{CaseToUltFactor}_{age+1}$$


Future Payments/Case
Dev Quarter
0
1
2
3
4
5
6
0
5
10
15
20
25
30
35

A good path to get started

- Organize data into report quarter triangle
- Calculate backwards-recursive factors
- Apply to current case reserves as a starting point
- Build the case algorithm (predictive model)
  - target future payments as of historical evaluations (including the adjusted case reserves as of now)
- Apply historically to triangle (can be accident period)
- Develop as usual

Indemnity Case Reserves Factor

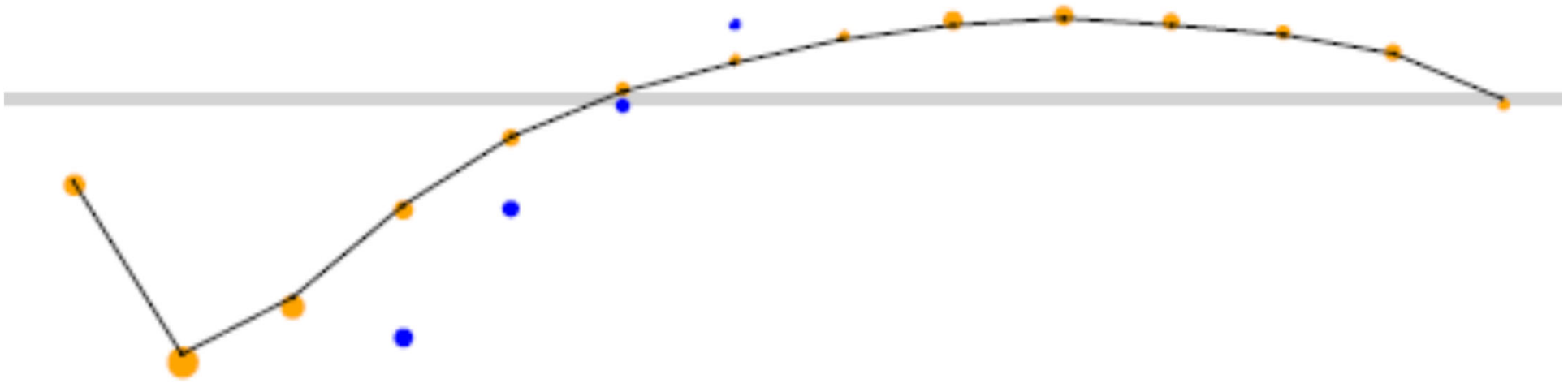


Most recent year’s indemnity payments

Indemnity Case Reserves Factor

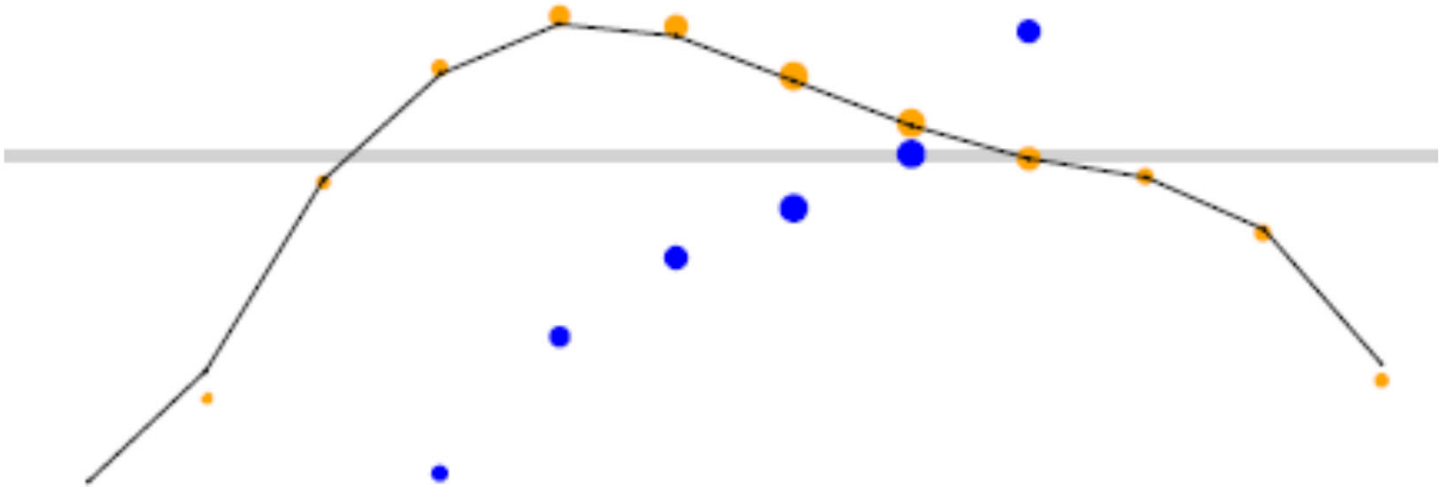
Claim Status

Indemnity Case Reserves Factor



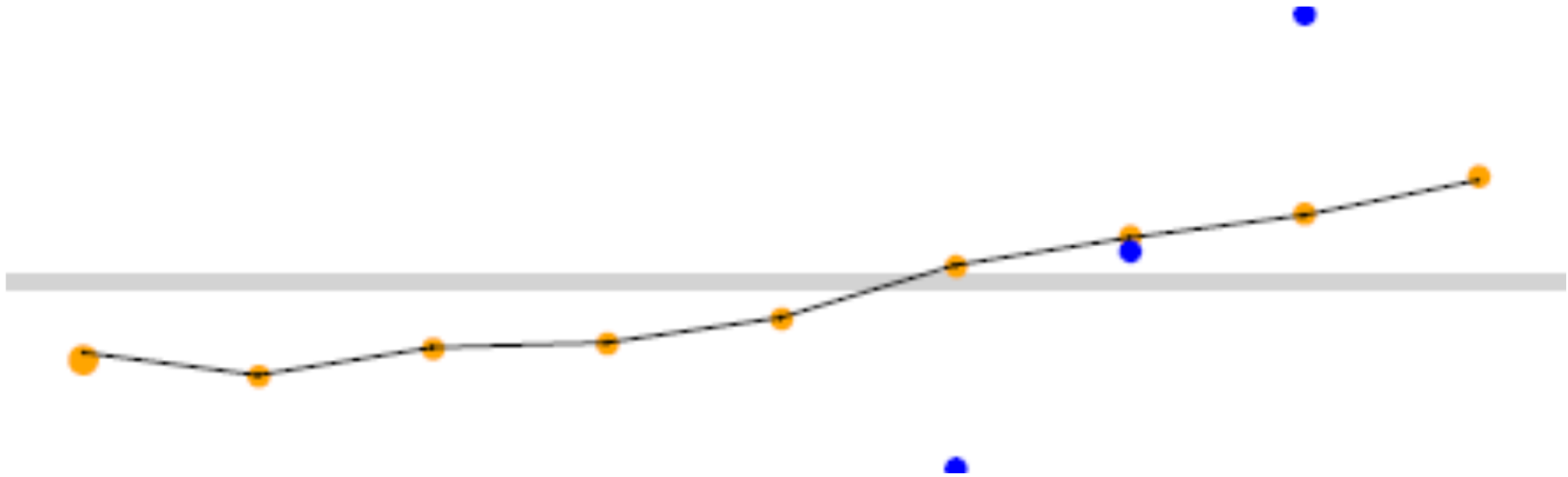
Years since injury

Indemnity Case Reserves Factor



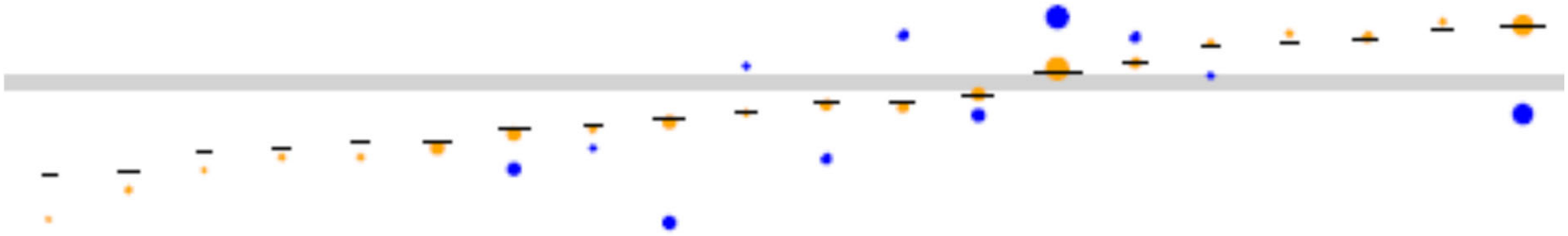
Years since birth

Indemnity Case Reserves Factor

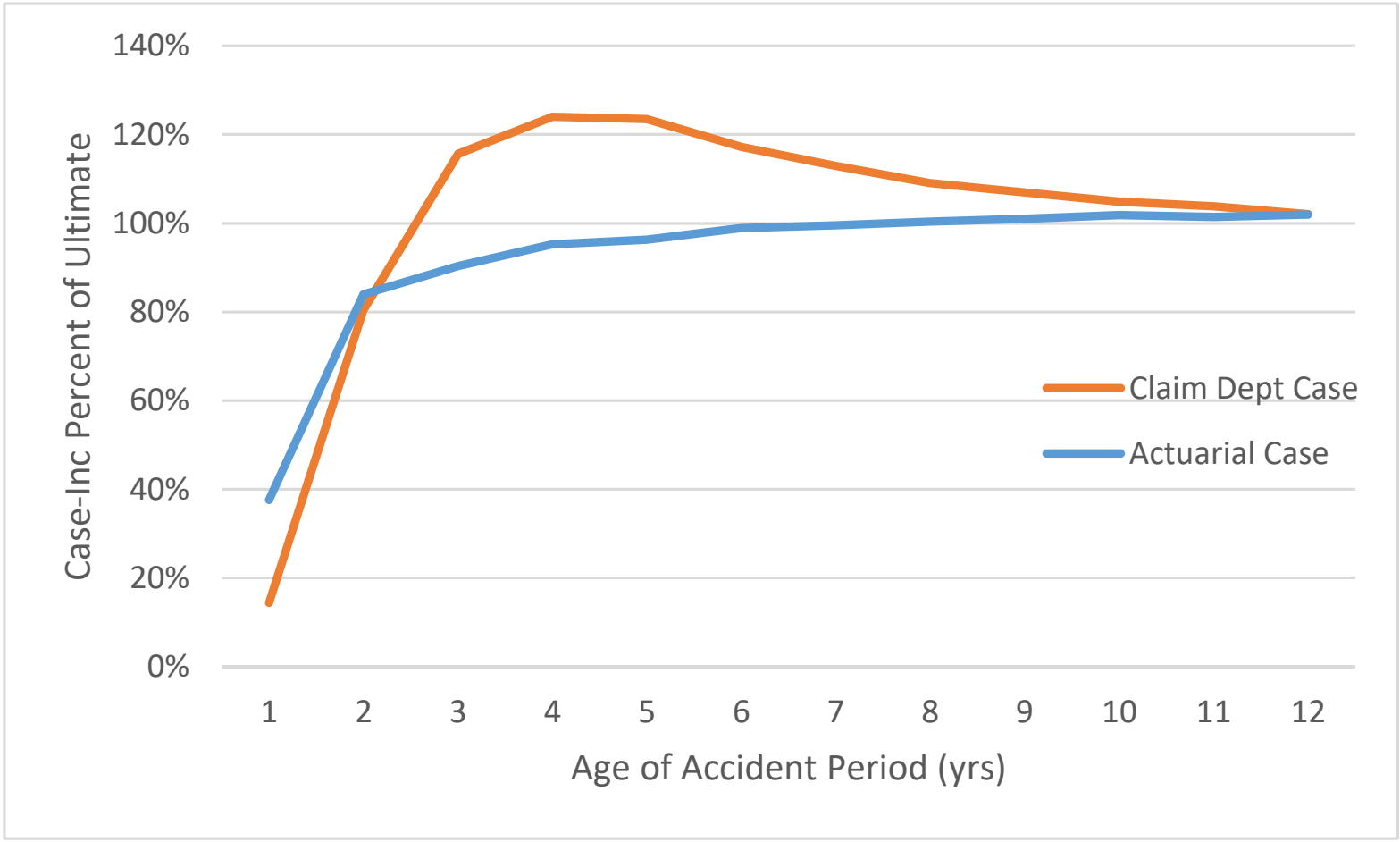


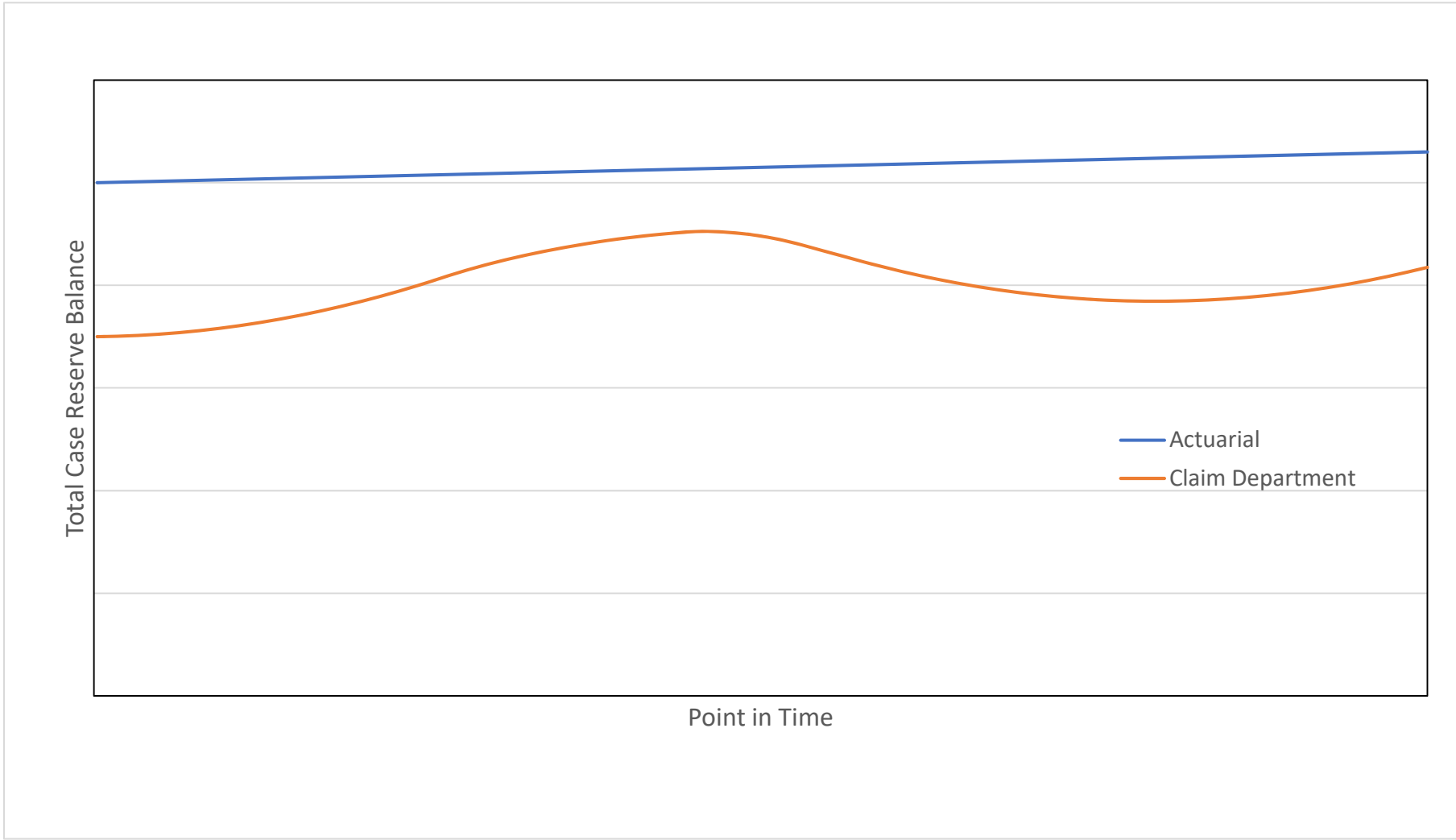
Most recent year’s medical payments

Indemnity Case Reserves Factor



State


140%
120%
100%
80%
60%
40%
20%
0%
Case-Inc Percent of Ultimate
1
2
3
4
5
6
7
8
9
10
11
12
Age of Accident Period (yrs)
Claim Dept Case
Actuarial Case


Total Case Reserve Balance
Point in Time
Actuarial
Claim Department

Complications

- Inability to apply algorithm to all historical claims
  - Adjust case reserves instead of building triangle directly
- Date of case reserve valuation date as a variable
  - Potentially important to reflect trend
  - Potentially at odds with goal of being consistently applied
  - Potential proxy for development age
  - Use with care (i.e. actuarial judgment)
- Dynamic Variables
  - Make sure to capture “as-of” value

Updates

- No need to go through the whole predictive modeling process each reserve analysis
- Simply re-apply the algorithm
- Revisit the algorithm less frequently or as new variables present themselves
- Not unusual to end up with different level of adequacy after adjustment, despite goal of 100%
  - With consistent application across triangle development factors should adjust

Summary

- Significant economic and analytical advantages to using separate case reserves for the actuary and for the claim department
- Building and actuarial case algorithm, using predictive modeling, claim and exposure characteristics at the claim level, and targeting 100% adequacy, can improve the quality of our estimates – not just for reserving but for pricing as well.
- In addition to the value of having the resulting algorithm, tremendous insight can be gained in the very process of building it.