

Predictive Modeling in Reserving

Predictive Modeling with Claim Analytics
CLRS Presentation ST-3
Chris Gross



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Predictive Modeling in Reserve Analysis

- It's all predictive modeling isn't it?
- This discussion refers to the what is commonly termed 'predictive modeling'- multivariate models, statistical rigor, etc.
- Emphasis in the past on pricing
- Reserving getting attention



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Ways to Incorporate Predictive Modeling Into Reserve Analysis

- Analysis of specific loss development data/processes, for example:
 - Case reserve adequacy
 - Closure rates
- Modification of triangles
- Reserve segmentation
- Full description of the entire process, with resulting estimate of reserves



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Why do it?

- Use more of the information contained in your data
- Improve predictive accuracy
- Quicker recognition of changing environment
- Better reserve allocations
- Layering of losses
- Improved operational or strategic business decisions



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Challenges

- Same as with P&C reserving in general
 - 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)



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A Fairly Simple Example

- Loss development on reported claims
- Ignore for now questions of emergence
- Also ignore re-opened claims, salvage and subrogation.
- Individual claim detail for 20 calendar quarters
- Only need data on claims that were open at the beginning of each quarter



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Data

<p>Financial Data</p> <ul style="list-style-type: none"> Beginning Case Reserve Ending Case Reserve Payment in Period <p>Timing Data</p> <ul style="list-style-type: none"> Accident Quarter Report Quarter Valuation Quarter 	<p>Exposure Characteristics</p> <ul style="list-style-type: none"> Type Product ZIP Code <p>Claim Characteristics</p> <ul style="list-style-type: none"> Loss Cause Loss Cause - Detail
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Claim activity from the beginning of the quarter to the end of the quarter

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graph TD
    A[Did the Claim Close?] --> B[Does the Claim Have a New Value?]
    A --> C[Is there a Payment?]
    A --> D[How much is the Payment?]
    B --> E[What is the New Value?]
    C --> D
    E --> D
  
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Arrows indicate dependency on other results

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

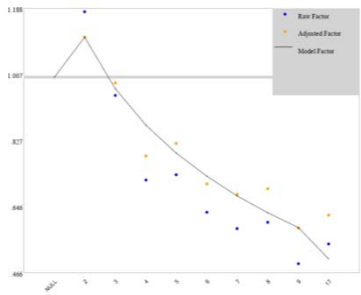
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Probability of a Claim Closing

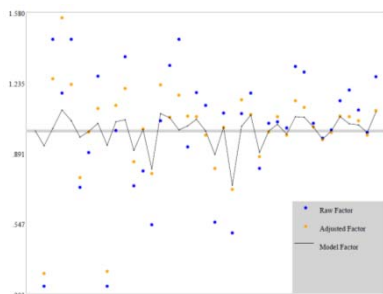
- Base probability of 71%
- Modification of this probability by various claim characteristic values that were found to have predictive value

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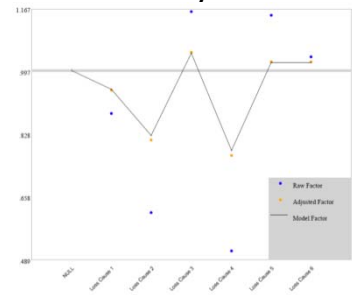
Close Probability – Claim Age



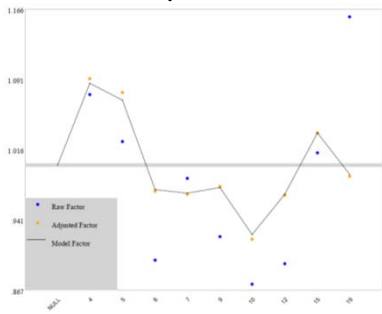
Close Probability – Loss Cause (detailed)



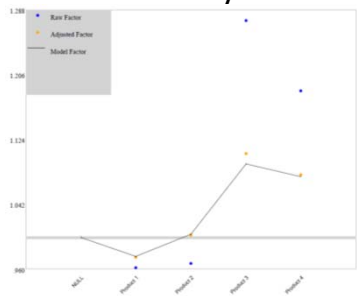
Close Probability – Loss Cause



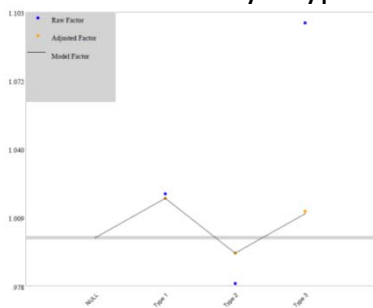
Close Probability – Accident Quarter



Close Probability - Product

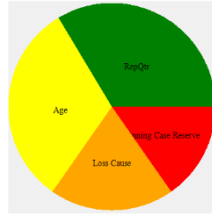


Close Probability - Type

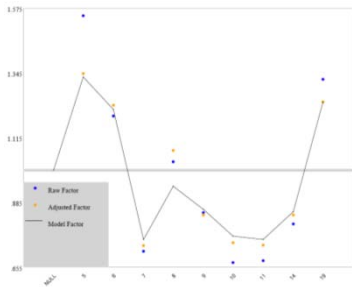


Probability of Change in Value (Given Not Closed)

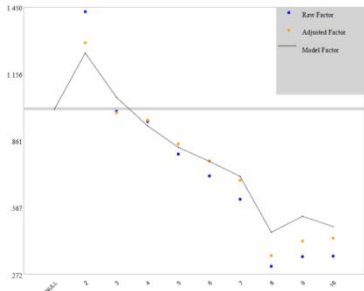
- Base probability of 37%
- 4 characteristics found to be predictive



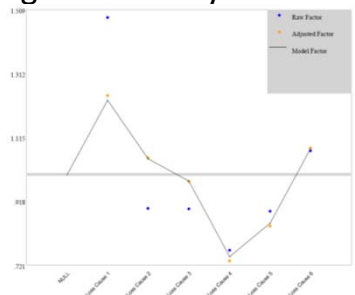
Change Probability – Reported Quarter



Change Probability – Claim Age



Change Probability – Loss Cause

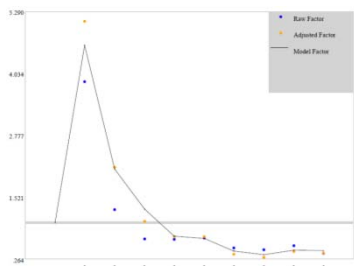


New Claim Value (Given Changed but Not Closed)

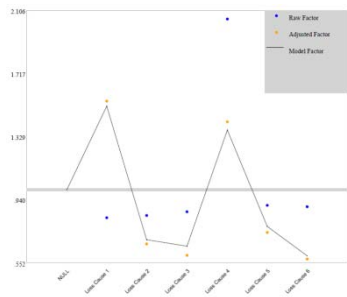
- Base factor of 1.98 to beginning case reserve
- Modification to this linear relationship, as well as five additional predictive characteristics



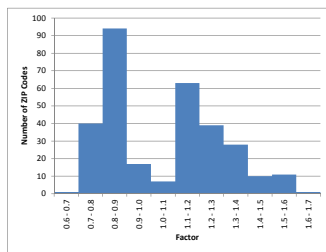
New Claim Value - Case Reserve



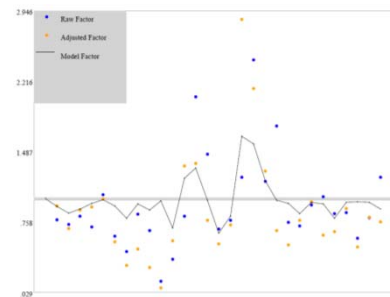
New Claim Value – Loss Cause



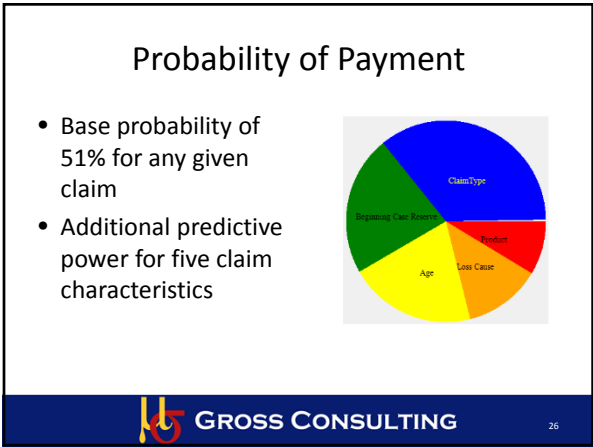
New Claim Value – ZIP Code

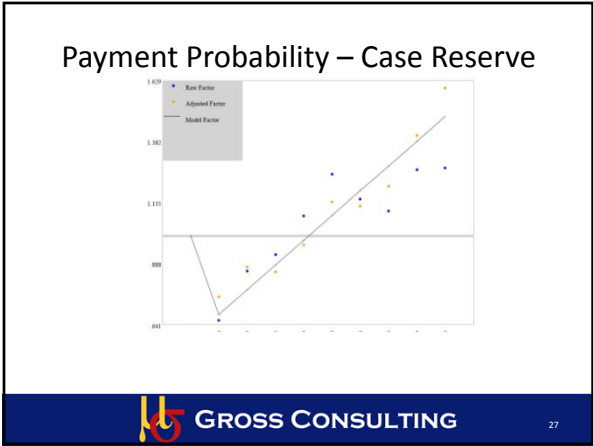


New Claim Value- Loss Cause (Detail)

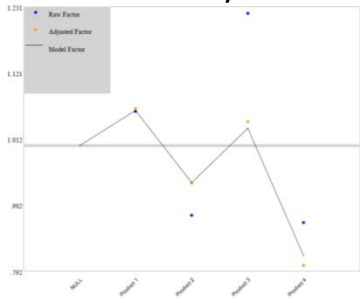






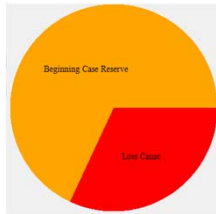


Payment Probability – Product

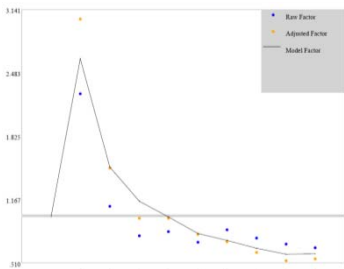


Paid on a Claim Closed (Given Payment Occurs)

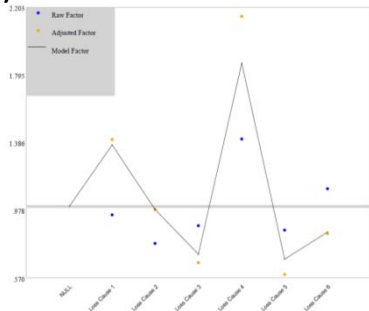
- Basic assumption of linearity with Case Reserves – base factor of 1.23
- Beyond that assumption, case reserve level and summarized cause of loss found to have predictive power



Payment Amount – Case Reserve



Payment Amount – Loss Cause

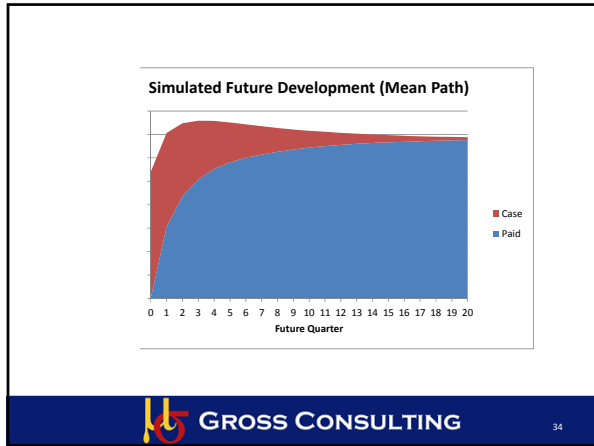


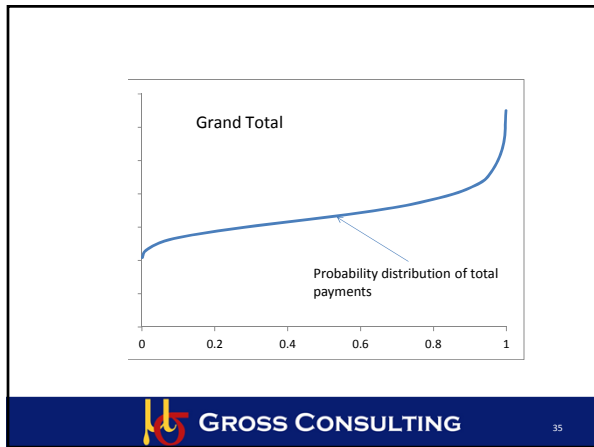
Fraction Paid on an Open Claim (Given Payment occurs)

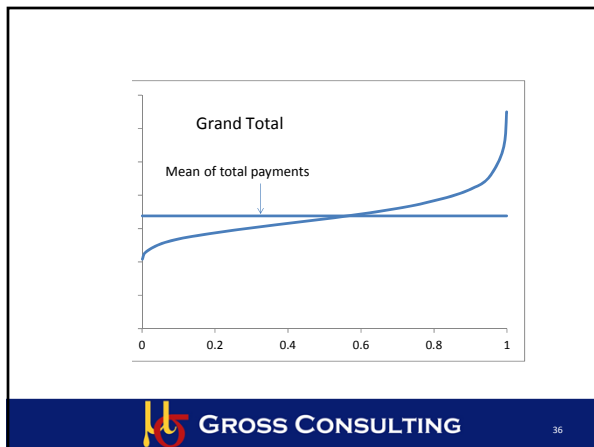
- Base factor to new value (or previous if unchanged) of 56%
- None of the variables were found to add predictive value

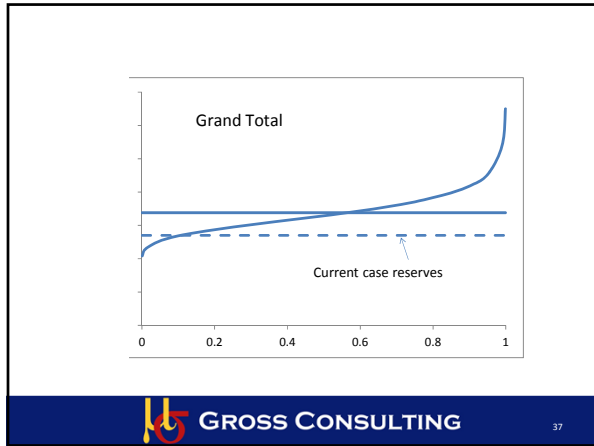
Bringing it together

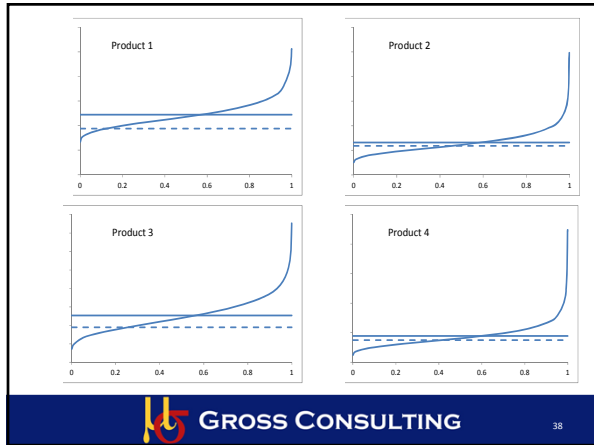
- Simulation can be used to project activity in the next quarter
- It is necessary to project not only the predictive relationships, but also the residual error term.
- Chain through quarters using information from the previous simulated quarter.
- Store results, preferably at the claim level.

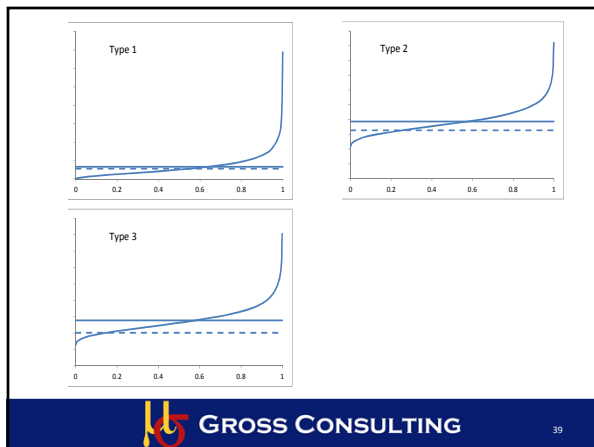


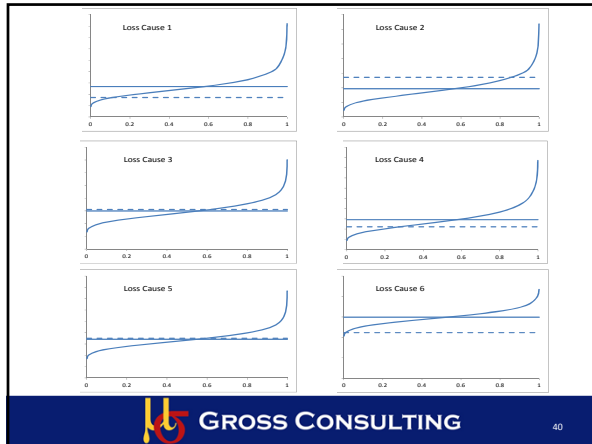












Discussion of Additional Complexity

- Relationship between Loss and ALAE
- Emergence
 - Added problem of unknown claim characteristics
 - Simulation approach driven by need for detail (ex. path is important, or only ultimate)
 - Valuable link to pricing
- Re-opened claims
- Changing claim characteristics
- Salvage & Subrogation

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Uses of Methods

- Opinion of reserve and uncertainty including interim projections and their uncertainty
- Investigating questions from a traditional triangle analysis
- Indicating potential problems with a triangle analysis
- More focused discussion with claim department
- More sophisticated allocation of reserves

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