Marrying Underwriter Intuition & Predictive Modeling - A Workers' Compensation Perspective

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Underwriting with Predictive Modeling

- Intuition versus Empiricism
- Art versus Math
- Collaboration

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Why Use Predictive Analytics?

Not Using Predictive Analytics for Pricing

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Fundamental Questions

- What is the underwriter's fundamental mission?
- What are the fundamental decisions an underwriter makes to accomplish the mission?
- What explicit or implicit predictions do underwriters make when making a decision?

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Pricing Risk

- Workers Compensation
  - Company placement ← Rules
  - Rating plan for a company ← Formula
  - Experience-based modifications ← Formula
    - Experience-mod
    - Retrospective-rating
    - Merit rating
  - Schedule rating ← Judgment
    - (or dividend plans)

- Key Question: Why would an underwriter schedule debit/credit a policy?

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How Accurate?

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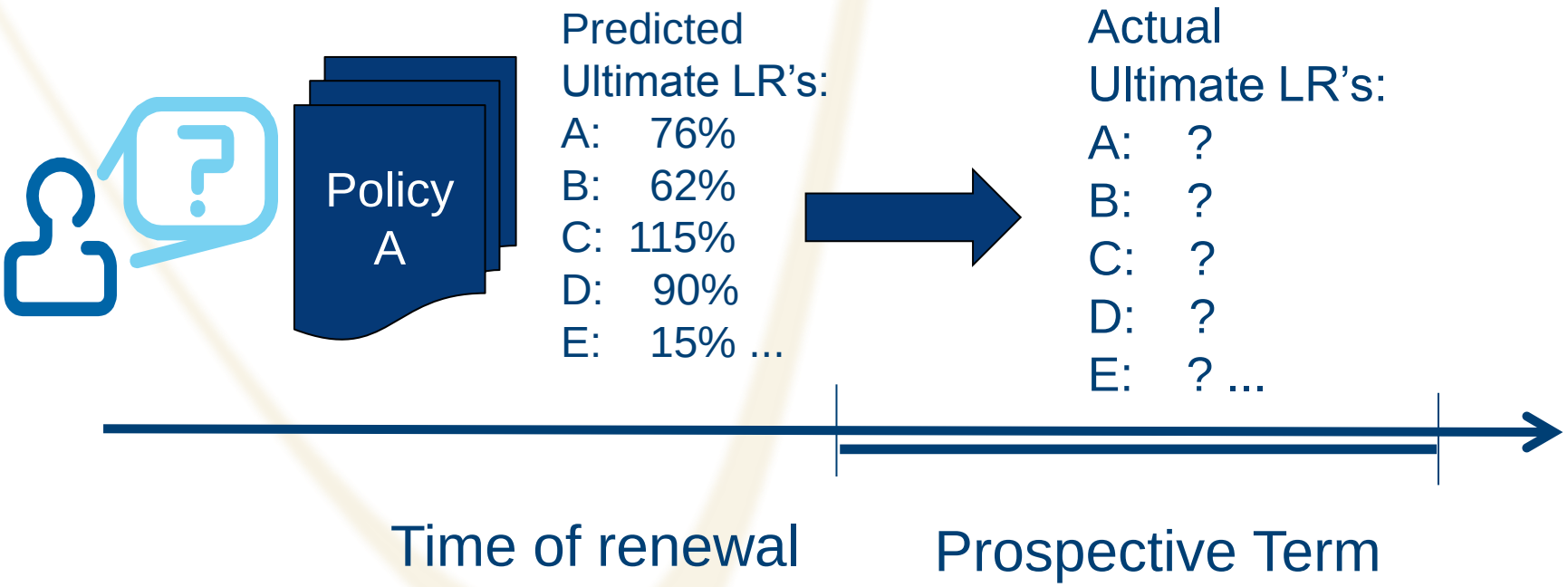
Prediction Accuracy: How Accurate is Accurate?

- Suppose you asked each member of your underwriting staff to make an explicit, numerical prediction of the ultimate loss ratio each policy will experience in the prospective term. How accurate would the predictions be?



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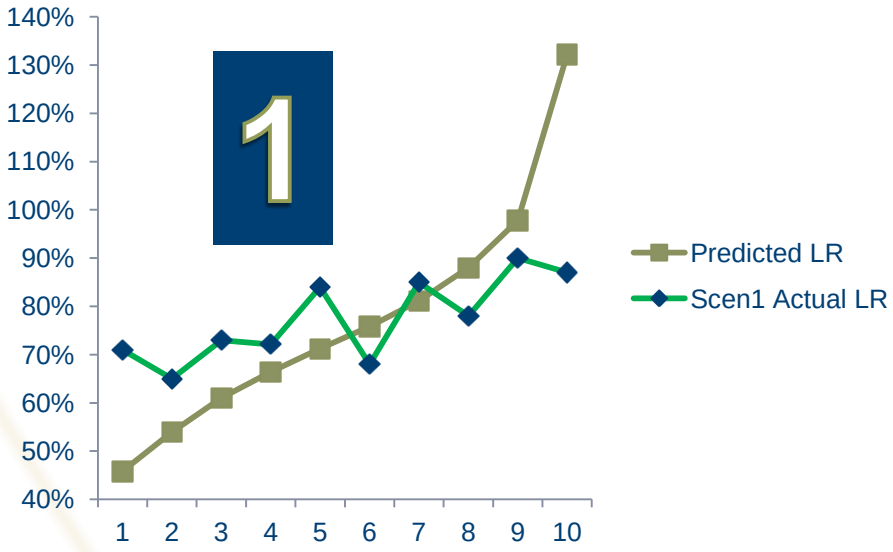
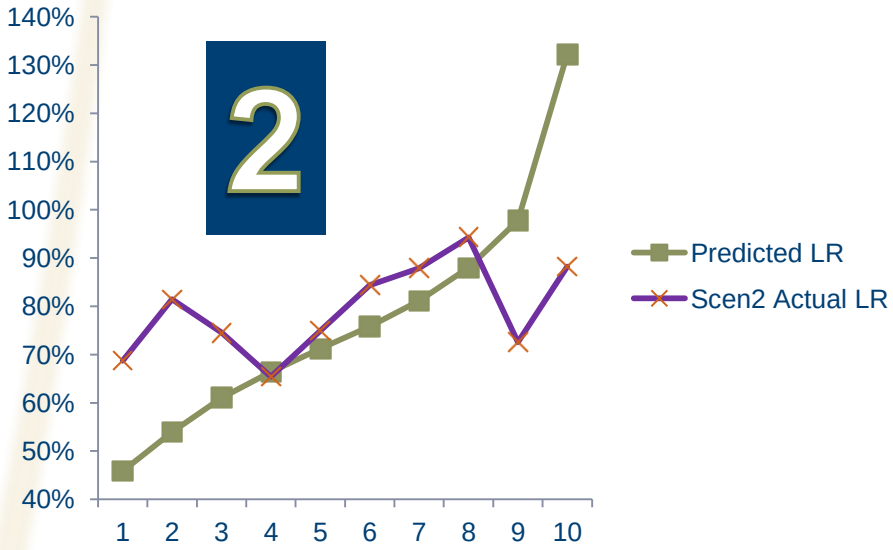
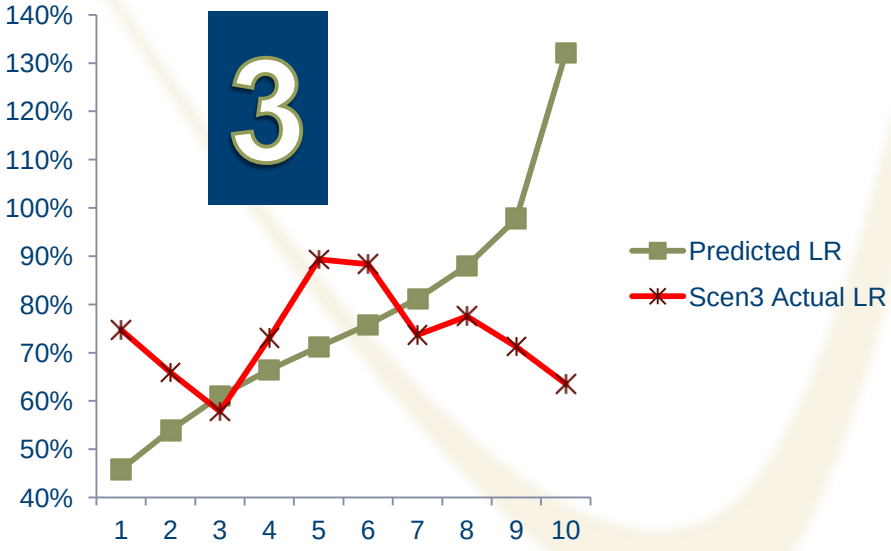
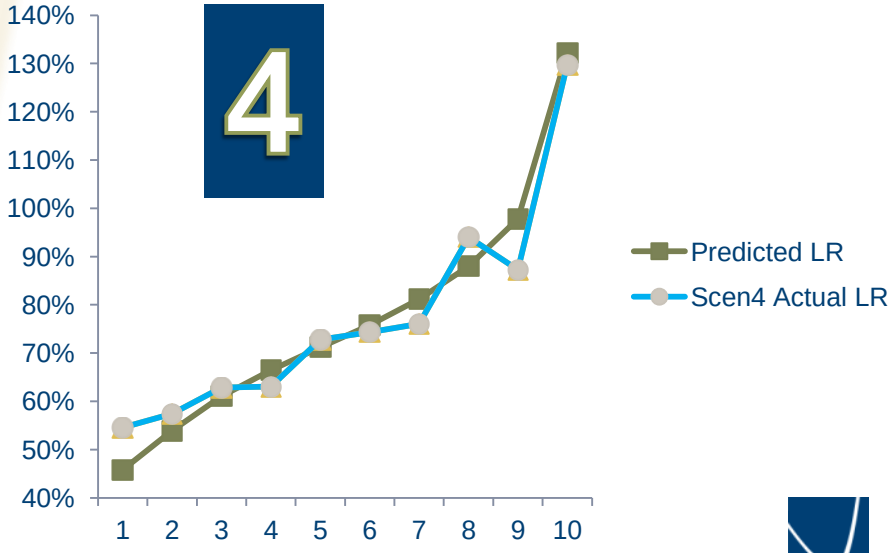
Actual LR results for 10 UW-predicted stacks









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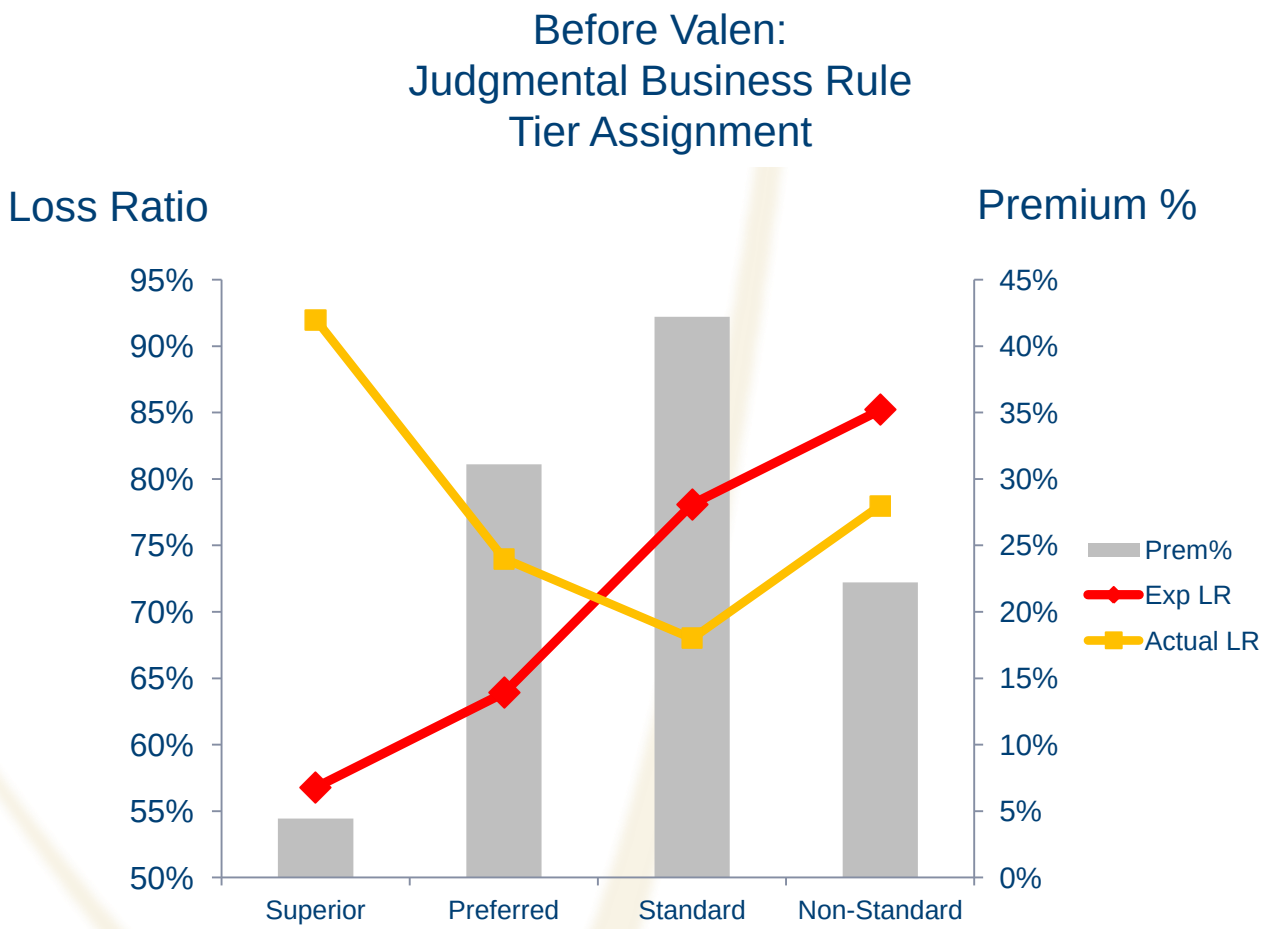
A Valen WC client, before Valen



Actual Loss ratio outcomes were far from rule-based predictions

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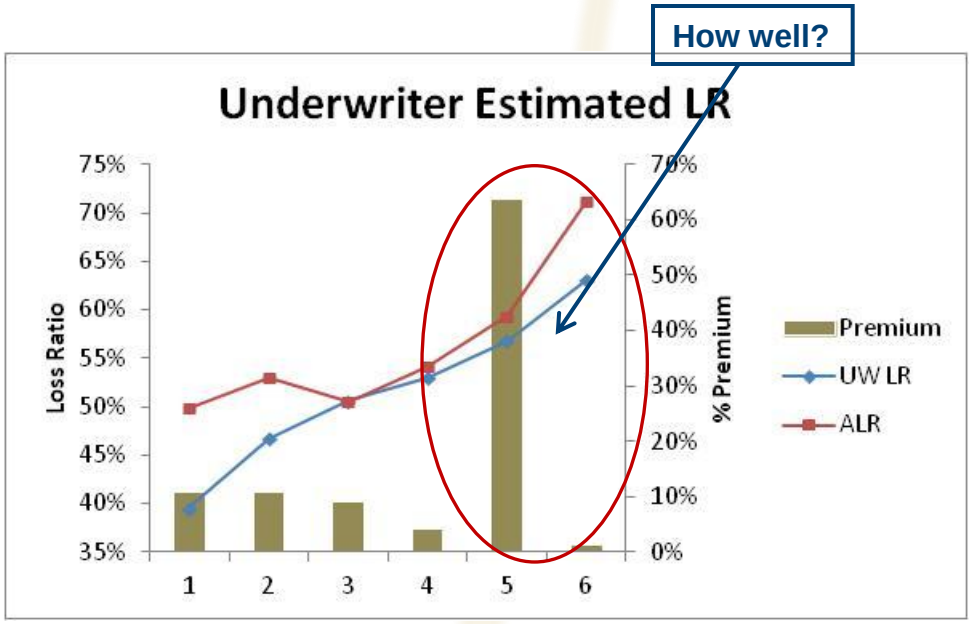
Underwriter Versus Model Results



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Underwriter Versus Model Results

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What Happened?

- Were company goals at play?
- Is this the result of the volume/profit tradeoff?
- Was the competitive marketplace a consideration?
- Could something else be at play?

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Decisions Under Uncertainty

"Economic research often assumes that people are motivated primarily by material incentives and make decisions in a rational way."

www.nobelprize.org

"But how do we know when irrational exuberance has unduly escalated asset values, which then become subject to unexpected and prolonged contractions…?"

Alan Greenspan

Are decisions performed in a rational way?

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Kahneman Conclusion

"Kahneman has shown that people are incapable of fully analyzing complex decision situations when the future consequences are uncertain. Under such circumstances, they rely instead on heuristic shortcuts or rules of thumb."

www.nobelprize.org

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Cognitive Studies

Comparing statistical models to human judgment alone

- Hastie and Dawes compiled hundreds of studies ranging from medical diagnosis to highway safety, financial stock values to live-stock quality. (Cooksey, 1996)
- Some findings of note:
  - Statistical models generally outperform “experts” often by great degrees
  - Experts are often good at selecting variables that are predictive, but are generally poor at weighting the variables, particularly when there are more than a very few
  - Few judgments exhibit non-linearity (though the experts describe their own process as often non-linear)
  - When seemingly pertinent, but in truth, irrelevant additional information is provided to judges, they become more confident in the accuracy of their judgments, although the true accuracy does not increase and often decreases

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Reference - Cognitive Errors

- 108 Types
  - Decision-making and behavioral biases
  - Biases in probability and belief
  - Social biases
  - Memory errors

- Examples
  - Clustering illusion
  - Selection bias
  - Confirmation bias
  - Deformation professionnelle
  - Texas Sharpshooter Fallacy
  - Base rate fallacy

Source – Wikipedia

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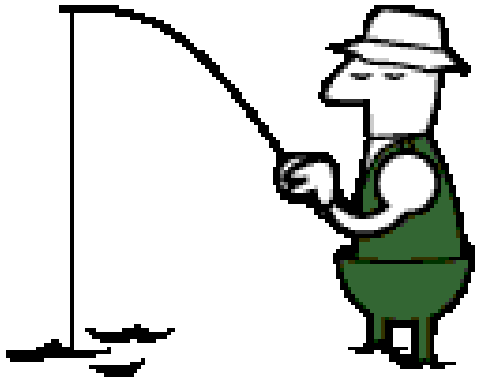
Common Modeling Pitfalls

- Over working the data
- Over fitting the model
- The fishing expedition



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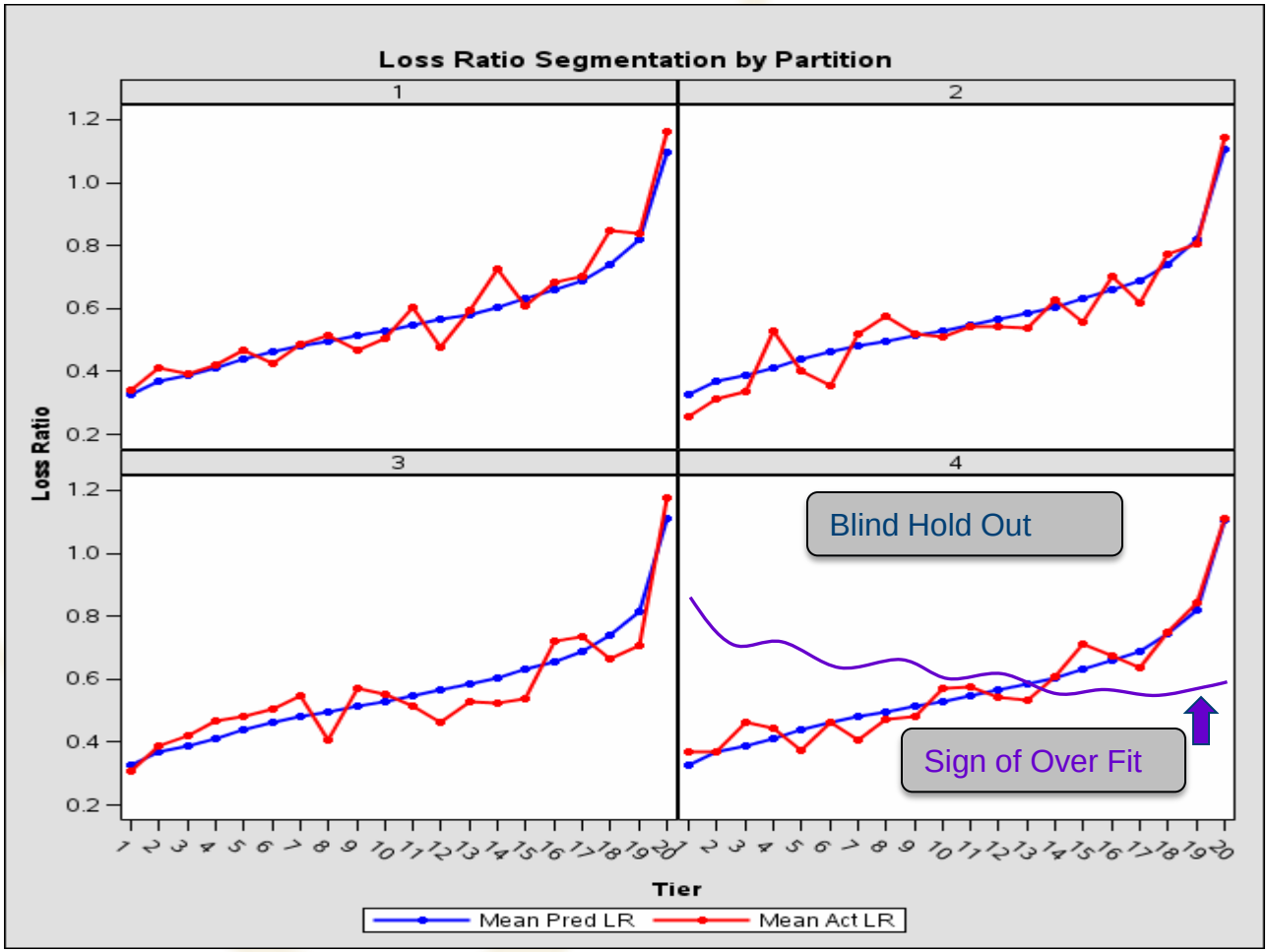
Validation

- Consistency across data partitions



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Workers' Comp Modeling Challenge

- Complexity
  - Risk heterogeneity
  - State to state differences
  - Size of risk
  - Claim types
  - Mix of Business
  - Number of classes
  - Diverse industry groups
  - Long tail lines of business
  - Inflation sensitive exposure base
  - Data volume

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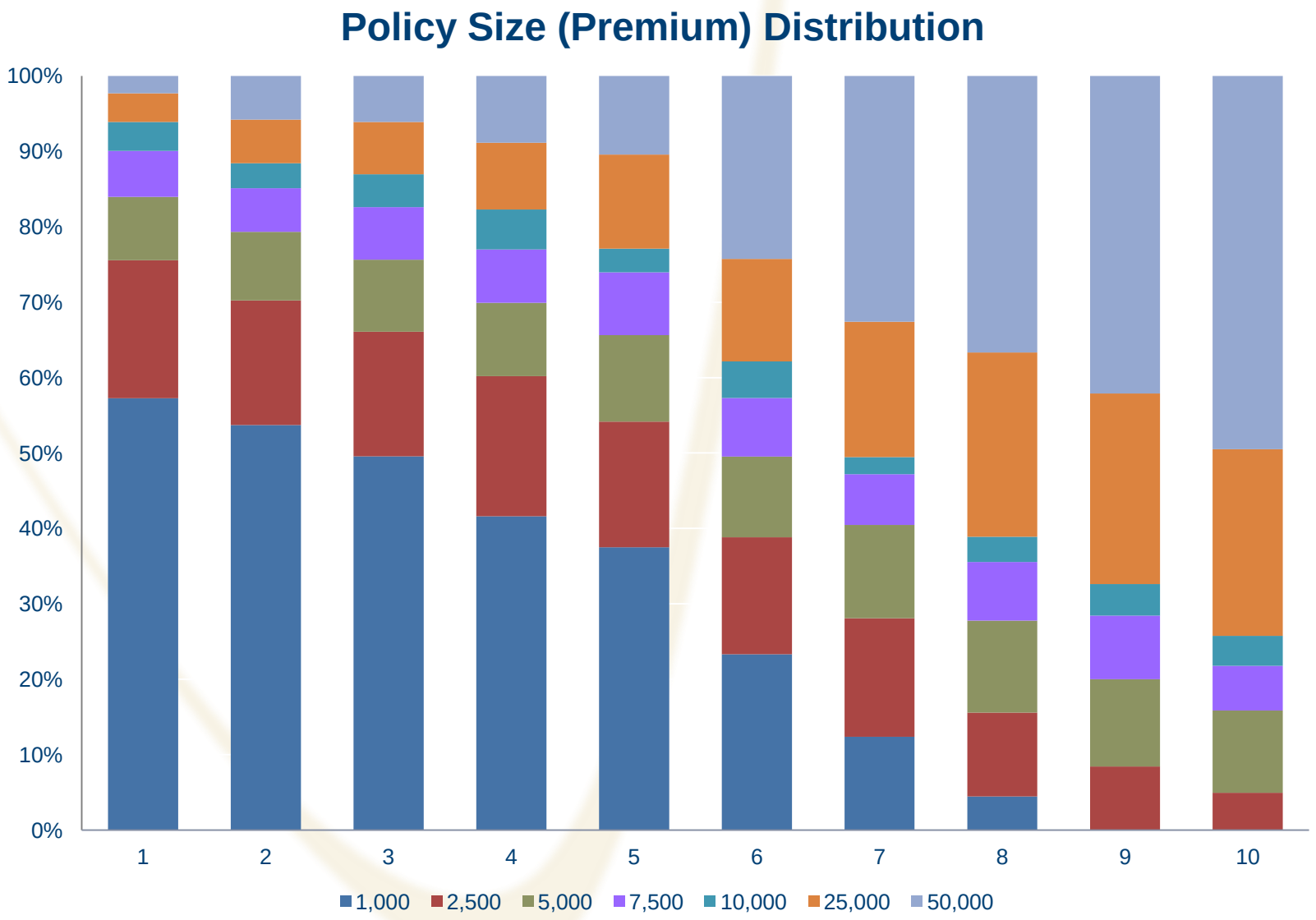
Policy Size Bias



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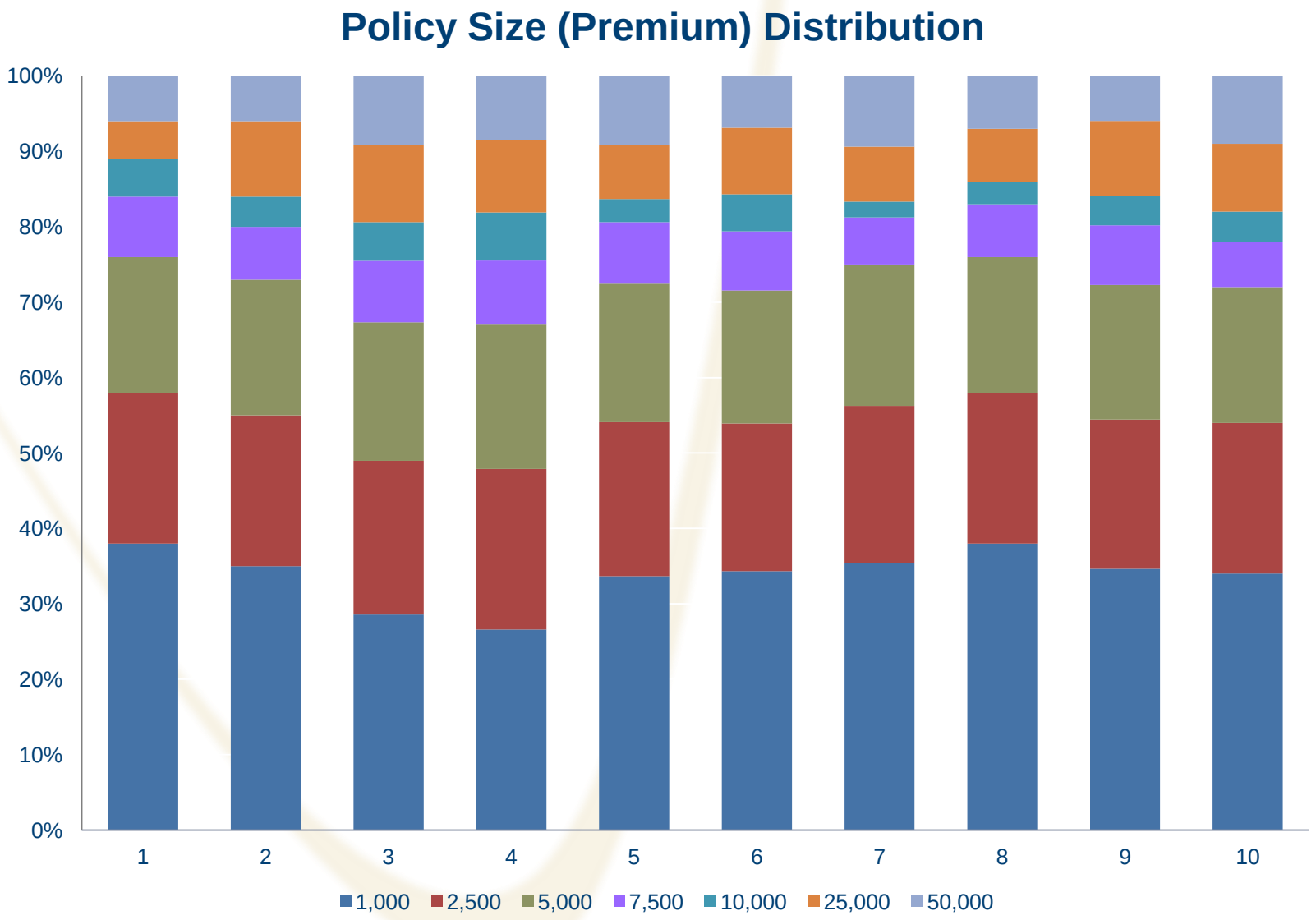
Uniform Distribution - Policy Size



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Challenges

Project:

- Identifying the business goal and formulating a modeling solution that addresses it
- Developing a Project Plan
- Data
- Modeling
- Translating the model properly into business usage
- Work-flow integration and software/production system implementation
- Monitoring

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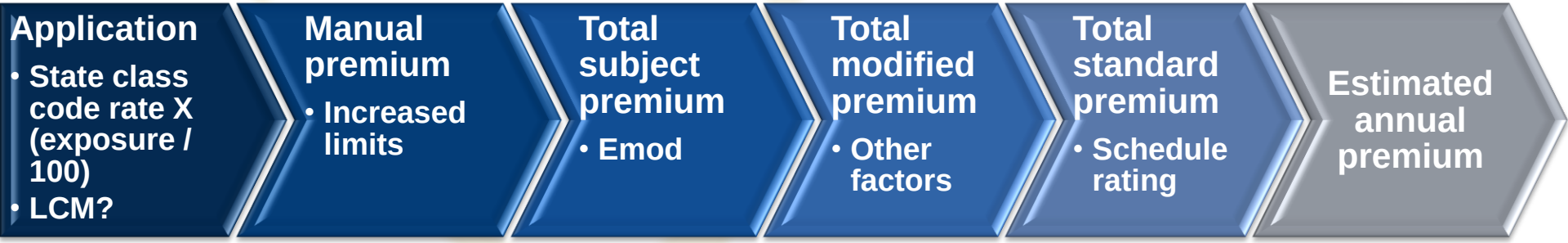
Work Flow Challenges

- Where will the scoring engine live?
- At what point during the logical process will the model be used? To make a risk judgement?
- What data is available at time of scoring?
- What are the underwriters going to do before and after they render the outputs?
  - What judgments have they already made?
  - What judgments will they make post scoring?
- How does the workflow constrain the data or the scoring parameters?



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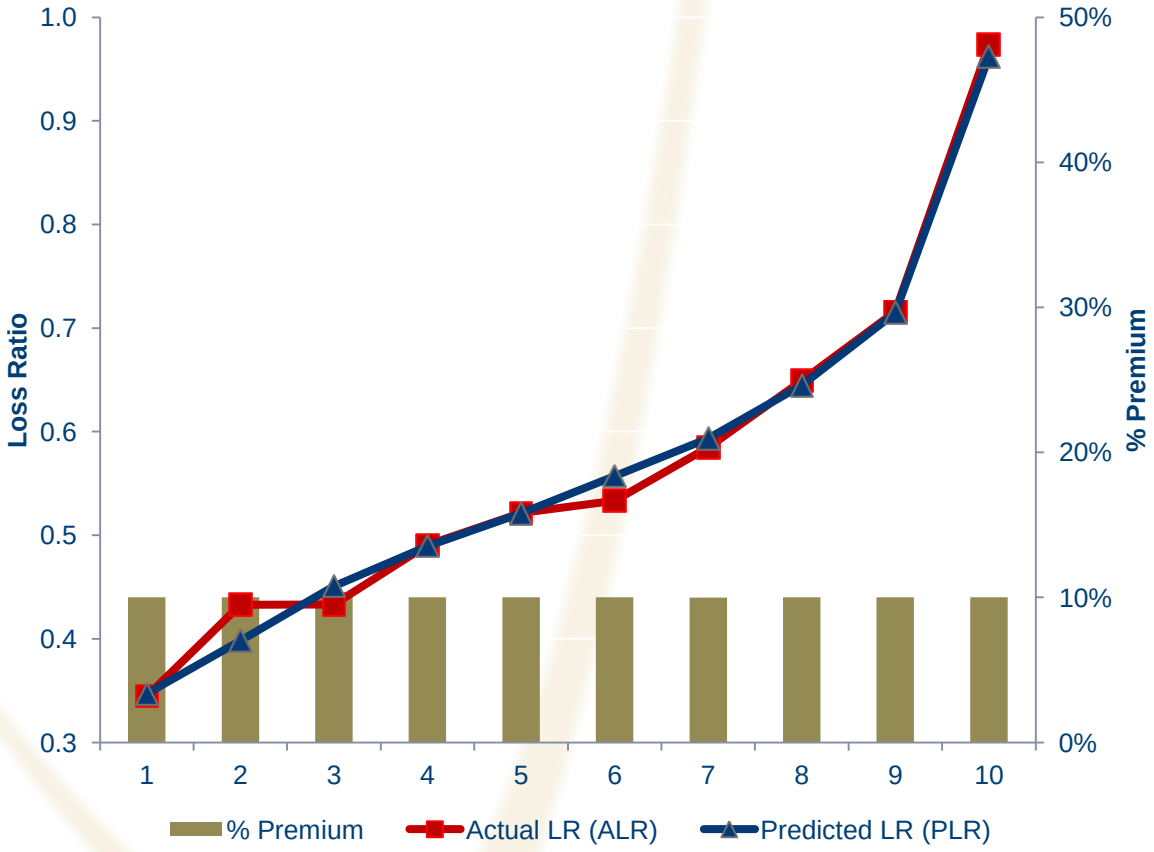
Can statistical models improve UW decisions?

- Results shown are the actual LR outcomes on a separate, blind sample of scored polices



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Thank You!

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