



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

CASE Spring 2010
Boca Raton, FL

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Agenda

- A Short Story
- Predictive Analytics and Underwriting

A Short Story

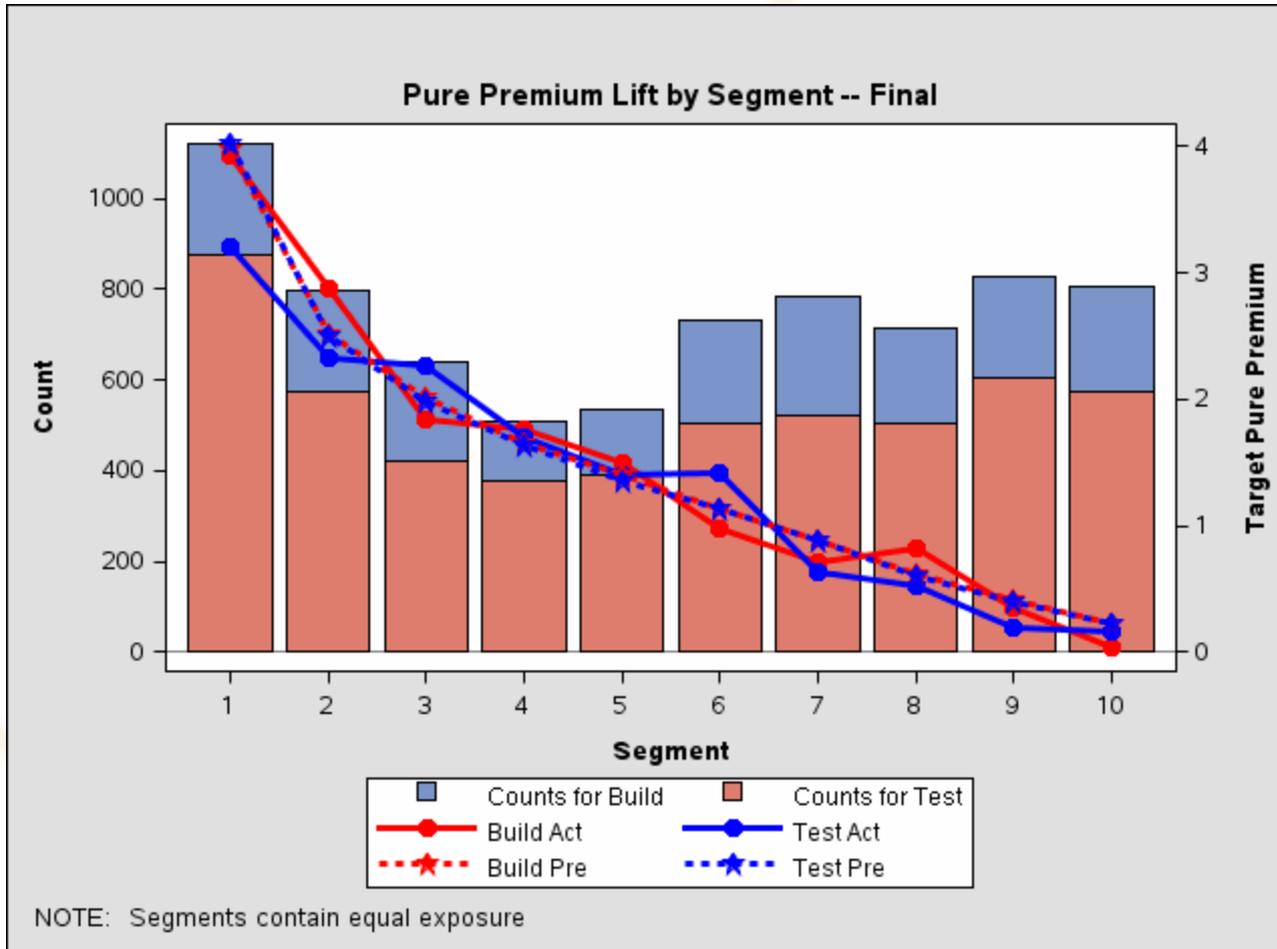
After Several Weeks of Analysis...

*the Predictive Modeler and
the Underwriter*

Meet...



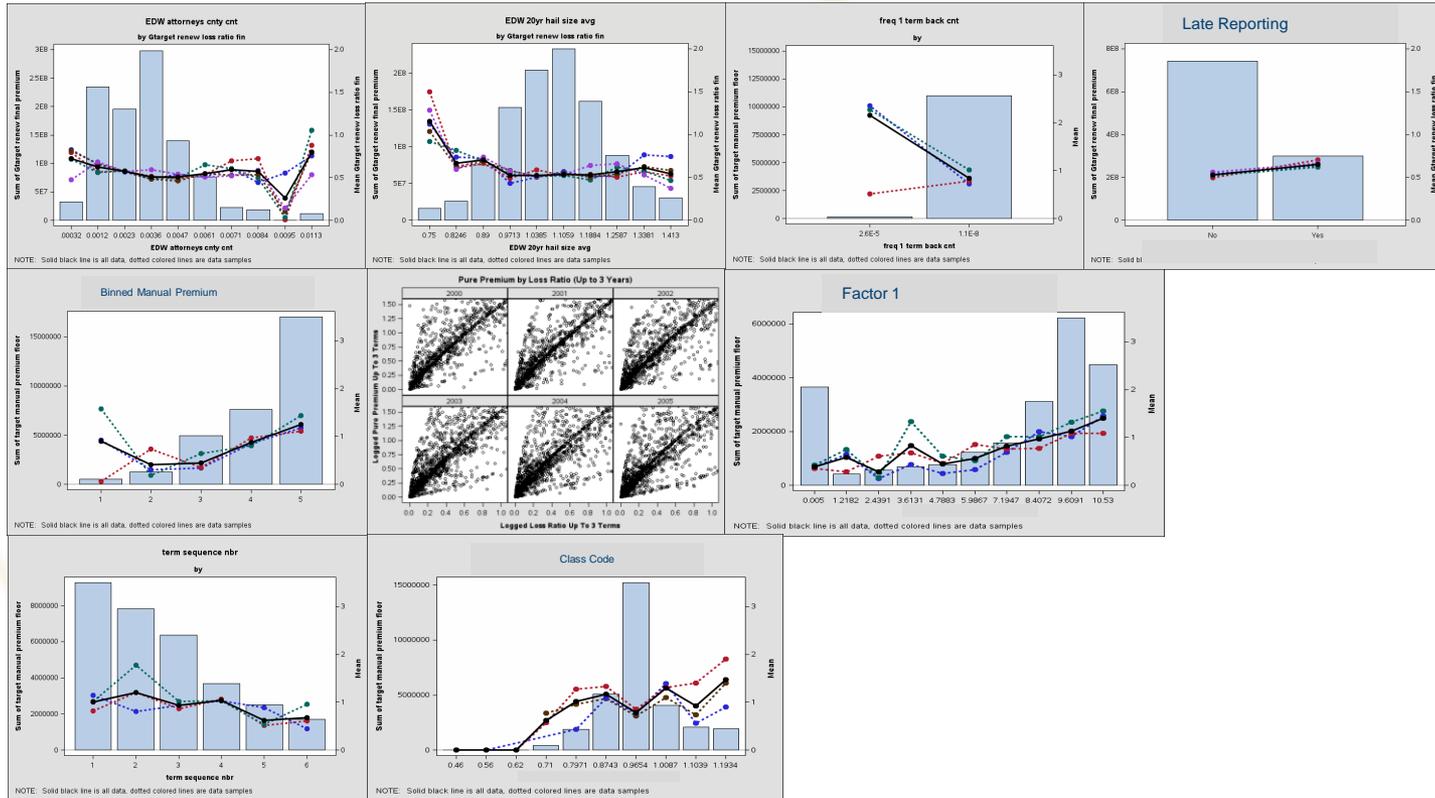
Initial Candidate Model



Risk Factors

- ❑ Attorney count by county
- ❑ Average hail size by county
- ❑ Late reporting >30 days
- ❑ Claim Frequency – prior year
- ❑ Synthetic factor – 3 prior term LR & PP
- ❑ Term sequence
- ❑ Binned Manual Premium
- ❑ Natural log (Class code/176 + 11,237)...(?!)

Risk Factor Results



Several Problems

- ❑ Incorrect or poorly defined target
- ❑ Premium issues
- ❑ Exposure issues
- ❑ Unexplainable risk factors
- ❑ Risk factors not available in production
- ❑ Inappropriate sample
 - Pool business
 - Hog confinement program
 - Large loss deductibles
- ❑ Underwriter's not involved
- ❑ ...

Several Months Later

The underwriting department, the actuarial department and the predictive modelers get on the same page



Can the process be improved?

The end...

Or

Is it?...



Why Use Predictive Analytics?

Not Using Predictive Analytics for Pricing



The Stage

- ❑ Intuition versus Empiricism
- ❑ Art versus Math
- ❑ Underwriting versus Predictive Modeling/Actuarial
- ❑ Collaboration



Perspectives

Target

Predictive
Modeler

Data

Sample design

Exploratory data analysis

Statistical method(s)

Validation

Refinements accuracy

Mathematical accuracy

Workflow

Underwriter

Acceptability

Ease of doing business

Agency system impact

Customer retention

Regulatory issues

Market Considerations

Implementation

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?

The Modeling Objective

Design, build, implement, monitor and refresh a predictive model that solves a specific underwriting objective.

Pricing Risk

Workers Compensation

- Company placement
- Rating plan for a company
- Experience-based modifications
 - Experience-mod
 - Retrospective-rating
 - Merit rating
- Schedule rating
 - (or dividend plans)

← Rules

← Formula

← Formula

← Judgment

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

How Accurate?



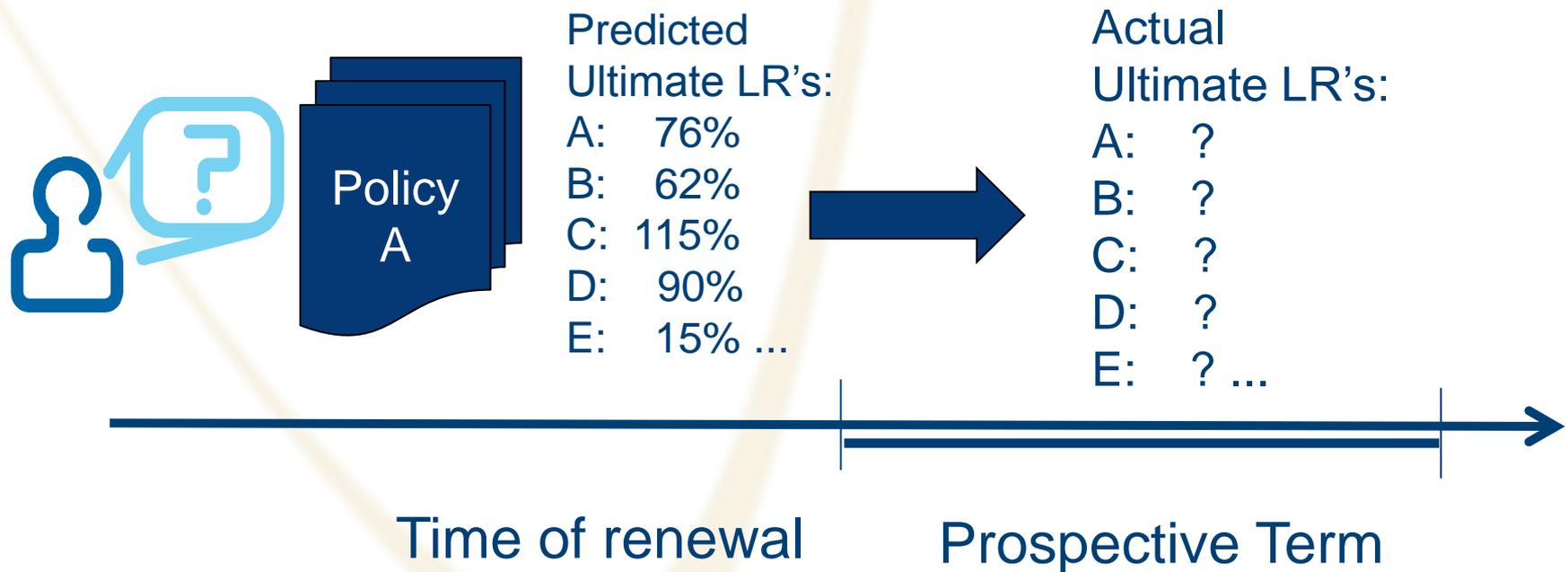
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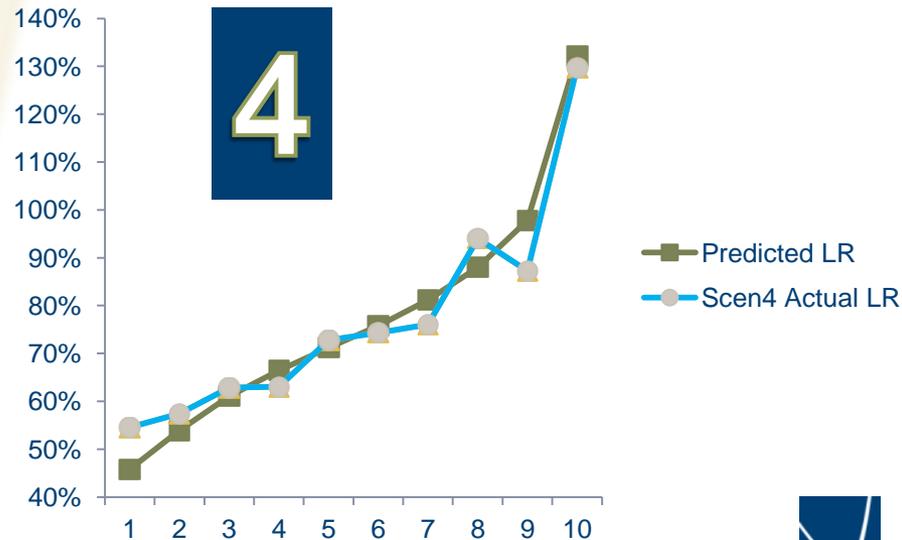
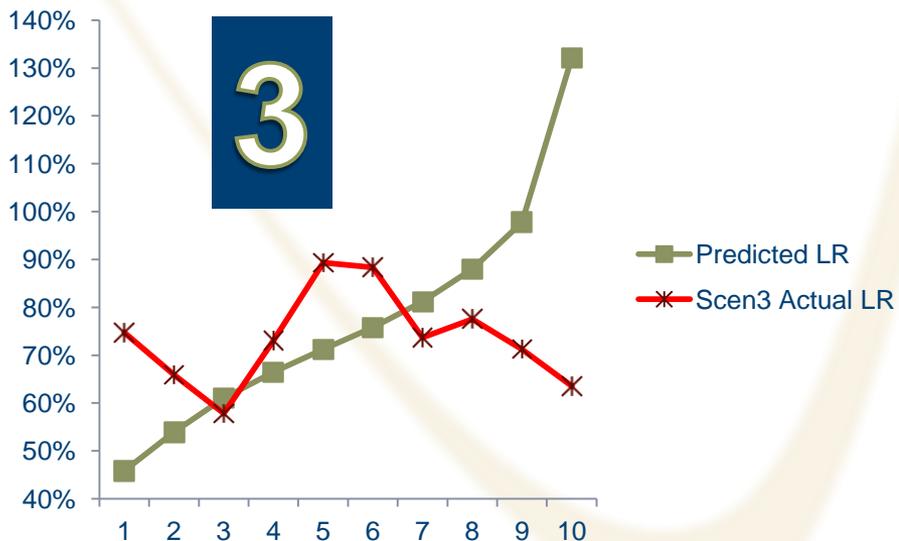
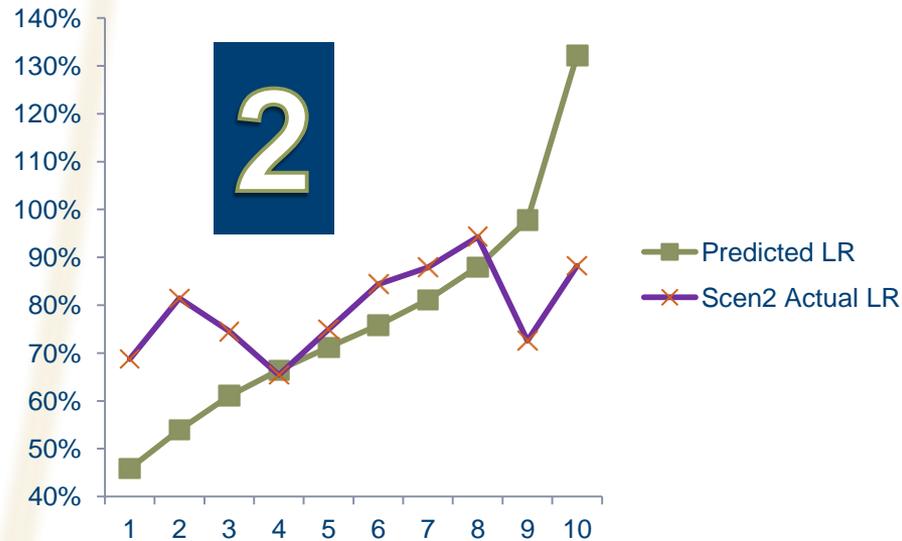
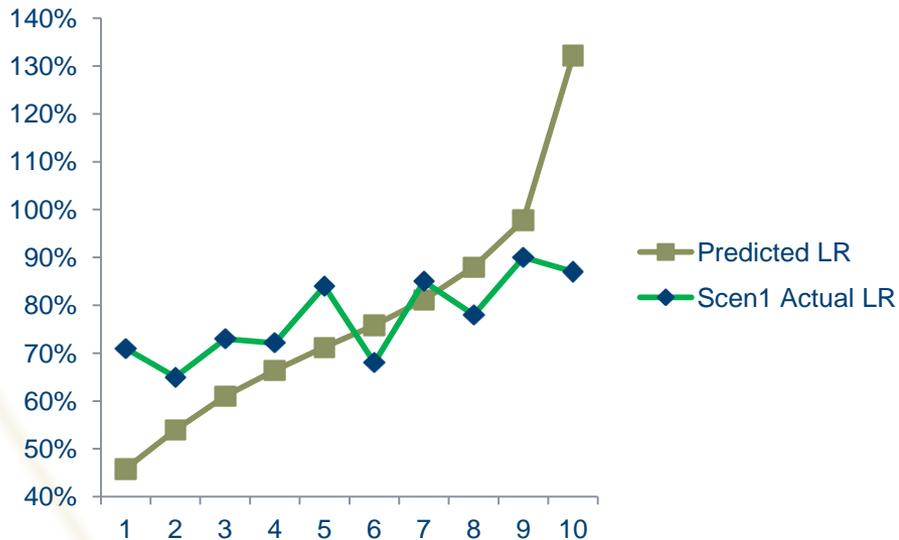


Prediction Accuracy: How Accurate is Accurate?

- 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?



Actual LR results for 10 UW-predicted stacks

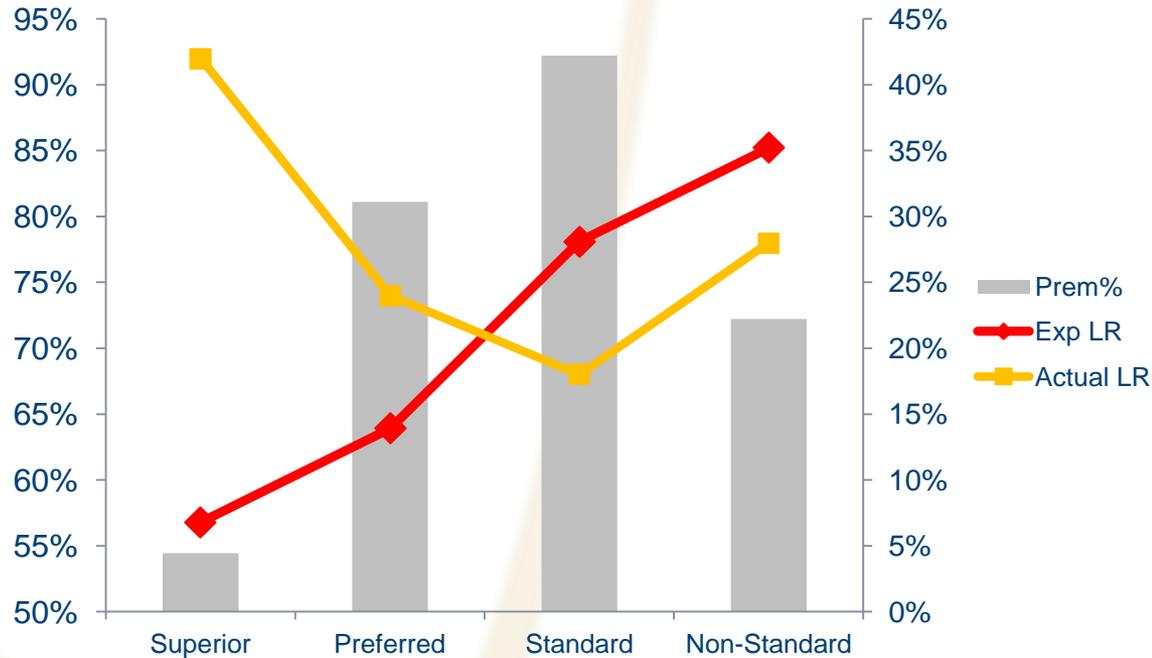


One of Valen WC clients, before Valen

Before Valen: Judgmental Business Rule Tier Assignment

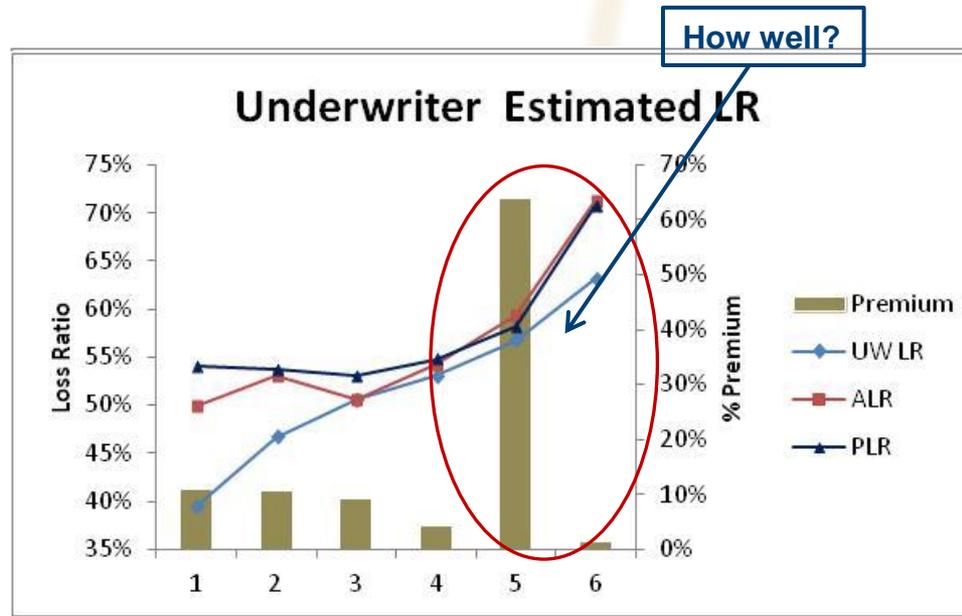
Loss Ratio

Premium %



Actual Loss ratio outcomes were far from rule-based predictions

Underwriter Versus Model Results



Underwriter Versus Model Results



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?

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?

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.”

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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

Reference - Cognitive Errors

■ 108 Types

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

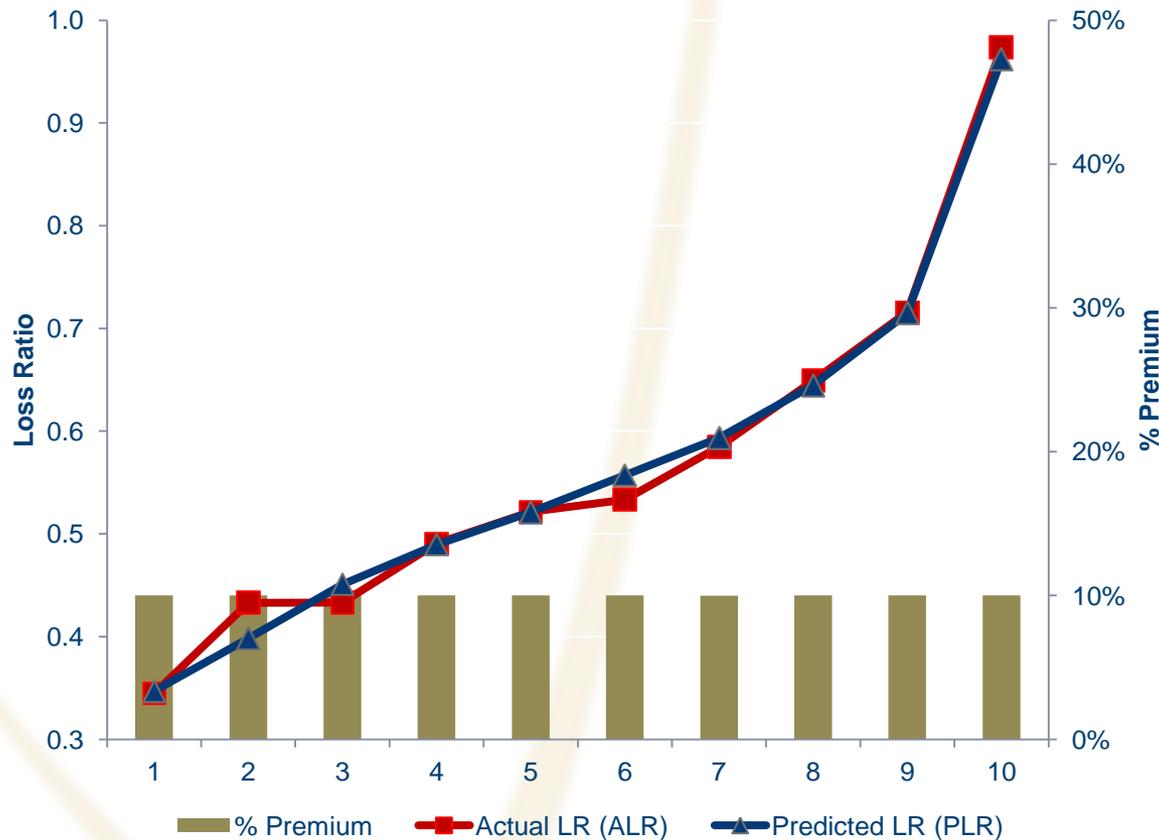
■ Examples

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

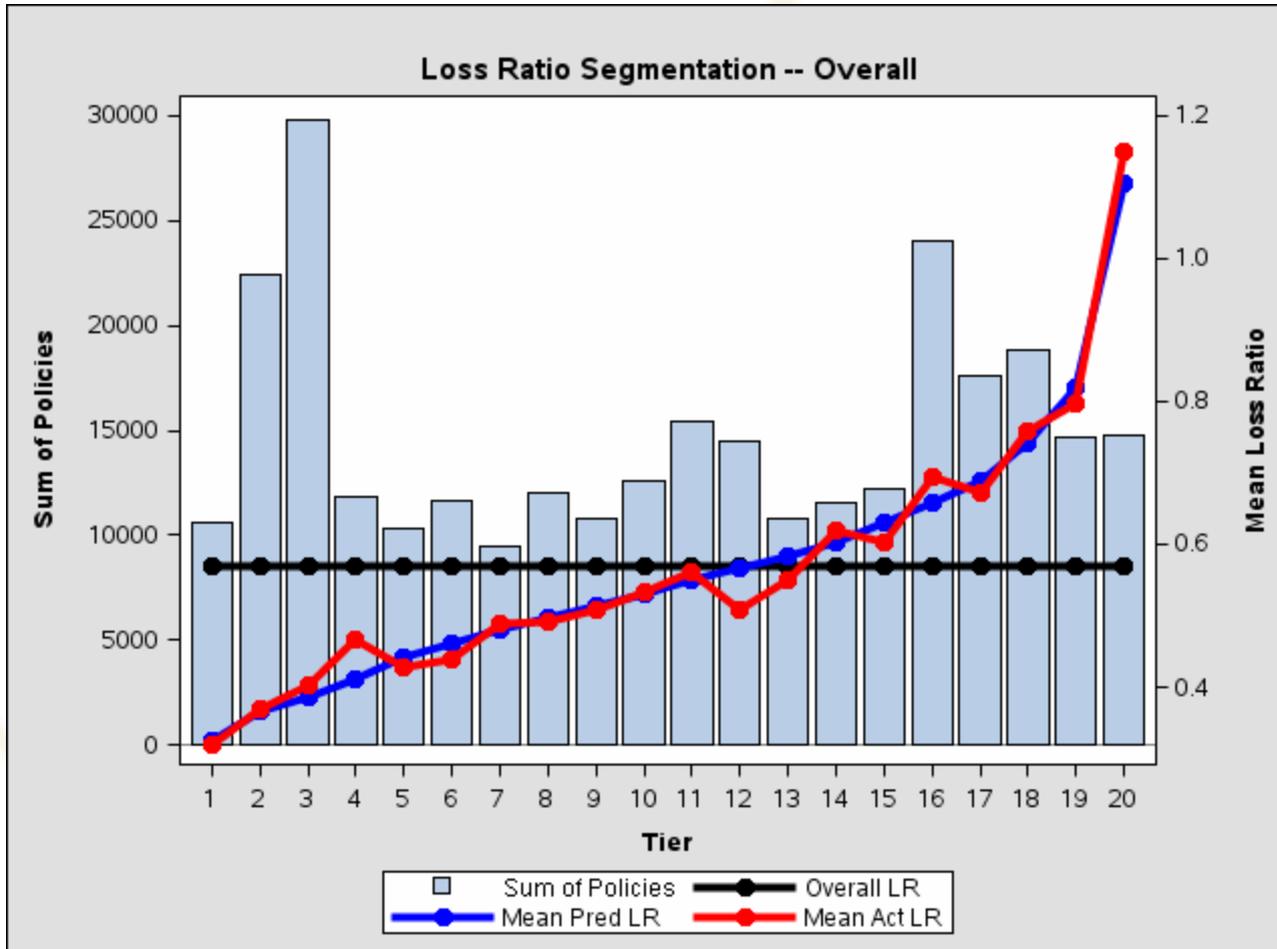
Source – Wikipedia

Can statistical models improve UW decisions?

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

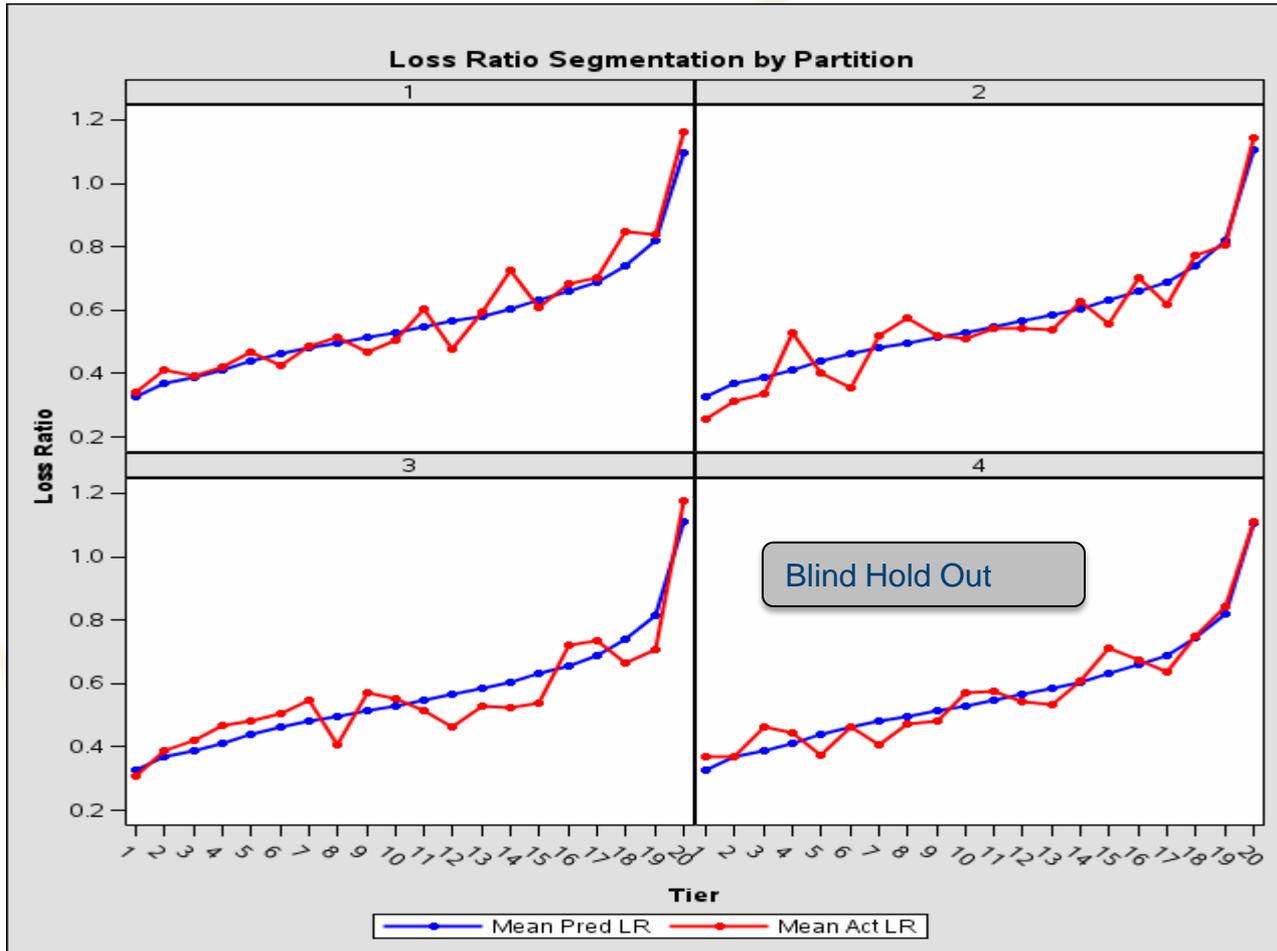


20 Price Points



Validation

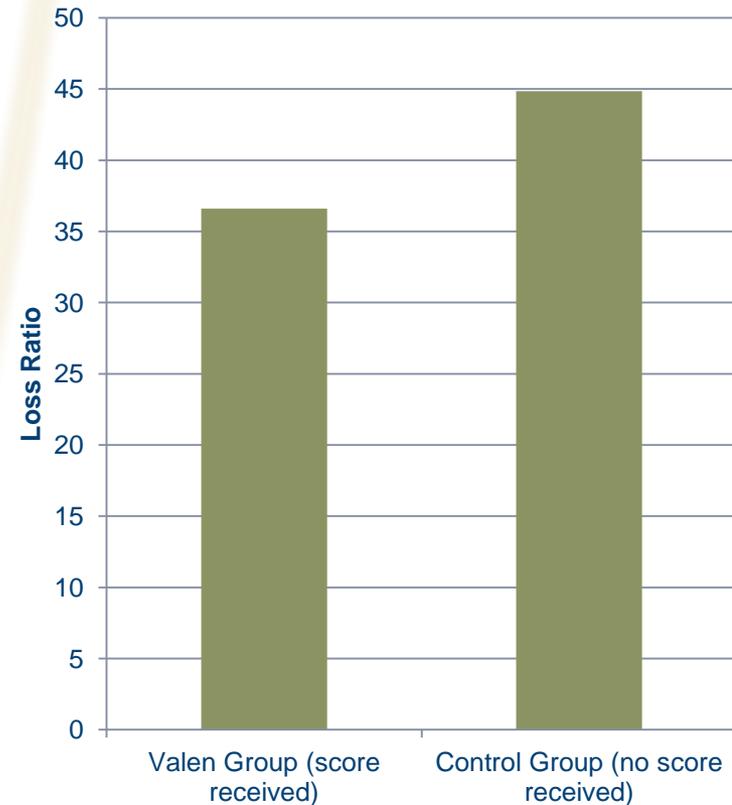
Consistency across data partitions



Case Study: Commercial Auto Insurance Pricing

- ✓ Valen developed a predictive model for a limousine book of business.
- ✓ The business goal for model usage was to lower loss ratio and increase profitability through more accurate risk-based pricing.
- ✓ The carrier chose to maintain status quo with one portion of their business as a benchmark for actual modeling results comparisons. Policies did NOT receive or use model predictions for this portion.
- ✓ **The loss ratio difference between the benchmark group and the scored group was 8%.**

Production Study: Limousine Underwriting



Getting There

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

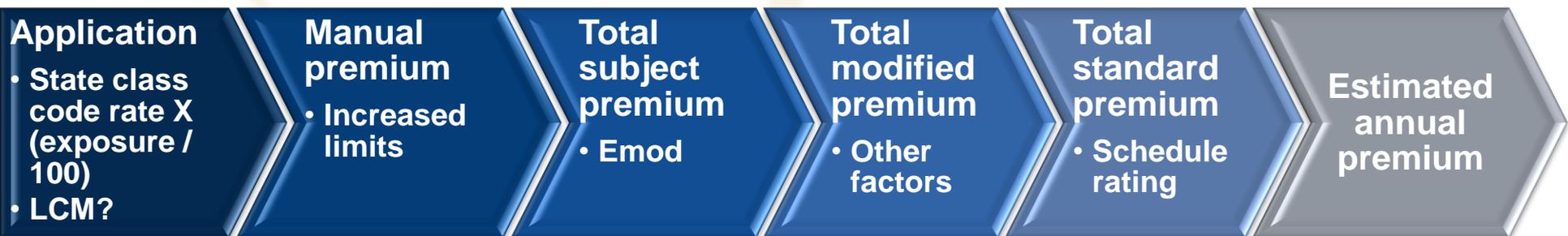
Challenges

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

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?



Challenges

Change management and investment:

- Moving forward means change
- Financial commitment and investment
- Cross-functional alignment

Business Impact

■ Benefits types:

- Combined ratio decreases
- Increased profit
- Lower average price
- Premium growth
- Lower ops cost (straight-through processing, claims management expense)

Benefit Drivers:

- Pricing accuracy
 - Price risk of worse policies
 - Profit opportunities on good risks
- Portfolio mix shifts to better risks
 - Higher retention rates on renewal business
 - Higher closing rates on good new business
- Expansion opportunities
- Higher submission rates from agents
- Higher underwriting efficiencies:
 - Straight-thru processing
 - Underwriters focused on problem policies

Questions?

Thank You!



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