2014 EAAC TAIPEI TAIWAN

18TH EAST ASIAN ACTUARIAL CONFERENCE

12-15 October 2014

Taipei International Convention Center in Taipei Taiwan

Predictive Modeling is More Than Modeling

Sheen X. Allen, FCAS MAAA CPCU FRM

How to Use Predictive Modeling as Part of An End-to-End Underwriting and Pricing Solution in A Fast Evolving Auto Insurance Market

Agenda

- Opening: Use GLM to Solve Business Problems
- Three Different Challenges
- Ranking Models for Underwriting Purposes
- Other Use of Ranking Models

Opening: Hammer vs Nails

Multivariate predictive models/generalized linear models

A problem --- Develop a rating algorithm to reflect the loss cost of each risk as accurately as possible.

B problem --- Develop a rating algorithm to be implemented in Country X during de-tariff

C problem --- Develop a business solution for rating and underwriting to be implemented in Country X during de-tariff

"If the only tool you have is a hammer, it is tempting to treat everything as if it were a nail. Some choose to work as best they can with important problems rather than restricting themselves to doing only that which they can do elegantly with the techniques already available"

- Abraham Maslow (1908-70) American psychologist

A --- Develop a rating algorithm to reflect loss cost as accurately as possible.

B --- Develop a rating algorithm to be implemented during rate de-tariff

C --- Develop a solution for underwriting to be implemented during de-tariff

A: reflect loss cost accurately

Set up GLM by coverage and select variables related to risk segmentation

Select loss cost as target variable and run all variables in GLM simultaneously *

Validate model results using statistical measures and use model output as rating factors for each variable

Build in trend, expenses, profit loading to generate rate tables by coverage

*contact author if interested in the difference between freq/sev models vs loss cost models

A --- Develop a rating algorithm to reflect loss cost as accurately as possible.

B --- Develop a rating algorithm to be implemented during rate de-tariff

C --- Develop a solution for underwriting to be implemented during de-tariff

B: Develop Rates for De-Tariff

Set up GLM by coverage and select variables related to risk segmentation.

Select loss cost as target variable and run **all** variables in GLM simultaneously

Validate model results using statistical measures and use model output as rating factors for each variable

Build in trend, expenses, profit loading to generate rate tables by coverage

B: Develop Rates for De-Tariff

- When regulation around variable X changes, models have to be "updated", which may result in unrelated variable Y factor change.
- When a new variable is added or removed, unrelated variables may be "impacted" during model update.
- When sales force is already doubting Actuarial Models, saying "*because muti-variate interactions caused the change in age factors when accident variables are changed*" may not go very far.

Select loss cost as target variable and run **all** variables in GLM simultaneously

Model design adjusted to reflect current market and business needs

Variables be grouped in to "stable" and "unstable" layers

Offsets used to stabilize the factors in the "lower" layer

B: All In vs Layered Approach

- Easy and quick
- Suitable for open market

VS.

- Regional/territory variables
- Very new variables to be tested and updated

- New or non-traditional rating variables subject to changes
- Variables restricted by certain states/regions/branches, but not others
- Variables subject to regulatory changes
- Example: accident history, vehicle type variable, credit score etc

- Standard rating variables
- Common across states/regions/branches
- Traditional interactions
- Unlikely to be heavily regulated

Balancing Stability, Flexibility, and Accuracy:
Restrict changes within top tier variable to limit the rate disruptions;
Add new variables to deal with regional specifics, without impacting other variables
When regulatory changes take place, limit changes to those variables w/o impacting others

A --- Develop a rating algorithm to reflect loss cost as accurately as possible.

B --- Develop a rating algorithm to be implemented during rate de-tariff

C --- Develop a solution for underwriting to be implemented during de-tariff

C: Solution for Underwriting

Set up GLM **by coverage** and select variables related to risk segmentation.

Select **loss cost** as target variable and run all variables in GLM simultaneously

Validate model results using **statistical measures** and use model **output as rating factors** for each variable

Build in trend, expenses, profit loading to **generate rate tables by coverage**

C: When A Rating GLM is Used Directly For Underwriting

Rating Models	Underwriting Needs
Rating tables are static	UW actions should be dynamic, and reflect change of portfolio & market
Rating is often done by coverage	UW is done on policy and account level and rarely done by coverage
Rating structure is often made up of rating factors	Underwriters often assess policies based on loss ratio
Rating focuses on point estimates & absolute value	UW focuses on risk segmentation and relative “ranking” order of risks
Rating model results are often validated by statistics	Underwriters are often not familiar with stat concepts & focus on actual loss ratios and personal experience

C: Develop UW Models for UW Purposes

Loss ratio at policy level as target variable; Tweedie distribution; Ranking model

- Standard premium or current rating table premium as denominator
- Sorting risks from high to low
- Model output is a risk ranking score

Create dynamic variables to timely/accurately reflect portfolio and market change

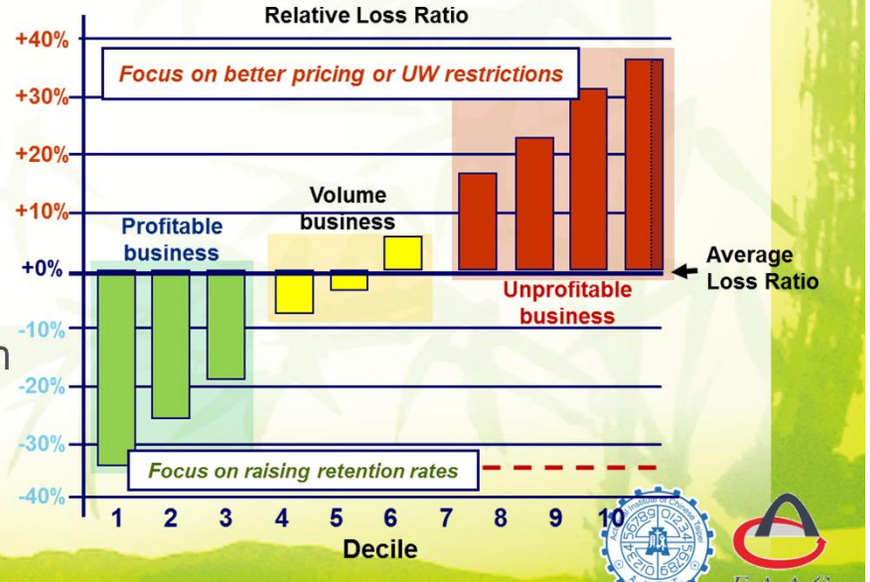
- Vehicle type vs vehicle type's loss ratio in the past year
- Territory vs Territory's loss frequency/severity in the past 2 years

Validate models using actual loss ratio based on ranking order results

- Focus on the ranking order of risks
- Actual loss ratio of each segment

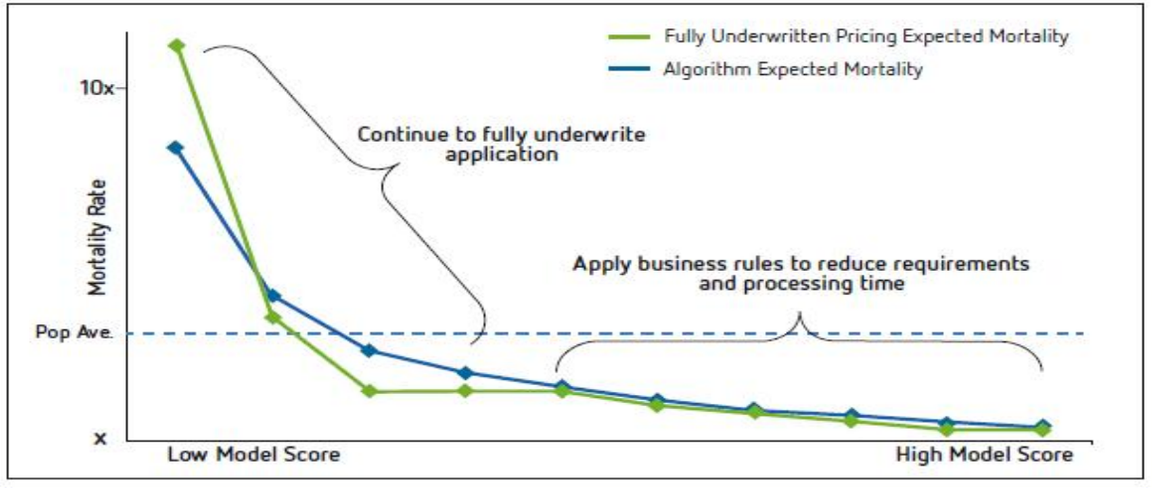
Use actual validation results to direct underwriting and other business actions

- Create Automated UW rules for low risk policies
- Raise rates, lower commission for high risk policies
- Outbound calling for low score/low retention policies



Other Use of Ranking Models

- 10% of drivers will make an auto insurance claim in a given year; Life insurers can typically expect <1 death in the first year of every 1,000 policies
- Modeling underwriting decisions rather than mortality offers the crucial advantage that provides short term feedback in high volumes
- Identify which applicants' profile does or does not justify the cost of the additional requirements
- Not a replacement for underwriter, but free up the underwriter's time for analysis of more complex risks
- Calculate a score for each applicant. Model suggests whether additional requirement are needed before making an offer
- Lower UW cost significantly



Conclusion

The end to end predictive modeling approach advocates that a successful predictive modeling project does not start with data nor does it end up with a statistical model. Rather, it starts with some business challenges and ends with successful implementation of a solution to resolve these challenges

Instead of focusing on fine-tuning his/her favorite “hammer”, modelers and actuaries are encouraged to give more thoughts to the business challenge itself in order to design the most suitable model structure and process to help achieve each specific business goal.

Effectively balance between “accuracy/statistical significance/mathematical elegance” with “actual business benefits/ease of use”, and thrive to be the **“business experts with strong modeling skills”** instead of “a strong modeler with some insurance knowledge”