The Rest of the Story: Applications and Practical Considerations of GLM & Predictive Modeling

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Outline of Presentation

- **What is a "good" model?**
- **Modeling and "customer-driven quality"**
- **A customer-focused timeline for model development**
- **The etiology, diagnosis and treatment of "predictive modeling anxiety" among product actuaries**
- **Understand the question being asked before you set up your model design**

What is a Good Model?

A good model …

1. Fits the data well
2. Is parsimonious
3. Is sufficiently useful

Let's focus on # 3 ….

A good model is sufficiently useful.

Reference: McCullagh, P., and Nelder, J.A., Generalized Linear Models, 2nd ed., 1989, section 1.1.4.

What determines the usefulness of a model?

It depends …

on the model's "environment"

Some model characteristics (specific variables/ interactions) considered very useful by one company/customer might be considered largely useless or overly burdensome by another.

The Issue: Customer-Driven Quality

Customer-Driven Quality:
Delivering products & services that meet or exceed *customer needs and expectations*.

- **Preconceived notions (biases)** of the product "owners" or product managers

- **"Buy-in" & cooperation** of every party along the chain of production (senior management, underwriters, marketing reps)

- **Adverse selection** & competitive pressures

Customer-Driven Quality (cont.)

- **"Variable CBA"**- Cost of acquiring the new variable for every future policy vs. additional predictive power provided

- **Marketing channel** – Impact of new rating/ underwriting plan on agents/ policyholders

- **System compatibility** – Cost & delay of system changes needed to implement the model (application, rating, underwriting, policy-issuance, data warehouse)
…. *"speed-to-market"*

A Timeline for Model Development

➢ **Meet with key decision-makers - Assess their initial perceptions & expectations**

➢ **Exploratory data analysis - Assess variable quality & expense, scrubbing, understand variable distributions for "banding"**

➢ **Assemble modeling database – Decide which variables (internal & external) to include, exclude or transform. Document reasons for decisions.**

Model Development Timeline (cont.)

- ➢ **Preliminary Model**
  - **"Crude" model**
  - **Demonstrates to customers the kind of thing the model can do**
  - **Gives them opportunity to visualize the model in light of their current practice**
  - **First opportunity for educating customers on some details of modeling & understanding constraints in greater detail**
  - **Begin to form an implementation committee**

Model Development Timeline (cont.)

- ➢ **"Initial Final" Model**
  - **Possesses all major elements that will be present in you final product**
  - **Include lift charts to demonstrate power of model**
  - **Rank variables from most to least predictive**
  - **Elicit customer's concerns & desires for further exploration (their last chance)**
  - **Formalize detailed implementation plan**

Model Development Timeline (cont.)

➢ **"Fine-Tuned" Model –**
The final product, with all "issues for further exploration" resolved

➢ **Implementation**
- **Actuary might be involved in system testing & validation**
- **Field training & "road shows"**

Product Actuary's Concerns

- "*Is this a countrywide model or are we customizing it to each jurisdiction?*"

- "*Does the model have a zero off-balance, or is there an off-balance that needs to be considered in an impact calculation?*"

- "*Can you provide documented support of the model for rate filings?*"

Product Actuary's Concerns (cont.)

- *"Will our aggregate product claim frequency or severity change as a result of a distributional shift in business?"* **(Reserving actuaries might ask the same question.)**

- *"You based the model on then-current loss costs in State X. The bureau has promulgated new loss costs. How does our adoption of the new loss costs affect our use of the model ?"*

**(For a bureau loss cost line, depending on the model design)**

Model Design from an Implementation Perspective

Option A:

- **Model Exposure***: **Exposure base used to rate the coverage** (car-years for Personal Auto; house-years for Homeowners; payroll for Workers Comp; vehicle-year for Commercial Auto; receipts, payroll, frontage, etc. for General Liability; etc.)

- **Null Hypothesis:**
  All rate relativities equal 1.000

- **Question Addressed by Model:**
  What are my optimal rate relativities?

- **Work Product:** Completely new rate/ underwriting relativity plan

* For freq. model if freq. & severity are modeled separately
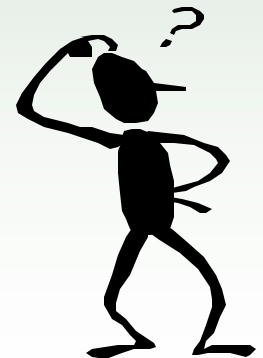
Model Design from an Implementation Perspective (cont.)

Option B:

- **Model Exposure**: Premium at current rates*
- **Null Hypothesis**: Current relativities are OK
- **Question Addressed by Model**:
  What <u>changes</u> need to be made to the current rate/underwriting plan?
  (And which changes provide the best lift?)
- **Work Product**: <u>Adjustments</u> to the current rate/underwriting relativity plan

* **Might not be able to model freq. & severity separately**