RATEMAKING AND PRODUCT MANAGEMENT (RPM 2014) SEMINAR

II-4

GETTING STARTED WITH PRICE OPTIMIZATION

– Concepts, Models, and Hurdles

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Agenda

- Defining Price Optimization
- Simple Scenarios
- The Flip Side: Opportunity to Profitability
- The Flop Side: Hurdle and Concern
- The Benefit: Simulation Exercise

Price Optimization – A Key Battle Field

- **A <u>pricing scheme</u> that optimizes <u>business measure of success</u> in a <u>specific investment horizon</u>**
  - Business measure includes, but not limited to, growth, profitability, customer satisfaction, cross-sell
  - Business goals can be achieved via also underwriting, marketing, claims handling strategies
  - Investment horizon is key as price optimization is usually served as Profit and Expense deferral mechanism
  - Price Optimization in very short: Cost + Demand

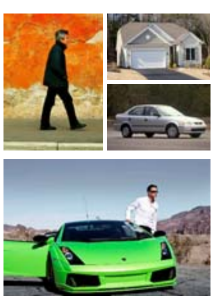
Loss Cost Modeling

- **Widely studied by industrial players and academia**
- **GLM: A convergence of industrial practice**
  - Standard text for CAS Exam 8
  - Effective publicity of CAS and vendors
  - Acceptance by regulators
  - Cost of exploring/implementing GLM can be very low

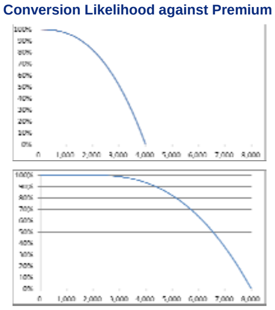
Demand Modeling

- **Relatively less studied**
- **Difficulty in collecting good quality quote information**
- **Not as many well-established literature available**
- **Many choose to use GLM to model instead**

Demand Modeling: Strong Premium interaction



Conversion Likelihood against Premium



Price Optimization – Scenario I

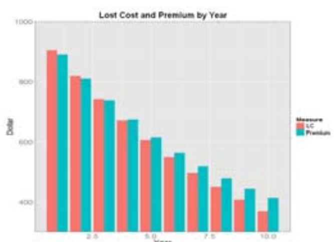
Break Even Premium = $ 1,200

Company A: $ 2,000
Company B: $ 2,500
Company C: $ 2,200

Optimal Price = $ 1,900

Price Optimization – Scenario II

- **Loss cost usually decreases as policyholder ages (reversal may happen at the tail)**



Price Optimization – Scenario II

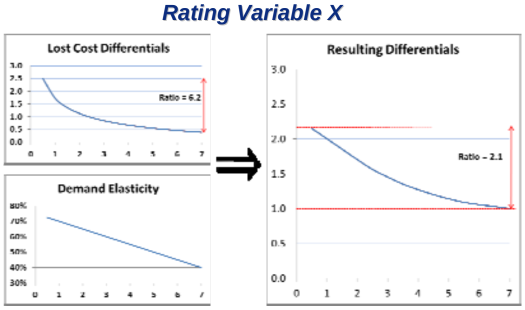
- **The initial loss that secures the conversion of customer can be beneficial**

Price Optimization – The opportunity

- **Since the battle field is relatively new, a simplified price optimization can serve as a good start.**
  - e.g. Deriving a pricing algorithm by tempering 1 variable

Resulting Differentials

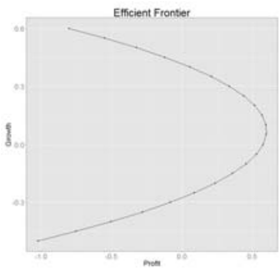
Rating Variable X



Price Optimization – The opportunity

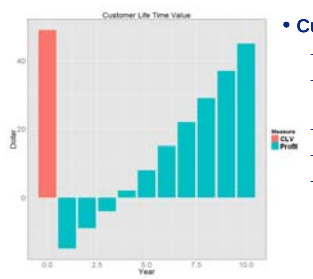
- **Since the battle field is relatively new, a simplified price optimization can serve as a good start.**
  - e.g. Deriving a pricing algorithm by tempering 1 variable
- **As understanding of the mechanism increases, so the complexity of the price optimization**
- **Thus, the start-up cost of price optimization can be affordable**

Evaluating a Pricing Strategy



- **Efficient Frontier**
  - Create a view of growth vs. profitability (or any business measures)
  - Decision makers can pick any feasible members according to business appetite

Evaluating a Pricing Strategy



- **Customer Lifetime Value**
  - Present values of profitability
  - Easy to explain to the audience with only 1 measure
  - Scenarios are comparable
  - Simplified modeling
  - Could result in outrageous premium increase to loyal policyholders

Scope can vary a lot

- **By number of components: Claim Frequency, Severity , Conversion, Retention, Expense, Convictions, Mid-term cancellation etc…**

Model Components to be considered

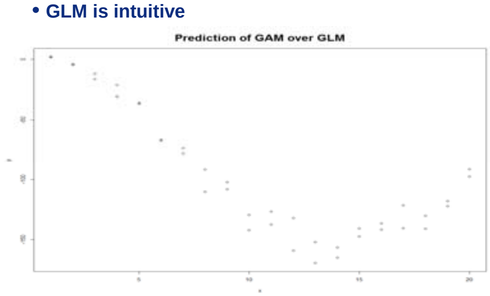
- **Expense Modeling**
  - Fixed vs. Variable
- **Mid-term cancellation and Penalty**
- **Interest Rates**
- **Conviction and Claims Rates**
  - Leads to claims/conviction free reward
  - Feedback to the rating algorithm

Scope can vary a lot

- **By number of components: Claim Frequency, Severity , Conversion, Retention, Expense, Convictions, Mid-term cancellation etc…**
- **By the modeling techniques for the component: GLM, GAM, Neural Network, Boosting etc…**

GLM vs. GAM vs. Data Mining

- **GLM is intuitive**



GLM vs. GAM vs. Data Mining

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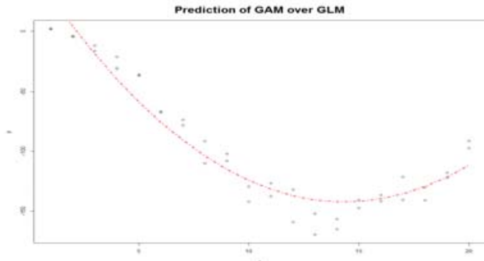
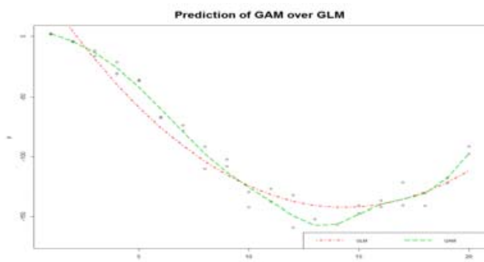


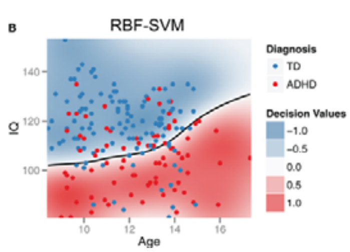
GLM vs. GAM vs. Data Mining

- GAM helps temper the extrapolation concern



GLM vs. GAM vs. Data Mining

- Explanatory variables has interaction usually



Scope can vary a lot

- By number of components: Claim Frequency, Severity , Conversion, Retention, Expense, Convictions, etc…
- By the modeling techniques for the component: GLM, GAM, Neural Network, Boosting etc…
- **By number of products: Auto + Property + Life**

Scope can vary a lot

- By number of components: Claim Frequency, Severity , Conversion, Retention, Expense, Convictions, etc…
- By the modeling techniques for the component: GLM, GAM, Neural Network, Boosting etc…
- By number of products: Auto + Property + Life
- **By the constraints: dislocation limit, minimum growth, etc…**
- **By the projection periods**

Results are highly sensitive to error

- **Reliance on highly accurate underlying models**
  - Combining models
  - Robustness of Assumptions
- **A deviation can be magnified under long projection horizon.**
- **An Alternative is to specify a short to medium**

Simulation – Goal

- Goal: Derive a price optimization algorithm to maximize net present value of the personal auto business
- The algorithm is in the form of multiplicative differentials
- Compare the results of various modeling techniques (GLM vs. GAM vs. data mining vs. actual)
- Attempt to quantify the modeling risk for various predictive models

Simulation – Underlying Assumption

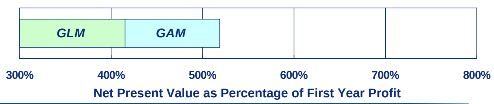
- Variables:
  - Multi-line (Y/N)
  - Years Claims Free (0-5 Years)
  - Loyalty(0 to 10 Years)
  - Age (25-50)
  - Premium
- 4 models:
  - Claims Frequency – Poisson
  - Conversion – Bernoulli
  - Retention – Bernoulli
  - Severity – Assumed to be constant at 10,000 for simplicity

Simulation – Assumptions (Cont'd)

- Interactions and non-linearity exist in all models
- Measure to optimized: Net Present Value of the portfolio
- We also assume all customers' lifespan is 50 years.
- Interest rate/ ROE/ yield = 10%

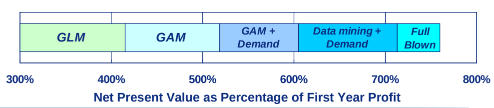
Base Case Scenario

- We use GLM/GAM to model the loss cost without considering demand models.
- GLM NPV as year 1 profitability = 415 %
- GAM NPV as year 1 profitability = 519%



Pricing with Demand Consideration

- Considering also the demand models, NPV will significantly increased.
- GLM LC + Demand NPV = 554%
- GAM LC + Demand NPV = 605%
- Data mining LC + Demand NPV = 713%
- Actual optimal NPV = 760%



Other Issues

- Consistency of implementation
  - Prospective vs. Retrospective
- Legal environment
- Competition