

Predictive Modeling for Personal Automobile Pricing

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Personal Auto Applications

- Vehicle Classification
- Territory Boundary Development
- Profit Optimization





Vehicle Classification



Vehicle Symbol – Traditional Approach

- Analyze experience of each vehicle type
 - Loss ratio or pure premium
 - By model year
- Group vehicles with similar experience into symbol groups
- Rating relativities set based on these groups
- Experience reviewed and changes made to vehicle assignments periodically
- File changes to symbols as made



Vehicle Symbol – Issues with Current Process

- Data sparseness
- Does not account for other characteristics related to the risk
- Most companies are using the same classifications
- New model years



Modified Vehicle Classification Approach

- Approach: use vehicle characteristics and performance information to classify/rate vehicles
- Steps
 - Data
 - Analysis
 - Application
 - Advantages



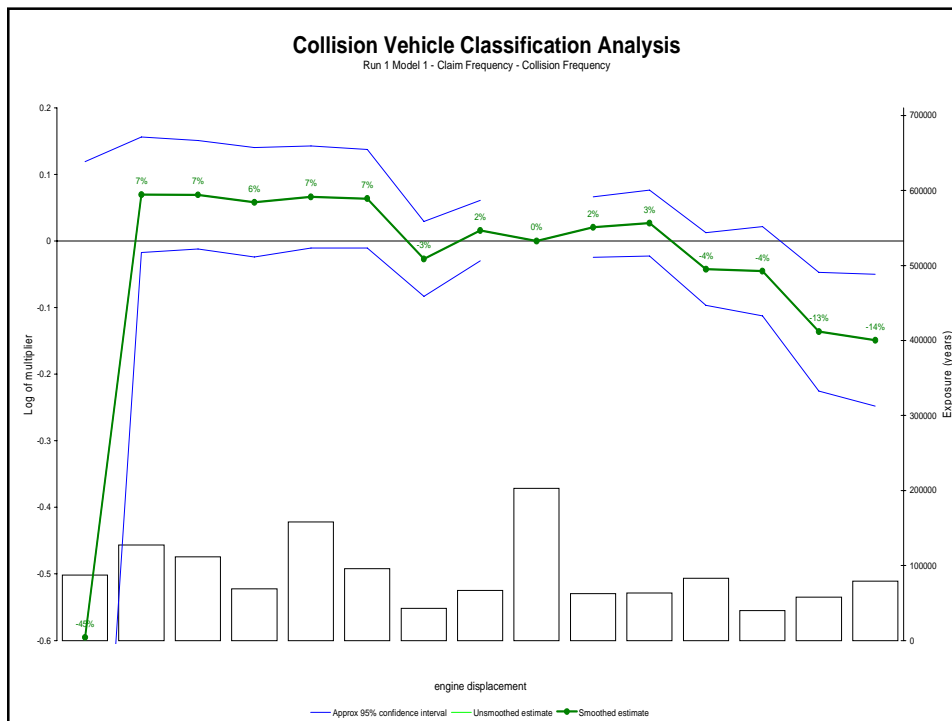
Modified Vehicle Classification Approach

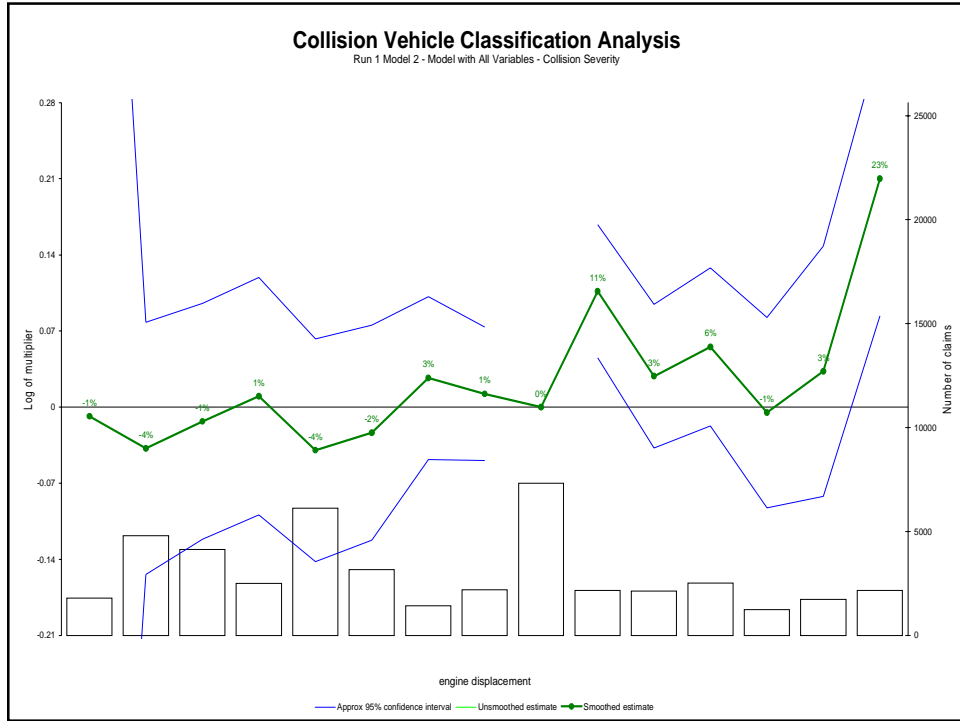
- Data

- R. L. Polk vehicle characteristics
- Highway Loss Data Institute vehicle data
- Crash test information

- Analysis - keep in mind...

- Frequency vs. severity
- Coverage differences
- Analysis specifications





Application

- Company specific symbols
- Enhancement to current symbols
- Series of additional rating factors



Territory Boundary Development



Approaches to Establishing Territories Using GLM

- Geographical risk factors
- Clustering
- Spatial smoothing



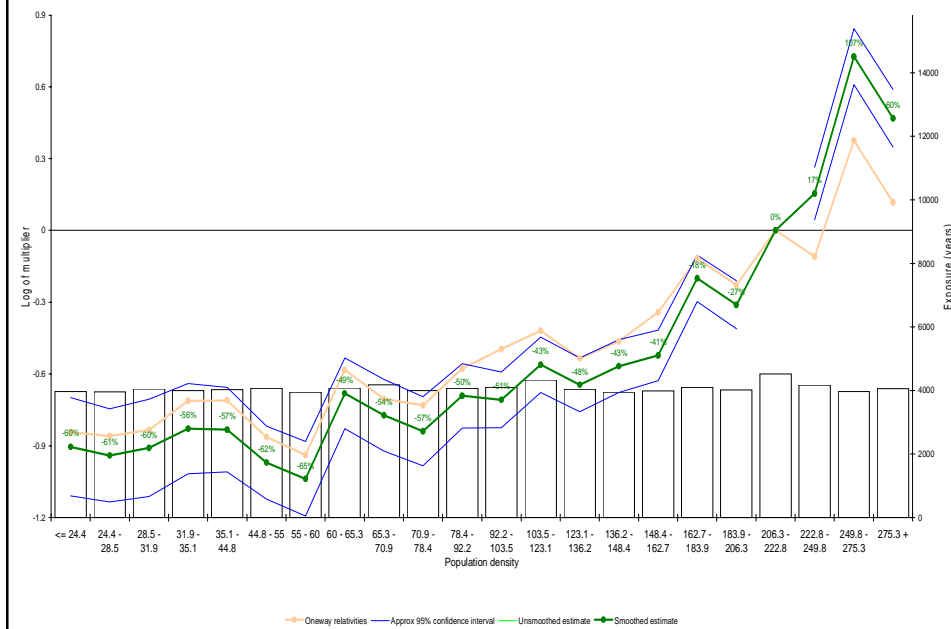
Geographical Risk Rating

- Explain geographical risk by specific factors
 - Population density
 - Theft rates
 - Vehicle density
 - Crime rates
- Generate GLM including these risk factors
- If risk can be explained by specific factors, decrease the importance of territory definition
- Goal: explain as much of risk as possible prior to clustering or smoothing



Fully worked example of the tutorial job

Run 1 Model 1 - Initial models - TPPD numbers



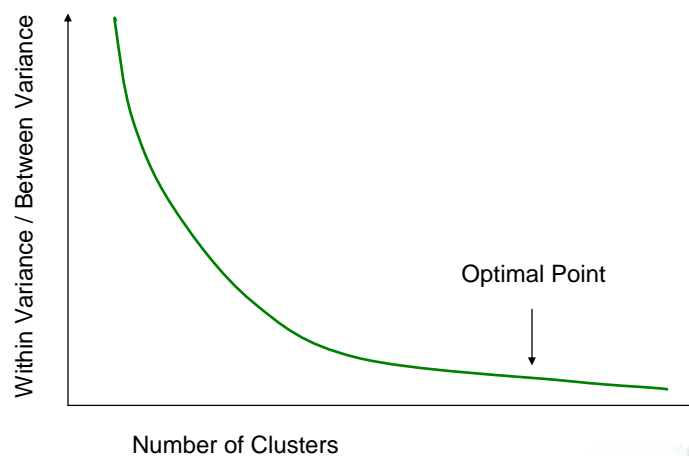
Clustering



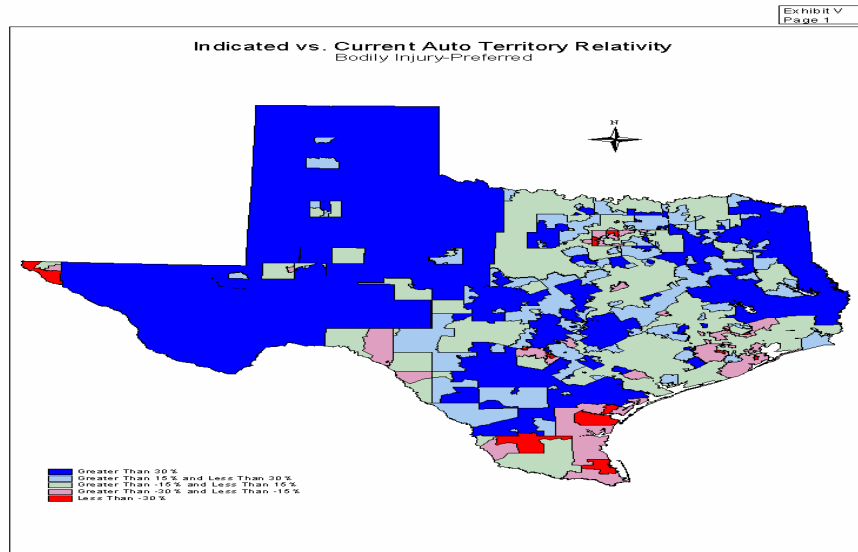
- Develop statistics by geographical area
- Apply credibility
- Specify clustering rules
- Join areas of like experience
- Review results



Review Deviance



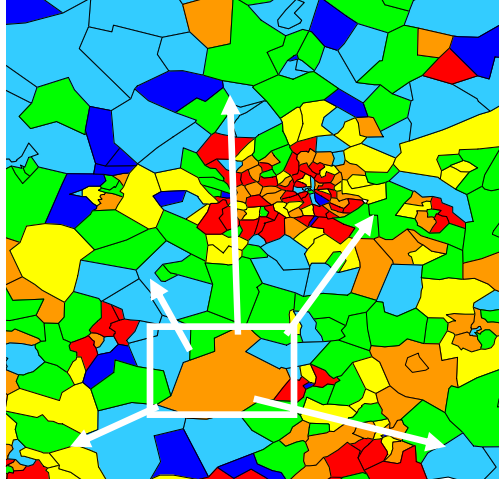
Clustering Example



Spatial Smoothing

- Explain non-geographical risk by fitting GLM to non-geographical factors
- Analyze residual risk by geographical area
- Smooth residuals
- Group areas into categories for risk rating

Smooth Residuals



Profit Optimization

Profit Optimization Applications

$$\text{Profit} = \text{Premium} - \text{Cost}$$

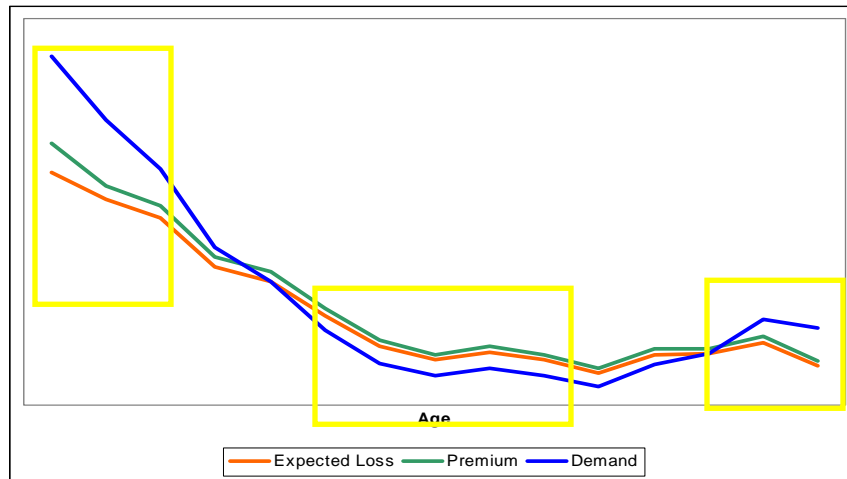
- Accounting for insurance demand
- Optimizing rate changes
- Artificial price restrictions



Accounting for Insurance Demand



Accounting for Insurance Demand



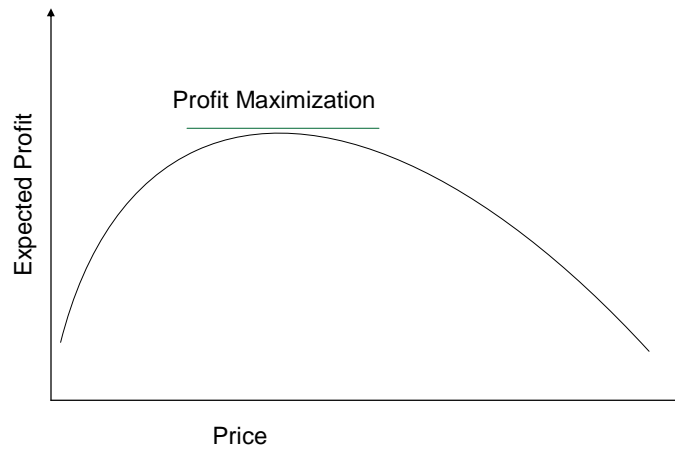
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Economics 101

- Overall Profit = (Premium – Cost) x # of Units
 - As price increases, profit increases all else being equal
 - As cost decreases, profit increases
 - As number of units increases, magnifies profit or loss

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Expected Profit Curve



Considerations in Insurance Demand

- Renewal analysis
- New business demand analysis
- Extended profitability analysis



Retention/Conversion Model Considerations

- Traditional Rating Factors
- Insurance Score (Credit, D&B)
- Claims/MVR/Underwriting History
- Number of Years Insured
- Distribution Channel
- Pricing Change
- Competitive Position
- Market Conditions
- Brand Value



Optimizing Rate Changes



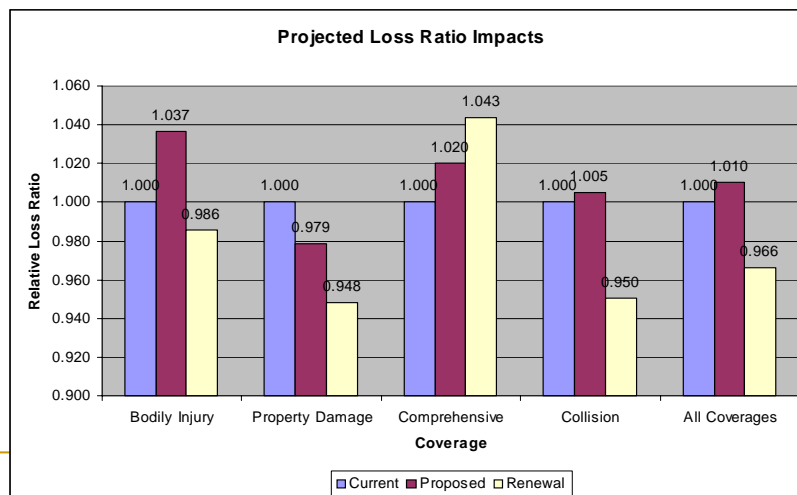
Economics 101

- Profit = (Price – Cost) x # of Units
- Price = \$1.00
Cost = \$0.50
of Units = 1,000
Profit = \$500
- ~~■ Price = \$2.00
Cost = \$0.50
of Units = 1,000
Profit = \$1,000~~

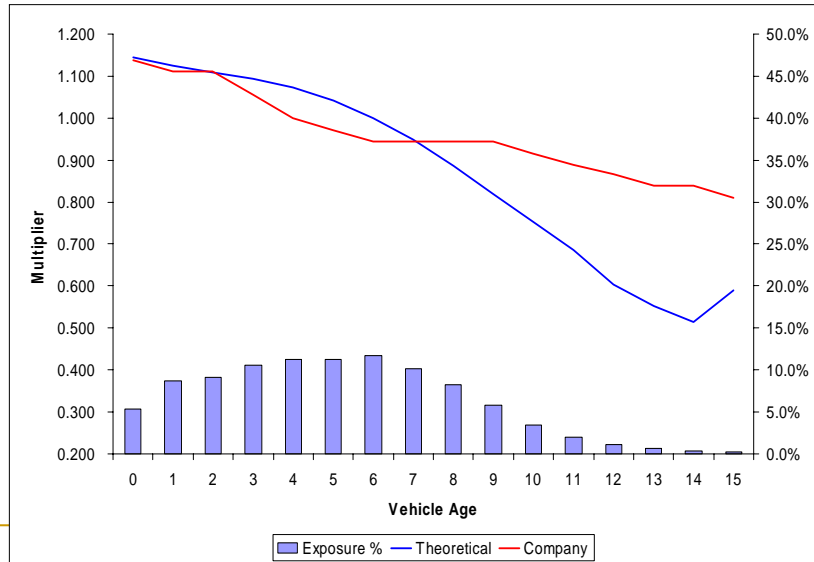
Traditional actuarial assumption is that 100% of the rate impact will be realized



Effective Rate Impacts



Artificial Price Restrictions



Application of Profitability Analysis

- Potential applicability for:
 - Rating
 - Marketing
 - Underwriting
 - Agency
 - Corporate Planning
 - Profitability Scoring
- Considerations
 - Data
 - Regulation
 - Corporate Culture