ISO Risk Analyzer®

Personal Auto

Environmental Module
Location Component of Loss Costs

• Territories should be *big*
  – Have a sufficient volume of business to make credible estimates of the losses.

• Territories should be *small*
  – Driving conditions vary within territory.
Some Environmental Features Related to Auto Accidents

• Proximity to Business Districts
  – Workplaces
    • Busy at beginning and end of work day.
  – Shopping Centers
    • Always busy (especially on weekends).
    • Better traffic lights & turn lanes.
  – Restaurants
    • Low traffic impact during day.
  – Schools
    • Increased signage and enforcement.
Some Environmental Features Related to Auto Accidents

- Weather
  - In combination with terrain.
  - Variability as well as typical conditions.

- Traffic Density
  - Less traffic sharing the same space decreases odds of collision.
Combining Environmental Variables

- Individually, the variables have predictable - but small - effect.
- Variables could have positive and negative effects.
- ISO built a model to calculate the combined effect of all variables.
  - Based on countrywide data, calibrated to very local conditions
- Losses are modeled by coverage and frequency severity separately
  - Allows for flexibility in relation of variables to loss
Data Sources

• ISO Data & Analytics
  – Statistical Data & Ratemaking Analyses
  – Weather Data (AIR)

• Additional Insurer Data – Development Partners

• Third-Party Data
Data Sources - Examples

- Comprised of over 1000 indicators

- Weather and Terrain

- Traffic Density and Driving Patterns

- Traffic Composition

- Traffic Generators

- Experience and trend
Modeling Techniques Employed

• **Sampling** — Stratification, Train / Validation / Test (TVT) partition.

• **Exploratory Data Analysis (EDA)** — univariate analysis, transformations, known relationship to loss.

• **Sub models / data reduction** — neural nets, splines, principal component analysis, k-means clustering.

• **Spatial Smoothing** — parameters related to auto loss patterns.

• **Variable Selection** — Stepwise, cross-validation and bootstrap techniques.
Weather Component

Environmental Model Loss Cost by Coverage

Frequency x Severity

Causes of Loss Frequency

Sub Model

Data Summary Variable

Raw Data

Coverage

Frequency

Severity

Traffic Generators

Traffic Composition

Weather

Traffic Density

Experience and Trend

Neural Net Weather RBF Model

Neural Net Weather MLP Model

Weather Factor Temperature

Weather Factor Precipitation

Other Weather Factors and Models

Weather Summary Variables

35 Years of Weather Data
Model Output

• Separate Models by Coverage
  – e.g. Bodily Injury Liability, Comprehensive

• ISO Risk Analyzer output is:
  – Predicted Loss Cost
  – Relativity – Normed to ISO territory
  – Components
  – Reason Codes
  – Scores
Model Testing and Review

• ISO conducted extensive testing in order to confirm predictive ability in total and by component.

• ISO had the model peer reviewed by Professor Abba Krieger, Chair of the Statistics Department at University of Pennsylvania’s Wharton School:
  – “Created with diligence that one rarely sees in industry.”
  – “All of the coefficients were significant ---”
  – “The coefficients made sense and the results were reproducible.
  – “It is clear that these models perform well.”
$\text{logit} = \ln \left( \frac{p}{1 - p} \right)$
Reason Codes

Predicted Loss Costs will be accompanied by up to 5 *Reason Codes*

- *Reason Codes* are distinct for each coverage
- *Reason Codes explain the departure from territory rating*
  - Ranked from greatest to least impact on rating
  - Identifying the effect in terms of eight dimensions:
    - likelihood or severity of loss (2) by (4) components
  - Each reason code also indicates the relative magnitude and direction associated with the reason
Reason Codes
Distribution of Component Reasons

PD/Liability

- F: Traffic Density
- S: Traffic Density
- F: Traffic Generators
- S: Traffic Generators
- F: Traffic Composition
- S: Traffic Composition
- F: Weather
- S: Weather

% of risks affected

-70.0% -60.0% -50.0% -40.0% -30.0% -20.0% -10.0% 0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0%

Pos: >= 10%
Pos: [ 7.5%, 10.0%)
Pos: [ 5.0%,  7.5%)
Pos: [ 2.5%,  5.0%)
Pos: [ 0.25%, 2.5%)
Neg: >= 10%
Neg: [ 7.5%, 10.0%)
Neg: [ 5.0%,  7.5%)
Neg: [ 2.5%,  5.0%)
Neg: [ 0.25%, 2.5%)
ISO’s Filing Plans

• ISO will be filing a rating rule based on Environmental module of Risk Analyzer Model

• Filing an optional rating plan

• Rating Rule “sits on top of” the existing ISO rating plan

• Rating rule with a multiplicative factor corresponding to a scoring range
Structure of ISO Rating Rule

<table>
<thead>
<tr>
<th>Score</th>
<th>Multiplier</th>
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<tbody>
<tr>
<td>744 – 800</td>
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<tr>
<td>712 – 743</td>
<td>0.80</td>
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<tr>
<td>464 – 537</td>
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<tr>
<td>258 – 289</td>
<td>1.20</td>
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<tr>
<td>200 – 257</td>
<td>1.25</td>
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