Allstate

Geographic Rating in Personal Lines Insurance Pricing

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Agenda

- Comparison of Approaches to Geographic Rating
- Risk Classification and Geographic Rating
- Considerations in Variable Selection
- Emerging Trends

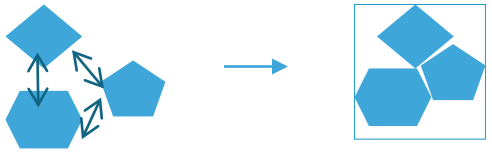
Comparison to Historical Territorial Techniques

1. Define Shapes

Territory Level

Smooth zip-level loss experience

Cluster zips into territories



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2. Analyze Loss

Territory Level

Pure Premium Relativity $= \frac{\Sigma\ Loss/Exp \text{ By Terr}}{\Sigma\ Loss/Exp \text{ State}}$

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3. Develop Indicated

Territory Level

Account for **Non-Geo** Effects

$$\frac{\text{Pure Premium Relativity}}{\text{Avg. Rating Plan Factor}}$$

Indicated Factor **by Territory**

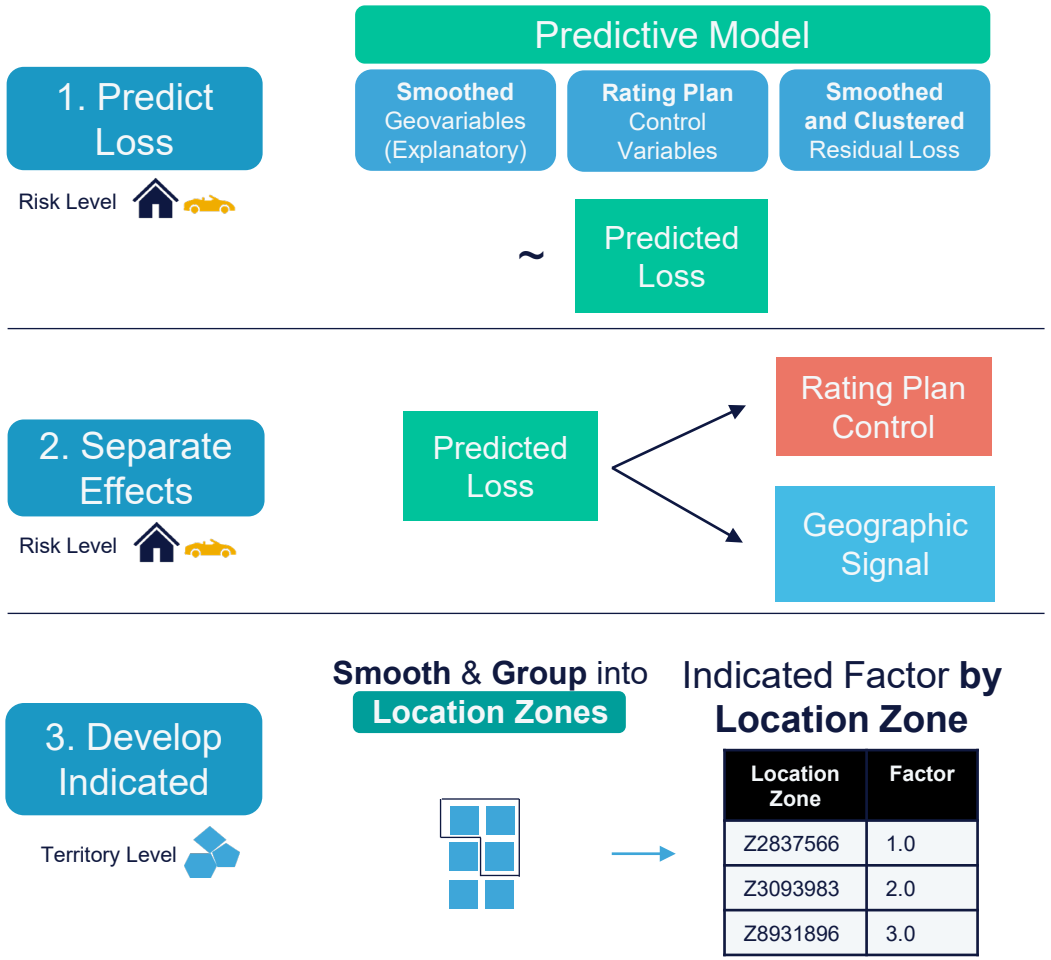
Territory	Factor
1	1.0
2	2.0
n	3.0

Historical Techniques

- Historical analyses use **aggregated claim history** at the zip code, county, or territory level
- Holdout validation techniques are not typically utilized using these approaches, as the modeler relies on **credibility standards** and **traditional actuarial techniques** to form stable rates

Confidence in the accuracy of geographic indications is *based on the appropriateness of the techniques used, founded in classical actuarial techniques*

Comparison to Historical Territorial Techniques



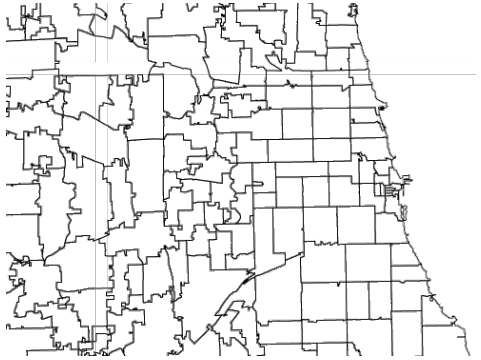
Modern Geographic Approach

- The territorial signal is first modeled at the **individual risk level**, then smooth and aggregates nearby risks together until a sufficient credibility is reached
- Holdout validation methods can be used to ensure that the model accurately predicts claims for data that was **not included in training**
- Using this approach, we can more explicitly **control for non-geographic effects and isolate the geographic signal**

Confidence in the accuracy of geographic indications is *based on data and statistics that can prove their accuracy, founded in contemporary predictive modeling best practices*

Zip Code vs. Geocoded Rating

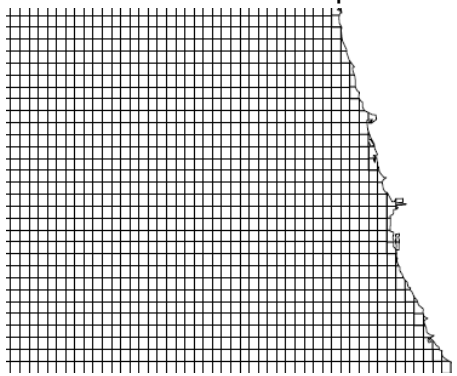
Zip Code, ~90square miles



31K

8000x

Geocoded Grids ~ ½ sq. miles



246M
200 sq. m grids

Zip Code Based Rating	Geocoded Rating
Determined by USPS	Defined by latitude / longitude
Oddly shaped, sizes vary	Uniform size and shapes can be used
Boundaries subject to change over time	Boundaries will not change over time
Large zip codes can smooth over smaller unique areas	Higher granularity allows enhanced risk matching, while also enabling more gradual differences between neighboring geographies

While geocoded boundaries offer many advantages for insurance pricing, implementation is hindered by the significant costs associated with migrating legacy systems

Geographic Modeling Process

Overview

- Risk characteristics are collected for each **individual policy** and for the **area** in which they reside
  - This information can be for the individual risk, or at the census tract / block / block group, or zip code level
- Model is fit at the policy level on its historical claims using the associated risk characteristics that were present at the time

f (Amount of Insurance + Home Age + …

Individual Risk Characteristics

+ Population Density + Median Age + …

Geodemographic Characteristics

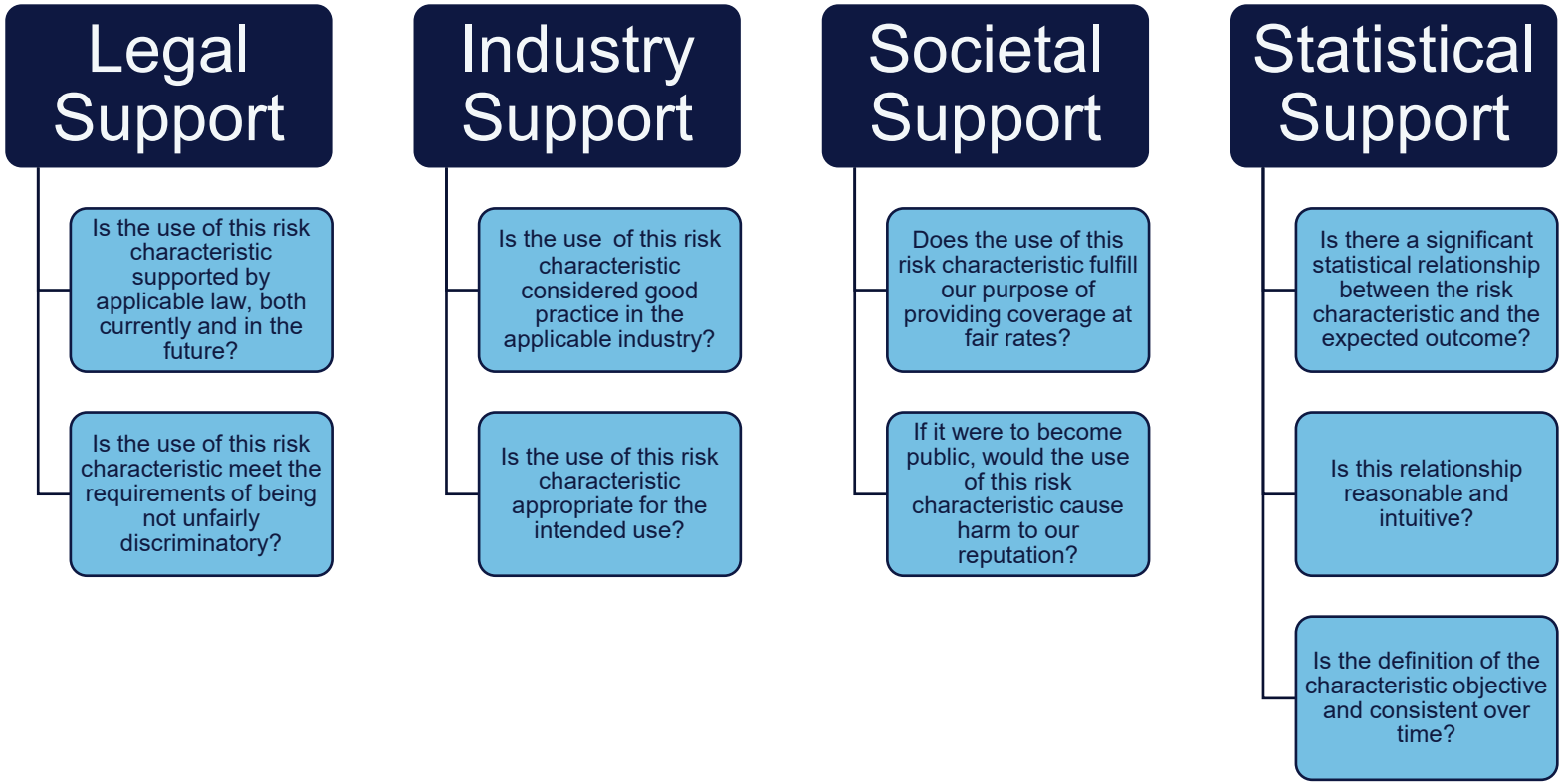
+ Avg Daily Precipitation + Freeze / Thaw Freq. + …

Weather and Environmental Related Characteristics

) = **Expected Claims**

Pre-Modeling Variable Selection

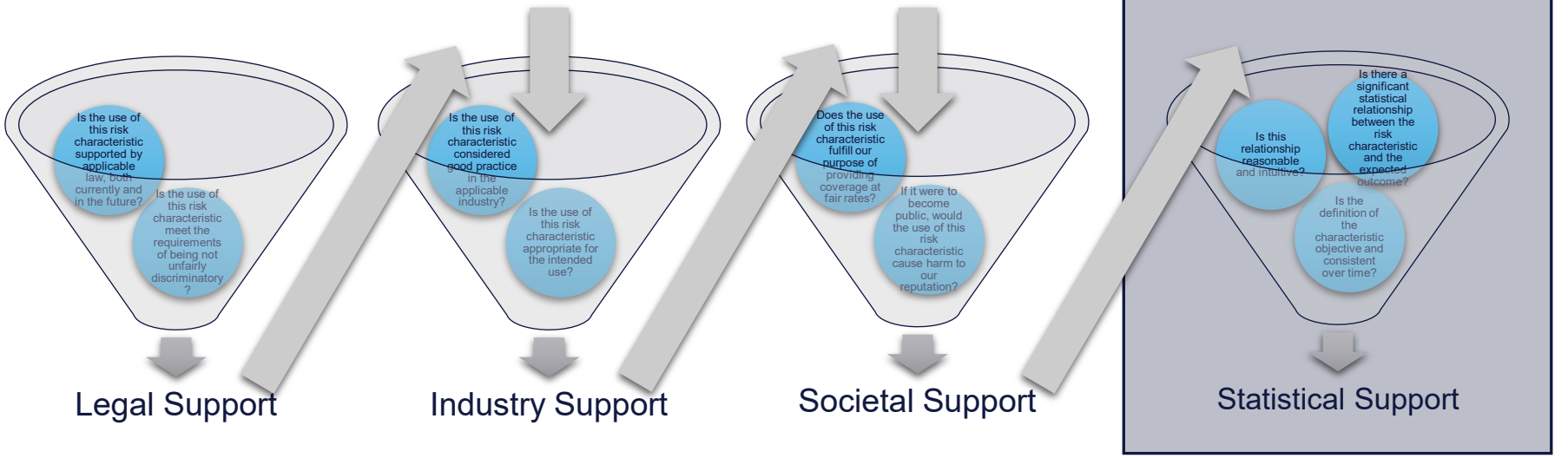
Considerations in Initial Variable Selection



Pre-Modeling Variable Selection

Sequential Decision-Making

- Variables that do not have legal, industry, or societal support should not be evaluated from a statistical perspective, nor should they enter the analytical models or systems

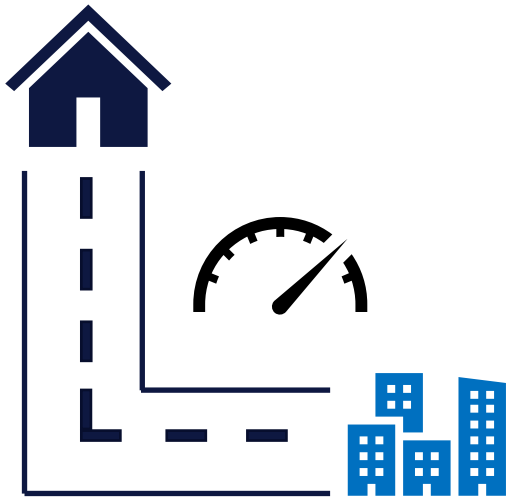


While this approach seeks to prevent the use of proxies of protected classes, we recognize that it does not ensure that the models will be free from disparate effects

Risk Classification Examples

Variable	Legal Support	Societal Support	Statistical Support	Included in Model?
Household % by Race	☒	☒	?	☒
Occupation % in Census Block	☒	☒	?	☒
Average Annual Property Tax	☑	☒	☑	☒
% Commute Within 60 miles	☑	☑	☒	☒
Population Density	☑	☑	☑	☑
Replacement Cost Estimate	☑	☑	☑	☑

Trends in Auto Geographic Rating



Refining through Telematics/Usage Based Insurance location information

- Typical approach assesses risk based on where the vehicle is **garaged/parked**
- With a connection to the insured/vehicle, risk can be assessed based on where the vehicle is **actually being driven** (starting point, stopping point, path taken)
  - Can also help inform the customers of traffic, construction, hazardous conditions, etc to be aware of on their route

Increased risk segmentation for more accurate risk assessment

- By better capturing other types of risk effects (e.g. driving behavior through telematics), the geographic effect can be more confidently and accurately captured
- Long standing Actuarial principle of creating more homogenous groupings of risk – meaning the risk are more similar and have less variation within a risk classification

Trends in Homeowners Geographic Rating

Aerial Imagery

- Features derived from aerial images can indicate potential risks of the individual property or surrounding area
  - Identification of these features can help insurers provide appropriate coverage
  - Can also be used to help alert customers to potential dangers and inform mitigation efforts

Location Score

- Aggregation of highly granular location data such as:
  - Soil conditions
  - Elevation / landforms
  - Slope
  - Landcover

Questions?