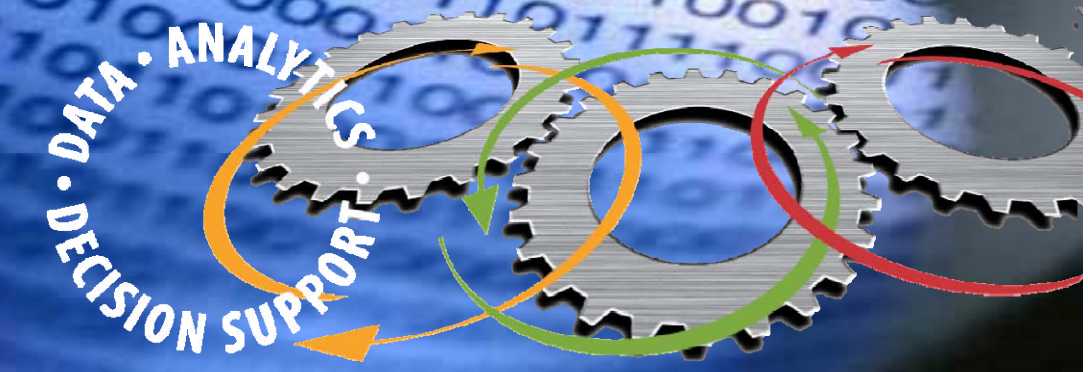
Estimating Loss Cost at the Address Level
Ratemaking Implications



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Estimating Loss Cost at the Address Level
Ratemaking Implications

- Comparison to other geographic ratemaking methods
- Credibility in local prediction
- Extending “Lift” concept to geographic ratemaking
- Address level modeling by peril
  - Implications for traditional rating variables in Homeowners

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Geographic Ratemaking
Method 1 – Local Loss Experience

- Based on losses directly associated with specific geographic area
- Credibility is based on volume of data within the area
- Credibility-weight with loss experience in surrounding areas
- In order to get meaningful rate differential, tends to result in larger territories

Geographic Ratemaking Method 2 – Local Residual

- GLM-based implementation of Method 1
- Calculate geographic residuals from GLM model using other rating variables as predictors
- Rate indication based on smoothed clustered residual data – credibility considered here
- Geographic component is “what’s left over” – no true attempt at prediction

Geographic Ratemaking Method 3 – Local Prediction

- Predictive model of local losses based on local characteristics, controlling for rating variables
- Indications are driven by predictive local loss-related characteristics
- No explicit credibility calculation
  - Directly evaluate accuracy of predictions
- Residuals are not used in indications

Distinctions

	Traditional Methods	Local Prediction
Basis of Loss Estimates	Losses (or Residual Losses) associated with local area	Characteristics of local area that are predictive of losses
Area Considered	Local area plus surrounding areas to reach credibility	All areas with loss and local characteristic data
Credibility Considerations	Volume of data (exposures or losses)	Accuracy of prediction
Residual Losses	Absorbed/smoothed into local loss estimates	Used for model diagnostics

Improving Accuracy by Combining Geographic Ratemaking Methods

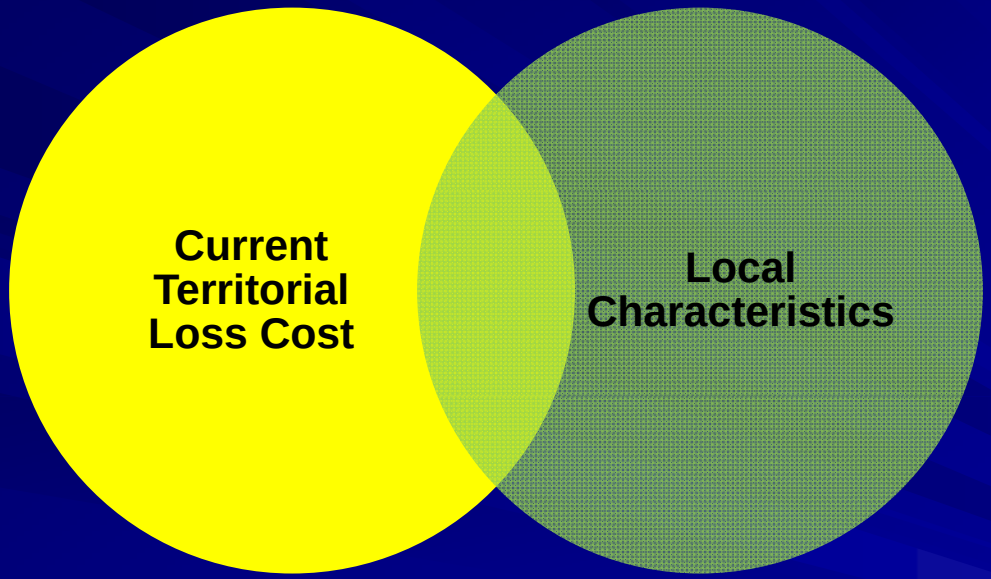
- Strengths of Local Prediction Methods
  - Predictive models based on local characteristics
  - Statistical measures of prediction accuracy
- Important Strength of Traditional Methods
  - Directly considers all loss data in an area, including losses not explained by predictive model

Improving Accuracy by Combining Geographic Ratemaking Methods

- Use traditional territorial loss cost as predictor variable in models
  - Enables model to capture effects not identified by other predictor variables
  - Helps to “true up” model predictions with traditional estimates
- Need to be aware that some effects of predictor variables may already be embedded in current territory loss costs

Improving Accuracy by Combining Geographic Ratemaking Methods

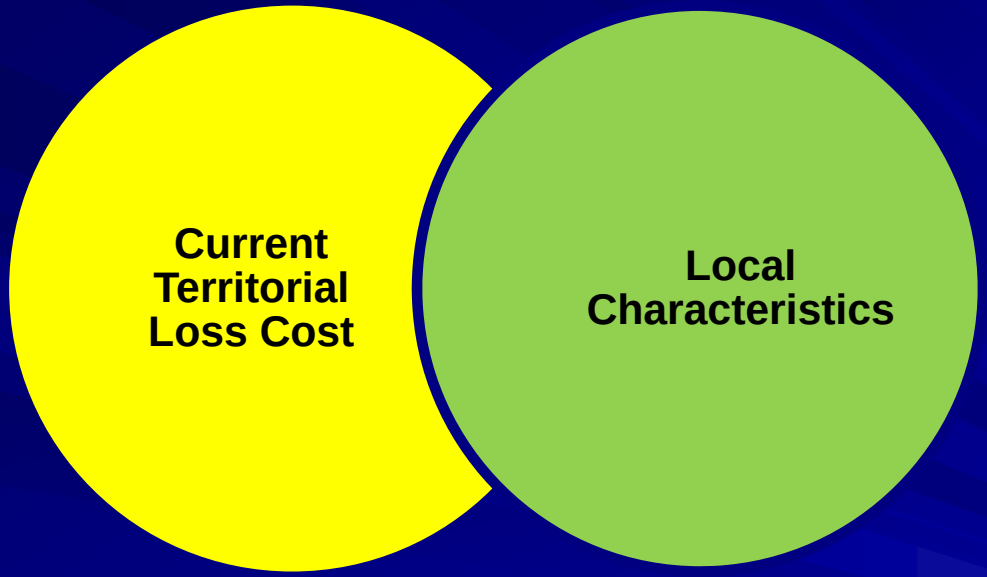
- Shared Predictive Effects



- Multivariate methods can address the overlap without double counting

Improving Accuracy by Combining Geographic Ratemaking Methods

- Separated Predictive Effects – Same Prediction



- Estimate the portion of current loss cost not explained by other predictors
- Use “Loss Cost Residual” as predictor

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Credibility

Statement of Principles regarding P&C Insurance Ratemaking (adopted 1988)

Credibility is a measure of the predictive value that the actuary attaches to a particular body of data. Credibility is increased by making groupings more homogeneous or by increasing the size of the group analyzed. A group should be large enough to be statistically reliable. Obtaining homogeneous groupings requires refinement and partitioning of the data. There is a point at which partitioning divides data into groups too small to provide credible patterns. Each situation requires balancing homogeneity and the volume of data.

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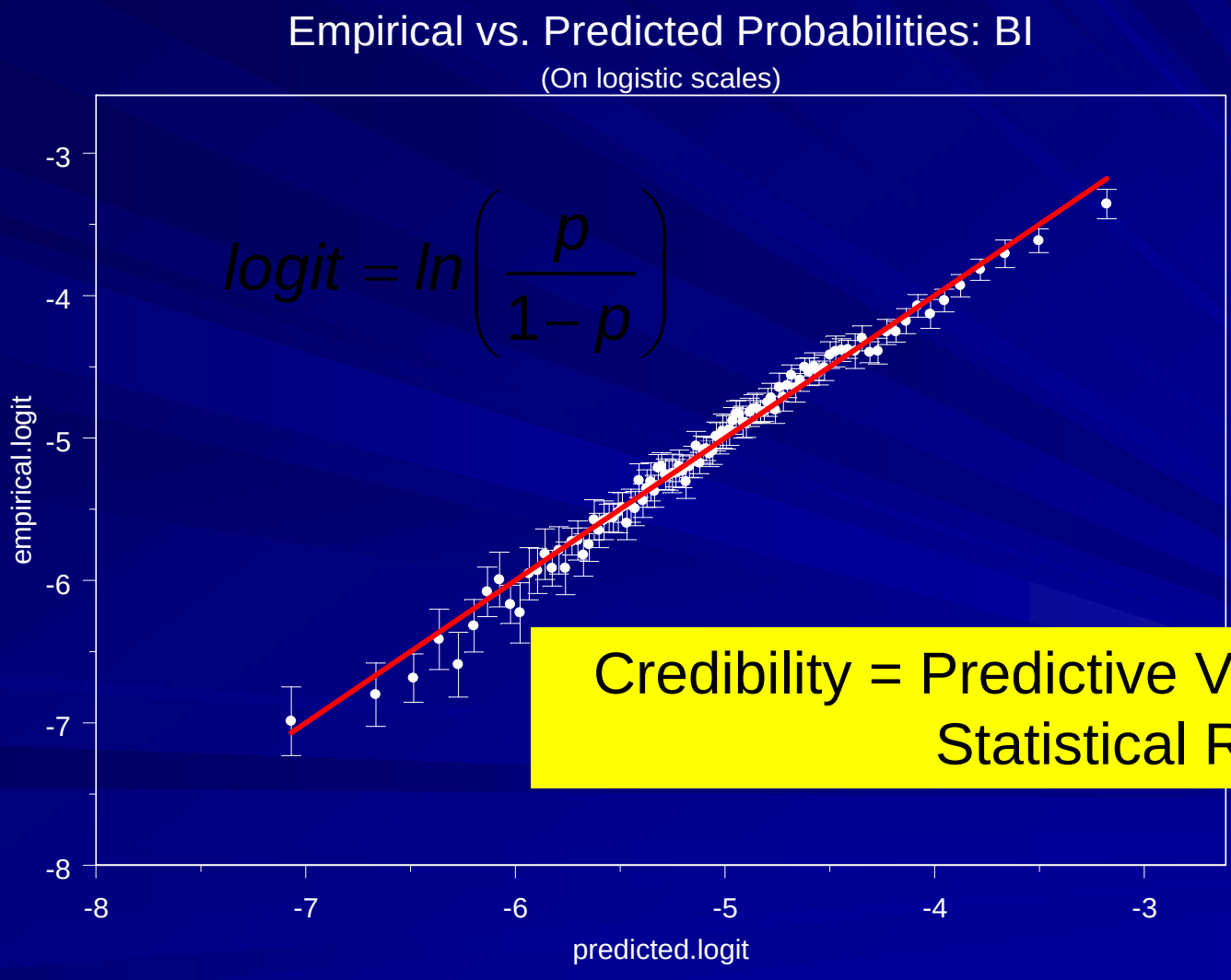
Overall Diagnostics - Frequency



Credibility = Predictive Value and Statistical Reliability

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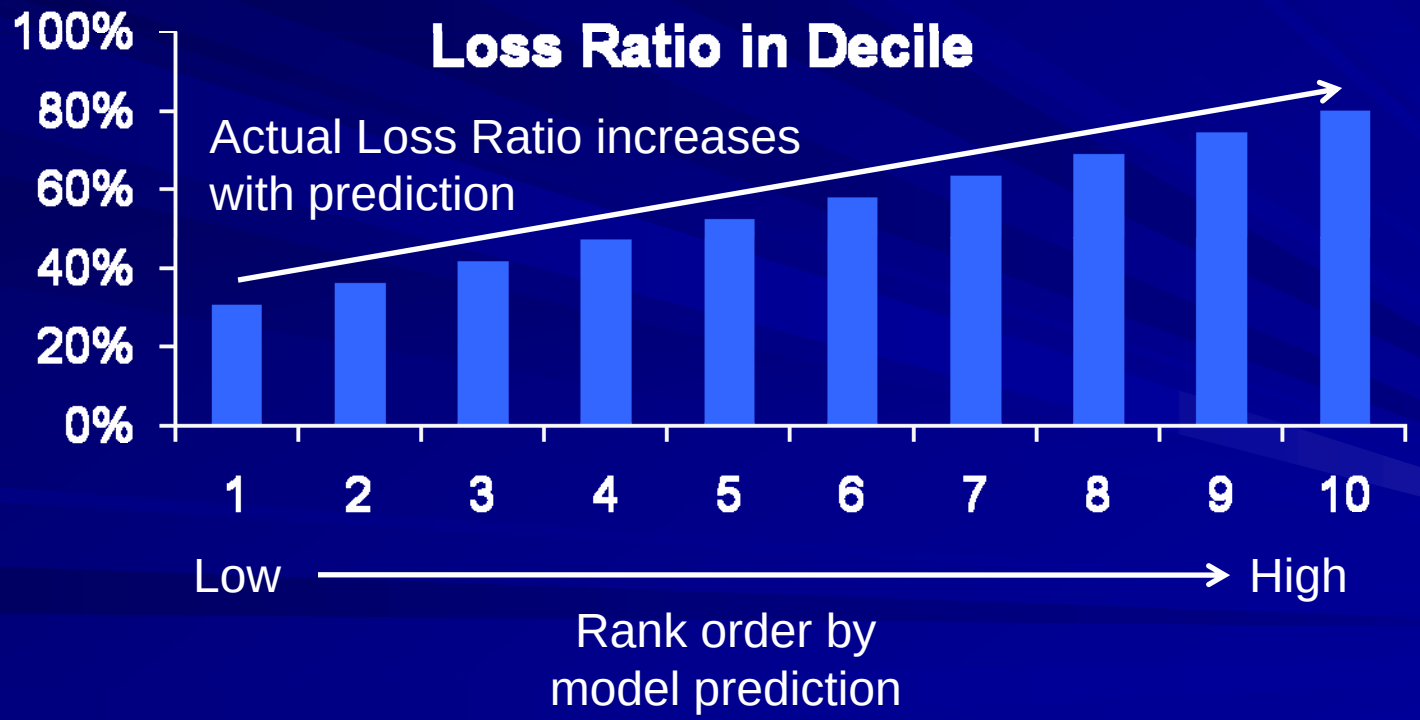
Extending the "Lift" Concept

- Familiar concept in predictive modeling to demonstrate segmentation



Extending the “Lift” Concept

- Key Question for Geographic Ratemaking
  - What do you use to rank order?
- Possible Alternatives
  - Model Prediction of Loss Cost
    - Natural extension of other predictive models
    - Neglects that some segmentation already exists in current territory differentials
  - Relativity to Current Territory Loss Cost
    - Better measure of what model adds to segmentation

Evaluating Lift

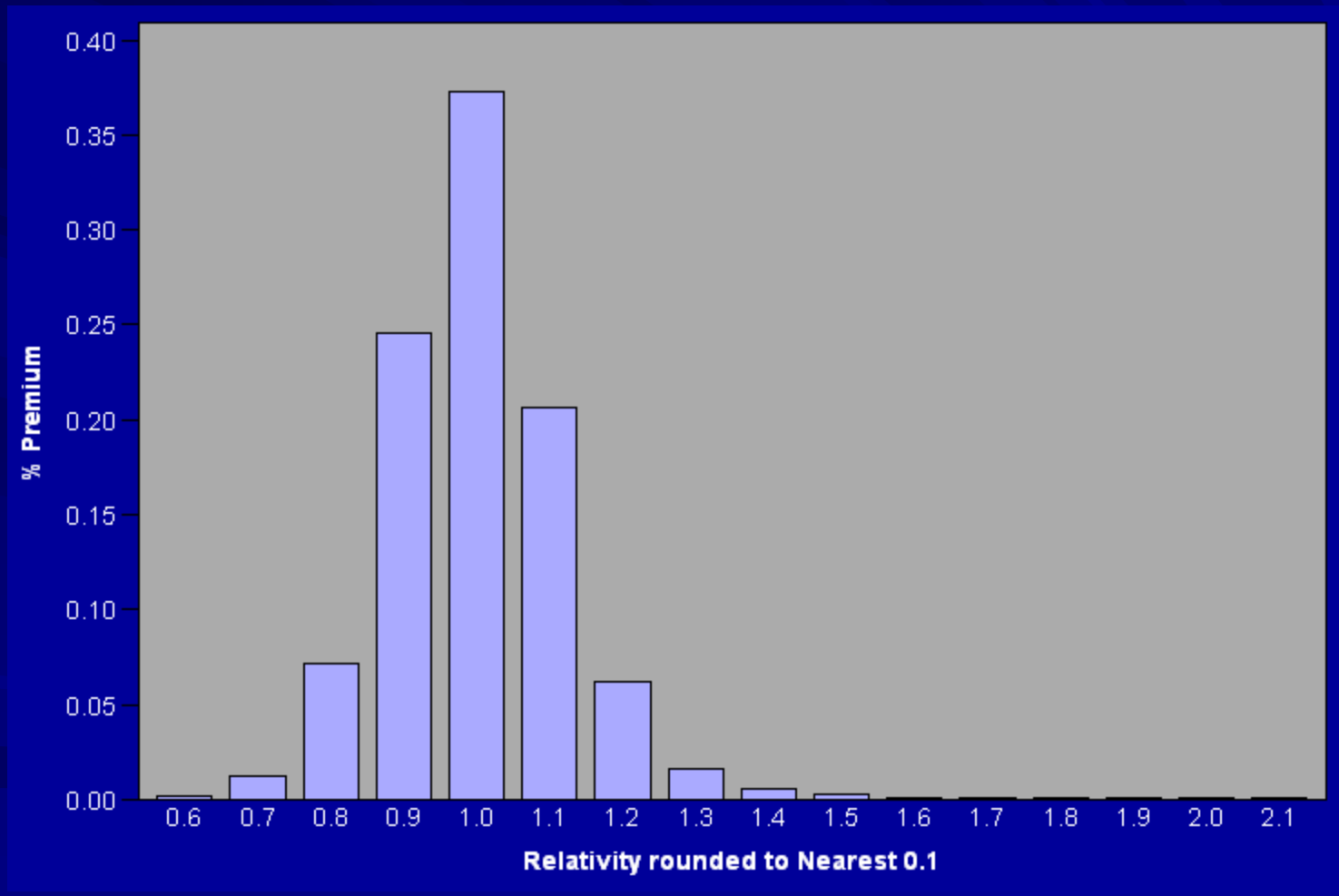
- Model output is deployed to a base class, standard limits and deductibles.
  - **Similar to current loss cost, but at garaging address rather than territory.**
- Define:

$$\text{Relativity} = \frac{\text{Model Output}}{\text{Current Loss Cost}}$$

Relativity is proportional to premium that could be charged with “refined loss costs” using the model output.

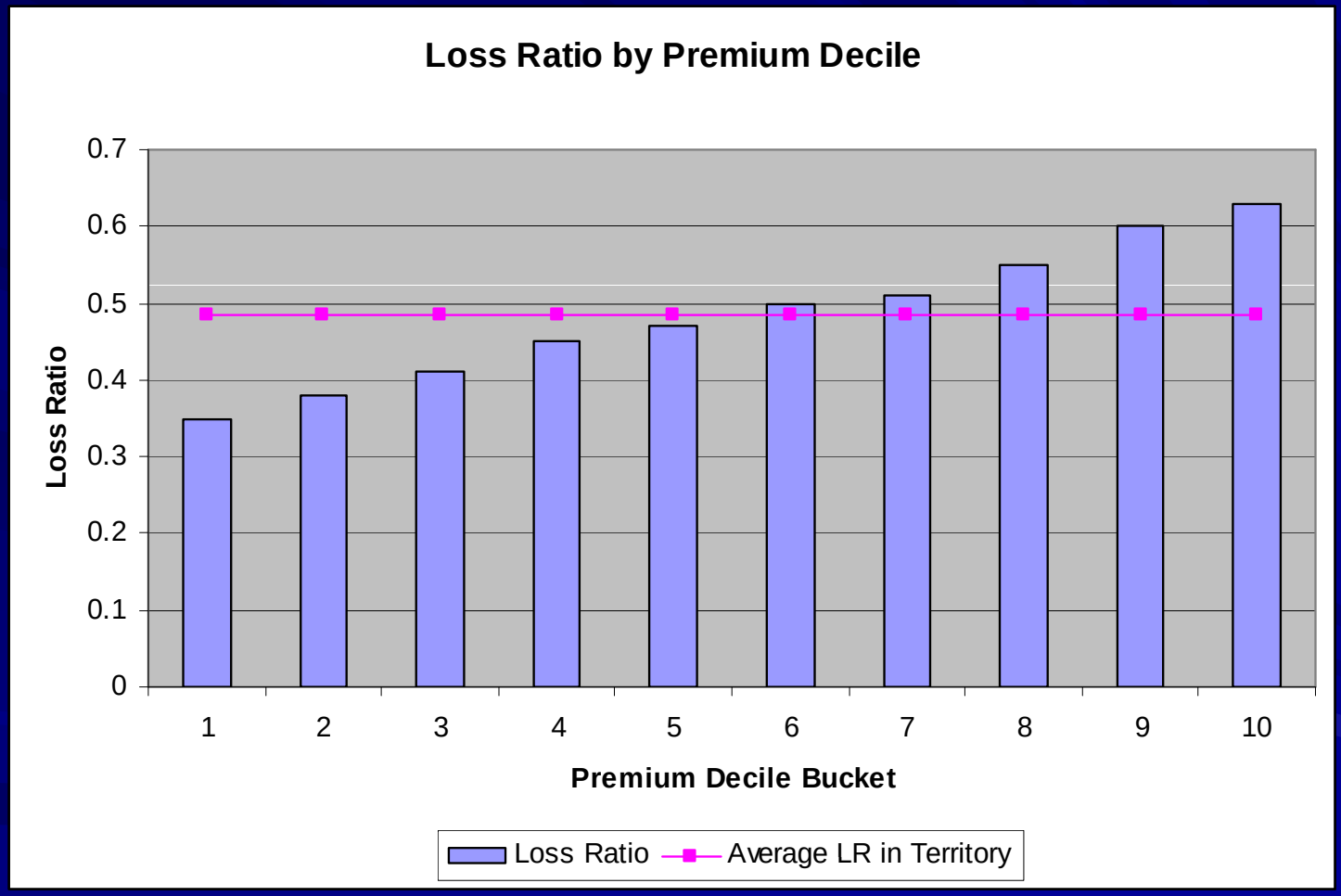
Evaluating Lift

Relativity within Territory



Evaluating Lift

Decile Chart by Relativity



Value of Lift (VoL)

- Assume a competitor comes in and takes away the business that is less than your class average.
- Because of adverse selection, the new loss ratio will be higher than the current loss ratio.
- *What is the value of avoiding this fate?*
- VoL is proportional to the difference between the new and the current loss ratio.
- May express the VoL as a $ per car year.

Value of Lift
Personal Auto Environmental Module

Coverage	Value of Lift
Bodily Injury	$4.99
Property Damage	$3.63
Collision	$1.61
Comprehensive	$4.85
Personal Injury (PIP)	$15.04
Combined	$13.29

Based on holdout sample of all coverages industry data (4.5 million records)

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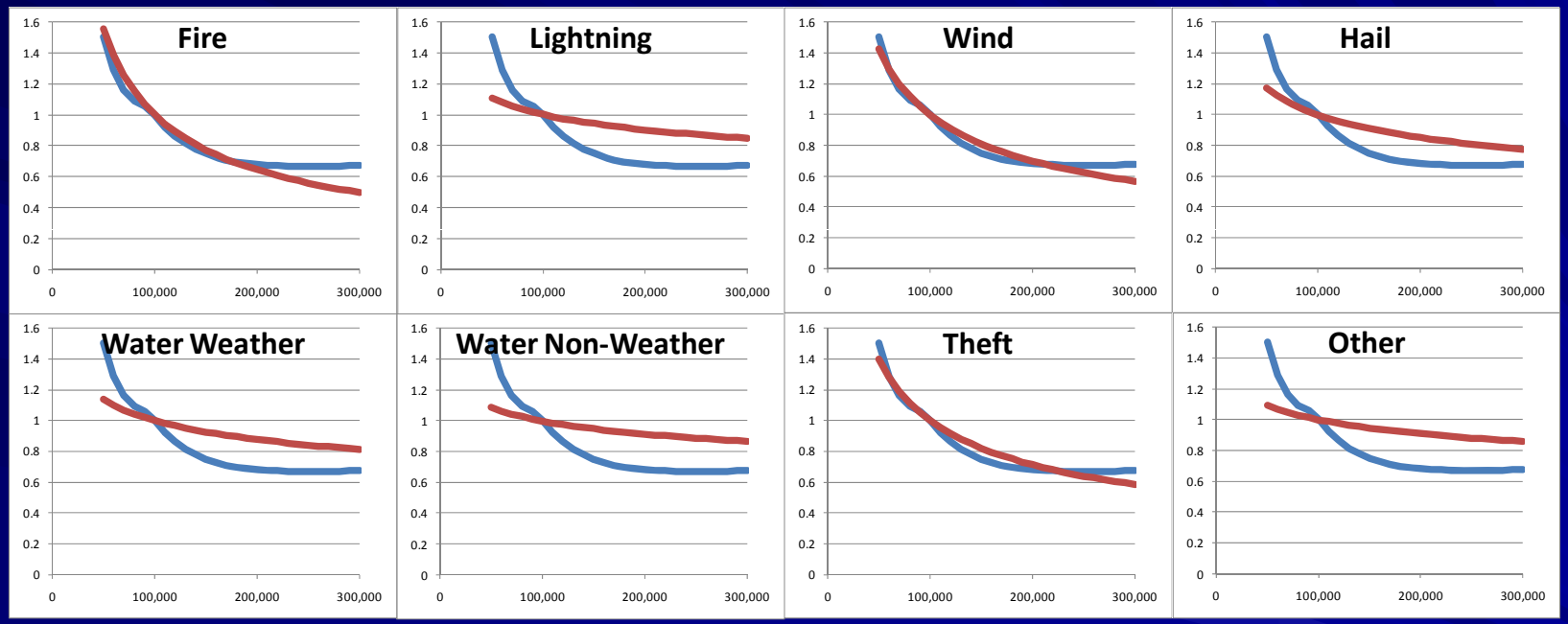
Address Level Modeling by Peril

- Certain rating variables have differing impacts by peril
  - Examples
    - Amount of Insurance
    - Deductible
- Address Level Modeling by Peril adds accuracy, but also complexity for these variables

Amount Relativities by Peril

Loss Cost per $1000 of Building Coverage



- Significant variation by peril

Amount Relativities by Peril

- Relativities that vary by peril provide lift
- Adds accuracy and complexity
  - All-peril relativities can be derived from peril-based relativities according to peril mix within the area
  - Local Prediction by peril may result in varying peril loss costs at the address level
- Effectively produces all-peril amount relativities that vary at the address level

Summary

- Address Level Modeling has several ratemaking implications
  - Different approach to geographic ratemaking
  - Inclusion of predictive environmental factors
  - Statistical assessment of “credibility”
  - More detailed view of homeowners rating variables
- Significant opportunity for segmentation

Questions?

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