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2013 CAS Ratemaking and Product Management Seminar

Predicting the Unpredictable Commercial Line Business

Predictive Modeling Applications for Specialty Lines

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Agenda

- Overview Specialty Lines Insurance

- Challenges of Specialty Lines

- Modeling Approach and Considerations

- Examples of Data Mining and Predictive Modeling for Specialty Lines Pricing and Underwriting

- Conclusion

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Overview of Specialty Lines

- Pricing and underwriting vary greatly between Private vs. Public Companies

- Liability driven business with a wide range of coverages: EPL, D&O, E&O, Crime, etc.

- "Account/multiple" products vs. "single" product

- Products and coverage not uniform from one carrier to another

- Typically claims made policies, not occurrence

- Some regional and medium size carriers have niche focus on certain products and segments

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Unique Challenges for Specialty Line

- Very low frequency: on average, 1 claim per $100,000 premium compared to 5 claims per $100,000 for GL

- High severity: typical limits include $10M or close to claim limit

- Data credibility: much less data points compared to personal or standard commercial line. Not uncommon to have only a few thousand data points for modeling

- Long development patterns:
  - Strong upward case development
  - Late conversion of notice claims to real claims

- Data quality issues:
  - Less standardization
  - More missing information
  - More subjective factors
  - etc.

- For different products, patterns and factors are different: calling for separate modeling by product

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Modeling Approach

- Various modeling techniques can be used:
  - Regression
  - GLM
  - Neural Networks
  - Decision Trees
  - Etc.

- In Deloitte's experience, the better solution is to produce a linear scoring model
  - Regression/GLM technique

$$LR = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_NX_N$$

  - Advantages:
    - Stability of model results
    - Easy to explain
    - Easy to understand, not black box
    - "Ranking" models are less sensitive to distribution assumptions or non-linear patterns than non-ranking models

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Key Considerations

- Increase credibility of modeling dataset and modeling result:
    - Use more/create more data, i.e. Cross Validation
    - Less grouping of the variables
    - Use notice claim in addition to claim with $

- Increase the robustness of the modeling results:
    - Avoid complex modeling function
    - Bootstrapping, resampling, and multiple random splits
    - Pure premium/loss ratio modeling instead of frequency/severity modeling
    - Capping large loss impact
    - Avoid over-fitting

- Enrich with additional data sources and variables:
    - Territorial demographic information
    - Business financial and operational information
    - Legal and litigation information

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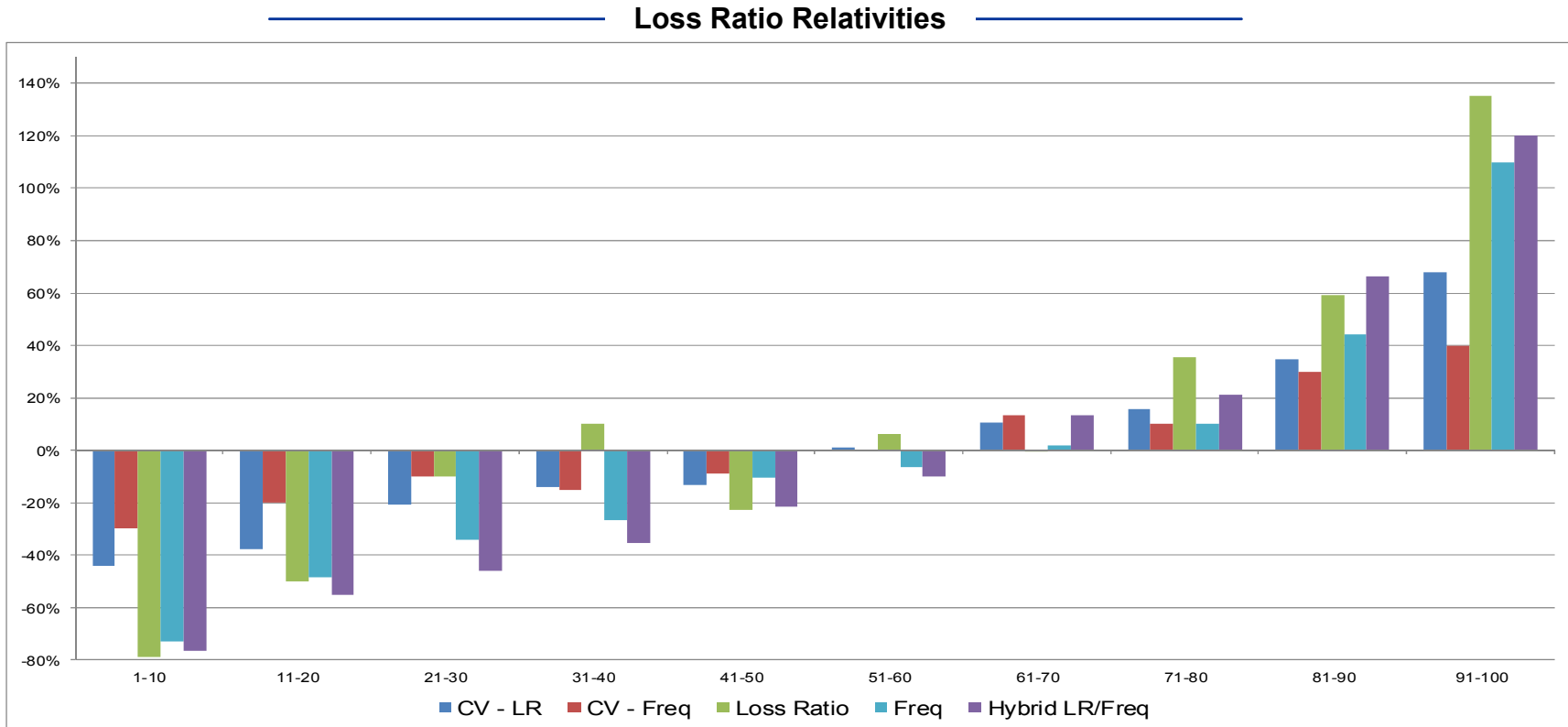
Modeling Approach – Cross Validation

When modeling data is thin, standard Train-Test-Validation approach may not be feasible. Use of Cross Validation technique will allow all data to be used to construct and test the model.

Cross Validation					
Model	**Modeling Data**				
	P1	**P2**	**P3**	**P4**	**P5**
M1	Test	Train	Train	Train	Train
M2	Train	Test	Train	Train	Train
M3	Train	Train	Test	Train	Train
M4	Train	Train	Train	Test	Train
M5	Train	Train	Train	Train	Test

– Data is randomly split into 5 bins (P1-P5)

– Model M1 is fitted P2-P5 and used to score P, Model M2 is fitted on P1 and P3-P5 and used to score P2, etc.

– P1 to P5 test scores are put together to create a lift curve

– All data points were used to fit the model, and at the same time all data points were used to test the model.

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Modeling Approach – Loss Ratio Evaluation

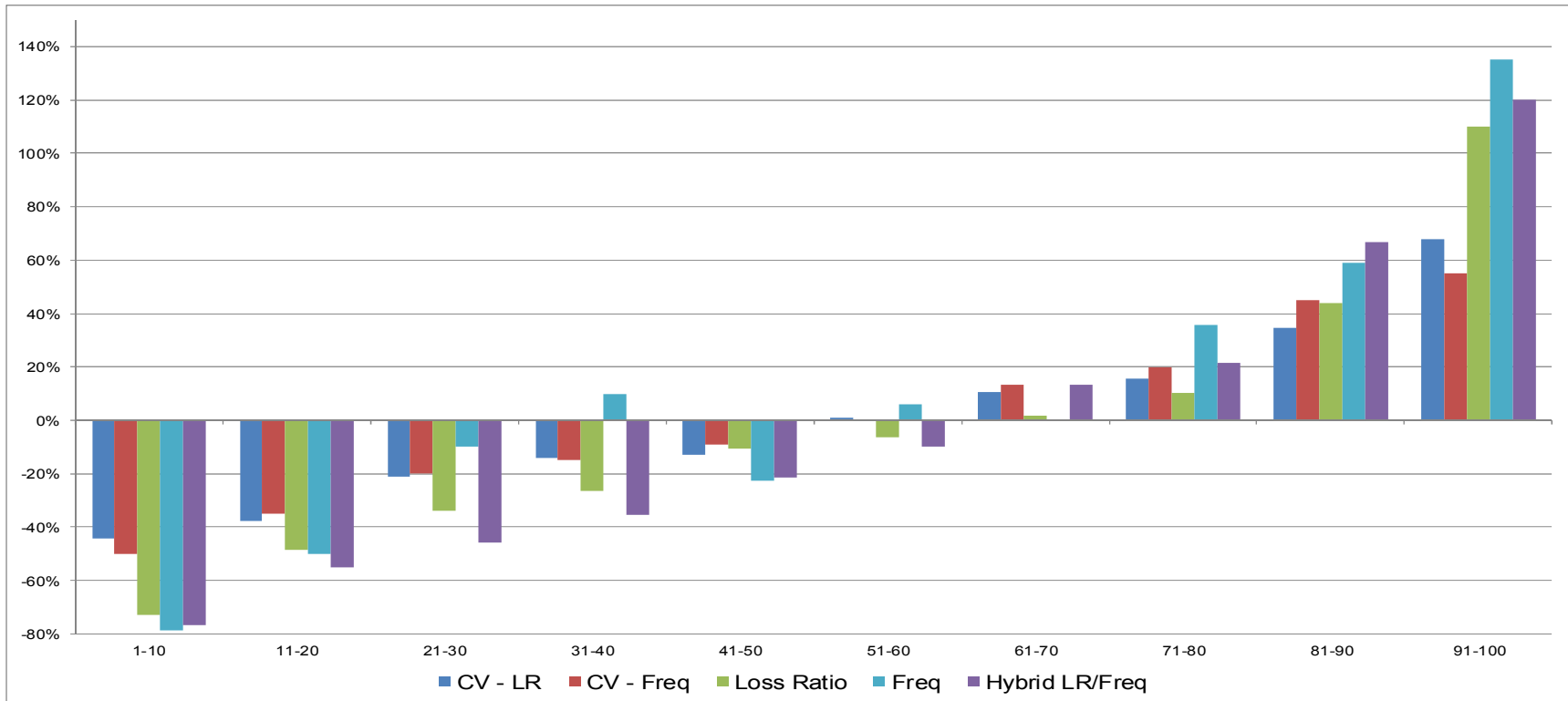Evaluate loss ratio relativities across different models.

Loss Ratio Relativities

- – Lift reversals will exist
- – Focus on trend
- – Look for consistency

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Modeling Approach – Frequency Evaluation

Evaluate frequency relativities across different models.

Frequency Relativities

– Look for consistency between frequency and loss ratio relativity patterns

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Conclusion

- Given the many different modeling techniques, regression/GLM performs sufficiently

- Objectively evaluate a wide range of modeling approaches across different evaluations

- Lack of modeling data can be overcome with use of cross validation approach

- With careful model design, segmentation can be achieved for Specialty Lines

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