Deloitte.

2014 CAS Ratemaking and Product Management Seminar, CL-2

Predicting the Unpredictable Commercial Line Business

Predictive Modeling Applications for Specialty Lines

Denys Lebedev, Sr. Consultant, Deloitte Consulting LLP

Washington DC

March 31st, 2014

Anti-Trust Notice

- The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.

- Under no circumstances shall CAS seminars be used as a means for competing companies or firms to reach any understanding – expressed or implied – that restricts competition or in any way impairs the ability of members to exercise independent business judgment regarding matters affecting competition.

- It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.

Agenda

- Overview of modeling specialty lines
- Challenges of modeling specialty lines
- Modeling approach and considerations
- Examples of model evaluation
- Conclusion

Overview of Modeling Specialty Lines

- Liability driven business with a wide range of coverages: EPL, D&O, Crime, Fiduciary, E&O, etc.
- Products and coverage not uniform from one carrier to another
- Pricing and underwriting vary greatly between Private vs. Public Companies
- “Account/multiple” products vs. “single” product
- Presence of multi-year policies
- Typically claims made policies, not occurrence
- Presence of complex reinsurance contracts

Challenges of Modeling Specialty Lines

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

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
  - GLM technique with *link* = *log* and *distr* = *Tweedie*

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

  - Advantages:
    - Stability of model results
    - Easy to understand, not black box
    - Easy to explain
    - "Ranking" models are less sensitive to distribution assumptions or non-linear patterns than non-ranking models
- Loss ratio adjustments:
  - Use developed trended incurred loss and expense capped at policy limit
  - Use on-leveled "basic limit" manual premium

Key Considerations for Modeling

- 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

- Increase credibility of modeling dataset and modeling results:
  - Use more / create more data: consider cross validation technique
  - Use notice claims in addition to claims with $ amounts

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

Use of Cross Validation Technique

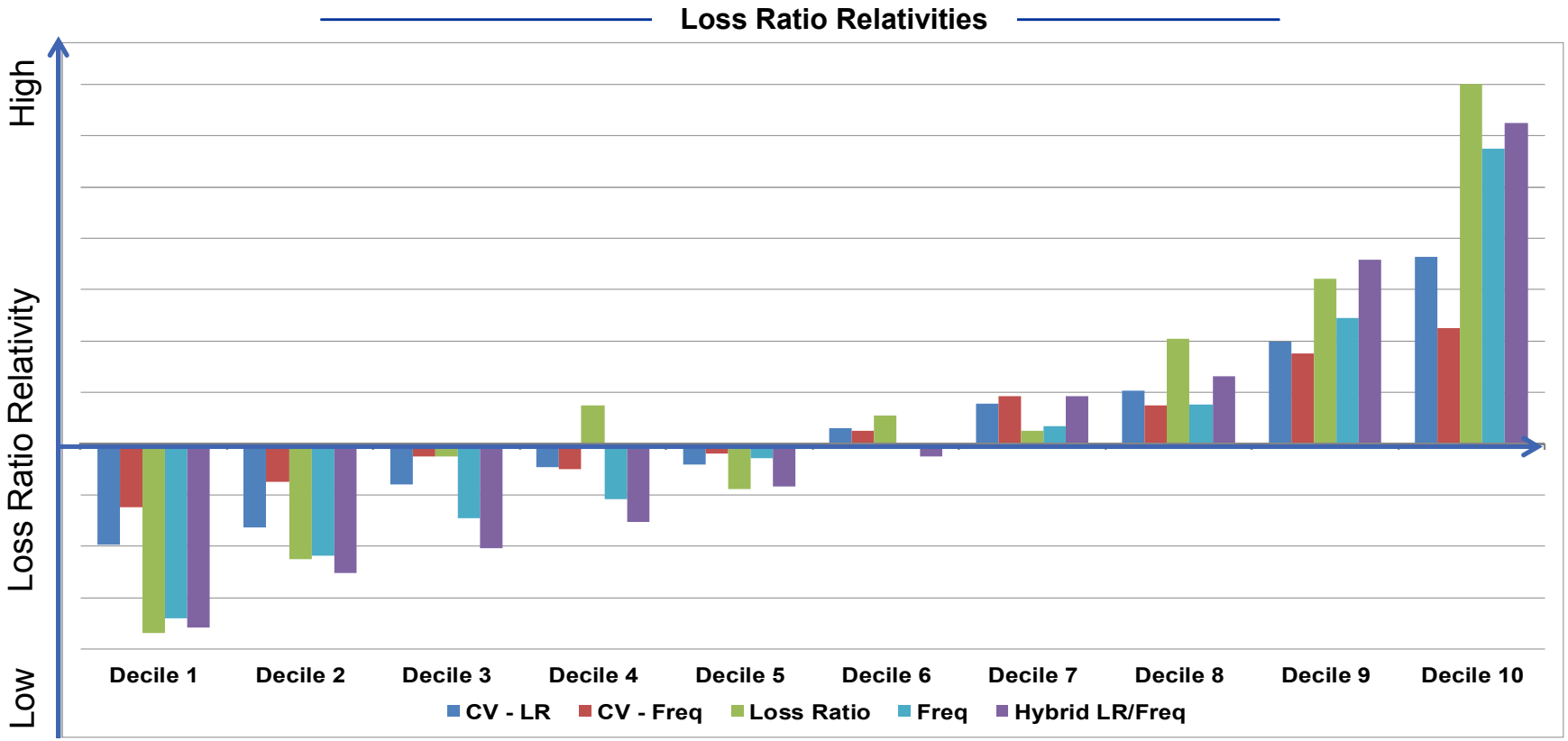
When modeling data is thin, standard Train-Test-Validation approach may not be feasible. Use of Cross Validation technique will allow all data to be used to construct and test the model.

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 P1, 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.

Model Performance Evaluation – Loss Ratio

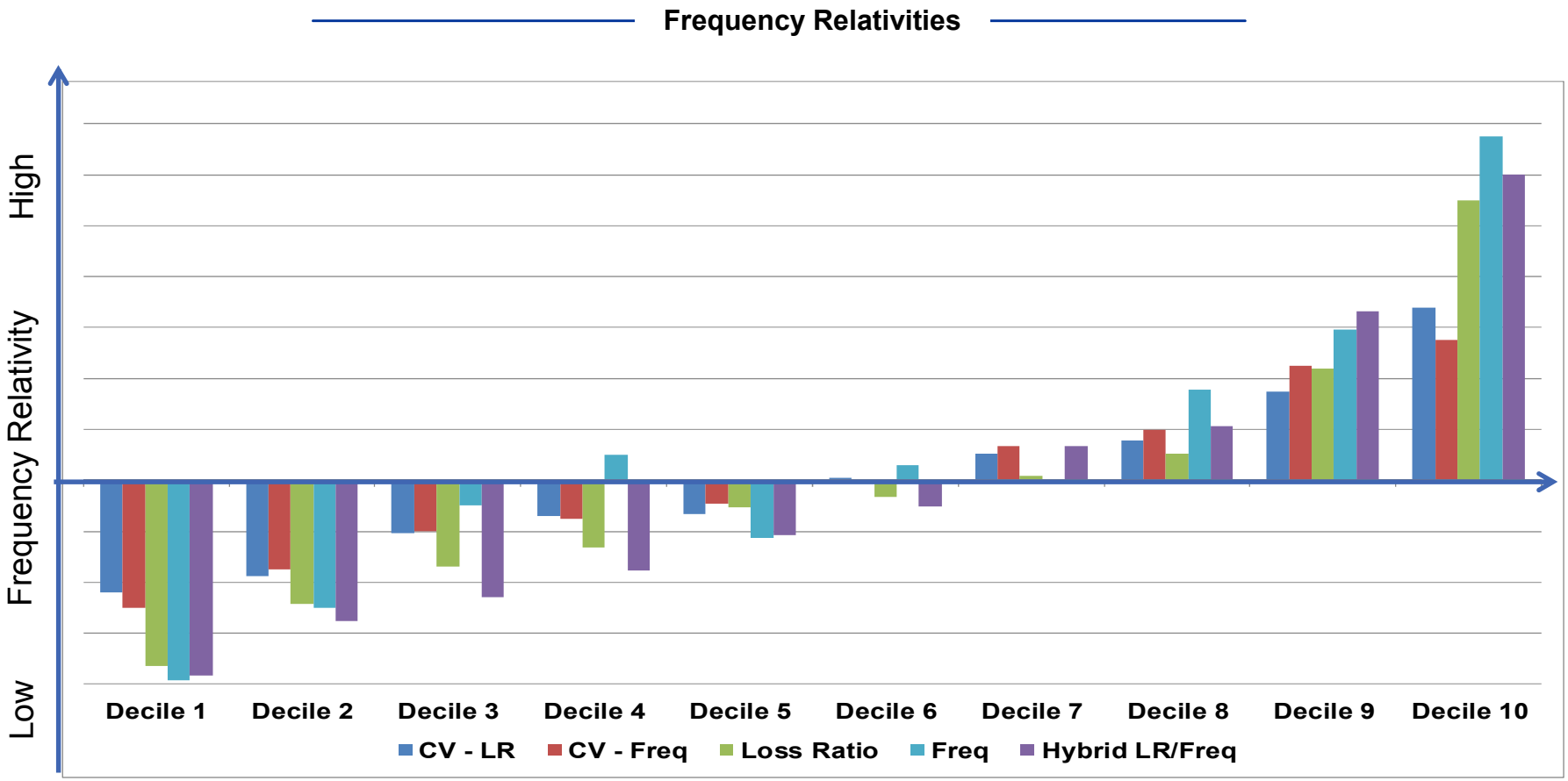
Evaluation of loss ratio relativities across different models



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

Model Performance Evaluation – Frequency

Evaluation of frequency relativities across different models



– Look for consistency between frequency and loss ratio relativity patterns

Conclusion

- Given the many different modeling techniques, regression/GLM performs sufficiently
- Lack of modeling data can be overcome with use of cross validation approach
- A modeler needs to objectively evaluate different aspects of model's performance
- With careful model design, segmentation can be achieved for specialty lines

About Deloitte

Deloitte refers to one or more of Deloitte Touche Tohmatsu, a Swiss Verein, its member firms, and their respective subsidiaries and affiliates. Deloitte Touche Tohmatsu is an organization of member firms around the world devoted to excellence in providing professional services and advice, focused on client service through a global strategy executed locally in over 140 countries. With access to the deep intellectual capital of approximately 150,000 people worldwide, Deloitte delivers services in four professional areas — audit, tax, consulting, and financial advisory services — and serves more than 80 percent of the world's largest companies, as well as large national enterprises, public institutions, locally important clients, and successful, fast-growing global companies. Services are not provided by the Deloitte Touche Tohmatsu Verein, and, for regulatory and other reasons, certain member firms do not provide services in all four professional areas.

As a Swiss Verein (association), neither Deloitte Touche Tohmatsu nor any of its member firms has any liability for each other's acts or omissions. Each of the member firms is a separate and independent legal entity operating under the names "Deloitte," "Deloitte & Touche," "Deloitte Touche Tohmatsu," or other related names.

In the United States, Deloitte & Touche USA LLP is the U.S. member firm of Deloitte Touche Tohmatsu and services are provided by the subsidiaries of Deloitte & Touche USA LLP (Deloitte & Touche LLP, Deloitte Consulting LLP, Deloitte Financial Advisory Services LLP, Deloitte Tax LLP, and their subsidiaries), and not by Deloitte & Touche USA LLP. The subsidiaries of the U.S. member firm are among the nation's leading professional services firms, providing audit, tax, consulting, and financial advisory services through nearly 40,000 people in more than 90 cities. Known as employers of choice for innovative human resources programs, they are dedicated to helping their clients and their people excel. For more information, please visit the U.S. member firm's Web site at www.deloitte.com