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Discussion of Using "Tiers" for Insurance Segmentation from Pricing, Underwriting and Product Management Perspectives

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Tier Rating is started from Personal Lines Rating

- Tier rating originated from personal lines in middle 1990s

- One reason for tier rating application is to integrate a wider range of "non-traditional" rating variables to improve risk segmentation and to increase pricing points:
    - **Credit**
    - **Liability symbol**
    - **Variable interactions. Specifically, interaction between traditional variables and non-traditional variables**
    - **etc**

- Another reason is for flexibility in managing state specific regulation requirements:
    - **Credit**
    - **Not-At-Fault Accidents**
    - **etc**

- To simplify the rating structure

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A Challenge for Personal Lines Product Management

While the fast development of modern rating plans significantly improves the rating accuracy and rating complexity, it also causes challenges for insurance industry:

- Disruption challenges
  - New rating plans may cause a significant book disruption for renew business
    - Capping the price change within x%, but some states may not allow such capping
    - Before the capping is fully un-winded, a new rating plans may kick in
    - Difficult to explain to policyholders for the causes of price change
    - Difficult to track changes
  - It is fairly common that new rating plans are implemented for new business only

- Version control and maintenance challenges
  - Different states may require different rating variables according to the state regulations.
  - Version control challenges for IT production, filing, rating manuals, book analysis etc.
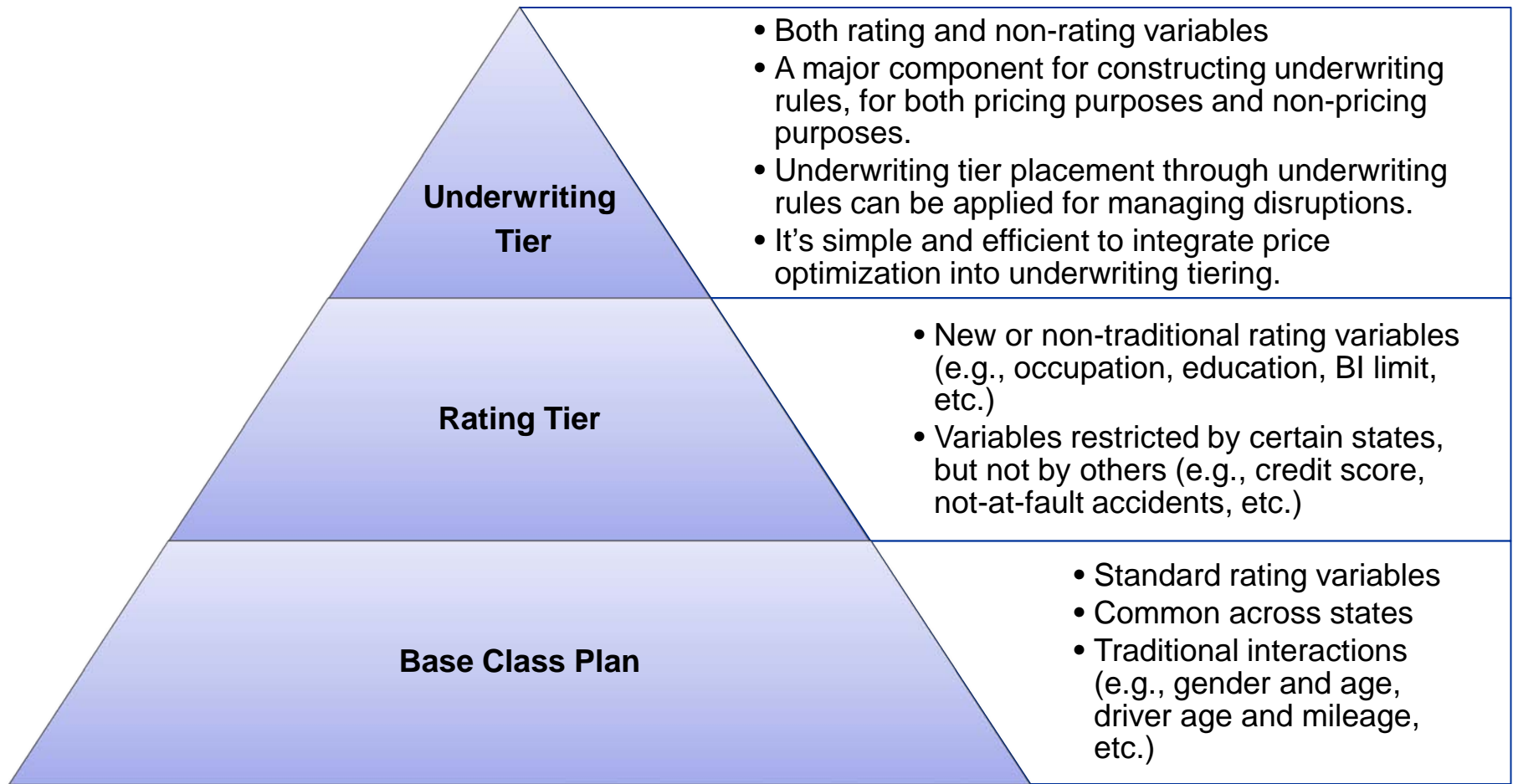
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Underwriting Tiers

- Outside of the manual and class rating

- A wider range of variables can be used, rating, non-rating, traditional, non-traditional, etc

- Many states don't require filing approval for underwriting tiers

- One writing company can have multi underwriting tiers

- On policy level and only differ on base rate between tiers – use underwriting tiers within writing companies to further expand the base rate range

- Can be used to manage disruption through underwriting tier placement

It is more efficient to apply both rating tiers and underwriting tiers to achieve an optimal personal line insurance pricing and product management

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A Double Tier Approach

A three layers pyramid structured approach is applied for improving pricing accuracy and underwriting efficiency

Underwriting Tier
- Both rating and non-rating variables
- A major component for constructing underwriting rules, for both pricing purposes and non-pricing purposes.
- Underwriting tier placement through underwriting rules can be applied for managing disruptions.
- It's simple and efficient to integrate price optimization into underwriting tiering.

Rating Tier
- New or non-traditional rating variables (e.g., occupation, education, BI limit, etc.)
- Variables restricted by certain states, but not by others (e.g., credit score, not-at-fault accidents, etc.)

Base Class Plan
- Standard rating variables
- Common across states
- Traditional interactions (e.g., gender and age, driver age and mileage, etc.)

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Rating Tier Vs. Underwriting Tier

Rating Tier Scoring

- By coverage, on exposure level

- Target – Loss Cost or Loss Ratio

- For Improving accuracy of point estimations

- Same for new business and renew business

- Only using rating variables, missing value not allowed

- Implementation – Applied for building rating tiers. Directly used in rating manual

Underwriting Tier Scoring

- On policy level

- Target – Loss Ratio

- For UW profitability segmentation

- Different for new business and renew business

- Using both rating and non-rating variables, missing value allowed

- Implementation (PL) – Further differentiating base rates with flexible tier placement. Improve UW efficiency.

- Implementation (CL) – Incorporating with schedule mod for balancing UW efficiency and pricing flexibility

Tier Applications in P&C Insurance – Rating & Underwriting

4 Major Categories

Personal Lines Rating Tiering

Personal Lines Underwriting Tiering

Commercial Lines Rating Tiering

Commercial Lines Underwriting Tiering

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Commercial Lines Rating Tiers: An Example for BOP

4 Tier Variables

Number of Losses:
- None
- 1
- 2
- 3+

Size of Losses:
- <=$5,000
- >$5,000

Years in Business:
- 0-1
- 2-4
- 5-15
- 16-20
- 21+

Account Size Threshold:
- Apartment - 2.4M
- Condo - 4.1M
- Office – 1.5M
- Commercial Condo- 4.3M
- Contractors – 0.1M
- Business -1.2M
- Relagious-2.2M
- Garage – 0.469M
- ……

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Commercial Lines Rating Tiers: An Example for BOP

- Loss ratio was used as the target to calculate tier relativities, that means the rating tiers are created in the residual of the other rating variables

- 3 interactive variables are constructed using the 4 tier elements
  - Interaction of number of losses and size of losses
  - Interaction of years in business and number of losses
  - Interaction of years in business and account size by industry group

- More than 40 rating tiers are defined using the loss ratio relativities of the 3 interactive variables.

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Commercial Line Rating Tiers: An Example for BOP

- Different with PPA, the number of losses in the tier structure is not normalized by exposure.

- Similar to number of losses, size of losses is also different by industry group.

- the tier factors are widely spread from 0.52 to 2.85
  - ❖ The tier distribution could be biased by industry group & policy size;
  - ❖ The tier factors are calculated by factorization.

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Commercial Line Underwriting Tier Score

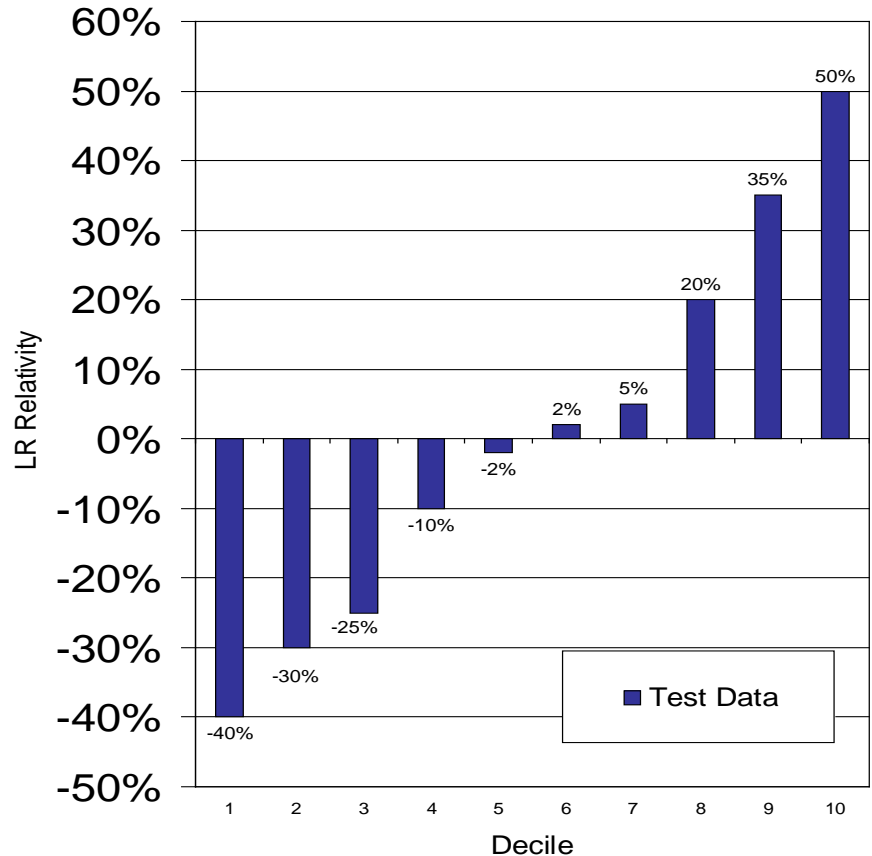- An underwriting scoring system can be generated based on a linear scoring model:

  Underwriting Tier Score $= \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_N X_N,$

  Where $X_1, X_2 \ldots X_N$ are selected underwriting variables

- An underwriting score is applied to differentiate profitability that goes beyond a given commercial line rating plan. Therefore, loss ratio is an obvious target variable for the creation of the score.

- For a commercial line operations, loss ratio lift curves are computed based on underwriting score to support schedule modifications and underwriting tiers.

Commercial Line Underwriting Score: A Lift Curve Sample

- Sort data by the underwriting score

- Break the data (test or validation) into 10 equal pieces
  - Best "decile": lowest score
  - Worst "decile": highest score

- In each decile, compute the *actual* loss ratio

- The spread in actual loss ratio is the "lift".

- Lift measures predictive power of the model

LR Relativity (y-axis), **Decile** (x-axis)

Values by decile: -40%, -30%, -25%, -10%, -2%, 2%, 5%, 20%, 35%, 50%

Legend: Test Data

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Commercial Line Underwriting Scoring

- Tier Score Elements

  - Loss experience variables

    - ✓ Claim Frequency = Number of Losses / Earned Premium

    - ✓ Loss Ratio = Incurred Loss / Earned Premium

    - ✓ Claim Frequency of No Loss Claims

    - ✓ By different prior year

    - ✓ Claim Reporting Lag

    - ✓ Indicator for Claim on Weekend or Holidays (Significant for WC)

  - Other frequently selected tier score elements

    - ✓ Policy variables

    - ✓ Agency variables

    - ✓ Whether variables

    - ✓ Demographic variables

    - ✓ Credit variables

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Two Types of Underwriting Tiering Variables

The algorithmic solution score is calculated by analyzing a variety of risk characteristics about each individual policy. These risk characteristics span a variety of different dimensions and are, in large part consistent with factors used in the underwriting process today.

Typically In UW Model →

- **Loss history (Renewal only)**
- **Zip code demographics**
- **Billing experience (Renewal only)**
- **Agency experience**
- **Policy age (Renewal only)**
- **Financial experience**
- **Vehicle characteristics (Auto)**
- **Building information (Property)**
- **Policy limits (Liability)**
- **Exposure complexity (WC)**

There are a number of predictive variables that are not used in the models but which could influence the decision process. It is not possible to list all of the variables, however consideration should be given to these factors.

Typically Out of UW Model →

- **Loss Control Reports**
- **Market Conditions**
- **What other insurers are likely competing for this risk**
- **Causes of historical losses**
- **Exposure to catastrophic losses**
- **Unique business characteristics**
- **Recent or emerging industry trends**

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Frequent Asked Questions on Commercial Lines Tiering

- Why the spread of underwriting model lift curves are narrower than the spread of rating tier factors?

- Should include rating variables in underwriting scoring?

  - **from a pricing perspective**

  - **from business implementation and state filing perspective**

- How to choose number of underwriting tiers based on underwriting scores and lift curves?

  - **Lift curve consideration**

  - **Tradeoff between pricing flexibility and low-touch/no-touch underwriting**

- How to handle writing companies and underwriting tiers?

- How to make the underwriting score based tiering to be harder for competitors to follow?

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