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Achieving Optimal Insurance Pricing through Class Plan Rating and Underwriting Driven Pricing

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by

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Agenda

- Three-Level Pricing Architect
- Personal Lines Pricing
- Commercial Lines Pricing
- Conclusions
- Q&A

Three-Level Insurance Pricing Architect

In general, the overall insurance pricing scheme can be classified into three levels of architect:

Three Levels Insurance Pricing Architect

- Level 1 – Basic rating plan
  - Primarily class plan driven
  - Objective pricing
  - Pricing on coverage/exposure level
  - Require regulatory filing and approval
- Level 2 - Underwriting driven pricing
  - Tiering, company placement, credits and debits, etc
  - Frequently pricing on policy or account level
  - Flexibility for allowing underwriters to adjust prices according to underwriting cycles and competitive environment
  - May not need regulatory approval
- Level 3 - Pricing optimization
  - Incorporate insured's price elasticity and competitive pricing position
  - Can be integrated with class plan rating or with underwriting pricing
  - Price optimization with class plan rating is more frequent for personal lines
  - Price optimization with underwriting pricing is more frequent for commercial lines

Personal Lines Pricing – Current Landscape

Structure for Level 1 and Level 2 Pricing

Basic Class Rating Plan (Auto):

- A Wide Range of Class Plan Variables
  - Driver characteristics
  - Vehicle characteristics
  - Coverage characteristics
  - Historical driving experience characteristics
  - Special factors and others
- State and territory base rate by coverage

Underwriting Driven Pricing (Auto):

- Multiple Writing Companies with Different Base Rates
  - Policy or account level characteristics – may overlap with the characteristics used for the class plan
  - Accept/Reject/Pool assignment
  - Company placement determined by the underwriting rules

Personal Lines Pricing – Current Landscape

- Predictive modeling techniques have been widely applied for personal lines pricing since early 1990s
  - GLM
  - Additional advanced modeling techniques, such as decision trees, non-linear modeling, etc
- Rating variables and rating structures
  - More non-traditional rating variables, such as credit and liability symbol
  - Complex variable interactions, driver age and vehicle types
  - More proprietary and "independent of bureau" rating variables, such as symbols and rating territory
  - As a result, more refined segmentation and pricing points in today's rating plans
- More challenges from regulatory review and approval process
- Frequent changes in rating plans due to updated data collection, new emerging data sources and variables, upgraded modeling techniques, and the frequent regulatory changes

Personal Lines Pricing - Challenges

While the fast development of today's 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, 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, etc

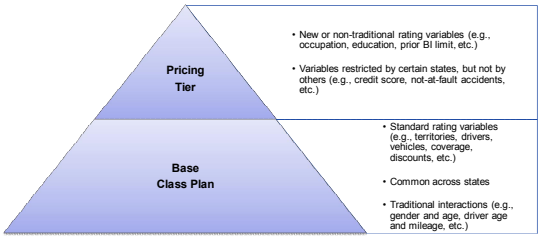
Personal Lines – Tier Pricing

A tiering approach can be a solution to address the challenges while maintaining complex rating products and competitive pricing:

- Assumption:
  - A countrywide base class plan with commonly used traditional class variables and parameters are fairly stable over long run.
- The design
  - Keep a countrywide base rating plan stable with minimal changes over time
  - Add pricing tiers on top of the base rating plan
  - New variables, creative variables, new designs, etc are part of the tier, but not part of the base class plan
  - Use "offset/residual" approach to determine the tier variables and tier factors
- Advantages
  - IT implementation becomes easier
  - Version control, rating plan maintenance, disruption control, etc require less effort
  - Easy to explain pricing changes to underwriters, product managers, regulators, and policyholders

Personal Lines – Tier Pricing

One approach for maintaining rate stability is to divide the entire rating plan into two parts: an underlying base class plan and a pricing tier on top of the base class plan



One major advantage of separating the base class plan and the pricing tier is the efficiency in managing the price changes and price disruption for individual risks.

Personal Lines – More about Tiers, Rating Tiers Vs. Underwriting Tiers

Rating Tier

- Part of a rating manual
- Constructed only using regulatory approved rating variables
- Documentation of tier assignment as part of rating plan and state filing
- Can be on coverage level, vehicle level or *policy level*
- Same tier/pricing structure and same factors across all the writing companies
- Can be used to understand/explain disruptions

Underwriting Tier

- Outside of a rating manual
- A wider range of variables can be used, rating, non-rating, traditional, non-traditional, etc
- Many states don't ask for filing approval for the underwriting tier structure.
- 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 tier placement

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

Personal Lines – Illustration Example of Rating Tiering

Variable	Value	Base Class Plan	Complete Class Plan	Base Class Plan and Tier
Territory	T1	0.6572	0.7750	0.6572
	T2	0.7899	0.7239	0.7899
	T3	0.5235	0.5791	0.5235
	T4	0.8573	0.8904	0.8573
	T5	1.0000	1.0000	1.0000
Driver Age	Yng	1.6431	1.329	1.6431
	Senr	1.0502	1.1378	1.0502
	Matr	1.0000	1.0000	1.0000
Vehicle Use	P	0.8701	0.9507	0.8701
	W	1.0000	1.0000	1.0000
Marital Status	M	0.8587	0.8673	0.8587
	S	1.0000	1.0000	1.0000
At Fault Accident	0	0.6533	0.7328	0.6533
	1	0.7892	0.8199	0.7892
	2	1.0000	1.0000	1.0000
CreditScore	0		2.1019	Tier 1: 1.0000
	1		1.8230	Tier 2: 1.2160
	2		1.5726	Tier 3: 1.3489
	3		1.1959	Tier 4: 1.7890
	4		1.0000	Tier 5: 1.9548
				Tier 6: 2.2512
NAFA_POL	0		1.0000	Tier 7: 2.5890
	1		1.1456	Tier 8: 3.1450
	2		1.7872	Tier = a * credit score + b * Nafa_Pol

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	2	1.0000	1.0000	1.0000
CreditScore	0		2.1019	Tier 1: 0.6125
	1		1.8230	Tier 2: 0.8977
	2		1.5726	Tier 3: 1.0000
	3		1.1959	Tier 4: 1.2790
	4		1.0000	Tier 5: 1.5548
				Tier 6: 1.7512
				Tier 7: 2.0290
				Tier 8: 2.1450
Major_Vio_POL	0		1.0000	
	1		1.1456	
	2		1.7872	

Tier = a * credit score + b * Nafa Pol

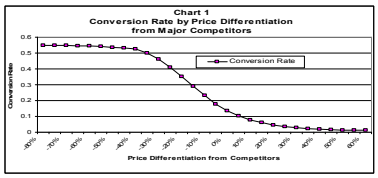
Significant Change in Base Class Plan; Hard to Track Down Disruption

No Change in Base Class Plan

Disruption All Contained in Tiers

Personal Lines Pricing - Optimization

- Optimization of Complete Class Plan
  - Consumer's demand and price sensitivity is on policy/account level with final total premium, not on detailed, by coverage level
  - Complex to integrate price elasticity in revising the complete class plan by coverage, by version, etc.
  - Again, regulatory approval, implementation, disruption and maintenance are all very challenging
- Price Optimization through Rating Tiering & Underwriting Tiering
  - Integration of policy level optimization and policy level tiers is straightforward, easier, and more efficient.



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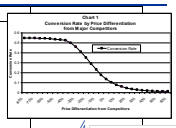
Tiers		



Tier factors:
- Credit
- Policy level driving record
- Years as an insured
- Billing payment records
- Account variables
- Territorial information
- Household composition
- Age and gender interaction

Intergarion of Tiers and Optimization

Tier 1: 0.4125	Tier 9:	Tier 17: ……
Tier 2: 0.4377	Tier 10:	Tier 18: ……
Tier 3:……	Tier 11:	Tier 19: ……
Tier 4:……	Tier 12	Tier 20: ……
Tier 5:……	Tier 13	Tier 21: ……
Tier 6:……	Tier 14	Tier 22: ……
Tier 7:……	Tier 15	Tier 23: 2.3578
Tier 8:……	Tier 16	Tier 24: 2.5609

Commercial Lines Pricing – Current Landscape

Structure for Level 1 and Level 2 Pricing

Basic Class Rating Plan:

- Industry class and state/territory base rate
- Additional class plan variables
  - Auto – vehicle use, vehicle type, coverage, etc (no driver characteristics though)
  - Property/BOP – building characteristics, protection class, coverage, etc
  - GL – coverage, etc
  - WC – special factors, no territorial rating

Underwriting Driven Pricing:

- Underwriting driven pricing in general includes two components:
  - Multiple writing companies with different base rates
  - Schedule credits and debits, IRPM, merit rating, other factors
- Traditional factors/rules are in general highly subjective, such as good risk management program, good safety program, etc.
- Generally used as a market driven pricing tool

Commercial Lines Pricing – Current Landscape

- Commercial lines predictive modeling has been catching up over the last several years
  - Latest survey indicates that 80% of personal line carriers use predictive modeling compared to 30% of commercial line carriers (probably more)
  - Predictive models are leveraging their learning from personal lines rating plan development to commercial lines rating and underwriting
- Compared to personal lines rating and underwriting, commercial lines rating and underwriting are very different
  - Complex and less homogenous exposure base and policy size
  - A great portion of the rating is driven by rating bureau driven, standard industry class plan (except BOP). Most carriers do not have credible enough data to develop their own proprietary, independent class base rate
  - Commercial lines data quality is much worse than personal lines data quality. Commercial lines IT resources are less experienced in extracting and preparing data for predictive modeling applications
  - Underwriting driven pricing for commercial lines can change the final price significantly. It is fairly common that a rating flexibility of +-50% beyond manual rates is allowed for commercial lines underwriting pricing. Therefore, commercial lines underwriters in general have more influence on the final price than personal lines underwriters

Commercial Lines – Advantages of Underwriting Pricing Tiers

Applying underwriting pricing on top of manual rating plan is an ideal design for commercial lines:

- Assumptions
  - The manual industry loss cost or rating plans are bureau driven
  - Companies do not have credible enough data for their own manual rating plans
  - Put competitive underwriting driven pricing on top of the manual class plans
  - The underwriting driven pricing can be implemented on policy level for company placement, credit and debit determination, tiering, etc
- The design
  - Separate the rating process between level 1 (base rate and class rate review) and level 2 (underwriting driven pricing)
  - For the level 2 modeling
    - Use "offset/residual" approach to remove the current base rate effect; or
    - Use "loss ratio" modeling approach by on leveling historical experience to the current level
    - Both approaches use Tweedie distribution modeling
    - Policy level modeling – the impact of non-homogenous policy size distribution on variable design and modeling assumptions

An Example - *Prior Year Claim Counts for Small CMP/BOP*

Prior 3 Years Claim Counts	Average Premium	% of Policies	Loss Ratio Relativity
0	$1,100	87%	-7%
1	$2,000	10%	18%
2	$3,400	2%	33%
3 and More	$9,600	1%	12%

- Prior year claim counts have been commonly used for underwriting and pricing, but it is more challenging to use it for commercial lines than personal lines
  - Using prior years claim counts for commercial lines results in less lift and a significant bias toward favoring small size policies (or severity driven industry classes)
  - Since exposure size is not uniform or homogenous for commercial lines, using claim counts directly for commercial lines is less ideal and requires further normalization

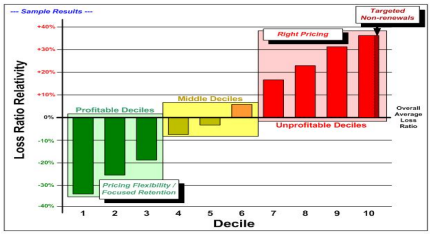
An Example - *Prior Year Claim Counts for Small CMP*

Prior 3 Years Claim Frequency, Normalized by $1,000 Actual Premium	Average Premium	% of Policies	Loss Ratio Relativity
0	$1,100	87%	-7%
>0 to 0.2	$9,400	3%	7%
0.2 to 0.4	$2,500	2%	30%
0.4 to 0.6	$1,400	2%	25%
0.6 to 1.0	$1,000	3%	53%
1.0 and More	$700	3%	82%

- After normalization by premium, the lift curve becomes very strong and smooth. Also, it does not penalize the large size policies
- Additional considerations for using prior years' claim frequency:
  - Exposure or premium: prefer premium because exposure base for commercial lines is complex
  - Actual premium or manual premium: manual premium is more accurate but actual premium is easier to implement
  - Consideration of timing of claims
  - Cumulative 3 years of claim frequency or free standing by year claim frequency

Commercial Lines Underwriting Driven Pricing

- Powerful multivariate predictive models can be built for commercial underwriting driven models using a wide range of data sources: policy, stat records, claims, drivers, MVR, billing, agency, territorial demographic, weather, business financial and operation data, etc
- Risk segmentation created from underwriting models



Commercial Lines Underwriting Driven Pricing - Implementation

Implementation of commercial lines underwriting driven pricing:

- Company placement
  - multiple companies with different base rates
  - Medium or small carriers and state funds may not have multiple writing companies
- Schedule credits/debits and IRPM: need to document the underwriting rules for credits and debits assignment
- Underwriting tiers
  - Can further enhance segmentation and expand pricing points beyond company placements and credits/debits
  - While the detailed algorithm for tier definition is not required to be filed in most states, the number of tiers and the tier relativities may have to be filed
  - Determination of number of tiers and tier factors needs business input
  - Balance pricing capacity and pricing flexibility – the more underwriting tiers are applied, the less flexible the underwriting driven pricing could be

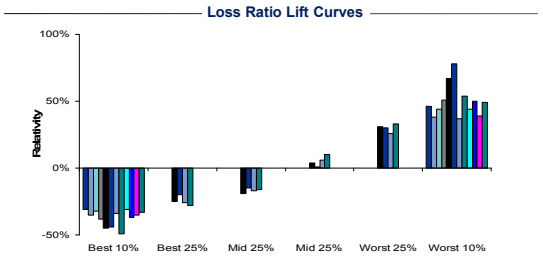
An Example – Balance pricing capacity and pricing flexibility

Model Lift		Tier Factors	IRPM low	IRPM high	$10,000 Manual Premium	
3-Tier Example						
0.6	0.85	0.8	0.75	1.06	6,000	8,500
0.85	1.15	1	0.85	1.15	8,500	11,500
1.15	1.45	1.2	0.96	1.21	11,500	14,500
5-Tier Example						
0.6	0.75	0.8	0.75	0.94	6,000	7,500
0.75	0.95	0.9	0.83	1.06	7,500	9,500
0.95	1.1	1	0.95	1.10	9,500	11,000
1.05	1.25	1.1	0.95	1.14	10,500	12,500
1.25	1.45	1.2	1.04	1.21	12,500	14,500

- Larger premium policies may need the pricing flexibility of IRPM
- Tiering may be preferred when over-use of credits by underwriters
- Lack of pricing flexibility for larger policies may increase underwriting exceptions to the model

Commercial Lines Underwriting Driven Pricing - Implementation

- Representative samples of segmentation results for commercial lines underwriting pricing models



Commercial Lines Underwriting Driven Pricing - Implementation

Translation of model lift curve results to underwriting pricing actions – considerations beyond statistical result:

- How to integrate with the base rate review process and adjust for overall target loss ratio
- Overall market competition position and external market conditions drive company placement, tiering, and application of debits and credits
- Minimize disruption for the renewal book
- Business growth strategy
  - Regional strategy
  - Industry focus
  - Policy size strategy

Commercial Lines Pricing - Optimization

Compared to personal lines, commercial lines pricing optimization is more difficult and challenging

- Top down market driven, composite level pricing for commercial lines compared to bottom up exposure driven pricing for personal lines
- Competitive pricing information is more diverse and hard to conduct an apple to apple comparison
- Less vendors exist to provide competitive pricing comparison for commercial lines
- Less quote, sales, or price negotiation information is captured electronically
- Data quality is worse
- Commercial lines (other than BOP) are in general less price elastic than personal lines
- The level 2, underwriting driven pricing design on the policy level is more easily integrated with the level 3, price optimization than the base rating plan

Conclusions

- Today's modern insurance rating can compose a 3 level pricing architect – the base class plan pricing for level 1, the underwriting driven pricing for level 2, and price optimization for level 3
- We propose that the level 2 underwriting driven price can be built independently and on top of the level 1 class plan pricing, instead of being developed completely together with the class plan pricing
  - The underwriting driven pricing is typically on policy level which can use either a pure premium-offset or loss ratio modeling approach
  - The implementation of underwriting driven pricing can be through company placement, credits and debit assignment, or tiering
  - For personal lines, it has a wide range of advantages, including easy implementation, version control, better communication, and disruption control
  - For commercial lines, it is an ideal design since most of the commercial lines industry class plans are bureau driven class plan
  - Additional advantages for such design include flexibility and no need for filing approval
  - It is easier to be integrated with level 3 price optimization since the price sensitivity for insurance consumers is on final, composite policy level price

Q&A

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