Price Optimization

An overview of the mechanics and implications on regulation and consumer concerns

A presentation for the 2015 CAS Annual Meeting

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Distribution and Use

- This presentation is intended solely for the 2015 CAS Annual Meeting for the purpose of discussing and understanding price optimization
- The document is incomplete without the accompanying discussion
- It is not intended nor necessarily suitable for any other purpose

With You Today

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Claudine leads Towers Watson's Property/Casualty Pricing and Product Management Team in the Americas. Her primary areas of expertise are insurance ratemaking and predictive modeling.

- 20+ years in the insurance industry, 10 years as a company actuary
- Co-author of ratemaking/modeling texts on the CAS exam syllabus
  - *Basic Ratemaking*
  - *Practitioner's Guide to Generalized Linear Models*
- Relevant industry participation
  - Co-author of draft Actuarial Standards of Practice (ASOP) on Ratemaking
  - Member of price optimization task force for AAA
  - Avid follower of the NAIC CASTF white paper on price optimization
  - Testified to NCOIL in July 2015

Agenda

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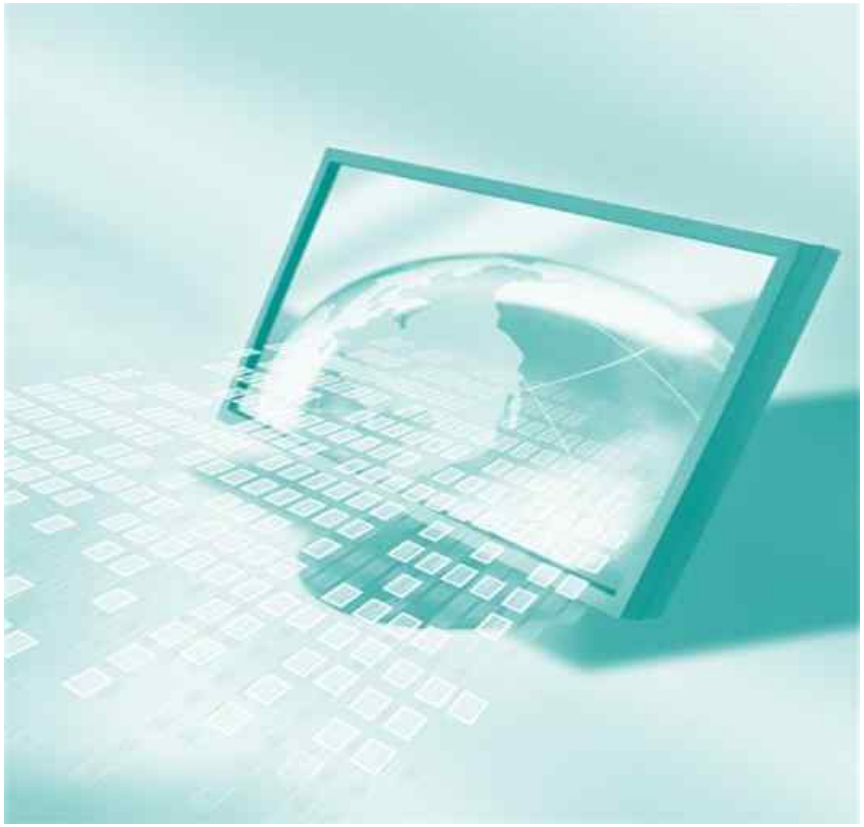
An overview of the pricing process

A case study in price optimization

Background

Data assets, pricing and the regulatory framework

- Companies are investing in the quality of data and the sophistication of analytics
- Today we'll focus on how analytics have changed the face of personal lines pricing
- We'll explore price optimization in the context of actuarial work, insurance company objectives and the regulatory framework



Defining price optimization

- Multiple definitions from actuarial bodies, regulatory bulletins, individual professionals or firms
- In the U.S., we aim to charge insurance prices that are commensurate with the cost of transferring individual risk
- This does not preclude acknowledging that
  - Mitigating large price changes at renewal provides stability
  - Competitive position influences mix of business which affects costs long-term
  - Some cross-subsidy is in the public's best interest (e.g., young drivers)
- In recent years the insurance industry has sought a more scientific way to understand and incorporate these influences, which has triggered concerns around unfair discrimination
- Rather than focusing on specific behaviors to avoid, some bulletins have broadly banned behaviors that have been accepted for decades

Some thoughts on statutory interpretation

- Does *"…. not excessive, not inadequate, not unfairly discriminatory"* statutory language mean strict adherence to the most recent cost estimates without consideration of the effect on customer, carrier, regulator?
- Conversely, does allowing deviations from cost estimate mean any price is acceptable?
- Where does the right answer lie?

An Overview of the Pricing Process

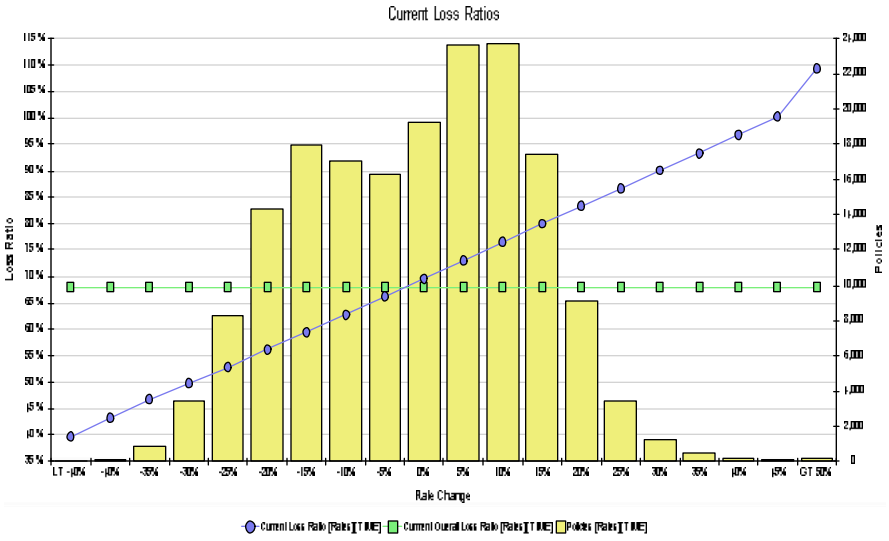
Pricing begins with cost estimation

- The first step in reviewing price adequacy is cost estimation
  - In the aggregate
  - By risk class
- Today most carriers use multivariate statistical analysis to estimate costs
  - Experience data is comprised of individual risks
  - Analysis is class-based
  - Modeled result is applied to individual risks

Statistically sound models with < 100 parameters can produce millions of price points

Compare cost-based rates to current and market

- A typical next step is to re-rate individual customers on proposed cost-based rates and compare the result to current rates
- This often results in considerable disparity, which is a function of:
  - Improved cost estimation reflecting additional predictors, better analytical methods
  - Pre-existing cross-subsidy in rates
  - Underlying costs are changing
- In addition, cost-based rates will naturally vary from competitors' rates



Pricing guides prudent deviations from cost-based

- Pricing is a collaborative process that guides us in how to address this disparity in a way that improves rate adequacy while also
  - Recognizing business objectives for retention and/or new business growth
  - Realizing operational constraints
  - Complying with laws and regulations
- Though previously done through judgment alone, today these decisions are made by Pricing Committee with guidance from models that project the implications of pricing scenarios on business goals (i.e., portfolio profit and volume, competitive position)

Reaction to Price

- How do we project customers' reaction to price?
  - We can study the decisions of thousands of insurance customers who were recently invited to renew or purchase insurance at a given price
- Demand models identify variables correlated with the yes/no insurance purchase decision and quantify the relationship
- Demand model characteristics include
  - Common rating characteristics (age, policy limit)
  - Factors that address the relationship between carrier and insured (tenure, distribution channel, products held)
  - Factors that address market alternatives (e.g., price competitiveness)
  - Historical price-related factors (premium, premium change)
- Just like loss cost models, these are class-level models that can then be applied to the individual policy

Integrating cost and demand

- Imagine you have a dataset containing every in-force customer
- You know each customer's current premium and policy characteristics
- You can apply class-level model results to each customer to estimate
  - Cost
  - Demand (probability of buying at a given price)
- You can now test different rate scenarios and project the effect on various metrics by class and in total
  - Profitability
  - Volume
  - Mix of business
  - Competitive position
  - Dislocation

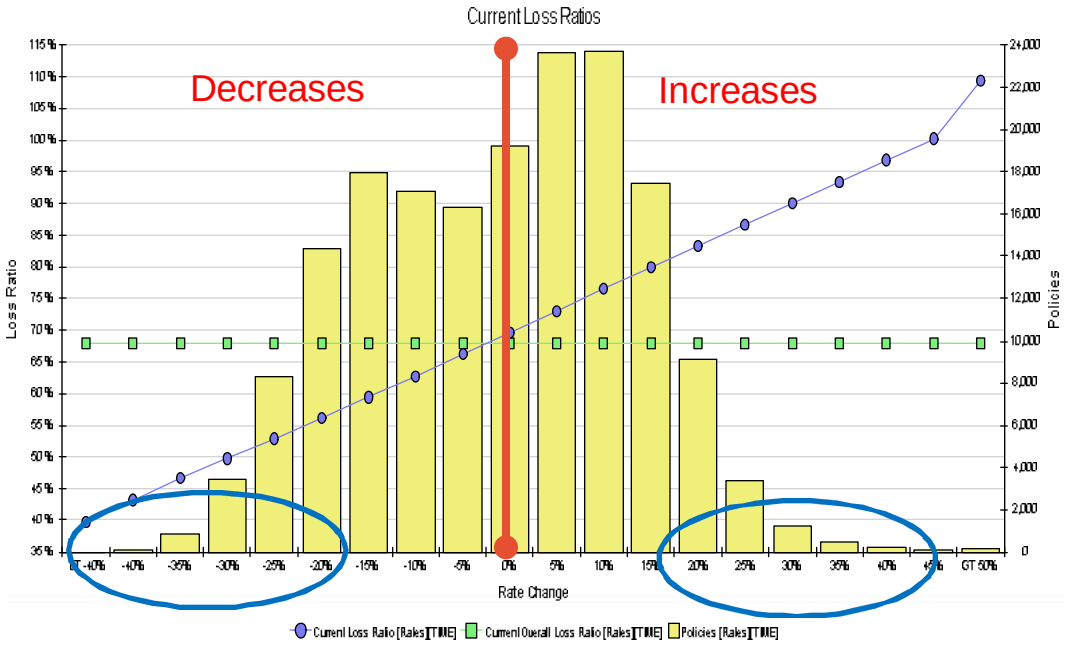
Optimization in practice

- Mathematical optimization algorithms perform the search more efficiently
- The same inputs are used
  - Customer dataset
  - Series of class-level models or assumptions about cost and demand
  - Targets and requirements
- Algorithms search a constrained universe of rates or rating elements to maximize some metric subject to requirement(s)
- An extremely important point to recognize is that constraints are used to ensure the optimization algorithm does not produce undesirable outcomes
  - Individual level
  - Class level
  - Portfolio level

A Case Study

Case Study: Rates based only on expected loss costs

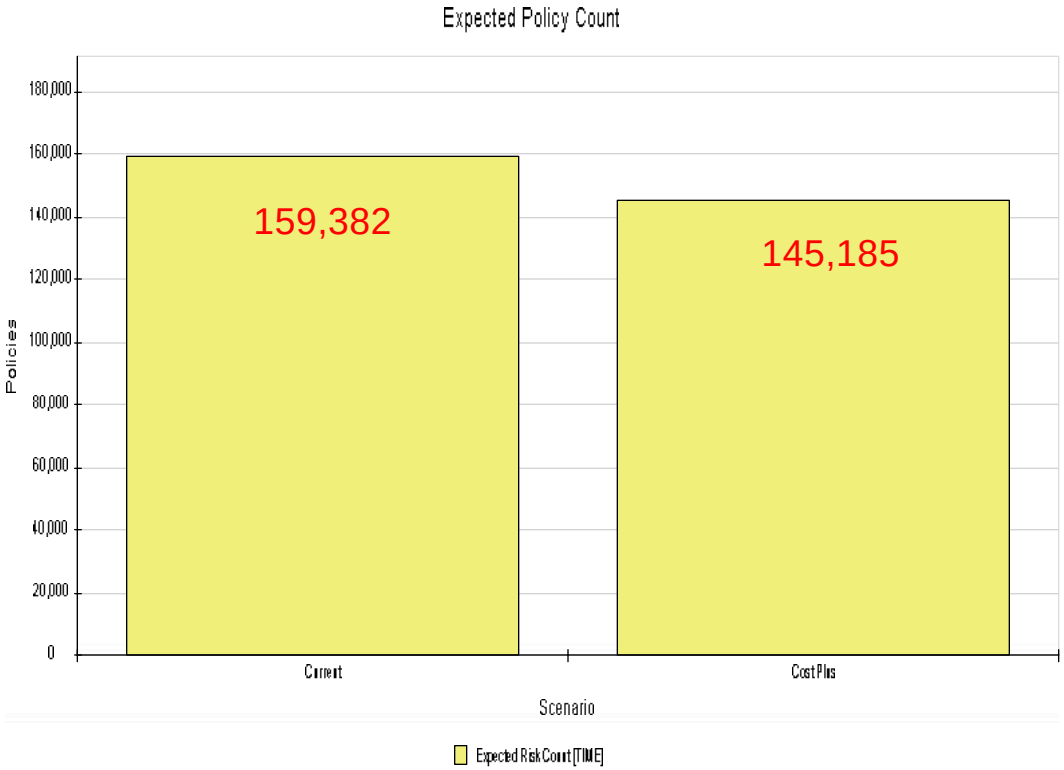
- The following scenario compares the current to the proposed rates where the proposed rates reflect expected loss costs and expenses.
- The increases and decreases are perfectly correlated with the historical loss ratio



- Notes
  - Overall current expected loss ratio is 68%
  - Proposal suggests rates should be increased by 10% for the 23K policies that have a current loss ratio of 77%
  - 14.7K policies will see a rate increase of 20% or more, and 27K policies will see a rate decrease of 20% or less

Case Study: Rates based only on expected loss costs

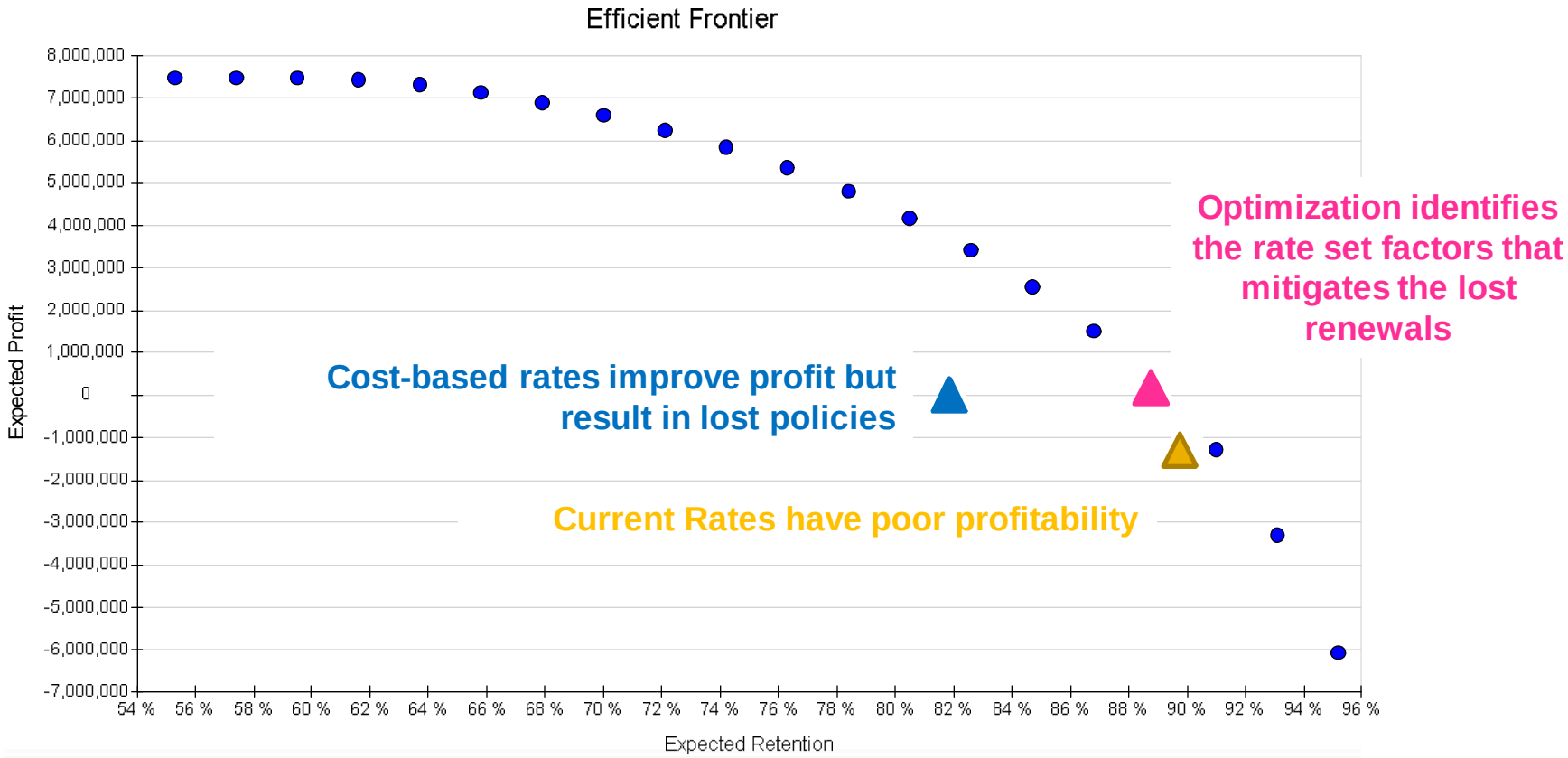
- Based on a policyholder retention model if the company moves to the cost-based rate, the retention is expected to drop from 90% to 82%



- Notes
  - Currently there are 159K policies
  - Moving to cost-based rates will result in 145K policies
- How do we move to a cost-based solution without losing this much business?

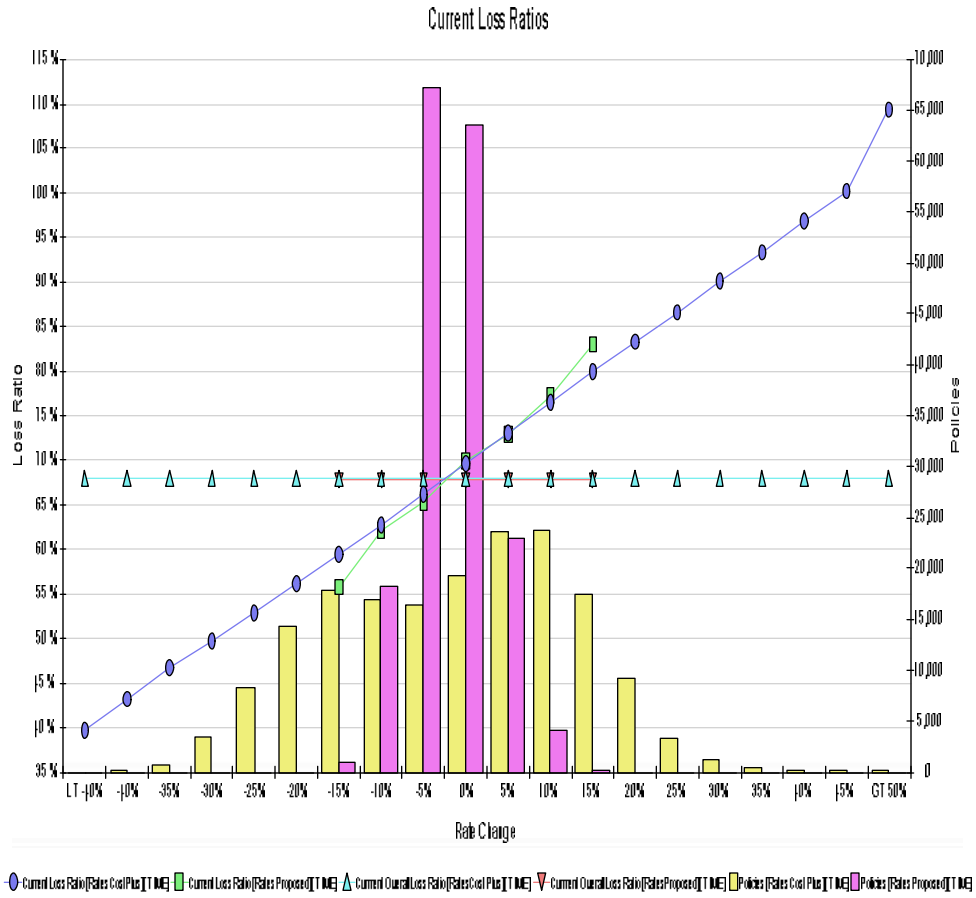
Case Study: Rates using optimization techniques

- Optimization frames the problem in a more systematic way



Case Study: Comparing optimized rates to the cost-based rates

- Search algorithms identify adjustments to the cost-based relativities resulting in:
  - More modest rate changes
  - Rate increases and decreases are still correlated with loss ratio (but no longer perfectly correlated)
- This creates a win-win situation
  - Insurers can move toward the cost-based indications without losing insureds
  - Portfolio stability is explicitly recognized in the process



Rate factor selections still need to be compared to indications

- This selection is likely to be acceptable

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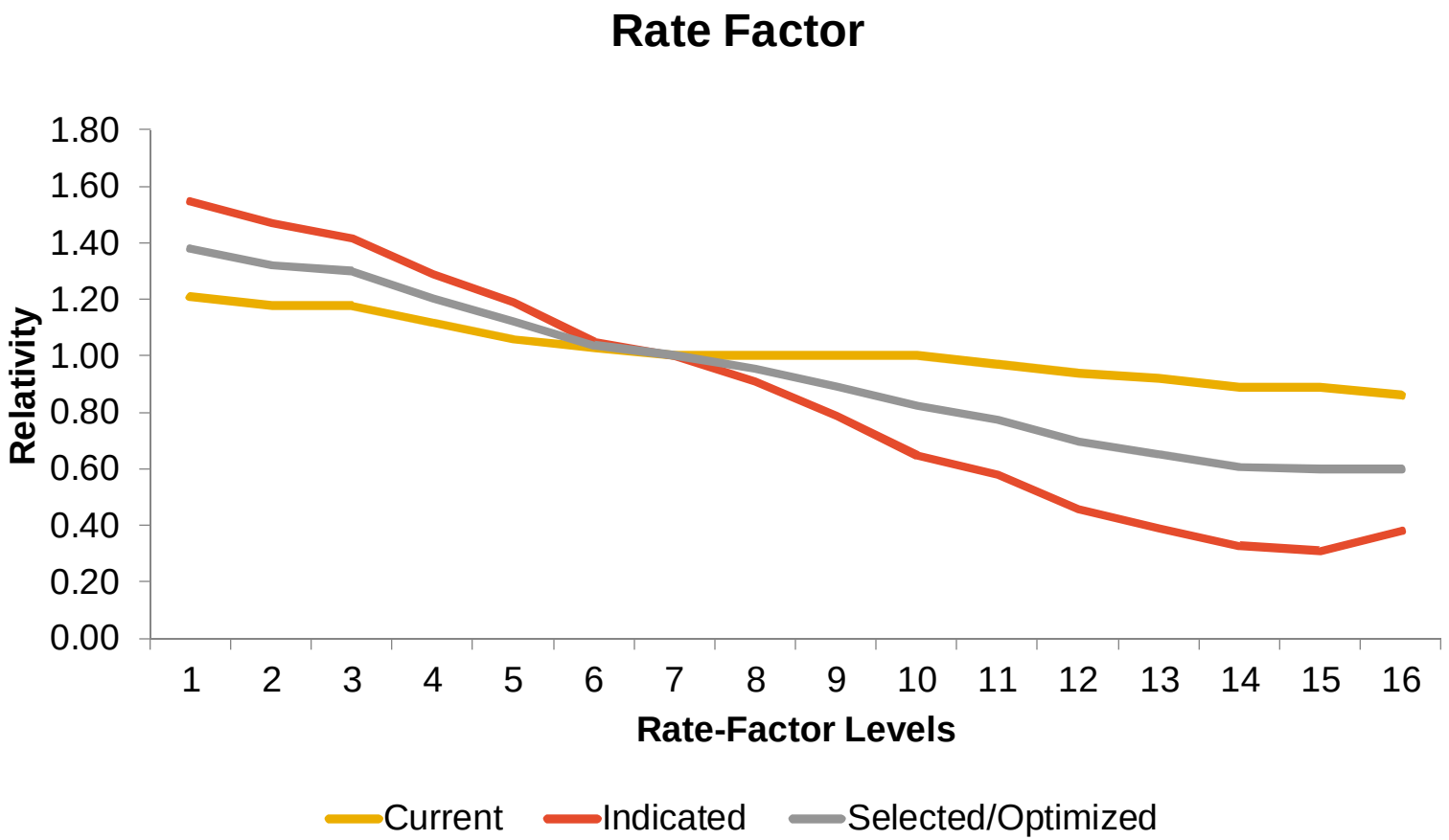

Is the selection in line with the indication?

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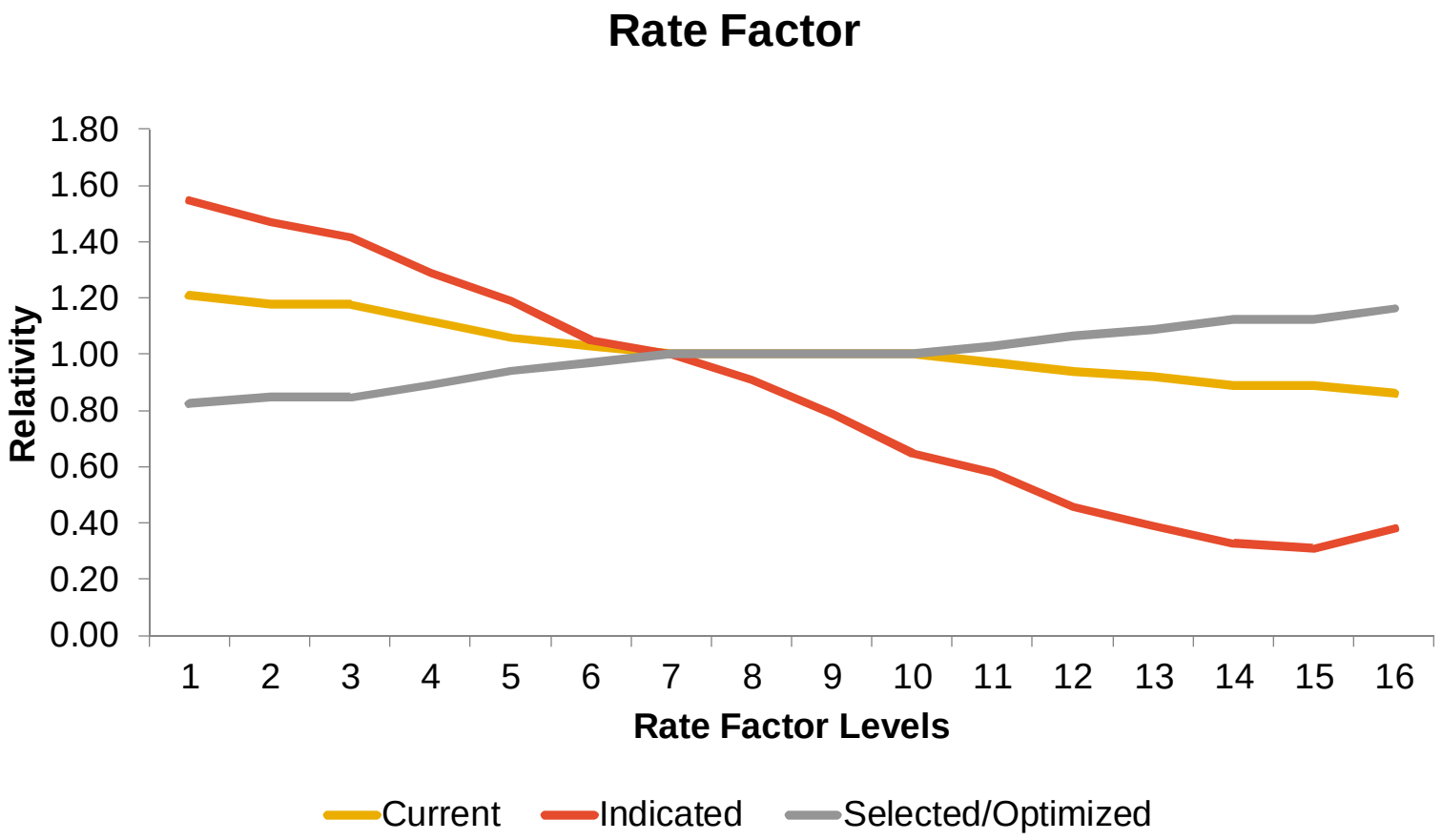
- This selection is likely to be challenged



An alternative mechanism to move rates toward cost-based

ILLUSTRATIVE

- Rather than modifying each individual rating factor, an alternative approach observed in the market is to introduce a new rating variable that moves the risk's current premium toward cost-based
  - Amount of movement may or may not be tempered by demand models
  - Individual risks may be grouped based on similar adjustment factor

Risk	Current Premium (1)	Cost-based Premium (2)	Premium Adjustment Factor (3)=(2)/(1)	Mitigated Adjustment Factor (4)=[(3)-1)/2]+1
1	$550	$580	1.05	1.03
2	$300	$360	1.20	1.10
3	$425	$389	0.92	0.96
4	$350	$400	1.14	1.07
5	$600	$640	1.07	1.04

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