Casualty Actuarial and Statistical (C) Task Force

Price Optimization White Paper

I. Introduction

1. Ratemaking is the process of establishing rates used in insurance or other risk transfer mechanisms. This process may involve a number of considerations including estimates of future loss costs, marketing goals, competition, and legal restrictions. Actuaries have a key role in the ratemaking process and are generally responsible for determining the estimated costs of risk transfer. However, the advent of sophisticated data mining tools and pricing models have allowed actuaries to provide more objective, quantitative information about the judgmental aspects of the rate-setting process instead of relying primarily on anecdotal evidence as has been the case in the past. This process is now referred to as “price optimization.”

2. Making adjustments to actuarially indicated rates is not a new concept; it has often been described as “actuarial judgment” or “underwriting judgment.” However, the use of modeling to guide judgments made during the rate-setting process is a more recent development.

3. Critics have recently objected to insurers’ use of price optimization. Some have argued that price optimization has been developed to increase insurers’ profits, by raising premiums on individuals who are less likely to shop around for a better price. It is presumed that many of these people are low income consumers. The Consumer Federation of America (CFA) has called price optimization unfairly discriminatory, claiming that it can result in drivers with the same risk profile being charged different rates.1

4. In late 2013, the Auto Insurance (C/D) Study Group (Study Group) began to study the use of price optimization in auto insurance. Because the topic of price optimization goes beyond auto insurance and requires a great deal of actuarial or statistical expertise, the Study Group asked the Casualty Actuarial and Statistical (C) Task Force (Task Force) to conduct necessary research on the use of price optimization, including regulatory implications, and respond to the Study Group with a report or white paper documenting the relevant issues.

5. In this paper the Task Force provides background research on price optimization, identifies potential benefits and problems with price optimization, and presents options for state regulatory responses. The Task Force does not issue an opinion on the policy decisions made by each state concerning rating practices that may incorporate price optimization.

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II. Price Optimization Background

6. Price optimization is a sophisticated tool based on predictive modeling intended to assist insurance companies in setting prices. It is an additional component of the pricing process in which the business manager goes from actuarial rates to final prices. According to Earnix\(^2\), price optimization utilizes a variety of applied mathematical techniques (linear, non-linear, integer programming) in the ratemaking process to analyze more granular data.

7. There are several different types of price optimization, and price optimization can be modeled at different levels. According to Towers Watson\(^3\), there are three main types of optimization used in ratemaking:
   1) Ratebook Optimization -- using mathematical algorithms informed by cost and demand models to adjust factors in an existing structure.
   2) Individual Price Optimization – a non parametric rate engine that builds a price based on the cost and demand for the product
   3) Hybrid Optimization – create a new rate factor based on the demand model that overlays the cost-based rate algorithm.\(^4\)

8. With “rate book optimization” the model can guide the adjustment of rating factors in the existing rating plan to achieve stated goals. These models generally determine selections at the classification level to optimize the insurer’s program.

9. With “individual price optimization” prices are determined at the individual policy level based on cost and demand. The output is often on a nonparametric basis generating prices that are often not related to an insurer’s rating plan. This type of price optimization is believed to be more common with retail or personal service companies in the U.S., and may be used for insurance pricing in other countries with different rating laws.

10. With “hybrid optimization” an additional factor is added to an insurer’s existing rating plan to incorporate other aspects from a demand model such as expected retention, profitability, premium volume, or expense. The new rating factor may be correlated with expected losses and is designed to modify the existing rating plan to achieve stated goals.

11. Some refer to “constrained” versus “unconstrained” optimization. Generally, constrained optimization refers to setting boundaries for the answer. For example, in price optimization, a price could be constrained by the current price and the fully loss-based indicated price.

\(^2\) Earnix Ltd. provides integrated pricing and customer analytics software that allows financial services companies to predict customer risk and demand and its impact on business performance. Its software platform allows insurance companies to harness customer data and optimize business performance across auto, home, commercial, and other product lines. (http://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapid=1745902)

\(^3\) Towers Watson & Company manages employee benefit programs, develops attraction, retention and reward strategies, advises pension plan sponsors on investment strategies, provides strategic and financial advice to insurance and financial services companies, and offers actuarial consulting. (http://www.bloomberg.com/profiles/companies/TW:US-towers-watson-&-co)

12. There is no single or widely accepted definition of price optimization. In economics price optimization is “(f)inding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones.”

13. Definitions of price optimization as used in insurance include the following:

- The Casualty Actuarial Society (CAS) defines price optimization as “the supplementation of traditional actuarial loss cost models to include quantitative customer demand models for use in determining customer prices. The end result is a set of proposed adjustments to the cost models by customer segment for actuarial risk classes.”
- Towers Watson defines price optimization as “a systematic process for suggesting adjustments to theoretical cost-based prices that better achieve business objectives, subject to known constraints.”
- Earnix defines price optimization as a “systematic and statistical technique to help an insurer determine a rate plan that better fits the competitive environment, within actuarial and regulatory standards.” Earnix adds that price optimization helps inform an insurer’s judgment when setting rates by producing suggested competitive adjustments that balances and helps the insurer achieve certain business goals, including loss ratios, customer retention and new business. Earnix describes price optimization as an application of prescriptive analytics as opposed to predictive analytics. Prescriptive analytics use predictive models and business goals as inputs to recommend decisions to achieve the optimal results.
- The Ohio Department of Insurance defines price optimization as varying premiums based upon factors that are unrelated to risk of loss in order to charge each insured the highest price that the market will bear.
- The Consumer Federation of America describes price optimization as a practice where premiums are set based on the maximum amount a consumer is willing to pay, rather than the traditionally accepted methods of calculating premiums based on projected costs, such as claims, overhead and profit.

14. Vendors (such as Towers Watson and Earnix) typically provide insurance companies with price optimization software. This software varies from insurer to insurer, as each insurer specifies its own objectives and constraints. According to Towers Watson, its software provides: a) an environment for a carrier to integrate its own models (e.g., loss cost models, expense assumptions, policyholder

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5 BusinessDictionary.com, Read more: [http://www.businessdictionary.com/definition/optimization.html#ixzz3VJDlmfkJ](http://www.businessdictionary.com/definition/optimization.html#ixzz3VJDlmfkJ)
9 Ohio DOI, Bulletin 2015-01.
10 Consumer Federation of America, August 29, 2013, letter to state insurance commissioners
demand models) on customer data and b) mathematical algorithms that search the universe of rating structure parameters (i.e., relativities) to identify the set(s) that most closely meet the carrier’s corporate objectives, subject to its constraints. Thus, each optimization exercise is unique to the insurer and relies on the insurer’s data, assumptions, input models, targets and constraints.

15. In the traditional rate-setting process, actuaries determine expected losses, expenses, and profit loading; management may make adjustments to reflect business considerations such as marketing/sales, underwriting, and competitive conditions. Regulators permit insurers to reflect judgment and the competitive environment in rates. However, the rate filer (insurer) must ensure that filed rates are not inadequate, excessive, or unfairly discriminatory. This table provides a high level comparison of these approaches:

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<th>Traditional Approach</th>
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<td>Base rate (loss cost) x adjustment factor</td>
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<td>Adjustment to rates are based on...</td>
<td>Market, regulatory, and other considerations</td>
<td>Price Optimization</td>
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16. Price optimization is based on quantitative modeling and is a departure from traditional cost-based ratemaking. It adds an additional quantitative layer to the insurance ratemaking process by using more complex models to more accurately quantify the effects of rate changes and improve profitability. The key difference is that with price optimization: (1) market demand and customer behavior are quantified instead of being subjectively determined; and (2) the effect of the rate deviation from the loss cost on business metrics is mathematically measured. Both approaches make adjustments to the filed and approved actuarial risk classification factors, but with price optimization these adjustments are made with more clearly defined goals in mind. Estimated losses and expenses remain the foundation of the cost-based rate-setting process.

17. Price optimization provides additional data analysis that can be used by management to make adjustments and more accurately forecast the outcome of a rate revision. Towers Watson says price optimization can be used to generate a much larger number of rate scenarios to run through the price assessment environment, and to identify which scenarios better achieve business objectives.

18. One of the most controversial ways that insurers are using price optimization is to analyze patterns of policyholder demand behavior. According to the CAS, until recently companies had limited ability to quantitatively reflect demand in pricing. Price optimization relies on the concept of “elasticity of demand of customers”—an economic measure to show response to demand for goods or services in relationship to price changes—to “optimize” prices.
19. Towers Watson notes that “elasticity of demand is a key ingredient” in the price optimization process. Towers Watson also notes that the input models in its optimization software include policyholder demand models, which “do not describe which customers shop more or less but rather how likely a customer is to renew a policy or accept an insurer’s quote.” Policyholder demand models, according to Towers Watson, are generally fit to recent, customer-level, historical data that contains information about the customer as well as what purchase decision the customer made (e.g., did the customer renew – yes/no, did she or he accept this quote – yes/no).

20. Price optimization has been used for years in other industries, including retail and travel. However, the use of price optimization in the insurance industry is relatively new. A 2013 Earnix survey of 78 major insurers found that 45% of large insurance companies (with gross written premiums over $1 billion) in North America currently use price optimization techniques, with an additional 29% of all companies reporting they plan to adopt this technique in the future.

III. Identify Benefits and Problems with Price Optimization

21. Since price optimization often affects the selected rating factors rather than the indicated rating factors and historically selected factors were often based on actuarial judgment, regulators may be using general guidelines to review insurer’s selected rating factors without asking (or realizing) how price optimization may influence the insurer’s selected factors. General guidelines some regulators are using include the relationship between the current, indicated and selected factors, how far the selected factors vary from the indications, or the relationship between factors for a class plan variable. Distilling the voluminous information connected with price optimization makes determining the extent and effect of a program difficult for regulators.

22. Price optimization may improve rate stability and lower an insurer’s long-term cost for providing coverage and limit policyholder disruption. This may be viewed as convenience for consumers who do not want to shop for insurance on a regular basis. If consumers realize more stability through price optimization, policyholder discounts for longevity may increase over time.

23. Consumer advocates argue that price optimization raises prices above the cost-based estimate of some policyholders who are known to be less likely to change insurers when faced with a price
increase below a certain threshold (targeting loyal customers or policyholders who would not shop around in the face of an increase). Consumer groups assert that low-income customers tend to shop around less frequently than relatively wealthy consumers, potentially a result of having fewer market options available.

24. Consumer advocates assert that price optimization is a departure from cost-based prices, in that it uses measures unrelated to risk of loss to determine premiums. They contend price optimization offers insurers strategies for increasing profit by systematically increasing premiums without any loss-based justification. Rates should be based on the cost of transferring risk, not the ability or willingness to pay. One concern from consumer advocates is price optimization may result in higher rates for lower income consumers.

25. In addition, consumer advocates believe price optimization allows companies to use pricing as a profit lever. The purpose of price optimization is “to achieve user-defined business goals,” (with user meaning insurer, not consumer or regulator).11

26. State insurance regulators are concerned with the shift from “loss-based ratemaking principles to principles that encompass subjective market driven ratemaking” 12 and question how price optimization “would not conflict with state rating laws that require rates not to be excessive, inadequate and unfairly discriminatory.”13

27. Maryland, the first state to take explicit action against price optimization in rate setting, released Bulletin B 14-23 on October 31, 2014. The Maryland Insurance Administration announced it determined that the use of price optimization, defined as the practice of varying rates based on factors other than the risk of loss, such as the willingness of policyholders to pay higher premiums than other policyholders, results in rates that are unfairly discriminatory in violation of state law. Insurers using price optimization techniques in Maryland were required to end such practices and resubmit rates compliant with the bulletin no later than January 1, 2015.

28. In February 2015, the Ohio Department of Insurance issued Bulletin 2015-01 noting that “price optimization involves gathering and analyzing data related to numerous characteristics specific to a particular policyholder that are unrelated to risk of loss or expense.”14 Insurer usage of the price elasticity of demand, or how much of a premium increase a particular policyholder will tolerate before switching insurers, is unrelated to risk of loss or expense. The Ohio Department said that by its nature price optimization can result in two insureds with similar risk profiles being charged different premiums. Insurance companies that use these price optimization techniques in Ohio were

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13 Ibid.
14 https://insurance.ohio.gov/Legal/Bulletins/Documents/2015-01.pdf
required to end the practice and resubmit rates compliant with the bulletin no later than June 30, 2015.

29. The California Department of Insurance issued a “Notice Regarding Unfair Discrimination in Rating Price Optimization” on Feb. 18, 2015 and generally defined price optimization as setting rates based on a willingness of an individual or group to pay more than another individual or group with the exact same risk profile. The bulletin states that any insurer currently using price optimization to adjust rates in California must cease doing so. “Any insurer that has employed price optimization to adjust its rates in the ratemaking/pricing process shall remove the effect of any such adjustments from any filing to be submitted subsequent to the date of the Notice. And any insurer that has a factor or factors based on price optimization in its rating plan shall remove the factor or factors in its next filing.”

30. On March 18, 2015, the New York Department of Financial Services sent a letter to property/casualty insurers and defined price optimization as the practice of varying rates based on factors other than those directly related to risk of loss, for example, setting rates or factors based on an insured’s likelihood to renew a policy or on an individual’s or class of individuals’ perceived willingness to pay a higher premium relative to other individuals or classes. The New York Department declared such practices as inconsistent with traditional cost-based rating approaches and said such practices could violate its law prohibiting rates to be unfairly discriminatory. The Department is seeking to determine whether insurers use price optimization in New York and has required insurers to answer the Department’s specific rating questions by April 15, 2015.

31. Insurers argue price optimization is a technological improvement over current practices and criticisms aimed at this process are describing “unconstrained” price optimization, not the “constrained” form of price optimization that insurers use in setting rates. For example, one insurer indicated that its price optimization process is constrained by the endpoints of a customer’s current rate and indicated rate (based on loss costs). This insurer’s price optimization algorithm determines where in that range the new rate will fall and all customers in the same risk class (as defined by multiple criteria) will receive the same rate based on this process.

32. Insurers also contend that price optimization is allowed under the current actuarial standards of practice. Robert Hartwig, president of the Insurance Information Institute, notes the price optimization process does not discriminate and does not abandon the core principle of risk-based pricing. It simply provides “more precision in the process associated with pricing and it allows insurers in an analytical way to deal with what-if scenarios.”

IV. Regulatory Responses to Price Optimized Rating Schemes

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33. State law requires that rates not be excessive, inadequate, or unfairly discriminatory. Regulators should identify principles under which those requirements are met for price optimized rating schemes.

34. The following are best practices/principles identified by the Task Force:

...to be developed

35. Regulators have a number of potential responses regarding price optimization. California, Maryland, and Ohio defined price optimization and issued bulletins. New York issued letters to insurers to further study price optimization.

36. Some state regulators may believe that existing state laws are sufficient to deal with price optimization and that no bulletin or other public statement is necessary. Most states have either not received a filing which incorporates price optimization into the rating process or have accepted filings with price optimization (knowingly or unknowingly). Many states are looking more closely at the issue and/or are waiting for the issue to be more thoroughly discussed and reported upon by NAIC and others.

37. Additional options for regulatory responses as identified by the Task Force include the following:

1) Don’t allow price optimization or a particular component of price optimization.

2) Modify or add specificity to what is required to be included in rate filings. Regulators could request specific disclosures in filings. Regulators could define an “indication” with more specificity. In regards to the definition of “indication,” one potential modification would be to request actuarial certification that the indications presented in the rate filing are based on cost considerations and are not otherwise adjusted. Or any adjustments made for non-cost-related items must be specifically shown in the rate filing. Such a certification might also include a statement that the factors used in price optimization, whether considered individually or in combination, are not correlated with and serve as proxies for other risk factors that would be considered discriminatory.

3) In a rate regulatory review, ensure all rating factors are disclosed and filed. Evaluate the filing to identify potentially unacceptable (e.g. unfairly discriminatory) factors and rates. Where the change in price is not in the direction of the indication, request specific reasoning from the company. Select additional questions to ask companies (See Appendix A for potential questions).
4) Define appropriate constraints on the price optimization process and outcomes. For example, a constraint might limit the pricing adjustment to be between the current rates and the cost-based indicated rate and always in the direction of the indicated rate. Another possible constraint would be to limit the factors that can be used in defining a risk class, such as a categorical or numerical measure of retention.

5) Identify potential changes to Market Conduct Exams. Companies should be asked who is in charge of the final price (Actuary, Underwriting, Marketing, other administrator).

6) Just as with credit-scoring models or catastrophe models, regulators should be sufficiently familiar with how a particular insurer’s model works and the accuracy and appropriateness of input data in order to make an informed determination regarding the key issues of excessive, inadequate or unfairly discriminatory rates. Therefore, regulators should establish regulatory practice with more in-depth review of insurer models and states and/or the NAIC should obtain additional regulatory expertise with such models.

7) Allow price optimization to the extent allowed by law.

V. Recommendations and Next Steps

...to be developed

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