Nov. 19, 2015

Casualty Actuarial and Statistical (C) Task Force

Price Optimization White Paper

I. Scope

1. In this paper, the Casualty Actuarial and Statistical (C) Task Force provides background research on price optimization, identifies potential benefits and drawbacks to the use of price optimization, and presents options for state regulatory responses regarding the use of price optimization in ratemaking. The Task Force is not expressing an opinion on the policy decisions that have been or may be made by each state concerning rating practices that may incorporate price optimization.

2. The primary focus of the paper is on personal lines ratemaking. Ratemaking concepts and principles (e.g., se are issues that

II. Introduction

4. 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 claims costs and expenses, profit and contingencies, marketing goals, competition, and legal restrictions. Actuaries play a key role in the ratemaking process and are generally responsible for determining the estimated costs of risk transfer. The advent of more sophisticated data mining tools and modeling techniques have allowed the use of more objective and detailed quantitative information for aspects of the rate-setting process for which insurers have traditionally relied on judgment or anecdotal evidence.

5. Making adjustments to actuarially indicated rates is not a new concept; it has often been described as "judgment." Insurers often considered how close they could get to the indicated need for premium without negatively affecting policyholder retention and how a given rate would affect the insurer's

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anular level. Formalized and

mechanized adjustments can be made to indicated rates for many risk classifications and, ultimately, perhaps even for individual insureds.

7. According to the Casualty Actuarial Society (CAS), until recently, companies had limited ability to quantitatively reflect individual consumer demand in pricing.[1] By measuring and using price elasticity of demand, an insurer can "optimize" prices to charge the greatest price without causing the consumer to switch to another insurer. It is this use of elasticity of demand that has led to criticisms that price optimization penalizes customers.

8. Critics object to insurers' use of price optimization when it results in unfairly discriminatory rates. Price optimization may use external, non-insurance databases to gather personal consumer information or detailed information about competitors' pricing to model consumer demand and predict the response of consumers to price changes. Some critics argue 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, and many of these people are low-income consumers. The Consumer Federation of America (CFA) asserts that price optimization introduces a systematic component to rate setting unrelated to expected losses or expenses. The CFA has called price optimization unfairly discriminatory, claiming that it can result in drivers with the same risk profile being charged different rates.[2]

9. Regulators accept some deviations from indicated rates and rating factors. However, they are concerned that the use of sophisticated methods of price optimization could deviate from traditional ratemaking, extending beyond acceptable levels of adjustment to cost-based rates and resulting in prices that vary unfairly by policyholder. Regulators in each state determine the acceptable level of adjustment allowable based on state law and regulatory judgment.

10. In late 2013, the NAIC's Auto Insurance (C/D) 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 Task Force to perform any additional research necessary on the use of price optimization, including studying regulatory implications, and respond to the Study Group with a report or white paper documenting the relevant issues.

III. Background: State Rating Law, Actuarial Principles and Definitions

11. The basis for all rate regulation is established by the state law—both statutory and case law. State authority is derived from the inclusion in almost all states' laws that personal lines insurance "rates

1. Casualty Actuarial Society Committee on Ratemaking Price Optimization Working Party
2. Consumer Federation of America, March 31, 2014. "Insurance Commissioners Should Bar Industry Practice of Raising Rates on

shall not be inadequate, excessive or unfairly discriminatory."[3] The NAIC has three model law guidelines related to rate regulation: 1) Property and Casualty Model Rating Law (File and Use Version) (#1775);[4] 2) Property and Casualty Model Rate and Policy Form Law Guideline (#1776);[5] and 3) Property and Casualty Model Rating Law (Prior Approval Version) (#1780).[6]

12. In Model #1775 and Model #1776, the description of "unfairly discriminatory rates" is as follows:

"Section 5. Rate Standards

Rates shall be made in accordance with the following provisions:

A. Rates shall not be excessive, inadequate, or unfairly discriminatory.

...

(3) Unfairly Discriminatory Rates. Unfair discrimination exists if, after allowing for practical limitations, price differentials fail to reflect equitably the differences in expected losses and expenses. ..."[7]

In Model #1780,[8] a description of "unfairly discriminatory rates" is suggested to be adopted in

a. In this paper, "price optimization" refers to the process of maximizing or minimizing a business metric using sophisticated tools and models to quantify business considerations. Examples of business metrics include marketing goals, profitability and policyholder retention.

b. "Actuarial judgment" is used in many of the actuarial methodologies in the rate-setting process (e.g., selection of loss development factors, trends, etc.). Actuarial Standard of Practice (ASOP) No. 1, *Introductory Actuarial Standard of Practice,* states that "the ASOPs frequently call upon actuaries to apply both training and experience to their professional assignments, recognizing that reasonable differences may arise when actuaries project the effect of uncertain events."[10] According to the CAS, "[i]nformed actuarial judgments can be used effectively in ratemaking."[11] Actuarial judgments are made throughout the ratemaking (as well as risk classification) process, including assumptions on the inputs and assessing the accuracy of the results. Price optimization is a tool and does not replace actuarial judgment in ratemaking; actuarial judgment remains a separate and distinct exercise that is fully consistent with and permitted by sound actuarial standards.

c. "Ratemaking" is "the process of establishing rates used in insurance or other risk transfer mechanisms. This process involves a number of considerations, including marketing goals, competition and legal restrictions, to the extent they affect the estimation of future costs associated with the transfer of risk."[12] Basic elements that go into the risk transfer estimate include claim and claim handling expense, underwriting expenses, policy acquisition and a reasonable profit.

d. A "cost-based" rate is an estimate of all future costs associated with an individual risk transfer and is developed from and consistent with the expected claims, claim handling expense, underwriting expenses, policy acquisition expense, a reasonable profit, investment income and

caused by significant changes to the insurer's base rates or its rating factors. Transition rules are effectively the same as capping rules, which can occur when overhauling a company's rating plan or when merging books of business from different rating plans.

IV. Price Optimization Background

15. There is no single or widely accepted definition of price optimization. In economics, optimization is "(f)inding an alternative with the most cost-effective or highest achievable performance under the given constraint

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customer retention and new business.[19] 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.

e. The Ohio Department of Insurance (DOI) describes price optimization as varying premiums based upon factors

20. With ratebook optimization, the model proposes alternative selections of rating factors in the existing rating plan to achieve an insurer's business goals. These models generally determine selections at the classification level to optimize the insurer's program. According to the CAS, insurers engaging in the ratebook form of price optimization will not charge different premiums to consumers with the same risk profile. The CAS says there is no mechanism in the insurers' rating plans to charge different premiums to consumers with the same risk profile.

21. With individual price optimization, prices are determined at the individual policy level based on cost and demand. This type of price optimization is believed to be more common with retail or personal service companies in the U.S. and in insurance pricing in other countries.

22. 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, rate of transition from the current premium towards the proposed premium, premium volume or expense. The new rating factor would be designed to modify the existing rating plan to achieve an insurer's business goals; the rating factor may or may not be correlated with expected costs.

23. Some distinguish between "constrained" versus "unconstrained" optimization. Generally, constrained optimization refers to an insurer setting maximum and minimum limits on the model's output. For example, in price optimization, a price could be constrained by the current price and the fully loss-based indicated price. Unconstrained optimization has no such limits.

24. Vendors such as Towers Watson and Earnix have developed commercially available software for carriers that perform price optimization. The use of the software can vary from insurer to insurer, as each insurer may specify its own objectives and constraints. According to Towers Watson, its software provides: 1) an environment for a carrier to integrate its own models (e.g., loss cost models, expense assumptions and policyholder demand models) on customer data; and 2) 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 optimTd[(fr) a0(p)-1(t7(o)-10(n)ie)-3(r1.63 2(es)s/e)8(t)-3([ )]TJ0.002 Tcv8tii 0 Tw 1.25567r

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filed rates are not excessive, inadequate or unfairly discriminatory. This table provides a high-level comparison of these approaches:

	Traditional Approach	Price Optimization Approach
Rating Plan Development:	Base rate (loss cost) x adjustment factor	Base rate (loss cost) x adjustment factor
Adjustment factors (for auto insurance) are based on …	Age, gender, territory, make and model year, and many other rating variables	Age, gender, territory, make and model year, and many other rating variables
Adjustment to rates based on market, regulatory and other considerations are based on …	Qualitative assessment	Qualitative and quantitative assessments informed by analysis of risk-related and non-risk-related data
Basis for adjustments to rates is …	Insurer judgment	Automatic, systematic analysis (modeling)

26. Price optimization based on quantitative modeling has been characterized by the CFA as a new technique and a departure from traditional cost-based ratemaking. The CFA says it uses additional, and sometimes more complex, models that incorporate non-risk-related factors to quantify the effects of rate changes with the objective to improve profitability, attract new business and retain existing business, or other measures (business metrics).

27. Traditional cost-based ratemaking often includes judgment to select rate factors to achieve insurer objectives. The key difference between traditional judgment and price optimized modeling techniques is that with price optimized modeling: 1) market demand and customer behavior are quantified instead of being subjectively determined; and 2) the effect of the deviation from the cost-based rate on business metrics is mathematically measured. Both approaches can make adjustments to the indicated cost-based rating factors, but with price optimization, these

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). [25]

30. Price optimization has been used for years in other industries, including retail and travel. However, the use of model-

33. Consumer advocates assert that deviation from cost-based ratemaking through price optimization will disfavor those consumers with fewer market options, less market power and less propensity to shop around—in particular, low-income and minority consumers.[28] Based on an Insurance Information Institute (III) poll, however, lower-income customers (under $35,000 annual income) are more likely to shop for insurance than more affluent individuals (above $100,000 annual income), who might shop less.[29] However, Robert P. Hartwig, president of the III, states that the "assertion that low-income consumers are particularly vulnerable because they do not shop is … entirely unsubstantiated." A poll conducted by the III "found that 68% of people with annual income under $35,000 compared prices when most recently buying auto insurance, a higher percentage than any other income group. [61%] of respondents with income above $100,000 said they had shopped around."[30] The CFA notes that only 18% of drivers shop for auto insurance every year, and 58% rarely or never shop according to a Deloitte survey.[31] A recent study by the Insurance Renc9f.b30oityhthystates

process associated with pricing, and it allows insurers in an analytical way to deal with what-if scenarios."[34]

36. State insurance regulators are concerned with the shift from "loss-based ratemaking principles to principles that encompass subjective market driven ratemaking"[35] and question how price optimization "would not conflict with state rating laws that require rates not to be excessive, inadequate and unfairly discriminatory."[36]

37. Insurers argue price optimization is a technological improvement over current practices, and criticisms are aimed at individual price optimization—not the ratebook form of price optimization used in setting rates.

38. Some insurers contend that price optimization is allowed under the current Actuarial Standards of Practice.

VI. Regulatory Responses to Price Optimized Rating Schemes

39. State law requires that rates not be excessive, inadequate or unfairly discriminatory. Regulators should consider whether these requirements can be met when price optimized rating schemes are used. Even if the requirements can be met, some constraints on the optimization might be needed.

40. Regulators have a number of potential responses regarding price optimization. Numerous states defined price optimization and issued bulletins prohibiting the defined practice. New York issued letters to insurers to further study price optimization. References to and some descriptions of bulletins are provided in the attached Appendix A.

41. Some state regulators believe that existing state laws are sufficient to deal with price optimization and that no bulletin or other public statement is necessary. Many states have not received a filing that stated price optimization was incorporated into the rating process. Many states are looking more closely at the issue or are waiting for the issue to be more thoroughly discussed and reported upon by the NAIC.

42. Regulators have broad authority to ensure rating practices are consistent with state rating laws. The Task Force identified the following options for regulatory responses to price optimized rating schemes:

    a. Determine which price optimization practices, if any, are allowed in a particular state.

34. Weisbaum, H., 2014. "Data Mining Is Now Used to Set Insurance Rates; Critics Cry Foul," accessed at www.cnbc.com/id/101586404.
35. Piazza, Richard, Casualty Actuarial and Statistical (C) Task Force letter to Gary R. Josephson, CAS President, regarding the CAS "Discussion Draft of Statement of Principles Regarding Property and Casualty Insurance Ratemaking," May 22, 2013.
36. Ibid.

b. Define any constraints on the price optimization process and outcomes.
    i.

iii. Filing of a report

that the states address the requirement in their state rating laws that "rates shall not be excessive, inadequate, or unfairly discriminatory."

45. The Task Force recommends that rating plans should be derived from sound actuarial analysis and be cost-based. The proposed rates developed from an actuarial analysis need to comply with state laws. They should also be consistent with the actuarial principles derived from a professional actuarial body and the actuarial standards of practice established by the Actuarial Standards Board (ASB).

46. The Task Force recommends that two insurance customers having the same risk profile should be charged the same premium for the same coverage. Some temporary deviations in premiums .3260.004n7a()-3(h)13

when the practice cannot be shown to be cost-based or comply with the state's rating law.

insurers use price optimization in New York and has required insurers to answer its specific rating questions by April 15, 2015.[40]

5. The Florida Office of Insurance Regulation Informational Memorandum OIR-15-04M was issued May 14, 2015.[41] Rates within a risk classification system would be considered fair if differences in rates reflect material differences in expected cost for risk characteristics. Price optimization involves analysis and incorporation of data not rela

8. The following additional states and district issued bulletins or communicated policies on price optimization:

    a. Virginia, July 2015[45]
    b. Indiana, July 20, 2015[46]
    c. Pennsylvania, Aug. 22, 2015[47]
    d. Maine, Aug. 24, 2015[48]
    e. District of Columbia, Aug. 25, 2015[49]
    f. Montana, Sept. 12, 2015[50]
    g. Rhode Island, Sept. 18, 2015[51]
    h. Delaware, Oct. 1, 2015[52]
    i. Minnesota, Nov. 16, 2015[53]

45. https://www.scc.virginia.gov/boi/co/pc/files/pc_handbook.pdf.
46. www.in.gov/idoi/files/Bulletin_219.pdf.
47. www.pabulletin.com/secure/data/vol45/45-34/1559.html.
48. www.maine.gov/pfr/insurance/bulletins/pdf/405.pdf.
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50. http://csimt.gov/wp-content/uploads/PriceOptMemo_091215.pdf.
51. www.dbr.state.ri.us/documents/news/insurance/InsuranceBulletin2015-8.pdf.
52. http://delawareinsurance.gov/departments/documents/bulletins/domestic-foreign-insurers-bulletin-no78.pdf?updated.
53. http://mn.gov/commerce-stat/pdfs/insurance-bulletin-price-optimization.pdf.

Appendix C

Potential Requirements for Rate Filings

1. The insurer should disclose the current, risk-based indicated (see #2 for definition) and the selected rating factor, rate or premium adjustments.

2. The risk-based indicated charge should be actuarially justified as the measurement of the cost to transfer risk from the insured to the insurer. Actuarial judgment [see 14.b for definition) to evaluate that transfer cost can be included.

3. The insurer must adequately explain any deviation from the actuarial indication to the selected change for each rating characteristic.

4. The insurer should disclose and adequately explain any capping rule and the plan to transition toward the indicated charge over time. Beyond the overall effect of capping or transition rules, the insurer should disclose and justify, in detail, any differences between new business and existing business pricing.

5. The insurer should disclose all data, sources and models used in ratemaking. In particular, the insurer should disclose use of customer elasticity of demand or demand models in the selection of rates. The insurer should disclose constraints used in the selection of rates. States should consider the proprietary nature of such information and grant confidentiality as appropriate and allowed under state law.

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Appendix D

Potential Questions for Regulators to Ask
Regarding the
Use of Models in P/C Rate Filings

Insurers might use a model in the development of proposed rates and rating factors. The Task Force offers some potential questions a regulator could ask regarding the use of models in rate proposals. Questions may include, but not be limited by, the following:

Model Description

1. Please provide a high-level description of the workings of the model that was used to select rates and rating factors that differ from the indicated.
2. What is the purpose of the model? What does the model seek to maximize or minimize (e.g., underwriting profit, retention, other) and explain.
3. Under what specific constraints is any maximization/minimization performed? Identify each constrained variable and its minimum and maximum values.

Model Variables

4. How were the input variables for your model selected?
    a. What is the support for the model variables, including the predictive values and error statistics for the model variables?
    b. Are the parameters loss-related, expense-related or related to the risk in some other way?
5. Which of the input variables are internal (customer-provided or deduced from customer-provided information) or external?
    a. Identify whether each input variable is used in your rating plan.
    b. For each external variable, please identify:
        i. The owner or vendor of the data (e.g., Department of Motor Vehicles).
        ii. Which variables are subject to the requirements of the federal Fair Credit Reporting Act.
        iii. How you ensure that the data are complete and accurate.
        iv. The framework, if any, that provides consumers a means of correcting errors in the data pertaining to them.

Model Constraints and Output

6. What level of granularity is your model output (e.g., the class plan level, individual rating factors, or some other level such as household or demographic segment that is different from the rating plan)?
7. What are the limits (or constraints) for the selected rating plan factors, if any?
8. How do the modeled values compare to the company experience?

Note: Regulators should evaluate the particular filing and associated costs to insurers to determine the extent of questioning needed. Regulators should also consider the potential proprietary nature of modeling information and grant confidentiality as appropriate and if allowed under state law.