

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., cost-based actuarial indications or unfair discrimination) may have application to commercial lines of business, as well.
3. Though price optimization could be used in risk selection, marketing or other insurer operations, these issues are not addressed in this paper. The NAIC should consider whether these are issues that need to be addressed.

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 premium volume and expense ratio. Before the introduction of data-driven quantitative techniques, the answers to these questions were largely subjective. Historically, when judgment was applied, the changes were made on a broad level (e.g., an entire rating territory).
6. In recent years, through a process or technique referred to by many as “price optimization,” insurers have started using big data (data mining of insurance and non-insurance databases of personal consumer information where permitted by law), advanced statistical modeling or both to select prices that differ from indicated rates at a very detailed or granular 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 Customers Based on Shopping Habits,” accessed at http://consumerfed.org/press_release/insurance-commissioners-should-bar-industry-practice-of-raising-rates-on-customers-based-on-shopping-habits/.

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 regulation but does not provide wording for the description.

13. The actuarial profession utilizes ratemaking principles. The following are the four principles in the CAS “Statement of Principles Regarding Property and Casualty Insurance Ratemaking”:

- a. Principle 1: A rate is an estimate of the expected value of future costs.
- b. Principle 2: A rate provides for all costs associated with the transfer of risk.
- c. Principle 3: A rate provides for the costs associated with an individual risk transfer.
- d. Principle 4: A rate is reasonable and not excessive, inadequate or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer.⁹

14. The following terms are used in this paper:

3. Illinois law only contains that requirement for workers’ compensation and medical professional liability. Kentucky statute § 304.13-031 includes the requirement only when the market is not competitive.

4. NAIC model law Guideline 1775; NAIC Model Regulation Service – January 2010.

5. NAIC model law Guideline 1776; NAIC Model Regulation Service – October 2010.

6. NAIC model law Guideline 1780; NAIC Model Regulation Service – October 2010.

7. NAIC Guideline 1775: Property and Casualty Model Rating Law (File and Use Version), Model Regulation Service—January 2010

NAIC Guideline 1776: Property and Casualty Model Rate and Policy Form Law Guideline, Model Regulation Service—October 2010.

8. NAIC model law guideline “Property and Casualty Model Rating Law (Prior Approval Version) Guideline 1780, Model Regulation Service—October 2010.

9. Casualty Actuarial Society, 1988. *Statement of Principles Regarding Property and Casualty Insurance Ratemaking*, accessed at www.casact.org/professionalism/standards/princip/sppcrate.pdf.

- 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 other risk transfer costs.
- e. The “actuarial indication” is also referred to as a “cost-based indication” and is an actuarially sound estimate of the cost to transfer covered risk from a policyholder to the insurer. These estimates are based on the data at hand, the analytical techniques used and actuarial judgment about the underlying cost drivers. There can be a variety of reasons why the actuarial indication could have limitations, such as low volume of data/credibility or a problem with data quality or biases in the analytical technique(s) used. Additionally, there could be changes that are not fully reflected in the data, such as internal company changes or changes in the external environment. The actuarial indication excludes adjustments that are not in accordance with actuarial principles.
- f. “Price elasticity of demand” (commonly known as just “price elasticity”) measures the rate of response of quantity demanded due to a price change. Price elasticity “is used to see how sensitive the demand for a good is to a price change. The higher the price elasticity, the more sensitive consumers are to price changes. A very high price elasticity suggests that when the price of a good goes up, consumers will buy a great deal less of it, and when the

10. Actuarial Standards Board, 2013. Actuarial Standard of Practice No. 1, *Introductory Actuarial Standard of Practice*.

11. Casualty Actuarial Society, 1988. *Statement of Principles Regarding Property and Casualty Insurance Ratemaking*, accessed at www.casact.org/professionalism/standards/princip/sppcrate.pdf.

12. Casualty Actuarial Society, 1988. *Statement of Principles Regarding Property and Casualty Insurance Ratemaking*.

- price of that good goes down, consumers will buy a great deal more. A very low price elasticity implies just the opposite—that changes in price have little influence on demand.”¹³
- g. A “rating plan” in the context of this paper is a structure of elements used to determine the premium to be charged a specific risk. The elements include a set of rules, risk classifications and sub-classifications, factors, discounts, surcharges, and fees applied to a base rate that determines the price to be charged a consumer to transfer risk to the insurer. Generally, a rating plan is embodied in a document called a rating manual.¹⁴
 - h. “Rating variables” (or “rating classes”) are those explicitly stated in the insurer’s rating plan and necessary to calculate the premium to be charged. Items such as loss development, trend or price elasticity would not be considered a rating variable unless these items are part of a filed rating plan. A rating variable includes consideration of tier placement within a company (but not across companies; underwriting determines the acceptability of a risk to a company) and insurance scores of all types.
 - i. A “rating factor” is the numerical value assigned to a rating variable for premium calculation purposes.
 - j. A “rating cell” is the result of any combination of rating variables in the rating plan.
 - k. The “rate” is defined as an estimate of all future costs associated with an individual risk transfer. A base value used as the starting point for the calculation of a premium and other rating factors that adjust the base value are considered to be rates.
 - l. A “risk profile” is the set of characteristics set forth in the insurer’s rating plan required to calculate the premium to be charged for the purpose of transferring the individual’s risk to the insurer. Two individuals with the same risk profile have the same risk, loss and expense expectations.
 - m. The “price” or “premium” charged a consumer incorporates management decisions after taking into account other considerations such as underwriting, marketing, competition, law and claims, in addition to the actuarial estimate of the rate. The price (or premium) charged is calculated by taking the individual’s risk profile and applying the final rates and rules contained in the insurer’s rating plan according to the policyholder’s relevant characteristics.
 - n. The purpose of “capping” or “transition” rules is to provide stability to the insurer’s book of business when large premium changes are possible. A premium or rate “capping” rule is a widely used practice where the change in premium from the current premium to the renewing premium (increase or decrease) is reduced. Capping impacts the premium change at renewal on a policy-by-policy basis and is usually in effect for a short period of time (e.g., the full approved premium will be charged after no more than three renewal cycles). Capping usually occurs when large policy premium changes (increases or decreases) are

13. Moffatt, M. Economics expert, Economics.about.com.

14. Paraphrased from the Casualty Actuarial Society’s [Foundations of Casualty Actuarial Science](#).

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 constraints, by maximizing desired factors and minimizing undesired ones.”¹⁵
16. Definitions or descriptions of price optimization as used in insurance, offered by various stakeholders, include the following:
 - a. The 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.”¹⁶
 - b. The American Academy of Actuaries’ (Academy) Price Optimization Task Force defines price optimization as “a sophisticated technique based on predictive modeling results and business objectives and constraints that are intended to assist insurance companies in setting prices. It is an additional component of the pricing process in which the business manager goes from cost-based rates to final prices by integrating expected costs with expected consumer demand behavior, subject to target business objective(s). The target business objective(s) may be to improve profit, increase volume, increase or maintain retention, or some combination thereof. These targeted business objectives represent the insurer’s pricing strategy. Price optimization is a technique used to achieve that pricing strategy.”¹⁷
 - c. 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.”¹⁸
 - d. Earnix defines price optimization as a “systematic and statistical technique to help an insurer determine a rating 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 balance and help the insurer achieve certain business goals, including loss ratios,

15. www.businessdictionary.com/definition/optimization.html.

16. Casualty Actuarial Society Committee on Ratemaking Price Optimization Working Party, 2014. “Price Optimization Overview.”

17. American Academy of Actuaries, April 15, 2015, letter.

18. Towers Watson, Nov. 3, 2014. Letter to Joseph G. Murphy, accessed at www.naic.org/documents/committees_c_d_auto_insurance_study_group_related_141103_towers_watson.pdf.

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 that are unrelated to risk of loss in order to charge each insured the highest price that the market will bear.²⁰
 - f. The Consumer Federation of America (CFA) 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.²¹
17. Many regulators have noted that price optimization is a complex process based on predictive modeling intended to assist insurance companies in setting prices. It is an additional component of the pricing process in which the insurer transitions from actuarial indicated rates to the selected rates charged individual risks.
18. According to Earnix,²² price optimization uses a variety of applied mathematical techniques (linear, nonlinear and integer programming) in the ratemaking process to analyze more granular data.
19. There are several different types of price optimization, and price optimization can be performed at different levels of aggregation. According to Towers Watson,²³ there are three main types of optimization used in ratemaking:
- a. Ratebook Optimization – using mathematical algorithms informed by cost and demand models to adjust factors in an existing structure.
 - b. Individual Price Optimization – a non-parametric rate engine that builds a price based on the cost and demand for the product.
 - c. Hybrid Optimization – create a new rate factor based on the demand model that overlays the cost-based rate algorithm.²⁴

19. Earnix. "Introduction to Price Optimization," accessed at

www.naic.org/documents/committees_c_catf_related_price_optimization_docs_referred_in_memo_to_castf.pdf.

20. Ohio DOI, Bulletin 2015-01.

21. Consumer Federation of America, 2013. Letter to state insurance commissioners.

22. 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; www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=1745902.

23. 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; www.bloomberg.com/profiles/companies/TW:US-towers-watson-&-co.

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 optimization exercise is unique to the insurer and relies on the insurer's data, assumptions, input models, targets and constraints. Some insurers develop their own price optimization software.
25. In the traditional rate-setting process, actuaries determine expected losses, expenses and profit loading; adjustments may be made to reflect business considerations such as marketing/sales, underwriting and competitive conditions. Depending on the situation, regulators may permit insurers to reflect judgment and the competitive environment in rates (e.g., to reflect differences expected in future costs that might differ from past costs or to avoid adverse selection and the resulting associated costs to the company and consumers). However, the insurer must ensure that

24. Guven, S., 2015. FCAS, MAAA, Towers Watson & Company. Presentation, Casualty Actuarial Society's RPM Seminar.

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

	<u>Traditional Approach</u>	<u>Price Optimization Approach</u>
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 adjustments are made to rating factors with more clearly quantified insurer goals, and in lieu of or in addition to adjustments to rating factors, price optimization could be used to adjust the rate or premium for an individual policy.
28. According to Towers Watson, price optimization incorporates models that generate a much larger number of rate scenarios to run through the price assessment environment and helps to better identify which scenarios best achieve business objectives.
29. 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).²⁵

30. Price optimization has been used for years in other industries, including retail and travel. However, the use of model-driven price optimization in the U.S. insurance industry is relatively new. A 2013 Earnix survey²⁶ of 73 major insurers found that 55% consider customer price elasticity. Of large insurance companies (with gross written premiums over \$1 billion), 45% currently use some form of price optimization, with an additional 29% of all companies reporting they plan to do so in the future. State regulators report receipt of few rate filings specifically identifying the use of price optimization. This may be because price optimization is not clearly disclosed to regulators when a filing is made or because price optimization is used in a manner that is not directly part of a filed rating plan.

V. Identify Potential Benefits and Drawbacks of Price Optimization

31. Price optimization affects the selected rates, rating factors or premium rather than the cost-based indications. Historically, selections are often based, in part, on judgment. Therefore, regulators are challenged with reviewing an insurer's selected rates or rating factors without, in certain cases, knowing how price optimization influenced the insurer's selections. General guidelines some regulators may use to review rates include the relationship between the current, indicated and selected rates or factors, how far the selected rates or factors vary from the indications, or the relationship between factors for a rating plan variable. Distilling the voluminous information connected with price optimization makes determining the extent and effect of a program much more difficult for regulators. In addition, regulators must rely upon insurers to present accurate and complete information on indicated rates and the adjustments to arrive at selected rates. Regulators do not currently have the data necessary for an independent evaluation of most of the insurer modeling and calculations.
32. One aspect of working with generalized linear models (GLMs) and rating plans is that they can produce large changes in the risk estimate of individual policies between versions (or when introduced in a rating plan), often as the compounding of many small changes across all the rating variables. As such, companies need ways to provide rate stability when implementing a new rating plan or changes to an existing rating plan. One of the goals within constrained optimization can be to limit policyholder disruption. According to the CAS,²⁷ 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 indirectly favorable for consumers who do not want to shop for insurance on a regular basis.

25. Marin, A. and T. Bayley, 2010. "Price Optimization for New Business Profit and Growth," accessed at www.towerswatson.com/en/Insights/Newsletters/Global/Emphasis/2010/iEmphasisi-20101.

26 Auto Insurance Pricing Practices in North America – Benchmark Survey, <http://earnix.com/auto-insurance-pricing-practices-in-north-america-3/3403/>.

27. Casualty Actuarial Society, 2014. Letter to the Casualty Actuarial and Statistical Task Force.

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 Research Council (IRC) reports 26% of households with incomes of \$100,000 or more reported shopping for auto insurance within the 12 months prior to the survey; 25% of households with incomes between \$60,000 and \$99,999 reported shopping; 25% of households with incomes between \$35,000 and \$59,999 reported shopping; 23% of households with incomes between \$20,000 and \$34,999 reported shopping; and 21% of households with incomes less than \$20,000 reported shopping. The IRC study notes that “among racial/ethnic groups, Hispanic respondents were least likely to have shopped (22%), while black respondents were most likely to have shopped (33%) for auto insurance.”³²
34. According to the CFA, there is no evidence that price optimization improves rate stability, lowers long-term costs or limits policyholder disruption. Price optimization is not needed to select rates less than indicated rates, as evidenced by decades of rate filings. It is unclear how an insurer’s long-term cost for providing coverage is improved by price optimization when price optimization is a non-cost-based adjustment to cost-based rate indications. Cost-based regulatory standards do not permit unfair discrimination in the name of “avoiding policyholder disruption.” It is important to present consumers with the true cost of insurance and the role of markets to allow consumers to address policyholder disruption by shopping around.³³
35. Mr. Hartwig claims the price optimization process does not (unfairly) discriminate and does not abandon the core principle of risk-based pricing. He said it simply provides “more precision in the

28. Comments of the Consumer Federation of America; Center for Economic Justice; Americans for Insurance Reform; United Policyholders; Center for Insurance Research; and Peter Kochenburger, NAIC Consumer Representative; on the March 24, 2015, Draft Casualty Actuarial and Statistical (C) Task Force Price Optimization White Paper, April 20, 2015.

29. Scism, L., 2015. “N.Y. Regulator Studying How Car, Other Insurance Rates Are Set,” *Wall Street Journal*, accessed at www.wsj.com/articles/n-y-regulator-studying-how-car-other-insurance-rates-are-set-1426793439?tesla=y.

30. Scism, L., Feb. 20, 2015. “Loyalty to Your Car Insurer May Cost You,” accessed at <http://blogs.wsj.com/moneybeat/2015/02/20/loyalty-to-your-car-insurer-may-cost-you/>.

31. “The Voice of the Personal Lines Consumer” a survey by Deloitte released in 2012.

32. Insurance Research Council, “Shopping for Auto Insurance and the Use of Internet-Based Technology,” June 2015.

33. Comments on the Casualty Actuarial and Statistical (C) Task Force’s Draft Price Optimization White Paper, *Consumer Federation of America and Center for Economic Justice*, not dated but received by the Task Force and posted as discussion material for the Task Force’s July 21, 2015, conference call.

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.cnn.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. A constraint might limit the pricing adjustment to be between the current rate and the actuarial indicated rate and always move in the direction of the actuarial indicated rate.
 - ii. A constraint might require selected rating factors to be between the current and actuarial indicated factors, within a confidence interval around the current/indicated factors, or directionally consistent with the current factors.
 - iii. A constraint might limit the variables that can be used in defining a risk class, such as a categorical or numerical measure of retention.
 - iv. A constraint might be that price optimization can only be applied to specific class sizes, not class sizes so small that price optimization could be applied at the individual insured level or to small groups of insureds.
 - v. A constraint could be that price optimization adjustment to rating factors must produce rates that maintain cost-based differences.
- c. Develop regulatory guidance on the meaning of statutory rate requirements so that rates are not excessive, inadequate or unfairly discriminatory.
 - i. Provide clear examples of what is unacceptable.
 - ii. Identify principles under which the legal requirements for rates are met.
- d. Enhance filing requirements using a specific definition of “actuarial indication” of needed rates and rating factors.
 - i. Consider whether the actuarial indication is a point estimate or any selected value within a confidence interval around the point estimate.
 - ii. Consider whether to require actuarial certification that the indications presented in the rate filing are based solely on cost considerations and are not otherwise adjusted.
 - iii. Consider requiring disclosure of any adjustments to rates that are not based on expected cost.
 - iv. Consider not allowing any non-cost-based adjustments to selected rates or rating factors.
- e. Require specific explanation or reasoning to support any proposed or selected rate that deviates from the actuarially indicated rate.
- f. Change filing requirements to require the following transparency, with consideration of state law regarding confidentiality:
 - i. Disclosure of whether price optimization, including any customer demand considerations, is used.
 - ii. Disclosure of differences in proposed prices for the insurer’s existing and new customers with the same risk profile.

- iii. Filing of a report showing the distribution of expected loss ratios under the current prices and under the proposed prices (e.g., a histogram with two series). If the distribution under proposed prices is wider compared to the distribution under current rates, then there could be additional subsidies in the proposed rates. Note that this could be affected by changes in an insurer's mix of business, etc.
 - iv. Disclosure of all data sources, models and risk classifications used by an insurer to calculate a premium, whether referred to as underwriting, tier placement, rating factors, discounts, surcharges or any other term.
 - v. Disclosure of which rating factor or factors are affected by price optimization, the size of the impact by rating factor and the cumulative impact of price optimization across all rating factors for existing policyholders and applicants for insurance.
 - vi. Filing of a certification by an actuary that all non-cost-based considerations affecting the proposed rates and rating factors are documented in the filing. The certification would also identify the exhibits where differences are shown. A more precise definition of price optimization may be needed.
- g. Ensure that the regulatory system does the following:
- i. Requires all rating factors be filed and all adjustments to indicated rates be disclosed.
 - ii. Maintains adequate resources for reviewing complex rate filings, including price optimization.
 - iii. Establishes regulatory practice with more in-depth review of price optimization models used in ratemaking.
 - 1. States and/or the NAIC should obtain expertise with models.
 - 2. Modeling experts should review how a particular model works and the accuracy and appropriateness of input data in order to make an informed determination regarding the statutory rate requirements.

VII. Recommendations for Regulators

43. This white paper is focused on price optimization in personal lines and its impact on rates. The previous paragraphs provide the Task Force's background research and study of price optimization. Utilizing this study, the Task Force makes the following recommendations regarding rates and regulatory rate review for personal lines insurance.
44. The Task Force recognizes there are numerous definitions of price optimization. Companies can use the term to encompass activities that might include retention models, elasticity of demand, maximization of profit, competitive analysis, etc. The Task Force agreed not to recommend a definition of price optimization but rather, under any definition of price optimization, recommend

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 might exist between new and renewal customers with the same risk profile because of capping or premium transition rules.
47. The Task Force acknowledges that not all rates and rating plans that are accepted or approved strictly adhere to the actuarial indications. While actuarial indications are largely preferred over pure judgment, regulators acknowledge that the actuarial indications are only an estimate of the cost to transfer risk and that some insurer judgment will inevitably enter the rate setting process. The Task Force recommends states allow flexibility reflecting insurance loss and expense costs in the selection of rating factors. Some additional recommendations regarding the acceptance of deviations from the actuarial indications are as follows:
 - a. The Task Force recommends the selection of a proposed rate between the currently approved rate and the actuarially indicated rate be allowed if based on reasonable considerations adhering to state law and consistent with actuarial principles and Standards of Practice reflecting expected insurance loss and expense costs.
 - b. The Task Force recommends that a selected rate outside the range defined by the current and indicated rate may be acceptable provided it is disclosed, complies with state law and is shown to be consistent with actuarial ratemaking principles and Standards of Practice.
 - c. The Task Force acknowledges that capping and transitional rules can be in the public’s best interest but recommends regulators consider the extent to which they will allow capping and transitional rating. Consideration should be given to the length of time over which premium changes will be limited before they reach the approved rate level, the size and reasonableness of capping’s upper and lower bounds, and the extent to which capping of one rate might affect rates charged to others.
48. The Task Force recommends that under the requirement “rates shall not be ... unfairly discriminatory,” insurance rating practices that adjust the current or actuarially indicated rates or the premiums, whether included or not included in the insurer’s rating plan, should not be allowed

when the practice cannot be shown to be cost-based or comply with the state's rating law. With due consideration as to whether practices are cost-based or in compliance with state rating law, the Task Force believes the following practices, at a minimum, are inconsistent with statutory requirements that "rates shall not be ... unfairly discriminatory:"

- a. Price elasticity of demand.
- b. Propensity to shop for insurance.
- c. Retention adjustment at an individual level.
- d. A policyholder's propensity to ask questions or file complaints.

49. The Task Force recommends that rating plans in which insureds are grouped into homogeneous rating classes should not be so granular that resulting rating classes have little actuarial or statistical reliability. The use of sophisticated data analysis to develop finely tuned methodologies with a multiplicity of possible rating cells is not, in and of itself, a violation of rating laws as long as the rating classes and rating factors are cost-based.

VIII. State Considerations

50. With due consideration of the above recommendations, the Task Force proposes the following:

- a. Consider issuing a bulletin to address insurers' use of methods that may result in non-cost based rates. (See Appendix B.)
- b. Consider enhancing requirements for personal lines rate filings to improve disclosure and transparency around rates, rate indications and rate selections. (See Appendix C.)
- c. Analyze models used by insurers in ratemaking to ensure the model adheres to state law and actuarial principles. A list of possible questions is provided to assist the regulatory analysis. (See Appendix D.)

Appendix A

State Actions Taken Prior to Adoption of the White Paper

1. Maryland, the first state to take explicit action against price optimization in rate setting, released Bulletin B 14-23 on Oct. 31, 2014.³⁷ The Maryland Insurance Administration announced it determined that price optimization is a practice in which an insurer varies rates based on factors other than the risk of loss, such as the willingness of some policyholders to pay higher premiums than other policyholders, resulting 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 Jan. 1, 2015.
2. In February 2015, the Ohio DOI 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.”³⁸ The bulletin says that 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 DOI 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 required to end the practice and resubmit rates compliant with the bulletin no later than June 30, 2015.
3. The California DOI 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.³⁹ The Notice 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.”
4. On March 18, 2015, the New York Department of Financial Services (NYDFS) sent a letter to P/C 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 NYDFS 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 NYDFS is seeking to determine whether

37. <http://insurance.maryland.gov/Insurer/Documents/bulletins/bulletin-14-23-unfair-discrimination-in-rating.pdf>.

38. <https://insurance.ohio.gov/Legal/Bulletins/Documents/2015-01.pdf>.

39. www.insurance.ca.gov/0250-insurers/0300-insurers/0200-bulletins/bulletin-notices-commiss-opinion/upload/PriceOptimization.pdf.

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 related to expected cost for risk characteristics—that is, it involves factors not related to expected loss and expense experience. The memorandum states the use of price optimization results in rates that are unfairly discriminatory and in violation of Sections 627.062 and 627.0651, Florida Statutes. Insurers that have used price optimization in the determination of the rates filed and currently in effect should submit a filing to eliminate that use. Insurers should ensure that any filings subsequent to the date of the Memorandum do not utilize price optimization in any manner.

6. The Vermont Department of Financial Regulation, Division of Insurance, issued Insurance Bulletin No. 186 titled Price Optimization in Personal Lines Ratemaking on June 24, 2015.⁴² The bulletin is applicable to all personal lines policies. Price optimization, in some of its application, involves the judgmental use of factors not specifically related to a policyholder’s risk profile to adjust the policyholder’s insurance premium. Unfair discrimination is considered to exist if price differentials “fail to reflect equitably the differences in expected losses and expenses”⁴³ for different classes of policyholders. The bulletin states that Vermont law is clear and that both base rates and rating classes must be based on factors specifically related to an insurer’s expected losses and expenses. Insurers are directed that all personal lines rate filings must disclose whether the company uses non-risk-related factors to help determine the insured’s final premium.

7. Washington’s Technical Assistance Advisory 2015-01 was issued July 9, 2015, by the state of Washington, Office of the Insurance Commissioner, on the subject of price optimization.⁴⁴ The advisory states Washington law requires that premium rates for insurance not be excessive, inadequate or unfairly discriminatory. A rate is not unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer. Thus, rates must be based on cost associated with risk. Charging higher rates to certain consumers based on their willingness to look elsewhere for insurance does not reflect a genuine increased cost incurred by the insurer. To the extent that an insurer’s use of price optimization results in premiums, rates or rating factors unrelated to cost and risk, it will be considered unfairly discriminatory and in violation of Washington law.

40. *Insurance Journal*, 2015. “New York DFS Opens Inquiry Into Price Optimization,” accessed at www.insurancejournal.com/news/east/2015/03/20/361413.htm.

41. www.floir.com/siteDocuments/OIR-15-04M.pdf.

42. www.dfr.vermont.gov/reg-bul-ord/price-optimization-personal-lines-ratemaking.

43. Chapter 128 of Title 8 V.S.A.

44. www.insurance.wa.gov/about-oic/newsroom/news/2015/documents/TAA-PO-July2015.pdf.

8. The following additional states and district issued bulletins or communicated policies on price optimization:
 - a. Virginia, July 2015⁴⁵
 - b. Indiana, July 20, 2015⁴⁶
 - c. Pennsylvania, Aug. 22, 2015⁴⁷
 - d. Maine, Aug. 24, 2015⁴⁸
 - e. District of Columbia, Aug. 25, 2015⁴⁹
 - f. Montana, Sept. 12, 2015⁵⁰
 - g. Rhode Island, Sept. 18, 2015⁵¹
 - h. Delaware, Oct. 1, 2015⁵²
 - i. Minnesota, Nov. 16, 2015⁵³

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.

49. <http://disb.dc.gov/node/1107816>.

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 B

Potential State Bulletin

INSURANCE BULLETIN XXX

DATE

PRICE OPTIMIZATION
In Personal Lines Ratemaking

This bulletin is applicable to all property and casualty insurers issuing personal lines policies in [STATE].

While there is no universally accepted definition of price optimization, the practice, in some of its applications, involves the use of factors not specifically related to an insured's expected losses and expenses but are used to help determine or to adjust an insured's premium. An example would be using an individual policyholder's response to previous premium increases to determine how much of a premium increase the policyholder will tolerate at renewal before switching to a different insurer. This practice can result in two policyholders receiving different premium increases even though they have the same loss history and risk profile. It can also result in premiums that are excessive or inadequate.

Property and casualty insurers doing business in [STATE] are reminded that all ratemaking must conform to the statutory requirements contained in [STATUTE(S)]. Rates must not be "... excessive, inadequate or unfairly discriminatory ...". A rate will be considered unfairly discriminatory if price differentials fail to reflect equitably the differences in expected losses and expenses for different classes of policyholders. Both base rates and rating classes must be based on policyholder characteristics specifically related to an insurer's expected losses, expenses or policyholders' risk. While insurers may employ actuarial judgment in setting their rates, judgmental adjustments to a rate may not be based on non-risk-related policyholder characteristics such as an individual's "price elasticity of demand," which seek to predict how much of a price increase an individual policyholder will tolerate before switching to a different insurer.

The following practices are inconsistent with statutory requirements that "rates not be ... unfairly discriminatory":

- a. Price elasticity of demand.
- b. Propensity to shop for insurance.
- c. Retention adjustment at an individual level.
- d. A policyholder's propensity to ask questions or file complaints.

The Department of Insurance (DOI) does not intend this bulletin to prohibit or restrict such practices as capping or transitional pricing when applied on a group basis. Insurers should group individual policyholders into justifiable, supportable, risk-based classifications and treat similarly situated policyholders the same with respect to insurance pricing. Likewise, the use of sophisticated data analysis to develop finely tuned methodologies with a multiplicity of possible rating cells is not, in and of itself, necessarily a violation of rating laws as long as the classifications are based strictly on expected losses, expenses or other justifiable, supportable risk characteristics.

[Drafting note: States will need to consider whether the bulletin should also apply to commercial lines policies and adjust the bulletin accordingly.]

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.
6. For any deviations around the actuarial indication, insurers should evaluate credibility of the actuarial indication and make appropriate actuarial assumptions. When rating classes are so granular that there is limited credibility, regulators should consider whether to allow such a rating plan.
7. Some states might decide to require an attestation of the proposed rates in a rate filing. Potential attestation could include:
 - a. Attestation that proposed rates are within a reasonable range of cost-based indications.
 - b. Attestation that actuarial indications are cost-based, which would inform regulators that any deviations from actuarial indications should be evaluated according to the law.
 - c. Attestation that actuarial indications are based on a sound actuarial methodology.
8. The insurer should provide a disruption report that shows the distribution of proposed policyholder premium changes (percentage change) when the existing book of business is renewed under the proposed rating plan.

Note: States should consider the proprietary nature of each requirement and grant confidentiality as appropriate and if allowed under state law.

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.