Rising Fellow

Fall 2023 CAS Exam 6U Study Guide

Contents

Government Insurers

Horn and Webel

Webel

CAS Financial Reporting Ch. 1 – 6 (Basics)

CAS Financial Reporting Ch. 7 (Balance Sheet)

CAS Financial Reporting Ch. 8 (Income Statement)

CAS Financial Reporting Ch. 13 (Overview of Schedules)

CAS Financial Reporting Ch. 14 (Schedule F)

CAS Financial Reporting Ch. 15 (Schedule P)

CAS Financial Reporting Ch. 18 (IEE)

CAS Financial Reporting Ch. 19 (RBC)

NAIC IRIS (also covers CAS Financial Reporting Ch. 20)

CAS Financial Reporting Ch. 26 (Taxation)

CAS Financial Reporting Ch. 30 (Future of SAP)

AAA Retained Risk

NAIC APPM, Preamble

NAIC SSAP 5R

NAIC SSAP 9

NAIC SSAP 53

NAIC SSAP 55

NAIC SSAP 63

NAIC SSAP 65

NAIC SSAP 66

ASC 944-020-15

COPFLR (also covers CAS Financial Reporting Ch. 16 – 17)

AAA CECL

Cedar

NAIC SSAP 62R

Freihaut and Vendetti

Klann

Introduction

How to Use This Guide

This guide is intended to **supplement** the syllabus readings. Although we believe it provides a thorough review of the exam material, the readings provide additional context that is invaluable. Please do NOT skip the syllabus readings.

Original Practice Problems

Original practice problems & solutions are included for all papers. The essay problems are **similar to flashcards** and are meant to capture the same content. If a topic is covered in an essay problem, then you should know it. The original practice problems are included within the study guide itself, as well as in separate Excel files. The Excel files can be downloaded from the online course.

Past CAS Exam Problems

Past CAS exams (including solutions) are included in Excel format within the study guide course.

A list of past CAS exam problems by paper can also be found within the study guide course. It categorizes all problems back to 2013.

Feedback

We always working to improve the Exam 6U Study Guide and the rest of the Rising Fellow study material. Please send us an email at **exam6@risingfellow.com** if you have feedback about any of the following:

- Sections that are confusing or could be improved
- Errors (ex. formatting, spelling, calculations, grammar, etc.)

Note that errata will be posted on the Rising Fellow website on an as-needed basis.

Blank Pages

Since many students want a printed copy of the study guide, blank pages have been inserted throughout the guide to ensure that all outlines and problem sets start on odd pages.

Kucera

Outline

I. Introduction

Kucera specifies that credit-based insurance scores allow insurers to better segment risks for the purpose of charging appropriate rates thus credit-based insurance scores are appropriate within risk classification and ratemaking. The removal of insurance scores will not lower overall premiums but rather redistribute the premiums to increase subsidy between high and low risks.

II. Definition of Credit-Based Insurance Score

An insurance score is a numerical score assigned to an insurance risk based on that risk's underlying characteristics which could be used in underwriting or rating. Thus, a credit-based score incorporates attributes from an insured's credit report. These models can be developed internally or by third-party vendors.

Credit-based insurance scores demonstrate strong correlation with expected costs. Thus, these scores are an important tool for segmenting risks.

III. Evaluation of How Insurers Use Credit-Based Insurance Scores

Within ratemaking, both the overall premium level and individual charged premium are important. Overall rate level should be set such that total premium from all risks covers all losses and expenses; individual rates should be set such that premium from the individual risk covers the expected cost for that risk. If risk classes are not segmented appropriately, then deterioration can occur in overall rate level.

Insurers used credit-based insurance scores in the following manners:

1) Determine whether prospective insureds qualify for insurance (underwriting)
2) Segment risks into different groups for rating

Insurance scores are being used to segment risks to homogenous groups so that appropriate premiums can be charged, which is aligned with ASOP No. 12 *Risk Classification*. The ASOP specifies that the actuary should select risk characteristics that are related to expected outcomes. Further, rates within a risk classification system would be considered equitable if differences in rates reflect material differences in expected cost for risk characteristics.

Studies have shown credit scores reflect significant differences in expected loss costs, and Kucera declares that rates using credit-based insurance score are not excessive, inadequate, or unfairly discriminatory.

Some insurers report that they have written more risks from general population by using credit-based insurance scores thus increasing availability.

IV. Discussion of How Current Economic Conditions Affected Policyholder Premiums Related to Credit-Based Insurance Scores

Kucera's comments were made in 2009 as the US was in the midst of an economic crisis with severe tightening of credit markets. During the time, people were experiencing loss of income, decreases in their asset value along with a rise in unemployment.

Regulators had expressed concerns that the economic crisis would lead to premium increases so Kucera analyzes the issue and stresses the importance of both the overall and individual levels of premium.

Aggregate Premium Effect:

- Insurers use insurance scores to determine rate relationships not to determine overall premium need
- If current economic crisis causes entire distribution of insured's insurance score to worsen, then insurer should adjust overall premiums so the company moves to appropriate aggregate level while maintaining rate relationships. This is no different than any other distributional shift for a rating variable that actuaries analyze with a rate review

Individual Premium Effect:

- Regulators may be concerned that a dramatic shift in credit scores could disrupt the current relativities among risks with insurance score
- This is not unique to insurance score. For example, young males and young females have become more similar in driving risk over time
- Insurers adjust classification plans to change differentials when these events occur
- Actuaries should regularly analyze indicated rate differentials which ensures rates are actuarially sound regardless of the current economic environment

Kucera does concede that an immediate distributional shift could result from an economic crisis where insureds could be harmed prior to the phenomenon appearing in data. However, he mentions that insurers are unaware of quantifiable evidence that has surfaced to demonstrate that such a shift has occurred, which is likely because renewal business makes up a majority of a company's business.

McCarty

Outline

I. Use of Credit-Based Insurance Scores in Personal Insurance

One of the purposes of regulation is to protect consumers, and this can be accomplished through rate regulation. Rates should not be unfairly discriminatory, and critics (including the author McCarty) argue that credit-based insurance scores are discriminatory against lower income and other classes of people. McCarty notes that while new sources of information (DNA testing, internet usage) exhibit mathematical correlations with insurance claims, this does not make them fair and valid criteria for insurance purposes.

II. Other Factors Considered to be Inappropriate

Race and genetic testing are examples from life insurance and health insurance respectively that might justify higher rates from an actuarial perspective but not supported by public policy and protection of consumers. Regulators need to balance the benefits of claims prediction with sound public policy.

Regulators should be sensitive to rating factors that are highly correlated with race, ethnicity, religious background, or income level. Occupation and education level are examples of rating variables that might be acting as proxies.

III. Criticisms of The Credit Reporting System

Weaknesses in the credit reporting system are also a challenge. Thus even if the methodology is correct, there would be inaccuracies in their application such as rating. Here are a few examples of those weaknesses:

- Consumer Reports study showed that 50% of reports contained errors
- Identity Theft

Credit reports disproportionately impact specific classes:

- Recent divorcees
- Recently naturalized citizens
- Elderly: Tend to use credit less often and thus have fewer credit relationships leading to lower credit scores
- Disabled
- Certain religious backgrounds
- Younger individuals that have not established credit histories

A downturn in the economy could potentially increase differences in credit scores since rising unemployment, home foreclosures, and inflation might deteriorate credit scores.

Studies show that credit scores show difference within frequency but not severity. It is very possible that the frequency is the same across populations, but those with higher scores are less likely to file a claim. Since low-income people cannot pay small out of pocket expenses, they file the claim whereas wealthier individuals may not file the claim as to avoid impact to claims history.

Insurer methods are not transparent to consumers and vary by company. Further, insurance credit scores could be negatively impacted by sound financial decisions that cannot be linked to personal insurance risks. For example, not using credit cards, having too few credit cards, and having an installment loan, all may adversely impact a credit-based insurance score.

IV. Disproportionate Impact of Credit-Based Insurance Scores

The main problem with credit score from McCarty's perspective is the relationship to race, ethnicity, and income status thus leading to disparate impact on select groups. The 2007 FTC report demonstrates strong correlations between credit scoring and race/ethnicity. A Texas DOI report also shows that ethnicity is correlated with credit score.

McCarty believes that credit-scoring is not necessary for proper underwriting and rating since it is indirectly measuring socioeconomic status.

V. Florida Actions Regarding Credit-Based Insurance Scores

In 2003, Florida enacted legislation to limit use of credit-based scores in personal auto and residential insurance. The industry strongly opposed Florida with four sentiments displayed below along with the **response from FL administrative law judge**:

1) Office did not have authority to prevent use of credit scoring as an underwriting and rating tool – **Response**: Did have the authority
2) Office did not have authority to define the term "unfairly discriminatory" – **Response**: Did have the authority
3) Insurers did not have the necessary data to demonstrate the effect of credit scoring on the protected classes – **Response**: Irrelevant
4) Definition of "disproportionate impact" was too vague – **Response**: Needed to be defined more comprehensively so revising

VI. Conclusion and 2007 FTC Report

McCarty reiterates that credit scores negatively impact people based on race, age, and religion; thus this cost outweighs the benefit of suggested enhanced pricing and underwriting. He expresses further concerns:

- Growing use of education and occupation
- Data provided by insurers may have been selected to show best case for credit-based insurance scores
- No premium data were used
- Transparency of report where trade associations received access prior to regulators

VII. State Involvement

States have taken action in regards to credit-scoring, and McCarty requests that federal action not preempt or diminish consumer protection enacted by state legislators. State actions include:

- Legislative or regulatory action limiting use of credit scoring in insurance
- Requiring regulatory access to credit scoring model

- Requiring notification of credit-score use to consumers
- Restricting insurance decisions based solely on credit-score model

McCarty does make a final note that he is representing the NAIC where other state commissioners may have different opinions. Proponents of credit-based scores argue that the scores are predictive of claims experience and thus could be used in rating without concern. Some commissioners believe the process is not *intended* to be discriminatory thus the disparate impact is coincidental. Some policyholders actually benefit from the use of credit.

Original Essay Problems

EP #1

Credit-based scores are typically utilized to improve risk classification systems by segmenting risks appropriately. Insurers A and B utilize the exact same rating algorithm. Insurer A implements a credit-based score rating variable.

Fully describe the effect on Insurer B.

EP #2

a) Briefly describe a credit-based score.
b) Fully justify the use of credit-based insurance scores in ratemaking.
c) Identify two uses for credit-based insurance scores.

EP #3

An insurer files a credit-based insurance score rating variable for private passenger automobile. A state regulator objects to the new rating variable by stating an economic recession would lead to premium increases for all policyholders.

a) Fully justify to the regulator the new credit-based insurance score variable by considering aggregate (overall) premium effect.
b) Fully justify to the regulator the new credit-based insurance score variable by considering individual premium effect.
c) Briefly describe how an immediate distributional shift could affect policyholders.
d) Briefly describe a reason why companies would continually evaluate rate differentials.

EP #4

Affordability and availability are two considerations for regulators. Compare and contrast the use of credit-based insurance scores **in ratemaking** using these two criteria.

EP #5

Affordability and availability are two considerations for regulators. Compare and contrast the use of credit-based insurance scores **in underwriting** using these two criteria.

EP #6

a) Briefly describe two elements that could be included in a credit-based insurance score.
b) Briefly justify whether these elements are unfairly discriminatory.

EP #7

A critic argues that credit-based insurance scores are correlative rather than causal.

a) Describe the difference between a correlative and causal variable.
b) Justify using credit-based insurance score as a rating variable even though it is correlative and not causal.
c) Identify two rating variables other than credit-based insurance scores that might be acting as proxies.
d) Identify a causal rating variable.

EP #8

Credit-based insurance scores can either be developed internally through proprietary models or through third-party vendors.

a) As a regulator, fully describe a concern with proprietary models.
b) As a regulator, describe a concern with a third-party vendor model.

EP #9

A critic argues that credit-based insurance scores are unfairly discriminatory.

a) Identify two groups of people that credit-based insurance scores unfairly discriminate against.
b) Even though credit-based insurance scores are correlated with loss cost, fully argue why they should not be used in ratemaking.
c) Identify three other rating variables that could be considered unfairly discriminatory.

d) Identify four characteristics that regulators are highly sensitive to if correlated with rating variables.

EP #10

Briefly describe three concerns with using credit-based insurance scores as a rating variable.

EP #11

Critics of credit-based insurance scores argue that there are weaknesses within credit reporting system.

a) Identify two weaknesses in the credit reporting system.
b) Identify four groups that credit reports disproportionately impact.
c) For two of the groups identifies in part b. above, briefly describe the disproportionate impact.

EP #12

a) Identify three reasons an economic downturn could potentially increase differences in credit scores.
b) Fully describe why credit scores may show a difference in frequency.
c) Briefly describe three sound financial decisions that may negatively impact credit scores.

EP #13

In 2003, Florida enacted legislation to limit use of credit-based scores in personal auto and residential insurance.

a) Briefly describe three sentiments from the industry to strongly oppose this legislation.
b) Briefly describe the three responses from a Florida administrative judge in response to the three sentiments from part a. above.

EP #14

McCarty specifies that the costs outweigh the predictive power benefits of credit-based insurance scores.

a) Identify two other variables that insurers are increasingly relying upon which troubles McCarty.

b) Identify two concerns with the 2007 FTC Report.

EP #15

a) Identify four actions that state regulators have taken to limit credit-based insurance scores.
b) Describe how a consumer may benefit from the use of credit-based insurance scores.
c) Briefly defend McCarty's request that federal action not preempt state legislation regarding credit scores.

Original Essay Solutions

ES #1

Insurer B will not have segmented classes appropriately which will cause deterioration. Overall rate level will deteriorate as Insurer B loses better risks to Insurer A while likely attracting higher loss risks at an inadequate rate level. Overall rate level should be set such that total premium from all risks covers all losses and expenses likely causing Insurer B to raise overall rates which further drives this cycle. This is also known as adverse selection.

ES #2

a) A credit-based score is a numerical score that incorporates attributes from an insured's credit report.
b) Credit-based scores better segment risks for the purpose of charging appropriate rates. Removing credit will not lower overall premiums but rather redistribute the premiums to increase subsidy between high and low risks. Insurance scores are being used to segment risks to homogenous groups so that appropriate premiums can be charged, which is aligned with ASOP No. 12 Risk Classification.
c) Credit-based insurance scores are used for ratemaking (risk classification) and underwriting.

ES #3

a) If a recession causes entire distribution of insured's insurance score to worsen, then insurer should adjust overall premiums so the company moves to appropriate aggregate level while maintaining rate relationships. Insurers use insurance scores to determine rate relationships not to determine overall premium need. This is no different than any other distributional shift for a rating variable that actuaries analyze with a rate review.
b) Actuaries should regularly analyze indicated rate differentials which ensures rates are actuarially sound regardless of the current economic environment. While regulators may be concerned that a dramatic shift in credit scores could disrupt the current relativities among risks with insurance score, this is not unique to insurance score. Insurers adjust classification plans to change differentials when these events occur.

c) If an insurer has not had time to react to a distributional shift since data is not readily available, then the policyholder may be harmed.
d) Competitive concerns

ES #4

If credit-based insurance scores are used in ratemaking, then availability should be increased as insurers are able to segment risk more appropriately thus allowing to charge appropriate rate for larger portion of population. However, affordability could be a concern as segments of population will be paying higher rate. Further, this variable may unfairly discriminate against these segments thus creating affordability concerns.

ES #5

If credit-based insurance scores are used in underwriting, then availability will likely decrease as insurers will not offer coverage to higher-risk insureds. The residual market may increase as a result of underwriting decisions. If insureds are placed in residual market, then insureds may be paying a higher premium for insurance coverage causing an affordability problem.

Further if insurers start to utilize credit in underwriting decisions, insurers must prospectively adjust premiums at overall level as book of business will change. The related decisions would also affect affordability for insureds.

ES #6

a) Number of inquiries into opening new accounts and Accounts 30 days or more past due
b) Number of inquiries into opening new accounts: Yes, an individual may require more access to credit and should not be penalized in insurance premiums.
   Accounts 30 days or more past due: Yes, an individual that has lower income is likely to miss payments and thus this is a proxy for income which is unfairly discriminatory.
   -OR-
   Number of inquiries into opening new accounts: No, an insured that is more reliant on credit will likely result in higher loss costs for an insurer.

Accounts 30 days or more past due: No, an insured that is past due on bills is more likely to file a claim with an insurer.

ES #7

a) A correlative variable has predictive power where levels of the variable are tied to loss costs but it may not explain the relationship. A causal variable has predictive power where levels of the variable are tied to loss costs and provides an explanation where the behavior/characteristic cause the higher loss costs.
b) Credit-scores are predictive of an insured's future claims experience. Insureds with lower scores are more likely to file a claim as cannot pay for small claims. Insurance score is not causing the claims experience, but it is correlated with the experience.
c) Occupation and education
d) Driving score through telematics (UBI) device

ES #8

a) A regulator shall protect the consumer. If a model is proprietary then it is unclear to the consumer, and thus the consumer may not understand how premium varies nor can the consumer potentially control his or her premium.
b) A third party vendor may not be appropriate in all cases so the regulator shall ensure that the insurer has used a third-party vendor model appropriately. A regulator needs to ensure the rates are not excessive, inadequate, or unfairly discriminatory to protect the consumer but also to protect solvency of the insurer.

ES #9

a) Low income and elderly
b) A rating variable should also consider public policy not solely predictive power. Credit-based insurance score is indirectly measuring socioeconomic status. Thus, this variable is unfairly discriminatory which violates one of the principles of ratemaking. Further, there are weaknesses within the credit reporting system.
c) Race, genetic testing, and salary
d) Race, ethnicity, religion, and income level

ES #10

Answers may include three of the following:

- Credit score has a relationship with race, ethnicity, and income status thus unfairly discriminatory
- Texas DOI report shows that ethnicity is correlated with credit score
- Credit score indirectly measures socioeconomic status
- There are weaknesses within the credit reporting system
- Insurer Methods/Models are not transparent to consumers
- Credit score goes against public policy even though it is predictive

ES #11

a) Credit reports may contain errors and identity theft
b) Credit reports disproportionately impact recent divorcees, recently naturalized citizens, elderly, disabled, certain religious backgrounds, and younger individuals.
c) Elderly tend to use credit less often and thus have fewer credit relationships leading to lower credit scores. Younger individuals may not have established credit histories.

ES #12

a) Unemployment, home foreclosures, and inflation
b) Insureds with higher scores are less likely to file a claim. Since low-income people cannot pay small out of pocket expenses, they file the claim whereas wealthier individuals may not file the claim as to avoid impact to claims history.
c) Not using credit cards, having too few credit cards, and having an installment loan

ES #13

a) There were four sentiments identifies so three of the following four.
    - Office did not have authority to prevent use of credit scoring as an underwriting and rating tool.
    - Office did not have authority to define the term "unfairly discriminatory"

- Insurers did not have the necessary data to demonstrate the effect of credit scoring on the protected classes
- Definition of "disproportionate impact" was too vague

b) Response to the sentiments identified in part a.
    - Did have authority
    - Did have authority
    - Irrelevant
    - Needs to be defined better so revising

ES #14

a) Education and occupation
b) Two of the following three:
    - Data provided by insurers may have been selected to show best case for credit-based insurance scores
    - No premium data were used
    - Transparency of report where trade associations received access prior to regulators

ES #15

a) Four state regulatory actions to limit credit-based insurance scores:
    - Limiting use of credit scoring in insurance
    - Requiring regulatory access to credit scoring model
    - Requiring notification of credit-score use to consumers
    - Restricting insurance decisions based solely on credit-score model
b) Lower risks insureds benefit as new rating variables are identified. Risks are thus further segmented which decreases the subsidy across risks.
c) State regulators that have taken action against credit-based insurance scores justify that they are protecting consumers. Thus, the state regulator would lose that consumer protection if federal action preempted state legislation.

NAIC Price

Outline

I. Introduction

This paper provides an overview of price optimization with a focus on rate regulation. Regulators are concerned with protecting consumers and ensuring rates are not excessive, inadequate, or unfairly discriminatory. Price optimization is presented through different viewpoints, thus both benefits and drawbacks are stated along with potential state regulatory responses. We expect this topic is set up for higher-level Blooms questions so think about it in context of other papers.

Ratemaking is the process of establishing rates used in insurance or other risk transfer mechanisms. The rise in big data and more sophisticated data mining tools has allowed more emphasis to be placed on objective and quantitative information for setting rates rather than traditionally relying on judgement or anecdotal evidence. Judgment is not a new concept in setting rates, but it was previously subjective. Recently through price optimization, insurers have used advanced statistical modeling to select prices that differ from indicated rates at a more granular level than traditional judgment. This includes the potential for individual pricing by using price elasticity of demand.

Critics have argued that price optimization is unfairly discriminatory since external, non-insurance databases are used to model consumer demand and predict the response of consumers to price changes. **Criticisms** include the following:

1) Price optimization increases profits by raising premiums on people who are less likely to shop. Some argue these people are also low-income consumers
2) Price optimization introduces a component to rate setting that is unrelated to expected losses or expenses
3) Drivers with the same risk profile may be charged different rates

Regulators have historically accepted some deviations from indicated rates and rating factors. What is an acceptable level of deviation? State regulations determine the acceptable level based on law and judgment.

II. Background of State Rating Law, Actuarial Principles, and Definitions

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." – from NAIC model law

The four CAS ratemaking principles are presented within the paper, but we will also be covering them within Porter Chapter 8 so not repeating here.

Several definitions are presented which are restated below:

Price Optimization: Process of maximizing or minimizing a business metric (profitability, marketing, retention) using sophisticated tools and models to quantify business considerations.

Actuarial Judgment: ASOPs call upon actuaries to apply both training and experience to their professional assignments. Price optimization is a tool and does not replace actuarial judgment in ratemaking. Judgment remains a separate and distinct exercise that is fully consistent and permitted by actuarial standards.

Ratemaking: Process of establishing rates used in insurance or other risk transfer mechanisms which includes considerations of competition, marketing goals, and legal restrictions.

Cost-based rate: Estimate of all future costs associated with an individual risk transfer and is developed from and consistent with the expected claims, claim handling expenses, underwriting expenses, policy acquisition expenses, profit, investment income, and other risk transfer costs.

Price Elasticity of Demand: measures the rate of response of quantity demanded due to a price change. The higher the price elasticity, the more sensitive to price.

Rate: Estimate of all future costs associated with an individual risk transfer.

Price or Premium: Incorporates management decisions after taking into account other considerations such as underwriting, marketing, competition, law and claims.

Capping or Transition Rules: Provide stability to the insurer's book of business when large premium changes are possible.

III. Price Optimization Background

There is no single definition of price optimization, so several price optimization definitions are presented with highlights shown below:

CAS: Supplementing traditional actuarial loss cost models to include quantitative demand models for use in determining customer prices.

AAA: Sophisticated technique based on predictive modeling results and business objectives and constraints that are intended to assist insurers in setting prices…goes from cost-based rates to final prices by integrating expected costs with expected consumer demand behavior, subject to target business objectives(s) that may improve profit, increase volume, increase or maintain retention, or some combination.

Towers Watson: Systematic process for suggesting adjustments to theoretical cost-based prices that better achieve business objectives, subject to known constraints.

Earnix: Systematic and statistical technique to help an insurer determine a rating plan that better fits the competitive environment, within actuarial and regulatory standards.

Ohio DOI: 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.

Consumer Federation of America (CFA): 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.

There are three main types of price optimizations:

1) **Ratebook** Optimization: Use cost and demand models to adjust factors in an existing structure to achieve business goals. Insurers engaging in this optimization will not charge different premiums to consumers with same risk profile
2) **Individual Price** Optimization: Non-parametric rate engine to build a price based on costs and demand at the individual policy level

3) **Hybrid** Optimization: Create a new rate factor based on demand model that overlays the cost-based rate algorithm. The new factor allows an insurer to achieve its business goals while it may or may not be correlated with costs

There is also a distinction between constrained and unconstrained optimization. Constrained refers to setting max and min limits on output which could be constrained by current price and loss-based indicated price. Unconstrained optimization has no limits.

Key differences between traditional ratemaking and price optimized ratemaking:

1) Market demand and customer behavior are quantified in optimization instead of subjectively determined
2) The effect of deviation from cost based rate on business metrics is mathematically measured with optimization

Elasticity of demand is a key component to price optimization and measures how likely a customer is to renew a policy or accept an insurer's quote. Price optimization has been used for years in other industries and international insurance. State regulators note that few filings specify the use of price optimization, which is likely from lack of disclosure not necessarily from lack of use.

IV. Potential Benefits and Drawbacks

Insurers typically provide current, indicated, and selected rates for regulator review. Regulators consider how far the selected rates vary from indications in addition to the relationships between factors. Regulators must rely upon insurers to present accurate and complete information on indicated rates while also considering the huge amount of data connected with price optimization.

Changing prices may cause large changes so companies need a way to provide rate stability for consumers. Price optimization can limit policyholder disruption and improve rate stability. This is favorable for consumers who do not want to shop regularly.

Consumer advocates argue that price optimization disfavors consumers with fewer market options, less market power, and less propensity to shop, in particular, low-income and minority consumers. In contrast, an III poll shows that lower-income consumers are more likely to shop for insurance than affluent consumers.

CFA further argues that price optimization is not needed to select rates less than indicated rates as evidenced by long history of rate filings. They also specify that it is not certain how an insurer's long-term cost for providing coverage is improved by price optimization since optimization is a non-cost based adjustment to cost-based indications.

President of III, Mr. Hartwig, claims that price optimization does not unfairly discriminate and does not abandon the core principle of risk-based pricing. It allows insurers in an analytical way to deal with what-if scenarios and have more precision.

Insurers contend that price optimization is a technological improvement over current practices, and criticisms are aimed at individual price optimization – not the ratebook form used in setting rates.

V. Regulatory Response to Optimized Rate Structures

Numerous states have defined price optimization and issued bulletins prohibiting the defined practice. Some state regulators believe existing state laws are sufficient to address price optimization and that no bulletins are necessary.

The paper proposes these **regulatory responses** for price optimization:

1) Determine which price optimization practices are allowed
2) Define any constraints on the price optimization process and outcomes
    - A potential constraint could limit the selected rate to be between the current and indicated while always moving in direction of indicated
    - A potential constraint might be that optimization can only be applied to larger class sizes, since price optimization on small class sizes could be applied at individual level
3) Develop regulatory guidance on the meaning of statutory rate requirements so that rates are not excessive, inadequate, or unfairly discriminatory
4) Enhance filing requirements using a specific definition of actuarial indication
    - Specify whether an actuarial indication is a point estimate or a value within a confidence interval around a point estimate
    - Potentially require certification that the indications are based solely on cost considerations

- Potentially require disclosure of any adjustments to rates that are not based on expected cost
- Consider not allowing any non-cost-based adjustments to selected rates

5) Require specific explanation or reasoning to support any proposed or selected rate that deviates from the actuarially indicated rate
6) Change filing requirements to require more transparency
   - Disclosure of whether price optimization and/or customer demand is used
   - Disclosure of differences in proposed prices for the insurer's existing and new customers with the same risk profile
   - Filing a report of expected loss ratio distribution under current and proposed prices such that a wider distribution of proposed prices suggests that more subsidies exist
   - Disclosure of all data sources, models, and risk classifications
   - Disclosure of which rating factor(s) are affected by price optimization
   - Filing of a certification by an actuary that all non-cost-based considerations affecting the proposed rates and factors are documented in the filing
7) Ensure regulatory system completes these actions:
   - Require all rating factors to be filed and all adjustments to indicated rates to be disclosed
   - Maintain adequate resources to review complex filings
   - Establish regulatory practice with in-depth review of price optimization

VI. Recommendations for Regulators

The Task Force recommends rating plans should be derived:

- From sound actuarial analysis
- Be Cost-based
- Comply with state laws
- Be consistent with ASOPs from ASB
- Be consistent with actuarial principles from a professional actuarial body

The Task Force recommends that two customers with the same risk profile should be charged the same premium for the same coverage. There could be temporary deviations from new and renewal

customers with the same risk profile as a result of capping or premium transition rules. The Task Force states that capping and transition rules are the public's best interest, but regulators should consider the following:

- Length of time to reach approved level
- Size of upper and lower cap
- Extent that capping one rate affects others

Actuarial indications estimate the cost to transfer risk, and judgment is part of the rate setting process. The Task Force recommends that states allow flexibility reflecting insurance loss and expense costs in the selection of rating factors. A selected rate that is outside of the range bound by current and indicated may be acceptable given that it is documented well and in compliance with state law and ASOPs.

Task Force believes the following practices are inconsistent with statutory requirements that rates shall not be unfairly discriminatory:

- Price elasticity of demand
- Propensity to shop for insurance
- Retention adjustment at individual level
- Policyholder propensity to ask questions or file complaints

The Task Force mentions the consideration of credibility and homogeneity where classes should be grouped homogeneously but not so small that credibility is sacrificed.

VII. State Considerations

Task Force proposals include these three ideas:

1) Issue a bulletin to address insurers' use of methods that may result in non-cost based rates
2) Enhance requirements for personal lines rate filings to improve disclosure and transparency
3) Analyze models used by insurers in ratemaking to ensure the model adheres to state law and actuarial principles

Original Essay Problems

EP #1

a) Fully describe price optimization.

b) Briefly describe two benefits of price optimization.

c) Briefly describe two concerns of price optimization.

EP #2

Compare and contrast price and rate.

EP #3

a) Describe the basis for rate regulation for personal lines insurance.

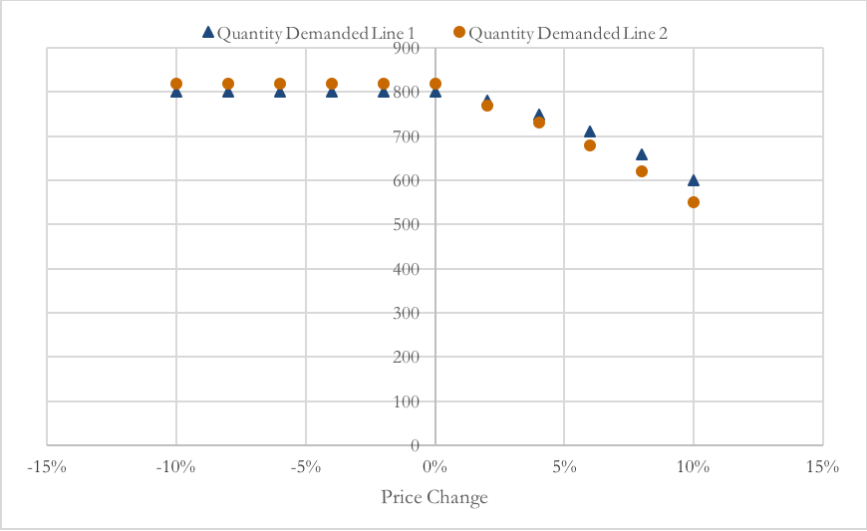
b) Describe unfairly discriminatory rates.

c) Provide three examples of unfairly discriminatory rates.

d) Describe an argument supporting that rate transition rules are unfairly discriminatory.

EP #4

The following graph displays price elasticity for two lines of business.



Fully evaluate the price elasticity for Line 1 and Line 2

EP #5

Compare and contrast the traditional ratemaking approach with the price optimization approach.

EP #6

Insurers have varying state filing strategies regarding disclosure.

a) Briefly describe a concern that regulators have regarding filing disclosure for price optimization.
b) Describe a concern for an insurer that is more transparent in filing strategy.
c) Identify four considerations from ASOP 41 Actuarial Communications that would provide guidance to actuaries making a rate filing with price optimization.

EP #7

Regulators are concerned with protecting consumers and ensuring rates are not excessive, inadequate, or unfairly discriminatory.

a) Fully explain why rates developed using price optimization could be unfairly discriminatory.
b) Briefly describe two reasons for the rise in price optimization.

EP #8

a) Describe actuarial judgment.
b) Compare and contrast judgment in traditional ratemaking compared to price optimization.

EP #9

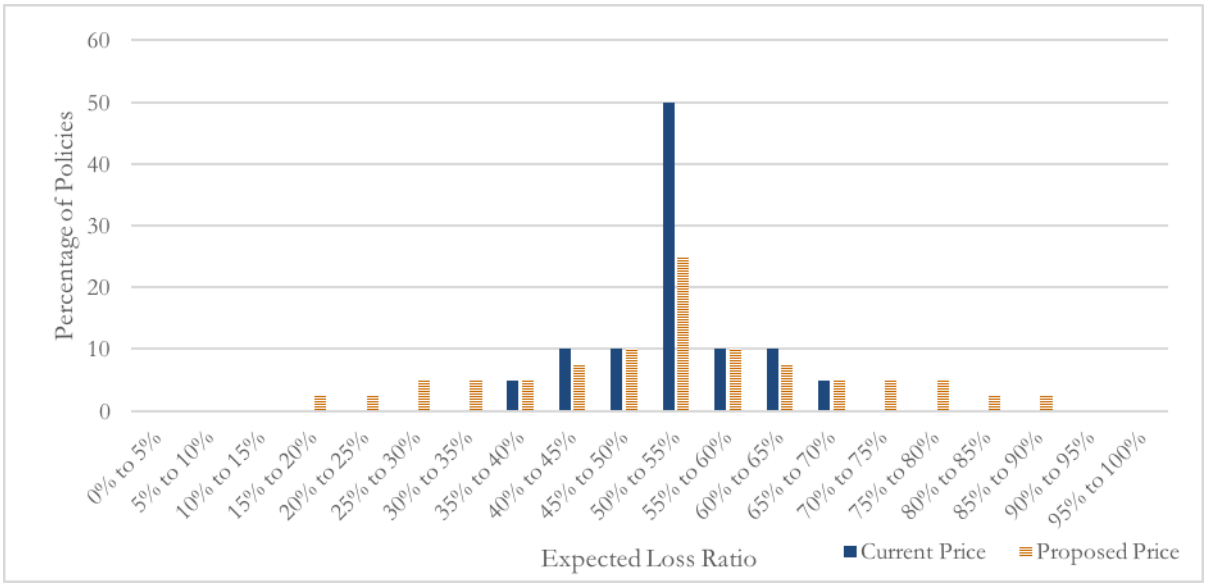
a) Describe price elasticity of demand.
b) Describe the relationship between price elasticity and insured sensitivity to price.
c) Describe rate transition rules.
d) Briefly describe one benefit of rate transition rules to the insurer and one benefit to the insured.

EP #10

a) Describe three types of price optimization.
b) Describe two differences between traditional ratemaking and price optimized ratemaking.

EP #11

The following report in a rate filing shows the distribution of expected loss ratios under the current and proposed prices.



a) As a regulator, justify whether price optimization may be used in the rate filing.

b) Briefly describe four disclosures that would increase transparency for filing requirements.

EP #12

A regulator mentions that few filings specify price optimization was used. Thus, the regulator concludes price optimization must not be used extensively.

a) Briefly describe a reason this statement may not be accurate.

b) Briefly recommend four regulatory responses for addressing price optimization.

EP #13

An insurer submits the following current, indicated, and selected for its proprietary tier rating factor for personal auto insurance.

Tier	Current	Indicated	Selected
1	1.00	1.00	0.90
2	1.10	1.10	1.05
3	1.20	1.25	1.22
4	1.30	1.35	1.35
5	1.40	1.40	1.40
6	1.50	1.40	1.45
7	1.70	1.80	1.90
8	1.90	2.00	2.10
9	2.10	2.25	2.25
10	2.30	2.60	3.00

a) Evaluate the selected relativities for reasonability and fulfilling the CAS Ratemaking Principles.
b) Briefly explain two considerations that can make a selected rate outside of current to indicated range acceptable.
c) Identify one argument for and against using price optimization to select rates.

EP #14

a) Briefly describe a benefit for consumers of price optimization.
b) Identify three consumer segments that price optimization disfavors.
c) Propose a regulatory constraint to price optimization.

EP #15

a) Describe the benefit to regulators of increased transparency in a rate filing.
b) Identify one drawback of increased transparency in a rate filing for an insurer.

EP #16

Rate transition rules are typically in the best interest of insureds.

a) Identify one concern of price optimization that can occur with rate transition.
b) Briefly describe three considerations from a regulatory perspective when reviewing rate transition rules.

EP #17

a) Identify four practices that should be followed for rate development.
b) If regulators are concerned with price optimization in their state, propose three solutions to improve communication and review.
c) Rates shall not be unfairly discriminatory. Identify four practices in rate development that are inconsistent with this principle for the Task Force.

Original Essay Solutions

ES #1

a) Price optimization is the process of maximizing or minimizing a business metric (profitability, marketing, retention) using sophisticated tools and models to quantify business considerations.
b) Price optimization can limit policyholder disruption and improve rate stability. It also allows insurers in an analytical way to deal with what-if scenarios and have more precision rather than subjective judgment.
c) There are several concerns stated in paper so two of the following: Prices may be unfairly discriminatory as same risk is charged different rate. Price optimization increases profits by raising premiums on people who are less likely to shop. Price optimization introduces a component to rate setting that is unrelated to expected losses or expenses. Consumer advocates argue that price optimization disfavors consumers with fewer market options, less market power, and less propensity to shop.

ES #2

Rate is an estimate of all future costs associated with an individual risk transfer. Price or Premium incorporates management decisions after taking into account other considerations such as underwriting, marketing, competition, law and claims. Using actuarial principles, an actuary will determine an indicated rate, but then the actuary incorporates the other considerations to select a charged price which may be equal or different.

ES #3

a) Rate regulation is established by state law which includes both statutory and case law. Typically, rates must not be inadequate, excessive, nor unfairly discriminatory.
b) Unfair discrimination exists if, after allowing for practical limitations, price differentials fail to reflect equitably the differences in expected losses and expenses.
c) Insurer utilizes race in rating.
   Insurer utilizes salary in rating.
   Insurer charges separate prices for two identical risks.

d) Through rate transition rules, two identical risks may be charged different premiums. As an example, this is achievable if one risk is new business and an identical risk is renewal business with rate transition applied.

ES #4

Line 2 has a higher price elasticity as consumers are more sensitive to price changes. Neither line increases demand as prices are lowered. Consumers for Line 2 are more sensitive. As the price change increases, then demand for each product decreases which aligns with expectations.

ES #5

Both traditional ratemaking and price optimization use a similar rating plan development where a base rate is multiplied by a set of adjustment factors. The adjustments are likely the same between traditional and price optimization as well. At this point, the approaches start to vary. Traditional ratemaking uses qualitative assessment to adjust for market and regulatory considerations whereas price optimization uses quantitative assessments in addition to qualitative. These assessments may be informed by risk-related and non-risk-related data. Finally, traditional ratemaking uses insurer judgment whereas price optimization uses modeling analysis.

ES #6

a) Price optimization may not be clearly disclosed. Also, price optimization may be used in a manner that is not directly part of a filed rating plan.
b) An insurer that is more transparent will disclose its use of price optimization which may invite scrutiny or questions from regulators which could be a disadvantage to a more transparent company. An insurer may use price optimization but not disclose then gain approval without questions.
c) Four considerations from ASOP 41:
    - The actuary should take reasonable steps to ensure that the actuarial document is clear and fair
    - Applicable law may prescribe material assumptions and methods
    - The clarity should be sufficient such that another actuary qualified in the same practice area could assess the reasonableness of the work as shown in the actuarial report

- Methods, Procedures, Data and Assumptions are a part of Scope of communication of actuarial work

ES #7

a) Critics have argued that price optimization is unfairly discriminatory since external, non-insurance databases are used to model consumer demand and predict the response of consumers to price changes. Price optimization increases profits by raising premiums on people who are less likely to shop. Some argue these people are also low-income consumers. Price optimization introduces a component to rate setting that is unrelated to expected losses or expenses. Drivers with the same risk profile may be charged different rates.
b) The rise in big data and more sophisticated data mining tools has allowed more emphasis to be placed on objective and quantitative information for setting rates.

ES #8

a) Actuaries bring to their assignments not only highly specialized training, but also the broader knowledge and understanding from experience. For example, the ASOPs frequently call upon actuaries to apply both training and experience to their professional assignments, recognizing that reasonable differences may arise from judgment when actuaries project the effect of uncertain events.
b) In traditional ratemaking, insurer judgment was utilized but typically qualitative assessment or anecdotal evidence. In price optimization, the judgment is objective while relying on quantitative information and modeling. Price optimization is a tool and does not replace actuarial judgment in ratemaking. Judgment remains a separate and distinct exercise that is fully consistent and permitted by actuarial standards.

ES #9

a) Price elasticity of demand measures the rate of response of quantity demanded due to a price change.
b) The higher the price elasticity, the more sensitive to price.
c) Rate transition rules provide stability to the insurer's book of business when large premium changes are possible. For example, an insured's premium may only change by +10% per

renewal even though the indicated increase is +25%. The insured will transition to the indicated premium over several renewals.

d) Rate transition can improve retention as price change is a primary driver of insurance cancellation. The insured benefits from a lower premium.

ES #10

a) **Ratebook Optimization**: Use cost and demand models to adjust factors in an existing structure to achieve business goals. Insurers engaging in this optimization will not charge different premiums to consumers with same risk profile.

   Individual Price Optimization: Non-parametric rate engine to build a price based on costs and demand at the individual policy level

   Hybrid Optimization: Create a new rate factor based on demand model that overlays the cost-based rate algorithm. The new factor allows an insurer to achieve its business goals while it may or may not be correlated with costs

b) Market demand and customer behavior are quantified in optimization instead of subjectively determined. The effect of deviation from cost based rate on business metrics is mathematically measured with optimization.

ES #11

a) The proposed prices have a wider distribution of expected loss ratios than current prices. From this data, there could be additional subsidies in the proposed rates driven by price optimization.

b) Disclosure of whether price optimization and/or customer demand is used.
   Disclosure of differences in proposed prices for the insurer's existing and new customers with the same risk profile.
   Disclosure of all data sources, models, and risk classifications.
   Disclosure of which rating factor(s) are affected by price optimization

ES #12

a) Price optimization may not be clearly disclosed. Also, price optimization may be used in a manner that is not directly part of a filed rating plan.

b) There are several mentioned so any four of the following responses:

- Determine which price optimization practices are allowed
- Define any constraints on the price optimization process and outcomes
- Develop regulatory guidance on the meaning of statutory rate requirements so that rates are not excessive, inadequate, or unfairly discriminatory
- Enhance filing requirements using a specific definition of actuarial indication
- Require specific explanation or reasoning to support any proposed or selected rate that deviates from the actuarially indicated rate
- Change filing requirements to require more transparency

ES #13

a) The insurer has selected relativities that move past indicated when going from current to selected. Without proper justification, the insurer may be creating prices that are inadequate (Tier 1,2), excessive (Tier 8-10), or even unfairly discriminatory. The insurer may be creating intentional subsidy when pricing at the individual rate level.
b) Documented well and complies with state laws and ASOPs
c) **For:** allows insurers in an analytical way to deal with what-if scenarios and have more precision than relying on subjective judgment.
   Against: Unfairly discriminates against consumer that do not shop.

ES #14

a) Rate stability
b) Three consumer segments are as follows:
   - Consumers that do not shop
   - Consumers with fewer market options
   - Consumers with less market power
c) Limit the selected rate to be between the current and indicated while always moving in direction of indicated. – OR – Optimization can only be applied to larger class sizes, since price optimization on small class sizes could be applied at individual level.

ES #15

a) The rate filing can be fully evaluated under the laws and statutes of its state. Increased transparency also creates consistency across insurers to protect consumers and insurer solvency.
b) Insurers want to protect competitive advantages and innovative analytical work.

ES #16

a) Through rate transition rules, two identical risks may be charged different premiums.
b) Length of time to reach approved level
Size of upper and lower cap
Extent that capping one rate affects others

ES #17

a) Practices include the following:
    - From sound actuarial analysis
    - Be Cost-Based
    - Comply with state laws
    - Be consistent with ASOPs from ASB
b) Three solutions to improve communication and review:
    - Issue a bulletin to address insurers' use of methods that may result in non-cost based rates.
    - Enhance requirements for personal lines rate filings to improve disclosure and transparency.
    - Analyze models used by insurers in ratemaking to ensure the model adheres to state law and actuarial principles.
c) Four practices that may be consistent:
    - Price elasticity of demand
    - Propensity to shop for insurance
    - Retention adjustment at individual level
    - Policyholder propensity to ask questions or file complaints

CASTF Predictive Models

Outline

I. Introduction

There are benefits to both consumers and insurers when insurers responsibly use predictive analytics along with big data. Predictive analytics can reveal insights into the relationship between consumer behavior and the cost of insurance, which lowers the cost of insurance and provides incentives for consumers to better control and mitigate loss.

The review of predictive models is an art which could be more efficient with best practices. Rates and models shall always be justified by the insurer. State insurance regulators review models to determine whether modeled rates are compliant with existing state laws and/or regulations.

II. Do Regulators Need Best Practices to Review Predictive Models?

Regulatory best practices need to be developed that do not unfairly or inordinately create barriers for insurers, as fewer choices and less innovation ultimately may hurt consumers. Best practices in the review of predictive models are valuable to both regulators and insurance:

- Adds uniformity and consistency of regulatory processes, while maintaining the benefits of the application of unique laws and regulations that address the state-specific needs
- Aid regulatory reviewers by raising regulators' level of model understanding
- Assist the states in identifying the model elements they should review to understand why the filed predictive model improves the company's rating plan and, therefore, makes that rating plan fairer to all consumers
- Help the state insurance regulator identify elements of a model that may influence the regulatory review as to whether modeled rates are appropriately justified, compliant with state laws and/or regulations, and whether to act on that information
- Provide a framework for the states to share knowledge and resources to facilitate the technical review of predictive models

- Lead to improved quality in predictive model reviews across the states, aiding speed to market and competitiveness of the state's insurance marketplace
- Aid training of new state insurance regulators and/or regulators new to reviewing predictive models
- Help the state insurance regulator understand if a predictive model is cost-based, compliant with state law, and how the model improves a company's rating plan
- Improve the efficiency and consistency among the regulatory review processes across the states thus companies get their products to market faster

Every state may have a need to review predictive models, whether that occurs during the approval process of a rating plan or during a market conduct exam.

III. Best Practices to Review Predictive Models

Review of predictive models by regulators should include these four elements:

1) Ensure that the selected rating factors, based on the model or other analysis, produce rates that are not excessive, inadequate, or unfairly discriminatory. The regulator can accomplish by completing the following tasks:

    - Compare the overall rate level impact of the proposed revisions to rate level indications
    - Determine whether individual input characteristics and resulting rating factors are related to the expected loss or expense differences in risk
    - Review the premium disruption for individual policyholders and how the disruptions can be explained to individual consumers
    - Review the individual input and output from the predictive model, as well as associated selected relativities, to ensure they are compatible with practices allowed in the state and do not reflect prohibited characteristics

2) Obtain a clear understanding of the data used to build and validate the model, and thoroughly review all aspects of the model, including assumptions, adjustments, variables, sub-models used as input, and resulting output. The regulator can accomplish by completing the following tasks:

    - Obtain a clear understanding of how the selected predictive model was built

- Determine whether the data used as input to the predictive model is accurate, including a clear understanding how missing values, erroneous values, and outliers are handled
- Determine whether any adjustments to the raw data are handled appropriately, including, but not limited to, trending, development, capping, and removal of catastrophes
- Obtain a clear understanding of how often each risk characteristic used as input to the model is updated and whether the model is refreshed, to help determine whether the model output reflects changes to non-static risk characteristics

3) Evaluate how the model interacts with and improves the rating plan. The regulator can accomplish by completing the following tasks:

- Obtain a clear understanding of the characteristics that are input to the predictive model
- Obtain a clear understanding of how the insurer integrates the model into the rating plan and improves the rating plan
- Obtain a clear understanding of how the model output interacts with non-modeled characteristics/variables used to calculate a risk's premium

4) Enable competition and innovation to promote the growth, financial stability, and efficiency of the insurance marketplace. The regulator can accomplish by completing the following tasks:

- Enable innovation in the pricing of insurance through the acceptance of predictive models, provided such models are in compliance with state laws and/or regulations, particularly prohibitions on unfair discrimination
- Protect the confidentiality of filed predictive models and supporting information in accordance with state laws and/or regulations
- Review predictive models in a timely manner to enable reasonable speed to market

Original Essay Problems

EP #1

Describe benefits to both consumers and insurers when insurers use predictive analytics along with big data responsibly.

EP #2

Identify four reasons why regulatory best practices regarding the review of predictive models are valuable.

ES #3

Identify four elements that regulators should review regarding predictive models.

EP #4

Identify four tasks the regulator should complete to ensure that the selected rating factors, based on the model or other analysis, produce rates that are not excessive, inadequate, or unfairly discriminatory.

EP #5

Identify four tasks the regulator should complete to obtain a clear understanding of the data used to build and validate the model, and thoroughly review all aspects of the model, including assumptions, adjustments, variables, sub-models used as input, and resulting output.

ES #6

Identify three tasks the regulator should complete to evaluate how the model interacts with and improves the rating plan.

ES #7

Identify three tasks the regulator should complete to enable competition and innovation to promote the growth, financial stability, and efficiency of the insurance marketplace.

Original Essay Solutions

ES #1

Predictive analytics can reveal insights into the relationship between consumer behavior and the cost of insurance, which lowers the cost of insurance and provides incentives for consumers to better control and mitigate loss.

ES #2

Four of the following reasons:

- Adds uniformity and consistency of regulatory processes, while maintaining the benefits of the application of unique laws and regulations that address the state-specific needs
- Aid regulatory reviewers by raising regulators' level of model understanding
- Assist the states in identifying the model elements they should review to understand why the filed predictive model improves the company's rating plan and, therefore, makes that rating plan fairer to all consumers
- Help the state insurance regulator identify elements of a model that may influence the regulatory review as to whether modeled rates are appropriately justified, compliant with state laws and/or regulations, and whether to act on that information
- Provide a framework for the states to share knowledge and resources to facilitate the technical review of predictive models
- Lead to improved quality in predictive model reviews across the states, aiding speed to market and competitiveness of the state's insurance marketplace
- Aid training of new state insurance regulators and/or regulators new to reviewing predictive models
- Help the state insurance regulator understand if a predictive model is cost-based, compliant with state law, and how the model improves a company's rating plan
- Improve the efficiency and consistency among the regulatory review processes across the states thus companies get their products to market faster

- Without best practices, barriers for insurers may be unfair or cumbersome which ultimately hurts consumers

ES #3

1) Ensure that the selected rating factors, based on the model or other analysis, produce rates that are not excessive, inadequate, or unfairly discriminatory
2) Obtain a clear understanding of the data used to build and validate the model, and thoroughly review all aspects of the model, including assumptions, adjustments, variables, sub-models used as input, and resulting output
3) Evaluate how the model interacts with and improves the rating plan
4) Enable competition and innovation to promote the growth, financial stability, and efficiency of the insurance marketplace

ES #4

The following four tasks:

- Compare the overall rate level impact of the proposed revisions to rate level indications
- Determine whether individual input characteristics and resulting rating factors are related to the expected loss or expense differences in risk
- Review the premium disruption for individual policyholders and how the disruptions can be explained to individual consumers
- Review the individual input and output from the predictive model, as well as associated selected relativities, to ensure they are compatible with practices allowed in the state and do not reflect prohibited characteristics

ES #5

The following four tasks:

- Obtain a clear understanding of how the selected predictive model was built
- Determine whether the data used as input to the predictive model is accurate, including a clear understanding how missing values, erroneous values, and outliers are handled

- Determine whether any adjustments to the raw data are handled appropriately, including, but not limited to, trending, development, capping, and removal of catastrophes
- Obtain a clear understanding of how often each risk characteristic used as input to the model is updated and whether the model is refreshed, to help determine whether the model output reflects changes to non-static risk characteristics

ES #6

The following three tasks:

- Obtain a clear understanding of the characteristics that are input to the predictive model
- Obtain a clear understanding of how the insurer integrates the model into the rating plan and improves the rating plan
- Obtain a clear understanding of how the model output interacts with non-modeled characteristics/variables used to calculate a risk's premium

ES #7

The following three tasks:

- Enable innovation in the pricing of insurance through the acceptance of predictive models, provided such models are in compliance with state laws and/or regulations, particularly prohibitions on unfair discrimination
- Protect the confidentiality of filed predictive models and supporting information in accordance with state laws and/or regulations
- Review predictive models in a timely manner to enable reasonable speed to market