

2019 Student Research Case Study Challenge

Design an Autonomous Vehicle Insurance Policy

Client Overview

You and your team of actuarial consultants have been assigned to a new client project. Sofia J. Fibonacci, FSA, chief actuary of the automobile insurance company Safelife, is preparing for her presentation to the Board of Directors on how to design an automobile insurance product for autonomous vehicles, and she needs your help.

Safelife has an 82-year history selling personal and commercial automobile insurance policies in the country of Carbia, a developed nation that has similar laws and regulations to the majority of states in the United States. At present, the top five automobile insurance companies in Carbia control about 70 percent of the market. With a 34 percent market share, Safelife is in the lead. In 2018, Safelife paid claims of approximately 4.5 billion Carbs (€ 4.5 billion), the currency of Carbia.

However, Safelife anticipates that the current automobile insurance market may eventually decrease with future public adoption of autonomous vehicles. Such a shift from traditional automobile products to autonomous vehicle products is likely to usher in a new era of risk and liability considerations that will demand big data capabilities and new actuarial models. At this time, no other company in Carbia has announced plans to design an insurance policy for autonomous vehicle owners, leading Safelife to believe there is potential for a first-mover advantage.

Accordingly, Sofia has been assigned to lead the design and development of a new insurance policy for autonomous vehicles. Her current management goal, assuming the evolution of autonomous vehicles grows as anticipated, is for the new policy to account for 20 to 25 percent of Safelife's overall business by the year 2030.

Project Objectives

Your objectives for this project are two-fold:

1. Recommend a design for a new autonomous vehicle insurance policy, and develop loss cost estimates, also known as pure premiums, for the new policy. Recommend a launch date for the policy and provide a ten-year forecast of pure premium from the point of launch.
2. Over this same time horizon, forecast what Safelife's pure premium will be from their traditional policies and the new autonomous vehicle policy combined, assuming they choose to develop your proposed autonomous vehicle policy. Also include a baseline forecast of pure premium assuming they do not develop an autonomous vehicle policy.

In anticipation of autonomous vehicles, the chief actuary and Board of Directors have kept a close eye on federal efforts to create autonomous vehicle legislation. In completing these two project objectives, they have asked you to consider how future legislation may impact insurance and liability regulations for autonomous vehicles. The government is currently developing autonomous vehicle and insurance regulations that mirror legislative efforts in the United States.

Deliverable Requirements

The expected deliverable is an executive report, informed by your research and analysis, summarizing your team's recommendations and addressing each of the following items in bold:

- **Which risks should the new policy cover and for whom? For any party covered by the policy, please describe their relationship to the vehicle and what the benefits of the policy will be.**

Key considerations:

- Who is most likely to adopt autonomous vehicles in Carbia, how will they be used, and what new risks will emerge as a result?
- What is the anticipated timeline for autonomous vehicle adoption?
- Which parties will face risk or liability exposure as a result of autonomous vehicle adoption, and what is their relationship to the vehicle?
- To what extent should the new policy include commercial and/or personal coverage?
- How and to whom will liability be assigned in the event of a claim?
- How will current and anticipated regulations impact your policy design?
- To what extent should the policy cover traditional automobile insurance risks versus new risks expected to emerge with autonomous vehicle usage?

- **At what level(s) should Safelife expect the new autonomous vehicle policy's pure premiums?**

Key considerations:

- What do you expect the frequency and size of claims to be?
- What do you expect the per-policy pure premium to be?
- How could the timing of market entrance impact pure premium?

- **When should Safelife launch the policy, and what are the anticipated pure premium projections based on anticipated sales? Please provide a 10-year forecast of pure premium, starting at the launch date, to inform your recommendations.**

Key considerations:

- How many autonomous vehicle policies do you expect Safelife to issue over the 10-year time horizon from the point of introduction?
- How many traditional vehicle policies do you expect Safelife to issue over the 10-year time horizon from the point of introduction?

- **Over the same time horizon, provide a baseline of Safelife's pure premium projections, assuming they choose not to develop the new policy.**

Key consideration: how will the introduction of autonomous vehicles affect the frequency and size of claims over time for Safelife's traditional personal and commercial auto?

- **Please include a sensitivity analysis on management’s goal that the new policy account for 20 to 25 percent of overall business by the year 2030. Please make recommendations based on your analysis. What are the range of potential risks and rewards associated with following each of your recommendations?**

Key consideration: what is the impact on pure premium for insurance policies for both autonomous and traditional vehicles.

- **Identify the key assumptions underlying your policy design and pricing that Safelife will need to test in order to bring your proposed policy to market successfully.**

Sofia requests that you include discussion of data limitations where relevant throughout your executive report. For example, how complete is the data underlying your assumptions and conclusions? What limitations were involved in completing your analysis?

Automobile Insurance Policies

Carbia is primarily an urban and suburban country, with very little rural area. Carbian law currently requires that all automobile owners purchase automobile insurance. Because the law is strictly enforced, all automobiles registered in Carbia are insured. Refer to Case Study Appendix 1: Automobile Insurance in Carbia for more information about insurance policies in Carbia. Safelife policies reflect these requirements.

Available Data

Sofia has provided you with ten years of Safelife claims data history for existing personal and commercial automobile policies. Please refer to Case Study Appendix 2: Historical Claims Data for more information about the data. Assume that the data is complete.

In developing predictions relating to the new autonomous vehicle insurance policy, you may use the current Safelife data, build your assumptions from scratch based on external research, or use some combination of these two approaches.

Report Specifications and Evaluation Criteria

Sofia has explained that Safelife evaluates its consulting teams on their methodological soundness. Therefore, Safelife reviews deliverables for the following criteria:

- Organization, form, clarity and cohesiveness of the report
- Clear responses to all questions,
- Thorough analysis,
- Creative and strategic recommendations,
- Consideration of secondary research—including, as necessary, an appendix showing a reference list of all sources cited throughout the report,
- Consideration of the provided data, including documentation of data limitations, and
- Documentation of assumptions, including currency assumptions.

Your report and any supporting calculations and/or code should be submitted in PDF and/or Excel format. To ensure every request is met, please carefully review the submission requirements on the following page.

Submission Requirements

Your team's submission should contain a written report and supporting calculations that meet the criteria outlined below. Please refer to the 2019 Student Research Case Study Challenge [Official Rules](#) for further information.

Written Report

Submit a written executive report that meets the following criteria.

1. Includes the team name, names of each team member and an email address for each team member
2. Addresses each item identified under "Deliverable Requirements"
3. Written in English
4. In PDF format (without any passwords)
5. Includes the team name and brief description in the filename of submitted files for quick identification
6. In 12-point, double-spaced font with standard margins
7. A maximum of 2,500 words, excluding the following items, which do not count toward the 2,500-word limit:
 - a. Figures of graphs/charts with captions summarizing key findings
 - b. Citations of external research
 - c. Reference list of cited sources at the end of your report
 - d. Supporting calculations and/or code
8. The report and supporting calculations must be original work of the submitting team. Previously published work should not be repurposed or submitted.

Supporting Calculations

Submit an Excel and/or PDF file containing all calculations, models and/or code completed during your analysis. Include the team name and brief description in the filename of submitted files for quick identification.

When and Where to Submit

Final submissions must be sent to research@soa.org by 11:59 pm Central Daylight Time, Friday, March 22, 2019.

Important Note

Please keep in mind the audiences who will read your report. While Safelife's chief actuary and her actuarial team will be interested in your in-depth calculations and analyses, corporate executives and the Board of Directors will only have the time and expertise to read your written narrative. Therefore, please be sure to include any conclusions you wish to highlight in the body of your written report.

Case Study Appendix 1: Automobile Insurance in Carbia

Carbian law requires that all automobile owners purchase automobile insurance. Before automobile ownership may be transferred legally, the new owner must provide proof of insurance that includes each of the following coverages. Safelife policies reflect these requirements.

- **Bodily Injury Liability:** Safelife pays for reasonable expenses for necessary medical and funeral services for others who are injured or die in an automobile accident when the insured is driving, regardless of fault. Safelife also pays for injury to others, including death, when an insured is legally liable for damages. If an insured is sued, Safelife provides legal representation. The maximum amount payable to a single person is €150,000 and the maximum amount payable per accident is €300,000.
- **Personal Injury:** Safelife pays the insured's necessary and reasonable medical expenses that are not covered by medical insurance and have been incurred as a result of an automobile accident, regardless of who caused the accident. The maximum amount payable to a single claimant is €30,000.
- **Property Damage:** Safelife pays for physical damage to, or destruction of, tangible property of another, including loss of use, for which an insured is legally liable. If an insured is sued, Safelife provides legal representation. The maximum amount payable to a single claimant is €150,000.
- **Collision:** Safelife pays for repair or cash value of the insured's vehicle if it collides with another vehicle, flips over, or crashes into an object (except animals), regardless of who caused the accident. The policyholder is responsible for the first €3,000 of cost, and the maximum amount that Safelife will pay in a single incident is the cash value of the vehicle less €3,000.
- **Comprehensive:** Safelife pays for repair or cash value of a vehicle from incidents other than a collision including: fire, theft, windstorm, vandalism, flood, damage from falling objects or hitting an animal. The policyholder is responsible for the first €3,000 of cost, and the maximum amount that Safelife will pay in a single incident is the cash value of the vehicle less €3,000.

Case Study Appendix 2: Historical Claims Data

Safelife has provided you with ten years of historical claims data from their personal and commercial automobile policies. Assume that the data is complete. This data can be used to forecast what the future might look like based on how the business looks today. To make predictions about how the future will look after the launch of a new autonomous vehicle insurance policy, you may adapt the current-state data or, alternatively, build your assumptions from scratch based on your research.

The data show the following items for each calendar quarter from 2009 through 2018:

- Calendar year and quarter
- Risk Class: Safelife classifies risks according to three categories, each with three classifications, for a total of 27 risk classes. The classes are coded by the first letter of the classifications within each category, in the following order:

Vehicle Size	Driver Age	Driver Risk
Small	Young	Low
Medium	Middle	Average
Large	Senior	High

For example, a policy that covers a large car with a primary driver who is middle-aged and has a driving record that indicates a higher likelihood of future claims-causing incidents would show a risk class code of LMH.

- Policy type
 - Personal: policies owned by individuals for their automobiles that are primarily for non-commercial use.
 - Commercial: policies owned by businesses for automobiles that are used primarily for business purposes.
- Number of car years of exposure: the annual equivalent of the number of insured vehicles in the quarter. A single vehicle covered for a full quarter is $\frac{1}{4}$ of a car year of exposure.
- Number of Claims Incurred: the number of claims that occurred in the quarter.
- Amount of Claims Incurred: the total amount paid for claims that occurred in the quarter, including payments that were made in subsequent quarters. Once a claim is received, Safelife pays it in full and closes the case; no further payments will be made.¹ Amounts are in Carbs (€) and are net of deductibles and copayments. Safelife uses neither reinsurance nor coinsurance.

¹ Closing claims cases upon payment is a simplified approach adopted for the Student Research Case Study Challenge. In reality, cases may be reopened for supplemental claims many months or years later.