UCLA Bruin Actuarial Society Seven Annual Case Competition Report
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This case competition is based on an auto insurance product. For this project, our team mainly focus on the following five areas. First, we compared the differences between driver averaging and driver assignment, as well as what considerations a company should take in when choosing between the two; Second, we explained the advantages of using GLM (Generalized Linear Model) for insurance ratemaking; Third, we found data issues and made the adjustment; Fourth, we discussed how to improve the future model; In the end, we provided some suggestions to enhance the future model and to extend the market.

	Driver Averaging	Driver Assignment
Profile 1	$3,132	$2,656
Profile 2	$3,878	$3,012
Profile 3	$1,068	$1,068

For Task 1, our team built an excel rater to calculate three profiles' premiums based on two methods: driver averaging and driver assignment. Our team found that the premium is usually higher under driver averaging method (Since Profile 3 has only one driver, the results are same under both methods). This is because driver assignment only uses primary driver's information to calculate the policy premium, while driver averaging method considers the information of all drivers in that policy.

Our team believes the driver assignment method has potential anti-selection issues because insurance company can not know who the true primary driver is. People can always assign safer drivers as primary drivers to get a cheaper policy. For instance, in Profile 2, the $800 difference between the two methods is because one of the drivers in Profile 2 is really risky (been taken off 5 driver points) but he is not a primary driver in the policy. As a result, the driver assignment method completely ignores him, which creates huge potential risks to the insurance company.

For Task 2, our team explores the advantages of using GLM for insurance ratemaking. GLM (generalized linear model) describes the relationship between response variable and predictors. Response variable Y can follow exponential family, such as normal and gamma distribution. There are many advantages of using GLM. The model is very flexible. Since it can follow a set of distributions, GLM can solve more complicated situations. Furthermore, generalized linear model is easy to understand because of the simple formula: **Premium = factor(s)*variable(s)**. Based on this simple linear model, people can easily understand how each covariate affects the premium.

Looking at the GLM output in the excel, we find some data issues. First, the indicated factor of driver point is incorrect. Driver point of 2 has an indicated factor of 1.16, which is significantly smaller than the indicated factor of driver point 1 (1.423). The set of data does not make sense since drivers with bad driving behaviors should be charged more. Therefore, our team suggests to adjust this indicated factor to a number between 1.423 (when driver point is 1) and 1.78 (when driver point is 3).

Besides the variable "Model Year", our team decides to add a new variable "Current Price of the Car" into the model. Our team believes that model year is not always positively correlated to the

repair cost of the car. For example, the repair cost of an old Lamborghini is still more expensive than the cost of a new Toyota. Thus, only using model year is not accurate for pricing, and we should consider the current price of the car. Finally, we think the variable "vehicle use" should be deleted from our model since the variable can face the risk of anti-selection. From the footnote in the excel, we notice that the information of vehicle use is reported by the insured, which means that insurance company has no way to investigate how insured use their cars. As the result, the insured can always take advantages from insurance companies. For instance, one who needs the car for business might report the use as commute to get a cheaper policy. Therefore, our team decides to delete this variable.

For future model enhancement, a company should always use the latest data for the most accurate result due to inflation and the advancement of technology. Legislative changes and the level of economic activity can also shift data within the selected period. Pros of using one countrywide model is that the policy is easy to carry out under the same national standard. The other pro is that companies do not need to hire people to calculate a different model if they have branches in other states. On the opposite side, one of the cons is that situations differ between states. For example, different natural environments, weather and landscapes, in states result in different levels of car damage, so a general model would not be sufficient for complex situations. Another con is that a countrywide model may lead to the imbalance of market competition. Some companies use a regional model to attract more customers because a regional model may lower insurance price. Relatively, other companies that carry out the national model will lose their competitivity.

Last, our team gives solution to resolve company's challenges. Due to low retention rate, the insurance company should decrease the premium for or give cash back to safer drivers. For example, if the driver has 0 driver point, the company can decrease the factor to less than 1. Also, the company can install tracking devices in insured driver's car to see whether they have good driving behavior. If yes, then the company can lower the premium. Another non-rating factor which can solve this problem is decreasing expense rate. For instance, the company can use cheaper office equipment. Furthermore, considering the low close ratio for younger drivers, the company can give a psychology survey to people with young age and little driving experience. The survey should test temper (depression and anxiety) of a driver. The reason behind adding this survey is that young drivers are considered to be outrageous while driving and are involved in accidents easily. Thus, when a psychology survey is available, if one has high achievement in the survey, then the company can lower a young driver's premium.

Our team compared driver averaging and driver assignment, explored the advantages of using GLM for insurance ratemaking, made adjustments to data issues, enhanced the future model for better use, and discussed the challenges a company could face as well as how to conquer them. In conclusion, our team successfully solved all the case questions by using the easiest and most concise methods.