Patrick Harmon

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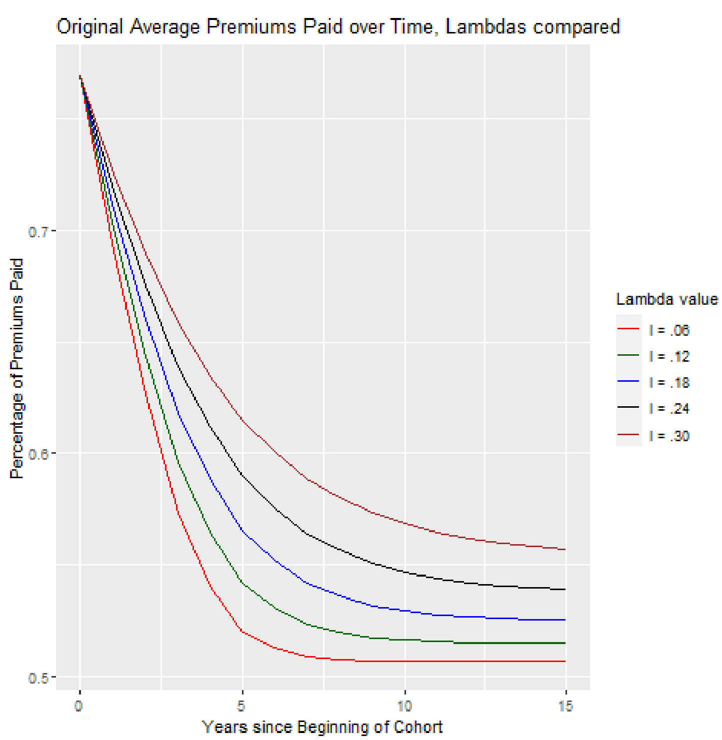
Executive Summary for Mastodon Insurance Company

Mastodon Insurance Company is facing a problem. The discounts given among drivers suggests that Mastodon Insurance Company is being overly generous with their discount program, resulting in larger losses of revenue than is sustainable. Using the data provided from the 15 year cohort of 600 drivers aged 25 or less at the beginning of the cohort, we can see that the discount program is too generous. To combat this, I suggest some modifications to the good driver program, which will maintain the core ideal that good driving should be rewarded with lower premiums, but bring in more premiums to the company.

To begin, I would like to explain my methodology. To perform my analysis I started by fitting our current program to a Markov Chain model based on a Poisson distribution. The Poisson distribution is the ideal distribution to model the behavior of this data set because it is a discrete distribution that can be used to express the probability of an even occurring a given number of times over a particular time interval when those events occur with mean rate and each even is independent of the previous occurrence of the event. In short, this seems like a strong candidate for the distribution of automotive accidents because I am making the assumption that the likelihood of a second accident occurring is not affected by when the previous accident happened and we can estimate how likely it is for a member of the cohort to have an accident in a year. The reason I have decided to use Markov Chains is because the way our system works is a kind of Markov Chain. Allow me to explain. The system as it currently stands works such that a driver who has no claims advances one category each year. The drivers that do file one or more claims are dropped down one category each year. Each category results in 10% more of a discount, starting at category 0 with a 0% premium discount, up to category 5 with a 50%

discount on premiums. So, in our system there are only two paths to go from whichever step you are currently on. The system does not look to previous steps to make the determination of where your new step will be and therefore we have a Markov Chain.

Now I would like to introduce the results of my analysis on the current system. Using estimators for lambdas of .06, .12, .18, .24, and .30 in the Poisson distribution, I have discovered some troubling information. By year 15 of the cohort Mastodon is collecting a mere 55.7% of premiums given a lambda of .30, highest possible lambda. This means that even given that a member of cohort is in an accident on average every 3 or 4 years, we will only be collecting an average of 55.7% of the original price of the premiums. If the average length between accidents is lower than that, say about 6 years, we will only collect 50.7% of our premiums on average. I have provided a graph of this problem. In our graph we can see that at the beginning of the cohort we are collecting over 75% of premiums on average, but by the end we are collecting less than 56% given any of our lambdas.



My proposed revision has two parts. First, we will reduce the discounts of each level. Starting at 0% we will go up by 7.5% instead, ending at category 5 being 37.5% off of premium prices. The second part of my plan calls for penalizing making multiple claims in a year more punitively. Instead of losing one level if they file two or more claims in the same year they should lose an additional level. This revision results in around an 11% uplift in average premiums paid at the end of the cohort, regardless of lambda value we chose as our estimator. Below I have provided some graphs. The one on the left shows the proposed revision's results, and the one on the right presents both the original program's results and the proposed revision's results on the same graph.