Bruin Mutual Executive Summary

Team 14

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Overview

The Bruin Mutual Actuarial Team was tasked with completing a reserving review for three lines of business: personal auto physical damage (physdam), personal auto liability, and homeowners property. We created a tool that manually imports data from the user's desired source file and automatically generates development triangles and implements reserving methods for each line of business. We present our reserving methods and analysis below, and put forth our recommendation for standardizing the auto physdam reserving process.

Chain Ladder Method

The chain ladder method operates with the assumption that historical loss development patterns are indicative of future loss development patterns. The method is relatively straightforward, and with reliable historical data, it is a powerful tool for predicting future claims. However when an insurer's current claims experience changes and there is only a small data set available, the chain ladder method will not produce an accurate estimate without proper adjustments. In our analysis of auto physdam claims, we see that the estimated annual reported and paid claim amounts both closely follow the annual premium trajectory, implying a reliable historical loss development pattern. However, in auto liability claims, we see that the gap widens between the estimated annual reported and paid claim amounts and the annual premium over time. This may be due to the COVID-19 pandemic, discouraging travel and hence, decreasing the report of auto liability claims.

Expected Method

Applying the expected method to homeowners claims, we find that since the ultimate incurred loss is greater than the premium in 2011, we get a ratio of 1.07, greater than 1. This is likely to overestimate the total ultimate loss for the other years. Changing the base year from 2011 to 2012 will provide us with a more accurate prediction for the future. On the other hand, for auto physdam claims, the base year 2011 tends to be an outlier, providing a too-small ratio. Similarly, we can change to calculate the ratio with the 2012 data for a more accurate result. Nevertheless, the expected method delivers a good projection in auto liability, especially since the incurred loss for accidents from 2018 to 2020 is below the normal standard. Therefore, by estimating the ultimate loss by premium, the expected loss ratio method is free from the influence of this data.

Bornhuetter-Ferguson Method

Analyzing the Incurred Loss Triangles via the Bornhuetter-Ferguson method, we can see that for the homeowners property claims, the development factor decreases rapidly after the first 24 months, showing that the emerging liability mainly comes from the IBNR within the first two years. In 2011, there is a possible outlier, as the actual ultimate loss is greater than the premium. Nevertheless, because of the advantages provided by the Bornhuetter-Ferguson method by combining the forecast based on the chain ladder method and the expected loss ratio, the outlier does not have a significant influence on calculation. For the line of auto physdam, the report and payment cycles are short, as all of the claims are solved within 36 months. The projecting ultimate incurred loss and the premium remained relatively stable, ranging from about eight to ten million dollars, which empowers to create an accurate model. Similarly, looking at auto liability, we also find that it has a short report and payment cycle, as all the claims are settled in seven years. The data remains stable until 2018 when it starts to have a sharp decrease compared to the incurred loss in previous years. Therefore, the ultimate loss projected from 2018 to 2020 may be significantly lower and affect the result.

Frequency-Severity Method

The Frequency-Severity Method involves multiplying the reported claim count and the average paid severity of claims. However, due to the possible difference between initial reserve and payment amount for each claim, the Frequency-Severity Method seems to underestimate the ultimate loss for all three lines, since the emerging liability is negative: **$(46,049,019)** for homeowners property, **$(39,292,755)** for auto physdam, and **$(3,879,475)** for auto liability (see Figure II). Years like 2018-2020 in auto liability may have an especially great influence on this issue with a significantly low average paid severity.

Recommendation: Standardize the Personal Auto Physical Damage Line of Business

Less reserving risk: When reserving methods are applied to the auto physdam line of business, the range in ultimate loss amounts remains relatively stable across 10 years (see Figure IV). Using the paid chain ladder method to see the historical trend, we see that the auto physdam range is significantly lower, at $**1,466,424**. Thus, standardizing the auto physdam line of business carries the least risk because the range of loss is smaller.

Development factor: The development factor stabilized at 1 after 36 months for auto physdam claims, which implies auto physdam has a shorter payment cycle, whereas auto liability claims settled after 84 months, and homeowners claims never settled. Shorter payment cycles make it easier to model future cost as more claims are reported and paid soon after, decreasing the amount of reported but not paid claims. Thus, since paid claims are the ultimate amounts, forecasting ultimate loss with a large amount of paid claims available will provide more precise predictions than with only reported claims.

Applying the Bornhuetter-Ferguson method: The current total incurred loss from auto physdam claims is $**97,615,551**. Since reserving is done to ensure there is enough cash to pay off future claims, the total ultimate loss predicted should exceed the current total incurred loss. The Bornhuetter-Ferguson method is the only method that provides a total ultimate loss that exceeds the total incurred loss, $**99,990,074**. All other methods underestimate the total ultimate loss, which do not serve our purpose of reserving for future claims (see Figure III).

Externalities: We note that the auto physdam line of business may have fluctuations, but it is significantly less prone to externalities than homeowners, which is increasingly impacted by climate change. As for auto liability, we see a sharp decrease in settled claims starting in 2017, and an all-time low starting claim amount for accident year 2020, which can be attributed to the COVID-19 pandemic as discussed previously.

CAT Reserving

Catastrophe reserving is necessary to prepare for catastrophic events. They are designed to accumulate a portion of the grand sum the insurer would have to pay for catastrophe claims. It is especially important for CAT reserving to be done separately so that the money is set aside, that too on a pre-tax basis. A challenge with CAT reserving is that when a catastrophe really happens, there is a sharp increase in the number of claims, subsequently requiring the insurer to pay a sum greater than that of the xCAT model and the company's regular cash flow. Determining how much money should be kept in CAT reserves is a challenge. A limited amount of historical data available for analysis due to the low probability of a catastrophe occuring makes estimating losses a challenge. On top of that, the severity and effects of each catastrophe vary greatly, so creating a working model is quite arduous. Another challenge with CAT reserving is that if there is a significant gap between the accident date and when the loss is settled and if the exchange rate changes relatively, the insurance agency can face a greater loss than they initially would have at the time of the accident.

Figure I: Bornhuetter-Ferguson Method

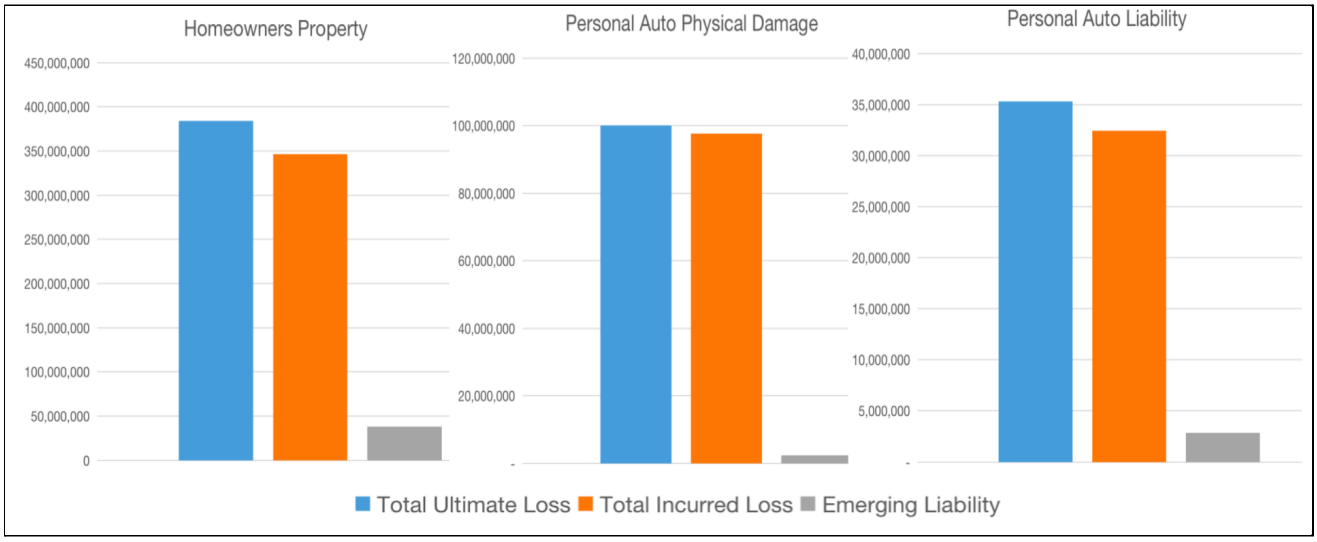

Figure II: Frequency-Severity Method

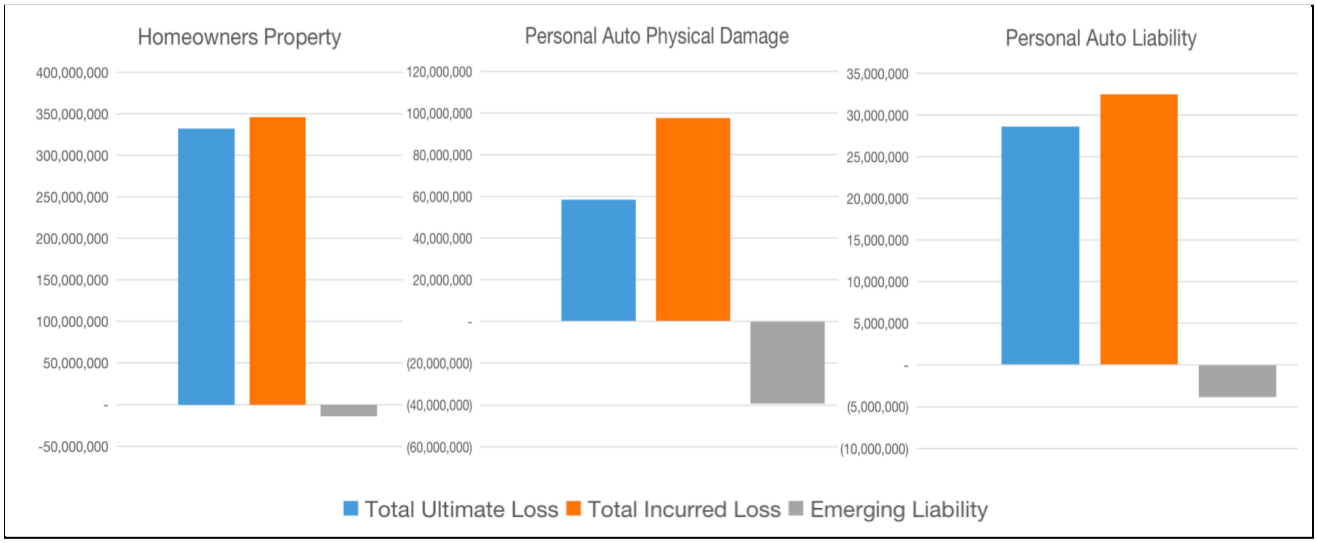

Figure III: Total Ultimate Loss Predictions

Method	Physdam	Liability
Chain Ladder (Reported)	66,011,648	26,367,701
Chain Ladder (Paid)	60,912,199	22,855,274
Expected	76,827,129	68,179,057
Bornhuetter-Ferguson	99,990,075	35,293,731
Frequency-Severity	58,322,797	28,591,573

Total Incurred Loss	97,615,552	32,471,048

Figure IV: 10-Year Ultimate Loss Range
(Paid Chain Ladder Method)