Bruin Mutual Insurance Company

Executive Summary

Team 11

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The Bruin Mutual actuarial team conducted a study on its three lines of business (LoBs): personal auto physical damage, personal auto liability, and homeowners property. A VBA tool was developed to process the provided Earned Premiums and Claims data, generate loss development triangles[1], and perform reserving method calculations[2]. Using this tool, we determined the ultimate loss for each accident year (AY) 2011-2020 and recommended a LoB to be standardized to minimize reserving risk. Furthermore, the company is interested in examining a separate catastrophes ("CATs") reserving process and identifying the challenges unique to CAT reserving. Our methodologies and solutions are discussed below.

Assumptions

Considering that actuarial judgment and experience, which vary from actuary to actuary, are crucial in determining loss adjustments and selecting ultimate losses, assumptions were made to support the selection process and our recommendations. First, our reserving methods adopt claim development factors based on the simple averages of the age-to-age factors in the latest 3 years to better account for the recent changes in the environment. This assumption, however, does not take into account the entire accident year periods analyzed. Additionally, while examining the advantages and disadvantages of each method, we assumed that the insurers are in a changing environment, as the most recent AY, 2020, presents potentially volatile data likely due to the emergence of the COVID-19 pandemic, along with economic and social policy changes, given the uncertain nature of the pandemic, in terms of both magnitude and duration.

Reserving Methods Analysis

For the Chain Ladder method, we must assume that future claims will be reported and paid similarly to claims observed in prior periods, which may be a disadvantage when there are significant changes in an unstable environment. However, despite this slight drawback, the chain ladder method is one of the oldest and most frequently-used reserving methods, as it is reliable and responsive, especially when operating in a stable environment with reliable and sufficient historical data.

When using the Expected method, we must assume that the expected loss ratio (ELR) and priori estimate relative to earned premiums can better estimate losses than historical development, which may be a disadvantage, as the ELR is subject to actuarial judgment and historical data is overlooked. On the other hand, this method maintains stability over time, as actual paid losses are not used in the calculations, which can be useful when there is a lack of historical data or a new regulation, policy, or line of business.

The Bornhuetter-Ferguson (B-F) method is a weighted combination of the Chain Ladder and Expected methods, allowing for more responsive estimates for mature years and more stable estimates for immature years when there is an uneven pattern of loss development or insufficient data. However, similar to the drawback of the Expected method, the B-F method must assume that unreported and unpaid losses will develop based on a priori estimate, which would require a reasonably accurate ELR.

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[1] Loss development triangles include annual cumulative reported and paid dollar, annual cumulative reported and paid claim count, average reported and paid claim severity, and average case outstanding.

[2] Reserving methods include Chain Ladder (reported and paid), Expected, Bornhuetter-Ferguson (reported and paid), and Cape Cod.

Finally, the Cape Cod method builds on the B-F method, using weights proportional to loss exposure and identical ELRs for all AYs. Thus, this method is dependent on a constant loss exposure and an accurate ELR, which may not be reliable when the data is thin or volatile. Despite this, the ELR is estimated using historical data, so variability in losses at early maturities do not significantly skew estimates.

Data Analysis and Recommendation

Looking at the Claims data for each LoB, we examined the data relationship and trends to pinpoint any notable shifts or abnormalities. For homeowners property, the cumulative reported and paid data in the early AYs of 2011 to 2014 have similar trends as the claims matured, where losses rapidly increased within the first year and gradually leveled off over time; however, the losses started to increase more rapidly for the more immature AYs of 2015 to 2020, particularly for AY 2017. For personal auto liability, the cumulative reported and paid data for each AY is inconsistent and fluctuating, where individual claims range from less than $10 to over $100,000, with a particularly notable shift in AY 2015 at age 12 to 24 months of a significant increase of about $4,000,000. Personal auto physical damage presented the most consistent cumulative reported and paid data, where the claims increase from age 12 to 24 months and then quickly level off after the age of 24 months for all AYs.

To select the ultimate loss for each AY 2011-2020, we took a simple average of all of the reserving methods excluding the Expected method and compiled the ultimate loss selections for each AY for each LoB in Figure 1.

To reduce the time used to complete the reserving analysis, we recommend standardizing the personal auto physical damage line to minimize reserving risk and the fallibility of assumptions used. Unlike the homeowners property cumulative claims, which continue to grow with maturity, and the auto liability cumulative claims, which display unpredictable and fluctuating patterns, auto physical damage cumulative claims appear consistent across all AYs and level off after 24 months of maturity. The B-F method is the recommended method because, after the latest AY, 2020, the emergence of the COVID-19 pandemic caused various environmental changes that makes it difficult to use the Chain Ladder method, which requires a stable and consistent environment. The Expected method would be useful in this changing environment, but it almost entirely disregards historical data, which may cause an issue when adjustments based on historical experience are needed. Similarly, the Cape Cod method would require various volume measures and a constant loss exposure, which may be difficult to determine in a changing environment. Using the B-F method will balance the actual and expected claims and best minimize reserving risk by utilizing both historical data and expected loss according to credibility weighting.

CAT Reserving Analysis

CAT data must be separated from xCAT data when making reserve estimates due to how differently catastrophes operate in comparison to non-catastrophic events. This distinction is intrinsically tied to the three main challenges of CAT reserving. First, with catastrophes, a sudden influx of claims must be dealt with due to the widespread physical damage of catastrophes on local communities, so a massive number of new claims need to be processed and evaluated in a short amount of time. Second, the financial cost stemming from the immense loss and property damage of catastrophes is significantly expensive, as many people and properties can be affected in a single catastrophic event. To combine CAT data with xCAT data would not be practical due to the tremendous difference in scale. Lastly, catastrophes are infrequent and volatile, both natural and man-made, thus making it difficult to predict when a catastrophe may occur and how much damage it will incur, as modern technology and tools to predict catastrophic events are still being developed. Overall, CAT reserving is extremely difficult to tackle in terms of quantity, quality, and unpredictability, so partitioning CAT data increases efficiency and practicality when performing reserving method calculations.

Figures

Accident Year	Ultimate Loss Selections ($) for		
	Auto Physical Damage	**Auto Liability**	**Homeowners Property**
2011	6,093,005.04	4,075,202.45	26,467,240.97
2012	6,167,101,82	2,576,402.25	28,091,633.06
2013	5,594,091.84	1,726,270.90	26,251,736.20
2014	5,727,696.43	3,632,517.81	26,735,559.58
2015	5,547,188.08	6,378,235.02	31,623,721.67
2016	6,000,913.12	1,831,354.14	30,904,648.57
2017	6,501,639.72	4,656,282.02	38,301,891.37
2018	5,952,411.07	1,535,039.32	31,128,096.70
2019	6,324,123.81	1,937,772.81	38,658,010.38
2020	6,620,224.86	3,921,467.68	40,970,167.56
Total	**60,528,395.79**	**32,270,544.40**	**319,132,706.06**

Figure 1. Ultimate Loss Selections for each AY 2011-2020 for each LoB.