

Institute of Actuaries of India

Subject CP2B – Actuarial Modelling (Paper B)

November 2019 Examination

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

Summary – Claims Reserves

Overview

The purpose of this project is to be able to calculate the claims reserves required in order to settle the payments for the claims already reported for the motor insurance portfolio of Grand Insurance Company.

Data

Data has been provided for claims reported and paid over the years from year 2012 to 2019. Inflation rates are also provided to be used for inflation adjusted chain ladder method as below-

2020	10.00%
2021	11.00%
2022	9.70%
2023	9.50%
2024	11.50%
2025	10.50%
2026	10.20%

Assumptions-

The following assumptions have been made in order to calculate the claims reserves-

- The claim amounts provided are correctly captured
- The development of claims will follow same pattern over the years
- The inflation is ignored for Basic chain ladder method
- The claims for year 2012 are fully developed and there will be no more payments in respect of those claims
- The past inflation is ignored for the inflation adjusted claims and only future inflation is considered

Calculation Approach

The claims reported and paid from year 2012 to 2019 are provided in “Data” tab.

The Data provided has been used to calculate the future claim payments for claims reported from 2013 to 2019 assuming that claims reported in 2012 are fully paid.

Firstly, the claims are cumulated to calculate the claims paid till date for each claim year till any development year. This is done by adding all individual claims paid in all development year till date. The development ratio is then calculated by dividing the claims paid till that development year by claims paid till previous development year for the corresponding claim years.

For example, development ratio for development year 1 = claims paid till development year 1 for all claim years from 2012 to 2018 / claims paid till development year 0 for all claim years from 2012 to 2018

Claims paid for claim year 2019 are not taken here as we do not have claims paid in development year 1 for 2019 claims.

Similarly, the development ratio is calculated for each development year.

The claims paid till any development year are multiplied by the development ratio for next year to calculate the claims paid till next development year. The lower triangle of the table is filled this way.

To calculate the claims reserves, the claims paid till date are subtracted from the claims calculated for last development year i.e. development year 7.

These are added for all claim years to calculate the total reserves.

For inflation adjustment, the inflation is cumulated to calculate the inflation adjustment needed for each of the calendar years. The claims projected above using development ratio are used to calculate the individual claims to be paid in each development year for each claim year. These individual claims are then adjusted for inflation. The inflation rate used for a claim is referred by adding claim year and development year so for a claim reported in year 2015 and paid in development year 5, the 2020 inflation rate is used.

The cumulative claims are calculated from above table and the claims reserves are calculated similar way as in basic chain ladder method.

The claims reserves are also calculated by adding all individual claims, inflation adjusted, in the lower triangle. These should match with above method and this is a check applied.

For Bornhuetter Ferguson method, the development ratios calculated in basic chain ladder method are used and the cumulated. The development ratio for a development year under this method = product of all development ratios for all development years till that development year under basic chain ladder method.

The lower triangle and claims reserves are then calculated in similar way as in basic chain ladder method.

Results –

The claims paid till each development year under each method summed over all claim years are as below-

Development Year->	0	1	2	3	4	5	6	7
Basic Chain Ladder	165,300	201,600	218,349	224,771	230,740	235,295	238,013	241,552
Inflation Adj BCL	165,300	202,039	219,437	226,362	233,133	238,656	242,225	247,311
Bornhuetter-Ferguson	165,300	206,434	229,734	243,209	255,762	265,376	271,555	275,593

The claims reserve for each of the method are calculated as below-

	Claims Reserves
Basic Chain Ladder	21,552
Inflation Adj BCL	27,311
Bornhuetter-Ferguson	55,593

The charts for the claims paid over development years summed for all claim years look as below-

Chart 1- Claims paid in each development year under basic chain ladder method-

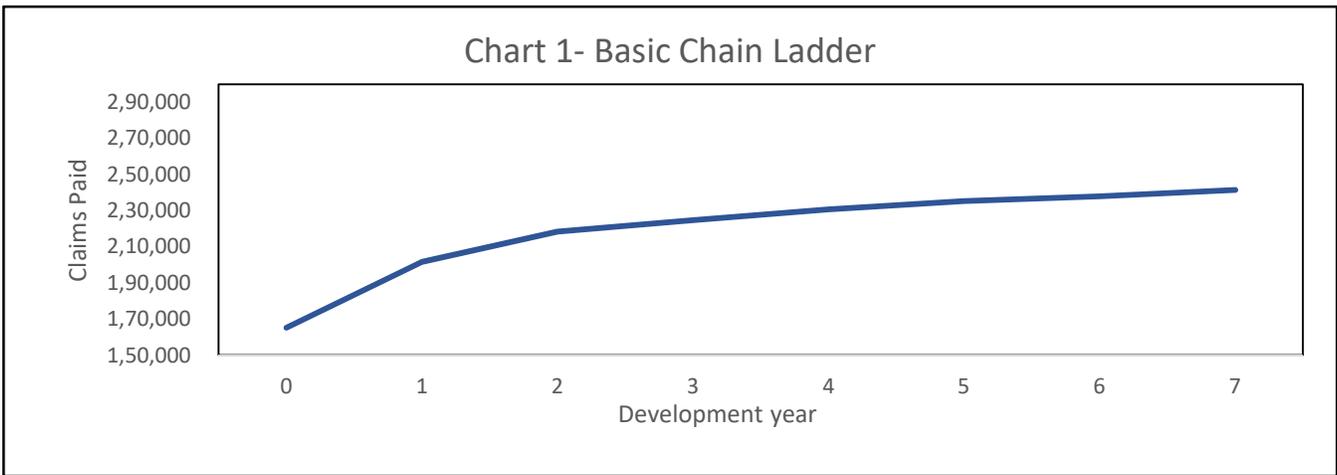


Chart 2- Claims paid in each development year under basic chain ladder method and inflation adjusted basic chain ladder method-

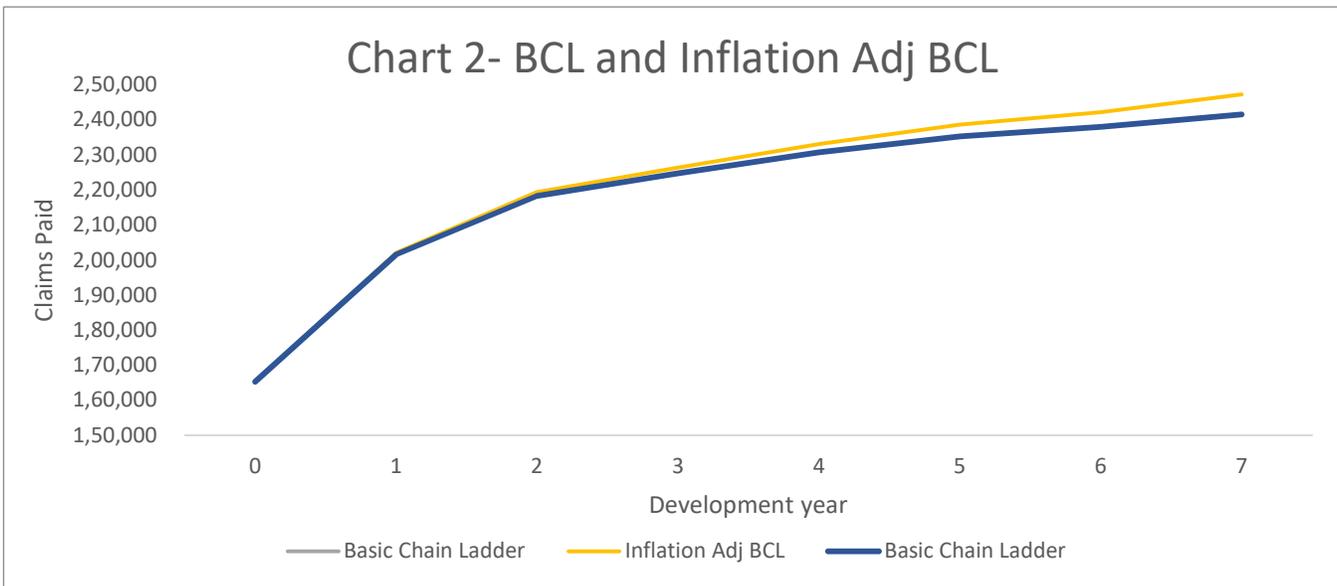
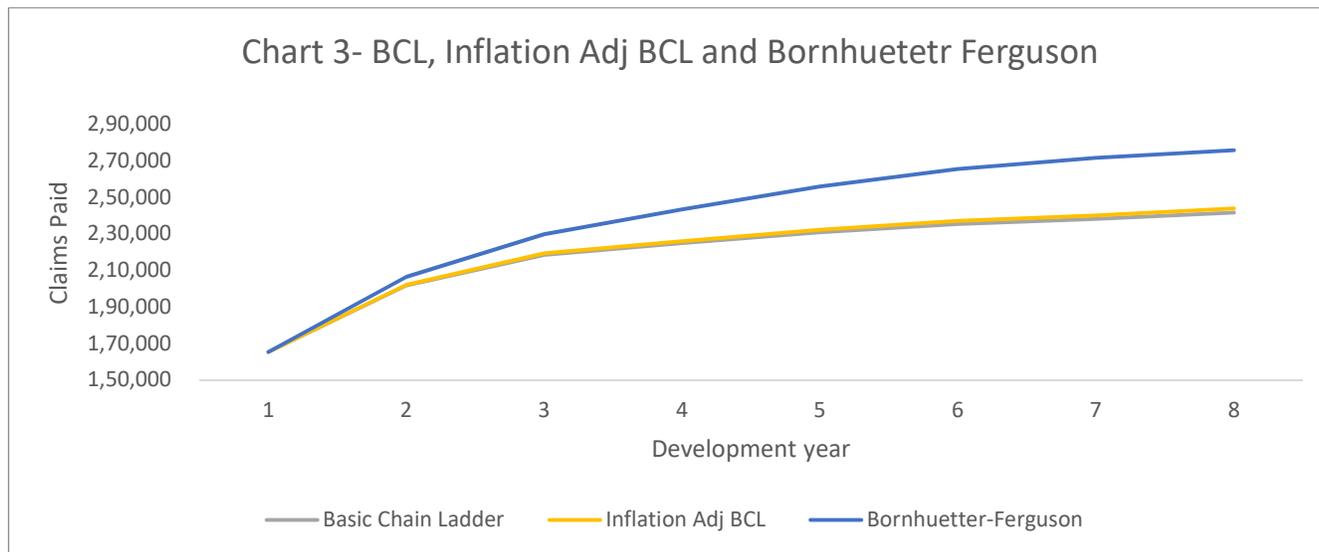


Chart 3- Claims paid in each development year under basic chain ladder method and inflation adjusted basic chain ladder method-



Conclusions-

- **Looking at results for basic chain ladder method and chart 1**, we know that the claims develop over the years and paid over the years in future.
- The claims paid increase from year 1 to 7 as the claims have been assumed to have fully developed by year 7 from claim year
- **Under chart 2**, as expected, the claims paid over future years for inflation adjusted method are higher as the inflation rates are applied for that calendar year to calculate the inflation adjusted claims. This increases the projected claims.
- **In chart 3**, the last method i.e. Bornhuetter Ferguson method results in highest claims paid and claims reserves
- The claims reserves are almost double of other two methods.
- These higher amounts are since the development ratios have been cumulated
- The claims developed in first two years are faster than later years. This can be seen in the shape of the chart for all methods above
- While for Bornhuetter Ferguson method, this is high till 4 years
- Under basic chain ladder method and inflation adjusted BCL, about 13%-14% claims are yet to be paid after accident year i.e. ~ 87% payment is made in accident year only
- Under Bornhuetter ferguson method, the claims paid in accident year are about 66%
- So BF method assumes that more claims are yet to develop as compared to basic chain ladder

Next Steps

- Review the appropriateness of the different methods used for claims projection.
- This can be done by using these methods for past data and see what best explains the claims paid in actuals
- The development years should be observed closely to check if the assumption that claims are fully developed by year 7 is correct
- Check the assumption of inflation. This should be linked to the cost increase as per the underlying portfolio to match with the actual payments
- Any costs associated with facilitation of claims like surveyor fee, reviews etc should be calculated and added to the claim's reserves
- Check for data in other claim years as well to have more credible numbers and less fluctuations
- This exercise should be repeated for multiple scenarios of inflation – High, medium and low to calculate a range of reserves to be used
- Any regulatory requirements for reserving process should be considered
- The BCL and Bornheutter Ferguson ignore the inflation. We must check if it makes sense to use inflation adjusted method only specially when inflation is a considerable factor
- Other portfolios with long or short development of claims should be considered for diversification
- Check the data for homogeneity. No different claims portfolios should be combined while projecting claims as that will distort the projected numbers
- Past inflation should be checked for to include and baseline these claim amounts to remove any bias caused by inflation
- There are more methods of calculating development of claims. Analyze the suitability of alternative methods
- To run the claims triangles for multiple scenarios of inflation and interest, high speed software should be considered
- Any regulations related payment of claims like timing, methods etc should be considered and additional claims associated should be incorporated
- Any taxes on claim payments to be considered for claims reserves
- Diversification with other long tail and short tail businesses or life insurance business
- Concentration risk of geography should be analysed
- For motor portfolio, consider the driver profiles at the time of underwriting to limit the claims and hence claim reserves
- Any changes which may have caused difference in development pattern of claims to be checked and only relevant years' data for future projection to be used
- Calibration of all the different methods should be done with past data to come up with right method of projection of claims
