

INSTITUTE OF ACTUARIES OF INDIA
EXAMINATIONS

31st May 2024

CP2B - Actuarial Modelling

Time allowed: 3 Hours 15 Minutes (14.45 – 18:00 Hours)

Total Marks: 100

Q. 1) Background information:

A large Indian insurance company, ABC General Insurance Ltd., writes non-life business all over the country. It sources business in various lines of business through multiple distribution networks. Their commercial vehicle own damage line of business, in particular, is a large, stable, and diversified portfolio.

The reserves for the commercial vehicle own damage portfolio are set once at the beginning of each year. The Appointed Actuary follows run-off triangles actuarial principle to set up reserves. **Incurred But Not Reported (IBNR)** reserve estimation model for 2024 has been prepared by the Valuation Actuary. He has calculated these reserves by using a basic chain ladder approach on incurred claims and has used 5-year weighted average loss development factors for the projecting liabilities.

Model and audit trail for the same has been provided to you.

Appointed Actuary, during his review of liabilities, observed that the years 2019 and 2020 saw a large improvement in claims experience. He believes that this is attributable primarily to the pandemic, COVID-19.

In 2019, when the first cases of the disease began to spread, the country went into a lockdown with vehicular movements significantly reduced to prevent the spread of the disease. This resulted in very few accidents and claims for the year 2019. As vaccination developed and more people developed immunity, lockdowns eased, and economic activity resumed over the next year. Though commercial vehicles began to ply during the lockdown to keep supply chains alive, they were still much less than in normal times because of generally dampened economic activity.

Considering the above information, Valuation Actuary has asked you recompute the IBNR reserves using the following additional methods:

- i) **Method 2:** Use 5-year (excluding 2019) weighted-average loss development factors. (4)
- ii) **Method 3:** Use 3-year weighted-average loss development factors. (3)

From 2021 onwards, the observed vehicle movement and number of accidents have gone back to pre-pandemic levels. However, Appointed Actuary has made a note that claims inflation seemingly has risen significantly after the pandemic and hence this should be allowed for in the IBNR calculations. To take into the account of the impact of the same, you have been asked to recompute the IBNR reserves using following additional method:

- iii) **Method 4:** Use 3-year weighted average development factors and apply an inflation adjustment of 5% p.a. for claims expected to arise in future for accident years 2020 onwards. (6)
- iv) Also, you've been asked to compare the results of all 4 methods by producing a suitable chart. (2)

We are at the end of the year 2024 and claims team has provided the claim amounts incurred in 2024, corresponding to each accident year. Appointed Actuary has asked the Valuation

Actuary to revisit the reserving method and see if adjustments considered at start of the year hold merit.

- v) You are required to calculate the difference of the actual and the expected claims incurred for each accident year in 2024. Expected claims using each of the 4 estimation methods must be considered for the comparison. (3)
 - vi) Also, plot these Actual versus Expected (AvE) results in a suitable graph. (2)
- [20]**

Q. 2) Summary:

- i) Methodology (including purpose, data, method, and assumptions): (27)
 - ii) Results, including charts (8)
 - iii) Commentary on results and conclusions (20)
 - iv) Next steps (15)
 - v) Drafting (10)
- [80]**

Audit Trail

Purpose- The purpose of this model is to calculate the claims reserves required in order to settle the payments for the claims already incurred and yet to be reported for the commercial vehicle motor own damage insurance portfolio.

Data- Data has been provided for claims reported and paid over the years from year 2014 to 2023. In the triangle, the rows represent accident or loss years, and the columns represent development years. Development year 1 refers to the same year in which loss has occurred, for example in cell C1 the value represents amounts incurred for accident year 2014 in the same year 2014.

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 implicitly taken into account for Basic chain ladder method, or not required.
- The claims for year 2014 are fully developed and there will be no more payments in respect of those claims.
- All claim amounts include claim related expenses.

Methodology-

A new worksheet is created named "Reserve Estimate 2023". The claims data provided in "Data" tab is linked to this worksheet in a cells B5:L15, under the heading "Cumulative Incurred Claims".

In row 17, the 5- year weight average development factors are calculated using the formula sum of incurred claims for development period n+1 divided by sum of incurred claims for development period n for all accident years. Where the number of years in the triangle is less than 5, the sum includes all available years for both numerator and denominator.

These development factors are used to project the cumulative claims for these development years in Table "Projected Incurred Claims" which is from Cell B20 to L30.

For example, in cell D30, development ratio for development year 1 of 1.876 is used to calculate the amount for development year 1 for claim reported in 2023 as below-
 $2723420 * 1.8756 = 5,108,057$.

Similarly, corresponding development ratios are used to fill values for each development year.

To calculate the claims reserves, the claims fully developed at end of year 2023.
Cells M21 to M30 are the ultimate amounts of claims for each loss year.
Cells N21 to N30 are the incurred amounts of claims for each loss year.
Cells O21 to O30 are the reserve for each loss year calculated as the difference between M – N for all rows 21 to 30.

Cell O31 is sum of cells O21 to O30, this gives the total IBNR for the commercial vehicle own damage book for year 2023.

In cells P31 to P34, IBNR reserves for each year are checked against the IBNR for the immediately preceding year and is expected to be greater. Any years where this is not true is highlighted.

In cells Q21 to Q30, the expected incurred amount for the year 2024 is calculated as the difference between the cumulative incurred for 2024 less cumulative incurred for the year 2023 from the triangle.
