Reserving

Stat 346 - Short-term Actuarial Math

Important Ratios

$$\text{Average Frequency} = \frac{\text{Number of Claims}}{\text{Exposure}}$$

- **Number of Claims:** The total number of claims reported in a given period.
- **Exposure:** The measure of risk, often represented in terms of policy years, vehicle years, or sum insured, providing a basis for comparing different risk units.

Understanding Exposure

We know the following about Scott and Joey.

- Scott has 2 losses
- Joey has 3 losses

Who has the higher likelihood of loss?

Understanding Exposure

The rest of the story

- Scott has 2 losses in the last 2 weeks
- Joey has 3 losses over the last 2 years.

Who has the higher likelihood of loss?

Understanding Exposure

Exposure is a basic unit of measure for risk.

Total Expected Loss = Expected Loss per Exposure $\times$ Exposures

Time is a common exposure level but there could even be better ones

- Discuss car claims in terms of claim per mile driven
- Disability claims for a business per employee, or even by employee hour worked.

Important Ratios

$$\text{Average Severity} = \frac{\text{Losses}}{\text{Number of Claims}}$$

$$\text{Pure Premium} = \frac{\text{Losses}}{\text{Exposure}} = \text{Frequency} \times \text{Severity}$$

$$\text{Loss Ratio} = \frac{\text{Pure Premium}}{\text{Actual Premium}}$$

Loss ratio is a measure of profitability. If it is low then profits are higher, but there are other things to consider.

Claim Related Expenses

ALAE (Allocated Loss Adjustment Expenses):

- Expenses assignable to a particular claim, including legal costs and expert witness fees.

ULAE (Unallocated Loss Adjustment Expenses):

- Expenses not easily allocated to a specific claim, such as payroll, rent, and computer expenses for the claims department.

DCC (Defense and Cost Containment):

- Expenses related to defense litigation and medical cost containment, whether provided internally or externally.

A&O (Adjusting and Other):

- Includes all claims adjusting expenses.

Examples of Claim Related Expenses

ALAE Examples:

- Payment to a law firm for defending a claim.
- Fees for an expert witness in a court case.

ULAE Examples:

- Salaries of the claims department staff.
- Office rent and utilities for the claims processing center.

DCC Examples:

- Costs associated with legal defense strategies.
- Expenses for medical reviews to contain claim costs.

A&O Examples:

- Costs for claims investigation teams.
- Expenses for claims adjustment software.

Key Dates in an Insurance Claim

Understanding the timeline of an insurance claim is crucial for both insurers and insureds. Here are the key dates involved:

- **Accident Date/Occurrence Date:** The date the loss occurred.
- **Report Date:** The date the insured reports the claim to the insurer.
- **Claim Create Date:** The date the claim handler enters the claim information into the insurer's data systems.
- **Transaction Date:** The date a financial transaction is made on a claim.
- **Settlement Date/Closed Date:** The date the final payment is sent to the insured for a claim, and the case reserve is set to 0.
- **Reopened Date:** The date when a claim that had been closed is reopened for further investigation or additional payments.
- **Policy Effective Date:** The date when the insurance policy goes into effect, marking the beginning of the coverage period.
- **Policy Expiration Date:** The date the policy is no longer effective, marking the end of the coverage period.

Understanding Payments for a Claim

In managing insurance claims, several financial measures are crucial:

Ultimate: The total losses that will eventually be paid out for claims.

Paid Losses: Payments already made to any party for a claim.

Case Reserves: Money set aside for total claim payments to be made.

Incurred: The sum of paid losses and case reserves. Represented as Incurred = Paid + Case Reserves.

IBNR (Incurred But Not Reported): Losses that have been incurred but not yet reported to the insurer.

Total reserves should equal Ultimate − Paid Losses, the sum of case reserves and IBNR, providing a comprehensive financial overview of the insurer's liability for claims.

Delving into IBNR: IBNER and IBNYR

The IBNR reserve can be further classified into two distinct types to better understand and manage latent claim liabilities:

IBNER (Incurred But Not Enough Reported): Represents the additional costs expected for claims that have been reported but are underestimated in the current reserves.

IBNYR (Incurred But Not Yet Reported): Refers to claims that have occurred but have not yet been reported to the insurer at all.

One important job of an actuary is to estimate reserves, because these two values are important to know. i.e. IBNR gives actuaries jobs.

Review of Loss Ratio

The **Loss Ratio** is a fundamental concept in insurance, defined as the ratio of total losses paid out by an insurer to the premiums earned. Mathematically, it is represented as:

$$\text{Loss Ratio} = \frac{\text{Total Losses}}{\text{Earned Premium}} = \frac{\text{Loss per Unit of Exposure}}{\text{Premium per Exposure}}$$

It serves as a measure of an insurance company's profitability and efficiency in underwriting risks.

Loss Ratio Method (Expected Claims Method)

The Loss Ratio Method, or Expected Claims Method, estimates future claims based on the expected loss ratio and the amount of earned premium. It is expressed as:

$$\text{Ultimate Loss} = \text{Expected Loss Ratio} \times \text{Earned Premium}$$

This method is particularly useful when historical data is limited or not reflective of future expectations.

Example: Loss Ratio Method

Suppose an insurer expects a loss ratio of 60% for the current policyholders, with \$10,000 in earned premiums for a given year. The estimated claims would be:

$$\text{Estimated Claims} = 0.60 \times 10,000 = \$6,000$$

Now suppose that we are three years down the road and only \$5,000 has been paid. Reserves should then be set to $6,000 - 5,000 = 1,000$.

Loss Ratio Method Example

We are given the following yearly payments and. case reserves for
accidents occurring in Year A

Year	Payments	Case Reserves
Year 1	$56,000	$32,000
Year 2	$18,000	$20,000
Year 3	$10,000	$12,000

We also know the loss ratio for accident year A was estimated using the
folllowng values

- 80 units of exposures.

- 150 claims expected

- The average severity per claim is $750

- The total earned premium is $140,000

What is the current IBNR for accident year A after year A+2?

Bornhuetter-Ferguson Method

The Bornhuetter-Ferguson Method combines one major element from a claims triangle and one major element from the loss ratio method. The idea is that

Expected Ultimate Loss = Expected Loss Ratio $\times$ Earned Premium

but also

$$\text{Expected Ultimate Loss} = \text{Paid Losses} * \prod_{i=1}^{\infty} f_i$$

where f_i is the i-th loss development factor. Reserves are then calculated using

Reserves = Expected Ultimate Loss $-$ Paid Losses

$$\text{Reserves} = \text{Expected Loss Ratio} \times \text{Earned Premium} \times \left(1 - \frac{1}{f_{ult}}\right)$$

where $f_{ult} = \prod_{i=1}^{\infty} f_i$

Example: Bornhuetter-Ferguson Method

Consider \$3,000 in paid claims, an expected loss ratio of 50%, \$10,000 in earned premiums, and a loss development factor of 1.5. The ultimate claims would be:

$$\text{Expected Ultimate Loss} = 0.50 \times 10,000 = 5,000$$

Then reserved would be

$$\text{Reserves} = 5000 \left(1 - \frac{1}{1.5} \right) = 1666.67$$

what would the loss ratio method say?

Example: All Three Methods

You have chosen the following paid loss development factors to model the lower half of a claims paid triangle.

1/0	2/1	3/2	4/3	$\infty/4$
1.41	1.22	1.16	1.08	1.04

You are setting reserves for the annual report in calendar year 7. For accident year 6 you have paid-to-date claims of \$420,000. The earned premium calculated for accident year 6 is is \$1,000,000 and the expected loss ratio is 0.6. Determine the estimated loss reserve using the chain ladder. method the loss ratio method, and the Bornhuetter Ferguson method.