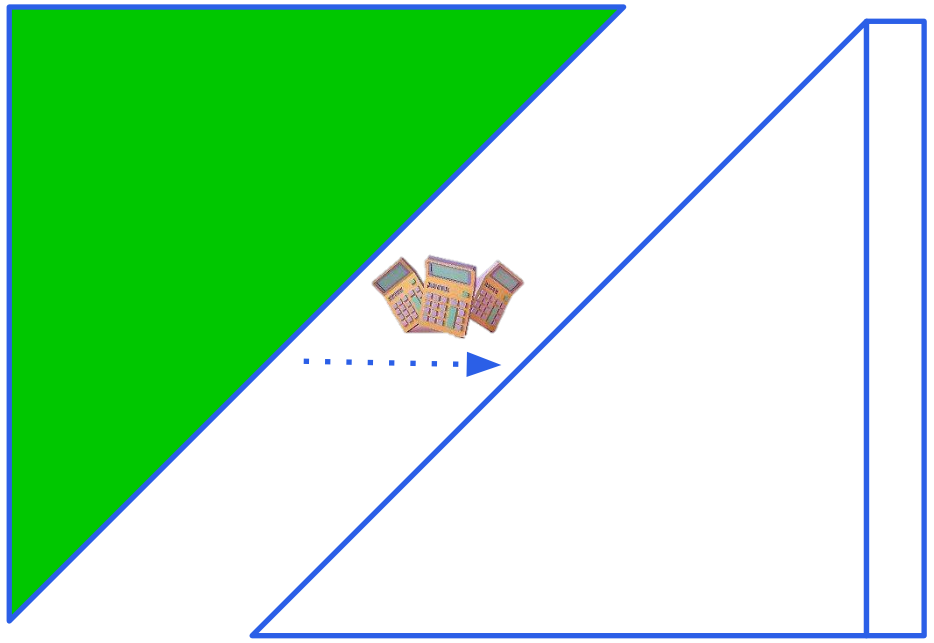
Fundamental Property Casualty Loss Reserving Concepts That Arbitrators Should Know



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AGENDA

- Stage Setting and Actuarial Professional Requirements
- Basic Reserving Methods and their Underlying Assumptions
- Allocating Reserves (and Paid Losses)

Stage Setting and Actuarial Professional Requirements



Introduction

Actuaries are experts in quantifying future contingent cash flows. We cannot predict the future; we estimate it using an expanding tool box of widely accepted methods that rely on assumptions that must be selected by the actuary.

Loss reserving "cannot be reduced to a purely mechanical process or to a 'cookbook; of rules and methods. The utilization and interpretation of insurance statistics requires an intimate knowledge of the insurance business as well as the actuary's ability to **quantify complex phenomena which are not readily measurable**."[1]

Actuaries are subject to professional Standards of Practice and the Code of Professional Conduct when performing actuarial services, such as estimating unpaid liabilities (i.e., loss reserves).

[1] Berquist, J.R., and Sherman, R.E., "Loss Reserve Adequacy Testing: A Comprehensive, Systematic Approach," Proceedings of the Casualty Actuarial Society LXIV, 1977, pp. 123-184.

Actuarial Standard of Practice No. 43, Property/Casualty Unpaid Claim Estimates

"3.6.1 Methods and Models - The actuary should consider methods or models for estimating unpaid claims that, in the actuary's professional judgment, are appropriate. … based on relevant factors including, but not limited to, the following:

a. the nature of the claims and underlying exposures;
b. the development characteristics associated with these claims;
c. the characteristics of the available data;
d. the applicability of various methods or models to the available data; and
e. the reasonableness of the assumptions underlying each method or model.

…"

"3.6.2 Assumptions - The actuary should consider the reasonableness of the assumptions underlying each method or model used. …"

Actuarial Standard of Practice No. 43, Property/Casualty Unpaid Claim Estimates

"3.6.7 Changing Conditions - The actuary should consider whether there have been significant changes in conditions, particularly with regard to claims, losses, or exposures, that are likely to be insufficiently reflected in the experience data or in the assumptions used to estimate the unpaid claims."

"3.6.8 Uncertainty - The actuary should consider the uncertainty associated with the unpaid claim estimate analysis … The actuary should consider the purpose and use of the unpaid claim estimate in deciding whether or not to measure this uncertainty…"

Where Is Actuarial Judgment Required?

Selection of data

Assessing the effect of changes in an insurer's operations

Adjusting claims data for influence of known and quantifiable events

Evaluating strengths and weaknesses of various techniques

Making the final selection of the unpaid claim estimate

Source: Berquist, J.R.; and Sherman, R.E., "Loss Reserve Adequacy Testing: A Comprehensive, Systematic Approach," Proceedings of the Casualty Actuarial Society LXIV, 1977, pp. 123-184.

Basic Reserving Methods and their Underlying Assumptions

The Development Method (a.k.a. “chain ladder”, “link ratios”)

Arrange data into a loss triangle (AY, PY, RY, UY, FY)

	Development Period (months)									
Accident Year	12	24	36	48	60	72	84	96	108	120
2016	32,119,126	36,409,161	38,500,000	40,016,413	41,365,986	41,909,837	42,644,752	43,395,902	44,350,612	44,272,400
2017	31,881,598	36,964,927	38,800,934	41,505,260	42,500,000	43,500,000	44,236,985	45,121,725	45,127,861	
2018	30,639,514	34,233,708	35,808,293	36,884,902	37,874,986	38,867,326	39,520,692	40,232,065		
2019	30,703,091	33,175,452	35,879,330	36,958,177	37,892,219	38,781,712	39,366,801			
2020	28,297,359	30,565,465	32,179,127	33,113,291	34,028,582	34,868,783				
2021	29,059,721	33,663,046	36,400,289	37,528,021	38,554,384					
2022	28,161,340	31,792,030	33,977,878	35,024,006						
2023	29,237,119	33,257,582	35,809,210							
2024	28,668,591	31,404,907								
2025	29,988,013									

Calculate link ratios

	Development Period (months)								
Accident Year	12 to 24	24 to 36	36 to 48	48 to 60	60 to 72	72 to 84	84 to 96	96 to 108	108 to 120
2016	1.1336	1.0574	1.0394	1.0337	1.0131	1.0175	1.0176	1.0220	0.9982
2017	1.1594	1.0497	1.0697	1.0240	1.0235	1.0169	1.0200	1.0001	
2018	1.1173	1.0460	1.0301	1.0268	1.0262	1.0168	1.0180		
2019	1.0805	1.0815	1.0301	1.0253	1.0235	1.0151			
2020	1.0802	1.0528	1.0290	1.0276	1.0247				
2021	1.1584	1.0813	1.0310	1.0273					
2022	1.1289	1.0688	1.0308						
2023	1.1375	1.0767							
2024	1.0954								

The Development Method (a.k.a. “chain ladder”, “link ratios”)

Select link ratios, tail factor

	Development Period (months)									
	12 to 24	24 to 36	36 to 48	48 to 60	60 to 72	72 to 84	84 to 96	96 to 108	108 to 120	Tail
Wtd Avg	1.1217	1.0640	1.0377	1.0275	1.0220	1.0166	1.0186	1.0109	0.9982	
Arith average	1.1213	1.0643	1.0371	1.0275	1.0222	1.0166	1.0185	1.0111	0.9982	
excl high and low	1.1217	1.0644	1.0323	1.0268	1.0239	1.0169	1.0180	1.0111	0.9982	
Selected	**1.1217**	**1.0640**	**1.0377**	**1.0272**	**1.0227**	**1.0167**	**1.0184**	**1.0110**	**1.0000**	**1.015**

Calculate Cumulative Development Factors, ultimate losses, reserves

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CDF	1.3824	1.2324	1.1583	1.1162	1.0866	1.0625	1.0450	1.0262	1.0150	1.015
Losses to date	29,988,013	31,404,907	35,809,210	35,024,006	38,554,384	34,868,783	39,366,801	40,232,065	45,127,861	44,272,400
Ultimate Loss	41,455,335	38,704,831	41,476,874	39,093,425	41,892,830	37,046,707	41,138,770	41,284,612	45,804,779	44,936,486
Reserves	11,467,322	7,299,924	5,667,664	4,069,419	3,338,446	2,177,925	1,771,969	1,052,548	676,918	664,086
Total Reserves	**38,186,220**									

The Development Method (a.k.a. “chain ladder”, “link ratios”)

Underlying assumptions

- Relative change in a given year’s claims from one evaluation point to the next is similar to the relative change in prior years’ claims at similar evaluation points
- Claims observed thus far tell you something about the claims yet to be observed (for all years, even immature ones)
- Consistent claim processing
- Stable mix of types of claims
- Stable policy limits and deductibles / SIRs
- Stable reinsurance & excess insurance program(s) throughout experience period

The Development Method (a.k.a. “chain ladder”, “link ratios”)

Primary assumption: reporting and payment of future claims will be similar to patterns observed in the past (esp. case reserve adequacy; speed of claims closure and payment)

- Appropriate when there are no recent major organizational changes and external environmental changes
- Particularly suitable for high-frequency, low-severity lines with stable and relatively timely reporting of claims.
  - Especially when volume of claims experience does not change significantly from year to year
- Not suitable for lines with uneven claims distribution throughout the year
- Not suitable for immature years of long-tail lines (such as workers’ compensation)
- Requires large volume of data (number of claims per year and years of development)

Bornhuetter-Ferguson Method

The Bornhuetter-Ferguson: blend of Development Method and Expected Loss Method

- Ultimate losses = losses reported to date + expected unreported losses
- Ultimate losses = losses paid to date + expected unpaid losses

… where …

- Expected unreported = (*a priori* ultimate) x (estimated % unreported)
- Expected unpaid = (*a priori* ultimate) x (estimated % unpaid)

Estimated % unreported and unpaid come from the Development Method

A priori ultimate source:

- Underwriting or pricing functions
- Prior reserve analysis
- Result of other reserving method

Bornhuetter-Ferguson Method

Oversimplified summary:

What happened, happened

The future will be as expected, regardless of what just happened

Bornhuetter-Ferguson Method

Key underlying assumptions

- Unreported (or unpaid) claims will develop based on prior expectations
- Claims activity to date (for a given AY, PY, RY, UY, or FY) contains no informational value regarding claims yet-to-be reported (or paid)

Key advantages

- Unusual activity in early development periods does not overly bias reserve estimate
- Not sensitive to lack of data in immature development periods (e.g., long-tail lines)

Bornhuetter-Ferguson Method

Other implicit underlying assumptions carried over from Development Method:

- Reporting and payment of future claims will be similar to patterns observed in the past (esp. case reserve adequacy; speed of claims closure and payment)
- Consistent claim processing
- Stable mix of types of claims
- Stable policy limits and deductibles / SIRs
- Stable reinsurance & excess insurance program(s) throughout experience period

Bornhuetter-Ferguson Simplified Example

- The *a priori* ultimate losses for AY 2024 are $100 m (Where did this *a prior* come from?)
- Reported losses as of December 31, 2024 are $75 m
- Paid losses are of December 31, 2024 are $29 m (so case reserves are $46 m)
- Selected 12 month-to-ultimate reported CDF of 1.325; ultimate losses for a given accident year expected to be 132.5% of the losses reported after 12 months; losses reported at 12 months are expected to be 1/132.5% = 75.47% of ultimate, so unreported % is 24.53%. **Total reserve estimate is $46 m (case) + $25.43 m (unreported) = $71.43 m**
- Selected 12 month-to-ultimate paid CDF of 3.634; ultimate losses for a given accident year expected to be 363.4% of losses paid after 12 months; losses paid at 12 months are expected to 1/363.4% = 27.5% of ultimate, so unpaid % is 72.5%. **Total reserve estimate is $72.5m**

Frequency-Severity Method

Use Development Method to derive separate estimates of

- Expected number of claims (frequency) and
- Expected average ultimate value of claims (severity)

Estimated ultimate losses are {expected frequency} x {expected severity}

Reserve estimate is {estimated ultimate losses} – {losses paid to date}

More often used for long-tail lines. Well suited for excess (re)insurance.

Need consistency with grouping and counting of claims

Many of the same underlying assumptions as the Development Method – particularly with regard to insurer operations and reinsurance

Can incorporate trends in exposure, frequency, severity, claims disposal rates

OK, BUT WHAT IF ONE OF THE FOLLOWING IS TRUE?

- There have been recent major organizational changes (e.g., claims, underwriting)
- There have been recent external environmental changes
- The mix of claims types is not stable
- Limits and deductibles have significantly changed over the years

Berquist-Sherman Methods

Adjusting for changes in operations and procedures

- **Treat "problem areas" through data selection and rearrangement**
  - Use PY when significant change in limits or deductibles
  - Use RY when significant change in external environment affects RY severities
  - Quarters instead of years when rapid growth / contraction
  - Others

Berquist-Sherman Methods

Adjusting for changes in operations and procedures

- **Treat "problem areas" through data adjustment**
  - Changes in case reserve adequacy: Restate case reserves (and reported losses) so that each diagonal in triangle is at same level of case reserve adequacy as the latest diagonal
  - Changes in settlement rates: Restate paid losses so that the average paid loss per claim, in each diagonal of the triangle, is at same level of paid-to-ultimate as the latest diagonal
  - Requires analyses of claim counts and rigorous actuarial analyses underlying assumptions

Allocating Reserves (and Paid Losses)

Allocating Reserves (and Paid Losses)

Why would one want to allocate losses? Which losses?

- Lack of loss detail (paid, case reserves, IBNR)
  - Location
  - Date of Loss
  - Coverage
  - Other

Data organization

- Analysis performed on one basis (AY, PY, UY, RY, FY), need to report on another
- Actuarial soundness required aggregating data into larger groups; need to report reserves for subgroups
- Other

Allocating Reserves (and Paid Losses) in the Absence of Data

Earned premium –a measure of exposure to loss during a time period

- If each day has the same exposure to loss as any other day (e.g., personal auto), premium earns evenly
- If the exposure to loss is not constant as to time, premium will not earn evenly
  - Seasonality (e.g., catastrophes)
  - Multiyear construction portfolios

Exposed Limits (and retentions)

- Particularly for reinsurance and excess insurance

Expectations gleaned from Development Method

- Loss dollars: case reserves, paid losses, reported losses, etc.
- Claim counts: reported, closed with payment, closed without payment, etc.
- Other

Allocating Reserves (and Paid Losses) Due to Data Organization

- Earned premium –a measure of exposure to loss during a time period
- Relative proportions of known items
  - Paid Losses
  - Reported Losses
  - Claim Counts
  - Others

Questions?