

Technical Workshop: Actuarial Reserving for Non-Life Business

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Overview

- Overview of the presentation:
 1. Why are actuarial reserves needed?
 2. Two main Components of Reserves of Non-Life Insurance Businesses
 3. Current SAMA regulations
 4. First Component: Claims Reserving Methods & Reserving Cycle
 - A. Claims Reserving Methodologies
 - i. Deterministic Methods
 - ii. Stochastic Methods
 - B. Reserving Cycle & Diagnostic Tools
 5. Second Component: Premium Reserves
 6. Latest Developments & Conclusions
- ***Audience: actuarial students from universities and young and dynamic actuarial analysts working in the industry.***

Why are Actuarial Reserves needed?

- Also commonly known as insurance or technical provisions, insurance liabilities or simply 'reserves'.
- Reasons for estimating actuarial reserves include:
 - **Covering the insurance liabilities for policies already written for various reporting purposes:**
 - for published accounts, tax reporting and solvency requirements (depending on regulatory regimes), internal management reporting
 - To assess the performance of business segments
 - To estimate the ultimate claim costs for pricing exercise
 - to assess the reasonableness of the claims (outstanding and/or incurred-but-not-reported) reserves held as at past valuation dates
 - To value liabilities of insurer in a mergers and acquisition transaction

Two Main Categories of Technical Provisions

Claims Reserves

- **Outstanding Claims Reserves:** estimated reserve needed to settle the known claims
- **Incurred-but-not-reported Claims (or IBNR) reserves:** estimated need to cover claims payments for accidents incurred but not reported, hence the name.
 - Contains the Incurred-but-not-enough-reported part as well.
- **Reserves for Claims Handling Expenses:** reserves held for settling the above categories.

Premium Reserves

- **Unearned Premium Reserve (UPR) and Additional UPR :**
 - based on uniform or non-uniform patterns of risk
 - Unearned means unexpired exposure or remaining portion of premium.
 - Reserve of premiums that are unearned using uniform risks referred to as UPR and additional amount as difference between uniform and non-uniforms patterns
- **Premium Deficiency Reserve:** held for inadequacy of premiums to ensure claims and expenses for remaining coverage period are enough.

Other reserves including Unallocated Loss Adjustment Expense reserves, Data Deficiency Reserves, Claims Equalization Reserve, Reinsurance Accrual Reserves, etc. However these are briefly covered.

Key SAMA Requirements on Actuarial Reserving

- Issued by SAMA, the Actuarial Work Regulations provide the instructions of actuarial role in the Kingdom of Saudi Arabia. It manages the role of appointed actuaries and/or internal actuaries employed by the insurers.
- It provides key guidance for life and non-life companies and actuaries including:
 - Roles and Responsibilities of Actuaries (section d)
 - Requirements of preparing reports and conduction data validation
 - Reports including:
 - Financial Conditions
 - Pricing Reports – Medical Expenses and Motor Insurance
 - Mid-year Review
 - Persistency Reports, and
 - Data Quality and Back-testing

Key SAMA Requirements on Actuarial Reserving

- Circular 173 – Financial Conditions Report 2018 along with SAMA FCR reporting template provided instructions for carrying out actuarial reserving requirements.
- Important reserving requirements:
 - Claims-side reserve requirements for all lines (paragraph 5, 6 and 7):
 - Paid and Incurred triangulation-based reserving for all lines of business preferred but for Medical and Motor business are mandatory
 - More than one reserving methodology be considered
 - Separately for gross claims, recoveries (Salvage and Subrogation separately where available), reinsurance recoveries
 - Discounting not permitted unless long-term nature of claims payouts such as annuity-based payments under liability claim.
 - Uncertainty around reserves needs to be communicated. Range of results under various methods or stochastic methodologies be adopted.
 - Premium-side reserves requirements (paragraph 3 & 4):
 - Unearned Premium Reserves,
 - Additional Unearned Premium Reserves,
 - Premium Deficiency Reserves

Claims Reserving

- Various methods are currently followed in practice, depending on available information and data. Primary ones include:
 - Deterministic methods:
 - Expected Loss Ratio method – assumption driven
 - Chain Ladder method – pattern driven
 - Bornhuetter-Ferguson method
 - ... (Inflation-adjusted Chain Ladder, Average Cost per Claim, Cape Cod, etc.)
 - Stochastic methods (but with limitations):
 - Mach method (based on CL)
 - Bootstrapping the Overly Dispersed Poisson (simulated-based CL)
 - ... (Negative Binomial, Normal approximation to Negative Binomial, BF-Bayesian version)
- Applicable (with some limitations) on:
 - paid and incurred developments
 - Periods can be annual, half-yearly, quarterly or even monthly (depending on company process and available data sizes)
 - Accident periods, reporting periods or even underwriting periods (mainly followed by reinsurers)

Claims Reserving – Deterministic models

Expected Loss Ratio method

- Naïve method, based on assumption of historical loss ratios or industry-wide ratio to derive the ultimate claims liability using premiums
- Applicable when data is:
 - Sparse
 - Unreliable, or
 - Missing – in case when the company is starting a new line of business (subject to approval from regulatory bodies)
- Subject to limitations, assumptions basis can be:
 - competitors' or industry available information,
 - underwriter's opinion or pricing basis,
 - historical or similar portfolios,
 - Break-even basis (i.e. 100%),
 - target loss ratio within business plan, or
 - based on reinsurer's opinion

Claims Reserving – Deterministic models

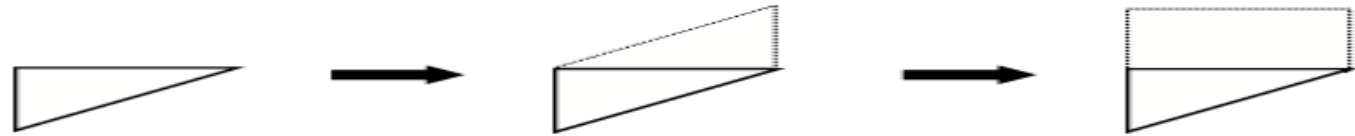
- Paid claims reserving is considered as known paid claims available at each Accident Year (AY)
- Ultimate Claims is a product of loss ratio and earned premiums
- Total loss reserve is estimate as Ultimate Claims less Paid Claims, instead of IBNR reserving

AY	Earned Premiums	Paid Claims	Expected Loss Ratio (ELR) Method			
			Assumption LR	Ultimate	Loss Reserves	Implied LR
1	33,025	33,328	100%	33,025	(303)	100%
2	53,719	51,701	100%	53,719	2,017	100%
3	40,611	41,247	100%	40,611	(636)	100%
4	65,845	60,993	100%	65,845	4,852	100%
5	107,136	88,623	100%	107,136	18,513	100%
6	106,203	63,095	100%	106,203	43,108	100%
	406,539	338,987		406,539	67,552	

Claims Reserving – Deterministic models

Chain Ladder method

- Method based on claims development behavior. It assumes that future pattern of claims development is derived from the past experience will remain stable.
- Also known as triangulation method but trapeziums or parallelograms can be used



- Derivation process:
 - Tabulation of claims on cumulative basis by AY and development year (DY)
 - Determination of development factors
 - Application of development factors to derive ultimate claims
 - From cumulative results, reserve estimates can be determined by taking difference between ultimate claims and known amounts

Claims Reserving – Deterministic models

- Triangulation based on Paid Claims. CL produces total Ultimate Claims from which the total loss reserves are determined.

Earned Premium	AY/DY	0	1	2	3	4	5
33,025	1	19,792	30,253	32,501	33,144	33,214	33,328
53,719	2	34,711	49,506	51,054	51,577	51,701	
40,611	3	28,281	39,824	40,586	41,247		
65,845	4	46,406	59,592	60,993			
107,136	5	64,641	88,623				
106,203	6	63,095					

- Link ratios, development factors (DF) and cumulative development factors (CDF) triangulation is shown below

AY/DY	0-1	1-2	2-3	3-4	4-5	5-Ult
1	1.5286	1.0743	1.0198	1.0021	1.0035	
2	1.4262	1.0313	1.0103	1.0024		
3	1.4081	1.0191	1.0163			
4	1.2842	1.0235				
5	1.3710					
6						

DF	average	1.4036	1.0370	1.0155	1.0022	1.0035	1.0000
	weighted	1.3816	1.0333	1.0147	1.0023	1.0035	1.0000

Selected CDF	weighted	1.4569	1.0545	1.0206	1.0058	1.0035	1.0000
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Claims Reserving – Deterministic models

Earned Premium	AY/DY	0	1	2	3	4	5	Ultimate
33,025	1	19,792	30,253	32,501	33,144	33,214	33,328	33,328
53,719	2	34,711	49,506	51,054	51,577	51,701	51,999	51,999
40,611	3	28,281	39,824	40,586	41,247	41,484	41,723	41,723
65,845	4	46,406	59,592	60,993	62,247	62,605	62,965	62,965
107,136	5	64,641	88,623	93,453	95,375	95,924	96,256	96,256
106,203	6	63,095	91,923	96,933	98,927	99,496	99,840	99,840

AY	Earned Premiums	Paid Claims	Chain Ladder (CL) Method				
			CDF	Comp. Fac	Ultimate	Loss Reserves	Ultimate LR
1	33,025	33,328	1.000	100%	33,328	-	101%
2	53,719	51,701	1.003	100%	51,880	179	97%
3	40,611	41,247	1.006	99%	41,484	237	102%
4	65,845	60,993	1.021	98%	62,247	1,254	95%
5	107,136	88,623	1.055	95%	93,453	4,830	87%
6	106,203	63,095	1.457	69%	91,923	28,828	87%
	406,539	338,987			374,317	35,329	

Claims Reserving – Deterministic models

Bornhuetter-Ferguson method

- This method relies on assumed run-off pattern and an estimate of ultimate claims for each period. This estimate is usually made using the loss ratio method. An external estimate is apportioned between past and future development.
- This method is credibility weighted method between expected loss ratio and chain ladder method, i.e.:

Ultimate Claim

= Known Paid Claim + Estimate of Ultimate Claim

*= Known Paid Claim + (1 – credibility) * Loss Ratio * Premium*

- As with ELR method, the ultimate claims can derived using assumptions discussed.

Claims Reserving – Deterministic models

- Suitable when:
 - Information of particular cohort is missing
 - Blending of exposure and experience is deemed appropriate
 - Used when development pattern is slow – especially long-tailed business

AY	Earned Premiums	Paid Claims	Bornhuetter-Ferguson (BF) Method				
			Ultimate LR	1 - Comp Fact	Ultimate	Loss Reserves	Implied LR
1	33,025	33,328	100%	0%	33,328	-	101%
2	53,719	51,701	100%	0%	51,887	185	97%
3	40,611	41,247	100%	1%	41,479	232	102%
4	65,845	60,993	100%	2%	62,320	1,327	95%
5	107,136	88,623	100%	5%	94,160	5,537	88%
6	106,203	63,095	100%	31%	96,402	33,307	91%
	406,539	338,987			379,576	40,589	

- Challenge – difficult to gather the *priori* estimate of ultimate claims.
- Different modifications can be applied to BF method

Claims Reserving – Deterministic models

Other Methods

- Inflation adjusted Chain Ladder method: this method makes inflation adjustments to Chain Ladder method using appropriate inflation rate
- Average Cost per Claim: this method uses CL approach but segregates development by number of claims (Frequency) and claim amounts per claim (Severity). Two CL approaches followed and ultimate claim is determined as Ultimate Number of Claims and Ultimate Claim Amount per Claim.
- Cape Cod method: similar to BF method, but instead of priori loss ratio assumption, this method uses weights proportional to a measure of exposure and inversely proportional to claims development.

Claims Reserving – Stochastic models

Why Stochastic Models?

- Claims process is inherently uncertain, Stochastic methods provide basis for determining variability of reserves and its potential impact on profitability and capital position.
- Assessing the adequacy of reserves
- Price insurance contracts as uncertainty incorporated in rates results in better estimation of rates.
- Measuring the volatility for reinsurance adequacy assessment
- Various others including:
 - Management decision-making to understand sources of variability of claims
 - Supporting investors to explain explicit and implicit risk margins
 - Capital allocation process

Claims Reserving – Stochastic models

Mack Method

- Uses past claims data to derive estimate of mean and variance of total ultimate claims. It doesn't consider any underlying distribution of claims experience i.e. a distribution free method. Based on Chain Ladder method projections
- Assumptions
 - The claims development is same for each accident period;
 - Future development of claim period is independent of historical developments (e.g. high factors in one period do not imply high or low factors in following periods;
 - Variance of cumulative claims to current development is proportional to cumulative amounts to previous development period.
- To estimate the variability in reserves through this method, Standard Normal and Log Normal distributions are fitted to the results of mean and variance and consequently construct quartiles to determine reserve variability.

Claims Reserving – Stochastic models

Bootstrapping the Overly Dispersed Poisson

- Bootstrapping the Overly Dispersed Poisson assumes that the incremental claims on the chain ladder method are derived from ODP distribution (with variance proportional, but not necessarily, to mean). Some assumptions to consider:
 - The run-off pattern is same for each accident period;
 - Increment values are statistically independent;
 - Variance of the incremental claims is proportional to mean; and
 - Incremental values are positive for all development periods
- Three-stage process:
 - Calculating the expected values and the residuals for each point in the claims triangulation
 - Re-sample (with replacement) from the residuals to obtain a new triangle – this is simulation process and is carried out multiple times.
 - Re-estimate reserve for each simulated triangle to obtain a set of estimate.
 - The method produces simulated reserve values and the distribution of results of simulated reserves can be estimated.

Claims Reserving – Stochastic models

- Quartiles can be constructed on these two methods;
 - 25th, 50th, 75th or other more percentiles can be constructed.
- Since Mack is distribution free, assumed Normal distribution for desired quartiles, whereas the Bootstrapping the ODP constructed its own distribution using 250 simulations (more the better!)
- Various other methods are adopted in practice, along with determining range of reserves in deterministic basis.

Best Estimate	35,329	35,329
Method	Mack Method - Normal	Bootstrapping the ODP
Minimum	Error	27,315
25th Quartile	31,749	33,495
50th Quartile	35,329	35,429
75th Quartile	38,909	37,447
Maximum	Error	47,254

Claims Reserving – Adjustments

Necessary Adjustments

- Homogeneity of the data; avoid heterogeneity:
 - Lines of business – combined or segregated (Motor, Medical, Employers' Liability, Travel, D&O/E&O, General Accident, Commercial and/or Residential Property)
 - Heads of Damage – damage/liability/bodily injury In-Patient, Out-patient, Others
 - Type of contract: Personal lines or Commercial lines
 - Currency or Region
- Segregation by gross and reinsurance claims;
 - Under gross claims (gross or net of deductibles), claims handling costs or Allocated Loss Adjustment Expenses, Salvage, Subrogation from Individuals and/or Corporates
 - Under Reinsurance; Proportional (Quota-Share, Surplus), Non-Proportional (Excess of Loss – Risk, Event or Aggregate), Facultative
- Segregation by attritional claims, large claims, catastrophe claims or latent claims
- Impact of Materiality and actuarial judgement
- Lack of or distortions in the data
- Inflation or trend impact
- Terms and conditions
- Changes in claims handling process, reserving philosophy or business mix
- Seasonality or cyclical

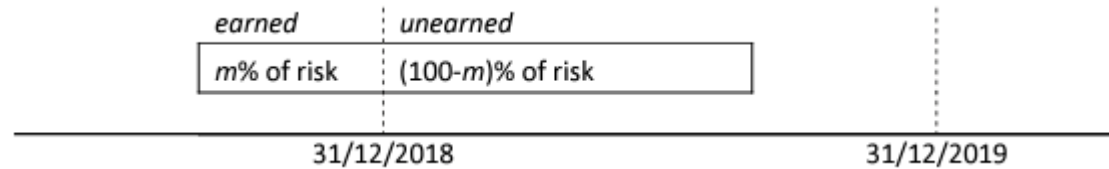
Claims Reserving – Assessing Results

Sensibility of Results: Analysis of Emerging Experience & Diagnostic tools

- Analysis of emerging experience – Actual v. Expected: identify sources of changes in the predictions:
 - Comparison of ultimate to ultimate every period
 - Comparison of projected to actual paid and/or incurred
 - Comparison of surplus/deficit in claim reserves
- Diagnostic tools:
 - Ratios:
 - paid, incurred or loss ratio progression
 - Paid-to-incurred and/or OS-to-incurred
 - IBNR-to-OS or IBNR-to-Ultimate
 - Frequency and severity
 - Reinsurance ratios
 - Patterns:
 - Changes in development pattern
 - Stability of development pattern
 - Benchmarks

Premiums Reserving

- Two types of premium reserves:
 - Unearned Premium Reserves and Additional UPR, and
 - Premium Deficiency Reserves.
- Unearned Premium Reserve: proportion of premium that is held for the unexpired risk at the Balance Sheet date. This is normally based on the uniform risks:



- For example: Premium SAR 10,000

Inception - Expiry Dates: 1 November 2018 – 31 October 2019
 Balance Sheet date: 31 December 2018

Earned: 60 days
 Earned: 0.1648
 Earned Premium: SAR 1,648

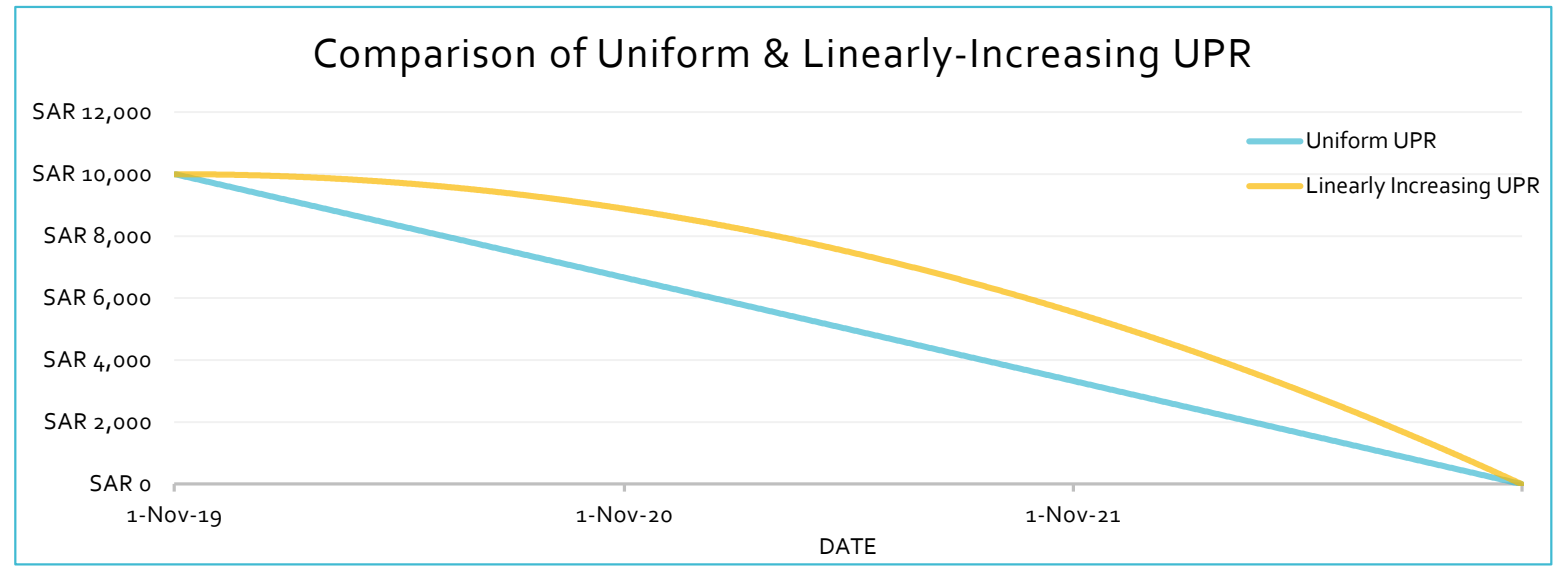
Unearned: 304 days
 Unearned: 0.8352
 Unearned Premium: SAR 8,352

Premiums Reserving

- As per SAMA FCR 2018 circular (Circular 173), all policies with one-year term shall hold UPR using $1/365$ ths method assuming risk is uniform over the policy year, except:
 - Marine Cargo Open Cover:
 - For one-year policies, last three months premiums if the dates of voyages are not known
 - For shorter-than-one-year, straight-line assuming risk is uniform if voyage dates are known, otherwise last three months premium if dates of voyages are not known.
 - Engineering Construction, Extended Warranty and/or Visitor-visa Medical Expenses insurances with term over one-year: assume risks are increasing linearly over the term of the policy.
- Assume additional UPR based on difference in linearly increasing and uniform risks.

Premiums Reserving

- Difference in UPR on uniform and linearly increasing risks:
 - Three – year term commencing 1 November 2019 until 31 October 2022; Premium SAR 10,000
 - At 31 December 2019, $UPR_{LI} = SAR\ 9,970$ and $UPR_{Uniform} = SAR\ 9,452$; \longrightarrow Additional UPR = SAR 517



Premiums Reserving

- Premium Deficiency Reserve: based on claims and expenses incurred on a group of premiums such that:
 - Claims and expenses > premiums

- Mathematically:

$$\begin{aligned} & \textit{Combined Ratio} \\ & = \textit{Loss Ratio} + \textit{Expense (including Commissions)} \\ & > 100\% \end{aligned}$$

- Hold PDR if the Combined Ratio is in excess of 100% as a product of **UPR** and **excess of Combined Ratio (110%) over 100%**.
- Currently needs to be determined at line of business level as per SAMA instructions.
- Consider expense allocation to line of business and ensure completeness, accuracy and appropriateness of the allocation basis.

Others Reserves

- **Unallocated Loss Adjustment Expense:** alternatively known as Claims Handling Expense required as % of loss reserves. “%” is dependent on expense allocation study. Normally excluded from IBNR where IBNR includes Allocated Loss Adjustment Expense.
- **Data Deficiency Reserve:** Currently dependent on the availability of the data to allow the actuary to conduct the necessary analysis:
 - 5% of net written premiums if quarterly paid and incurred P&C triangulations by line of business are not made available
 - 5% of net written premiums if monthly paid and incurred Medical Expenses triangulations are not made available.
 - Actuarial judgement necessary for deciding granularity of results.
- **Reinsurance Accrual Reserve:** required for reinsurance arrangements where they include adjustment to premiums and/or commissions based on the performance of the claims experience. Requires projected ultimate loss ratio to determine the how much is due to or from reinsurers under the arrangements.

Others Reserves

- **Claims Equalisation Reserve (not required by SAMA presently):** built overtime from the profitability of the Company to withstand fluctuations in profit to smoothen and stabilize them. Large profits can help set up buffers in Claims Equalisation Reserve whereas can be released in years of loss or low profits.
- **Catastrophe Reserve (not required by SAMA presently):** Based on the exposure levels on Property, Engineering and Energy business against flood and earthquake. The assessment of impact using reinsurance credit quality and net of reinsurance exposures.

Latest Developments

- the International Accounting Standards Board issues International Financial Reporting Standards 17 (IFRS 17) in May 2017 to replace IFRS 4:
 - Becoming live from 1 January 2022 i.e. financial statements of 31 December 2021 needs to be prepared in accordance to IFRS 17.
 - Establishes principles for recognition, measurement, presentation and disclosure of insurance contracts
 - Introduces more transparency, comparability and globalize the reporting requirements
 - Requirement of level of aggregation: portfolio of similar risks managed together; level of performance (Onerous, No significant chance of becoming onerous and Others)
 - Measurement models – General Measurement Model, Variable Fee Approach, Premium Allocation Approach
 - Change in representation of Profit & Loss account and Balance Sheets
- Read reports relating to insurance business developments:
 - SAMA website: 2018 The Saudi Insurance Market Report covers Performance, Market Indicators about different insurance segments

Conclusions & Thank You!

- Covered content:
 - Claims reserving:
 - Deterministic models
 - Stochastic models
 - Premiums reserving
 - Other reserves
 - Latest Developments
- Comments and Questions?!
- Thank you!
- Presenter can be reached at:
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