



Technical Provisions in Reinsurance: The Actuarial Perspective

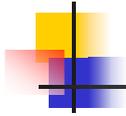
IAIS Reinsurance Subcommittee
Copenhagen
May 30, 2002

Presented by Dr. Hans Peter Boller, Converium Ltd (Switzerland)
on behalf of the International Actuarial Association (IAA)

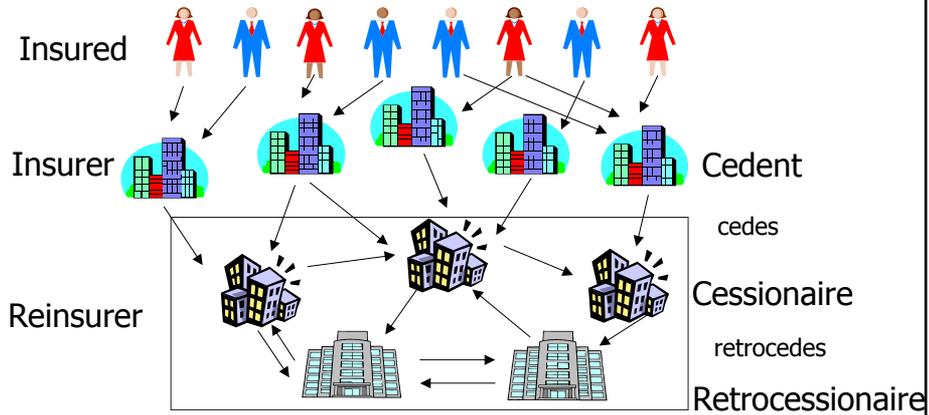


Purpose of this presentation

- Present techniques for setting technical provisions in reinsurance
- Explain challenges faced by reinsurers in doing so
- Give some practical examples
- Provide insight in solutions and how an appropriate actuarial process can support this

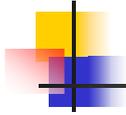


The universe of risk transfer

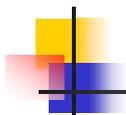
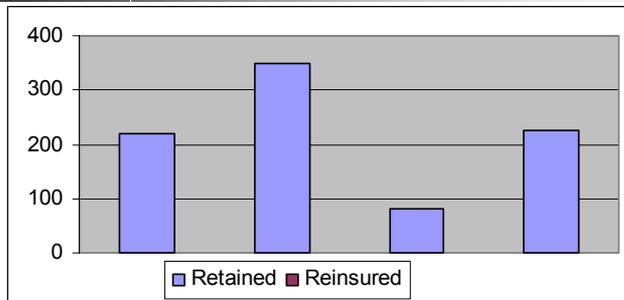


Reinsurance types

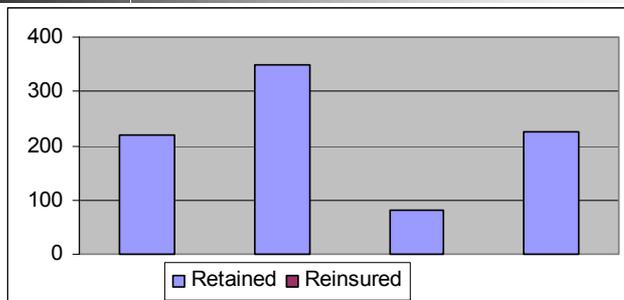
- **Treaty**
 - **Proportional**
 - Quota share
 - Surplus
 - **Non-proportional**
 - Excess of loss (XL)
 - Stop loss
- **Facultative**
- **Mix of the above and Alternative Risk Transfer (ART)**
- Features such as **Aggregates, reinstatements, loss corridors etc** as modifications and extensions



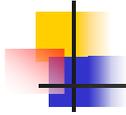
Quota share



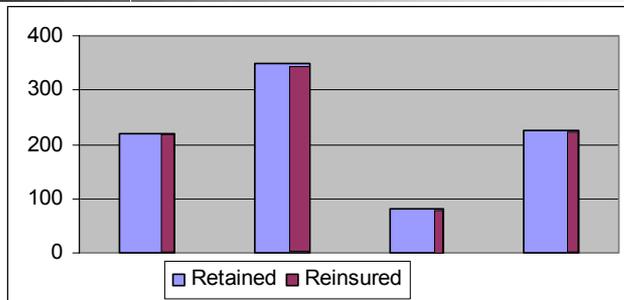
Quota share (20 %)



The reinsurer assumes a fixed percentage of (each and every) claim thereby sharing losses, or profits equally with the cedent.



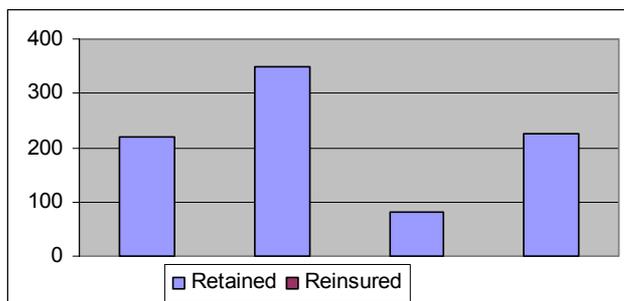
Quota share (20 %)

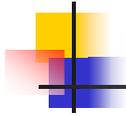


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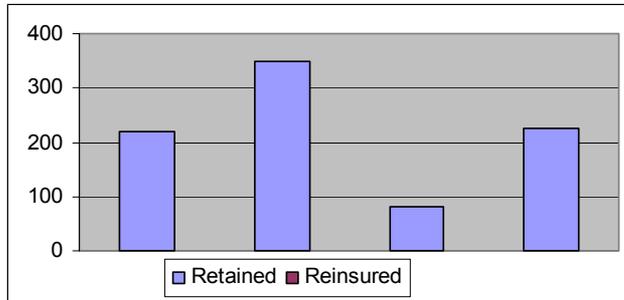
Excess of loss reinsurance





Excess of loss reinsurance

XL with priority = 100

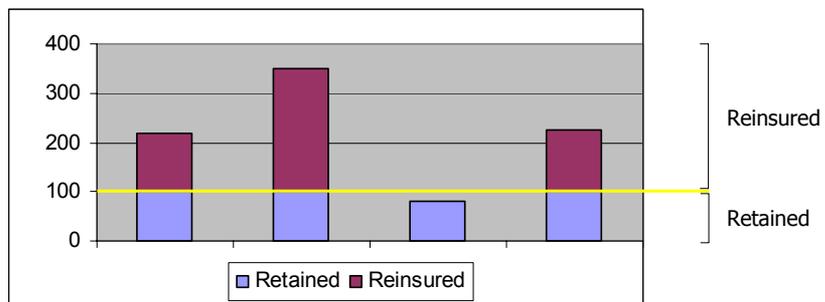


For each loss the reinsurer assumes the amount exceeding the agreed priority.

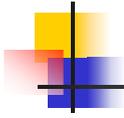


Excess of loss reinsurance

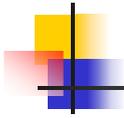
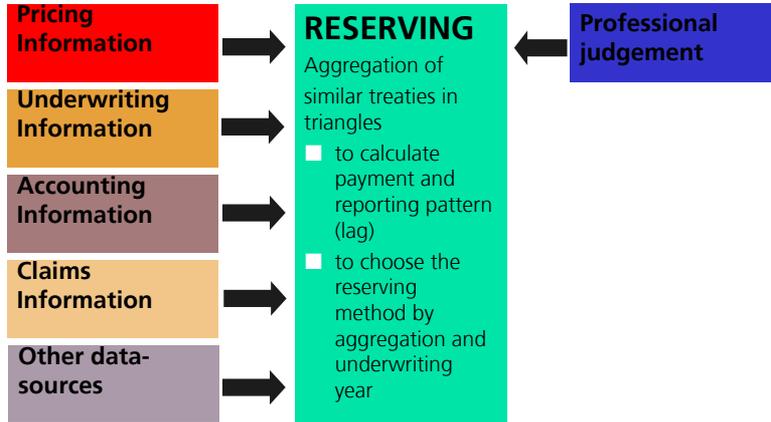
XL with priority = 100



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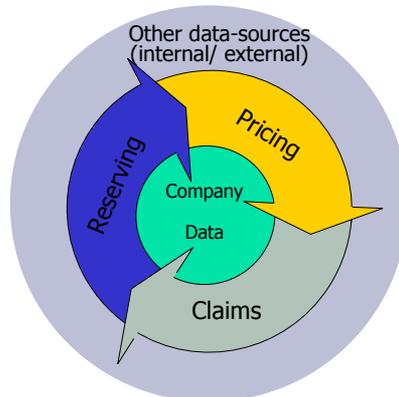


Reserving is not an isolated exercise



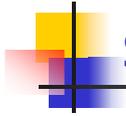
Reserving as a process

- Top-down and bottom up
- Feed-back to pricing and claims



- Feed-back to reserving and claims

- Analysis of trends
- Feed-back to reserving and pricing



Setting technical provisions

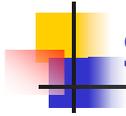
The estimation of loss reserves is an **inherently uncertain** process as it attempts to **reliably** give an insight into **future** claims emergence. This uncertainty can, but does not necessarily need to, be more pronounced in reinsurance than in primary insurance.

There is a **variety of quantitative techniques/ models** to estimate the ultimate outcome of losses. These techniques have to be supplemented by **professional** and **managerial judgment**.



Setting technical provisions

- Models and their application are **mechanical in nature**
- Results of the models **can be misleading** if not interpreted carefully
- Application of models is only **starting point for discussions** with other departments followed by professional and management judgement



Setting technical provisions

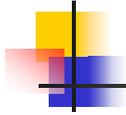
“It is misleading to assume that a formulaic solution to setting technical provisions can be arrived at. Instead, an approach involving best practice guidance and placing responsibility on decision-makers to explain and fully document their work (is) preferable.”

Statement of Groupe Consultatif to European Commission, March 2002



Challenges in setting R/I reserves

- Setting technical provisions in reinsurance is more complicated than in insurance
- Seven Reasons:
 - Longer report lags
 - Reserves typically develop
 - Patterns differ greatly by contract type and LOB
 - Scarcity of industry data/statistics
 - Selected information provided by cedent
 - Heterogeneity of data received
 - Magnified importance of adequate reserve setting



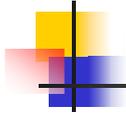
Longer reporting lags

- **Lag:** time expiring between loss occurrence and report to insurer or reinsurer
- Delay due to loss filtering through insurer's system and periodic notification interval to reinsurers
(e.g.: - motor accident with severe bodily injury on Sept 25 (3Q)
 - notified to insurer on Oct 2 (3Q)
 - subsequent inquiries over 3 months to evaluate severity
 - reported to reinsurer in January (1Q next year)
- Danger of undervaluation of serious claims at early stage



Reserves often develop

- Economic and social inflation drive loss costs up (esp. for XoL business)
- Inflation makes losses trigger layers where they did not before
- **BUT:** This can often be accounted for by actuarial methods



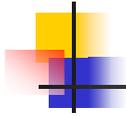
Patterns differ greatly by contract type

- Difference by
 - Type of contract (Prop, NP)
 - Reinsurance line / LOB
(Life/Non-Life; Cat, Credit, Liability, Aviation , ...)
 - Specific contract conditions
(Aggregates, limits, instatements, loss corridors, ...)
 - By cedant
(Coverage, terms, conditions of original policies; information is "second hand", filtered, reporting standards differ by cedent)
 - By intermediary
(intermediaries use different "formats" to disseminate information)



Scarcity of industry data/statistics

- Due to differences mentioned before, data is heterogeneous, often "apples and pears"
- Homogenous data hard to collect by account, and particular on an industry basis
- Examples/attempts: RAA statistics in USA; Tillinghast's Global Loss Distribution study for GTPL and ML in Europe



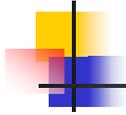
Selected cedent information

- **Cedants typically filter data**
(eg. Loss figures only on claims in excess of attachment point, data transmission errors from erroneous data extraction, accident year statistics have to be converted to underwriting year)
- **Any delivered data has an inherent time lag**
- **No/little data on individual claims, sometimes upon requests**
- **Sometimes disruptive data**
(eg. change in claims handling & reserving practice)
- **R/I requires clear description of data**



Heterogeneity of data

- **Each cedant pays differently**
(fast/slow, partial/complete)
- **Each cedant sets reserves differently**
(what's a small claim, bulk reserves, reserve to limits/worst case, expected salvage & subrogation, ...)
- **Coding/interpretation: What's a loss, what is loss adjustment expense, what is a case reserve?**
- **System changes over time**



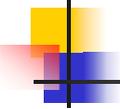
Adequate reserve setting

- Setting reserves is not a mechanic exercise, but a process of making informed decisions in light of the preceding 6 points
- Q/S driven by underlying rates and conditions (rate and terms changes)
- Allow for anticipated or observed trends and changes



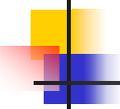
Why reinsurance reserves do not have to be “riskier”

- **Again:** reinsurance actuaries know of the seven challenges
 - they have known them for long
 - they know how to deal with it methodologically and via professional judgment
 - Historically, they usually developed the reserving methods which the primary companies picked up later



Why reinsurance reserves do not have to be “riskier”

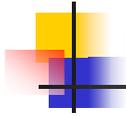
- Most important **advantage** of reinsurers
 - R/I have a much **broader overview**, usually globally
 - For example, they see not on ONE motor account in a country (like a primary insurer), but MANY accounts and practices
 - Because of this, they are **able to anticipate emerging trends** much earlier than primary insurers
 - This is also the reason why reinsurers usually perform an advisor and consulting task to insurers



Reserving requires 2 elements

- Premiums
reflect exposure and volume
- Losses
information on claims materializing
- **LOSS RATIO = LOSSES / PREMIUMS**
- Both are a function of losses* !!!
 Both need to be estimated !

* Premiums are often loss sensitive, eg. Reinstatements, sliding scales,



Premium elements

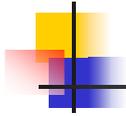
- **Premium elements are:**
 - Written Premium (WP)
 - Written Premium Accruals (WPA)
 - Earned Premium (EP)
 - Unearned Premium Reserves (UEPR)
 - Commission (are disregarded for simplicity)



Premium elements

- **Premium elements are:**
 - Written Premium (WP)
 - Written Premium Accruals (WPA)
 - **Earned Premium (EP)**
 - Unearned Premium Reserves (UEPR)
 - Commissions (are disregarded for simplicity)

Reserves must be set in respect to exposed risks, ie. the earned portion



Written premium accrual

Written Premium Accrual =

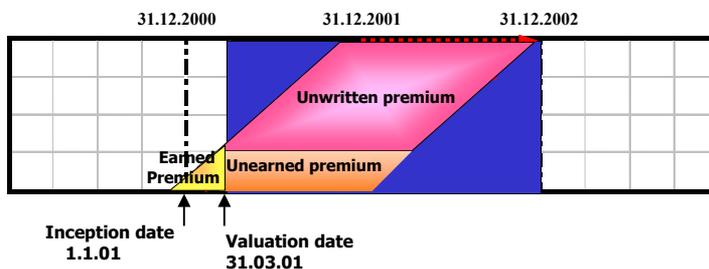
Written Premium

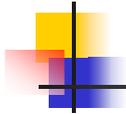
- Received Premium



Premiums : An Example

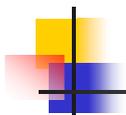
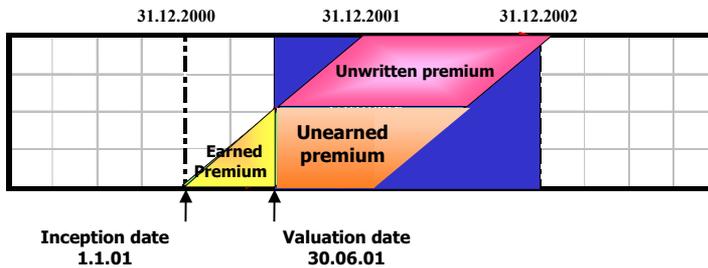
12 Months treaty, 12 Month underlying Policy,
Risk Attaching Base
Valuation Date : 31.03.01





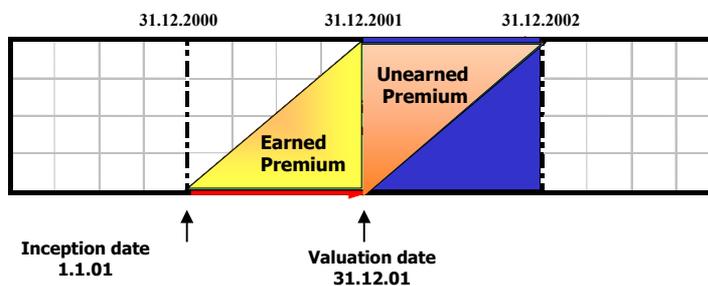
One quarter later ...

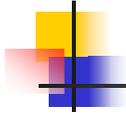
12 Months treaty, 12 Month underlying Policy,
Risk Attaching Base
Valuation date : 30.06.01



At the end of the year

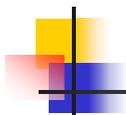
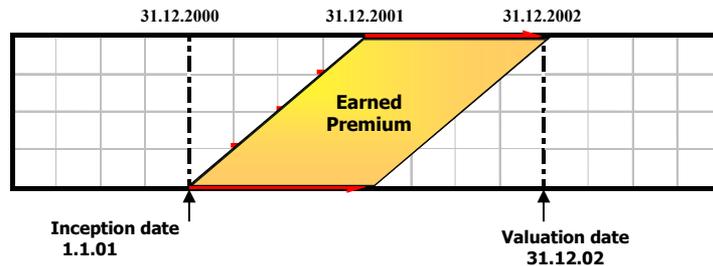
12 Months treaty, 12 Month underlying Policy,
Risk Attaching Base
Valuation date : 31.12.01





Two years after writing the policy

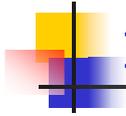
12 Months treaty, 12 Month underlying Policy,
Risk Attaching Base
24 months after the inception



Loss elements

■ **Loss side :**

- Paid losses
- Reported case reserves
- Additional case reserves (ACRs)
- Incurred but not reported losses (IBNR)
- Ultimate Losses, or Ultimate Loss Ratio
- Combined Ratio (ie. including commissions)



IBNR - Reserves

- IBNR is composed of two elements:
 - "IBNYR": Incurred Claims but not **yet** recorded
 - "IBNER": Incurred but not enough reported (i.e. the difference between the unpaid amounts recorded by the claim file, ie. case reserve, and the estimated total loss liability as of a particular valuation date).



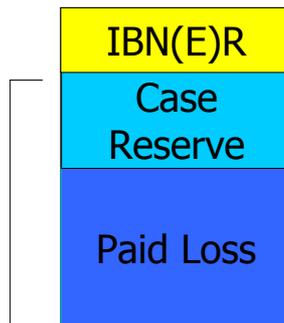
IBNR - Reserves

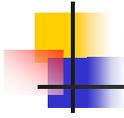
Estimated Ultimate Loss =

Unreported Loss

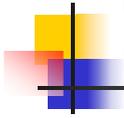
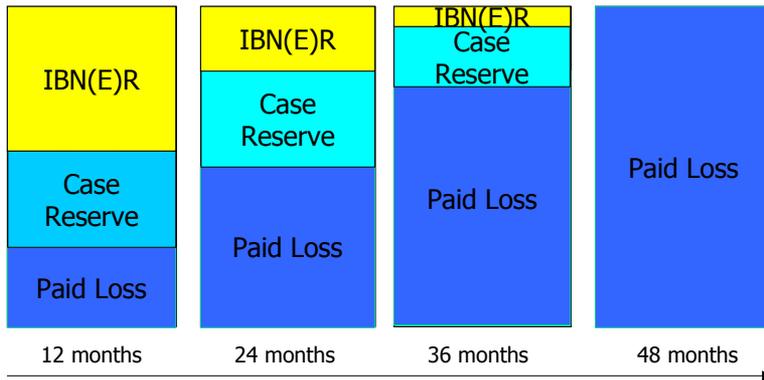
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Reported Loss

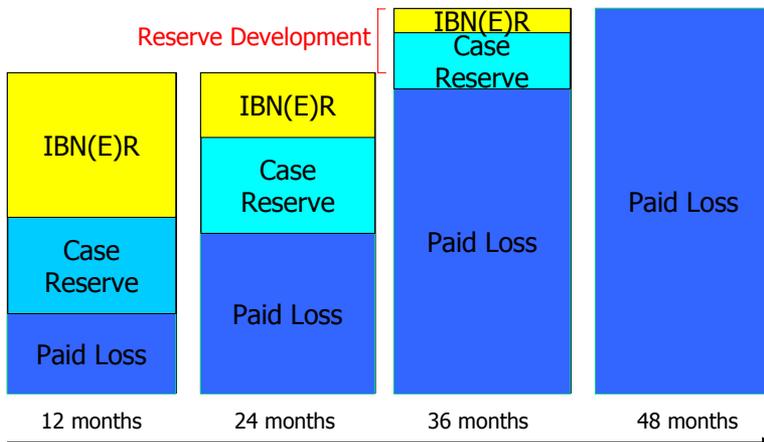


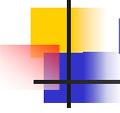


Estimating expected ultimate losses



Revising estimated ultimate losses upwards over time





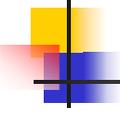
How to find out: the reserve process

- Regular **reserve analyses**
- General approaches:
 - Bottom up: evaluating & reserving each transaction
 - Top down: traditional actuarial triangle approach
- Both methodologies ideally reconcile, otherwise in-depth analysis
- **External** independent checks done by auditors or regulators per year end



Slicing and dicing the portfolio

- Analysis by reasonable partition of portfolio into homogeneous segments
 - eg partition by
 - type and line of business ("LOB")
 - region
 - currency
 - client
 - profit center, etc.



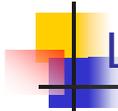
Traditional reserving methods

- Common reserving methods:
 - (Pricing) Loss Ratio
 - Chain Ladder (Paid & Incurred)
 - Bornhuetter-Ferguson (Paid & Incurred)
- Frequently used alternatives/extensionations
 - Cape Cod Method
 - Berquist Sherman Method
 - Benktander Method
 - Thomas Mack Model
 - Reserving by scenarios (Non-Traditional)



Lag factors are used to project EstUltL

- The reinsurer depends on the ceding company to regularly (annually, quarterly) release premium and loss information affecting the reinsurer.
- The time between the release of this information from the ceding company to the reinsurer is called **time Lag**, the %-increase the **lag factor** and the aggregation **Loss Development Factors (LDF)**



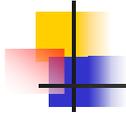
Loss Development Factors/ Lag Factors

- There are 2 types of loss development factors/Lags:
 - **Paid Loss LDF/Lag :**
Developed from (underwriting year) paid loss triangles
 - **Incurred LDF/Lag :**
Developed from (underwriting year) incurred triangles
- In order to develop these triangles contracts have to be grouped into homogeneous partitions
- Incurred and Paid loss triangles are developed by partition and by underwriting year.



Expected Loss Ratio Method

- Generates an Expected Ultimate loss based on Pricing Expectation
 - $\text{Ultimate Loss} = \text{Ultimate Premium} * \text{ELR}$
 - $\text{Unreported Loss (IBNR)} = \text{Ultimate Loss} - \text{Reported Losses}$
- Assumes that Ultimate losses and Reported Losses are totally uncorrelated
- Is assumed to be valid for "green" years for which loss experience as of the valuation is not yet deemed credible.



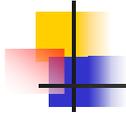
Loss Development Method

- The loss development method totally ignores pricing information and evaluates the contract ultimate loss based entirely on the loss experience of the contract and expected further loss development.
- Ultimate Loss =
Reported Loss * Loss Development Factor
- Can be calculated on Paid or on Incurred basis



Bornhuetter Fergusson Method

- This method weights **actual** loss experience as of the valuation date with pricing **expectations**
- The weight is given by the lag :
 - 100% lag = we believe 100% what is booked, no more development,
 - 0% lag = we believe 100% what the U/W indicated or what was priced
- Calculated IBNR are totally uncorrelated with the loss experience of the contract



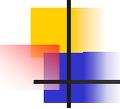
How to estimate IBNR

Unreported Loss ($IBNR_t$) =

- 1. Expected Ultimate Loss – Reported Losses t
--> **Expected Loss Ratio Method**
- 2. Reported Loss t * Loss Development Factor (t,inf)
– Reported Loss t
--> **Loss Development Method
(Chain Ladder Method)**
- 3. Expected Ultimate Loss * (% not yet reported t)
--> **Bornhuetter Ferguson Method**

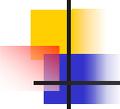


U.Y.	1	2	3	4	5	6	7	8	9	10
1992	7'155	7'382	7'383	7'428	7'952	8'018	8'035	8'143	8'097	8'117
1993	3'486	3'917	3'948	4'341	4'202	4'185	4'337	4'493	4'548	
1994	13'805	13'765	14'073	15'572	15'533	15'851	15'787	15'786		
1995	33'152	34'431	33'656	33'566	33'497	33'301	33'329			
1996	5'627	5'852	5'470	5'542	5'355	5'445				
1997	11'689	12'146	11'930	11'206	10'926					
1998	3'443	3'916	3'263	3'176						
1999	5'509	5'662	5'398							
2000	7'666	6'734								
2001	9'673									
Lags	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	
1992	1.032	1.000	1.006	1.071	1.008	1.002	1.013	0.994	1.002	
1993	1.124	1.008	1.100	0.968	0.996	1.036	1.036	1.012		
1994	0.997	1.022	1.106	0.997	1.020	0.996	1.000			
1995	1.039	0.978	0.997	0.998	0.994	1.001				
1996	1.040	0.935	1.013	0.966	1.017					
1997	1.039	0.982	0.939	0.975						
1998	1.137	0.833	0.973							
1999	1.028	0.953								
2000	0.878									
Averages:	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	tail
All Simple	1.035	0.964	1.019	0.996	1.007	1.009	1.016	1.003	1.002	1.000
All weighted	1.025	0.978	1.014	0.998	1.004	1.002	1.009	1.001	1.002	1.000
3yr Simple	1.015	0.923	0.975	0.980	1.011	1.011	1.016	1.003	1.002	1.000
3yr weighted	0.982	0.948	0.964	0.989	1.004	1.002	1.009	1.001	1.002	1.000
All x Hi/Lo	1.043	0.976	1.018	0.985	1.007	1.002	1.013	1.003	1.002	1.000
Avg of Avg	1.020	0.958	0.998	0.989	1.007	1.005	1.013	1.002	1.002	1.000
Selected:	1.020	1.000	1.000	1.000	1.004	1.002	1.009	1.001	1.002	1.000
Cumulative	1.039	1.019	1.019	1.019	1.019	1.015	1.013	1.003	1.002	1.000



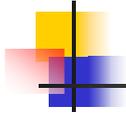
Synopsis: Estimated Ultimate Loss

- Loss estimate for the entire life of the treaty, ie. the amount expected spent by the time the contract is “dead”
- Based on :
 - Underwriting/Pricing information (Expected Loss)
 - Loss experience as of the valuation period (Paid loss, Case reserve,...)
 - Development information for partition (lag factor)
 - Ultimate Premium (ie. including reinstatements, APs, ...)
- $\text{Ultimate Loss Ratio} = \text{Ultimate Losses} / \text{Ultimate premiums}$
- Usually, for each method done on a paid and incurred basis



Summary

- Setting technical provisions is a blended process of
 - understanding the data
 - applying and comprehending the mechanics of each method
 - carefully interpreting the results
 - balance/validate results with insight from claims, u/w, accounting and management
 - making a professional judgment as to the adequate technical provision



Summary

- Setting reserves in reinsurance poses the challenge to appropriately and reliably estimate future claims in emergence in an environment with scarce and/or late data
- It is more of a challenge in reinsurance than in primary insurance, but reinsurers
 - have developed methods to deal with it
 - can compare/anticipate trends much better than insurers due to their much broader overview
- There is no general recipe to setting technical provisions
- There is no universally applicable method or tool, and there should not be one as it can not replace professionalism