

---

# Introduction to Experience Rating

John W. Buchanan  
CARE Seminar – INTMD1  
June 6, 2011

**PLATINUM**  
UNDERWRITERS REINSURANCE, INC.

## Antitrust Notice

---

- The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.
- Under no circumstances shall CAS seminars be used as a means for competing companies or firms to reach any understanding – expressed or implied – that restricts competition or in any way impairs the ability of members to exercise independent business judgment regarding matters affecting competition.
- It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.

## Acknowledgement

**Thanks to Dave Clark and Tice Walker for their prior presentations that help form this presentation.**

3

## Agenda

- **Basic Experience Rating Methodology**
  - Basic steps and information needed
  - Own company information vs. defaults
  - Diagnostics – Emergence testing
- **Case Study – Experience Portion**
  - Some preliminaries
  - Some calculations
  - Pulling it all together
- **Advantages / Disadvantages**
- **Questions?**

4

## Basic Steps in Experience Rating

1. Assemble Data
2. Adjust Subject Premium to Future Level
3. Trend and Layer Losses
4. Apply Loss Development
5. Check Results and Assumptions for Reasonableness

5

## Step 1. Assemble Data

**First Rule: Apples-to-Apples collection of historical subject premium and loss data**

$$\text{Experience Rate} = \frac{\text{Trended Ultimate Layer Losses}}{\text{Trended OnLevel Subject Premium}}$$

6

## Step 1. Assemble Data

---

### Second Rule: Get all the detail on historical losses

- Include all historical losses that would trend into the layer (*rule of thumb: get all losses > half of your attachment point*)
- Split out ALAE for each loss
- Include historical policy limits (*and SIR if applicable*)
- Confirm that losses are assembled by reinsurance treaty terms
  - for example, by occurrence, not by claimant if event based cover
- Compare to prior submission to identify any significant changes and emergence

7

## Step 2. Adjust Subject Premium to Future Level

---

- Goal is to adjust historical premium to a level “as if” it has been written during the future period
- The split between “rate” and “price” is not always obvious (e.g., where are LCMs or package factors included?): get a full description from the ceding company
- Obtain rate change rollups including all debits/credits, off-balance factors, etc. for both renewal and new business
- A more rigorous submission may include “extending exposures” to derive projected, current and historical exposure levels
- Include information from audits to verify and validate submission information

8

## **Step 2. Adjust Subject Premium to Future Level**

- Filed [manual] rate changes
- “Price-level” changes
  - Schedule-Rating, debits/credits, company tiers, etc.
  - Also include “soft” changes such as terms & conditions, changes in underwriting standards, etc.
  - Aggregated roll-ups
- Exposure Trend
  - (for inflation-sensitive exposure bases)

9

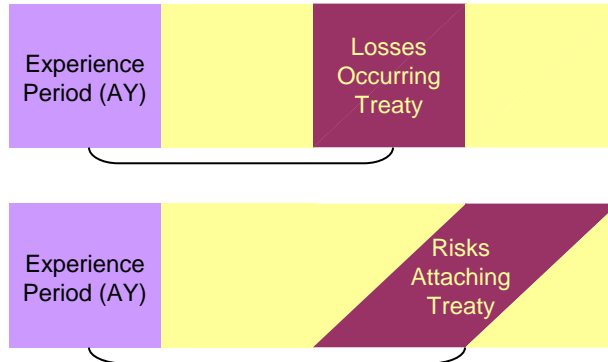
## **Step 3: Trend and Layer Losses**

- Purpose is to bring the historical value up to the average level in the future period
- Typically we apply trend and then cap the trended loss at the historical policy limit
- Hidden assumption: All losses trend at the same percent (trend does not vary by size of loss)
- Trends selected based on company indicated severity and frequency trends where credible and industry defaults

10

### Step 3: Trend and Layer Losses

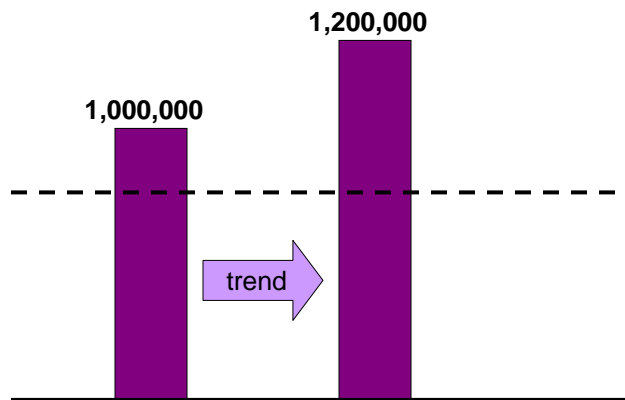
#### Depends on Treaty Basis



11

### Step 3: Trend and Layer Losses

#### Leveraged Effect




12

### Step 3: Trend and Layer Losses

#### Impact on Excess Layer

Layer:	500,000	excess of	500,000
	<u>Untrended</u>	<u>Trended</u>	<u>Trend %</u>
Total # of Claims	100	100	
Pareto B	125,000	135,000	
Pareto Q	1.55	1.55	
Overall Severity	227,273	245,455	8.0%
Layer Counts	8.3	9.1	9.9%
Layer Severity	313,899	315,687	0.6%
Layer Loss Cost	2,590,513	2,864,008	10.6%



All numbers are for illustration only, and not for use in pricing.

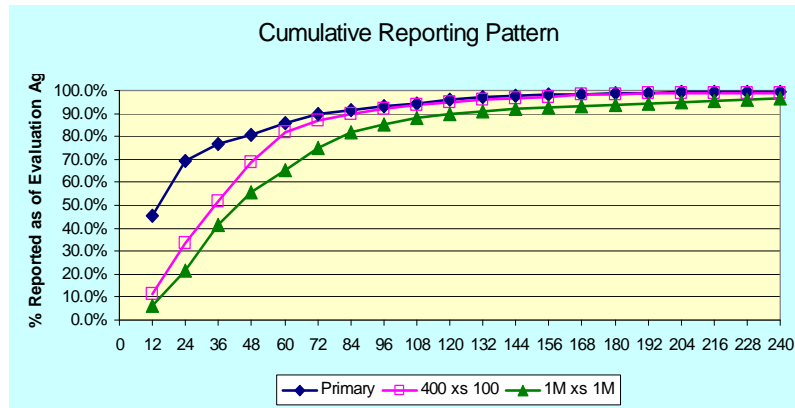
13

### Step 4: Develop Losses to Ultimate

- Factors depend on Layer of Reinsurance being priced
  - We apply LDFs to trended layer losses so that all years are on the same basis.
- Development is an aggregate loss concept
  - Includes new claims (“true IBNR”), development on known claims, reopening of closed claims, etc
- LDFs selected based on company indicated where credible and industry defaults

14

## Step 4: Develop Losses to Ultimate



All numbers are for illustration only, and not for use in pricing.

15

## Step 4: Develop Losses to Ultimate

Problem:

- Most recent periods are very green and may have zero losses reported to date. Should they be included? Alternatively, if there are losses, then they are hit with huge LDF.
- Possible Solutions: B-F or “Cape Cod” Methods

16



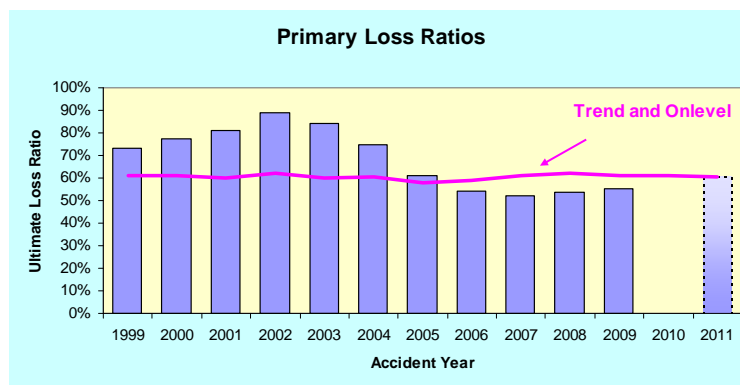
## Step 5. Check Results for Reasonableness

- Graphical Display of Loss Ratios or Burns
- Comparisons
  - Emergence testing - Prior years' Experience Rating – micro and macro across accounts
  - Exposure Rating

17

## Step 5. Check Results for Reasonableness

### Individual Company Indications



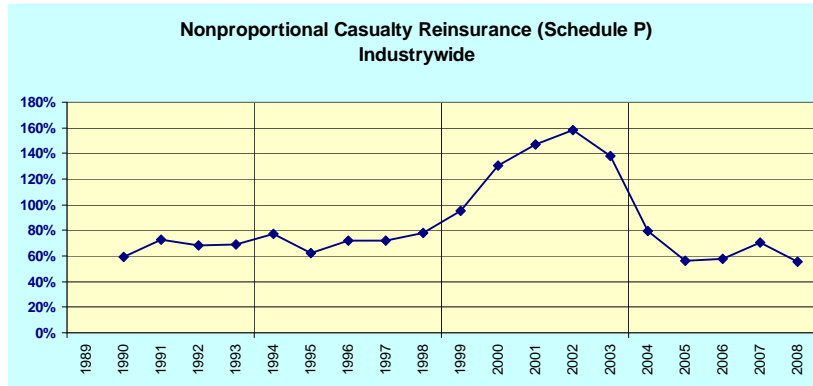
**Goal after all trending, developing and on-leveling is to produce relatively flat loss or burn ratios across the years**

All numbers are for illustration only, and not for use in pricing.

18

## Step 5. Check Results for Reasonableness

### Compare to Industry Indications



Prior to trending, developing and on-leveling

All numbers are for illustration only, and not for use in pricing.

19

## Step 5. Check Results for Reasonableness

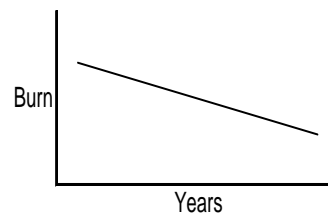
### Experience Rating Pressure Indicators: Inspect Burn ratios by Year



Upward slope pressure indicators:

- Not enough trend
- Too much LDF
- Too much later year rate change
- Too much earlier year rate change

...



Downward slope pressure indicators:

- Too much trend
- Not enough LDF
- Not enough later year rate change
- Not enough earlier year rate change

...

20

## Step 5. Check Results for Reasonableness

### Simple Emergence test of actual versus expected\*:

Actual versus Expected Analysis							
Accident Year	Evaluated 12/31/2009	LDF	Evaluated 12/31/2010	LDF	Expected Link Ratio	Expected Dvlpmnt	Actual Dvlpmnt
2001	571,093	1.103	599,683	1.077	1.024	13,787	28,590
2002	492,265	1.141	559,165	1.103	1.034	16,959	66,900
2003	319,707	1.195	219,653	1.141	1.047	15,131	-100,054
2004	1,762,534	1.277	1,831,330	1.195	1.069	120,944	68,796
2005	250,563	1.407	285,397	1.277	1.102	25,508	34,834
2006	577,569	1.633	969,391	1.407	1.161	92,772	391,822
2007	362,216	2.087	854,699	1.633	1.278	100,702	492,483
2008	333,336	3.376	712,321	2.087	1.618	205,879	378,985
2009	110,169	14.169	408,968	3.376	4.197	352,220	298,799
<b>Total</b>	<b>4,779,452</b>		<b>6,440,607</b>			<b>943,902</b>	<b>1,661,155</b>

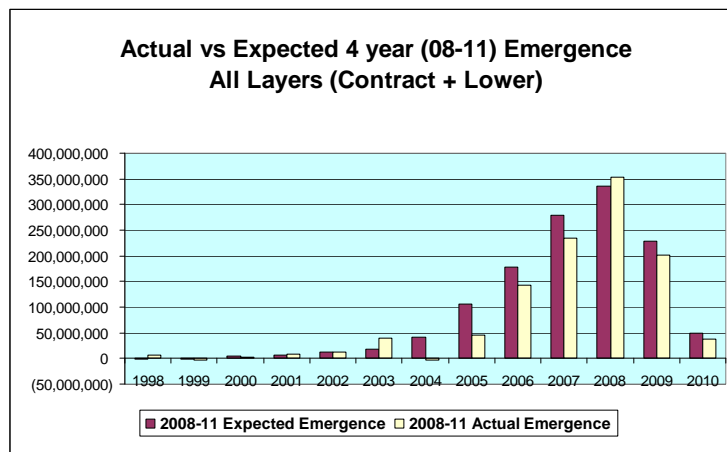
\* Expected values can get quite complicated, incorporating BF or Cape Cod values, in addition to possibly credibility weighing in last year's Exposure selections

All numbers are for illustration only, and not for use in pricing.

21

## Step 5. Check Results for Reasonableness

### Compare to Roll-up of "Industry" Emergence



All numbers are for illustration only, and not for use in pricing.

22

## Case Study

---

23

## Case Study: Preliminaries

---

- Terms of Subject Business
  - \$100k xs \$100k
  - Losses Occurring basis
  - LAE is pro-rata
  - Estimated Subject EP = \$40M
- Information provided
  - Historical Premium, adjusted to prospective earned rate level
  - Premises Liability only, Table 1
  - List of individual claims, Loss greater than \$50k, plus ALAE, each at successive annual evaluations

24

### Steps 1/2: Assembling the Data – Historical Experience

Treaty Year	Adjusted Subject Earned Premium	Subject Reported L&ALAE	Subject Reported Counts
2001	26,471,130	0	0
2002	25,839,654	121,638	1
2003	23,751,778	962,293	7
2004	24,116,512	548,373	3
2005	27,085,710	101,634	1
2006	26,124,453	433,472	1
2007	32,301,844	383,064	3
2008	37,808,219	295,429	4
2009	41,489,120	0	0
2010	40,992,570	103,942	1
Total	305,980,990	2,949,845	21
Prospective 2011	40,000,000		

Subject premium already on-levleed  
 Note: Fictitious data – for illustration only

25

### Step 3: Trended Loss Summary

Treaty Year	Adjusted Subject Earned Premium	Subject Reported L&ALAE	Subject Reported Counts	Severity Trend	Frequency Trend	Adjusted Subject Reported L&ALAE	Adjusted Subject Reported Counts
2001	26,471,130	0	0	1.657	1.000	51,032	1
2002	25,839,654	121,638	1	1.573	1.000	125,048	1
2003	23,751,778	962,293	7	1.484	1.000	1,137,320	7
2004	24,116,512	548,373	3	1.415	1.000	745,593	4
2005	27,085,710	101,634	1	1.335	1.000	101,865	2
2006	26,124,453	433,472	1	1.268	1.000	433,472	1
2007	32,301,844	383,064	3	1.211	1.000	383,064	3
2008	37,808,219	295,429	4	1.154	1.000	372,765	5
2009	41,489,120	0	0	1.100	1.000	157,264	1
2010	40,992,570	103,942	1	1.049	1.000	104,136	1
Total	305,980,990	2,949,845	21			3,611,558	26

Note: Fictitious data – for illustration only

26

### Step 3: Trended, Layered, and Limited Loss Details

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Acc Year	Rpt Loss	Rpt ALAE	Policy Limit	Layered Loss	Pro-rata ALAE	Layered Loss & ALAE	Severity Trend	Trended Loss	Policy Limited Trended Loss	Trended ALAE	Policy Limited Trended Layered Loss	Trended Pro-rata ALAE	Policy Limited Trended Layered Loss & ALAE
2008	500,000	47,756	500,000	100,000	9,551	109,551	1.154	577,160	500,000	55,125	100,000	11,025	111,025
2008	227,607	2,446	500,000	100,000	1,075	101,075	1.154	262,731	262,731	2,823	100,000	1,075	101,075
2008	60,000	94	500,000	0	0	0	1.154	69,259	69,259	108	0	0	0
2008	59,197	107,537	100,000	0	0	0	1.154	68,332	68,332	124,132	0	0	0
2008	150,000	13,892	1,000,000	50,000	4,631	54,631	1.154	173,148	173,148	16,036	73,148	6,774	79,923
2008	55,000	63,829	1,000,000	0	0	0	1.154	63,488	63,488	73,680	0	0	0
2008	100,000	76,836	1,000,000	0	0	0	1.154	115,432	115,432	88,694	15,432	11,857	27,289
2008	<b>125,000</b>	<b>25,862</b>	200,000	<b>25,000</b>	<b>5,172</b>	<b>30,172</b>	1.154	<b>144,290</b>	<b>144,290</b>	<b>29,853</b>	<b>44,290</b>	<b>9,163</b>	<b>53,453</b>
	<b>1,276,803</b>	<b>338,252</b>		<b>275,000</b>	<b>20,429</b>	<b>295,429</b>		<b>1,473,840</b>	<b>1,396,680</b>	<b>390,451</b>	<b>332,870</b>	<b>39,895</b>	<b>372,765</b>
2009	100,000	1,466,356	1,000,000	0	0	0	1.100	110,040	110,040	1,613,580	10,040	147,224	157,264
2009	<b>100,000</b>	<b>64,636</b>	100,000	<b>0</b>	<b>0</b>	<b>0</b>	1.100	<b>110,040</b>	<b>100,000</b>	<b>71,125</b>	<b>0</b>	<b>0</b>	<b>0</b>
	<b>200,000</b>	<b>1,530,992</b>		<b>0</b>	<b>0</b>	<b>0</b>		<b>220,080</b>	<b>210,040</b>	<b>1,684,705</b>	<b>10,040</b>	<b>147,224</b>	<b>157,264</b>
2010	<b>1,000,000</b>	<b>39,423</b>	1,000,000	<b>100,000</b>	<b>3,942</b>	<b>103,942</b>	1.049	<b>1,049,000</b>	<b>1,000,000</b>	<b>41,355</b>	<b>100,000</b>	<b>4,136</b>	<b>104,136</b>
	<b>1,000,000</b>	<b>39,423</b>		<b>100,000</b>	<b>3,942</b>	<b>103,942</b>		<b>1,049,000</b>	<b>1,000,000</b>	<b>41,355</b>	<b>100,000</b>	<b>4,136</b>	<b>104,136</b>

(5) = Min [ Max [ (2) - Att , 0 ] , Lim ]  
 (6) = [ (5) / (2) ] \* (3)  
 (7) = (5) + (6)  
 (9) = (2) \* (8)  
 (10) = Min [ (4) , (9) ]  
 (11) = (3) \* (8)  
 (12) = Min [ Max [ (10) - Att , 0 ] , Lim ]  
 (13) = [ (12) / (10) ] \* (11)  
 (14) = (12) + (13)

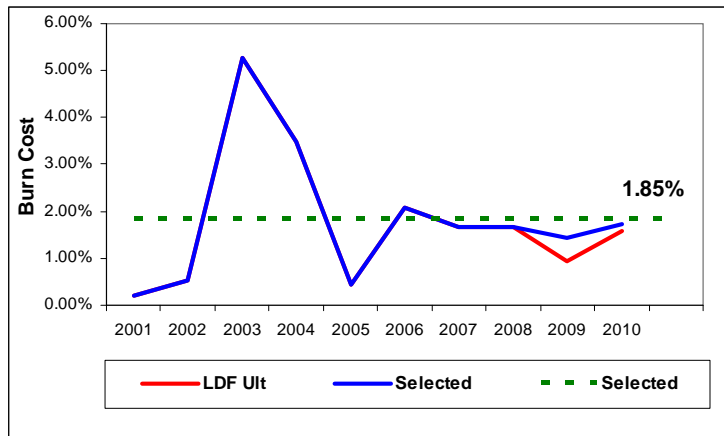
Note: Fictitious data – for illustration only

### Step 4: Develop Losses and Indicated Burns

Treaty Year	Adjusted Subject Earned Premium	Adjusted Subject Reported L&ALAE	Adjusted Subject Reported Counts	XS LDF	LDF Burn Cost	Cape Cod Burn Cost	Selected Burn Cost	Selected Ultimate Adjusted Subject L&ALAE
2001	26,471,130	51,032	1	1.070	0.21%	0.21%	0.21%	54,605
2002	25,839,654	125,048	1	1.082	0.52%	0.51%	0.52%	135,302
2003	23,751,778	1,137,320	7	1.101	5.27%	4.96%	5.27%	1,252,189
2004	24,116,512	745,593	4	1.129	3.49%	3.35%	3.49%	841,775
2005	27,085,710	101,865	2	1.174	0.44%	0.66%	0.44%	119,589
2006	26,124,453	433,472	1	1.249	2.07%	2.04%	2.07%	541,406
2007	32,301,844	383,064	3	1.396	1.66%	1.72%	1.66%	534,757
2008	37,808,219	372,765	5	1.704	1.68%	1.75%	1.68%	635,192
2009	41,489,120	157,264	1	2.506	0.95%	1.45%	1.45%	600,223
2010	40,992,570	104,136	1	6.192	1.57%	1.74%	1.74%	712,519
Total	305,980,990	3,611,558	26		1.68%	1.77%	1.77%	5,427,557
Prospective 2011	40,000,000						1.85%	741,067

Note: Fictitious data – for illustration only

## Step 5: Check Results for Reasonableness



29

## Experience Rating Recap

- Assemble data
- Estimate rating year on-level premium and losses using relevant parameter defaults/overrides for:
  - Rate changes
  - Trends (severity, frequency, exposure)
  - Loss Development (excess layers)
  - Line of business/hazard group indicators
- Adjust for historical changes in:
  - Exposures / business covered
    - Careful with “as-if” adjustments
  - Policy limits
- Check results including actual vs. expected emergence
  - Micro and macro

30

### **Advantages of Experience Method**

- Reflects client's actual layer experience
- Works best with high frequency layers
- Data may be adjusted to reflect current exposures
- Appropriate use of company indicated and industry defaults can help smooth random results
- Changes in experience results and emergence easier to explain to other parties such as underwriters, brokers, and ceding companies

31

### **Disadvantages of Experience Method**

- Requires lots of data
- Changes in limits (drift?) and exposures may reduce credibility of historical experience
- Projections can vary wildly due to small number of claims
- Free cover
- Possible over-reliance in soft market

32



### Specific Experience Method Challenges

- Deriving appropriate industry defaults
- Adjusting for changing mix of business
- Adjusting for changing policy limits
- Inclusion of excess policies
  - Supported excess vs unsupported excess
- Adjusting for risk vs. clash/event contracts
- Including potential for extra contractual obligations and excess of policy limit losses (ECO / XPL)

33

### Questions?

34

## Appendix

35

## Appendix (Steps 1/3: Data Assembly Complexity – SIR vs. Umbrella)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Treatment	SIR	Rpt Loss Net of SIR	Rpt ALAE	Policy Limit	Layered Loss	Pro-rata ALAE	Layered Loss & ALAE	Severity Trend	Trended Loss	Policy Limited Trended Loss	Trended ALAE	Policy Limited Trended Layered Loss	Trended Pro-rata ALAE	Policy Limited Trended Layered Loss & ALAE
XS	250,000	100,000	1,466,356	1,000,000	0	0	0	1.100	135,140	135,140	1,613,580	35,140	419,577	454,717
XS	50,000	100,000	64,636	100,000	0	0	0	1.100	115,060	100,000	71,125	0	0	0
		<b>200,000</b>	<b>1,530,992</b>		<b>0</b>	<b>0</b>	<b>0</b>		<b>250,201</b>	<b>235,140</b>	<b>1,684,705</b>	<b>35,140</b>	<b>419,577</b>	<b>454,717</b>
Erodes	250,000	100,000	1,466,356	1,000,000	100,000	418,959	518,959	1.100	385,140	385,140	1,613,580	100,000	418,959	518,959
Erodes	50,000	100,000	64,636	100,000	50,000	21,545	71,545	1.100	165,060	150,000	71,125	50,000	23,708	73,708
		<b>200,000</b>	<b>1,530,992</b>		<b>150,000</b>	<b>440,504</b>	<b>590,504</b>		<b>550,201</b>	<b>535,140</b>	<b>1,684,705</b>	<b>150,000</b>	<b>442,667</b>	<b>592,667</b>

**XS**

(6) = Min [ Max [ (3) - Att , 0 ] , Lim ]  
 (7) = [ (6) / (3) ] \* (4)  
 (8) = (6) + (7)  
 (10) = [ (2) + (3) ] \* (9) - (2)  
 (11) = Min [ (5) , (10) ]  
 (12) = (4) \* (9)  
 (13) = Min [ Max [ (11) - Att , 0 ] , Lim ]  
 (14) = [ (13) / (11) ] \* (12)  
 (15) = (13) + (14)

**Erodes**

(6) = Min [ Max [ (2) + (3) - Att , 0 ] , Lim ]  
 (7) = [ (6) / [(2) + (3)] ] \* (4)  
 (8) = (6) + (7)  
 (10) = [ (2) + (3) ] \* (9)  
 (11) = Min [ (2) + (9) , (10) ]  
 (12) = (4) \* (9)  
 (13) = Min [ Max [ (11) - Att , 0 ] , Lim ]  
 (14) = [ (13) / (11) ] \* (12)  
 (15) = (13) + (14)

Note: Fictitious data – for illustration only

36

### Appendix (Step 4: Develop Losses to Ultimate)

- LDF Method:

$$\text{Ultimate} = \text{Reported} \times \text{LDF}$$

- Bornhuetter-Ferguson (B-F) Method:

$$\text{Ultimate} = \text{Reported} + \text{Prem} \times \text{ELR} \times (1 - 1/\text{LDF})$$

- But what ELR do we use?

37

### Appendix (Step 4: Develop Losses to Ultimate)

- “Cape Cod” method is a special case of the B-F method.

- The ELR is selected to be equal to the final value of the all-year average loss ratio.

$$\text{ELR} = \frac{\sum \text{Ultimate Loss}}{\sum \text{Subject Premium}}$$

38

## Appendix (Step 4: Develop Losses to Ultimate)

“Cape Cod” ELR turns out to be calculated simply as follows:

$$\text{ELR} = \frac{\sum \text{Reported Loss}}{\sum \text{Premium/LDF}}$$

Where Premium/LDF is the “exposed premium” corresponding to the loss that we would expect to have been reported to date.

39

## Appendix (Step 4: Develop Losses to Ultimate)

Key Formulas in “Cape Cod” Method:

$$\text{Cumulative \% of Loss Reported} = 1 / \text{LDF}$$

$$\frac{\text{Reported Loss} \times \text{LDF}}{\text{Subject Premium}} = \frac{\text{Reported Loss}}{\text{Subject Premium} / \text{LDF}}$$

40