A Methodology for Avoiding the Pitfalls of Excess Loss Development

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IABA 2017 Meeting

July 29, 2017

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Agenda

- The Quandary
- A Typical Approach
- A Simple Example
- An Alternative Method
- Testing of the Approach – Results
- Real World – Results & Limitations
- Conclusions

The Quandary

The Quandary

Suppose development excess of $1 million is as follows:

300 - 312	312 - 324	324 - 336	336 - 348	348 - 360	360 - 372	To Ult
0.920	1.028	1.078	0.960	1.066	1.041	
1.012	1.032	0.811	1.023	0.989		
1.054	0.971	0.986	0.849			
0.986	1.010	1.033				
1.015	1.070					
1.044						

Also suppose RAA tail for Attachment 3 is 1.680

What tail would you pick?

A Typical Approach

Excess Loss Development

- Development triangles of claims history in excess of a fixed retention/deductible

- Tail
  - Industry excess LDFs (e.g., RAA)
  - Curve fit

Issues

- Significant volatility in the excess layer
- Varying retentions are not directly considered
- Leveraging impact of inflation is ignored
- Significant reliance placed on initial pricing loss ratios in an exposure-based method

A Simple Example

Loss Development – unlimited, no inflation

Unlimited amounts as of 12 months, AY 1:

Claim 1	100
Claim 2	375
Claim 3	250
Claim 4	500
Total as of 12 months	1,225

Assume claims develop to ultimate by age 36:

12:24 Unlimited Factor	3.60
24:36 Unlimited Factor	1.25

Loss Development – unlimited, with inflation

Assume 5% inflation:

Unlimited Development	12	24	36
Year One	1,225	4,410	5,513
Year Two (5 % Inflation)	1,286	4,631	5,788
Year Three (5 % Inflation)	1,351	4,862	6,078

Unlimited Age to Age Factors	12:24	24:36	12:Ult
Year One	3.60	1.25	4.50
Year Two (5 % Inflation)	3.60	1.25	4.50
Year Three (5 % Inflation)	3.60	1.25	4.50

Loss Development – excess of 350, with inflation

Assume 5% inflation and a fixed deductible of 350 per claim:

Excess of 350 Development	12	24	36
Year One	175	3,010	4,113
Year Two (5 % Inflation)	219	3,231	4,388
Year Three (5 % Inflation)	265	3,462	4,678

Excess Age to Age Factors	12:24	24:36	12:Ult
Year One	17.20	1.37	23.50
Year Two (5 % Inflation)	14.77	1.36	20.06
Year Three (5 % Inflation)	13.08	1.35	17.67

Loss Development – excess of 350, with inflation

Using excess LDFs to project ultimate values:

Excess of 350 Development	12	24	36	Projection
Year One	175	3,010	4,113	4,113
Year Two (5 % Inflation)	219	3,231		4,414
Year Three (5 % Inflation)	265			5,732

Excess Age to Age Factors	12:24	24:36	12:Ult
Year One	17.20	1.37	
Year Two (5 % Inflation)	14.77		
Year Three (5 % Inflation)			
Weighted Average	15.85	1.37	21.65

An Alternative Method

A fundamental relationship

$$CDF_{12}^{XS} = \frac{Ultimate^{XS}}{RptLoss_{12}^{XS}}$$

$$CDF_{12}^{XS} = \frac{ELF}{[RptLoss_{12}^{Unl} - RptLoss_{12}^{Lim}]}$$

$$CDF_{12}^{XS} = \frac{ELF}{[1/CDF_{12}^{Unl} - (1/CDF_{12}^{Lim})x(1-ELF)]}$$

Example Continued

Limited to 350 Development	12	24	36
Year One	1,050	1,400	1,400
Year Two (5 % Inflation)	1,068	1,400	
Year Three (5 % Inflation)	1,086		

Limited Age to Age Factors	12:24	24:36	12:Ult
Year One	1.33	1.00	
Year Two (5 % Inflation)	1.31		
Year Three (5 % Inflation)			
Weighted Average	1.32	1.00	1.32

	Unlimited	Limited	ELF
Year One	5,513	1,400	0.746
Year Two	5,788	1,400	0.758
Year Three	6,078	1,436	0.764

Example Continued – The result

	Excess CDF	Excess Ult	Actual	Error
Year One	1.00	4,113	4,113	0.00%
Year Two	1.36	4,388	4,388	0.00%
Year Three	17.54	4,642	4,678	-0.77%

	Projection with Excess Triangle	Actual	Error
Year One	4,113	4,113	0.00%
Year Two	4,414	4,388	0.58%
Year Three	5,732	4,678	22.53%

Testing of the Approach – Assumptions

Different scenarios – Base Case

- Pattern can be constant or varied
- Frequency trend can be increasing by 1%, decreasing by 1%, or non-existent
- Frequency can be constant or varied
- Inflation can be 0, 3%, or 10%
- Severity randomization can be based on the same variability for all years (the "1 Year" scenario) or different random seed for each of the 8 years (the "8 Year" scenario)
- Retention can be constant, move exactly with inflation, or increase by round number increments that mimic inflation
- Basic Retention is $400,000

Different scenarios – Other Assumptions

- 216 scenarios generated for base case
- Lognormal severity/ Poisson frequency is modeled
- Variability set such that simulated ELFs are close to industry ELFs
- All Year Weighted Average LDFs are selected
- RAA Tail is used to match retention
- Limited Tail is used with alternative method – based on RAA tail, NCCI tail, and ELF from simulated data
- Results are based on comparison of LDF methods only

Testing of the Approach – Results

Effects of Inflation / Retention

Inflation	Retention	Wtd Average Unlimited	Wtd Average Limited	Wtd Average Excess	Non Tail Wtd Avg Excess	Alternative Method Excess
0.00%	Constant	2.05%	1.68%	9.08%	0.45%	0.79%
0.00%	Exact	2.05%	1.68%	9.08%	0.45%	0.79%
0.00%	Rounded	2.05%	1.68%	9.08%	0.45%	0.79%
3.00%	Constant	*2.13%*	*2.69%*	*11.22%*	*2.42%*	*-0.22%*
3.00%	Exact	2.13%	1.93%	10.61%	0.19%	0.51%
3.00%	Rounded	2.13%	1.80%	10.54%	0.18%	1.12%
10.00%	Constant	*2.28%*	*5.15%*	*17.53%*	*8.23%*	*-2.26%*
10.00%	Exact	2.28%	2.47%	14.05%	-0.46%	-0.12%
10.00%	Rounded	2.28%	2.47%	14.07%	-0.71%	-0.48%

Effects of Pattern Variation & Severity Variation

	Wtd Average Unlimited	Wtd Average Limited	Wtd Average Excess	Non Tail Wtd Avg Excess	Alternative Method Excess
Constant	0.00%	0.66%	7.46%	-2.42%	-0.78%
Varied	4.31%	4.13%	15.93%	4.91%	0.98%

	Wtd Average Unlimited	Wtd Average Limited	Wtd Average Excess	Non Tail Wtd Avg Excess	Alternative Method Excess
1 year	2.20%	2.45%	14.41%	3.70%	0.16%
8 year	2.11%	2.34%	8.98%	-1.21%	0.04%

Other than the base case

Most noticeable effect was increasing the variability in the pattern

Inflation	Retention	Wtd Average Unlimited	Wtd Average Limited	Wtd Average Excess	Non Tail Wtd Avg Excess	Alternative Method Excess
0.00%	Constant	7.07%	4.55%	21.40%	9.41%	6.67%
0.00%	Exact	7.07%	4.55%	21.40%	9.41%	6.67%
0.00%	Rounded	7.07%	4.55%	21.40%	9.41%	6.67%
3.00%	Constant	*7.22%*	*5.44%*	*23.60%*	*11.39%*	*5.76%*
3.00%	Exact	7.22%	4.87%	23.32%	9.36%	6.43%
3.00%	Rounded	7.22%	4.79%	23.11%	9.23%	6.93%
10.00%	Constant	*7.50%*	*7.55%*	*29.51%*	*16.73%*	*3.81%*
10.00%	Exact	7.50%	5.52%	27.55%	9.08%	5.88%
10.00%	Rounded	7.50%	5.51%	27.74%	8.95%	5.62%
	All Varied Scenarios	7.26%	5.26%	24.34%	10.33%	6.05%
All Varied Scenarios Lower CV as above		4.31%	4.13%	15.93%	4.91%	0.98%

Other Observations

- Frequency has very little effect
- Other retentions show similar results (tested $250,000 and $500,000)
- Combining retentions implies similar results
- Cape Cod of results made bias greater

Real World – Results & Limitations

The Quandary – Revisited

- Suppose Limited to $1 million development looks as follows:

300 - 312	312 - 324	324 - 336	336 - 348	348 - 360	360 - 372	To Ult
1.000	1.000	1.002	1.002	1.001	1.000	
0.999	1.001	1.001	1.001	1.001		
1.004	1.001	1.002	1.003			
1.004	1.002	1.003				
1.002	1.003					
1.003						

- Unlimited looks as follows:

300 - 312	312 - 324	324 - 336	336 - 348	348 - 360	360 - 372	To Ult
0.998	1.001	1.005	1.000	1.003	1.001	
0.999	1.003	0.993	1.002	1.000		
1.005	1.000	1.002	0.999			
1.003	1.002	1.004				
1.002	1.005					
1.005						

The Quandary – Revisited

- If we pick a 1.00 tail on unlimited and limited and weighted average factors, we get a 96:Ult which is higher than NCCI
- We can compare method Ultimates as follows (RAA tail is 1.68):

Excess Factors with RAA Tail	Excess Factors with No Tail	Alternative Method
1,329,909	791,877	611,650
117.43%	29.47%	0.00%

The Quandary - Revisited

Suppose development excess of $1 million is as follows:

300 - 312	312 - 324	324 - 336	336 - 348	348 - 360	360 - 372	To Ult
0.920	1.028	1.078	0.960	1.066	1.041	
1.012	1.032	0.811	1.023	0.989		
1.054	0.971	0.986	0.849			
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1.015	1.070					
1.044						

Also suppose RAA tail for Attachment 3 is 1.680

When Data is Sparse

- Certain assumptions must be made – such as selection of ELF and interpolating between patterns:

Deductible	Limited 12:Ult	Unlimited 12:Ult	ELF from Data	ROL per Million	Excess 12:Ult
100,000	2.299	3.274	0.450	0.600	6.799
200,000	2.423	3.274	*0.390*	0.400	7.267
350,000	2.532	3.274	*0.330*	0.154	8.093
1,000,000	2.758	3.274	0.230		8.753

- The Rate on Line bounds on the ELF and reasonability of resultant pattern make selection of ELF narrow.

Conclusions

Conclusions

- Both using excess factors and using alternative methods require assumptions
- For excess factors:
  - Must assume tail by curve fit or industry
  - Must assume distortions of inflation are immaterial
- Alternative method
  - Must assume an unlimited or limited tail
  - May have to assume ELFs in between retention or industry ELFs
- With the data we have seen, the alternative method assumptions are easier to make and provide more stable & reasonable answers

Thank you!