Casualty Loss Reserve Seminar

Are you properly calculating your ceded reinsurance loss reserves?

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September 15, 2009

Deloitte.

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Agenda

Common Actuarial Methods

Approaches for Estimating Ceded Reserves

Reinsurance Contract Types

Other Issues

Common Actuarial Methods

Common actuarial methods

- Loss Development Method
- Expected Loss Method
  - Increased Limits / Excess Loss Factors
- Bornhuetter-Ferguson Method
- Frequency/Severity
  - Stochastic

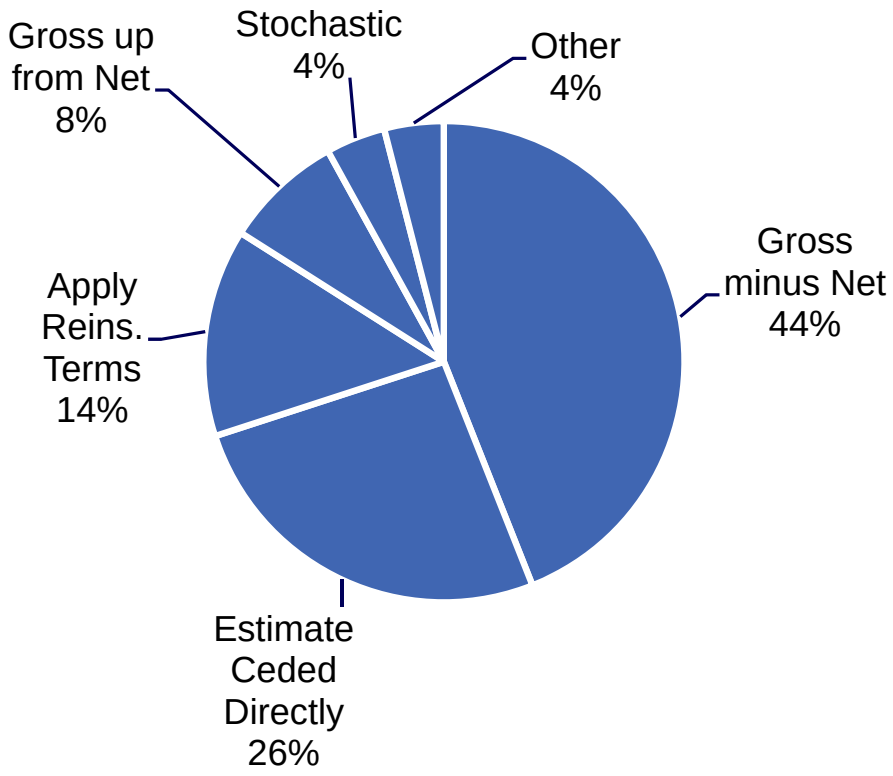
Approaches for Estimating Ceded Reserves

Approaches for estimating ceded reserves

- Gross estimate minus net estimate
- Ceded estimated using methodologies
- Ceded estimated by applying reinsurance to gross
- Gross up from net estimate
- Stochastic modeling

Results of Informal Survey

Percentage of Respondents



Survey Details

We conducted an informal survey of actuaries at Towers Perrin and Deloitte Consulting covering 35 respondents regarding the approaches they have used.

Approaches vary because:

- Reinsurance structure being reviewed
- Data availability and limitations
- Personal preference

Approaches for estimating ceded reserves

- Gross estimate minus net estimate
  - Using various reserving methodologies, estimate gross liabilities separately from net liabilities
  - Subtract the net estimate from the gross estimate
  - Assumptions
    - Gross and net loss development patterns
    - Gross and net initial expected loss estimates
  - Data needed
    - Gross and net loss triangles

Approaches for estimating ceded reserves

- Gross estimate minus net estimate (cont.)
  - Pros
    - Typically more credible data is available for gross and net analyses
    - Gross and net reserves are displayed on Statement of Actuarial Opinion
  - Cons
    - Different development patterns and initial expected loss ratios need to be used
    - If little or no ceded activity has taken place, then gross and net LDFs and IELRs may be similar
    - Reasonability testing may take quite some time
    - Varying reinsurance limits and retentions complicate the net analysis

Approaches for estimating ceded reserves

- Calculate ceded estimate directly
  - Using various reserving methodologies, estimate ceded liabilities
  - May include using gross losses as a basis for expected ceded losses
  - Assumptions
    - Appropriate loss development patterns (limit and retention)
    - Initial expected ceded loss estimates
  - Data needed
    - Ceded loss triangles

Approaches for estimating ceded reserves

- Calculate ceded estimate directly (cont.)
  - Pros
    - Relies on actual ceded history
  - Cons
    - If ceded history is sparse, development patterns and initial expected loss ratios may be difficult to determine
    - Varying reinsurance limits and retentions complicate the ceded analysis

Approaches for estimating ceded reserves

- Apply reinsurance program to gross losses
  - Using various reserving methodologies, estimate gross ultimate losses
  - Apply reinsurance program to the gross ultimate losses by year
  - Assumptions
    - Gross LDFs
    - Initial expected loss estimates
  - Data needed
    - Gross loss triangles and/or individual loss history
    - Details of reinsurance program

Approaches for estimating ceded reserves

- Apply reinsurance program to gross losses (cont.)
  - Pros
    - Typically gross loss history is more credible than ceded
    - Beneficial for common reinsurance treaty features
  - Cons
    - May be difficult to apply per occurrence/per risk reinsurance to gross data

Approaches for estimating ceded reserves

- Gross up from net
  - Using various reserving methodologies, estimate net ultimate losses
  - Estimate ceded losses directly from ceded data (similar to other method)
  - Assumptions
    - Net LDFs
    - Initial expected net loss estimates
  - Data needed
    - Net loss triangles and/or individual loss history
    - Details of reinsurance program

Approaches for estimating ceded reserves

- Gross up from net (cont.)
  - Pros
    - Typically net loss history is more credible than ceded
    - More conservative than subtracting ceded from gross
  - Cons
    - Determining ceded amounts may be difficult due to credibility issues

Approaches for estimating ceded reserves

- Simulation
  - Using stochastic modeling to determine the impact of ceded reinsurance on reserves
  - Individual/aggregate claims history used to estimate frequency and severity or aggregate distributions
  - Apply reinsurance contract terms to results of the model
- Assumptions
  - Loss distributions
  - Loss trend
  - Loss development
- Data
  - Individual/aggregate claims history

Approaches for estimating ceded reserves

- Simulation (cont.)
  - Pros
    - Beneficial trying to estimate the impact of unusual contract features (aggregate limits, caps & corridors, etc.)
    - Useful when retentions and limits change by year
    - Useful when reserve ranges are needed
  - Cons
    - Credible data may be hard to come by
    - Results are dependent upon fitting proper distributions

Reinsurance Contract Types

Excess of Loss (Per Risk /Per Occurrence)

- Straight forward
  - Estimate gross ultimate loss and net ultimate loss using different loss development factors, then subtract the net ultimate loss from the gross ultimate loss to estimate ceded ultimate loss
  - Estimate ceded losses directly reflecting the attachment points and limits for each year
  - In situations where ceded claim history is sparse or non-existent, methods such as simulation or expected loss may be more reasonable
- Contract contains deductibles, aggregate limits, etc.
  - Estimating ceded liabilities using simulation is preferred
    - Robust individual claim history is required
  - Otherwise, adjusting LDFs and expected losses to reflect contract provisions may be necessary

Excess of Loss Examples

Example 1: Assumptions

- Two companies purchase per occurrence coverage
  - $250,000 excess of $250,000
- Attritional losses = $1 million per year
- Large loss potential same for both companies
  - 50% chance of loss
  - $500,000
  - Reported at 36 months at full value
  - Paid at 84 months at full value
- “L Company” has a large loss every other year
- “LF Company” has never had a large loss
- Loss Development as shown in following tables

“L Company” - Gross Paid Triangle

Large loss gets paid at 84 months

	12	24	36	48	60	72	84
2003	290,000	400,000	625,000	800,000	909,091	975,610	1,500,000
2004	290,000	400,000	625,000	800,000	909,091	975,610	
2005	290,000	400,000	625,000	800,000	909,091		
2006	290,000	400,000	625,000	800,000			
2007	290,000	400,000	625,000				
2008	290,000	400,000					
2009	290,000						
	12-24	24-36	36-48	48-60	60-72	72-84	84-96
2003	1.379	1.563	1.280	1.136	1.073	1.538	
2004	1.379	1.563	1.280	1.136	1.073		
2005	1.379	1.563	1.280	1.136			
2006	1.379	1.563	1.280				
2007	1.379	1.563					
2008	1.379						
Incremental	1.379	1.563	1.280	1.136	1.073	1.281	1.000
Cumulative	4.310	3.125	2.000	1.563	1.375	1.281	1.000

“L Company” -Gross Reported Triangle

Large loss is reported at 36 months

	12	24	36	48	60	72	84
2003	500,000	666,667	1,409,091	1,452,381	1,500,000	1,500,000	1,500,000
2004	500,000	666,667	909,091	952,381	1,000,000	1,000,000	
2005	500,000	666,667	1,409,091	1,452,381	1,500,000		
2006	500,000	666,667	909,091	952,381			
2007	500,000	666,667	1,409,091				
2008	500,000	666,667					
2009	500,000						
	12-24	24-36	36-48	48-60	60-72	72-84	84-96
2003	1.333	2.114	1.031	1.033	1.000	1.000	
2004	1.333	1.364	1.048	1.050	1.000		
2005	1.333	2.114	1.031	1.033			
2006	1.333	1.364	1.048				
2007	1.333	2.114					
2008	1.333						
Incremental	1.333	1.739	1.040	1.041	1.000	1.000	1.000
Cumulative	2.512	1.884	1.083	1.041	1.000	1.000	1.000

“LF Company” - Gross Paid Triangle

No Large Losses

	12	24	36	48	60	72	84
2003	290,000	400,000	625,000	800,000	909,091	975,610	1,000,000
2004	290,000	400,000	625,000	800,000	909,091	975,610	
2005	290,000	400,000	625,000	800,000	909,091		
2006	290,000	400,000	625,000	800,000			
2007	290,000	400,000	625,000				
2008	290,000	400,000					
2009	290,000						
	12-24	24-36	36-48	48-60	60-72	72-84	84-96
2003	1.379	1.563	1.280	1.136	1.073	1.025	
2004	1.379	1.563	1.280	1.136	1.073		
2005	1.379	1.563	1.280	1.136			
2006	1.379	1.563	1.280				
2007	1.379	1.563					
2008	1.379						
Incremental	1.379	1.563	1.280	1.136	1.073	1.025	1.000
Cumulative	3.448	2.500	1.600	1.250	1.100	1.025	1.000

“LF Company” - Gross Reported Triangle

No Large Losses

	12	24	36	48	60	72	84
2003	500,000	666,667	909,091	952,381	1,000,000	1,000,000	1,000,000
2004	500,000	666,667	909,091	952,381	1,000,000	1,000,000	
2005	500,000	666,667	909,091	952,381	1,000,000		
2006	500,000	666,667	909,091	952,381			
2007	500,000	666,667	909,091				
2008	500,000	666,667					
2009	500,000						
	12-24	24-36	36-48	48-60	60-72	72-84	84-96
2003	1.333	1.364	1.048	1.050	1.000	1.000	
2004	1.333	1.364	1.048	1.050	1.000		
2005	1.333	1.364	1.048	1.050			
2006	1.333	1.364	1.048				
2007	1.333	1.364					
2008	1.333						
Incremental	1.333	1.364	1.048	1.050	1.000	1.000	1.000
Cumulative	2.000	1.500	1.100	1.050	1.000	1.000	1.000

“L Company” – LDF Method Results

Results with differing LDFs

Gross (Unlimited)

Year	Reported Losses	LDF	Ultimate Losses	Paid Losses	Total Reserves
2005	1,500	1.000	1,500	909	591
2006	952	1.041	992	800	192
2007	1,409	1.083	1,527	625	902
2008	667	1.884	1,256	400	856
2009	500	2.512	1,256	290	966
Total	**5,028**		**6,530**	**3,024**	**3,506**

Large Losses

Year	Incurred Amount	Reported Amount	Paid Amount
2005	500	500	0
2006	0	0	0
2007	500	500	0
2008	0	0	0
2009	0	0	0

Net (Limited to 250 per occ.)

Year	Reported Losses	LDF	Ultimate Losses	Paid Losses	Total Reserves
2005	1,250	1.000	1,250	909	341
2006	952	1.045	995	800	195
2007	1,159	1.090	1,263	625	638
2008	667	1.691	1,127	400	727
2009	500	2.254	1,127	290	837
Total	**4,528**		**5,763**	**3,024**	**2,739**

Ceded (Excess 250 per occ)

	Gross - Net Reserves
	250
	(3)
	263
	129
	129
	767

“LF Company” – LDF Method Results

Results with similar LDFs

Gross (Unlimited)

Year	Reported Losses	LDF	Ultimate Losses	Paid Losses	Total Reserves
2005	1,000	1.000	1,000	909	91
2006	952	1.050	1,000	800	200
2007	909	1.100	1,000	625	375
2008	667	1.500	1,000	400	600
2009	500	2.000	1,000	290	710
Total	**4,028**		**5,000**	**3,024**	**1,976**

Large Losses

Year	Incurred Amount	Reported Amount	Paid Amount
2005	0	0	0
2006	0	0	0
2007	0	0	0
2008	0	0	0
2009	0	0	0

Net (Limited to 250 per occ.)

Year	Reported Losses	LDF	Ultimate Losses	Paid Losses	Total Reserves
2005	1,000	1.000	1,000	909	91
2006	952	1.050	1,000	800	200
2007	909	1.100	1,000	625	375
2008	667	1.500	1,000	400	600
2009	500	2.000	1,000	290	710
Total	**4,028**		**5,000**	**3,024**	**1,976**

Ceded (Excess 250 per occ)

	Gross - Net Reserves
	-
	-
	-
	-
	-
	-

“L Company” – BF Method Results

Results with differing LDFs

Gross (Unlimited)

Year	Reported Losses	LDF	Initial Expected Losses	BF Method Ultimate Losses	Selected Ultimate Losses	Paid Losses	Total Reserves
2005	1,500	1.000	1,250	1,500	1,500	909	591
2006	952	1.041	1,250	1,002	1,002	800	202
2007	1,409	1.083	1,250	1,505	1,505	625	880
2008	667	1.884	1,250	1,253	1,253	400	853
2009	500	2.512	1,250	1,252	1,252	290	962
Total	**5,028**		**6,250**	**6,513**	**6,513**	**3,024**	**3,489**

Large Losses

Year	Incurred Amount	Reported Amount	Paid Amount
2005	500	500	0
2006	0	0	0
2007	500	500	0
2008	0	0	0
2009	0	0	0

Net (Limited to 250 per occ.)

Year	Reported Losses	LDF	Initial Expected Losses	BF Method Ultimate Losses	Selected Ultimate Losses	Paid Losses	Total Reserves
2005	1,250	1.000	1,125	1,250	1,250	909	341
2006	952	1.045	1,125	1,001	1,001	800	201
2007	1,159	1.090	1,125	1,252	1,252	625	627
2008	667	1.691	1,125	1,126	1,126	400	726
2009	500	2.254	1,125	1,126	1,126	290	836
Total	**4,528**		**5,625**	**5,755**	**5,755**	**3,024**	**2,731**

Ceded (Excess 250 per occ)

	Gross - Net Reserves
	250
	1
	253
	127
	126
	758

“LF Company” – BF Method Results

Results with similar LDFs

Gross (Unlimited)

Year	Reported Losses	LDF	Initial Expected Losses	BF Method Ultimate Losses	Selected Ultimate Losses	Paid Losses	Total Reserves
2005	1,000	1.000	1,250	1,000	1,000	909	91
2006	952	1.050	1,250	1,012	1,012	800	212
2007	909	1.100	1,250	1,023	1,023	625	398
2008	667	1.500	1,250	1,083	1,083	400	683
2009	500	2.000	1,250	1,125	1,125	290	835
Total	**4,028**		**6,250**	**5,243**	**5,243**	**3,024**	**2,219**

Large Losses

Year	Incurred Amount	Reported Amount	Paid Amount
2005	0	0	0
2006	0	0	0
2007	0	0	0
2008	0	0	0
2009	0	0	0

Net (Limited to 250 per occ.)

Year	Reported Losses	LDF	Initial Expected Losses	BF Method Ultimate Losses	Selected Ultimate Losses	Paid Losses	Total Reserves
2005	1,000	1.000	1,125	1,000	1,000	909	91
2006	952	1.050	1,125	1,006	1,006	800	206
2007	909	1.100	1,125	1,011	1,011	625	386
2008	667	1.500	1,125	1,042	1,042	400	642
2009	500	2.000	1,125	1,063	1,063	290	773
Total	**4,028**		**5,625**	**5,121**	**5,121**	**3,024**	**2,097**

Ceded (Excess 250 per occ)

Gross - Net Reserves
-
6
11
42
63
121

Comparison of Results

Comparison of L Company to LF Company using the LDF and BF Method Results

LDF Method

Year	LF Company Gross - Net Reserves	L Company Gross - Net Reserves		Difference	% Diff from Diff LDF
2005	-	250			
2006	-	(3)			
2007	-	263			
2008	-	129		(129)	-100%
2009	-	129		(129)	-100%
Total	**-**	**767**			

BF Method

Year	LF Company Gross - Net Reserves	L Company Gross - Net Reserves		Difference	% Diff from Diff LDF
2005	-	250			
2006	6	1			
2007	11	253			
2008	42	127		(85)	-67%
2009	63	126		(64)	-51%
Total	**121**	**758**			

Example 1: Results

- "LF Company"
  - Does not show different loss development patterns for gross and net
  - Results in ceded losses being understated
    - LDF method does not include a provision for ceded claims
    - BF method includes a provision for ceded claims, but still understated
  - Other methods such as using an expected value of ceded losses or simulation of large losses may be more appropriate
- "L Company"
  - Does show different loss development patterns for gross and net
  - Results in ceded losses being estimated with proper reflection of losses in excess of the retention

Example 2: Assumptions

- Reviewing two basic types of reinsurance contracts
  - $250,000 excess of $250,000
  - Statutory limits excess of $250,000
- Trying to determine the impact of a $1 million aggregate limit to the reserves
- Credible history of claims excess of $125,000 provided
- Frequency of claims follows a Poisson distribution
  - lambda = 5
- Severity of claims follows a Lognormal distribution
  - Mu = 12.197
  - Sigma = 0.681

Example 2: Assumptions (cont.)

- Loss trend assumed to be 0%
- No partial payments on pending claims
- 4 closed claims resulted in $0 paid excess of $250,000

Example 2: Assumptions

Frequency distribution

	Poisson	
lambda	5	

mean	5.000
sd	2.236

# of claims	Prob of Claims in a given year	Cumul Prob
0	0.7%	0.7%
1	3.4%	4.0%
2	8.4%	12.5%
3	14.0%	26.5%
4	17.5%	44.0%
5	17.5%	61.6%
6	14.6%	76.2%
7	10.4%	86.7%
8	6.5%	93.2%
9	3.6%	96.8%
10	1.8%	98.6%
11	0.8%	99.5%
12	0.3%	99.8%
13	0.1%	99.9%
14	0.0%	100.0%
15	0.0%	100.0%
16	0.0%	100.0%
17	0.0%	**100.0%**

Example 2: Assumptions

Severity distribution

	Lognormal
mu	12.197
sigma	0.681

Trunc	125,000
mean	250,000
sd	300,000

Cum Prob.	Fitted Loss
1%	165,657
5%	189,670
10%	207,825
20%	236,760
30%	263,712
40%	291,834
50%	323,253
60%	360,588
70%	408,352
80%	476,684
90%	599,542
95%	732,760
99%	1,091,726
Severity Mean	375,000

Example 2: Assumptions

Claims history and LDFs

Year	Reported Claims	Closed Claims	Pending Claims	Excess Claim LDF
1	3	2	1	1.000
2	7	2	5	1.500
3	2	0	2	2.000
4	1	0	1	4.000
5	0	0	0	25.000
Total	**13**	**4**	**9**	

Example 2: Model

- 10,000 iterations
- Simulate expected claims by year
- Apply BF method to get estimated IBNR claims
- For each open claim (pending + IBNR), simulate a severity
- Split severities into loss layers
  - <$250K
  - $250K-$500K
  - >$250K
- Aggregate layer losses by year
  - Limit to $1mm per year

Comparison of Results

Impact of an aggregate limit on the two difference reinsurance contract types

	Per Occurrence	
Aggregate Limit	**$250,000 excess of $250,000**	**Statutory excess of $250,000**
None	2,224,983	3,000,274
$1 million per year	2,189,107	2,607,168
Difference	**35,876**	**393,106**

Example 2: Results

- Reserves are impacted by aggregate limit
- Use of simulation makes estimating the impact fairly simple
- Requires credible data to determine the frequency and severity distribution
- Dependent on the distributions and fits used

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