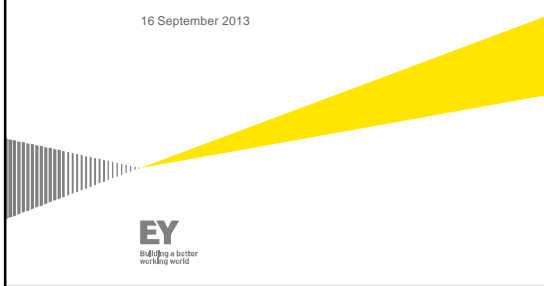**Loss reserve variability and reserve ranges — part I**

2013 Casualty Loss Reserve Seminar

16 September 2013

EY
Building a better
working world

Agenda

► Background

► Reserve ranges in Actuarial Standards of Practice (ASOPs) and Statements of Actuarial (SAOs)

► Deterministic approaches to reserve ranges

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Background — uses for reserve ranges

► Insurance company management — may aid in decision of what reserve to book
► Statement of actuarial opinion and actuarial opinion summary
► SEC filings — reliability of current earnings
► Risk management and capital modeling — scenario-testing and worst-case scenarios
► Mergers and acquisitions — reliability of current earnings, profitability, ranges of future outcomes
► Audits and statutory examinations — testing of management's best estimate
► Rating agencies — assess reserve variability

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Reserve ranges in ASOPs and SAO implications

► While reserve ranges are mentioned in a few ASOPs, the most relevant are:
  ► ASOP 36 — statements of actuarial opinion regarding property/casualty loss and loss adjustment expense reserves
  ► ASOP 43 — property/casualty unpaid claim estimates

► Also of relevance are:
  ► American Academy of Actuaries Committee on Property and Liability Financial Reporting (COPLFR) practice note on SAO on property and casualty loss reserves
  ► National Association of Insurance Commissioners regulatory guidance on property and casualty statutory statements of actuarial opinion

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ASOPs — key paragraphs

► **ASOP 36 — 3.7 Reserve Evaluation**
  The actuary should consider a reserve to be reasonable if it is within a range of estimates that could be produced by an unpaid claim estimate analysis that is, in the actuary's professional judgment, consistent with both ASOP No. 43, *property/casualty unpaid claim estimates*, and the identified stated basis of reserve presentation.

► **ASOP 43 — 2.1 Actuarial Central Estimate**
  An estimate that represents an expected value over the range of reasonably possible outcomes

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Range of (reasonable?) estimates

► ASOP 36 (revised in 2010) no longer uses the phrase "range of *reasonable* estimates" — instead stresses a "range of estimates" that is consistent with ASOP 43 and the identified stated basis of reserve presentation.

► COPLFR practice note still makes reference to a "range of reasonable estimates."
  ASOP No. 36 states that a reserve is reasonable if it is within the actuary's range of reasonable reserve estimates. This standard defines the range of reasonable estimates as a range of estimates that could be produced by appropriate actuarial methods or alternative sets of assumptions that the actuary judges to be reasonable. Note that the range of reasonable estimates is narrower, perhaps considerably, than the range of possible outcomes of the ultimate settlement value of the reserve.

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Range of estimates vs. range of reasonably possible outcomes

► Range of reasonably possible outcomes — conceptually tends to involve a statistical distribution

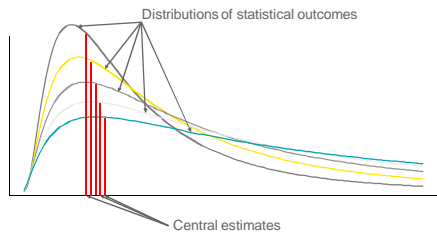► Range of estimates — range of values that an actuary could produce as an actuarial central estimate

Range of estimates vs. range of reasonably possible outcomes

Distributions of statistical outcomes

Central estimates

ASOP 43 — disclosures concerning the reserve range

4.2 Additional disclosures — in certain cases, consistent with the intended purpose or use, the actuary may need to make the following disclosures in addition to those in Section 4.1: a. **In the case where the actuary specifies a range of estimates, the actuary should disclose the basis of the range provided, for example, a range of estimates of the intended measure (each of such estimates considered to be a reasonable estimate on a stand-alone basis); a range representing a confidence interval within the range of outcomes produced by a particular model or models; or a range representing a confidence interval reflecting certain risks, such as process risk and parameter risk.**

ASOP 20 — discounting of property/casualty unpaid claim estimates

3.5 Ranges — the actuary should consider the uncertainty in the discounted unpaid claim estimate when determining a range of estimates. The actuary should recognize that the uncertainty inherent in discounted unpaid claim estimates generally is different than the uncertainty inherent in undiscounted unpaid claim estimates.

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Actuarial opinion implications — change in estimates disclosure

► New to the 2012 SAO instructions, the following is required (formerly was *encouraged*):
  An exhibit or appendix showing the change in the estimates from the prior actuarial report, including extended discussion of factors underlying any material changes

► The COPLFR practice note suggests the appointed actuary may wish to consider the following in the actuarial report:
  Exhibit(s) and discussion related to material changes in the range of estimates from the prior year (if a range is included in the actuarial report), if meaningful and practical, including discussion of any material expansion or contraction of the range relative to the prior year

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Actuarial opinion implications — Risk of Material Adverse Deviation (RMAD)

► National Association of Insurance Commissioners regulatory guidance suggests — *when concluding whether RMAD exists, the appointed actuary should consider the materiality standard in relation to the range and the carried reserves.*
  ► *If the materiality standard, when added to the carried reserves, exceeds the high end of the range, it may be logical to conclude that RMAD does not exist.*
  ► *If the materiality standard, when added to the carried reserves, is within the range, RMAD likely exists.*

► Implies a relationship between the materiality standard and the (upper) width of the range

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Deterministic approaches to setting reserve ranges

► Standard percentage

► Range formed via a variety of methods

► Range formed by varying assumptions

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Standard percentage

► Examples:
  ► Personal auto, homeowners +/-5%
  ► Commercial auto, workers' compensation +/-7.5%
  ► General liability +/-10%
  ► Products liability, medical malpractice +/-15%
  ► Construction defect, asbestos and environmental exposures +/-25%
► A judgmental selection potentially based on:
  ► The credibility of the loss volume
  ► Variability of the historical results
  ► Projected Incurred But Not Reported (IBNR)/case ratio for recent years (higher ratio — wider range)
  ► Size of loss reserve relative to the company's surplus
► May be tested using diagnostics — aiding in the disclosure requirement

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Range formed via a variety of methods

► Use a variety of projection methods such as the paid and incurred loss development methods, paid and incurred Bornhuetter-Ferguson (B-F) methods, IBNR/case development method, frequency-severity methods, etc.
► Judgmentally select a high and low estimate for each year based on the indications from each method
► Use diagnostics as a sanity check
  ► Does the low estimate imply negative IBNR?
  ► For older years, is the percentage width of the range wider while the dollar width is narrower?
  ► Does the high estimate yield IBNR-to-case ratios seem unreasonably high?
  ► Do the resulting high and low loss rates make sense?

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Illustrative example — source of data

► Data is taken from four random companies schedule Ps, downloaded from SNL.com by SNL Financial, LC.

► Data is adjusted by scalars, so that the premium volume is roughly equivalent amongst the four.

► Data is for line products liability — occurrence.

► A reserve analysis was performed using five basic actuarial projection methods.

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Example — choosing the high end of the range

Selection of ultimate loss — variety of methods

Accident year ending 12/31/XXXX	Reported loss dev method	Paid loss dev method	Average reported severity method	Reported loss B-F method	Paid loss B-F method	Selected ult loss	Selected high ult loss
2003	326,887	303,895	332,613	327,769	309,307	326,887	332,613
2004	378,323	368,409	387,134	381,506	380,331	373,366	377,771
2005	297,305	304,237	304,229	305,950	328,382	300,771	304,233
2006	268,812	294,111	276,881	276,889	308,692	281,461	285,496
2007	304,068	337,568	315,886	307,223	335,873	320,818	326,727
2008	289,852	303,182	306,635	292,447	303,208	296,517	304,909
2009	265,502	279,500	285,841	261,822	264,958	272,501	282,670
2010	222,510	272,315	239,405	224,838	241,172	247,413	255,860
2011	215,402	252,381	231,807	213,264	219,489	216,377	231,807
2012	218,052	247,785	227,152	216,254	218,535	217,395	227,152
Total	2,786,713	2,963,383	2,907,583	2,807,962	2,909,947	2,853,506	2,929,238
					Paid	1,769,108	1,769,108
					Unpaid loss	1,084,397	1,160,129
							7.0%

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Example — using diagnostics to assess your selected high end

Diagnostic assessment of selected high

Accident year ending 12/31/XXXX	Selected high ult loss	Case reserves	IBNR reserves	IBNR :case ratio	Upper range width	Range %	Selected loss rate	High loss rate
2003	332,613	42,249	13,211	0.31	5,726	11.5%	0.49	0.50
2004	377,771	41,465	13,321	0.32	4,405	8.7%	0.45	0.45
2005	304,233	27,819	24,314	0.87	3,462	7.1%	0.38	0.39
2006	285,496	19,070	41,581	2.18	4,035	7.1%	0.46	0.47
2007	326,727	30,697	57,278	1.87	5,909	7.2%	0.57	0.58
2008	304,909	53,866	71,205	1.32	8,391	7.2%	0.59	0.61
2009	282,670	60,771	99,896	1.64	10,169	6.8%	0.66	0.69
2010	255,860	40,070	133,490	3.33	8,447	5.1%	0.68	0.71
2011	231,807	37,149	147,257	3.96	15,430	9.1%	0.65	0.70
2012	227,152	27,944	177,477	6.35	9,757	5.0%	0.66	0.69

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Range formed by varying assumptions

► Range formed by varying assumptions
  ► Loss Development Factors (LDF) selections, in particular tail assumptions
  ► B-F initial expected loss ratio
► Risk of a compounding effect of extreme assumptions
► Could be time consuming

Example — choosing high and low LDFs

Incurred loss age-to-age factors — varying assumptions

	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108
2003	2.354	1.322	1.235	1.169	1.154	1.059	1.024	1.028
2004	1.684	1.425	1.355	1.154	1.256	.0997	1.043	1.022
2005	1.707	1.469	1.283	1.346	1.058	1.008	1.046	
2006	1.733	1.455	1.472	1.118	1.040	1.040		
2007	2.046	1.445	1.170	1.146	1.085			
2008	1.763	1.391	1.135	1.216				
2009	1.585	1.381	1.215					
2010	1.500	1.329						
2011	1.545							
St Av	1.768	1.402	1.267	1.191	1.119	1.026	1.038	1.025
Wtd Av	1.762	1.401	1.260	1.188	1.123	1.024	1.037	1.025
LAST 3 St Av	1.543	1.367	1.174	1.160	1.061	1.015	1.038	
Last 3 Wtd A	1.545	1.370	1.172	1.159	1.062	1.012	1.037	
St x Hi/lo	1.723	1.404	1.252	1.171	1.099	1.024	1.043	
High	1.768	1.404	1.267	1.191	1.123	1.026	1.043	1.027
Select	1.723	1.401	1.252	1.171	1.099	1.024	1.038	1.023
Low	1.543	1.367	1.172	1.159	1.061	1.012	1.037	1.022

Example — choosing high and low LDFs

Incurred loss development method — varying assumptions

Accident year ending 12/31/XXXX	Reported loss @ 12/31/12	Selected factor	Selected ult loss based on rptd devt	High factor	High ult loss based on rptd devt	Low factor	Low ult loss based on rptd devt
2003	319,402	1.023	326,887	1.033	330,018	1.02	325,813
2004	364,450	1.038	378,323	1.052	383,251	1.03	376,723
2005	279,919	1.062	297,305	1.080	302,442	1.06	295,805
2006	243,815	1.102	268,812	1.126	274,754	1.10	267,420
2007	269,449	1.128	304,068	1.156	311,430	1.11	299,074
2008	233,704	1.240	289,852	1.298	303,256	1.18	275,293
2009	182,774	1.453	265,502	1.546	282,573	1.37	249,523
2010	122,370	1.818	222,510	1.958	239,615	1.60	195,784
2011	84,550	2.548	215,402	2.750	232,493	2.19	184,924
2012	49,675	4.390	218,052	4.863	241,554	3.38	167,669
Total	2,150,208		2,786,713		2,901,386		2,638,028
		Paid loss	1,769,108		1,769,108		1,769,108
		Unpaid loss	1,017,606		1,132,277		868,921
					11.3%		-14.6%

Example — choosing high and low initial loss cost selections for B-F method

Bornhuetter-Ferguson methods — varying assumptions

Accident year ending 12/31/XXXX	Preliminary loss Cost	2.0% trend to 12/31/12	Trended loss cost	Selected loss cost	% unrptd	Ult loss based on rptd B-F	High loss cost	High % unrptd	High ult loss based on rptd B-F
2003	0.472	1.195	0.564	0.547	2%	327,769	0.594	3	332,160
2004	0.448	1.172	0.525	0.558	4%	381,506	0.605	5	389,216
2005	0.384	1.149	0.442	0.569	6%	305,950	0.617	7	315,899
2006	0.459	1.126	0.517	0.580	9%	276,889	0.630	11	287,290
2007	0.572	1.104	0.632	0.592	11%	307,223	0.642	13	317,994
2008	0.590	1.082	0.639	0.604	19%	292,447	0.655	23	309,195
2009	0.661	1.061	0.702	0.616	31%	261,822	0.668	35	280,027
2010	0.683	1.040	0.710	0.628	45%	224,838	0.682	49	243,294
2011	0.707	1.020	0.721	0.641	61%	213,264	0.695	64	230,897
2012	0.706	1.000	0.706	0.653	77%	216,254	0.709	79	235,675

Total									
	All Yr Wtd	0.587			Total	2,807,962			2,941,647
	Avg ex Hi/Lo	0.624			Paid	1,769,108			1,769,108
	4 Yr Wtd	0.709			Unpaid	1,038,854			1,172,540
	Selected	0.653							12.9%
	High select	0.709							

Example — using diagnostics to assess your selected high end

Diagnostic assessment of selected high

Accident year ending 12/31/XXXX	Selected high ult loss	Case reserves	IBNR reserves	IBNR: case ratio	Upper range width	Range %	Selected loss rate	High loss rate
2003	332,160	42,249	12,758	0.30	4,392	8.7%	0.49	0.50
2004	389,216	41,465	24,766	0.60	7,710	13.2%	0.46	0.47
2005	315,899	27,819	35,980	1.29	9,950	18.5%	0.39	0.40
2006	287,290	19,070	43,375	2.27	10,401	20.0%	0.45	0.47
2007	317,994	30,697	48,545	1.58	10,770	15.7%	0.55	0.57
2008	309,195	53,866	75,491	1.40	16,749	14.9%	0.58	0.62
2009	280,027	60,771	97,253	1.60	18,205	13.0%	0.64	0.68
2010	243,294	40,070	120,924	3.02	18,456	12.9%	0.62	0.67
2011	230,897	37,149	146,347	3.94	17,632	10.6%	0.64	0.70
2012	235,675	27,944	186,000	6.66	19,421	10.0%	0.66	0.71