

Loss reserve variability and reserve ranges

2014 Casualty Loss Reserve Seminar

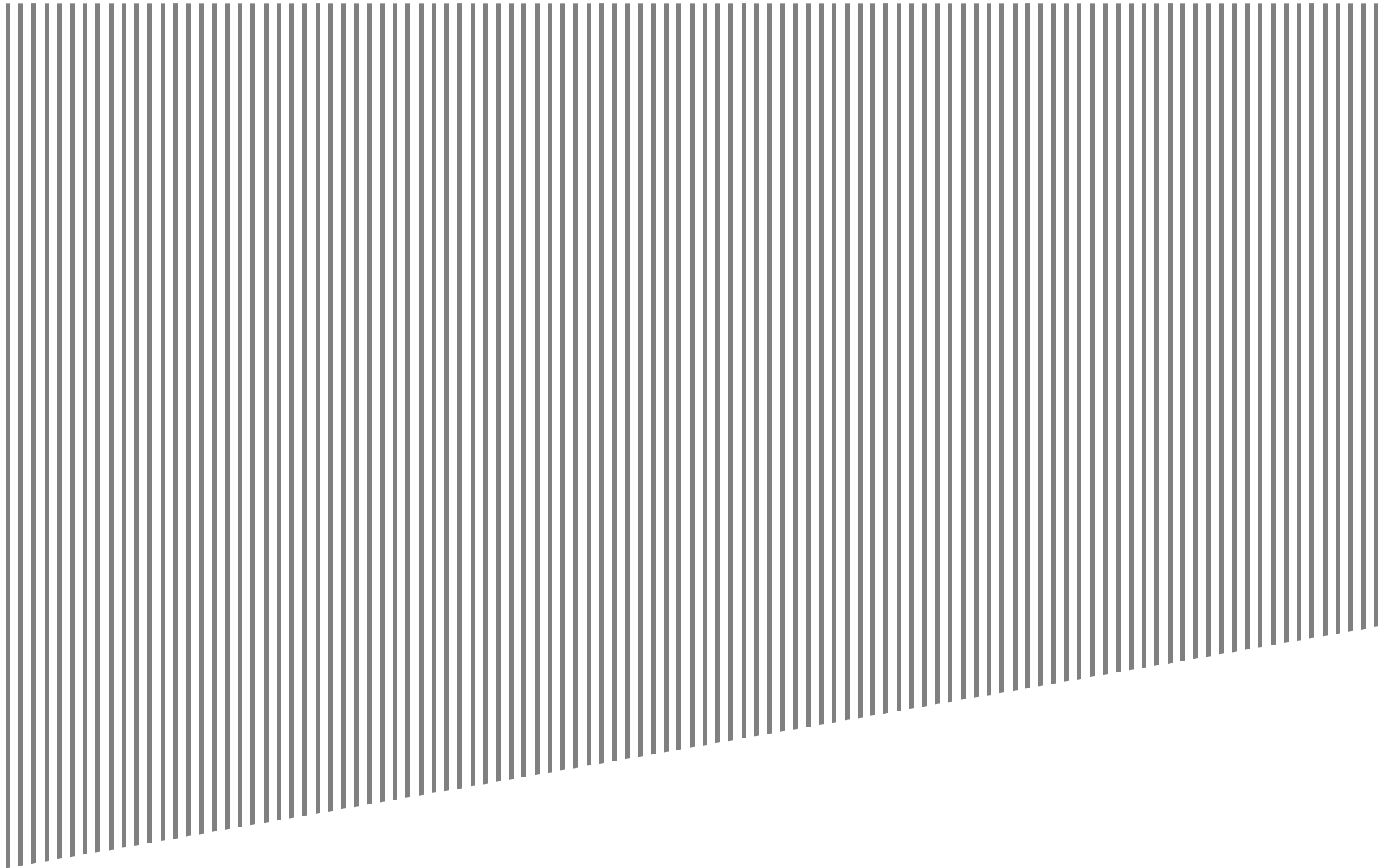
15 September 2014



Agenda

- ▶ Background
- ▶ Reserve ranges in Actuarial Standards of Practice (ASOP) and Statements of Actuarial Opinion (SAO)
- ▶ Deterministic approaches to reserve ranges

Background



Uses of ranges

- ▶ **Company management**
 - ▶ As an aid to setting management's best estimate
- ▶ **Risk management and capital modeling**
 - ▶ Scenario testing and worst-case scenarios
- ▶ **SEC filings**
 - ▶ Reliability of current earnings, profitability, ranges of future outcomes
- ▶ **Mergers and acquisitions**
 - ▶ Profitability, ranges of future outcomes
- ▶ **Audits and statutory examinations**
 - ▶ Testing of management's best estimate
- ▶ **Reports supporting the Statements of Actuarial Opinion (SAO) and Actuarial Opinion Summary (AOS)**
 - ▶ Opinion on management's best estimate
- ▶ **Rating agencies**
 - ▶ Assess reserve variability

Purposes of ranges

Two types of ranges are commonly discussed:

- ▶ **Range of possible outcomes**

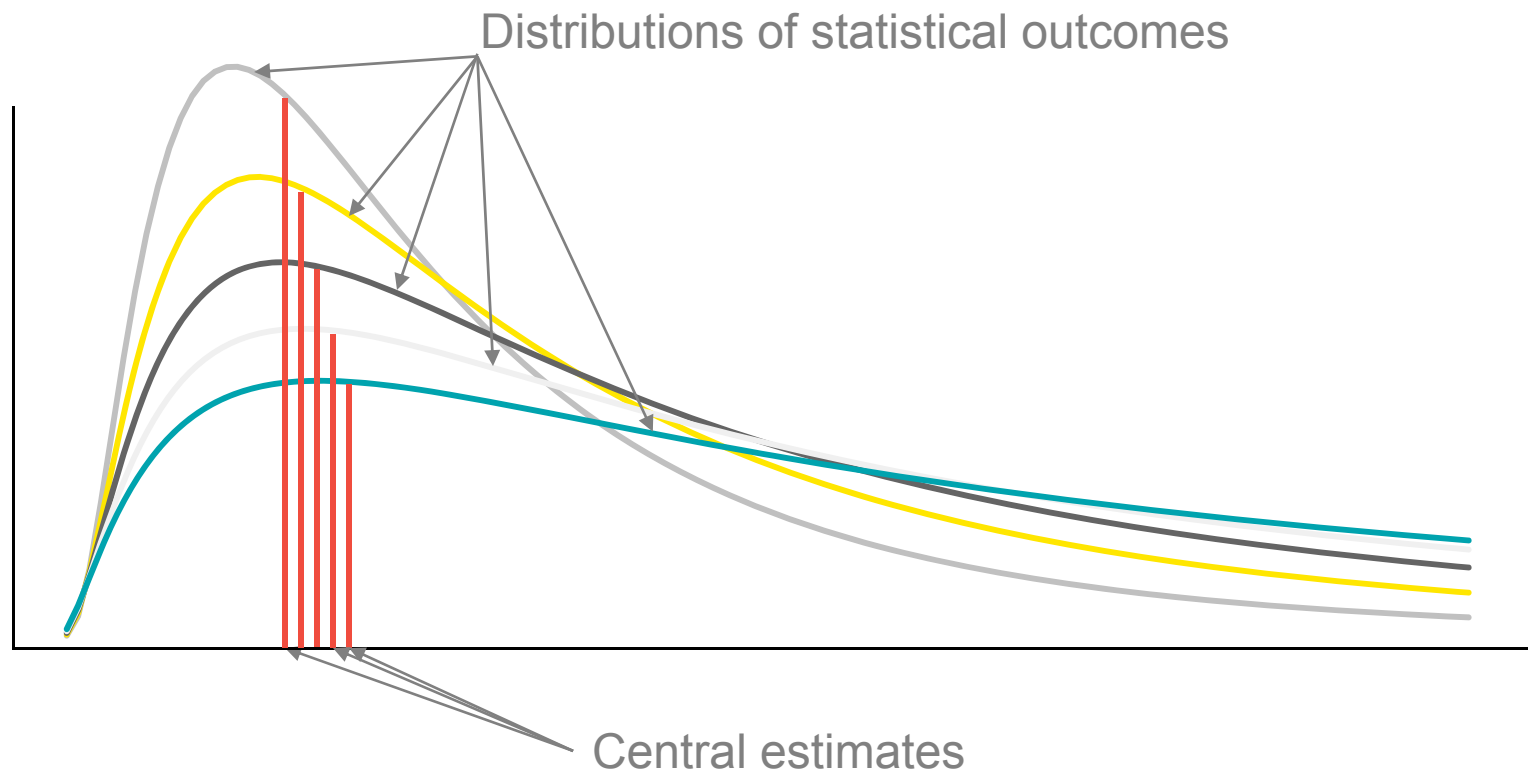
- ▶ Includes the full range of potential results of the claim process
- ▶ Involves a statistical distribution that attempts to quantify the probabilities of all possible outcomes, including those that are very unlikely

- ▶ **Range of reasonable estimates**

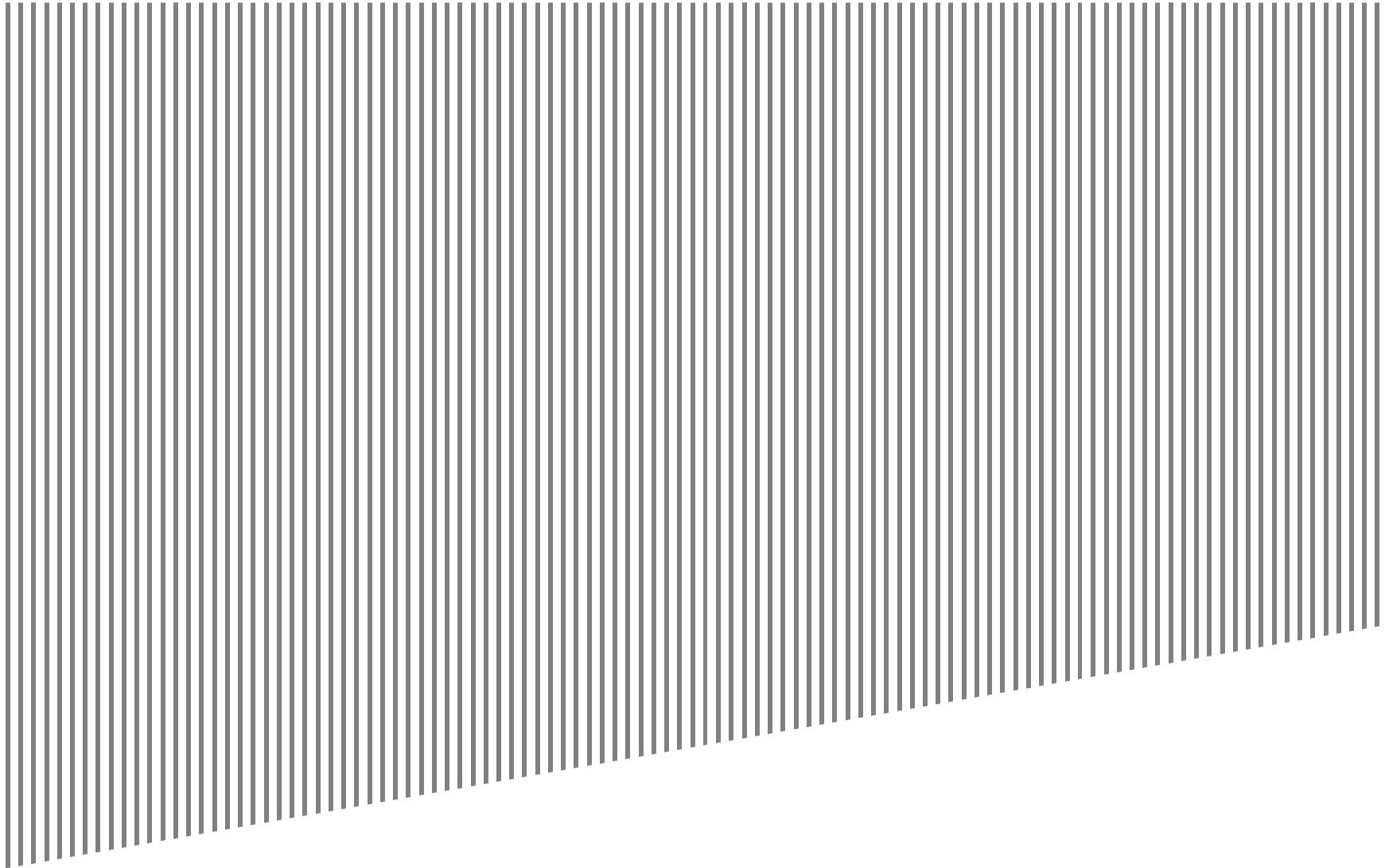
- ▶ Range of values that an actuary could produce as an actuarial central estimate
- ▶ Expresses the degree of uncertainty in an estimate
- ▶ Produced by evaluating different actuarial methods or alternative sets of assumptions that the actuary judges to be reasonable

A range of reasonable estimates considers primarily parameter and model risk, not process risk.

Range of estimates versus range of reasonably possible outcomes



Actuarial Standards of Practice (ASOP) and Statements of Actuarial Opinion (SAO)



Reserve ranges in ASOP 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

ASOP 36 and 43 — 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”**

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.
 - ▶ 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 all possible outcomes of the ultimate settlement value of the reserve.
- ▶ COPLFR practice note still makes reference to a “range of reasonable estimates.”

ASOP 43 — disclosures concerning the reserve range

ASOP 43, 4.2a “Additional disclosures – In the case when 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

ASOP 20, 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.”

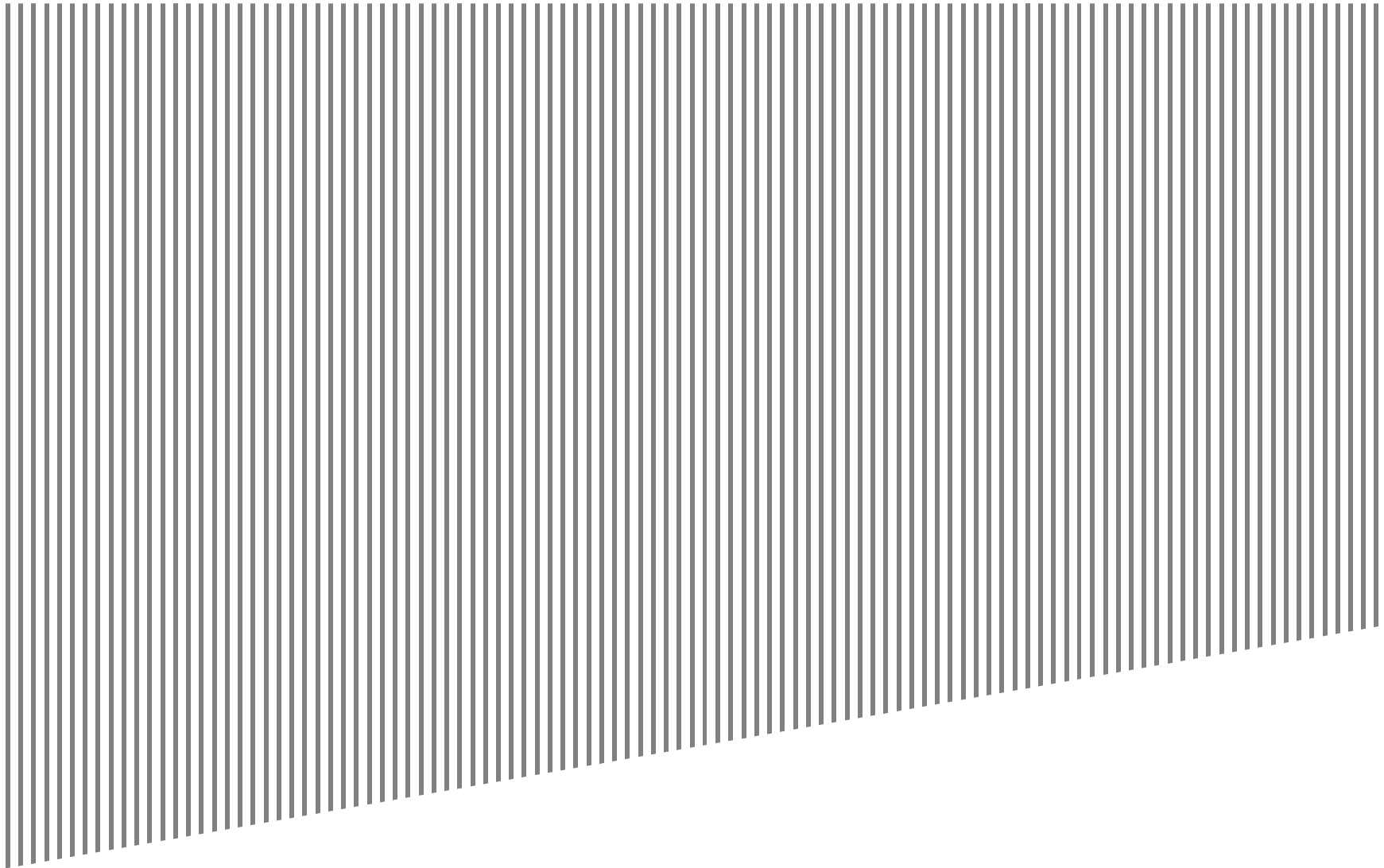
Actuarial opinion implications — change in estimates disclosure

- ▶ SAO instructions, the following is required (prior to 2012 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

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

Deterministic approaches to setting reserve ranges



Deterministic approaches to setting reserve ranges

- ▶ Standard percentage
- ▶ Range formed via a variety of methods
- ▶ Range formed by varying assumptions

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

Range formed via a variety of methods

- ▶ Use a variety of projection methods:
 - ▶ Paid and incurred loss development methods
 - ▶ Paid and incurred Bornhuetter-Ferguson (B-F) methods
 - ▶ IBNR/case development method
 - ▶ Frequency-severity methods
- ▶ 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?

Illustrative example — source of data

- ▶ Data is taken from four random companies' schedule Ps (all from publicly available sources)
- ▶ Data is adjusted by scalars, so that the premium volume is roughly equivalent among the four.
- ▶ Data is for line products liability — occurrence.
- ▶ A reserve analysis was performed using five basic actuarial projection methods.

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
2004	326,887	303,895	332,613	327,769	309,307	326,887	332,613
2005	378,323	368,409	387,134	381,506	380,331	373,366	377,771
2006	297,305	304,237	304,229	305,950	328,382	300,771	304,233
2007	268,812	294,111	276,881	276,889	308,692	281,461	285,496
2008	304,068	337,568	315,886	307,223	335,873	320,818	326,727
2009	289,852	303,182	306,635	292,447	303,208	296,517	304,909
2010	265,502	279,500	285,841	261,822	264,958	272,501	282,670
2011	222,510	272,315	239,405	224,838	241,172	247,413	255,860
2012	215,402	252,381	231,807	213,264	219,489	216,377	231,807
2013	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%

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
2004	332,613	42,249	13,211	0.31	5,726	11.5%	0.49	0.50
2005	377,771	41,465	13,321	0.32	4,405	8.7%	0.45	0.45
2006	304,233	27,819	24,314	0.87	3,462	7.1%	0.38	0.39
2007	285,496	19,070	41,581	2.18	4,035	7.1%	0.46	0.47
2008	326,727	30,697	57,278	1.87	5,909	7.2%	0.57	0.58
2009	304,909	53,866	71,205	1.32	8,391	7.2%	0.59	0.61
2010	282,670	60,771	99,896	1.64	10,169	6.8%	0.66	0.69
2011	255,860	40,070	133,490	3.33	8,447	5.1%	0.68	0.71
2012	231,807	37,149	147,257	3.96	15,430	9.1%	0.65	0.70
2013	227,152	27,944	177,477	6.35	9,757	5.0%	0.66	0.69

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
2004	2.354	1.322	1.235	1.169	1.154	1.059	1.024	1.028
2005	1.684	1.425	1.355	1.154	1.256	.0997	1.043	1.022
2006	1.707	1.469	1.283	1.346	1.058	1.008	1.046	
2007	1.733	1.455	1.472	1.118	1.040	1.040		
2008	2.046	1.445	1.170	1.146	1.085			
2009	1.763	1.391	1.135	1.216				
2010	1.585	1.381	1.215					
2011	1.500	1.329						
2012	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
2004	319,402	1.023	326,887	1.033	330,018	1.020	325,813
2005	364,450	1.038	378,323	1.052	383,251	1.030	376,723
2006	279,919	1.062	297,305	1.080	302,442	1.060	295,805
2007	243,915	1.102	268,812	1.126	274,754	1.100	267,420
2008	269,449	1.128	304,068	1.156	311,430	1.110	299,074
2009	233,704	1.240	289,852	1.298	303,256	1.180	275,293
2010	182,774	1.453	265,502	1.546	282,573	1.370	249,523
2011	122,370	1.818	222,510	1.958	239,615	1.600	195,784
2012	84,550	2.548	215,402	2.750	232,493	2.190	184,924
2013	49,675	4.390	218,052	4.863	241,554	3.380	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
2004	0.472	1.195	0.564	0.547	2%	327,769	0.594	3%	332,160
2005	0.448	1.172	0.525	0.558	4%	381,506	0.605	5%	389,216
2006	0.384	1.149	0.442	0.569	6%	305,950	0.617	7%	315,899
2007	0.459	1.126	0.517	0.580	9%	276,889	0.630	11%	287,290
2008	0.572	1.104	0.632	0.592	11%	307,223	0.642	13%	317,994
2009	0.590	1.082	0.639	0.604	19%	292,447	0.655	23%	309,195
2010	0.661	1.061	0.702	0.616	31%	261,822	0.668	35%	280,027
2011	0.683	1.040	0.710	0.628	45%	224,838	0.682	49%	243,294
2012	0.707	1.020	0.721	0.641	61%	213,264	0.695	64%	230,897
2013	0.706	1.000	0.706	0.653	77%	216,254	0.709	79%	235,675
Total						Total	2,807,962		2,941,647
	All Yr Wtd		0.587			Paid	1,769,108		1,769,108
	Avg ex Hi/Lo		0.624			Unpaid	1,038,854		1,172,540
	4 Yr Wtd		0.709						12.9%
	Selected		0.653						
	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
2004	332,160	42,249	12,758	0.30	4,392	8.7%	0.49	0.50
2005	389,216	41,465	24,766	0.60	7,710	13.2%	0.46	0.47
2006	315,899	27,819	35,980	1.29	9,950	18.5%	0.39	0.40
2007	287,290	19,070	43,375	2.27	10,401	20.0%	0.45	0.47
2008	317,994	30,697	48,545	1.58	10,770	15.7%	0.55	0.57
2009	309,195	53,866	75,491	1.40	16,749	14.9%	0.58	0.62
2010	280,027	60,771	97,253	1.60	18,205	13.0%	0.64	0.68
2011	243,294	40,070	120,924	3.02	18,456	12.9%	0.62	0.67
2012	230,897	37,149	146,347	3.94	17,632	10.6%	0.64	0.70
2013	235,675	27,944	186,000	6.66	19,421	10.0%	0.66	0.71

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