

Homing in on a Range: What the ASOPs don't tell you about ranges and variability

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Session Outline

- **Michael Solomon** – ranges in actuarial practice
- **Richard Riley** – ranges in legal and tax practice



Introduction to Michael Solomon

- FCAS, MAAA, CERA
- Adjunct Professor, Actuarial Science at Temple University
- 1st Prize, Society of Actuaries/ Casualty Actuarial Society Joint Risk Section Cybersecurity call for Essays
- 1st Prize, Professionally Speaking Toastmasters public speaking competition
- CAMAR Vice President
- Member, Committee for P&C focused ERM Seminars
- Member, CAS/ CIA/ SOA Impairment Project Oversight Group



RANGE WE CAN BELIEVE IN



Q: When do we use ranges



A: When do we use ranges

- Appointed Actuary - Management sets reserves
- Underwriters to set price
- Management to set price?
- Audit of other actuaries work
- Pricing? (Not focus for this conference)



Sources

- Walker & Littman “Applications of Reserve Ranges and Variability in Practice” (paper)
- Littman “How Much is enough: An Empirical testing of the Relationship between the Variability of Reserve Estimates and the volume of data” (paper)
- Brendon/ Patel “Developing a reserve range, from theory to practice” (presentation)
- My LinkedIn Page: Spreadsheets behind tables (& slide deck)



Q: Different ranges for different contexts?



Q: What do ASOPs say about ranges?



A: What do ASOPs say about ranges?

- Not much!
- ASOP 27 – Pensions
- ASOP 36 – “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 ...”
- ASOP 43 – Actuarial Central Estimate (A.C.E.) is “expected value over a range of reasonably possible outcomes”.



P&C INDUSTRY STUDY

- Year -end 2016 P&C Combined Industry Schedule P (so net of reinsurance, sal & sub) WC + CMP
- For “long-tailed” lines
- Used deterministic methods:
 - Paid/ Reported Loss Development Method
 - Paid/ Reported Bornhuetter Ferguson Methods
 - Frequency/ Severity Methods
 - Case Development Method



P&C INDUSTRY STUDY – A.C.E.

- Mechanical for exercise – would review each pick in practice
- LDF = All-year Weighted
- 120-Ult = 96-120
- A priori IELR= 2007-2015 Weighted Average from LDMs
- Selected Ultimate
 - Incurred Year 2006 & Prior – \$0
 - 2007 – 2012 – Average Paid/Reported Loss Development Method
 - 2013 – 2016 – Average Paid/Reported Bornhuetter Ferguson Method



P&C INDUSTRY STUDY – A.C.E.

Actuarial Central Estimate (2007-2016), \$000s	
Selected Ultimate	438,531,270
Paid to Date	336,623,743
Unpaid Loss & DCCE	101,907,527



P&C INDUSTRY STUDY – Range 1 -/+ 5%

Unpaid Loss & DCCE	
A.C.E.	101,907,527
Low	96,812,150
High	107,002,903



P&C INDUSTRY STUDY – Range 2 -/+ 10%

Unpaid Loss & DCCE	
A.C.E.	101,907,527
Low	91,716,774
High	112,098,279



P&C INDUSTRY STUDY – Range 3 -10%/+ 15%

Unpaid Loss & DCCE	
A.C.E.	101,907,527
Low	91,716,774
High	117,193,655



P&C INDUSTRY STUDY – Range 4&5 – Lowest/ Highest Overall Indication

Accident	Indicated Ultimate Loss & DCCE WC					
Year	Paid LDM	Incurred LDM	Paid BF	Incurred BF	Freq/Sev	Case DF
2007	\$25,298,328	\$27,120,268	\$25,290,628	\$27,088,423	\$25,281,880	\$28,334,895
2008	25,487,760	27,450,342	25,436,408	27,382,860	25,477,922	29,006,873
2009	23,280,921	24,747,478	23,268,318	24,696,788	23,288,328	25,705,229
2010	23,881,215	25,259,089	23,783,867	25,156,328	23,891,515	26,205,093
2011	24,430,153	25,751,098	24,300,429	25,609,411	24,424,155	26,692,622
2012	23,679,593	24,824,835	23,806,548	24,784,588	23,681,042	25,636,760
2013	23,600,004	24,793,892	24,151,671	24,915,353	23,592,972	25,651,811
2014	23,872,681	24,886,710	24,982,172	25,260,293	23,828,799	25,535,323
2015	23,834,648	25,159,360	25,691,888	25,786,261	23,807,152	25,892,434
2016	23,063,345	25,400,998	26,533,413	26,424,966	23,047,910	26,249,877
Total	240,428,648	255,394,070	247,245,342	257,105,271	240,321,675	264,910,916



P&C INDUSTRY STUDY – Range 4&5 – Lowest/ Highest Overall Indication

Accident Year	Indicated Ultimate Loss & DCCE CMP					
	Paid LDM	Incurred LDM	Paid BF	Incurred BF	Freq/Sev	Case DF
2007	\$15,357,286	\$15,392,765	\$15,405,275	\$15,415,092	\$15,342,353	\$15,431,523
2008	19,674,285	19,638,181	19,639,413	19,621,698	19,655,829	19,605,085
2009	17,010,976	16,973,792	17,014,640	16,975,988	16,978,867	16,943,170
2010	17,922,061	17,858,056	17,882,851	17,841,902	17,875,882	17,809,411
2011	21,642,157	21,559,090	21,384,219	21,454,098	21,578,312	21,503,712
2012	19,918,795	19,867,484	19,745,038	19,801,244	19,871,850	19,837,487
2013	17,535,517	17,641,358	17,776,206	17,723,848	17,524,318	17,693,412
2014	19,070,732	19,280,812	19,300,391	19,358,151	19,044,672	19,402,052
2015	17,420,787	17,743,501	18,438,641	18,206,009	17,387,959	17,963,815
2016	18,181,542	18,361,151	19,471,373	19,015,895	17,937,711	18,454,651
Total	183,734,138	184,316,190	186,058,047	185,413,925	183,197,753	184,644,318



P&C INDUSTRY STUDY – Range 4 – Lowest/ Highest Indication, by line

	Paid LDM	Incurred LDM	Paid BF	Incurred BF	Freq/Sev	Case DF	Average
Ultimate:	424,162,786	439,710,260	433,303,389	442,519,196	423,519,428	449,555,234	435,461,715
Unpaid:	87,539,043	103,086,517	96,679,646	105,895,453	86,895,685	112,931,491	98,837,972



P&C INDUSTRY STUDY – Range 5 – Lowest/Highest by line by year

	A.C.E	Min	Max
Ult	438,531,270	422,751,264	451,886,185
Unpaid:	101,907,527	86,127,521	115,262,442
		-15%	13%



P&C INDUSTRY STUDY – Range 6 – Changing Parameters

- Mentioned (about Pensions) in ASOP 27
- Q: Do you pick high/low for each LDF/ Expected loss etc?
- If pick lowest reasonable for every individual parameter, and lowest method for each selection, could get very low result.



P&C INDUSTRY STUDY – Range 6 – Changing Parameters 2

- Low = LDFs Min (2,3,4,5, all year weighted). 120-Ult = 108-120
- High = LDFs Max (2,3,4,5, all year weighted). 120-Ult = 84-120.



P&C INDUSTRY STUDY – Range 6 – Changing Parameters 3

	A.C.E	Min	Max
Ult	438,531,270	430,740,463	447,848,998
Unpaid:	101,907,527	94,116,720	111,225,255
		-8%	9%



Comparisons with Small Company

- How much will ranges change?
- Used “Secura” for Small Company
 - Not my client; I have no special knowledge of company
 - Therefore no conclusions should be drawn about Secura’s carried reserves.
 - Took data from Schedule P



Comparison – Range 4 – Lowest/ Highest Indication, by line

	Indicated Ultimate Loss & DCCE						
	Paid LDM	Incurred LDM	Paid BF	Incurred BF	Freq/Sev	Case DF	Average
Ult	424,162,786	439,710,260	433,303,389	442,519,196	423,519,428	449,555,234	435,461,715
Unpaid:	87,539,043	103,086,517	96,679,646	105,895,453	86,895,685	112,931,491	98,837,972
					-15%	11%	

	Indicated Ultimate Loss & DCCE						
	Paid LDM	Incurred LDM	Paid BF	Incurred BF	Freq/Sev	Case DF	Average
Ult	848,496	849,493	865,626	858,035	848,037	851,189	853,479
Unpaid:	147,477	148,474	164,607	157,016	147,018	150,170	152,460
			2%		-9%		



Comparison – Range 5 – Lowest/Highest by line by year

	A.C.E	Min	Max
Ult	438,531,270	422,751,264	451,886,185
Unpaid:	101,907,527	86,127,521	115,262,442
		-15%	13%

	A.C.E	Min	Max
Ult	862,644	836,185	875,124
Unpaid:	161,625	135,166	174,105
		-16%	8%



Comparison – Range 6 – Changing Parameters

	A.C.E	Min	Max
Ult	438,531,270	430,740,463	447,848,998
Unpaid:	101,907,527	94,116,720	111,225,255
		-8%	9%

	A.C.E	Min	Max
Ult	862,644	845,201	890,581
Unpaid:	161,625	144,182	189,562
		-11%	17%



Comparison - Summary

Range#	Description	Industry		Secura	
		Low	High	Low	High
1	-/+5%	-5%	5%		
2	-/+10%	-10%	10%		
3	-10%/+15%	-10%	15%		
4	Lowest/Highest, by line	-15%	11%	-9%	2%
5	Lowest/Highest, by line, by year	-15%	13%	-16%	8%
6	Changing Parameters	-8%	9%	-11%	8%



Possible Conclusions – Do you agree?

- Difference is more/less/about what you thought?
- Changing Parameters is better than other methods? Is it added value worth the effort?
- Is my approach too mechanical to be meaningful comparison?
- IMHO: Range reflects uncertainty. What are we uncertain about? I suggest about LDFs/ Parameters, not which method to use. So changing parameter selection more accurate guide to reasonable range. Agree/ Disagree?

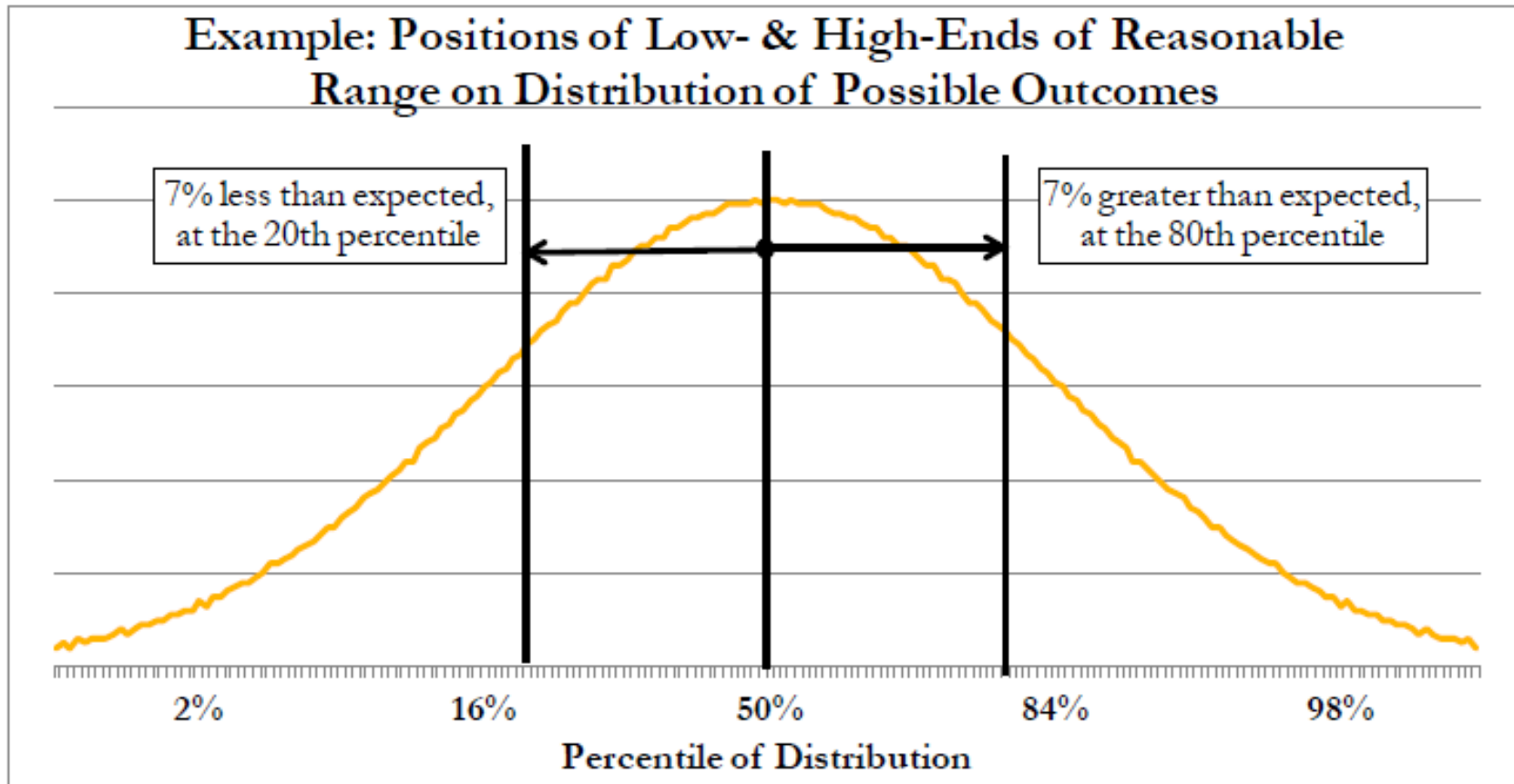


Walker/Littman

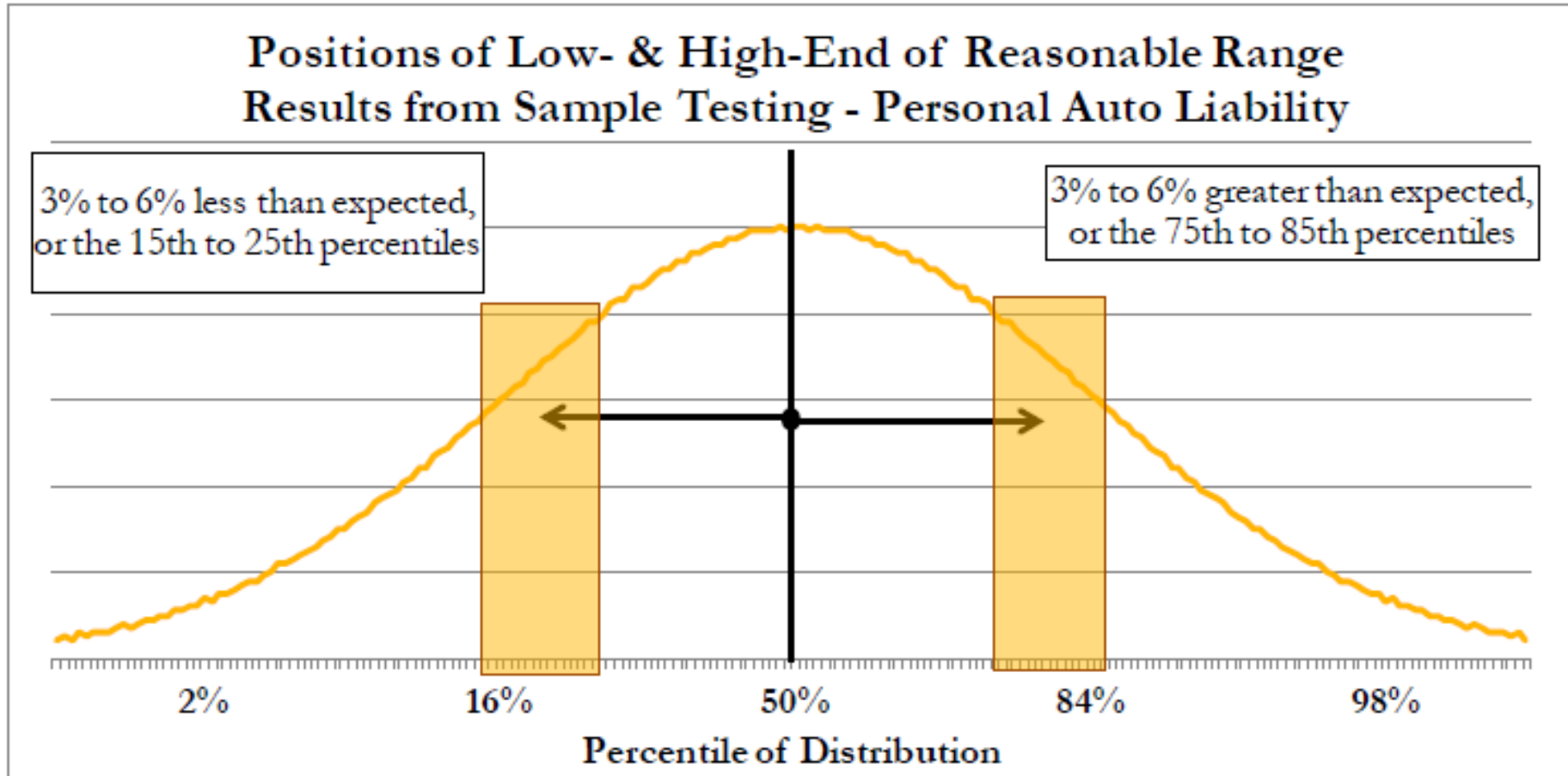
- Used Mack for Confidence Interval. Judged their range (from deterministic methods) against confidence interval. 10 sample companies from Sch P; mixture of large, medium, small.
- LOBs:
 - Personal Auto Liability
 - Homeowners
 - GL Occurrence
- Q: Will LOB affect range? If so, how much? Which will be top?



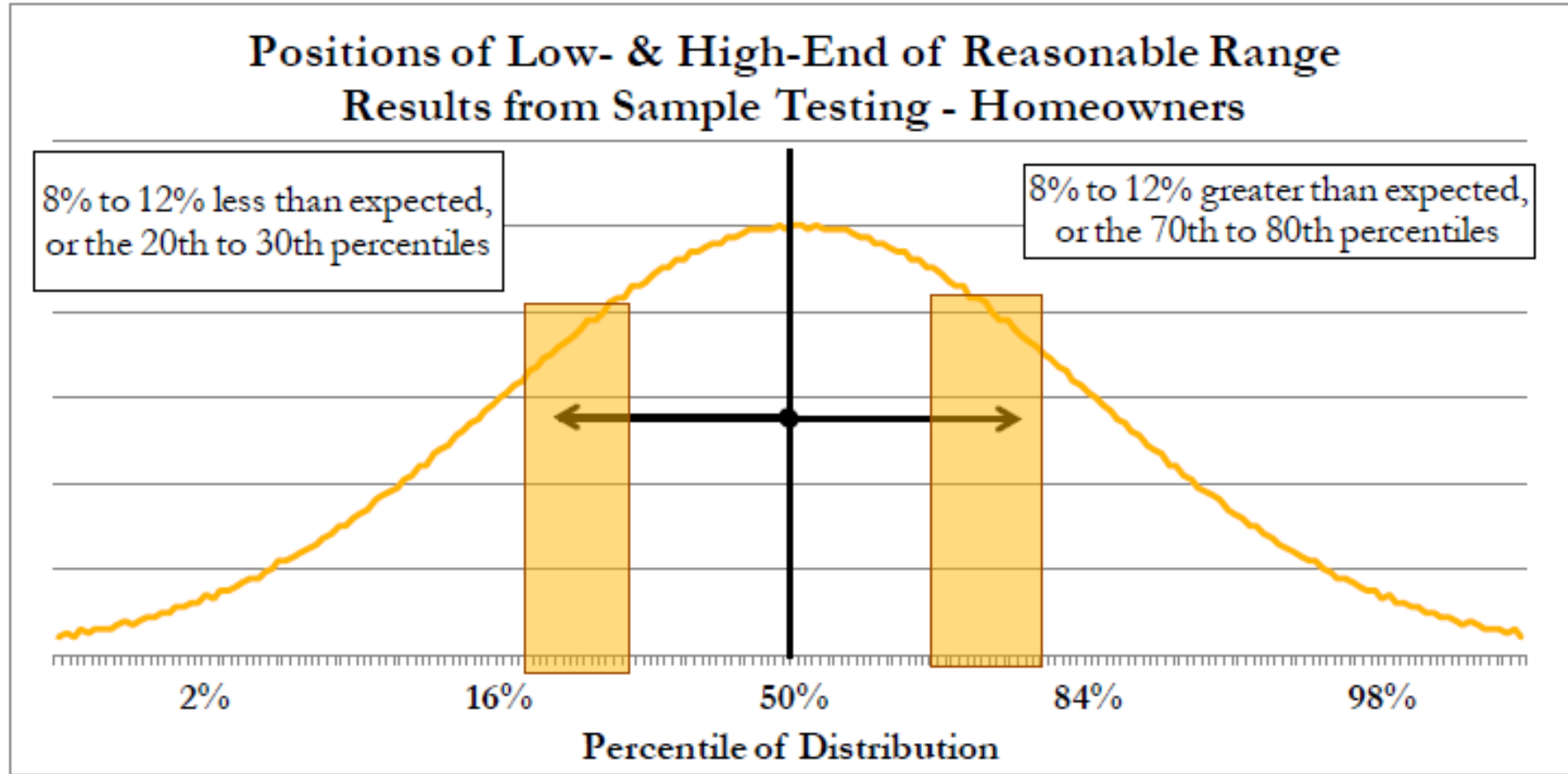
From Walker/Littman



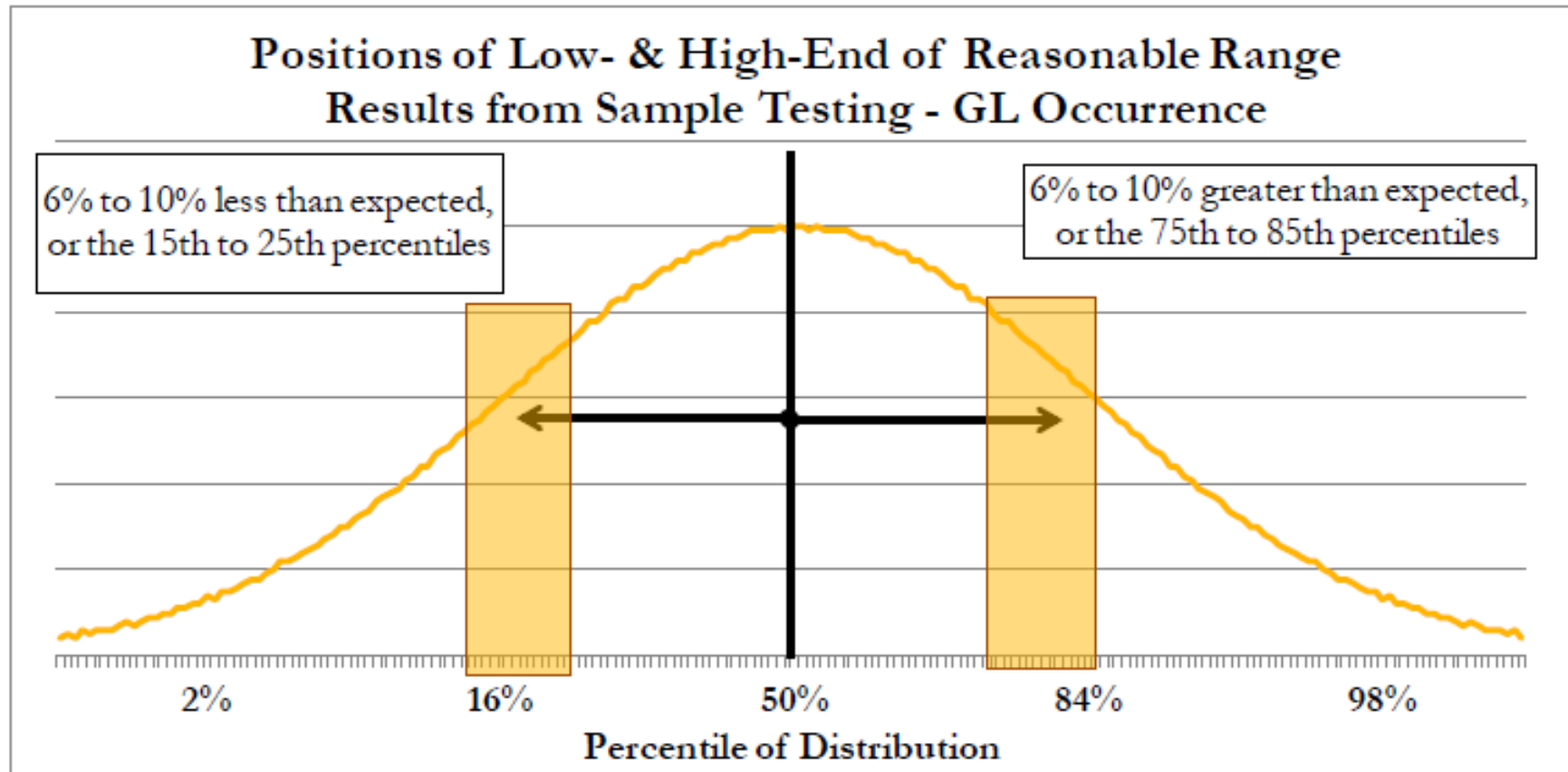
From Walker/Littman



From Walker/Littman



From Walker/Littman



Walker/Littman Possible Conclusions

- Is by line change more/less/about what you would think?
- Given many practitioners have blanket rule, any difference in % should give pause for thought.
- How would % change by size of company?
- Large companies can do sophisticated analysis but smaller companies can't as easily. The analysis will suggest that smaller companies should hold more reserves which could affect profitability/capitalization - affecting pricing. Is this OK with the industry?
- How should reserves affect capitalization?



P&C INDUSTRY STUDY – Range 9 – Confidence Interval

- For stochastic range, could just tweak parameters (like Range 7 & 8)
- Q: Actuary picks 5th/95th confidence interval as range. OK?
- Q: If not 5th/95th, what is reasonable?
- Q: Can this approach even be used for a range of reasonability?
- Q: Would size of reserves affect range more/less than deterministic methods?



Outline of Legal and Tax Issues

- Tax rules for unpaid loss reserves: “fair and reasonable estimate” of only “actual unpaid losses.”
- Basic treatment of actuarial ranges by IRS and in tax cases involving loss reserves.
- First (and crucial) tax case dealing with ranges: *Utah Medical* (1998).
- Most recent tax cases on loss reserves, with important discussion of ranges: *Acuity Insurance* (2013).
- *Minn. Lawyers* (2000) and *Wis. Physicians* (2001) tax cases: some “pushback” on use and effect of ranges.
- Lessons and guidance on use of actuarial ranges in IRS audits and tax cases.



Loss Reserve Tax Rules

“Fair and reasonable” tax standard for deducting unpaid losses.

- Internal Revenue Code § 832(b)(5) defines “losses incurred”
 - Losses paid (net of salvage & reinsurance), plus
 - Discounted unpaid losses at end of current year (net), less
 - Discounted unpaid losses at end of prior year (net)
- IRS Reg. § 1.832-4 states every insurance company must be prepared to establish that its unpaid losses
 - Represent only “actual unpaid losses” and
 - Are a “fair and reasonable estimate” of such losses



Loss Reserve Tax Rules cont'd

Legal definition of insurance company taxable income is expressly tied to NAIC Annual Statement

- Internal Revenue Code (tax law) states gross income is “computed on the basis of the underwriting and investment exhibit of the annual statement approved by the National Association of Insurance Commissioners.”
 - Judge in *Acuity* case observed this is one of the few places in Code (maybe only place) where income is explicitly defined with reference to an “outside” source.
- NAIC statutory accounting standards (SSAP 55) state that insurance company management must record its “best estimate” of unpaid losses in the Ann Stmt.



Basic Tax Treatment of Actuarial Ranges

- Actuary determines sound actuarial range *in advance* and management picks its “best estimate” w/in range: “fair & reasonable” tax test satisfied. *Utah Medical.*
- Internal or opining actuary’s use of ranges to support central estimate or opinion, and experts’ use of ranges to testify on reserve reasonableness, all valid and helpful: *Acuity.*
- **HOWEVER:** fact that carried reserve falls “in a range” does not confirm reserve validity for tax purposes, if other factors indicate reserve was not reasonable or actuarially sound. *Minn. Lawyers and Wis. Physicians.*



Utah Medical case (1998)

- Monoline single-state MPL insurer.
- “[B]ounds of [actuary’s] range are the sums of the high & low end estimates of ultimate loss for each coverage year, at the Dec 31 valuation dates.”
 - Size of range: 26% of low end of range.
- Management selected carried reserve within the actuary’s range, near high end. Court upheld.
- Actuary testified any point in range would have been a reasonable reserve.
- Midpoint of actuarially sound range is not the only fair and reasonable estimate. Court rejects “tax equipoise” concept suggested by IRS.



Acuity Insurance case (2013)

- Multiline multistate P&C insurer based in Wisconsin.
- IRS asserted 2006 reserve was 15% (\$96M) overstated, did not comply with IRS regulation requiring “fair and reasonable” estimate of “actual unpaid losses”
 - Challenged actuarial selections as too conservative
 - Pointed to history of reserve redundancy
- Court upheld carried reserve in full.
- Key result: Loss reserve determined in accordance with NAIC and ASOP standards is best available evidence of “fair and reasonable” reserve for tax purposes.
- With regard to ranges: Key factors are reasonable size of range, reasonable assumptions underlying range.
- Neither *Acuity* case nor *Utah Medical* says that if you “fall in the range,” the case is over. Ranges are a useful tool, but are not “conclusive” any more than the Annual Statement reserve amount standing alone is “conclusive” for tax purposes.



Acuity cont'd

- In determining a fair & reasonable reserve for tax purposes, court gives substantial weight” to evidence that reserve “fell within a range of reasonable reserve estimates as determined by the appointed actuary in accordance with the ASOPs.”
- Various ranges discussed in *Acuity*:
 - Internal actuary’s ranges: 19% and 28% of low end of range.
 - Opining actuary’s range: 15%.
 - Taxpayer’s expert #1: 21%
 - Taxpayer’s expert #2: 21%
 - Utah Medical range: 26%
 - *Minn. Lawyers* range (found not reasonable): 70% to 120%
 - IRS suggestion of max. reasonable range: 20%



Acuity cont'd

- One IRS expert in *Acuity* did not compute a “range,” but rather developed a central estimate plus a 75th percentile confidence level upper bound (about 5% higher than central estimate).
- Taxpayer strongly challenged “confidence level” approach; no court case has used or approved that approach.
- Court did not determine whether approach valid, but did not reject out of hand.



Minn. Lawyers case (2000)

- Monoline single-state lawyers' professional liability insurer.
- Ann Stmt reserves consisted of claims department's case reserves plus management-determined "adverse development reserve" of 37% to 50% of total reserve.
- Tax Court (upheld by Court of Appeals) ruled taxpayer's reserves did not meet "fair & reasonable" standard; accepted appointed actuary's central estimate instead.
- No actuarially based support for "adverse development reserve."
- Appointed actuary's range too wide to be reliable (70% to 120% of low end of range). Court did not reject outright, but dubious. "Evidence is insufficient for us to evaluate" ranges of that size.



Wis. Physicians case (2001)

- Monoline single-state MPL insurer.
- Outside actuaries provided point estimates, no explicit ranges.
- Management increased actuaries' estimates by 10%, pointing to various factors said to demonstrate greater uncertainty.
- Tax Court ruled taxpayer's reserves did not meet "fair & reasonable" standard. Management's 10% add-ons not supported by actuarial analysis, and Court dubious about uncertainty factors.
- No actuarially determined ranges involved, but there was testimony about an "implied range" of 10% around a central estimate – which the Court rejected.
 - "[T]here is no evidence in the record of any actuarial standard that supports an 'implied range' of plus or minus 10 percent around an actuary's point estimate" – though Court acknowledges general testimony by actuaries about uncertainty in loss reserve estimates.



Lessons and Guidance

For insurance companies and their actuaries, lessons from Tax Court cases include:

- Maintain clear, comprehensive written records confirming the detailed actuarial analysis underlying reserve estimate and range.
- If carried reserve exceeds professional actuary's point estimate, maintain records showing that carried reserve was determined in consultation with actuaries and reflected actuarial input.
- Actuaries should develop explicit range in advance of management's determination of carried reserve, if possible.
 - Cost may be a factor.
- Disclose comprehensive records early in an IRS audit; may persuade IRS that a challenge would not be appropriate.



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