Reserving Styles —

Are Actuaries In-Sync with their Stakeholders?

Mark Littmann, FCAS, MAAA

Abstract

Motivation. Reserving actuaries are constantly faced with forming estimates that inherently reflect consideration of data and information that spans from initial expectations to actual claims experience. The actuaries and their stakeholders (e.g., members of management) may implicitly or explicitly apply different perspectives on the relative merits of projections based on actual experience or initial expectations, or projections that reflect a blending of the two. As an actuary associated with an audit firm, Mr. Littmann encounters these situations frequently, primarily in a reserving context. Apparently subtle differences in perspectives among actuaries and among various stakeholders when actual experience diverges from expectations (generating divergent projections of unpaid claim estimates) can generate substantial dialogue. The paper presents an exploration of historical progressions of recognizing accident year losses, casts light on certain implications of common actuarial methods, and provides insight on the notion of a reserving cycle akin to an underwriting cycle. The investigation provides a framework for dialogue among stakeholders to the reserving process, as well as identifies areas where actuaries may be able to enhance the technical aspects of, and their communications from, their work processes.

Method. The paper provides examples of the historical progression of accident year loss ratios booked by the industry in aggregate and for a sample of companies. A model is presented to demonstrate the extent to which a combination of cyclical accident year loss ratios and alternate views from stakeholders on their 'best estimates' to be adopted at a point in time can create differences in the estimates of unpaid claims liabilities.

Results. The outcomes are a framework for expressing views on responsiveness to the emerging claims data in relation to initial expectations, as well as illustrations that provide actuaries with insights on the implications of differing views on loss picks. The paper identifies matters for actuaries to discuss among themselves and with their stakeholders. Discussions around these concepts and implications in advance of the periodic reserves meetings may help the meetings go more smoothly.

Conclusions. Apparently small differences in styles for making loss picks from among projections that span from initial expectations to extrapolations from actual data can yield noticeable differences in reserve estimates. Differences in selection approach between stakeholders do matter and create the need for discussion, transparency and documentation.

Keywords. Reserving Methods. Management Best Estimate. Reserve Variability. Credibility.

Disclaimer. Beginning in Section 4, the paper includes commentary, tables, and charts that illustrate a scenario where management's loss picks (for ultimate losses and the associated reserves) are based on the paid Bornhuetter-Ferguson (BF) method and an actuary's loss picks are based on the reported BF method. Under no circumstance should the scenario (or anything else in the paper) be construed as indicative of the author's nor his employer's view on any insurance company management or actuary, nor the author's or his employer's view on any preferred actuarial projection method(s) as the basis for loss picks or booked amounts.

1. Background

The Casualty Actuarial Society's (CAS) literature and seminar archives include papers and presentations that analyze the performance of loss reserves established by insurance companies in terms of how original provisions have fared against the subsequent experience. Various descriptions and potential explanations have been offered for an apparent cyclical pattern to reserve adequacy, akin to the commonly regarded cycle of pricing adequacy. Certain approaches, frequently involving statistical metrics, for testing the performance of various actuarial techniques have been described, with an apparent purpose to enhance the technical strength of the actuarial estimates.

This paper takes a different perspective on the matter. To set the stage for this, I recall the CAS Centennial Celebration in New York in November 2014, at which a luncheon speaker offered the audience a simple challenge. If someone tosses a coin 12 times and 3 heads result, what is the probability of a head on the next toss? Of course, we actuaries have been trained to avoid falling into the trap of responding quickly with 25%, since we treat the 12 observations as a random sample from a population of possible outcomes where we believe that the probability of a head on any toss is 50%. Therefore, we ignore the actual experience and give full consideration to our expectation based on external information. But, if we were informed that the coin-flipper was a con-artist, which introduced the possibility that the coin was biased, then that supplemental information might influence how we respond to the 12 observations and consequently our view on the likelihood of a head on the next toss.

The example illustrates the dilemma that actuaries and management face when confronted with claims data and various actuarial projections of ultimate losses and the corresponding reserves. For medium to long tail lines, initial expectations of ultimate losses are often closely aligned with expectations based on pricing. The dilemma is to know when, and to what extent, to migrate from the original expectation to the experience-based projections. Stated another way, the dilemma is how to choose an ultimate loss estimate based on a collection of projections from different methods applied to alternate data sets and which reflect certain judgments for key parameters, including initial expected losses, development factors, and assessments on the effects of internal operational changes or external environmental conditions.

As multiple personnel are often involved in the analysis of unpaid claims estimates and in forming a view as to the level of reserves to be recorded in an entity's financial statements, differences in the perspectives of these personnel on the relative merit of alternate projections can drive differences in views as to the relative adequacy of the booked reserves.

2. Historical performance of ultimate loss estimates

Publicly-available Schedule P data were obtained and analyzed to assess the progression of accident year booked ultimate loss ratio estimates from the 12-month valuation to subsequent valuations, particularly for medium- to long-tail lines. For short-tail lines, where a substantial portion of ultimate losses are generally paid by the end of the accident period, there is generally lesser variation in the booked loss ratio from 12-months to subsequent valuations. For the longer-tail lines, insurance company management often books ultimate loss ratios at 12 months that are characterized as being "in line with pricing expectations." Hindsight often demonstrates that the ultimate losses are higher or lower than the amounts booked at 12 months, consistent with the historical phenomenon of the cyclical nature of pricing adequacy over time.

Table 1 shows accident year ultimate loss ratios at 12 months and at 72 months for the P&C insurance industry for four lines of business.[1]

Table 1

Comparison of Accident Year Loss Ratios at 12- and 72-months Maturity
Property/Casualty Insurance Industry

		2005	2006	2007	2008	2009
PAL	at 12 months	67%	66%	69%	69%	73%
	at 72 months	63%	63%	67%	67%	70%
	Ratio	0.94	0.96	0.97	0.97	0.97
CAL	at 12 months	61%	62%	62%	62%	63%
	at 72 months	58%	58%	61%	61%	60%
	Ratio	0.95	0.94	0.97	0.98	0.96
CMP	at 12 months	61%	53%	55%	69%	60%
	at 72 months	56%	47%	50%	65%	60%
	Ratio	0.92	0.90	0.92	0.94	0.99
GL-Occ	at 12 months	66%	64%	66%	67%	69%
	at 72 months	55%	54%	60%	61%	61%
	Ratio	0.84	0.85	0.91	0.92	0.89

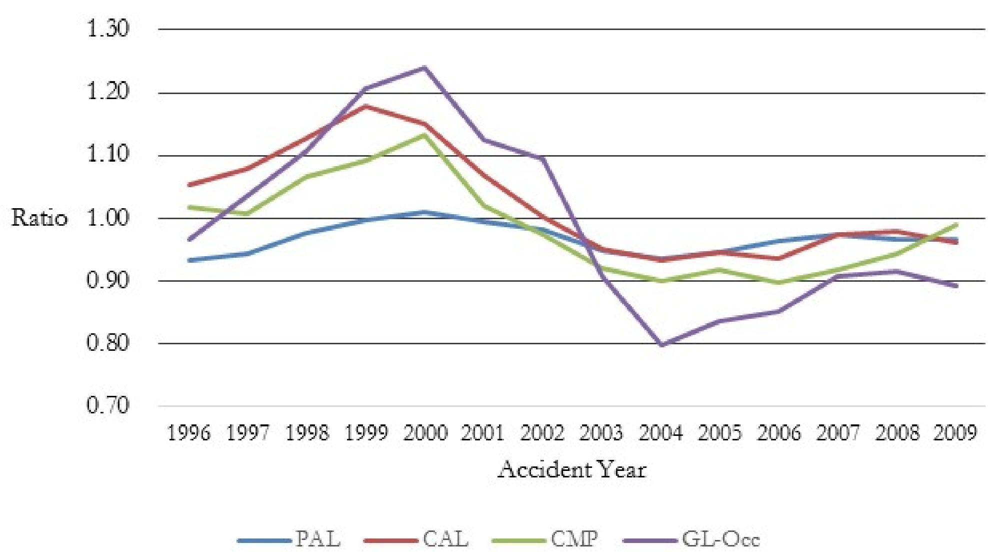
PAL = Private Passenger Auto Liability
CAL = Commercial Automobile Liability
CMP = Commercial Multi-Peril
GL-Occ = General Liability – Occurrence
Source: SNL Financial website. P&C Industry Composite.

[1] Throughout this paper, amounts are shown in various tables and charts. The actual amounts contain more digits than are displayed, and therefore, some apparent arithmetic may be influenced by rounding.

The booked ultimate loss ratios demonstrate varying degrees of change from the 12 month valuation to the 72 month valuation. The magnitude of change appears smallest for the automobile lines, with changes a bit larger for CMP, with still larger changes for GL-Occurrence. For these accident years, we also note that the changes are favorable, as the booked loss ratios at 72 months are less than those booked at 12 months.

Comparable data as shown in Table 1 are provided in Appendix A for a longer experience period, spanning accident years 1996 to 2009. Over the 14-year period, initial booked loss ratios deviated upward and downward with subsequent valuations. Chart 1 shows the ratios of the 1996 to 2009 accident year booked loss ratios at the 72-month valuation, in comparison to the loss ratio booked at the 12-month valuation.

Chart 1
Ratios of Accident Year Booked Loss Ratio at 72-months
Compared to Booked Loss Ratio at 12-months
US P&C Insurance Industry



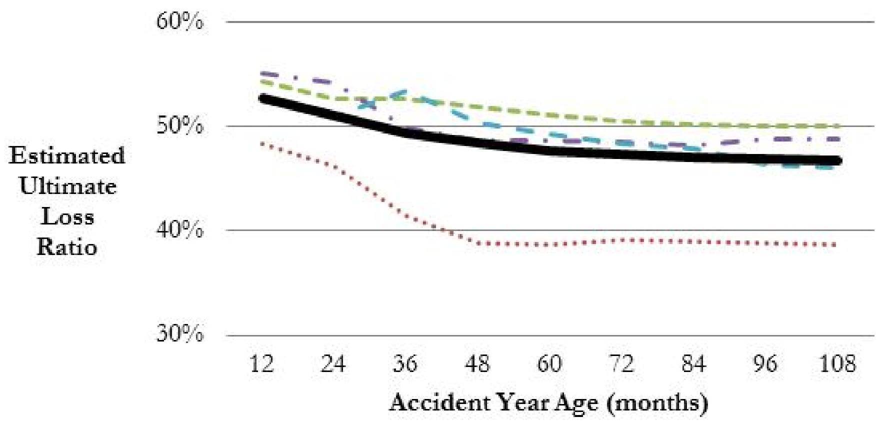
For Personal Auto Liability (PAL), the ratios were in the range from 0.93 to 1.01 over the 14 accident years, with an average ratio of 0.97 (favorable 3%). In contrast, the booked loss ratios for General Liability – Occurrence at 72-months, on average, were within 1% of the loss ratios booked at 12-months. On an accident year by accident year basis, however, individual years' ratios were as low as 0.80 and as high as 1.24.

A particular focus area for this paper is assessing the progression of loss ratios from an initial valuation to subsequent valuations on the path toward "true" (and final) ultimate. Charts 2a and 2b show the progression for CMP and GL-Occurrence, respectively, for the 2006 accident year, from 12 months through the 72 month valuation, and continuing to the 108 month valuation at year-end

2014 reporting. The data are shown for the P&C insurance industry (bold/black line) and for four companies/groups from among the Top 10 based on market share for each line.

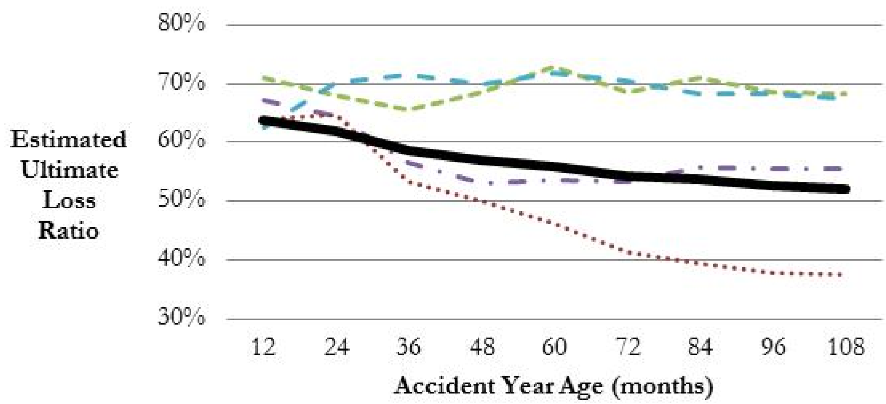
Chart 2a

Progression of Booked Ultimate Loss Ratios
CMP - Accident Year 2006
P&C Industry (bold/black) & 4 Top-10 Companies



For Commercial Multi-Peril for accident year 2006, the industry booked loss ratio at 12 months was 53%, and the booked loss ratio appeared to stabilize at the 72 month valuation at 47%. Thus, with hindsight, the initial booked loss ratio decreased by 10% over subsequent valuations. For the four companies in the sample from the Top 10, initial booked loss ratios decreased by 7% to 19%.

Chart 2b
Progression of Booked Ultimate Loss Ratios
General Liability - Occurrence -- Accident Year 2006
P&C Industry (bold/black) & 4 Top-10 Companies



For General Liability – Occurrence for accident year 2006, the industry booked loss ratio at 12 months (at year-end 2006) was 64%. The booked loss ratio decreased to 54% at the 72 month valuation, with further decreases to 52% at the 108 month valuation (at year-end 2014). With hindsight, the initial booked loss ratio decreased by 18% over subsequent valuations. For the four companies in the sample from the Top 10, one company's initial loss ratio decreased by about 40%, while another's increased by about 10%.

When the ultimate loss ratio is sufficiently different than the estimate at 12 months, there appears to be a tendency for the magnitude of the change to be related to the length of the paid/reported loss emergence pattern. Thus, it is not surprising that larger changes from initial booked loss ratios are observed for GL-Occurrence than for CMP, and, that the booked loss ratios for GL-Occurrence continue to evolve at valuations beyond 72 months, while CMP's loss ratio appears to have stabilized by that valuation.

Along the path from an accident year aging from 12 months to 72 months (or beyond), at what point was there sufficient claims data or other indicators that the ultimate estimates made at 12 months would not hold up? Stated another way, why didn't the industry (or individual companies) get it "right" sooner? If the early claims experience deviated from initial expectations, why didn't booked loss ratios demonstrate a greater response to the data?

In this paper, I explore the notion that, along the path of an accident year aging, different stakeholders to the reserving process take different positions on the degree of responsiveness to the emerging data, as evidenced by differing bases for ultimate loss estimates and the corresponding reserves. What if actuaries' estimates respond more quickly to the emerging claims experience than management in the formation of the best estimate? In the next section, the nature and key features of common actuarial projection methods are identified and described.

3. Features of Actuarial Projection Models

Actuarial analysis of unpaid claims estimates is often performed utilizing multiple methods, which can be applied to various types of data. The table below identifies four common actuarial methods, and types of claims data to which the methods can be applied.

Methods	**Types of Data**
Expected Loss (EL)	Paid losses
Bornhuetter-Ferguson (BF)	Reported losses (payments plus case reserves)
Benktander (BKT)	Claim counts
Chain Ladder (CL) (also known as loss development)	

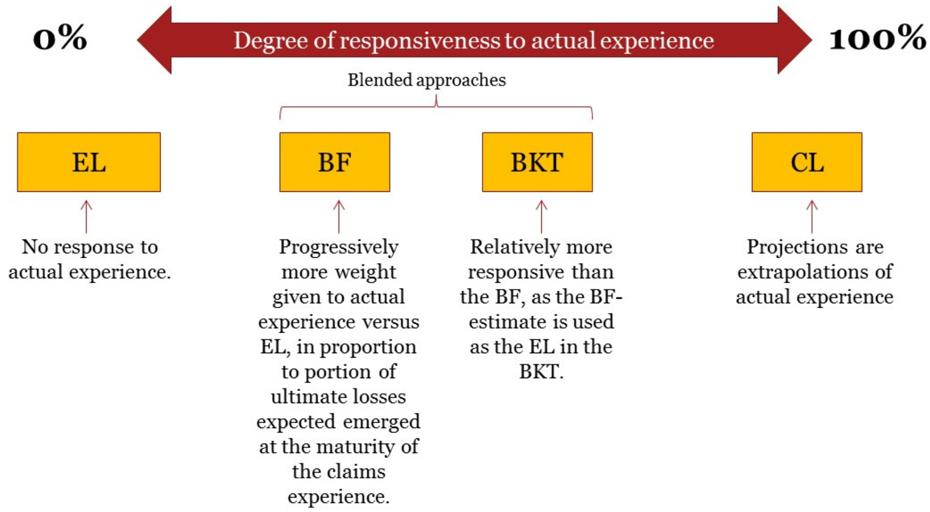
The key parameters of the methods require that judgments be made for each parameter in the application of the methods to a particular set of data. The table below identifies the parameters for each of the methods.

	Methods			
Parameter	**EL**	**BF**	**BKT**	**CL**
Initial expected losses	●	●	●	
Loss development factors (including a tail factor)		●	●	●

By their nature, the four actuarial methods have varying degrees of responsiveness to the actual claims experience. Figure 1 provides a comparison.

Figure 1

Comparative Responsiveness of Actuarial Methods to Actual Experience



In a rare situation where the actual claims experience for an accident period emerges in line with expectations (based on initial expected losses and the expected emergence pattern), all methods will generate the same (and accurate) projected ultimate losses, and there is no divergence among the methods' projections.

Actual claims experience inevitably deviates, to some degree, from expectations, whether in the level of ultimate losses once all claims are reported, settled, and closed, or in the pattern by which the losses emerge, or both. When actual experience deviates (whether favorably or adversely) from expectations, the projections from various methods will diverge, due to the different degree of responsiveness of each method to the actual loss experience. Table 2 shows illustrated BF- and CL-projections that reflect an initial expected loss of 100, a true ultimate of 92, and actual emerged losses being less than expectations at each valuation date, but demonstrating inconsistent deviations to expected amounts. (The assumed loss reporting pattern is shown in Appendix C.)

Table 2

Illustration of BF and CL Projections

when Actual Experience emerges Inconsistently Less than Expected

	Accident Period Age						
	1	2	3	4	5	6	7
Expected	35	55	70	85	90	95	100
Actual	35	52	61	71	78	89	92
% deviation	-1%	-6%	-13%	-16%	-13%	-7%	-8%
BF-estimate	100	97	91	86	88	94	92
CL-estimate	99	94	87	84	87	93	92

In Table 2[2], the actual reported losses at the 1st valuation are with 1% of expectations, such that the BF and CL projections are closely aligned with the initial expected ultimate. By the 4th valuation, the extent of the divergence in cumulative actual versus expected reported losses increased to 16%, thereby decreasing the CL projection to 84. The BF-projection has a tempered response to the actual experience, with an estimate of 86 at the 4th valuation. As the actual experience settles to an 8% favorable deviation at the 7th valuation, the BF and CL estimates are the same and converge at the true ultimate of 92.

Of course, in a scenario where actual loss emergence is greater than expectations, the relative positions of the projections would be reversed, with the CL projection becoming larger than the initial expected ultimate, with the BF method yielding a projection higher than the initial expected amount, but less than the CL projection.

For the remainder of this paper, the emphasis is on exploring implications of divergence of methods projections in terms of responsiveness to actual emerged claims experience, with an assumption that the pattern of actual emergence is in line with expectations, although perhaps on a path to a level of ultimate losses that differs from initial expectations. Therefore, the following examples reflect a consistency in the actual and expected pattern of emergence. Using the same assumptions underlying Table 2 above, Table 3 shows a scenario where actual experience deviates from expected experience consistently over the valuations.

Table3

Illustration of BF and CL Projections

when Actual Experience emerges Consistently Less Expected

	Accident Period Age						
	1	2	3	4	5	6	7
Expected	35	55	70	85	90	95	100
Actual	32	51	64	78	83	87	92
% deviation	-8%	-8%	-8%	-8%	-8%	-8%	-8%
BF-estimate	97	96	94	93	93	92	92
CL-estimate	92	92	92	92	92	92	92

2 In the example, the BKT projection is deliberately not shown, for ease of presentation. The BKT projection is more responsive to the emerged claims experience than the BF, since its algorithm effectively re-cycles the BF projected loss as the input for another BF projection. Thus, the BKT projection generally falls between the BF and CL projections.

Cumulative actual reported losses emerge in the expected pattern, albeit 8% less than expected at each valuation date. The CL projection is consistent at 92 for all valuation dates, since the actual emergence pattern is in line with the expected pattern. The BF projection at the 1st valuation is slightly less than the initial expected amount, and it decreases progressively at successive valuations by the difference in actual versus expected emerged losses.

Appendix B contains an exhibit that provides details of the computations included in Table 3, including additional calculations for the BKT projection. With the spectrum of responsiveness to emerged data as illustrated in Figure 1 above in mind, the response of the BF is equivalent to the reciprocal of the loss development factor to ultimate (that is, the expected loss emergence percentage). In this example, the BF response at the 2nd valuation is 55%. The responsiveness of the BKT projection is dependent on both the expected emergence percentage and the degree to which actual experience diverges from expectations; in Appendix B, the BKT response at the 2nd valuation in this example is 80%.

Additional projections could be illustrated if the methods are applied to multiple types of data, for instance, paid losses and reported losses. This increases the potential divergence among the projections and illustrates another (implicit or explicit) judgment that actuaries and management must make in order to form a view on an actuarial central estimate and management's best-estimate for financial reporting.

The reader may wish to re-visit the charts shown in Section 2 with the progression of booked ultimate loss estimates for the industry and four companies. The progressions tend to follow a deliberate migration from initial expectations of ultimate loss at 12 months toward the value accrued by the 72-month to 108-month valuations. Nevertheless, neither I, nor the reader, can infer definitively whether the progressions followed an explicit, intentional path, (for instance, a reported-BF path) or reflected a changing mix of considerations over time.

4. When Styles Diverge (not just the Projections)

The implications around differing degrees of responsiveness to emerged claims data become apparent in the internal and joint discussions among insurance company actuaries and management, their external actuarial consultants, and the external audit firm's actuarial specialists that support the audit of the company's financial statements. To illustrate:

- Company management may form a view that it takes a while for the actual claims experience and the related projections to be sufficiently credible for management to deviate from initial expectations of ultimate loss for a particular accident period.

- A company's actuary may form a view that a staged approach to selecting ultimate losses is appropriate. For example, for the initial and second valuations, the EL method may be chosen (absent any individual large claims or losses arising from catastrophe events). For the third and subsequent valuations, the actuary may choose a BF estimate, and then shift toward a BKT- or CL-based estimate at valuations nearing the expected completion of the emergence pattern.

- An external consulting actuary (and/or the actuary supporting the external audit firm) may form a view that the ultimate losses for an accident period's initial period-end valuation are best represented by initial expected losses, but then may shift to a BF- or BKT-based estimate for subsequent valuations.

There are differing manners by which the parties may express their views as to the basis for the chosen estimate. These could be based strictly on the passage of time, the magnitude of the development factor, or the type of data.

It can be quite plausible and reasonable that management forms a view for best-estimate ultimate losses and the associated reserves that are different than the actuarial indication. Management may have valid and supportable rationale, considering features of the company's business and operations, as well as external trends and conditions, which management believes have not been fully incorporated within the actuarially-determined projections. For instance, for a portfolio that is exposed to individual large, late-reported claims, for which there has been an extended period of relatively benign claims experience, management may form a best-estimate that is greater than an actuarial indication that reflects a stated or unstated degree of response to the benign historical development experience.

Differences in judgments for forming a view on ultimate losses do not fall solely between actuaries and personnel from other backgrounds and functional roles. Indeed, differences in estimates arise among multiple actuaries involved in the analysis of unpaid claim liabilities for a particular business segment, legal entity, or an insurance company group.

Differences in how actuaries (whether company or external) and management pick ultimate loss estimates will generate differences in estimated unpaid claims liabilities. The illustrations above have shown the relative progression of projections for a single accident period over its successive valuations. Using the same set of assumptions above (where actual emerged losses deviate consistently and favorably from expectations), with initial expected losses of 100 and ultimate losses of 92, Chart 3 shows the progression of ultimate loss projections from the expected loss, paid BF, reported BF, and chain ladder methods.

Chart 3
Comparative Projections of Ultimate Losses

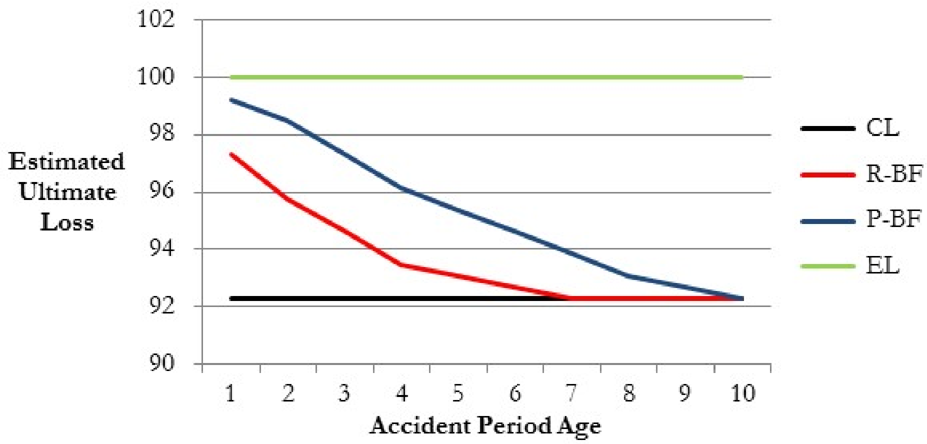


Table 4 shows the array of estimates of ultimate loss by method (as shown in Chart 3), as well as the cumulative payments at each age.

Table 4
Comparative Projection of Ultimate Losses

	Estimated Ultimates				
Age	EL	CL	P-BF	R-BF	**Paid**
1	100	92	99	97	9
2	100	92	98	96	18
3	100	92	97	95	32
4	100	92	96	93	46
5	100	92	95	93	55
6	100	92	95	93	65
7	100	92	94	92	74
8	100	92	93	92	83
9	100	92	93	92	88
10	100	92	92	92	92

The CL-projection is consistently $92 over the valuations, as the claims experience, although less than expectations, is following the expected loss emergence pattern. The EL has a 0% response to the emerging data, maintaining the estimate at $100 over time. The paid and reported BF projections reflect a blending of the CL and EL estimates. Table 5 shows the corresponding progressions of estimates of unpaid claims arising from the methods.

Table 5
Comparative Projections of Unpaid Claims

Age	EL	CL	P-BF	R-BF
1	91	83	90	88
2	82	74	80	77
3	68	60	65	62
4	54	46	50	47
5	45	37	40	38
6	35	28	30	28
7	26	18	20	18
8	17	9	10	9
9	12	5	5	5
10	8	-	-	-

In this example, at the 1st valuation, the $8 difference between the CL and EL estimates of unpaid claims liabilities represents 9% of the CL estimate ($83). By the 5th valuation, the $8 difference between the EL and the CL estimates represents 21% of the CL-estimate of unpaid claims ($37) for the accident period. Maintaining the initial expected losses as the estimated ultimate at the 10th valuation yields an unpaid claim estimate of $8, even though the expected payment pattern suggests that no further payments are expected. At some point along the way from accident year inception, to initial period-end valuation, and to final settlement of all attendant claims, stakeholders need to move off the initial expected loss estimate and respond to the actual claims experience. But when? And to what?

Extending the investigation to the recognition of the accident year incurred losses in a calendar year income statement of an insurance company, Table 6 shows the progression of ultimate loss estimates based on the CL and the paid and reported BF methods, along with the calendar year recognition.

Table 6

Recognition of Accident Year Losses

	Accident Year Ultimates				Calendar Year Incurred Losses		
Age	CL	P-BF	R-BF	Cal Yr	CL	P-BF	R-BF
1	92	99	97	1	92	99	97
2	92	98	96	2	-	(1)	(2)
3	92	97	95	3	-	(1)	(1)
4	92	96	93	4	-	(1)	(1)
5	92	95	93	5	-	(1)	(0)
6	92	95	93	6	-	(1)	(0)
7	92	94	92	7	-	(1)	(0)
8	92	93	92	8	-	(1)	-
9	92	93	92	9	-	(0)	-
10	92	92	92	10	-	(0)	-
				Sum	92	92	92

As illustrated, the CL estimate of ultimate losses for the accident year is accurate at the 1st valuation, and so the recognition of incurred losses is fully contained to the corresponding calendar year. For the reported BF projection, which reflects a blending of initial expectations ($100) and actual reported emergence over time, the initial recognition is $97. Subsequent calendar year results reflect favorable development, in total of $(5) for the reported BF, until the true ultimate of $92 is recognized by the 7th year on a reported basis. The recognition of the true ultimate losses from the paid BF approach is slower, with $99 recognized in the 1st year and favorable development of $(7) in subsequent periods.

The framework and illustrations become more intriguing when the results are compiled from successive accident years at successive calendar year-end reporting dates, where there are deviations in the emerging experience from initial expectations. For this illustration, we utilize the notion of an underwriting cycle, where the conditions around pricing and loss trends yield a cyclical pattern of ultimate loss ratios. Chart 4 illustrates the cycle used in subsequent examples, in terms of its "peaks and valleys" and the time-period from peak-to-valley and valley-to-peak.

Chart 4
Cycle Assumptions for Accident Year Loss Ratios
and a Constant Expected Loss Ratio over Time

Over the entire period, we assume that the initial expected loss ratio is a constant 65%, with actual loss ratios spanning from 50% to 80% over a 24 year period. That is, a starting loss ratio of 65% increases to 80% over a 6-year period, decreases to 50% over a 12-year period, and then returns to 65% over the next 6 years. With a constant premium volume of $154 each year, the expected losses are $100, with actual losses ranging from $77 (when the loss ratio is 50%) to $123 (when the loss ratio is 80%). Appendix C shows the assumptions for premium volume and loss ratios by accident period, as well as the accident period loss payment and reporting patterns.

The results that are shown in the following tables and charts reflect a model where company management ("Mgmt") consistently forms a best-estimate of ultimate and the corresponding reserves based on the paid BF approach. This reflects a tempered approach in terms of its responsiveness to the emerged claims data from the initial to subsequent valuations. Management's estimates are compared to an actuary's estimate, which is consistently based on the reported BF approach. Therefore, the actuary's estimates reflect a tendency for greater responsiveness to the emerging claims experience than management's.[3]

[3] The reader is reminded of the Disclaimer within the Abstract for this paper. The author's use of the illustrative preferences for method selection by "management' and "an actuary" is intended solely to facilitate the description of the scenario and the potential implications of different method selections on one stakeholder's view of the relative position of another stakeholder's estimate for unpaid claims liabilities, rather than referring to the two stakeholders as "Stakeholder A" and "Stakeholder B."

Table 7 shows the array of estimates for the first three accident periods for the first three calendar periods, in order to provide the reader with a view on the mechanics of the model, before showing the overall results once the illustration reaches steady-state in terms of a rolling set of 10 accident years contributing to a calendar year's result.

Table 7

Projected Ultimate Losses by Method and Selected by Stakeholders
Accident Years 1 to 3 at Calendar Year-ends 1 to 3

AY	Age	EL	CL	P-BF	R-BF	Mgmt	Actuary
1	1	100	104	100	101	100	101
	2	100	104	101	102	101	102
	3	100	104	101	103	101	103
2	1	100	108	101	103	101	103
	2	100	108	102	104	102	104
3	1	100	112	101	104	101	104

For accident year 1, the assumed expected loss is $100 (65% loss ratio) and the true ultimate is assumed to be $104 (68% loss ratio, and indicated by the CL at each age). At the first valuation, management's pick for ultimate losses is based on the paid BF ($100), which is slightly higher (rounding) than the expected losses of $100. The actuary's pick ($101) is a bit more responsive to the emerging experience.

At the second valuation for accident year 1, management's estimate increases to $101, while the actuary's estimate increases to $102. These changes represent prior year development in the calendar year when the change in estimate is made.

Table 8 shows the progression of the respective estimates, for the current accident period and for changes in the estimates for prior periods.

Table 8

Progression of Ultimate Loss Estimates by Accident Year by Calendar Year

		Calendar Year				Calendar Year		
	AY	1	2	3		1	2	3
		Ultimate				Prior Year Development		
Mgmt	1	100	101	101			0	1
	2		101	102				1
	3			101				
					Sum =>		0	1
Actuary	1	101	102	103			1	1
	2		103	104				2
	3			104				
					Sum =>		1	2

Each estimate of ultimate for the current accident period is shown in the boxed-cells in the left-portion of the table. The change in estimates for prior accident periods during a calendar period are shown and compiled (shaded cells) in the right-portion of the table.

Management's current accident year estimates are less than the actuary's estimates, due to the lesser response of the paid BF approach to emerging claims data than that of the reported BF approach. Thus, relative to the recognition of the ultimate losses from the actuary's picks, management's recognition of ultimate losses is delayed. For instance, for accident year 1, ultimate losses of $104 will need to be recognized. By the third valuation, management has recognized $101 while the actuary's estimate is $103; management will have subsequent development of $3, while the actuary's estimate will develop by $1.

Table 9 shows the components of calendar year results over the 1st ten years of the model.

Table 9
Illustration of Current Accident Year and Calendar Year Incurred Losses
Years 1 to 10

	Current AY		Change in Prior		Calendar Year	
Year	Ult Mgmt	Ult Actuary	Ult Mgmt	Ult Actuary	Ult Mgmt	Ult Actuary
1	100	101	0	0	100	101
2	101	103	0	1	101	103
3	101	104	1	2	103	106
4	102	105	3	4	104	109
5	102	107	5	6	107	113
6	102	108	7	8	109	117
7	102	107	10	11	112	118
8	102	105	12	12	114	117
9	101	104	13	12	115	116
10	101	103	14	10	115	113

Over the 1st ten years, the actuary's loss picks for the current accident year are higher than management's. (Recall that years 1 to 10 reflect ultimate loss ratios greater than initially expected.) Still, both the actuary and management underestimate the true ultimates, as evidenced by the adverse development of prior years' estimates in calendar year results. Table 10 shows the results as the company reaches a 'steady state' in years 10 to 20.

Table 10
Illustration of Current Accident Year and Calendar Year Incurred Losses
Years 10 to 20

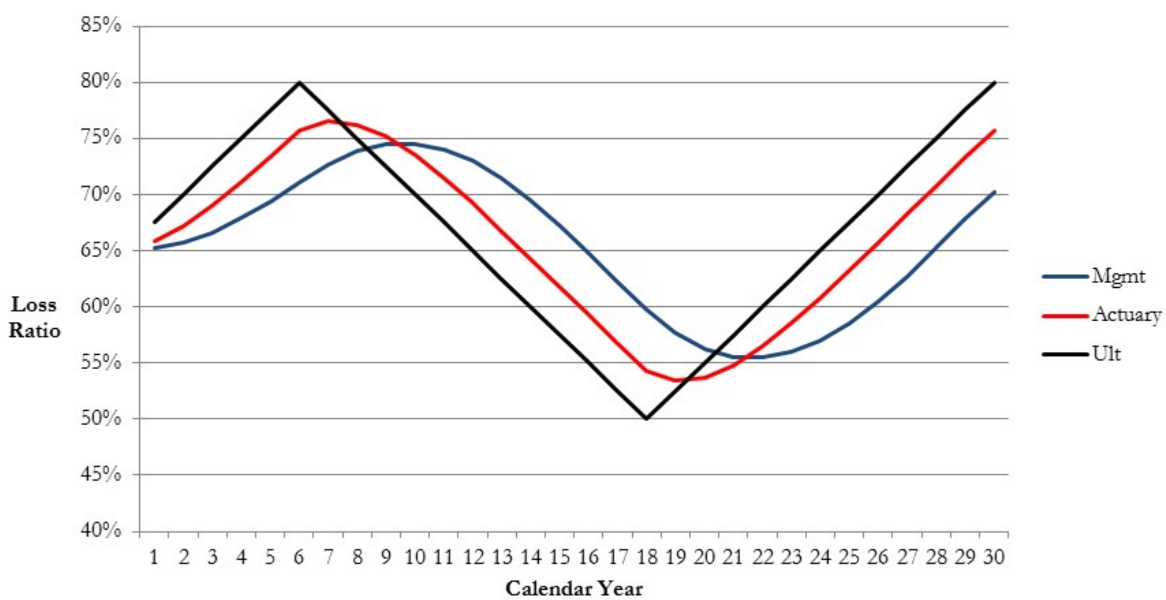
	Current AY		Change in Prior		Calendar Year	
Year	Ult Mgmt	Ult Actuary	Ult Mgmt	Ult Actuary	Ult Mgmt	Ult Actuary
10	101	103	14	10	115	113
11	100	101	13	9	114	110
12	100	100	12	7	112	107
13	100	99	10	4	110	103
14	99	97	8	2	107	99
15	99	96	5	(1)	103	95
16	98	95	1	(3)	100	91
17	98	93	(2)	(6)	96	87
18	98	92	(6)	(8)	92	83
19	98	93	(9)	(11)	89	82
20	98	95	(12)	(12)	87	83

At year 12, true ultimate losses return to 100 (65% loss ratio), and both management and the actuary recognize this as their views of current accident year losses. However, the financial results for calendar year 12 are still hurt by adverse development from inadequate funding of prior accident years.

The results at year 15 begin to show favorable development of the actuary's prior years' estimates; it takes until year 17 for management's estimates to show favorable development. Although the true loss ratio for accident year 18 reaches its low at 50% ($77 ultimate loss), that calendar year's incurred losses of $92 reflect management's current accident year estimate of $98, and favorable $(6) development from prior years. The actuary's initial view of the current accident year loss ratio at year 18 is $92, giving a bit more recognition to the emerged favorable experience than management's $98, but both still higher of the ultimate emerged loss of $77.

The relative trends in loss ratios are shown in Chart 5 below. The chart, based on the assumptions underlying the outcomes, conveys the common notion that the cycle of calendar year booked loss ratios often reflects a delayed and tempered view of the cycle of ultimate accident year loss ratios.

Chart 5
Comparison of Calendar Year Loss Ratios
Based on Alternate Judgments for Ultimate Accident Year Loss Picks



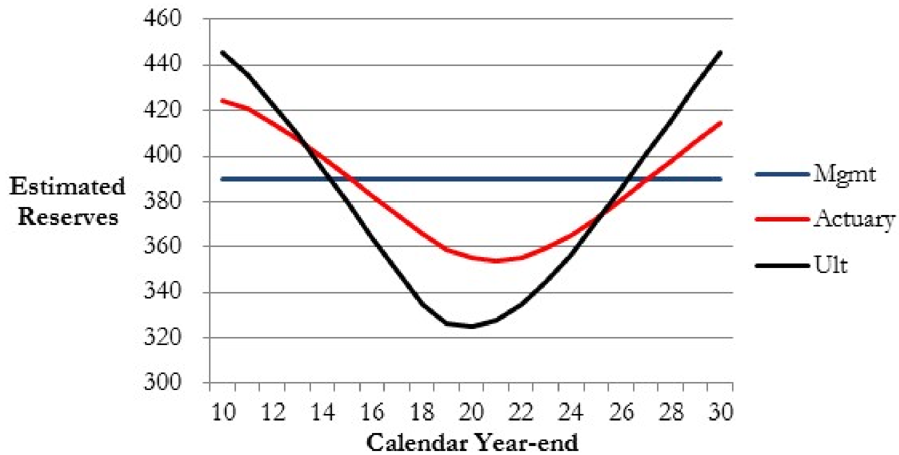
Viewing the model's results in terms of actuarial indicated and management booked loss reserves at successive financial reporting dates provides additional insights as to the potential implications from alternate judgments for the basis of ultimate loss picks. Chart 6 below illustrates the indicated unpaid claim estimates for years 10 to 30 (the 'steady state' period of the model) as selected by management (based on the paid-BF), by the actuary (based on the reported-BF), and based on the (true or hindsight) ultimate.

Chart 6

Comparison of Unpaid Claim Estimates

Based on Alternate Judgments for Ultimate Accident Year Loss Picks

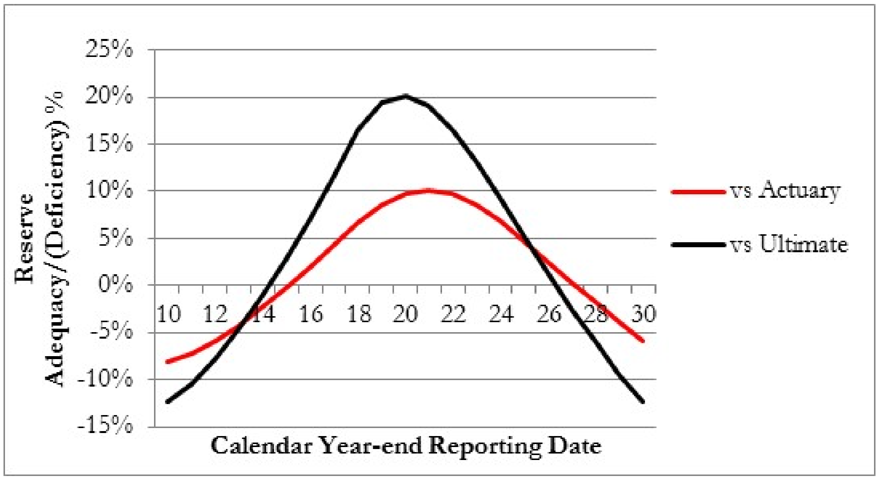
At end of Years 10 to 30



Once in a steady state, with constant premium volumes and ELR's, and the paid-BF as the basis for management's picks, the indicated reserves are constant at $390. The actuary's estimates of unpaid claims liability fall and rise over the period shown, with a partial response in selecting ultimates given the deteriorating and improving true claims experience. The hindsight (true) reserves, based on the cyclical accident year ultimates, demonstrate a greater degree of variability, driven by the constant premium volume and rising and falling levels of accident period incurred losses.

The implications of these relative reserve estimates at a point in time, and over time, are further highlighted in Chart 7, which shows the estimated adequacy of management's reserves, in relation to the actuary's indicated reserves at the particular financial reporting date (the red line), and in relation to ultimate (the black line). A 0% reserve adequacy position corresponds to the situation when the booked reserves are equal to another estimate, whether the actuarial indication or the hindsight (true) estimate of unpaid claims. When management's reserve is below the actuary's (or hindsight) estimate, a negative percentage is shown.

Chart 7
Relative Reserve Adequacy Position of Booked Reserves over Time
Based on Alternate Judgments for Ultimate Accident Year Loss Picks
At end of Years 10 to 30



Adequacy Position vs Actuary = (Booked minus Actuary Indication) / (Actuary Indication)

Adequacy Position vs Ultimate = (Booked minus Ultimate Indication) / (Ultimate Indication)

Differences in perspectives for loss picks that may be perceived as 'small' can generate differences in reserve estimates (at a point in time, not only at ultimate) that are relatively large. Management's reserves at the end of calendar year 10 (four years after the peak true loss ratio for accident year 6) are 8% less than the actuary's indication at that time. Eleven years later (at the end of calendar year 21), after loss ratios have improved, management's reserves are 10% greater than the actuary's indication.

A hindsight (ultimate) view of booked reserves is commonly disclosed in a loss reserve runoff schedule in a public insurance company's 10K annual report, or can be derived from manipulations of data presented in Schedule P of insurance companies' statutory-basis annual statement. In Chart 7 above, management's reserves booked at year-end 10 would be ultimately revealed as having been 12% deficient, and the year-end 20 reserves would be revealed to have been 20% redundant.

An integrated view of the model, in terms of its assumptions for cyclical accident year loss ratios, and the hypothetical management's approach to booking accident year losses (based on a paid-BF method), is shown in Chart 8, including the hindsight view of booked reserve adequacy:

Chart 8
Comparison of Loss Ratios and Hindsight Reserve Adequacy

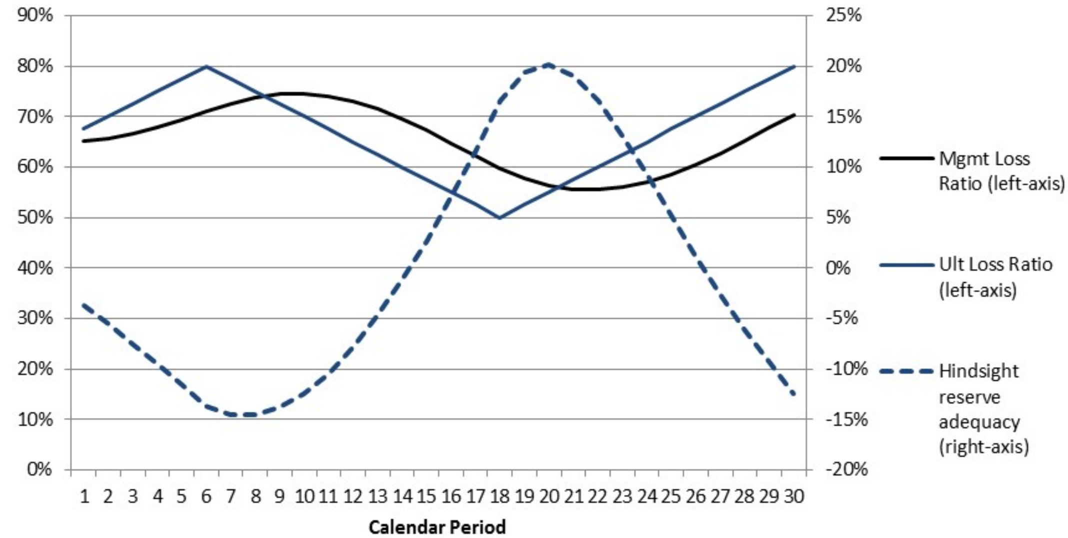


Chart 8 shows the full range of 30 years in the underlying model, including the first 10 years before the steady state is reached in terms of the levels of claim payments and reserves. The chart provides a view on hindsight reserve adequacy over the full range of the assumed cycle.

- A paid BF approach for selecting loss picks creates a delayed recognition of accident year losses, thereby generated a delayed and tempered cycle of calendar year loss ratios, relative to the accident year loss ratio cycle.
- The relative adequacy of loss reserves derived from a paid BF approach, based on the scenario illustrated by the model, ranges from 15% deficient to 20% redundant, in relation to the unpaid claims liabilities from the true ultimate losses. The reserve adequacy cycle is inverted to the true loss ratio cycle, and, in this example, is lagged by 2 periods (driven by the collection of assumptions underlying the model).

5. So, Now What?

I close this paper with a collection of observations, questions, and responsive thoughts (not answers) regarding potential implications of the content in previous sections.

1) The model is simplistic in that it reflects a flat initial expected loss ratio. That is not reality.

   Yes, the model is simplistic when viewed from that vantage point. I acknowledge that managements consider the current accident year's experience when setting ultimate losses and the associated reserves at the initial annual reporting. The scenario illustrates a tempered response to the initial expected loss ratio, by way of the paid BF at *all valuations. I believe the model is instructive as is; of course, the model could be enhanced to show some variation in the initial expected losses, although such variation would likely be less than that manifest by true ultimate losses.*

2) What happens if differences in stakeholders' styles on the basis of loss picks become "large" in terms of the differences among unpaid claims estimates? Stated another way, at what point are different styles (and differences in reserve estimates) too large to tolerate from an "actuarial reasonability" perspective?

   While a valid and thought-provoking question, it goes beyond the scope of this paper.

3) If a company's management books its best estimate that is different than the company's actuarial indication, what are implications on the level of documentation that is expected?

   Standards of practice for the accounting and actuarial professions require that sufficient documentation of the analysis supporting booked amounts and actuarial indications exists. Where the booked amounts are equivalent to the actuarial indication, then documentation that meets the actuarial standards should be sufficient. Where management considered the actuarial indication and formed its estimate based on alternate judgments regarding assumptions, methods, or basis of picks, management should have sufficient documentation highlighting the areas of difference and the basis (evidence, rationale) for such differences.

4) Is the author suggesting that any rational stakeholder adopt a chain ladder projection at an "early" maturity when the development factor to ultimate is "large?"

   Maybe; that would depend on the relative stability of the historical development experience and consistency in company underwriting and claims operations. The author believes that there is opportunity for actuaries to enhance their measurement and communication of the degree of certainty that can be associated with actuarial indications from different methods and types of data. "Inherent volatility" or "large LDF's" are common reasons for discounting or outright ignoring chain-ladder projections at early maturities. But, has the actuary compiled a history of the various projections over time to assess which tend to perform better than others? Has the actuary tested the performance of methods? This was an area of investigation in <u>Claim Reserving: Performance Testing and the Control Cycle</u>, by Yi Jing, Joseph Lebens, and Stephen Lowe (CAS, 2009). Therein they described a testing approach for evaluating the "skill" of a method, as a "measure of the amount of variation captured by the particular actuarial method." They also wrote that "the control cycle should involve an ongoing assessment of the estimation skill of the actuarial methods currently being employed, and exploration of opportunities to enhance overall estimation skill by implementing better actuarial projection methods."

5) Is the author suggesting that, at some point along the path of an accident year maturing, a particular projection method could be viewed as "wrong" in relation to another method?

   Many individual judgments are made in the course of a reserving analysis and each of these, individually, could be viewed as reasonable, optimistic, conservative, or unreasonable. Generally, the scope of an actuary's professional opinion regarding reserves is on the appropriateness of methods and reasonableness of assumptions and judgments <u>in total</u> (all accident years, all analysis segments), not on individual elements. This is consistent with the actuarial opinion on the loss reserves in aggregate, not for individual claims.

So, my response is "No," in that an individual judgment for a particular method for a particular accident year is likely not the subject of a professional opinion. Still, in this context, consider the following.

Chart 9

Comparison of Ultimate Loss Estimates
Based on Alternate Judgments for Ultimate Accident Year Loss Picks
With a View on a "Reasonability Interval" of the CL-projection

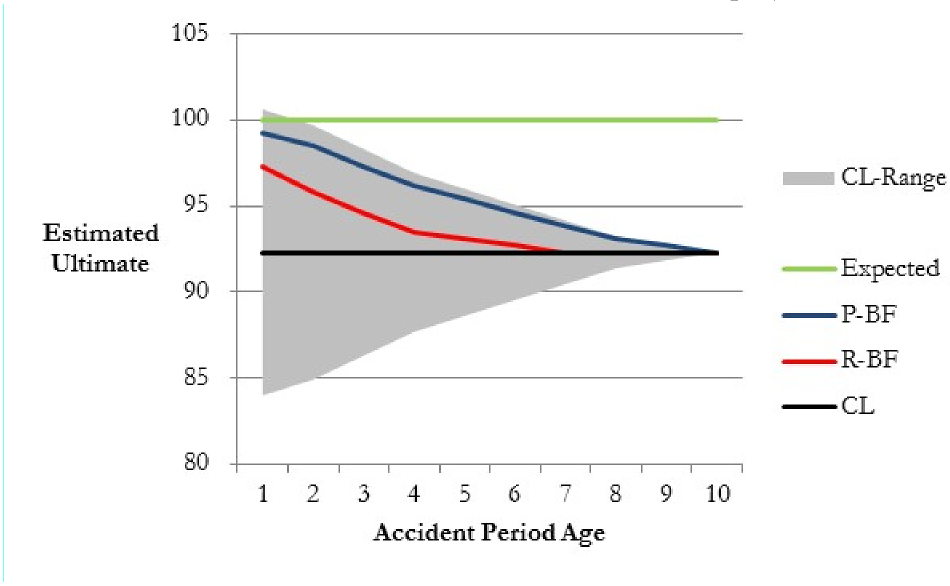


Chart 9 is similar to Chart 3, showing the progression of ultimate loss projections from four basic methods. I have added a shaded area to illustrate a potential range ("reasonability interval") of projected amounts from the Chain Ladder method. The range decreases in breadth over time as the accident year matures. Based on the graphic, the Expected loss pick at the 1st or 2nd valuation would be within, albeit at the high-end of the CL-range. By the 3rd valuation, the Expected amount would not fall within the CL-range. At that point, would a pick based on Expected loss be "wrong?"

6) Is the author suggesting that the stakeholders document their styles for how they generally form their picks?

A documented reserving policy for an insurance company is an element of good governance around reserves, as the reserves are a significant accounting estimate in the financial statements. The company actuary, management, and the Board (audit committee) should ensure a common understanding of their own, and each other's, perspectives, tendencies, principles, and objectives (that is, styles). Likewise, company stakeholders and key personnel from the external audit firm should ensure understanding of each other's perspectives.

A documented reserving policy will help to describe management's view on "why now?" in terms of a response to the emerging claim experience, whether for reporting on results for a quarter for which detailed actuarial re-projections are available or not, and also in response to one or more individual large loss events.

The reserve decision making-process is fluid as internal and external conditions evolve and change over time. Therefore, an overly prescriptive policy is not realistic, desirable, or appropriate.

6. Conclusions

The styles of management and an actuary for selecting loss picks do matter. An articulated policy surrounding how management selects its estimate is good governance to recognize that this selection process does matter and is not subject to whim. Documentation of the selection process of management promotes transparency for stakeholders and is a check that the policy has been followed. It also provides, through transparency, a check on the bounds of how large style differences can become as quantified by the extent of differences from actuarial loss picks. Further, the actuary should ensure that documentation of the actuarial process is in compliance with actuarial standards of practice.

Actuaries and management should communicate, up front, and share their views on how they each think about the degree of responsiveness to the emerging data that their loss picks will likely reflect. When the reserving styles of the various stakeholders are in-sync, the periodic discussions around the period's claims experience and forming views on indications and booked reserves are smoother and less contentious, as compared to when the styles are out-of-sync.

Acknowledgements

The author acknowledges and appreciates the contributions of Kathlyn Herrick and Lisa Slotznick to this paper. Kathlyn assisted with the compilation of industry data and preparing some of the charts displayed herein. Kathlyn and Lisa reviewed an early draft of the paper and enhanced the readability of the paper. Responsibility for any remaining typos, errors, or lack of clarity remains with the author.

Biography of the Author

Mark Littmann is a principal in the Actuarial Services practice of PricewaterhouseCoopers LLP, the US member firm of the PwC global network of firms. He leads actuarial teams supporting external financial audits of insurance organizations and corporations with self-insured exposures and providing consulting services regarding reserving valuations and processes and other analytical applications. He has a degree in Mathematics and Economics from Valparaiso University. He is a Fellow of the CAS and a Member of the American Academy of Actuaries.

Appendix A

US P&C Industry Booked Loss Ratios
Accident Years 1996 to 2009
At 12-month & at 72-month Valuations
(plus 108-month valuation for GL-Occurrence)

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average
PAL	at 12 months	76%	73%	71%	75%	79%	78%	76%	71%	68%	67%	66%	69%	69%	73%	72%
	at 72 months	71%	69%	70%	75%	80%	78%	75%	67%	64%	63%	63%	67%	67%	70%	70%
	Ratio	0.93	0.94	0.98	1.00	1.01	1.00	0.98	0.95	0.94	0.94	0.96	0.97	0.97	0.97	0.97
CAL	at 12 months	77%	78%	77%	78%	77%	73%	67%	64%	62%	61%	62%	62%	62%	63%	69%
	at 72 months	81%	84%	87%	92%	89%	78%	67%	60%	57%	58%	58%	61%	61%	60%	71%
	Ratio	1.05	1.08	1.13	1.18	1.15	1.07	1.00	0.95	0.93	0.95	0.94	0.97	0.98	0.96	1.02
CMP	at 12 months	74%	68%	74%	74%	71%	75%	60%	56%	59%	61%	53%	55%	69%	60%	65%
	at 72 months	76%	68%	79%	80%	81%	76%	59%	52%	53%	56%	47%	50%	65%	60%	64%
	Ratio	1.02	1.01	1.07	1.09	1.13	1.02	0.97	0.92	0.90	0.92	0.90	0.92	0.94	0.99	0.99
GL-Occ	at 12 months	80%	81%	82%	79%	79%	89%	72%	69%	68%	66%	64%	66%	67%	69%	74%
	at 72 months	77%	84%	91%	95%	98%	101%	79%	63%	55%	55%	54%	60%	61%	61%	74%
	Ratio	0.97	1.04	1.11	1.21	1.24	1.13	1.10	0.91	0.80	0.84	0.85	0.91	0.92	0.89	0.99
	at 108 months	78%	86%	99%	102%	101%	102%	80%	63%	53%	53%	52%				
	Ratio	0.98	1.07	1.20	1.29	1.27	1.14	1.11	0.90	0.78	0.81	0.82				

Loss ratios for GL-Occurrence demonstrated a degree of further development from the 72-month valuation to the 108-month valuation.

For personal auto liability (PAL), the average ratio of the loss ratio at 72-months divided by the loss ratio at 12-months) over the 14 accident years was 0.97 (favorable 3%), with observations that spanned from 0.93 to 1.01.

In contrast, the booked loss ratios for General Liability – Occurrence at 72-months, on average, were within 1% of the loss ratios booked at 12-months. On an accident year by accident year basis, however, individual years' ratios were as high as 1.24 and as low as 0.80. At 108-months, the highest and lowest ratios were 1.29 and 0.78.

Appendix B

Numerical Example to Illustrate Degree of Responsiveness
of Alternate Methods to Actual Loss Experience

	EL	BF	BKT	CL
A Premium	125	125	125	
B Reported Losses	51	51	51	51
C IELR	80%	80%		
D LDF (to Ultimate)		1.82	1.82	1.82
E Expected Reported %		55%	55%	55%
F Expected IBNR %		45%	45%	45%
G Expected Loss	**100**	100		
H Expected Reported Loss		55		
I Expected IBNR Loss		45		
J BF Estimated Ultimate		**96**		
K Initial Expected Loss for BKT			96	
L Expected IBNR Loss for BKT			43	
M BKT Estimated Ultimate			**94**	
N CL Estimated Ultimate				**92**
O Response to Actual	0%	55%	80%	100%

Item(s)	Notes
A, B	Assumed data for the illustration
C, D	Assumptions for the key parameters of the methods.
E, F	Derived from D.
G	A multiplied by C
H, I	Derived from E, F, & G
J	B plus I
K	Equal to J
L	Derived from K & F
M	B plus L
N	B multiplied by D
O	Derived as (Difference of method-estimate to the EL-estimate) divided by the (Difference of the EL and the CL-estimate)

Appendix C

Assumptions for Accident Year Premium, ELR's, and Ultimate Loss Ratios
and Accident Year Loss Payment and Reporting Patterns

Supporting the Tables & Charts in Section 4

AY	Premium	ELR	Ult LR	AY Age	Payment	Reporting
1	154	65%	68%	1	**10%**	**35%**
2	154	65%	70%	2	**20%**	**55%**
3	154	65%	73%	3	**35%**	**70%**
4	154	65%	75%	4	**50%**	**85%**
5	154	65%	78%	5	**60%**	**90%**
6	154	65%	80%	6	**70%**	**95%**
7	154	65%	78%	7	**80%**	**100%**
8	154	65%	75%	8	**90%**	**100%**
9	154	65%	73%	9	**95%**	**100%**
10	154	65%	70%	10	**100%**	**100%**
11	154	65%	68%			
12	154	65%	65%			
13	154	65%	63%			
14	154	65%	60%			
15	154	65%	58%			
16	154	65%	55%			
17	154	65%	53%			
18	154	65%	50%			
19	154	65%	53%			
20	154	65%	55%			
21	154	65%	58%			
22	154	65%	60%			
23	154	65%	63%			
24	154	65%	65%			
25	154	65%	68%			