Loss Reserving and Ratemaking
In An Inflationary Environment
by
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Review by: E. LeRoy Heer

Mr. Shatoff has presented a concise and straightforward model depicting the reporting, reserving and settling of claims. In this age of complex econometric models which attempt to account for N-tuples of factors which may or may not significantly influence the observable phenomenon being studied, it is often easy to overlook the power inherent in a simple model to isolate the crucial factors involved. Conversely, it is also true, that in the analysis of a "naive" model, one tends to let one's analysis and thought processes become naive as well.

Herein is the crux of my problem with Mr. Shatoff's model and his conclusions. Mr. Shatoff states, as a conclusion from his analysis, that:

"The model shows that errors in ratemaking and loss reserving are inevitable in an environment of fluctuating inflation."

While this may be true in the strictest sense, I would take issue with the idea that the errors must be of the magnitude depicted, if the actuary has applied some judgment to the model's indications.

The results of the model and the conclusion reached by Mr. Shatoff assume that simple straightforward application of the mechanistic reported loss development model will be accepted by the actuary in setting reserves and thus will lead to erroneous conclusions in reserving and ratemaking. I would strongly challenge that assumption as unrealistic in day-to-day actuarial practice.

It is the province of the actuary to estimate the probable outcome and impact of future contingent events (such as ultimate loss settlement). He accomplishes his task by using his knowledge of current forces affecting these pending future outcomes (as well as historical knowledge of the past). The idea that a trained and experienced actuary would ignore the economic forces at work in the environment and not attempt to adjust his results accordingly, but rather would rely strictly upon a model that projects past historical data, marks a certain lack of actuarial maturity in dealing with reserving and ratemaking problems.

Changes in the rate of inflation are not events that, in general, occur in our economy suddenly and without warning. These changes occur only after observable forces have been at work for some time. Contrary to Mr. Shatoff's statement, "Clearly, at the end of year 3, when rates must be set for year 4, there is no way to predict the onset of inflation two years in the future.", there is available to the actuary much data that is useful in predicting such events. For some examples, the growth rate of the money supply, the magnitude and general direction of movement in employment and unemployment, the nature of the observable competitivenesss in the economic marketplace, the state of international trade balances and many other indicators which precede a change in the value of currencies.

While the actuary cannot precisely predict the exact turning point, nor the exact rate of change, he should have some expectation of the direction that future currency values will take and a fair estimate of the probable magnitude. Unless the actuary has been lulled to sleep by the uniformity of the past, he will act upon his expectations and, all other things being equal, that action will likely err to the conservative side when it comes to reserving for claims.

In the example set forth in the paper, the historical claims cost inflation rate of 0% in years 1 through 5 jump to a 5% annual rate of change in years 6 and 7 then remain at the higher price level for years 8 through 10. Thus, if the inflation index were displayed on an annualized basis, using year 1 as the base year, one would have a claims cost inflation index that looks like this:

Year	Claims Cost Index	Year	Claims Cost Index
1	1.0000	6	1.0500
2	1.0000	7	1.1025
3	1.0000	8	1.1025
4	1.0000	9	1.1025
5	1.0000	10	1.1025

Let's retain Mr. Shatoff's assumption that the number of claims and their constant dollar severity do not change, i.e., the nature of the damage represented by the claim remains physically constant. Thus the only factor affecting claims payout is the price level (value of money). Let us also assume the settlement patterns with respect to timing remain the same as set forth in the model.

The fact that inflationary pressures affecting claim costs have been building would have been noticed by the actuary in the latter part of year 4 and almost certainly by early year 6 (when year-end 5 reserves are established). The signs of price-level pressures would have been very evident and very much publicized by the media that monitors the economic sector.

At the end of year 5, the actuary knows that he has the following situation with respect to historical incurred and still pending claims:

Losses Paid and Reserved as of Year-end 5

Accident Year	Cumulative Paid Losses	Known Case Reserves	IBNR Reserve	Incurred Lossess
3	$7,000	$ 0	$ 0	$7,000
4	5,000	2,000	0	7,000
5	2,000	3,000	2,000	7,000

Due to his knowledge of the economic world around him, the actuary will likely anticipate that inflation is coming and estimate that it will be 3% in year 6. (How does this happen? The actuary has noticed that economic predictions as to stable currency have been gloomy and that deficit government spending have already devalued the currency -- he estimates, based on informed judgment, that year 6 will sustain 2 to 4% claim cost inflation). He will thus adjust his estimates accordingly and consider other possible analytical methods to obtain reserve estimates.

Since he perceives that the historical indications will not hold true for the future, due to anticipated changes in the value of money (inflation rate), he will most likely seek another method to adjust the reserves to required levels. At the least, he will add supplemental reserves of $150 or 3% to the case reserves outstanding at year-end in order to reflect his expectations.

At this point, because of his uncertainty about the future, the actuary will stop and assess his reserving method. Since the actuary perceives that future settlements will be affected by an adverse inflation of 3% annually (his subjective estimate at year-end 5), he likely will perform further analysis to separate paid and outstanding losses by accident year and report year so that he may derive a better estimation of how long pending items will remain outstanding and thus will be exposed to inflationary change.

At this point in time we have reported claims pending of $5,000 from accident year 5: $3,000 of which we expect to pay in year 6 from accident year 5 and $2,000 of which we expect to pay in year 6 from accident year 4. We also anticipate that a late reported claim arising from year 5 will be reported in year 6 and settled in year 7. At this point we would adjust those pending reserves upward by 3%, so that our revised grid becomes:

Acc. Year	Adjusted Incurred Reported Loss Development at Age: 12	24	36 (Ultimate)
2	$5,000	$7,000	$7,000
3	5,000	7,000	7,000
4	5,000	7,060	
5	5,090		

We would then alter our historical loss development factors or seek another method to establish the reserve.

It is likely that we would seek a method that placed less emphasis upon past development under conditions which are now largely irrelevant. The current expectation, past history aside, anticipates that the IBNR expected from accident year 5 would have a settlement value of ($2,000)(1.03)(1.03) = $2,122 when settled in year 7. Thus our reserve at year-end 5 would not be $7,000, but rather $7,272. This reserve is made up of $5,000 case reserves plus $150 of supplemental case reserve plus our higher IBNR. The total increase in reserve brought about by these changes is nearly 4%.

I believe this sets forth a rather more realistic approach than Mr. Shatoff's model. The actuary has appropriately brought to bear his skills in extrapolating from external data and events an expectation of impact on claims costs. Further, he has done this prior to waiting for the events to work their way into the ultimate development of the numbers.

The following judgments that the actuary might reasonably come to and consider are outside the indications of the mechanistic model. However, their basis would have been observable in the economy.

1. At year end 5, the actuary assesses that an inflation rate of 3% will obtain into the future.
2. At year end 6, the actuary adjusts his estimate to 5% anticipated inflation on pending cases, due to more data and another year's observations.

3. At year end 7, the actuary anticipates a decline in the inflation rate to 3% for year 8 and subsequent.

4. At year end 8, the actuary becomes convinced that the inflation rate has leveled off at 1.1025 of the year 1 price level.

Under these assumptions the actuary would adjust the outstanding reserves from the amounts reported, to take into account his anticipation of inflationary pressures, the reserve carried at each year end would be adjusted to reflect the actuary's anticipation of loss cost at the time those losses are settled. Adjustments would be made to both the reported case reserves and the expected IBNR Reserve. The following table outlines these adjustments and the resulting Reserves.

Calendar Year	Actuarial Inflation Index Expectation for:		Year-Ending Reserve Adjusted by Actuarial Expectation		
	Year x+1	Year x+2	Reported	IBNR	Total
1	1.000	1.000	$5,000	$2,000	$7,000
2	1.000	1.000	5,000	2,000	7,000
3	1.000	1.000	5,000	2,000	7,000
4	1.000	1.000	5,000	2,000	7,000
5	1.03	1.0609	5,150	2,122	7,272
6	1.05	1.1025	5,250	2,205	7,455
7	1.1025	1.1356	5,513	2,271	7,784
8	1.1025	1.1025	5,513	2,205	7,718
9	1.1025	1.1025	5,513	2,205	7,718
10	1.1025	1.1025	5,513	2,205	7,718

As one can see this quite improves the accuracy of the reserving and thus will also improve the quality of the pricing. I have revised the author's Exhibit 2 to reflect what this judgmental adjustment to the mechanistic loss reserving model accomplishes.

Reviewer's Revision of Author's
Exhibit 2
Carried and Required Reserves

Year End	Calendar Year Estimated Incurred Losses	Carried Reserve	Required Reserve	Difference	Error as % of Required Reserve
1	$7,000	$7,000	$7,000	$ 0	0
2	7,000	7,000	7,000	0	0
3	7,000	7,000	7,000	0	0
4	7,000	7,000	7,100	-100	-1.4%
5	7,622	7,272	7,455	-183	-2.5%
6	7,533	7,455	7,717	-262	-3.4%
7	8,046	7,784	7,717	+67	+0.9%
8	7,650	7,717	7,717	0	0
9	7,717	7,717	7,717	0	0
10	7,717	7,717	7,717	0	0

Summary

While this reviewer believes that simple models and straightforward analyses can be useful to the actuary, it is very important to remain cognizant that numerical indications must often be augmented by informed judgment. It is the job of the actuary to be familiar enough with the economic environment to formulate such expectations and apply them properly.

If models and numerical formulae were applied absolutely and without some subjective inputs, the actuary could be quite easily replaced by a knowledgeable clerk operating a calculator, or a computer. Analysis, anticipation and forecasting are part and parcel of the actuary's profession. Applying our skills at assessing future contingencies from current events and data, then combining that judgmental assessment with historical indications to develop "best" estimates is the actuary's chief function.

We are paid to know our current environment, and anticipate its implications for the future. Historical data and previously developed procedures can only serve as a starting point for the actuary in developing his estimates of future ultimate loss costs and prices.