ACCTUARIAL ISSUES TO BE ADDRESSED
IN PRICING INSURANCE COVERAGES
By E. James Stergiou

REVIEWED BY Sheldon Rosenberg and Aaron Halpert

As most actuaries that have had an opportunity to prepare a rate filing will tell you, the ratemaker will generally have to convince three principals that the rate he is generating is a reasonable one. First, he must convince himself. This first step alone is, in many cases, a difficult and laborious task due to the many technical uncertainties with which an actuary must deal. However, only when this task is accomplished can one proceed to the next level of review.

Second, company management must be in agreement with the conclusions offered by the actuary. The questions posed by management will generally deal less with technical specifics of how the rate indications were developed and more often with whether due consideration has been given to past or proposed changes in all aspects of company policy as it affects the claims department, marketing department, underwriting department or others.

Finally, having gained the blessing of his management, the actuary must also receive approval for the filing from the respective regulatory agency. The regulator has the responsibility of seeing that rates promulgated by him are adequate and neither excessive nor unfairly discriminatory. At this point the actuary must be able to defend any judgement made within the rate filing; be it expense provisions, classification criteria, etc.

It is in dealing with this third level of review, that Mr. Stergiou provides us with much helpful advice in how to prepare a better rate filing.

He discusses and provides several examples of variables that he feels currently receive summary treatment at best and are more often perhaps totally ignored in the preparation of a rate filing. Yet, several of these factors may, in his opinion, have a direct and significant impact on the bottom line results.

The thrust of the author's points are that consideration of these variables will lead to better understanding on the part of regulators and the insureds they represent, and thus facilitate receiving approvals of needed rate revisions. One must wonder however to what extent action taken by regulators are based on considerations that are well beyond the scope of the technical arguments being presented.

We feel that Stergiou's paper would have been more effectively presented, had he keyed his remarks toward that important first level of review. Certainly the elements of ratemaking referenced in this paper relate to the technical soundness of a rate review; they should therefore be geared toward the ratemaker, to be used as a tool to convince himself that the answer he gets is a realistic and non-biased one.

Another issue to be raised in light of the additional exhibits the author wishes to see incorporated in rate reviews is that an actuary may never have the time nor the need to look at all the

pieces of information that may impact a given rate indication. The key juncture therefore becomes the point at which the data base is defined and report specifications are prepared. The actuary must always leave himself the option of looking at data in a specific format, but may actually exercise that option only if and when it becomes necessary to do so. This issue will have particular meaning in the area of loss development as will be discussed later.

Another comment pertaining to the entire paper, is that the author's purpose would have been better served had he used examples incorporating actual data rather than hypothetical data. The latter, although *designed to make a point, may not be true representations of the* "real world." An example based on actual annual statement data would have been particularly effective in illustrating the authors contention that applying the traditional loss development approach to data in Part 2 of Schedule P of a company's statement will lead to projections of ultimate losses that are "far different than those predicted in the company's balance sheet."

Comments of a specific nature will now be addressed to several of the issues mentioned in Mr. Stergiou's paper.

Loss Development Factors

The method of developing losses by analyzing historical age-to-age valuations of incurred (or paid) losses is evaluated by Stergiou. He points out several instances where this approach may lead to a

biased forecast of ultimate losses. But does it? Let's examine two of his examples carefully. His first example deals with the case of a company that has changed its reserving adequacy gradually over time. To show how a bias may result, he first employs the traditional loss development approach in Exhibit I to project the needed reserves for the years listed. He then adjusts the outstanding losses by assuming the latest diagonal to be indicative of the company's present reserving practice. These most recent reserves are "detrended" at 10% annually in order to estimate what loss reserves in prior years would have been had the company used its current reserve practices. After adjusting the outstanding losses he adds back the paid losses and recalculates the needed reserves on Exhibit V-B. These ultimate incurred losses based on the adjusted outstanding losses are 8% lower than the ultimate incurred losses on Exhibit I.

We do not agree though that this comparison between Exhibits I and V-B is proper. If one examines the link ratios on Stergiou's Exhibit I, it becomes evident that the chosen ratios should not be the average of the link ratios in each column. One chooses the average only when several elements are believed to be sample estimates of the same underlying value. In this example, there is clearly a downward trend in the link ratios over time. This by itself is fairly conclusive evidence that the company is becoming more accurate in setting its initial reserves. Thus rather than using an average of historical age-to-age loss development factors, an actuary faced with the figures on Exhibit I might use the link

ratios based on the latest available information (the last link ratio in each column). Perhaps he would even project a trend in these ratios and use a ratio lower than that of the latest years. Had the last link ratio in each column of Exhibit I been used instead to project ultimate losses, the projected losses would have been 3,330,920. This number serves as a more reasonable comparison to Stergiou's result on Exhibit V-B.

The point is, a bias exists only if the traditional loss development procedure is used blindly without examining the numbers for trends. If a trend of the type in Exhibit I exists, then it can be incorporated into the procedure in conjunction with information derived from the more detailed exhibits presented by Stergiou.

The same comment applies to the second example presented in Exhibit VI of Mr. Stergiou's paper. In that exhibit, loss development factors are based on historical movements in paid losses. After analyzing disposal patterns on Exhibit VI-A, and realizing that the company is currently closing claims at a faster rate than during the earlier experience period, the author adjusts the historical paid losses in Exhibit VII-B so that the underlying pay-out pattern for all years is the same.

Once again, the downward trend in the link ratios on Exhibit VI would have yielded similar information. The average should not (and in most rate reviews would not) be chosen as the representative link ratio. Again, the main point is that prominent changes in the company's handling of claims or reserves are usually evident from

the traditional loss development diagonals themselves. In these cases additional information may be required to aid in the selection of representative link ratios. In the examples cited, an actuary choosing the average link ratios would not just risk losing credibility with regulators but would more importantly derive a wrong answer.

Regarding the examples themselves, we feel that the reader is left somewhat confused in proceeding from the example based on incurred losses (Exhibit I) to the example based on paid losses (Exhibit VI). Unless told otherwise, one believes they are both based on the same experience. The author would best serve the reader by stating clearly that they are not.

It should be mentioned that Stergiou's method for adjusting the outstanding losses derives no information from reserves prior to the latest diagonal. While the evidence of a 30% trend in average outstanding losses (when overall inflation is assumed to be 10%) may signal a change in reserve adequacy, some information may still be derived from prior diagonals. One way to do this would be to multiply each of the earlier average outstanding losses by $(1.3/1.1)^n$ where n is the number of years between the evaluation of the reserve and the latest evaluation date. In this way outstanding losses would be on the same "adequacy level" and yet yield independent pieces of information. The analogue of this is when one uses several policy years of data in reviewing liability rates. Because each year is at a different cost level, a trend factor is applied to each

year's data. However, the earlier years are not set to be equal to the latest year divided by the trend factor. Instead all the years are used to derive a trend factor and after the trend is applied, each year's information is used in setting the rates.

The adjustment made on Exhibit VII-A to reflect the change in the company's settlement rate raises an interesting question. The author mentions that "although use of report year data....is preferable, many insurers do not have such data readily available. However, the Exhibit VII-A (Sheets 1-5) calculation is usually available and can be used for our purpose." The key question is, without any information regarding reported claims, how can the ratios on Exhibit VII-A, Sheet 5 be hypothesized. Specifically, how does one assume that 50% of all claims to ultimately be reported for Accident Year 1978 are paid as of the first maturity. It would seem therefore that an adjustment based on disposal ratios (which are perhaps difficult to retrieve within a company's data base, but are actual numbers rather than assumed ratios) would be preferable.

One must also be careful in defining cases where it would be proper to apply the author's adjustment to paid losses. For example had the numbers in his Exhibit VII-A, Sheet 5 been changed only slightly, the resulting adjustment would lead to questionable results. The author claims that the adjustment leads to more stable link ratios. If the numbers in column 2 of Exhibit VII-A, Sheet 5 were changed to read as follows:

Year	1	2	3	4	5
1974	.30	.40	.75	.90	1.00
1975	.35	.45	.80	.95	
1976	.40	.50	.85		
1977	.45	.55			
1978	.50				

then the general arguments in favor of making the author's adjustment would still hold (i.e. disposal ratios are still increasing over time). However, the derived first to second link ratios after the adjustment would be

	1-2
1974	.732
1975	.853
1976	1.036
1977	1.322

As can be seen, the author's adjustment does not lead to stable results in this case.

Trend Factors

Stergiou provides an interesting example of how calendar year paid claim cost trend factors may be distorted when the average settlement date is changing over time. While the assumption in his example that average paid claim cost increases with each maturity level within an accident year is certainly a familiar assumption, the idea that significantly different trends exist at each maturity is somewhat surprising. It is important to note though that the distortion in

trend can occur even when the underlying severity trend is the same at each maturity level. This will happen when there is a sudden increase in claim frequency. To see this, consider the simple case where 50% of ultimate claims are closed in the year they are incurred, 50% in the following year. The underlying severity trend is 10% for both types of claims. Also assume that 100 claims are incurred each year except the latest year when 200 claims are incurred. The loss data may look as follows:

Accident Year	Number of Claims Incurred	Average Claim Cost For Claims Paid	
		During Year	In Following Year
1970	100	1000	2000
1971	100	1100	2200
1972	100	1210	2420
1973	100	1331	2662
1974	100	1464	2928
1975	100	1611	3222
1976	100	1772	3544
1977	100	1949	3898
1978	200	2144	4288

The corresponding calendar year paid claim cost data would then be as follows:

Calendar Year	Average Paid Claim Cost
1971	1550.00
1972	1705.00
1973	1875.50
1974	2063.00
1975	2269.50
1976	2497.00
1977	2746.50
1978	2728.67

Notice that the paid claim cost entry for the latest calendar year is distorted due to the fact that it contains an artificially large number of smaller claims (closed within the accident year). Thus, we see there are other good and sufficient reasons to exercise care when using paid claim cost data for trend, particularly in lines with a long payout pattern.

Expenses

Two models for calculating rate changes are presented by the author as alternatives to the loss ratio procedure currently used. The current procedure is:

$$\text{Indicated Rate Change} = \frac{\text{Rate Level (Indicated) Loss Ratio}}{\text{Expected Loss Ratio}} - 1$$

The alternative models presented are:

a) Indicated Rate Change =

$$\frac{\text{Rate level Loss Ratio + Fixed Expense Ratio}}{1 - \text{Variable Expense Ratio}} - 1$$

b) Indicated Rate Change =

$$\frac{\text{Rate Level Loss Ratio}}{1 - \text{Variable Expense Ratio}} + \text{Fixed Expense Ratio} \times \text{Inflation Factor} - 1$$

It is difficult to interpret the inflation factor included in model (b) above. Is this a relative trend factor to measure how fast fixed expenses are growing relative to premium? Are variable expenses loaded on this part of the premium?

Also, it should be noted that using model (a) above (as the author does in Exhibit III-A) implicitly makes the drastic assumption that fixed expense dollars will remain the same as during the experience period.

Perhaps a more appropriate model would be:

c) Indicated Rate Change =

$$\frac{\text{Rate Level Loss Ratio + (Fixed Expense Ratio)}t}{1 - \text{Variable Expense Ratio}} - 1$$

Where t is the rate at which fixed expense dollars will be increasing for the period for which rates are being set.

This formula can be derived as follows. Suppose L' is the rate level loss ratio (i.e. L' = l'/P where l' is the projected loss

dollars, and P represents premium at present rates). Furthermore suppose f is the fixed expense dollars needed during the experience period, and f' is the fixed expense dollar that will be needed during the upcoming period (i.e. f' = tf). Also define F' = f'/P, F = f/P, and let V be the variable expense ratio. If r - 1 is the indicated rate level change, then:

$$(1-V)rP = PL' + PF'$$

$$= PL' + PFt$$

$$r = \frac{L' + Ft}{1 - V}$$

Again, model (a) above implicitly assumes t=1. The indicated rate change derived by the author in Exhibit III-A using the simple loss ratio method is +16.7%. This implicitly assumes that fixed expenses will also increase at 16.7% annually. His second calculation based on model (a) indicated a +15.0% change. Had he used model (c) with the assumption that fixed expense dollars are increasing at 10% a year the result would have been:

$$\frac{.700 + .065\ (1.10)}{1 - .335} - 1 \doteq .160$$

It is important to note that fixed expenses will be decreasing as a percentage of premium (i.e. after the rate change fixed expenses will constitute .065(1.1)/1.16 = .062 of premium) but the loading in the equation should be .065(1.1) rather than just .065.

Investment Income

While the author explicitly mentions in the text of his paper that he is not discussing the propriety of reflecting investment income in the ratemaking process, the reader may be easily misled by the words used in Exhibit X, Sheet 1. It states "the cash flow discount model.... produces an investment income offset to the gross premium to reflect reserves for losses and unearned premium". The numbers derived on line (20) of Exhibit X, Sheet 3, are only one source of input into the general equation to calculate the company's total return. The appropriateness of this return for the risk being assumed by the insurer, must be weighed in choosing the corresponding underwriting profit to be used in calculating rates.

The numbers calculated on line (20) of Exhibit X also seem unnecessarily high until various assumptions are recognized. An expected loss ratio of .86 is used and no commissions are contemplated. The results in line (20) are extremely sensitive to these assumptions. For example suppose commissions are 20% of premium and therefore the expected loss ratio is .66. Line (20) then becomes:

	@ 9%	@ 10%
(20) Present value of income less present value of outgo	18.27%	19.72%

FINAL COMMENTS

Mr. Stergiou's paper has made an important contribution in reinforcing our need to always test the assumptions incorporated in a filing. He has gone even further by sharing with us specific tests he uses to verify the accuracy and reasonableness of loss development factors. We do not believe his intent is to give us a method to use, by rote, to replace the methods we currently use. Rather, his goal is to get us to constantly reappraise our assumptions. This goal is as important as any in the ratemaking process and is well worth the author's efforts.