DISCUSSION BY JEROME A. SCHEIBL

The essence of a sound actuarial ratemaking procedure is a balanced intelligent appraisal of all pertinent information leading to a best estimate of future occurrences translated into unit costs. This suggests that a necessary and important element in the ratemaking process is the continuous evaluation of methods and data bases as they relate to the forces affecting losses and expenses. Without such an evaluation, ratemaking becomes a mechanical process of merely measuring past results without proper focus on the accuracy, stability, and responsiveness of rate levels.

Economic, social, technological, and political forces have left their marks on workers' compensation insurance since Ralph Marshall's day. Their dynamic influences continue to be observed along with revolutionary changes in our society's attitudes toward individual rights, the role of government, and the responsibilities of business. As might be expected, therefore, the continual evaluation of the ratemaking process of a line so sensitive to these forces suggests occasional revisions to keep pace with conditions expected to exist during the time rates are to apply.

Mr. Kallop's paper describes the 1975 National Council on Compensation Insurance ratemaking procedure, thereby updating the Marshall paper[1] and filling a void in casualty actuarial literature on workers' compensation ratemaking technique. His presentation serves a second but equally important purpose in that it demonstrates how and why the National Council procedures currently differ from those used years ago. He carefully points out that innovations adopted in the ratemaking process are not suggestive of defects in the older methods but are rather necessary adjustments to develop rates that are responsive to the changing nature of the workers' compensation line and the conditions by which it is affected. Mr. Kallop illustrates the need for flexibility in methodology in arriving at the best estimate of the financial aspects of future occurrences.

[1] Marshall, R. M., *Workmen's Compensation Insurance Ratemaking*, (Revised 1961), Casualty Actuarial Society.

Approximately half of the countrywide workers' compensation premium volume is generated in states where the National Council provides rate calculations from data it has compiled either as a ratemaking organization or on an advisory basis. The other half of the volume is written in states where rates are developed either by an independent rating bureau or by a governmental body.[2]

Ratemaking methods may and do differ among those used by the National Council and by independent state bureaus. This discussion illustrates how one independent bureau has coped with the problem of assuring responsive ratemaking methods through somewhat different approaches than those used by the National Council. Its methods and those of the National Council have the common goal of achieving the best estimate of the financial effects of future occurrences. Therefore, variations in techniques and results should not detract from the actuarial soundness of the rates that are derived therefrom.

Annual premium volume in California is currently about 1½ billion dollars. This represents approximately ⅓ of the business not under the jurisdiction of the National Council or approximately 17% of the countrywide volume for all carriers in non-monopolistic states. Data is gathered and rates are promulgated by the Workers' Compensation Insurance Rating Bureau of California.[3]

California rating practices differ somewhat from those in other states. Rates published in the manual are the minimum rates that must be used by all carriers on all business. Loss and expense constants are not provided for in manual rules which is consistent with the minimum pricing concept. Premium discounts are not permitted and all experience modifications are promulgated on an intra-state basis. Retrospective rating is permitted on a monoline basis only and only through the use of a prescribed tabular plan.

[2] These states are California, Delaware, Massachusetts, New Jersey, New York, Pennsylvania, and Texas.

[3] Formerly the California Inspection Rating Bureau and hereinafter referred to as the California Bureau.

The California Bureau recognized several years ago that the workers' compensation situation in that state was such that rate level adequacy and stability could best be achieved by emphasizing responsiveness to conditions and experience in the ratemaking process. Aggregate policy year data was first used in a 1961 rate revision in lieu of unit report data. This data was used in conjunction with calendar year experience in a manner similar to the National Council procedure except that 60% weight was given to calendar year data rather than the 50% weight used by the National Council. Greater responsiveness was also achieved about the same time through the compilation of calendar quarter data permitting the use of the most recent four quarters in the determination of the rate level adjustment factor.

Development factors through 1970 were based on three-year average incurred policy year loss ratio developments as compared to the National Council practice of developing separate ratios for premium and losses using two-year averages. Losses were assumed to be developed to an ultimate basis at 84 months. In the 1972 revision it was noted that loss development followed a cyclical pattern using incurred data. The use of three-year averages made it difficult to project peaks and troughs of the pattern. It was apparent in 1972 that the incurred loss ratio development pattern was approaching a trough in the cycle. The ratemaking procedure was revised at that time to what was considered to be a more responsive method based on a three-year average paid-to-paid approach. The three-year average incurred-to-incurred approach was readopted in 1975 after it appeared that the trough in the development cycle had been passed.

Subsequent to the presentation of Mr. Kallop's paper, the National Council introduced loss ratio trend into its ratemaking procedure to recognize the imbalance of social and economic inflationary influences on premiums and losses. Although trend factors are derived from twelve-month rolling calendar year loss ratios measured at the end of each half year, such factors are used in conjunction with both the policy year and calendar year data in rate calculations. Observed trends are adjusted for credibility using a Spearman Rank Correlation D-statistic approach.

An on-level loss ratio trend was suspected in California experience as early as 1962. Trend factors were calculated on the basis of twelve-month rolling calendar periods measured at the end of each succeeding quarter. Trend factors were made a part of the formal calculations of the calendar year loss ratio from 1963 through 1968. A change was made in 1970 to

base trend calculations on the 16 latest quarterly loss ratios after adjustment for seasonality. In addition, a trend factor other than unity was used only when the data was determined to be significant using the two-sided Spearman Rank Correlation Coefficient and a 95% significance level.

In 1969 it was determined that further responsiveness in the ratemaking process might be achieved if calendar/accident year data were used. Calls for such data have been issued each year since that time and have provided the basis for a major revision in the rate level determination process in 1976.

The new method uses calendar/accident year loss ratios for a number of years adjusted to reflect development to ultimate values and to current premium and benefit levels. This data is trended using a double exponential smoothing method.[4] Since accident year data projected by this method is on an exponential basis giving greatest weight to the latest accident year and progressively diminishing weights to each prior year, trended data can be determined on a cumulative basis. The influence of older years on projected experience diminishes significantly with age. Because of the exponential nature of the curve determined by this method, the loss ratio used in the rate level calculation is derived directly from the extrapolated curve. This is in contrast to the usual linear method of applying the calculated trend to actual experience.

Accident year incurred loss development factors have followed a rather definite upward pattern in recent years. This suggests that the three-year average development used for projection purposes may not be sufficiently responsive for ratemaking purposes. Possible alternatives are the use of trended factors or the factor for the latest year. The later option was selected in a filing made early in 1976.

Mr. Kallop alluded to a new approach under study for developing rates for classes with credibility less than unity. This approach, utilizing country-wide relativities to complement state relativities, may be considered as yet another step toward more rate responsiveness in that it will result in rates more closely corresponding to the peculiarities of each manual class. The California Bureau classification rate calculations also use supplementary

[4] This method is illustrated in the Appendix as it has not been commonly used for ratemaking purposes in the past. It is more fully described in Brown, Robert G., Smoothing, Forecasting & Prediction of Discrete Time Series, 1963. Prentice-Hall.

data when two policy years do not qualify for 100% credibility. Rather than external data, however, the California Bureau achieves responsiveness by adding earlier years until full credibility is reached subject to a maximum of five years.

Both the National Council and California Bureau, each in its own way, have focused much attention and research on the need for responsiveness in ratemaking methods. The fact that techniques may differ is irrelevant as long as each bureau continues to develop what it believes to be its best estimates of future costs under future conditions—the goal of every ratemaker.

APPENDIX

The double exponential smoothing technique may be demonstrated by an example using a filing made by the California Bureau early in 1976.[5] The filing, as applied to new and renewal business, contemplated an effective date of April 1, 1976, with a subsequent revision scheduled for January 1, 1977. Therefore, the midpoint of the exposure period in this illustration is February 15, 1977.

Calendar/accident year loss ratios adjusted to the then current premium and benefit levels as developed to ultimate values are shown in Column (1) of the following table.[6] These values are used to derive the point ($\hat{a}$) and the slope ($\hat{b}$) at the midpoint of accident year 1974. The loss ratio at the midpoint of the exposure period (2.625 years from the midpoint of accident year 1974) is derived by a linear extrapolation from point $\hat{a}_{1974}$ using slope $\hat{b}_{1974}$.

Points and slopes on the exponential curve are defined as:

and
$$\hat{a}_t = 2S_t - S_t^{[2]} \tag{1}$$

$$\hat{b}_t = \frac{\alpha}{1 - \alpha}(S_t^{[2]}) \tag{2}$$

[5] Credit is given to David Skurnick, former California Bureau Actuary, who adapted the double exponential smoothing technique to projecting loss ratios for ratemaking purposes.

[6] Accident year loss ratios prior to 1969 are estimated from policy year data. Because of the weighting process inherent in the smoothing technique, the effects of such early year estimates on the projected loss ratio are minimal.

where:

α = a selected weight to be given to
the latest X in deriving S_t and to
the latest S_t in deriving $S_t^{[2]}$.

$S_t = \alpha X + (1 - \alpha) S_{t-1}$

$S_t^{[2]} = \alpha S_t + (1 - \alpha) S_{t-1}^{[2]}$

X = on level loss ratio

The California Bureau Actuarial Committee used historical policy year data to test various values of α to determine a value that resulted in an optimum balance of rate level adequacy, stability, and responsiveness. After a number of tests, including variations of α by age of data, an α of .2 was selected.

The calculations of $\hat{a}_t$ and $\hat{b}_t$ are straightforward and can be easily traced in the following table. It should be noted that it is not necessary to determine these values for each year—only for the point where extrapolation begins.

Since it is necessary to have a value of S_{t-1} to determine S_t, it is necessary to estimate an initial S_{t-1} using assumed values for $\hat{a}_{t-1}$ and $\hat{b}_{t-1}$. The technique used in this filing was to determine a least squares regression line based on accident year 1966-1970, assume the slope of this line to be b_{t-1} and extrapolate to t — 1 to derive the value of $\hat{a}_{t-1}$. Since these estimates are made in rather early years they have a minimal effect on the projected loss ratio.

ACCIDENT YEAR LOSS RATIO PROJECTION BY MEANS OF DOUBLE EXPONENTIAL SMOOTHING

$\alpha = .2$

Midpoint of Accident Year	(1) On Level Loss Ratio	(2) S_t $.2 \times (1) + .8 \times S_{t-1}$	(3) $S_t^{[2]}$ $.2 \times S_t + .8 \times S_{t-1}^{[2]}$	(4) $\hat{a}_t$ $2S_t - S_t^{[2]}$	(5) $\hat{b}_t$ $\frac{.2}{.8}(S_t - S_t^{[2]})$
		.5264*	.4828*		
7/1/66	.5879	.5387	.4939		
7/1/67	.5748	.5460	.5043		
7/1/68	.5956	.5559	.5146		
7/1/69	.6510	.5749	.5267		
7/1/70	.6043	.5808	.5376		
7/1/71	.6600	.5966	.5494		
7/1/72	.7391	.6251	.5645		
7/1/73	.7639	.6529	.5822		
7/1/74	.7801	.6783	.6015	.7551	.0192

Projected loss ratio as of:
$2/15/77 = \hat{a}_{1974} + 2.625\,\hat{b}_{1974} = .7551 + 2.625(.0192) = .8055$

*Values obtained by deriving $\hat{a}_{1965}$ and $\hat{b}_{1965}$ from the least squares regression line based on observed loss ratios for accident years 1966-1970 and simultaneously solving the identities in columns (4) and (5) to derive the initial S_t and $S_t^{[2]}$.