DISCUSSION BY WILLIAM P. AMLIE

Mr. Hurley stated his partialities for the fire insurance ways. We all might share his feeling after reading, for example, *Best's Review* for January 1974 "The 1969-1973 statutory underwriting gain for fire is the best five year dollar record of any line of business written by the stock insurers . . . and . . . fire insurance is a consistent profit maker for the mutuals."

His appended list of papers in the *Proceedings of the Casualty Actuarial Society* illustrates the wide range of topics a discussion of commercial fire ratemaking could encompass, and justifies narrowing the scope of the paper to recounting the history of the present methods, and explaining an actual calculation of overall rate adjustment and its distribution to classification. Proposing and evaluating other possible procedures, or considering changes entailed in merging monoline and package experience, or data produced under different statistical plans, would have been beyond the purview of the paper.

One consistent extension would have made the paper more valuable to a student seeking a complete description of a current rate revision. These revisions, unlike the paper, do not stop short at determining the change by classification. The revised rates or indicated changes extend to construction/protection groups within classification. A brief outline could have been given of the respective part in these changes of formula-derived credibility-weighted loss ratios, and of judgement, and the necessity of keeping fixed relationships and minimum differences between groups.

Section 5,B. gives in detail the present system of spreading the overall needed rate change to classification. The student might be interested in comparing this method to those described in the *Proceedings of the Casualty Actuarial Society* for other lines in which the change for a segment must be derived by supplementing its own experience by that of larger and more credible geographical or industrial areas. The combined changes for all segments must be adjusted to produce the overall change required. In the author's notation, L, variously subscripted, is the loss ratio made by combining the loss ratios of smaller segments in proportion to their premium, and M is a combination of credibility weighted loss ratios. Thus M_c is the credibility weighted ratio of the state classification loss ratio, ${}_sL_c$, with that of the region for the class and group of classes, ${}_rL_c$ and ${}_rL_g$. These M ratios in turn are combined by weighting them in proportion to premium. No symbols were shown for this, and the clumsy notation of a double subscript

may be pardonable: M_{cg} is the average of M_c ratios, each given weight in proportion to its premium in the classification Group, M_{ge} is the average of credibility-weighted Group ratios M_g, weighted in proportion to each Group's share of earned premium in the experience used in determining the statewide overall rate change. Various indices and correction factors are needed in revisions by segment to adjust the M ratios so they produce the required overall change. In Section 5,B; 3.c and d, the relativity for the specific class could be shown as $\frac{M_c}{M_{cg}} \cdot \frac{M_g}{M_{ge}}$.

This formula for deriving specific class adjustment factors is used in ratemaking for some other lines of business. For burglary, column 10 is expressed by the same formula, if M_c is the credibility-weighted territory and entire state loss ratio for a classification, and M_g the weighted average of the state loss ratio for a single classification and for all classifications.[1]

The formula also applies to general liability-manufacturers and contractors, where the territorial division is between state and national.[2] There, in contrast to commercial fire, it was thought necessary to bring the loss ratio of the larger area to the average State level of experience before it could be used. Another difference was in completing M_c to the extent ${}_sL_c$ lacked 100% credibility by the average of ${}_rL_c$ and ${}_sL_g$, rather than using ${}_rL_g$ to the extent the combined credibilities ${}_sZ_c$ and ${}_rZ_c$ were below 100%. The ${}_rL_g$ loss ratio for the larger geographic and industry area was not used in calculating M_c for general liability.

These differences between ratemaking methods for different lines could be more easily identified if someone could establish a better notation than my double subscripts to enable concise comparisons. Similarities between lines are now apt to be obscured in the necessarily lengthy arithmetic examples presented in any description of ratemaking mehods. Comparisons might be gratifying to students of a taxonomic turn of mind, but more significantly they could focus attention on whether methods should differ or be identical. A uniform and concise notation should facilitate comparisons between the methods described in the *Proceedings* for setting classification relativities for the different lines of business.

[1] Steven H. Newman, "Burglary Insurance Ratemaking," *PCAS*, LIII (1966), p. 322.

[2] Jeffery T. Lange, "General Liability Insurance Ratemaking," *PCAS*, LIII (1966), p. 45.

Mr. Hurley's catalogue of papers omitted his own "A Credibility Framework for Gauging Fire Classification Experience", *PCAS*, Volume XLI, (1954). He there proposed separate credibility tables for Dwellings, Mercantile Contents and Manufacturing, to replace the single and arbitrary table then in use. The credibility tables presently used seem to be cruder versions of the tables proposed in that earlier paper. Credibility is now found by dividing six years premium at present rates by this premium plus one of three constants. The constant is $500,000, $2,500,000 or $10,000,000, the largest value being selected for classes of high hazard risks with expectation of unstable loss ratios. The proposed table also intends to vary credibility inversely to fluctuations in the loss ratio.

Perhaps the unstated credibility definitions of the present formula are also close to those proposed then. That standard gave 100% credibility if the body of experience would produce a loss ratio 10% higher than the "true underlying" ratio fewer than 3 times in a hundred, and zero credibility if it would exceed this limit 30 or more times. This corresponded to 1.9 and 0.5 standard deviations, respectively, of experienced loss ratios about the expected. Due warnings were given of possible inapplicability of the binomial distribution for this purpose.

I calculated the standard deviations of annual collected loss ratios about the six year ratio for some of the larger classification in recent commercial fire revisions in two large states. Variations in actual frequency and claim size would have provided a better test than variation in loss ratios, and loss ratios at present levels might be more appropriate than the actual ratios used in the attached graph of this data. The average ratio in the revisions was about 54.0%. By the standard above for zero credibility. 0.5σ would equal 10% of this ratio, 5.4%, and $\sigma = 10.8\%$. At 100% credibility $1.9\sigma = 5.4\%$, and $\sigma = 2.8\%$, by the standard given.

Standards were not set for partial credibility. The graph simply connects σ for zero and 100% credibility by a line. Partial credibility might have been found by the square root rule, for example, or by carrying the definition forward consistently to find σ for 50% credibility so that the area representing classifications with loss ratios more than 10% above the underlying loss ratio is equal to the average of the 3% for 100 and 30% for zero credibility.

The graph is a rough test of credibility in that the greater the fluctuation of loss ratios from year to year the smaller the credence that can be

given data for ratemaking. If the formula does not give excessive credibility, the points should fall close to the line for higher credibilities. The extreme variation is in the more hazardous groups B and C, but the annual loss ratios of the least hazardous group, A, seem also to vary more than was contemplated when assigning credibility.

The credibility assigned is one of the more important features of any rate revision. A derivation of a fire table would involve extensive theory and data on the split between "basic" and "peak" or "trivial and non-trivial" losses. The great variation in size of fire claims complicates any theoretical derivation of a credibility standard. Presumably, the effect would be to increase the requirement from those in the *PCAS* XLI paper even more than the liability and automobile numbers of claims were increased when size of claim was introduced in similar formulas. The paper might have mentioned any empiric tests made of the present formula. To what extent, for example, does actual variation in loss ratios support the different constants for the three groups?

Mr. Hurley points out excessive efforts "to 'true up' rates with the vagaries of class loss experience" can imperil rate adequacy. This, and the successful results produced by the ratemaking methods so well described in his paper perhaps show there is no need for any revision, but some basis of comparing credibility standards in commercial fire to those used in other lines would have been of interest.

AUTHOR'S REVIEW OF DISCUSSIONS

It was a happy stroke that the reviewers, Messrs. Amlie and Schneiker, while neither neglected an overview of the paper, each singled out somewhat different aspects for critical analyses and further commentary thereon.

After supplying valuable background on the formation and activities of the National Insurance and Statistical Association, Mr. Schneiker prefaced certain timely and pertinent commentary on present fire ratemaking practices with a valid distinction between manual class rating on many casualty lines and class adjustments in fire insurance when each insured's rate differs contingent on the schedule rating of the physical hazards of the particular risk.