DISCUSSION BY J. S. SAWYER

Mr. Bickerstaff has presented an excellent paper on the rating of Automobile Collision coverage. As he points out, there is a great need for a review of our Automobile Physical Damage ratemaking techniques. Unlike the Liability coverages which have been treated rather exhaustively in respect to the characteristics contributing to loss, our Physical Damage ratemaking techniques have largely ignored the loss characteristics inherent in the automobile itself.

His use of the lognormal model provides a fine example of the use of a mathematical tool in the solution of a practical problem. As with any model there are practical problems which must be solved prior to its actual use in determining rates.

Among the problems that I foresee are the following:

1. It will be difficult to secure reliable information regarding the damageability and repairability of a given model of automobile prior to its introduction to the public.

2. The model assumes that given a certain vehicle with an expected severity of loss, one can calculate the appropriate deductible credits to be applied. From past experience, we know that such things as geographical location of the risk and type of driver can contribute heavily to the loss severity. For example, let us assume that all cars in a given cost group are used in an urban area where the impact speed of any collision is assumed to be relatively low and damage is largely confined to bumpers and fenders. In this particular instance, the value of the deductible would be greater than if we took the identical group of cars and used them in a rural area where impact speeds of 60-100 m.p.h. might be common and therefore severity much worse. Thus, it would seem that a grouping by vehicle repairability characteristics alone would not be sufficient to calculate the value of the deductible. From this, one might argue that the basic territorial rate would remove any distortion along these lines and that automobiles of various cost groups would tend to stay in some relation to each other. However, from the physical characteristics of some of the crash tests that have been conducted recently, it is not clear to me that two automobiles which sustain substantially different damage at

some given impact speed will not have nearly the same amount of damage at some other impact speed. This would necessitate extensive tests at various impact speeds to determine if an automobile of one model was properly grouped with an automobile of some other model.

3. The assumption was made in Mr. Bickerstaff's paper that the absolute frequency was the same for all repair cost groups. This seems to me to be a dangerous assumption since it is perhaps more likely for a youthful operator to operate an automobile in one of the lower repair cost groups. Admittedly, I have not seen which automobiles might be in the groups contemplated by Mr. Bickerstaff, but assuming that a Chevrolet is not to be grouped with a Cadillac, it might well turn out that the absolute frequency for the two groups is substantially different simply because of the mix of operator characteristics involved. Geographical variation of frequency may also significantly affect the charge for the proper deductible and may also tend to nullify the assumption of constant frequency.
4. The use of the truncated lognormal distribution is valid only when applied to raw data which conforms to the lognormal distribution above the deductible amount. In actual practice, the problem of "padding" deductibles may alter the true deductible Collision data by throwing claims under the deductible into the distribution and thus make it unreliable in estimating the first dollar Collision claim distribution. This would be especially true if the data to be considered were for $100 deductible claims rather than the $50 deductible used. Since the type of deductible chosen by the insured seems to vary in proportion to his Collision cost, it may well be that the only data available in certain areas would be the $100 deductible experience in which case this "padding" would be most prevalent.

The foregoing is not meant to criticize the intent of the paper presented, but rather to point out the practical problems which I foresee will need to be overcome before a workable model can be established. I am in wholehearted agreement that we need to put our house in order in regard to Physical Damage ratemaking and the steps outlined in Mr. Bickerstaff's paper present a thought provoking and valuable contribution to such a change. The reader should also consider the extension of this valuable tool

to other ratemaking disciplines such as the pricing of deductibles in the various amount of insurance categories in the Homeowners line. The path which Mr. Bickerstaff has started us on may well prove to be one of the most valuable practical tools in ratemaking.

DISCUSSION BY DALE NELSON

This paper, in the reviewer's mind, is one of the finest to have been presented to the Society in recent years. Not only for its subject matter, but also for the author's approach. It is a superb example of an actuarial attack on an important problem. Most papers tend to concentrate on either the practical or the theoretical side of the problem; this one encompasses a very readable blending of both sides.

In view of the widespread publicity in recent years concerning the damageability and repairability characteristics of today's cars and the rash of studies underway to isolate and quantify those characteristics, Mr. Bickerstaff's paper is certainly opportune. On the assumption these studies will be successful in developing some appropriate damageability indices or expected average repair costs, he advances a ratemaking approach for automobile physical damage which would directly take this new information into account. In the process, he develops a fairly complete model of the expected loss profile for the physical damage coverages, particularly Collision, including the effects of deductibles and Actual Cash Values. This in itself is a much needed, and long overdue analysis.

Also incorporated in this model is a concept which may prove to be the most useful of the whole paper—the built-in trend (or inflationary) factor. It is conceivable that, in the not-too-distant future, rate structures for both automobile liability and physical damage will incorporate such built-in automatic adjustment factors based on standardized indices. Something similar is already in use in the Homeowner's area—through Insurance to Value programs—and, of course, Mr. Masterson's recent *Proceedings* papers fall right down this alley. In this manner, many of the rate filings for routine (and, nowadays, expected) upward adjustments could be avoided—thus saving considerable time and effort for both the regulators and the insurers.

Getting back to the paper at hand, one might quibble with the author's statement that "The peculiarities involved in auto physical damage have never received the same rigorous scrutiny . . . that has been given liability ratemaking techniques" on the grounds that auto liability has not been confronted with a problem of quite the same maginitude. (No-Fault, however, is now correcting that situation.) I suppose the lack of attention to the physical characteristics of the automobile stems largely from the somewhat incongruous dichotomy which used to pervade the respective rate-

making approaches for the casualty and the property lines. Oversimplified, this dictated that in casualty ratemaking, once the classifications were established, one relied solely on past experience, almost to the complete exclusion of other considerations (including engineering), while in property ratemaking just the opposite was emphasized. One could speculate that the problem at hand would have been solved long ago had auto physical damage been kept in the property area.

Neither extreme is the answer, though. Both are important, and both should be taken into account. Thus, while the casualty actuary might tend to express a rating relativity (R) as

$$R_{new} = Z \cdot A + (1\text{-}Z) \cdot R_{old}$$

where A is the actual (projected) experience indication and Z is a suitable weight or credibility factor, and the property actuary might express it as

$$R_{new} = E,$$

where E is an indicator based on engineering or theoretical considerations, perhaps what is really needed is

$$R_{new} = Z \cdot A + (1\text{-}Z) \cdot E$$

In this light, Mr. Bickerstaff has provided us with a suitable candidate for E in the case of automobile physical damage—at least for repairability/deductible elements; namely, the lengthy expression given in his paper for the Net Loss Cost for repair group α, age group n, with initial list price L, depreciation factor d, inflationary rate r, and deductible D. Actually, he is suggesting that E stand on its own, but I think in practice a more suitable approach would involve a weighting of the experience with the model's indications. Once a new automobile model has been introduced, and some actual crash experience is available, it would be foolhardy to rely completely on the prior estimates of the expected repair costs.

As partial confirmation that this model is in the right direction, it might be noted that the experience for the present symbol groups substantiates the author's finding that the relationships between loss costs by deductible tend toward constant dollar differences rather than uniform percentage differences.

As noted earlier, the paper is concerned primarily with the Collision coverages and doesn't touch on the closely related problem of the Comprehensive coverage. But it is evident that the same approach lends itself to handling that coverage also. It would be probably be necessary to segment the coverage by cause of loss (fire, theft, windstorm, etc.) or in some fashion "gimmick" the size of loss distribution in order to recognize the disproportionate number of total losses. Also, since the comprehensive perils, particularly theft and windstorm, vary considerably by geographical area, some care would be necessary in piecing the parts back together. This latter type problem doesn't affect Collision quite so much, although a case could be made for taking into account the variation in the number of single car crashes, which tend to involve greater damage on average.

Finally, turning to the technical portion of the paper, some further work undoubtedly needs to be done in the area of parameter estimation for the size of loss distributions. Specifically, the method used by the author to eliminate the "spread" parameter S^2 is a little weak. It appears that he has simply assumed an arbitrary value for S, which is independent of the underlying data. Initially I thought that a handle could be gotten from the first moment distribution; but, as it turned out, this only provides another estimate of $S^2 + \sigma^2$. In view of the truncation problem we may find that the graphical estimate for the total variance is, in fact, a good, practical estimate of σ^2.