I am sure many company actuaries would be happy to contribute their perhaps painfully gained expertise in devising their own company formula methods.

When we look at the magnitude of some development factors and the apparent trends in these development factors themselves, and shudder at the possibility that our current rate levels may continue inadequate as these factors must lag with respect to current reserving and with respect to current pressures upon managements by which reserves may be deemed, to say the least, no more than those required for minimum necessity, it seems high time that more sophisticated methods of loss experience valuations be adopted. The individual statistical agencies cannot establish and enforce reserving disciplines within company offices; this would not only be impracticable, but would usurp management and company functions. But isn't it true that the ratemaker assumes something less than his responsibility in not having adequate assurance his loss experiences are as accurate as good actuaries might be able to make them?

Perhaps I would like most of all to applaud Mr. Cook for getting at a troublesome problem in a problem-solving way; he incidentally stirs one to some peripheral thinking too. Shouldn't we, as actuaries, presumably responsible to our function, be vitally concerned with anything and everything about rate levels?

DISCUSSION BY MAVIS A. WALTERS

Charles Cook's paper on trend and loss development factors is a valuable document for any actuary who finds himself or herself in the position of trying to explain ratemaking techniques and procedures to laymen or non-technicians. He defines clearly and concisely the terms "trend" and "loss development," and these definitions help to distinguish the two concepts. The definitions are followed by a statement of the traditional "overlap" fallacy; and in fact, Mr. Cook summarizes the argument much more cogently than some of its chief proponents. He then proceeds to refute the position quite simply and directly by discussing the purpose of the rates, i.e. to provide adequate funds to settle claims which result from accidents. The problems arise from the very simple fact that in the ratemaking procedure the actuary must make adjustments on the experience of the past in anticipation of changes in the future. From a theoretical point of view this paper pre-

sents the problem in a manner which is easily understood and then concludes by resolving it quite convincingly.

However, since Mr. Cook's paper is a theoretical presentation, it occurred to me that looking at some real data and setting up a practical example might illustrate even more clearly the conclusion which he has reached. This concrete example also demonstrates that the controversy over a possible overlap between trend and loss development is a significant one in terms of its quantitative effect on rate levels and eventual underwriting results.

In this review we have analyzed the private passenger automobile experience in California for all companies reporting to the Insurance Rating Board in order to test the hypothesis that, in fact, no overlap does exist. California was selected since it is a state where rate revisions are made annually, following the standard IRB formula and usually for relatively small adjustments. If an overlap really did exist, then the IRB ratemaking procedure, which applies loss development and trend successively, would tend to produce slightly more than the profit provision provided for in the rate structure. For bodily injury in particular, an unreasonably high profit might be expected when reviewing past underwriting results, since, presumably, the overlap is most pronounced for this coverage.

The latest available 10/20 B.I. experience in California does not show this to be the case. For the accident year ended June 30, 1969 the actual loss ratio is 76%. Since the break even point for IRB companies is approximately 71% in California, this result indicates that instead of realizing an unusually high profit on bodily injury our companies have suffered an underwriting loss of approximately 5%. These figures would certainly seem to lead to the conclusion that instead of reflecting too much trend, too little trend was actually used in the ratemaking formula. To further verify this conclusion and to determine what the effect on the actual experience would be if an overlap did, in fact, exist, we made some additional calculations.

Since we were reviewing the results for the year ended June 30, 1969, we had to make adjustments on the actual rate levels in effect from July 1, 1967 through June 30, 1969. For the two rate revisions effective during this period (in August, 1967 and September, 1968) we assumed that there was an overlap between trend and loss development and eliminated this overlap by using the model described in Mr. Cook's paper. Although the actual B.I. loss development factors reflect an adjustment to 63 months of maturity,

generally 60% to 70% of the development occurs within 39 months. It was
assumed for the sake of this analysis that only 39 months of development
were used in order that we might proceed along the lines described in the
paper.

In the 1967 rate revision, experience for the accident year ended June
30, 1966 was used with a 32 month trend projection. Since fiscal accident
year experience is evaluated as of September 30, the loss development fac-
tors would presumably adjust for the inflationary changes to December 31,
1968 in this case. The 32 months of trend, similarly, would adjust for
inflationary changes from January 1, 1966 to September 1, 1968. In this
instance then, an "overlap" of 23 months would be evident: from September
30, 1966 to September 1, 1968. In order to eliminate this overlap a new
rate level change was calculated by using only 9 months of trend in lieu of
the original 32. In this first revision, i.e., the one effective August 23, 1967,
the original indication was for virtually no change for bodily injury. By ad-
justing the figures to reflect only 9 months of trend we find that this indica-
tion is reduced to −2.8%. If this decrease is carried forward and the addi-
tional adjustment for trend on the second revision, i.e., the one effective
September 4, 1968, is made, the actual indication in that filing of +4.9% is
reduced to +0.3%. The actual effect of the two revisions combined was
for an increase of 4.3% in bodily injury rates. With the adjustments to
eliminate the overlap, the combined effect amounts to a reduction of 2.5%
in B.I. rates. Translating these effects into loss ratios, we note that the
actual B.I. loss ratio for the accident year ended June 30, 1969 of 76%
is increased to 79% by eliminating the presumed overlap. In other words,
if in 1967 and 1968 we had believed that there was, in fact, an overlap
between trend factors and loss development factors, we would have reduced
the B.I. rates by two and a half percent rather than increasing them 4.3%.
Furthermore, the actual underwriting loss of 5% would have increased
to 8%.

Consequently, from these figures it can be seen quite clearly that elimi-
nating the presumed "overlap" does not have the anticipated result of reduc-
ing any immoderately high profit but rather has the effect of producing
an even more adverse loss ratio and a greater underwriting loss. These
results emphasize the fact that the standard IRB ratemaking formula as
used in establishing rates from July 1967 through July 1969 rather than
overstating the trend actually resulted in an underestimation of this element.
In fact, this example based on California data may very well understate the

effects of eliminating the alleged overlap, since the trend factors in this example were relatively small and the actual rate level changes during the period being considered were relatively minor. If another state with higher trend factors and greater indicated rate level changes had been selected, the effect of eliminating the supposed overlap would have been much greater.

In order to verify that the earlier IRB trend procedure was deficient and did not produce excessive profits because of an "overlap" we summarized the latest available 10/20 B.I. experience for a group of 25 states somewhat similar to California in that their rate levels were based substantially on the normal ratemaking procedure and no unusual regulatory delay had been encountered. For these states the actual bodily injury experience was even worse than the California experience. For the group 10/20 bodily injury loss ratio was approximately 79% as compared with the corresponding California figure of 76%. This means that for these states as a whole the underwriting loss was even greater than that suffered in California; and consequently, the conclusions drawn from the further analysis of the California data would appear to be reasonable.

In another section of his paper the author suggests that reserving errors can be compounded by loss development factors and the effect of these errors can be severe. Of course, if we are considering the data for only one company for any one given year this is obviously true as is demonstrated by the example shown in the paper. The loss development procedure in use by the IRB is one in which these possible errors are, in fact, virtually eliminated. Attached to this review is an exhibit setting forth the 15 to 27 month and 27 to 39 month B.I. loss development factors for the latest five years for all companies reporting to the IRB for a representative group of states. There are a couple of observations which can be made on the basis of this exhibit. First, in each instance it is evident that most of the development occurs between the first and second reporting, i.e. between 15 and 27 months. Second, for the larger states as well as the countrywide 10/20 experience the factors from year to year appear to be relatively consistent. The standard procedure at the IRB for the automobile lines is to use an average factor (3 years for the larger states and 5 years for the smaller ones) in order to determine a reasonable approximation of the "true" development to be expected on the latest year's incurred losses. Since an average factor is used for each successive reporting (i.e., in large states the latest three 15 to 27 month factors are averaged, then the latest three 27 to 39 month factors are averaged, etc., and finally for the three latest available years the

51 to 63 month factors are averaged) and these average factors are then multiplied to determine the 15 to 63 month development factor, any reserving errors are corrected in the process. Naturally, the fact that the IRB development factors are based on such a large volume of losses also contributes to the minimizing of any possible reserving errors, and the relative consistency of the factors from year to year.

There were two other valuable sections in Mr. Cook's paper: one discussing the application of paid claim cost trend to incurred losses and the other the application of both trend and loss development to calendar year experience. In the former section one point the author makes is that any index which measures the rate of inflation of accident costs could be used as a trend factor, and a proper government index, if it existed, might be just as valid as paid claim costs. Certainly, further study and exploration in this area should be made.

In summary, Mr. Cook's paper was extremely well-written, and his points well thought out. It is gratifying at last to have a work such as this to refer to when a convincing argument and clear examples are needed.

COMPARISON OF BODILY INJURY LOSS DEVELOPMENT FACTORS

AUTOMOBILE LIABILITY INSURANCE – PRIVATE PASSENGER CARS

All Companies Reporting to I.R.B.   Voluntary and Assigned Risks

15 to 27 Month Factors

Accident Year	Countrywide 10/20 Limits	Calif. 10/20	Ill. 10/20	Ky. 10/20	Miss. 5/10	N.J. 10/20	Pa. 10/20	Wyo. 10/20
1963	1.090	1.107	1.035	1.069	1.002	1.113	1.094	1.052
1964	1.106	1.134	1.089	1.056	1.057	1.178	1.147	1.026
1965	1.124	1.141	1.080	1.103	1.039	1.183	1.136	1.082
1966	1.128	1.140	1.069	1.125	1.028	1.211	1.142	1.097
1967	1.123	1.120	1.068	1.127	1.001	1.155	1.113	.959
Latest 3 Yr. Avg.	1.125	1.134	1.072	1.118	1.023	1.183	1.130	1.046
5 Yr. Avg.	1.114	1.128	1.068	1.096	1.025	1.168	1.126	1.043

27 to 39 Month Factors

Accident Year	Countrywide 10/20 Limits	Calif. 10/20	Ill. 10/20	Ky. 10/20	Miss. 5/10	N.J. 10/20	Pa. 10/20	Wyo. 10/20
1962	1.013	1.008	1.014	1.021	1.016	1.013	1.022	.856
1963	1.027	1.009	1.037	1.026	.990	1.042	1.050	.986
1964	1.027	1.011	1.021	1.016	1.000	1.046	1.030	.951
1965	1.038	1.016	1.029	1.006	.999	1.078	1.043	1.080
1966	1.032	1.025	1.025	.999	1.023	1.046	1.043	.923
Latest 3 Yr. Avg.	1.032	1.017	1.025	1.007	1.007	1.057	1.039	.985
5 Yr. Avg.	1.027	1.014	1.025	1.014	1.006	1.045	1.038	.959