relation of returns between each pair of lines. The rationale is well presented and the technique is neat.

The reviewer has prided himself on a progressive attitude toward the introduction of refined actuarial techniques in the management of our business. Now he seems to be rejecting an interesting, forward-looking technique, and saying nonsense, it's not relevant to our business, it's not practical, it will never get off the ground. Undoubtedly the Markowitz E-V criterion has its uses, and the investment portfolio may be a fruitful area for its employment. But the underwriting portfolio, because of the profound practical considerations that Professor Ferrari lists but does not sufficiently evaluate, is not, in the reviewer's opinion, a proper field for effective use of the technique described.

## DISCUSSION BY LEROY J. SIMON

The Ferrari paper is one of the most significant papers we have had in the Casualty Actuarial Society *Proceedings*. It will stand as a landmark to be referred to many, many times in the future by researchers and actuaries alike. The paper touches me in a personal way because for at least six years I have carried a note to myself to attempt to develop a "balanced book approach combining profit with stability." This paper is the first significant step in that direction.

The author is a very strict critic of his own work because he never hesitates to point out the areas in which caution must be exercised. He does not offer his paper as a panacea for management or as a computerized substitute for decision making. He does, however, give us an insight into a very powerful tool and shows how it would operate. Particularly impressive is the fact that he has actually applied the technique in a concrete situation and presents the results for the reader to review. As one would suspect, the results do not say "do this" or "don't do that" but rather point in directions where the company would benefit if they would place additional emphasis or impose some restraints. This may give direction to field force efforts, channel advertising themes, or suggest areas for agency contests which the company may wish to pursue. It is rather doubtful that a manager would examine these results and cut out a given line of business merely because of the indications. As the author points out, there are many more factors to be considered other than the results of a statistical analysis. However, management now has an additional signpost pointing in the proper direction which should be a helpful guide in their decision making process.

We must all keep in mind that many procedures and techniques in the

actuarial sphere come about through a process of advancing a rough idea and then polishing it by successive improvements. If each of us was required to take each of his ideas to a point where all practical limitations had been removed before the idea was advanced to his colleagues, I fear that we would have a rather slender *Proceedings* and a rather meager body of actuarial theory. Because he so meticulously sets forth the limitations of the method, the author should not be faulted for not having eliminated them. Nor do I believe he should be expected to withhold his paper from the actuarial fraternity because he realizes he does not have a perfect product with complete solutions to the problems presented.

When the author states, "this and other similar difficulties can be alleviated by introducing expectations into historical parameters by adjustments based on subjective judgment," Mr. Rodermund responds, "Thus seat-of-pants wisdom, a traditional tool of the underwriter, is introduced to the computer!" From the general tone of the review and the punctuation of the reviewer's sentence I can only assume this was meant in criticism. My view is quite different. I would say, "Thus subjective judgment, a tool traditionally felt to be outside of the actuary's domain, has been recognized as being subject, in some measure, to mathematical manipulation." If the use of subjective judgment and degrees of belief were removed from the kit of Bayesian statisticians, some of the most important advances by this group would disappear. The author did well to recognize the ability to use subjective judgment in the technique.

Having worked for both a large company and medium-size or small company, I cannot agree with the idea that small companies can't use the Ferrari approach and big companies don't need it. I do not believe that any well-managed, progressive, forward-looking company, regardless of its size, ever feels that it has enough information upon which to base major management decisions. Companies are always striving for profitable operations and attempting to limit the fluctuation of their experience and the author has presented them with another piece of information that will help in reaching these objectives.

I can see a very interesting use of this technique in the reinsurance field. It could provide a valuable adjunct to the reinsurance consultant if he were able to "cookbook" a company (or even an entire industry) and show a client some of his profitability/variability alternatives. Through some further effort he could then show how the function of reinsurance in controlling some of the variability could allow a better combination of profitability/variability for the client.

In his third closing comment with respect to company objectives, Mr. Rodermund, in my opinion, misses the point. The objective of this method is not to tell a company which natural markets it ought to seek, because each company has an operating philosophy and a base of operations which is fundamental to the operation of that company. Much of this basic philosophy can be reflected in Ferrari's approach as shown by the examples. It is a credit to the technique that it is able to accommodate this type of restriction rather than requiring a company to either write a maximum amount of one line or write none of it.

In summary, I believe that this paper represents one of the landmarks in actuarial work and will be referred to many times over the years as actuaries attempt to quantify the decision making processes in the insurance business. Providing more information and eliminating the guesswork in certain areas can only lead to sounder decisions and a greater degree of confidence in the conclusions reached.

## AUTHOR'S REVIEW OF DISCUSSIONS

The author is gratified that his paper on portfolio selection inspired comment by four reviewers of considerable stature in the insurance industry. The large body of literature on portfolio selection is no longer void of an application to the property and liability insurance business and the dialogue contained in the reviews is a welcome supplement to the original effort.

Much of the criticism contained in the reviews was predictable since the same limitations of portfolio selection can be found in the financial literature on securities portfolios. Indeed, many of the problems surrounding practical application were suggested in the paper and the reviewer, in some cases, simply expanded on them.

Rennie seems particularly disturbed over "the assumption that the expected return and risk on each line of insurance are single valued, regardless of the proportion of the total portfolio committed to that line of insurance." This is a valid concern but Rennie did not give the author credit for recognizing this problem. The author states that "Perhaps the most troublesome problem with the input to a portfolio selection model is that the assumptions of risk and return may not hold up if an attempt is actually made to acquire a prescribed portfolio," and then goes on to discuss this admittedly troublesome limitation.

The author agrees with Bondy that one should not resign himself to losses in certain lines, but he would also argue that if the likelihood for im-