

Mr L. P. FOLDES: I should like to comment briefly on three points arising from Professor Borch's interesting paper. First, may I add to his list of surveys of actuarial theory the French text by Dubourdiou (1952). This work is accessible to the outsider who is familiar with ordinary elementary probability, and follows an approach very similar to that of Professor Borch's paper.

Secondly, I wanted to comment briefly on the economic justifiability of the principle of equivalence, but since it is so late I shall just say one sentence. In the form in which Professor Borch has stated it, namely that "the expected value of claim payments under a contract should be equal to the expected value of premiums received", this principle has all the usual weaknesses of any economic theory which assumes that prices must necessarily be adjusted to average costs of production.

Finally, I should like to comment on the following passage (p. 450): "The real problem of the company now is to find the value of  $k$  which gives the 'best' of the stochastic processes in the set we have defined. . . . However, there is no sense in talking about the 'best stochastic process' unless one has some rule or criterion for deciding when one process should be preferred to another, i.e. a *preference ordering* over a set of stochastic processes. This points to the need for a generalization of the Bernoulli principle, which was shown in Section 2 to give a very convenient representation of preference orderings over a set of probability distributions. So far there does not seem to have been any attempt to extend this principle to sets of stochastic processes." Please note that in this passage Professor Borch refers to three distinct concepts: that of the decision rule or criterion, that of preference ordering, and that of Bernoullian utility. The assumption that a person decides according to a preference ordering is more restrictive than the assumption—which is presumably indispensable—that he follows a decision rule or criterion; and the assumption that his ordering can be represented by a Bernoullian utility function is more restrictive still. There is, of course, still a good deal of disagreement as to the postulates which are reasonable even in the case of theories which apply to *individuals*. The point which I want to emphasize is that additional difficulties arise when we consider insurance *companies* (or other companies which bear risk). A company is an organization, that is to say, a social system, one of whose functions is the resolution of conflict among its participants. It is not generally reasonable to impose on the decision procedures of an organization the same requirements of consistency as are appropriate in the case of an individual. It may therefore be inadvisable to place too much emphasis on the notions of ordering and utility in devising decision criteria. An alternative approach might be to start from the observation that the interests of particular groups of participants in an organization are often closely tied to the values taken by particular numerical variables. For example, in Professor Borch's case of an insurance company the policy holders and creditors are interested in the risk of default  $(1 - R)$ , or in the expected life of the company before ruin  $(D)$ , while shareholders are interested in the capitalized value of dividends  $(V)$ . It would be interesting to consider systematically the possibility of a theory of decision criteria for insurance companies or other organizations based on such "indicative" variables. As a tentative suggestion, the variables related to the interests of the most important groups of participants might reasonably be incorporated in the criterion function, while other variables could be introduced into suitable inequality constraints. An approach of this kind might help to justify the use of such criterion functions as

$$\max \{ \alpha \log V + (1 - \alpha) \log D \},$$

which Professor Borch uses in the last section of his paper.