

## BOOK REVIEW

A.E. VAN HEERWAARDEN (1991): *Ordering of risks: Theory and actuarial applications*. Thesis/Tinbergen Institute (Tinbergen Institute research series; no. 20), Amsterdam, 159 pages, US\$ 21.00/DFl. 37.50.

This thesis is a coherent and thorough survey of the up-to-date theory of ordering of risks and its possible applications in actuarial models.

For all order relations given, the equivalence of various definitions is proven, sufficient conditions for order relations to hold are given, and connections with other order relations are studied. Furthermore, order preserving properties under certain manipulations are examined; e.g. order preservation under convolution, mixing, compounding and discretization of distribution functions are investigated.

These techniques are applied to five different actuarial models.

1. For *portfolio models* stop-loss order is applied to describe the approximation of an individual model by a collective model. Furthermore, order relations are given within and also between parametric families of distributions that are used to model claimsizes and claimnumbers.
2. For the *classical ruin model* where the adjustment coefficient exists it is shown that order relations between claim amounts induce ordering of ruin probabilities and this is used to compute bounds for ruin probabilities. On this place it would also have been of interest to study the ordering of ruin probabilities for heavy-tailed claimsize distributions.
3. Properties of several conventional *premium principles* are examined with special emphasis on order preserving properties. Furthermore, a new premium principle, called the "Dutch principle", is introduced. As a combination of the expected value principle and the stop-loss principle it comprises properties of both.
4. In a chapter on *optimal reinsurance* the author proves that a number of different optimization criteria lead to a stop-loss contract. The well-known result that the stop-loss contract is optimal for fixed reinsurance premiums is here again derived using ordering of risks.
5. Ordering relations for risks are applied to *survival distributions* and implications of ordered survival distributions for net single premiums are analyzed. The chapter concludes with two practical life actuarial applications.

Most of the results of this thesis have already been published, a considerable amount in M. J. Goovaerts, R. Kaas, A. E. Van Heerwaarden, T. Bauwelinckx (1990): *Effective Actuarial Methods*. Elsevier (Amsterdam) [see the book review in the *Astin Bull.* 21 (1991), 151f]. In summary, the thesis under review provides a carefully written presentation of its topic.

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