

## BOOK REVIEWS

J. VAN EEGHEN, E. K. GREUP and J. A. NIJSSEN (1983). *Rate Making*. Surveys of Actuarial Studies, No. 2. Nationale-Nederlanden N.V., Rotterdam. 138 pages.

The series Surveys of Actuarial Studies, published by the Research Department of the Nationale-Nederlanden with G. W. de Wit as editor, covers, in its first two volumes, two important R's of actuarial nonlife activity: Reserving and Rate making. The first volume, *Loss Reserving Methods*, was reviewed in *Astin Bulletin* 14, No. 1.

As the name of the series implies, the present volume contains, in a condensed and logically ordered form, material from a large number of actuarial books and papers, as well as some general statistical methods. The valuable bibliography at the end of the booklet contains some eighty references.

The plan of the book is as follows. In the Introduction the rate making process in general is discussed. After that, the treatment is entirely devoted to the risk premium part of the premium. Chapter 1 treats the selection of tariff variables (rating factors). Determination of tariff classes, defined via the tariff variables chosen, is considered in Chapter 2. Chapter 3, Parameter estimation in modelled tariff structures, treats the problem of estimating the risk premium, or the claims frequency or the average claims size, as a function of the tariff class. In Chapter 4 an example of the credibility approach is given. Finally, Chapter 5 gives a brief outline of the problem of large claims.

In general, each method of analysis is given a brief but sufficiently detailed presentation. Then there are some hints on numerical computation and, in most cases, also numerical examples. Finally, the authors give their own comments on the method.

In the following I will give some of my own comments on the contents of the book.

In the Introduction, "the (known) solidarity part" of the premium is introduced as a separate premium component. This refers to an intentional omission of some premium differentiation, for social reasons. The issue has obviously attracted a great deal of interest in the Netherlands recently. It is not unknown in other parts of the world. Still I think it belongs to the larger context of the difference between risk factors, i.e., factors influencing the risk, and rating factors, which are the factors actually used for premium calculation. Personally, I would have liked this difference, which is not exclusively caused by feelings of social fairness, to be more clearly set out in the discussion.

Chapter 1 presents Lemaire's linear regression selection method, Hallin-Ingenbleek's unmodelled selection procedure and, as a nice contribution from the statistical tool-box, a method based on discriminant analysis. In the comments it is pointed out that exact significance levels are difficult to establish for the procedures. In particular, assumptions of normality and homoscedasticity will mostly be violated in practice. Especially the latter (equality of variances) I find questionable as it is generally inconsistent with the compound Poisson model. With this in mind, as the authors point out, the methods may however be efficient tools for exploratory data analysis.

In Chapter 2 methods of cluster analysis are applied to the problem of reducing a maximal number of basic classes, defined by the tariff variables, to a smaller number of tariff classes. One method is Dickmann's application of general cluster analysis to insurance problems, based on variation within and between clusters. The other is the method of Loimaranta, Jacobsson and Lonka, which is based on likelihood estimation and tests of mixtures of distributions. The concept of the chapter is very elegant. The two methods of cluster analysis may be used to produce a set of admissible subdivisions of the portfolio. Finally, the credibility related method of Schmitter and Straub, which is also described, may be used to judge between them.

In the first part of Chapter 3 non-parametric methods of estimation in modelled tariff structures are considered: Simon-Bailey (minimum chi-square), graduation by marginal totals and least squares. Applications are made to multiplicative and additive models. Comments on methods and models are generally well elaborated. Reference is given to a number of papers according to which the additive model should produce a better fit for insurance data, even if the majority of existing rating systems rather seem to be multiplicative. So for balance I should mention that the Swedish motor insurance data from 1977, analyzed by Hallin-Ingenbleek in *SAJ* 1983, No 1, showed a somewhat better fit for the multiplicative model than for the additive one, as did data from 1979. The second part of the chapter is devoted to a careful presentation of maximum likelihood methods, containing *inter alia* Ter Berg's treatment of loglinear models for Poisson, gamma and inverse Gaussian distributions.

The last two chapters are rather short. Chapter 4 presents the elegant Bühlmann-Straub model. For tariff construction this credibility approach has to be applied with some care, according to the reviewer's experience. This is because it starts out from the assumption that the risk groups under study are similar, in the sense that their risk characteristics are assumed to be chosen at random from one and the same collective. The method therefore has a tendency to give too small differences between risk groups. The case for experience rating of individual contracts may be different.

The fifth chapter on large claims outlines methods of Schäffer-Willeke and Gisler. The problem of large claims is a nuisance in tariff construction work, at least as soon as personal injury claims or fire claims are present. So, as a practitioner one could have hoped for a fuller treatment, perhaps including the division of claims into more than two size groups (e.g., normal claims, excess claims, superexcess claims) and/or some help from the theory of outlying observations. Maybe one could hope for another volume in the series on this subject?

In summary, the authors have collected in a limited space an astonishingly rich material on general rate making methods. They have deliberately refrained from discussing the loading for commissions and expenses, and problems pertaining to special lines of business. There is no mentioning of investment income. These limitations are most natural considering the size of the book. It should be of great value to every non-life actuary.

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