

## REVIEWS

*Modelling Extremal Events.* BY P. EMBRECHTS, C. KLUPPELBERG AND T. MIKOSCH (Springer-Verlag, 1997)

Extremal events are occurrences which are statistically very rare, but, when they happen, are of major significance. Examples are major disasters, huge insurance claims, and extreme environmental events. The rarity of such events makes their statistical treatment both difficult and specialised. In this wonderfully encyclopedic work, the authors collect together, for the first time, all the relevant probabilistic and data analytic techniques appropriate to analysing extremal behaviour — with the exception only of a few very specialised areas, such as multivariate extreme value theory.

The prerequisites for reading the book are a basic knowledge of probability and statistics, at about the level of a first degree in these subjects. It is designed to be used both as a graduate text — in risk theory, extreme value theory, data analysis for extremes, and time series analysis — and also as a reference for researchers in applied fields, notably those of insurance and financial mathematics. In both of these aims it succeeds admirably. Perhaps one reason is the unusually well-controlled treatment of the mathematics. This is developed in sufficient detail to permit understanding without reference to external sources. However, proofs of more classical results are frequently omitted or sketched, as appropriate.

As already suggested, the scope of the book is considerable. The probability theory covers both those models applicable to essentially cumulative events, i.e. extremes of sums of random variables (risk theory), and those appropriate to extremes of individual random variables (extreme value theory). No prior knowledge of these subjects is assumed, yet the most recent research is clearly treated. Particularly welcome is the detailed consideration, in both the above areas, of heavy-tailed distributions — these are frequently those most appropriate to applications. The modern point-process treatment of classical extreme value theory is also comprehensively developed. This throws much light on what was previously a rather obscure subject, clarifying, for example, the relation between maxima and exceedances, and the relative roles of the generalised extreme value and generalised Pareto distributions.

Rather less space is devoted to the more difficult topic of data analysis. However, the authors provide an extremely lucid introduction to current techniques. As is entirely appropriate, there is great emphasis on exploratory and graphical methods.

The book is written with an eye on applications in insurance and finance. Those with an interest in environmental extremes — for example severe storms — are much concerned with problems of seasonality and short-term dependence. The latter topic is treated primarily in the context of financial time series models, while there is relatively little consideration of the former.

A final chapter considers a number of special topics, for example extremal indices and ARCH processes, while an appendix gives a concise treatment of all the background probability theory—surely the first love of the authors. Lest you wish to explore further, the book provides a useful 646 references.

S. ZACHARY

*A Sense of Security: 150 Years of Prudential.* BY LAURIE DENNETT (Granta Editions, 1998)

Actuaries will enjoy reading this 150th anniversary book. Although long (over 400 pages) it is easy to read; but it is far from a coffee-table book, as it contains the results of some fascinating research, and shows that many of the issues currently facing the life assurance industry have parallels in the past.

The company's name in 1848 was 'The Prudential Mutual Assurance, Industrial & Loan

Association' although the inclusion of 'Mutual' was notwithstanding the shareholder participation. The first valuation was in 1853, and there were no divisible profits, no possibility of a dividend. However, also that year, the Deed of Settlement was amended, and the clauses which made it difficult to allocate a dividend to shareholders before the bonus was given to with-profits policyholders were rescinded. Interest at 5% was given to shareholders, and there was provision for periodic valuations at which 80% of the new profits were to be distributed as bonus, 20% to the shareholders.

The author tells us, in some detail, about the directors over the years, and the way in which the company has been managed. In particular, the development of industrial branch business was associated with the challenge to reduce expenses and lapses, and a theme in the book is the striving for a reputation for fair play.

It is interesting to read of the part played by Prudential, as a major company, in lobbying regarding Government policy. It was one of the objectors to a Bill introduced by Gladstone, when Chancellor of the Exchequer in 1864, intended to make it easier to buy life assurance through savings banks. Gladstone's response was to make a speech in the Commons, referring to the accounts of the Prudential: "as it stands it presents a balance of £41,000 in favour of the society: but it has been examined by actuaries, and those gentlemen, proceeding upon principles which are no more open to question than a proposition of Euclid, say, that instead of a balance of £41,000 in favour of, there is one of £30,000 against the society".

The company responded the following day: "I am quite at a loss to understand how any actuary could form an opinion without being supplied with all the necessary data ... I am prepared to maintain the substantial accuracy of the balance sheet in question; and to state that the valuation of the policies was conducted by a competent actuary ...".

However, actuaries were not always looked upon favourably. In 1852 a new prospectus, supposedly to include new premium rate tables, was ordered, but the actuary procrastinated over the preparation of these to such lengths that he was given £25 and dismissed. Later on, we read that the 1891 valuation required the whole clerical staff of 700 to work overtime for 7 months!

By the 1870s women were being employed, although the women clerks were strictly segregated from the men in the entrances, stairways and dining facilities that they used and the parts of the building where they sat. The book records much about the staff, including the dramatic and sporting clubs. The cricket team celebrated the opening of its new ground in 1903 with a match against W. G. Grace's London County XI; Grace was a Prudential medical referee.

The author also remarks that there was a long-standing practice of the company paying the income tax of Chief Office employees, only discontinued after the Second World War.

More recently, the author tells us of the 'Man from the Prudential', noting that the image varied in the countries in which the company did business. Credit is also given to Frank Redington for his 1952 paper on immunisation theory.

The history brings us up to date with the purchase (and then sale) of estate agencies, the Financial Services Act and the acquisition of Scottish Amicable. Prudential's initial venture into banking is here, too; by the end of 1997 35% of Prudential customers were investing their maturities in a Prudential deposit account.

There are many photographs and drawings, including one of Staple Inn.

At the end of the book there is a useful statistical appendix, and several pages of references.

This is not a short book. However, the research of the author has brought to life a fascinating history which chronicles how the Prudential has played such a major part in the development of the British life assurance industry.

C. D. O'BRIEN