

REVIEW

Bonus-Malus Systems in Automobile Insurance. By JEAN LEMAIRE (Kluwer Academic Publishers, Dordrecht, 1995)

This book is a detailed statistical/mathematical/financial investigation of bonus-malus systems (no claims discount systems in United Kingdom terminology) in motor insurance. It is a technical book which makes extensive use of recent research in this area, much of it by the author himself. It is also a very readable book—no surprise to readers familiar with Lemaire's written work—which can be recommended, not only to those with a professional interest in motor insurance, but also to those interested in seeing an application of actuarial research. In the Preface, Lemaire says he has "attempted to write a book that can be read by the entire ASTIN membership, not by its academic subset". In this, I think, he is successful. The technical prerequisites are only an understanding of the material in the syllabus for the Subject C examination, particularly C2, and a passing acquaintance with utility functions, now sadly no longer in the Subject C syllabus.

Almost all bonus-malus systems in the world are based on numbers of claims, rather than numbers and/or amounts of claims. Part 1 of the book discusses models for claim number distributions, in particular the Poisson distribution and the Poisson mixed with the Gamma distribution or the Inverse Gaussian distribution. Lemaire uses data from a Belgian company to assess the appropriateness of each of these distributions in motor insurance. He also includes an interesting appendix showing how well these distributions fit data sets from areas as diverse as the number of dental cavities observed in children and the number of goals per team per game in North America's National (Ice) Hockey League.

Possibly the most interesting chapter in Part 1, even in the whole book, is Chapter 2. This traces the development of bonus-malus systems in Belgium, from their introduction by one company as a successful marketing initiative in 1961 to the development of a new system introduced in 1992. The reasons for introducing the new system were that in 1992, under the old system with its 18 levels of discount (or surcharge):

"over 65 per cent of the policyholders enjoyed the maximum discount, and over 80 per cent of the policies belonged to one of the three highest discount classes";

"Even drivers with a claim frequency of 0.20 (twice as bad as the average) will end up in class 1. They will spend most of their driving lifetime in that class";

"The main victims of the system become the young policyholders who ... need several claim-free years to reach the average (discount) class"; so that

"Instead of penalizing the bad policyholders, the bonus-malus system had become a tool to surcharge inexperience."

Does any of this sound familiar in a U.K. context?

Part 2 of the book is an evaluation of the 'toughness' of bonus-malus systems. Lemaire discusses four different measures of toughness:

—the relative stationary average level for premiums;

—the coefficient of variation of a policyholder's premiums;

—the elasticity of the system, i.e. the response of the system to a change in the claim frequency; and

—the average optimal retention, i.e. the accident cost amount below which a policyholder should not make a claim in order to minimise his/her premiums and accident costs.

Lemaire then uses factor analysis to combine these four measures into a single 'index of toughness', which turns out to be almost equivalent to the coefficient of variation of a policyholder's premiums. The different measures of toughness are discussed in a theoretical setting, and then applied to thirty different bonus-malus systems in operation around the world. Details of these systems are given in a 20-page appendix to Part 2. The U.K. is represented by two systems, what Lemaire describes as a typical U.K. system with and without protected full no claims discount. These two systems rank 15th (unprotected) and 23rd (protected) out of the 30 systems in Lemaire's overall Index of Toughness, although Lemaire repeatedly remarks that 'tough' is synonymous with neither 'good' nor 'bad'.

Part 3 of the book discusses the design of an optimal bonus-malus system. A notable feature of this part is the chapter on The Effect of Expense Loadings. Although this is a technical book, Lemaire never loses sight of the practical realities of motor insurance.

The final Part of the book discusses the possibility of replacing a bonus-malus system by a system based on a high policy excess financed by a loan from the insurer. This alternative does not emerge from Lemaire's analysis with much to recommend it.

Among its many good points, the book does have one negative feature. This is Lemaire's curious preference for simulation rather than analytic calculation. Much of the analysis in the book is based on the stationary distribution for a bonus-malus system, i.e. the distribution of the policyholders over the different classes once the system has stabilised. The determination of this stationary distribution requires solving a set of simultaneous linear equations, a task easily performed by well-established computer routines and mathematical software packages. Why then does Lemaire explain, on pages 76 and 77, how to solve these equations 'long hand' in the case of the Brazilian system, which involves seven levels of discount, and then say that he used simulation throughout the book "because it proved to be computationally much simpler"? To make matters worse, Lemaire does not tell us how many simulations were used in his calculations, saying only that the number was 'extensive'. However, this is a relatively minor complaint about an otherwise very interesting and very readable book.

H. R. WATERS