Actuarial Modelling Of Claim Counts Risk Classification Credibility And Bonus Malus Systems By Michel Denuit 10 Aug 2007 Hardcover

This is a comprehensive and accessible reference source that documents the theoretical and practical aspects of all the key deterministic and stochastic reserving methods that have been developed for use in general insurance. Worked examples and mathematical details are included, along with many of the broader topics associated with reserving in practice. The key features of reserving in a range of different contexts in the UK and elsewhere are also covered. The book contains material that will appeal to anyone with an interest in claims reserving. It can be used as a learning resource for actuarial students who are studying the relevant parts of their professional bodies' examinations, as well as by others who are new to the subject. More experienced insurance and other professionals can use the book to refresh or expand their knowledge in any of the wide range of reserving topics covered in the book.

Claims reserving is central to the insurance industry. Insurance liabilities depend on a number of different risk factors which need to be predicted accurately. This prediction of risk factors and outstanding loss liabilities is the core for pricing insurance products, determining the profitability of an insurance company and for considering the financial strength (solvency) of the company. Following several high-profile company insolvencies, regulatory requirements have moved towards a risk-adjusted basis which has lead to the Solvency II developments. The key focus in the new regime is that financial companies need to analyze adverse developments in their portfolios. Reserving actuaries now have to not only estimate reserves for the outstanding loss liabilities but also to quantify possible shortfalls in these reserves that may lead to potential losses. Such an analysis requires stochastic modeling of loss liability cash flows and it can only be done within a stochastic framework. Therefore stochastic loss liability modeling and quantifying prediction uncertainties has become standard under the new legal framework for the financial industry. This book covers all the mathematical theory and practical guidance needed in order to adhere to these stochastic techniques. Starting with the basic mathematical methods, working right through to the latest developments relevant for practical applications; readers will find out how to estimate total claims reserves while at the same time predicting errors and uncertainty are quantified. Accompanying datasets demonstrate all the techniques, which are easily implemented in a spreadsheet. A practical and essential guide, this book is a must-read in the light of the new solvency requirements for the whole insurance industry.

This book teaches multiple regression and time series and how to use these to analyze real data in risk management and finance.

The book aims at presenting technical and financial features of life insurance, non-life insurance, pension plans. The book has been planned assuming non-actuarial readers as its “natural” target, namely - advanced undergraduate and graduate students in Economics, Business and Finance; - professionals and technicians operating in Insurance and pension areas, whose job may regard investments, risk analysis, financial reporting, etc, and hence implies a communication with actuarial professionals

and managers. Given the assumed target, the book focuses on technical and financial aspects of insurance, however avoiding the use of complex mathematical tools. In this sense, the book can be placed at some “midpoint” of the existing literature, part of which adopts more formal approaches to insurance problems implying the use of non-elementary mathematics, whereas another part addresses practical questions totally avoiding even simple mathematical tools (which, in our opinion, can conversely provide effective tools for presenting technical and financial features of the insurance business).
There are a wide range of variables for actuaries to consider when calculating a motorist’s insurance premium, such as age, gender and type of vehicle. Further to these factors, motorists’ rates are subject to experience rating systems, including credibility mechanisms and Bonus Malus systems (BMSs). Actuarial Modelling of Claim Counts presents a comprehensive treatment of the various experience rating systems and their relationships with risk classification. The authors summarize the most recent developments in the field, presenting ratemaking systems, whilst taking into account exogenous information. The text: Offers the first self-contained, practical approach to a priori and a posteriori ratemaking in motor insurance. Discusses the issues of claim frequency and claim severity, multi-event systems, and the combinations of deductibles and BMSs. Introduces recent developments in actuarial science and exploits the generalised linear model and generalised linear mixed model to achieve risk classification. Presents credibility mechanisms as refinements of commercial BMSs. Provides practical applications with real data sets processed with SAS software. Actuarial Modelling of Claim Counts is essential reading for students in actuarial science, as well as practicing and academic actuaries. It is also ideally suited for professionals involved in the insurance industry, applied mathematicians, quantitative economists, financial engineers and statisticians.
In the past few decades, many significant insights have been gained into several areas of computational methods in sciences and engineering. New problems and methodologies have appeared in some areas of sciences and engineering. There is always a need in these fields for the advancement of information exchange.The aim of this book is to facilitate the sharing of ideas, problems and methodologies between computational scientists and engineers in several disciplines. Extended abstracts of papers on the recent advances regarding computational methods in sciences and engineering are provided. The book briefly describes new methods in numerical analysis, computational mathematics, computational and theoretical physics, computational and theoretical chemistry, computational biology, computational mechanics, computational engineering, computational medicine, high performance computing, etc.
This collection of articles addresses the most modern forms of loss reserving methodology: granular models and machine learning models. New methodologies come with questions about their applicability. These questions are discussed in one article, which focuses on the relative merits of granular and machine learning models. Others illustrate applications with real-world data. The examples include neural networks, which, though well known in some disciplines, have previously been limited in the actuarial literature. This volume expands on that literature, with specific attention to their application to loss reserving. For example, one of the articles introduces the application of neural networks of the gated recurrent unit form to the actuarial literature,

whereas another uses a penalized neural network. Neural networks are not the only form of machine learning, and two other papers outline applications of gradient boosting and regression trees respectively. Both articles construct loss reserves at the individual claim level so that these models resemble granular models. One of these articles provides a practical application of the model to claim watching, the action of monitoring claim development and anticipating major features. Such watching can be used as an early warning system or for other administrative purposes. Overall, this volume is an extremely useful addition to the libraries of those working at the loss reserving frontier.
A Hands-On Approach to Understanding and Using Actuarial Models Computational Actuarial Science with R provides an introduction to the computational aspects of actuarial science. Using simple R code, the book helps you understand the algorithms involved in actuarial computations. It also covers more advanced topics, such as parallel computing and C/C++ embedded codes. After an introduction to the R language, the book is divided into four parts. The first one addresses methodology and statistical modeling issues. The second part discusses the computational facets of life insurance, including life contingencies calculations and prospective life tables. Focusing on finance from an actuarial perspective, the next part presents techniques for modeling stock prices, nonlinear time series, yield curves, interest rates, and portfolio optimization. The last part explains how to use R to deal with computational issues of nonlife insurance. Taking a do-it-yourself approach to understanding algorithms, this book demystifies the computational aspects of actuarial science. It shows that even complex computations can usually be done without too much trouble. Datasets used in the text are available in an R package (CASdatasets).
Based on the syllabus of the actuarial industry course on general insurance pricing — with additional material inspired by the author's own experience as a practitioner and lecturer — Pricing in General Insurance presents pricing as a formalised process that starts with collecting information about a particular policyholder or risk and ends with a commercially informed rate. The main strength of this approach is that it imposes a reasonably linear narrative on the material and allows the reader to see pricing as a story and go back to the big picture at any time, putting things into context. Written with both the student and the practicing actuary in mind, this pragmatic textbook and professional reference: Complements the standard pricing methods with a description of techniques devised for pricing specific products (e.g., non-proportional reinsurance and property insurance) Discusses methods applied in personal lines when there is a large amount of data and policyholders can be charged depending on many rating factors Addresses related topics such as how to measure uncertainty, incorporate external information, model dependency, and optimize the insurance structure Provides case studies, worked-out examples, exercises inspired by past exam questions, and step-by-step methods for dealing concretely with specific situations Pricing in General Insurance delivers a practical introduction to all aspects of general insurance pricing, covering data preparation, frequency analysis, severity analysis, Monte Carlo simulation for the calculation of aggregate losses, burning cost analysis, and more.
In the years since the publication of the best-selling first edition, the incorporation of ideas and theories from the rapidly growing field of financial economics has precipitated considerable development of thinking in the actuarial profession. Modern Actuarial Theory and Practice, Second Edition integrates those changes and presents an up-to-

date, comprehensive overview of UK and international actuarial theory, practice and modeling. It describes all of the traditional areas of actuarial activity, but in a manner that highlights the fundamental principles of actuarial theory and practice as well as their economic, financial, and statistical foundations.

This volume contains the proceedings of the 22nd International Conference on Medical Informatics Europe 2009 (MIE) in Sarajevo, Bosnia and Herzegovina, September 2009. The scientific topics presented in these proceedings range from national and transnational ehealth roadmaps, health information and electronic health record systems, systems interoperability and communication standards, medical terminology and ontology approaches, and social networks to web, web 2.0, and semantic web solutions for patients, health personnel and researchers.

The debate between the proponents of "classical" and "Bayesian" statistica} methods continues unabated. It is not the purpose of the text to resolve those issues but rather to demonstrate that within the realm of actuarial science there are a number of problems that are particularly suited for Bayesian analysis. This has been apparent to actuaries for a long time, but the lack of adequate computing power and appropriate algorithms had led to the use of various approximations. The two greatest advantages to the actuary of the Bayesian approach are that the method is independent of the model and that interval estimates are as easy to obtain as point estimates. The former attribute means that once one learns how to analyze one problem, the solution to similar, but more complex, problems will be no more difficult. The second one takes on added significance as the actuary of today is expected to provide evidence concerning the quality of any estimates. While the examples are all actuarial in nature, the methods discussed are applicable to any structured estimation problem. In particular, statisticians will recognize that the basic credibility problem has the same setting as the random effects model from analysis of variance.

This practical introduction outlines methods for analysing actuarial and financial risk at a fairly elementary mathematical level suitable for graduate students, actuaries and other analysts in the industry who could use simulation as a problem solver. Numerous exercises with R-code illustrate the text.

This book proposes a review of Long-Term Care insurance; this issue is addressed both from a global point of view (through a presentation of the risk of dependence associated with the aging of the population) and an actuarial point of view (with the presentation of existing insurance products and actuarial techniques for pricing and reserving). It proposes a cross-view of American and European experiences for this risk. This book is the first dedicated entirely to long-term care insurance and aims to provide a useful reference for all actuaries facing this issue. It is intended for both professionals and academics.

This carefully written monograph covers the Sparre Andersen process in an actuarial context using the renewal process as the model for claim counts. A unified reference on Sparre Andersen (renewal risk) processes is included, often missing from existing literature. The authors explore recent results and analyse various risk theoretic quantities associated with the event of ruin, including the time of ruin and the deficit of ruin. Particular attention is given to the explicit identification of defective renewal equation components, which are needed to analyse various risk theoretic quantities and are also relevant in other subject areas of applied probability such as dams and storage processes, as well as queuing theory. Aimed at researchers interested in risk/ruin theory and related areas, this work will also appeal to

graduate students in classical and modern risk theory and Gerber-Shiu analysis.
The U.S. Dept. of Housing & Urban Dev't. (HUD), through its Fed. Housing Admin. (FHA), provides insurance for private lenders against losses on home mortgages. FHA's largest insurance program is the Mutual Mortgage Insurance Fund, which currently is self-financed & operates at a profit. FHA submitted a re-estimateÓ of $7 billion for the credit subsidy & interest for the Fund as of the end of FY 2003, reflecting a reduction in estimated profits. Given this substantial re-estimate, this report determines what factors contributed to the $7 billion re-estimate & the underlying loan performance variables influencing these factors. Also, assesses how the loan performance variables underlying the re-estimate could impact future estimates of new loans. Illus.
On May 27-31, 1985, a series of symposia was held at The University of Western Ontario, London, Canada, to celebrate the 70th birthday of Pro fessor V. M. Joshi. These symposia were chosen to reflect Professor Joshi's research interests as well as areas of expertise in statistical science among faculty in the Departments of Statistical and Actuarial Sciences, Economics, Epidemiology and Biostatistics, and Philosophy. From these symposia, the six volumes which comprise the "Joshi Festschrift" have arisen. The 117 articles in this work reflect the broad interests and high quality of research of those who attended our conference. We would like to thank all of the contributors for their superb cooperation in helping us to complete this project. Our deepest gratitude must go to the three people who have spent so much of their time in the past year typing these volumes: Jackie Bell, Lise Constant, and Sandy Tarnowski. This work has been printed from "camera ready" copy produced by our Vax 785 computer and QMS Lasergraphix printers, using the text processing software TEX. At the initiation of this project, we were neophytes in the use of this system. Thank you, Jackie, Lise, and Sandy, for having the persistence and dedication needed to complete this undertaking.
All property and casualty insurers are required to carry out loss reserving as a statutory accounting function. Thus, loss reserving is an essential sphere of activity, and one with its own specialized body of knowledge. While few books have been devoted to the topic, the amount of published research literature on loss reserving has almost doubled in size during the last fifteen years. Greg Taylor's book aims to provide a comprehensive, state-of-the-art treatment of loss reserving that reflects contemporary research advances to date. Divided into two parts, the book covers both the conventional techniques widely used in practice, and more specialized loss reserving techniques employing stochastic models. Part I, Deterministic Models, covers very practical issues through the abundant use of numerical examples that fully develop the techniques under consideration. Part II, Stochastic Models, begins with a chapter that sets up the additional theoretical material needed to illustrate stochastic modeling. The remaining chapters in Part II are self-contained, and thus can be approached independently of each other. A special feature of the book is the use throughout of a single real life data set to illustrate the numerical examples and new techniques presented. The data set illustrates most of the difficult situations presented in actuarial practice. This book will meet the needs for a reference work as well as for a textbook on loss reserving.
Machine learning is a relatively new field, without a unanimous definition. In many ways, actuaries have been machine learners. In both pricing and reserving, but also more recently in capital modelling, actuaries have combined statistical methodology with a deep understanding of the problem at hand and how any solution may affect the company and its customers. One aspect that has, perhaps, not been so well developed among actuaries is validation. Discussions among actuaries’ “preferred methods” were often without solid scientific arguments, including validation of the case at hand. Through this collection, we aim to promote a good practice of machine learning in insurance, considering the following three key issues: a) who is the client, or sponsor, or otherwise interested real-life target of the study? b) The reason for working with a particular data set and a clarification of the available extra knowledge, that

we also call prior knowledge, besides the data set alone. c) A mathematical statistical argument for the validation procedure.

"Newly organized to focus exclusively on material tested in the Society of Actuaries' Exam C and the Casualty Actuarial Society's Exam 4, 'Loss models : from data to decisions', fourth edition, continues to supply actuaries with a practical approach to the key concepts and techniques needed on the job."--Back cover.

We describe a new approach to estimate the pure premium for automobile insurance. Using the theory of hidden Markov models (HMM) we derive a Poisson-gamma HMM and a hybrid between HMMs and generalized linear models (HMM-GLM). The hidden state is meant to represent a driver's skill thus capturing an unseen variable. The Poisson-gamma HMM and HMM-GLM have two emissions, severity and claim count, making it easier to compare to current actuarial models. The proposed models help deal with the overdispersion problem in claim counts and introduces dependence between the severity and claim count. We derive maximum likelihood estimates for the parameters of the proposed models and then using simulations with the Expectation Maximization algorithm we compare the three methods: GLMs, HMMs and HMM-GLMs. We show that in some instances the HMM-GLM outperforms the standard GLM, while the Poisson-gamma HMM under-performs the other models. Thus in certain situations it may be worth the added complexity of a HMM-GLM.

Presents a comprehensive treatment of the increasingly topical field of reinsurance Reinsurance: Actuarial and Statistical Aspects provides a survey of both the academic literature in the field as well as challenges appearing in reinsurance practice and puts the two in perspective. The book is written for researchers with an interest in reinsurance problems, for graduate students with a basic knowledge of probability and statistics as well as for reinsurance practitioners. The focus of the book is on modelling together with the statistical challenges that go along with it. The discussed statistical approaches are illustrated alongside six case studies of insurance loss data sets, ranging from MTPL over fire to storm and flood loss data. Some of the presented material also contains new results that have not yet been published in the research literature. An extensive bibliography provides readers with links for further study.

This text introduces the commonly used, basic approaches for reserving and ratemaking in General Insurance. The methods are described through detailed examples that are linked from one chapter to another to illustrate their practical application. Also, professionalism requirements and standards of practice are presented to set the context for the methods and examples.

This monograph presents a time-dynamic model for multivariate claim counts in actuarial applications. Inspired by real-world claim arrivals, the model balances interesting stylized facts (such as dependence across the components, over-dispersion and the clustering of claims) with a high level of mathematical tractability (including estimation, sampling and convergence results for large portfolios) and can thus be applied in various contexts (such as risk management and pricing of (re-)insurance contracts). The authors provide a detailed analysis of the proposed probabilistic model, discussing its relation to the existing literature, its statistical properties, different estimation strategies as well as possible applications and extensions. Actuaries and researchers working in risk management and premium pricing will find this book particularly interesting. Graduate-level probability theory, stochastic analysis and statistics are required.

This book on counting statistics presents a novel copula-based approach to counting dependent random events. It combines clustering, combinatorics-based algorithms and dependence structure in order to tackle and simplify complex problems, without disregarding the hierarchy of or interconnections between the relevant variables. These problems typically arise in real-world applications and computations involving big data in finance, insurance and

banking, where experts are confronted with counting variables in monitoring random events. In this new approach, combinatorial distributions of random events are the core element. In order to deal with the high-dimensional features of the problem, the combinatorial techniques are used together with a clustering approach, where groups of variables sharing common characteristics and similarities are identified and the dependence structure within groups is taken into account. The original problems can then be modeled using new classes of copulas, referred to here as clusterized copulas, which are essentially based on preliminary groupings of variables depending on suitable characteristics and hierarchical aspects. The book includes examples and real-world data applications, with a special focus on financial applications, where the new algorithms' performance is compared to alternative approaches and further analyzed. Given its scope, the book will be of interest to master students, PhD students and researchers whose work involves or can benefit from the innovative methodologies put forward here. It will also stimulate the empirical use of new approaches among professionals and practitioners in finance, insurance and banking.

Leading the way in this field, the Encyclopedia of Quantitative Risk Analysis and Assessment is the first publication to offer a modern, comprehensive and in-depth resource to the huge variety of disciplines involved. A truly international work, its coverage ranges across risk issues pertinent to life scientists, engineers, policy makers, healthcare professionals, the finance industry, the military and practising statisticians. Drawing on the expertise of world-renowned authors and editors in this field this title provides up-to-date material on drug safety, investment theory, public policy applications, transportation safety, public perception of risk, epidemiological risk, national defence and security, critical infrastructure, and program management. This major publication is easily accessible for all those involved in the field of risk assessment and analysis. For ease-of-use it is available in print and online.

List of members for the years 1914-20 are included in v. 1-7, after which they are continued in the Year book of the society, begun in 1922.

Until now there were no published analyses of the recent solvency work conducted in Europe, specifically the risk categories proposed by the International Actuarial Association (IAA). Answering the insurance industry's demand in the wake of the EU Solvency II project, Solvency: Models, Assessment and Regulation provides a concrete summary and review of solvency and inspires additional work in the field. Following an introduction to the concept, the first section of the book provides a historical review of solvency, detailing solvency regulation and accounting within the EU. A review of the steps leading to Solvency II looks at accounting, supervision, the actuarial field, the first phase of Solvency II, international approaches to banking, and the solvency systems of 12 major nations. The second section explores the current basis for solvency modeling, focusing on the valuation of assets and liabilities, dependency and various conservative approaches, as well as a baseline and benchmark approach. This section also provides examples of risk structure and the effects of diversification. The final section discusses groups and internal modeling as it relates to EU Solvency II. It addresses insurance groups, financial conglomerates, reinsurance, the importance of internal modeling and stress testing, and the current state of the second phase of EU Solvency II.

This book summarizes the state of the art in generalized linear models (GLMs) and their various extensions: GAMs, mixed models and credibility, and some nonlinear variants (GNMs). In order to deal with tail events, analytical tools from Extreme Value Theory are presented. Going beyond mean modeling, it considers volatility modeling (double GLMs) and the general modeling of location, scale and shape parameters (GAMLSS). Actuaries need these advanced analytical tools to turn the massive data sets now at their disposal into opportunities. The exposition

alternates between methodological aspects and case studies, providing numerical illustrations using the R statistical software. The technical prerequisites are kept at a reasonable level in order to reach a broad readership. This is the first of three volumes entitled Effective Statistical Learning Methods for Actuaries. Written by actuaries for actuaries, this series offers a comprehensive overview of insurance data analytics with applications to P&C, life and health insurance. Although closely related to the other two volumes, this volume can be read independently.

Modern Actuarial Risk Theory contains what every actuary needs to know about non-life insurance mathematics. It starts with the standard material like utility theory, individual and collective model and basic ruin theory. Other topics are risk measures and premium principles, bonus-malus systems, ordering of risks and credibility theory. It also contains some chapters about Generalized Linear Models, applied to rating and IBNR problems. As to the level of the mathematics, the book would fit in a bachelors or masters program in quantitative economics or mathematical statistics. This second and.

The volume presents innovations in data analysis and classification and gives an overview of the state of the art in these scientific fields and applications. Areas that receive considerable attention in the book are discrimination and clustering, data analysis and statistics, as well as applications in marketing, finance, and medicine. The reader will find material on recent technical and methodological developments and a large number of applications demonstrating the usefulness of the newly developed techniques.

This new edition of the Handbook of Insurance reviews the last forty years of research developments in insurance and its related fields. A single reference source for professors, researchers, graduate students, regulators, consultants and practitioners, the book starts with the history and foundations of risk and insurance theory, followed by a review of prevention and precaution, asymmetric information, risk management, insurance pricing, new financial innovations, reinsurance, corporate governance, capital allocation, securitization, systemic risk, insurance regulation, the industrial organization of insurance markets and other insurance market applications. It ends with health insurance, longevity risk, long-term care insurance, life insurance financial products and social insurance. This second version of the Handbook contains 15 new chapters. Each of the 37 chapters has been written by leading authorities in risk and insurance research, all contributions have been peer reviewed, and each chapter can be read independently of the others.

This second volume examines practical real-life applications of predictive modeling to forecast future events with an emphasis on insurance.