

## Non Life Insurance Pricing With Generalized Linear Models

*Non-life insurance pricing is the art of setting the price of an insurance policy, taking into consideration various properties of the insured object and the policy holder. Introduced by British actuaries generalized linear models (GLMs) have become today a the standard approach for tariff analysis. The book focuses on methods based on GLMs that have been found useful in actuarial practice and provides a set of tools for a tariff analysis. Basic theory of GLMs in a tariff analysis setting is presented with useful extensions of standard GLM theory that are not in common use. The book meets the European Core Syllabus for actuarial education and is written for actuarial students as well as practicing actuaries. To support reader real data of some complexity are provided at [www.math.su.se/GLMbook](http://www.math.su.se/GLMbook).*

*Health Insurance aims at filling a gap in actuarial literature, attempting to solve the frequent misunderstanding in regards to both the purpose and the contents of health insurance products (and 'protection products', more generally) on the one hand, and the relevant actuarial structures on the other. In order to cover the basic principles regarding health insurance techniques, the first few chapters in this book are mainly devoted to the need for health insurance and a description of insurance products in this area (sickness insurance, accident insurance, critical illness covers, income protection, long-term care insurance, health-related benefits as riders to life insurance policies). An introduction to general actuarial and risk-management issues follows. Basic actuarial models are presented for sickness insurance and income protection (i.e. disability annuities). Several numerical examples help the reader understand the main features of pricing and reserving in the health insurance area. A short introduction to actuarial models for long-term care insurance products is also provided. Advanced undergraduate and graduate students in actuarial sciences; graduate students in economics, business and finance; and professionals and technicians operating in insurance and pension areas will find this book of benefit.*

*The prescription drug market -- Proposed solutions for rising drug prices -- Measuring the value of prescription drugs -- Measuring drug value : whose job is it anyway? -- Institute for Clinical and Economic Review (ICER) -- Other US value assessment frameworks -- Do drugs for special populations warrant higher prices? -- Improving value measurement -- Aligning prices with value -- The path forward.*

*Combining Fair Pricing and Capital Requirements for Non-life Insurance Companies*

*Risk Theory and Reinsurance*

*a study of survival trees, random forests and gradient boosting /*

*Optimal Premium Pricing Strategies for Nonlife Products in Competitive Insurance Markets*

*Health Insurance*

***Major challenges for life insurance companies have been posed by an unprecedented wave of mergers and acquisitions in the insurance industry and the emergence of non-traditional competitors such as banks, mutual fund companies and investment advisory firms. This is the first book to analyze the determinants of firm performance in the life insurance industry by identifying the 'best practices' employed by leading insurers to succeed in this dynamic business environment. The book draws upon data from insurer financial statements as well as upon an extensive survey of life insurer management practices and strategic choices in distribution systems, information technology, mergers and acquisitions, human resources and financial strategies. Generic strategies such as cost leadership, customer focus, and product differentiation are analyzed as well as strategic practices specific to the insurance industry. Best practices are identified by measuring the economic efficiency of insurers and by comparing firms across the industry. Both cost and revenue efficiency are measured relative to best practice efficient frontiers consisting of the industry's dominant life insurance firms. Economies of scale and the effects of mergers and acquisitions on efficiency are also analyzed. Financial strategies are examined with specific reference to pricing policy, valuation of assets and liabilities, and the current state of firm-level risk management systems. The benchmarks established are the result of extensive fieldwork that identifies key financial risks and methodologies to both measure and manage them at the firm level. The results discussed in the book indicate that firm performance is significantly correlated with management practices and strategic choices. Thus, life insurers can improve profitability by adopting optimal combinations of strategies. The book contains important new material on the effects of strategic choices in product distribution systems, information technology, mergers and acquisitions, human resources, and financial risk management policies. In the area of efficiency, the methodology provides a new approach for identifying peer groups of insurers and measuring the performance of individual insurers relative to their peer group. On the topics of risk and pricing, new insights are offered relative to current methodologies and in regard to areas where improvement is clearly warranted. The book concludes with an analysis of the future opportunities and challenges in the life insurance industry facing managers, and the strategic options available to them to cope with these changes.***

***A good mixture of practical problems and their solutions. Addresses students with no knowledge of insurance and insurance practitioners who recall mathematics only from some distance. Prerequisites are basic calculus and probability theory. Annotation copyrighted by Book News, Inc., Portland, OR***

***Novi Dewan establishes a status quo of the Indian health and life insurance industry and discusses the best practices for various elements of the marketing mix. She complements secondary research with recent empirical data accentuating the emerging opportunities and challenges in the Indian Insurance Industry by using standardized interviews with opinion leaders and CEOs of several insurers.***

***Non-Life Insurance Pricing with Generalized Linear Models***

***Claims Reserving in General Insurance***

***The Regulation and Structure of Non-life Insurance in the United States***

***Insurance Risk and Ruin***

***A Market Analysis on the Significance of Price Differentiation Factors in Non-Life Insurance***

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.

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).

This second edition expands the first chapters, which focus on the approach to risk management issues discussed in the first edition, to offer readers a better understanding of the risk management process and the relevant quantitative phases. In the following chapters the book examines life insurance, non-life insurance and pension plans, presenting the technical and financial aspects of risk transfers and insurance without the use of complex mathematical tools. The book is written in a comprehensible style making it easily accessible to advanced undergraduate and graduate students in Economics, Business and Finance, as well as undergraduate students in Mathematics who intend starting on an actuarial qualification path. With the systematic inclusion of practical topics, professionals will find this text useful when working in insurance and pension related areas, where investments, risk analysis and financial reporting play a major role.

Applied to Home-building Insurance

Investment Income and Non-life Insurance Pricing

A Marketing Approach

Introduction to Insurance Mathematics

On the Robust Stability of Pricing Models for Non-Life Insurance Products

**Predictive modeling uses data to forecast future events. It exploits relationships between explanatory variables and the predicted variables from past occurrences to predict future outcomes. Forecasting financial events is a core skill that actuaries routinely apply in insurance and other risk-management applications. Predictive Modeling Applications in Actuarial Science emphasizes life-long learning by developing tools in an insurance context, providing the relevant actuarial applications, and introducing advanced statistical techniques that can be used to gain a competitive advantage in situations with complex data. Volume 2 examines applications of predictive modeling. Where Volume 1 developed the foundations of predictive modeling, Volume 2 explores practical uses for techniques, focusing on property and casualty insurance. Readers are exposed to a variety of techniques in concrete, real-life contexts that demonstrate their value and the overall value of predictive modeling, for seasoned practicing analysts as well as those just starting out.**

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.

This master thesis aims at better understanding how price differentiation criteria are used in the pricing of auto insurance products, with a special focus on the Swiss market. During the research, it has been found that apart from a few exceptions, all examined risk factors are significant to a different degree in the determination of the auto insurance premium. Furthermore, evidence has been discovered that discrepancies remain across the examined insurance companies, with respect to how relevant a factor is as a driver in the premium calculation process. Last but not least, it has been found that the risk factors identified by insurers as more relevant do not always coincide with what consumers perceive.

Non-Life Insurance Mathematics

Theory and Practice

From Principles to Practice

Technical and Financial Features of Risk Transfers

Pricing Methods in Non-life Insurance: GLM and GLMM

*PRICING INSURANCE RISK A comprehensive framework for measuring, valuing, and managing risk Pricing Insurance Risk: Theory and Practice delivers an accessible and authoritative account of how to determine the premium for a portfolio of non-hedgeable insurance risks and how to allocate it fairly to each portfolio component. The authors synthesize hundreds of academic research papers, bringing to light little-appreciated answers to fundamental questions about the relationships between insurance risk, capital, and premium. They lean on their industry experience throughout to connect the theory to real-world practice, such as assessing the performance of business units, evaluating risk transfer options, and optimizing portfolio mix. Readers will discover: Definitions, classifications, and specifications of risk An in-depth treatment of classical risk measures and premium calculation principles Properties of risk measures and their visualization A logical framework for spectral and coherent risk measures How risk measures for capital and pricing are distinct but interact Why the cost of capital, not capital itself, should be allocated The natural allocation method and how it unifies marginal and risk-adjusted probability approaches Applications to reserve risk, reinsurance, asset risk, franchise value, and portfolio optimization Perfect for actuaries working in the non-life or general insurance and reinsurance sectors, Pricing Insurance Risk: Theory and Practice is also an indispensable resource for banking and finance professionals, as well as risk management professionals seeking insight into measuring the value of their efforts to mitigate, transfer, or bear nonsystematic risk.*

*Unter Insurance-Linked Securities (ILS) versteht man innovative Finanzprodukte, welche Versicherungsrisiken aus den eng abgegrenzten Märkten der Erst- und Rückversicherungswirtschaft herauslösen und mittels Verbriefung auf Kapitalmärkten handelbar machen. Durch ILS erhalten Investoren die Möglichkeit, für die Bereitstellung von Deckungskapital in Versicherungsrisiken zu investieren und im Gegenzug eine Versicherungsprämie zu erhalten. Hierbei verfolgt das Werk zwei Ziele. Zum Einen, die Durchführung einer genauen Analyse der zugrunde liegenden Zahlungsströme, der beworbenen Eigenschaften und jener Risiken, welche mit einer Investition in ILS verbunden sind. Zum Anderen, die Überprüfung der Anwendbarkeit und Passgenauigkeit vorgeschlagener versicherungsmathematischer und marktorientierter Bewertungsverfahren für ILS sowie die Unterbreitung möglicher Vorschläge für Bewertungsverfahren. Da ILS regelmäßig dazu verwendet werden Extremrisiken zu verbrieften, werden beide Untersuchungen unter expliziter Berücksichtigung der statistischen Eigenschaften von Extremrisiken durchgeführt. Im Ergebnis lässt sich festhalten, dass ILS Investitionen mit eigenen Spezifika darstellen. Investoren sollten diese kennen und berücksichtigen. Dies gilt gerade vor dem Hintergrund der stetig steigenden Zahl von ILS, welche insbesondere in den Zeiten der Niedrigzinsphase als attraktives Investment gesehen werden. Das Buch richtet sich an Investoren und Interessierte, die sich über ILS als Investitionen und deren Bewertung informieren möchten.*

*The goal of this book is to show the reader how, starting with a portfolio (collection) of insured risks, they can compute a reservation price (required premium) for the portfolio, and derive reservation prices for (i.e., allocate required premiums to) the components of the portfolio (regions, lines of business, etc.) in a defensible manner. Being able to do this, the reader can also, as a corollary, assess the*

*performance of different lines, evaluate needed reinsurance, or optimize overall strategy. Numerous innovative concepts are presented, among them: the use of two distinct risk measures--capitalization and pricing--in combination; analysis of pricing via thin layers or tranches, which leads to a new vision of how expected loss, risk margin, and capital are distributed across the spectrum of losses, and also to spectral risk measures for pricing; a financial perspective on thin layers to inform the design of spectral risk measures; concepts of consumption versus funding of capital, leading to the linear yield and leverage equivalent spectral risk measures; two complementary approaches to capital cost allocation. Risk--its definition and measurement--is first addressed in generality. The pricing of a portfolio of risks is analyzed from a financial perspective and leads to spectral risk measures. Financial principles are further applied to designing specific spectral risk measures to meet specific criteria at the portfolio level. The application of spectral risk measures for pricing the individual risks in the portfolio then emerges naturally. Further sections address implementation within simulation models, optimization of risk transfer, and areas for further development. The Casualty Actuarial Society is currently revising its exam syllabus for Part 9, which covers the same topics as this book. The authors are working with the relevant committee with the aim of having the book become the principle text for the exam. The CAS has moved from using papers to a more unified treatment, based on a single text, in their other exams, but Part 9 has yet to be updated. Approximately 400 people take Part 9 each year.*

**Regression Trees for Pricing in Non-life Insurance**

**The Right Price**

**Life Insurance Fact Book**

**Tacit Collusion**

**Game Theoretical Approaches for Pricing of Non-life Insurance Policies Into a Competitive Market Environment**

Non-Life Insurance Pricing with Generalized Linear ModelsSpringer

In this paper, we design a model for the insurance pricing process of a portfolio of different (dependent or independent) non-life products. A standard decision function for the determination of the premium is proposed which use the recent claim experience and a negative feedback mechanism of the known surplus value. The model assumes a time-varying, bounded delay factor, time-varying parameters and different types of norm-bounded uncertainties. Finally, a Linear Matrix Inequality (LMI) criterion is derived for the investigation of the robust stability of the system. For the first time, a classical tool for the robust control analysis of engineering systems has been applied for the insurance pricing process of non-life products, extending further the existing literature. An example with 2 dependent non-life products illustrates the results of the paper.

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.

Computational Actuarial Science with R

Basic Actuarial Models

Risk Modelling in General Insurance

Stochastic Methods for Credit Risk

Price Setting and Price Regulation in Health Care

A wide range of topics to give students a firm foundation in statistical and actuarial concepts and their applications.

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.

The objectives of this study are to describe experiences in price setting and how pricing has been used to attain better coverage, quality, financial protection, and health outcomes. It builds on newly commissioned case studies and lessons learned in calculating prices, negotiating with providers, and monitoring changes. Recognising that no single model is applicable to all settings, the study aimed to generate best practices and identify areas for future research, particularly in low- and middle-income settings. The report and the case studies were jointly developed by the OECD and the WHO Centre for Health Development in Kobe (Japan).

Handbook of Insurance

The Solution to a Finite Pricing Duopoly and Evidence from Japanese Non-life Insurance

Pricing in General Insurance

Indian Life and Health Insurance Industry

**In non-life insurance, a loss reserve represents the insurer's best estimate of outstanding liabilities for losses that occurred on or before a valuation date. The accurate prediction of outstanding liabilities is key to setting reserves and calibrating insurance rates, which are two interconnected primary functions of actuaries. For instance, inadequate reserves could lead to deficient rates and thereby increase solvency risk. Also, excessive reserves could increase the cost of capital and regulatory scrutiny. Therefore, reserving accuracy is essential for insurers to meet regulatory requirements, remain solvent, and stay competitive. The loss reserve prediction in non-life insurance is usually based on macro-level models that use aggregate loss data summarized in a run-off triangle. The main strengths of the macro-level models are that they are easy to implement and interpret. But, the limited ability to handle heterogeneity among triangle cells and changes to the business environment may lead to inaccurate predictions. Recently, micro-level reserving techniques have gained traction as they allow an analyst to use the information on the policy, the individual claim, and the development process to predict outstanding liabilities. Granular covariate information allows environmental changes to be captured naturally to improve reserve predictions. In non-life insurance, the payment history can be predictive of the timing of a settlement for individual claims. Ignoring the association between the payment process and the settlement process could bias the prediction of outstanding payments. To address this issue, In this dissertation, I introduce into the literature of micro-level loss reserving a joint modeling framework that incorporates longitudinal payments of a claim into the intensity process of the claim settlement. I discuss statistical inference and focus on the prediction aspects of the model. I demonstrate applications of the proposed model in the reserving practice and identify scenarios where the joint model outperforms macro-level reserving methods using simulated data. Moreover, I present a detailed empirical analysis using data from a property insurance provider. I fit the joint model to a training dataset and use the fitted model to predict the future development of open claims. The prediction results using out-of-sample data show that the joint model framework outperforms existing reserving models that ignore the payment-settlement association. In pricing insurance contracts for non-life insurers, current methods often only consider the information on closed claims and ignore open claims. In case of a shift in the insurer's book risk profile, open claims could reflect the change in a timely manner compared to closed claims. This dissertation presents an intuitive ratemaking model by employing a marked Poisson process framework. The framework ensures that the multivariate risk analysis is done using the information on all reported claims and makes an adjustment for incurred but not reported claims based on the reporting delay distribution. Using data from a property insurance provider, I show that by determining rates based on current data, the proposed ratemaking framework leads to better alignment of premiums with claims experience. Among other things, accurate risk pricing suggests that all market participants, insurers, and customers, bear reasonable costs for risks assumed.**

**"Offers a mathematical introduction to non-life insurance and, at the same time, to a multitude of applied stochastic processes. It gives detailed discussions of the fundamental models for claim sizes, claim arrivals, the total claim amount, and their probabilistic properties....The reader gets to know how the underlying probabilistic structures allow one to determine premiums in a portfolio or in an individual policy." --Zentralblatt für Didaktik der Mathematik**

**This open access volume of the AIDA Europe Research Series on Insurance Law and Regulation offers the first comprehensive legal and regulatory analysis of the Insurance Distribution Directive (IDD). The IDD came into force on 1 October 2018 and regulates the distribution of insurance products in the EU. The book examines the main changes accompanying the IDD and analyses its impact on insurance distributors, i.e., insurance intermediaries and insurance undertakings, as well as the market. Drawing on interrelations between the rules of the Directive and other fields that are relevant to the distribution of insurance products, it explores various topics related to the interpretation of the IDD - e.g. the harmonization achieved under it; its role as a benchmark for national legislators; and its interplay with other regulations and sciences - while also providing an empirical analysis of the standardised pre-contractual information document. Accordingly, the book offers a wealth of valuable insights for academics, regulators, practitioners and students who are interested in issues concerning insurance distribution.--**

**Predictive Modeling Applications in Actuarial Science: Volume 2, Case Studies in Insurance**

**A Value-Based Prescription for Drug Costs**

**A Legal Analysis**

**An Introduction with the Poisson Process**

**Non-Life Insurance-Linked Securities: Risk and Pricing Analysis**

The focus of this book is on the two major areas of risk theory: aggregate claims distributions and ruin theory. For aggregate claims distributions, detailed descriptions are given of recursive techniques that can be used in the individual and collective

risk models. For the collective model, the book discusses different classes of counting distribution, and presents recursion schemes for probability functions and moments. For the individual model, the book illustrates the three most commonly applied techniques. Beyond the classical topics in ruin theory, this new edition features an expanded section covering time of ruin problems, Gerber-Shiu functions, and the application of De Vylder approximations. Suitable for a first course in insurance risk theory and extensively classroom tested, the book is accessible to readers with a solid understanding of basic probability. Numerous worked examples are included and each chapter concludes with exercises for which complete solutions are provided. Reinsurance is an important production factor of non-life insurance. The efficiency and the capacity of the reinsurance market directly regulate those of insurance markets. The purpose of this book is to provide a concise introduction to risk theory, as well as to its main application procedures to reinsurance. The first part of the book covers risk theory. It presents the most prevalent model of ruin theory, as well as a discussion on insurance premium calculation principles and the mathematical tools that enable portfolios to be ordered according to their risk levels. The second part describes the institutional context of reinsurance. It first strives to clarify the legal nature of reinsurance transactions. It describes the structure of the reinsurance market and then the different legal and technical features of reinsurance contracts, known as reinsurance 'treaties' by practitioners. The third part creates a link between the theories presented in the first part and the practice described in the second one. Indeed, it sets out, mostly through examples, some methods for pricing and optimizing reinsurance. The authors aim is to apply the formalism presented in the first part to the institutional framework given in the second part. It is reassuring to find such a relationship between approaches seemingly abstract and solutions adopted by practitioners. Risk Theory and Reinsurance is mainly aimed at master's students in actuarial science but will also be useful for practitioners wishing to revive their knowledge of risk theory or to quickly learn about the main mechanisms of reinsurance.

Generalized linear models have the important property of providing unbiased estimates on a portfolio level. This implies that generalized linear models manage to provide accurate prices on a portfolio level. On the other hand, neural networks may provide very accurate prices on an individual policy level, but state-of-the-art use of neural networks does not pay attention to unbiasedness on a portfolio level. In fact, this is an implicit consequence of using early stopping rules in gradient descent methods for model fitting. In the present paper we discuss this deficiency and we provide two different techniques that remove this drawback of neural network model fitting.

Black Book - Non-Life Insurance: Strong Reserve Adequacy & Profits, Even If Pricing Down

Encyclopedia of Quantitative Risk Analysis and Assessment

Pricing Insurance Risk

Insurance Distribution Directive

Joint Model Prediction for Individual-level Loss Reserving and a Framework to Improve Ratemaking in Non-life Insurance