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REVIEWS

Loss Models: From Data to Decisions. By Stuart A. Klugman, Harry H. Panjer & Gordon E. Willmot 3rd edition, John Wiley & Sons, 2008. 726pp. ISBN: 9780470187814

This book provides in depth coverage of modelling techniques used throughout many branches of actuarial science. Whilst many of the topics, such as modelling long-tail distributions, are particularly useful in general insurance, they are becoming increasingly relevant throughout the insurance, pensions and investment industries. The exceptional high standard of this book has made it a pleasure to read and review.

This book has so much depth and useful detail that it is difficult to cover all the aspects in a short review — the highlights are covered below.

Part 1: Introduction

The introduction sets the tone for the book well. The basics of modelling are introduced, with the background for random variables, moments and generating functions. There is already a section on the tail of distributions and how these might be classified, as well as a section on comparing the tails of different distributions. The introduction starts discussing different measures of risk, which are useful in many areas including operational risk analysis. Value-at-Risk (VaR) is covered as well as Tail-Value-at-Risk (TVaR) which is equal to the VaR plus the average excess of all losses that exceed the VaR. So, the TVaR provides additional information of the distribution above the VaR limit.

Part 2: Actuarial Models

There are detailed sections covering continuous and discrete distributions. Whilst these are typically covered in most statistics books, this book covers them from an actuarial slant. The effects of deductibles and excesses on probability distributions are investigated.

Extreme value theory is covered in the context of continuous distributions. Extreme value distributions such as the Gumbel (used in flooding), Weibull (wind speed modelling) and Frechet are discussed.

Multivariate distributions and copulas are introduced allowing the modelling of dependent variables. Modelling dependence between variables is a challenging area of actuarial science with a lot of room for growth. Aggregate loss models and discrete and continuous ruin models are also covered in detail.

Part 3: Construction of Empirical Models

In this section there is a review of statistics which I found useful. Interval estimation, hypothesis testing, mean-square-error are just some of the topics I have studied before which were quickly brought back to an easy understanding.

Empirical models are covered in detail, also for grouped and modified data. Kernel density models are introduced as a method of creating smooth empirical like distributions.

Part 4: Parametric Statistical Methods

This chapter is a detailed guide to fitting parametric models. The method of moments and percentile matching are covered, as well as maximum likelihood estimation and its importance for modelling long-tail distributions. Bayesian methods for parameter estimation are also discussed.

A section on model selection I found particularly useful. Having developed a number of possible models — how best to choose between them? The issues and considerations are covered exceptionally well. A number of detailed examples highlight the issues in practice.

Part 5: Adjusted Estimates

There is an excellent section covering spline interpolation. This method of fitting a smooth line to a series of points has many uses and is well explained.

There is also detailed coverage of credibility theory. All the different approaches to credibility are covered, from the simple and practical, to the most theoretical approaches.

Part 6: Simulation

This section is probably the only area of the book where more detail would add value. Whilst the value of simulation is discussed and several useful examples are given, such as valuing the cost of options and guarantees, more detail on topics such as deflators would certainly add value.

One of the strengths of this book is that it introduces topics at an early stage and goes into more detail throughout the book showing how they can be used in practice. This helps strengthen understanding and is useful for the practitioner. The topics throughout this book are made a lot clearer with many useful examples. There are also exercise questions throughout — the solutions to these exercises are available in a separate answer booklet.

This is an excellent reference for any professional actuary working in modelling. The issues are all explained from an actuarial view-point relating directly to the topics we face in practice. Whilst this book is required reading for Society of Actuaries (SOA) and Casualty Actuarial Society (CAS) actuarial students, UK actuarial students are likely to find it a non essential supplement to their current course reading. From my own background of having qualified in the last five years, I found it a great refresher on the topics previously studied as part of the Institute of Actuaries examinations,

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but also an introduction to other useful subjects; in particular extreme value theory, tail-value-at-risk, copulas, kernels and spline interpolation being just a few.

James Sharpe

Interdisciplinary Statistics: Statistical and Probabilistic Methods in Actuarial Science. By Philip J. Boland, Chapman & Hall, 2007. 351pp. ISBN: 9781584886952

This textbook is aimed at students studying for insurance or actuarial exams. Much of the material overlaps with the statistical elements of the current core technical subjects, especially the models module. It therefore makes a useful alternative reference source for students looking for an additional presentation of the material over and above course notes.

The textbook covers a wide range of statistical topics, focusing on those closest to general insurance. The chapters include: claims reserving and pricing with run-off triangles; loss distributions; risk theory; ruin theory; credibility theory; no claims discounting; generalised linear models; and decision and game theory.

The book assumes a level of statistical knowledge broadly consistent with some A-Level statistics, in particular familiarity with probability distributions and random variables. There is, however, an appendix on basic probability distributions and basic probability tools such as moment generating functions, convolutions, conditional probability and distributions, and maximum likelihood estimation.

Each chapter starts with an introduction to the insurance background of the techniques helping to put the theory into a general insurance context. Most chapters can be read independently of the others which makes this a useful supplementary resource to someone already studying actuarial statistics.

Each chapter contains a number of questions covering the theory, useful for checking the readers' understanding and initial grasp of material. There are circa 150 questions spread across eight chapters with answers to half of these. This makes it possible to use the book in classroom/seminar situations. However, anyone using the book to support distance learning or self study will probably wish to seek out additional question and answer support.

The presentation of the material itself is well done. Starting with the real world insurance problem and developing the theory to find the statistical approach. This aids the reader to understand and retain the material. Case study style examples are presented throughout the text to add to the context and show the power of the methods presented.

Although this text is well explained in a reading style, it still succeeds in incorporating mathematical rigour. The text includes all the theorems and proofs which support the main topics and methods. In addition there are a substantial number of numerical examples throughout the book which both illustrate and develop the theory.

Overall this is an excellent textbook presenting a range of statistical techniques used in general insurance. It is well presented from an applied perspective with examples to aid understanding. A student following a course of self study will probably still need to supplement the textbook with additional question practise but otherwise it forms a comprehensive course.

HELEN FRANCE

Synthetic CDOs: Modelling, Valuation and Risk Management. By CRAIG MOUNFIELD, Cambridge University Press, 2008. 369pp. ISBN: 9780521897884

This book describes the quantitative modelling of the collateralised debt obligations (CDOs) from a practitioners' point of view.

Chapter 1 introduces the basic concepts of the credit derivatives such as credit default swaps (CDSs), CDOs, and synthetic CDOs in particular.

Chapter 2 discusses the single-name default models and the dependency models. The reduced-form credit model and the Gaussian copula approach are summarised as the standard model used throughout the book. In order to help the readers understand the dependency structure, the author uses intuitive examples to illustrate the shortcomings of linear correlation, and describes in detail the algorithm to generate Gaussian copula.

Chapter 3 starts with the pricing model for a vanilla CDS and an example of Monte Carlo simulations. Since the CDSs are the most straightforward and transparent credit derivatives, the author takes the opportunity to analyse the three risk factors affecting the value of a credit product: underlying default, recovery, and protection counterparty.

Chapter 4 introduces iTraxx and CDX, two liquidly traded credit indices, and the so-called correlation trading arising from the tranched exposures to the index portfolio.

The first part of Chapter 5 is devoted to the Monte Carlo valuation of default baskets. For comparison, the second part explains the semi-analytic valuation approach based on the simple single-factor credit model. In either case, correlation is highlighted as an important variable.

Chapter 6 outlines the standard market model (Gaussian copula) for the valuation of synthetic CDOs. The key quantity of the model is the portfolio loss distribution as it defines the contingent cashflow for each different tranche.

Chapter 7 extends the previous chapter to carry out more detailed analysis of the standard market model. A lot of sensitivity analyses and graphs are presented in this chapter. Readers should find it helpful to scrutinise the graphs first and then compare their qualitative explanation with those given by the author.

Chapter 8 quantifies some risk measures widely used in a bank to monitor the daily profit & loss fluctuations: CS01 (sensitivity of tranche PV to the movement in the underlying par CDS spread), correlation vega (sensitivity to the default correlation), VoD (sensitivity to the outright default), and time decay (sensitivity to the contractual life of a tranche). In addition, the author introduces the concept of value-at-risk (VaR), and gives two examples of credit spread VaR and default VaR.

Chapter 9 starts with a brief description of how to calibrate the correlation parameter such that the model price of a standard tranche matches the market price. The implied correlation derived in this way is not constant across different tranches and maturities and the term ‘correlation smile’ is used to portray such a pattern. The standard modification approach, as explained by the author in an intuitive way, is to use the ‘base correlation’, although it has some technical limitations when applied to a bespoke tranche.

The limitation of the correlation is caused by the shortcoming of the standard model, and Chapter 10 extends the discussion to the variations of the standard model. Readers are encouraged to refer to the papers recommended in the book, and explore further the pros and cons of each improved model.

Chapter 11 briefly describes the exotic CDOs, including CDO squared (CDOs whose underlying collaterals are synthetic CDOs), cashflow CDOs (asset backed security CDOs in particular), and asset-backed CDSs.

Chapter 12 introduces the correlation trading, a trading strategy that exploits the sensitivity of synthetic CDOs to CDS spread and correlation. In the first half of the chapter, the author uses the numerical examples to explain the long/short positions and different delta hedging strategies. Two case studies are presented in the second half of the chapter: the 2005 correlation dislocation due to auto-industry downgrading, and the pre-2008 credit crunch due to sub-prime defaults.

In Chapter 13, the author talks about the quantitative risk management techniques used at the aggregated bank level, many of which are similar to those discussed in Chapter 8 but with a further complication of book overlay.

The final chapter is devoted to the more advanced technique of hedging simulation, where a bank uses a (more traceable) replicating portfolio to simulate the dynamic life behaviour of a credit derivative and measure the effectiveness of its hedging strategy. The same methodology is applicable to the counterparty credit exposure management.

For someone who wants to pursue a career in credit derivatives, this is a recommendable reference book. Written in a very practical way, the technical contents of the book should not be too difficult to follow for a reader with intermediate quantitative skills.

Throughout the book, the author reiterated the issue of model risk, i.e. how the value of a credit derivative may change with respect to the different underlying assumptions and models chosen. The model risk will be escalated to a systematic risk if the flawed model is used as a 'standard' model across the whole banking industry. Therefore, even for readers less keen to the technical details of modelling and valuation (actuaries, pension trustees, etc.), this book provides a deep insight into the credit derivatives and will help them better understand the risk vs. reward features of CDO investment.

FEIFEI ZHANG

Financial and Actuarial Mathematics. By WAI-SUM CHAN & YIU-KUEN TSE, McGraw Hill, 2008. 400pp. ISBN: 9780071258562

This book is an introduction to financial and actuarial mathematics, aimed at students on elementary actuarial courses, typically first- or second-year undergraduates, although there are glimpses of more advanced topics. The authors, both experienced teachers, were motivated by students' requests for more applications and illustrations (was there ever a student who asked for fewer?).

The first two-thirds or so of the book covers financial mathematics, with chapters on: Interest accumulation and time value of money; Annuities; Rates of return; Amortization and sinking fund; Bonds; Bond management; Applications; and Stochastic interest rates.

The writing is clear and concise and is, indeed, well-provided with examples, and a good selection of exercises. A nice feature is that guidance is given on using spreadsheets, with screenshots of Excel used to solve simple problems. It would surely be absurd, today, to write on this subject without acknowledging the computational realities. The book passes this test, but nevertheless has to prepare the student for pencil-and-paper examinations.

Chapter 1 introduces annual, periodic and continuous compounding from the start, with traditional notation. This suits the authors' admirable desire for logic and rigour, and it means these tools can be deployed in examples throughout the book, but it raises considerably the first hurdle that the student must clear. There may be advantages, at least in undergraduate courses, in postponing varieties of compounding until the student has a good grasp of the main ideas. That said, by judicious skipping, and selection of examples, the alternative course could be pursued.

Chapters 6 (Bond management) and 7 (Applications) introduce numerous topics, ranging from several notions of matching and immunisation, to financial assets, indices and inflation. The treatment is concise but clear and the many examples are welcome. The brief treatment of stochastic interest rates in Chapter 8 is distinctly more sophisticated than earlier sections; students with a solid grasp of probability ought to find it stimulating.

The last three chapters introduce 'actuarial mathematics' under the headings: Survival models and life contingencies; Life insurance (Chapter 9), life annuities and net premiums (Chapter 10); and Short-term risk models for life insurance (Chapter 11).

Chapter 9 introduces survival models based on random lifetimes before turning to the life table as a calculating tool. The treatment in Chapter 10, however, I found rather inconsistent. Assurance benefits are introduced *via* the random present value, denoted Z, induced by the random future lifetime. The associated net single premium is then $E[Z]$. However, random lifetimes are avoided in writing down 'actuarial present values' of life annuities, which are defined as expressions of the form $\sum v^t {}_tp_x$. This hardly seems necessary for a student who has followed Chapter 8, and the inconsistency (or perhaps another reason) means that the important relationships of the form $A_x = 1 - d\ddot{a}_x$ are relegated to an exercise. Some compensation for this odd presentation is that spreadsheet exercises are included.

The final chapter is motivated by risk theory more than by life insurance, although it offers some useful insights. Based on one-year life insurances, distributions and risk loadings based on aggregate claims in homogeneous and non-homogeneous portfolios are covered, including the de Pril recursion. This perhaps tends to draw the student away from the mainstream, given that policy values are not covered.

This book can certainly be recommended for an introductory course in financial mathematics, as main or supplementary reading.

ANGUS S. MACDONALD