PAVEL V. SHEVCHENKO

# Modelling Operational Risk Using Bayesian Inference

Springer

# Modelling Operational Risk Using Bayesian Inference

**Bertrand K. Hassani**

**Modelling Operational Risk Using Bayesian Inference:**

    **Modelling Operational Risk Using Bayesian Inference** Pavel V. Shevchenko,2011-01-19 The management of operational risk in the banking industry has undergone explosive changes over the last decade due to substantial changes in the operational environment Globalization deregulation the use of complex financial products and changes in information technology have resulted in exposure to new risks which are very different from market and credit risks In response the Basel Committee on Banking Supervision has developed a new regulatory framework for capital measurement and standards for the banking sector This has formally defined operational risk and introduced corresponding capital requirements Many banks are undertaking quantitative modelling of operational risk using the Loss Distribution Approach LDA based on statistical quantification of the frequency and severity of operational risk losses There are a number of unresolved methodological challenges in the LDA implementation Overall the area of quantitative operational risk is very new and different methods are under hot debate This book is devoted to quantitative issues in LDA In particular the use of Bayesian inference is the main focus Though it is very new in this area the Bayesian approach is well suited for modelling operational risk as it allows for a consistent and convenient statistical framework for quantifying the uncertainties involved It also allows for the combination of expert opinion with historical internal and external data in estimation procedures These are critical especially for low frequency high impact operational risks This book is aimed at practitioners in risk management academic researchers in financial mathematics banking industry regulators and advanced graduate students in the area It is a must read for anyone who works teaches or does research in the area of financial risk      *Modelling Operational Risk Using a Bayesian Approach to Extreme Value Theory* María Elena Rivera Mancía,2014 Extreme value theory is concerned with the tail behaviour of probability distributions In recent years it has found many applications in areas as diverse as hydrology actuarial science and finance where complex phenomena must often be modelled from a small number of observations Extreme value theory can be used to assess the risk of rare events either through the block maxima or peaks over threshold method The choice of threshold is both influential and delicate as a balance between the bias and variance of the estimates is required At present this threshold is often chosen arbitrarily either graphically or by setting it as some high quantile of the data Bayesian inference is an alternative to deal with this problem by treating the threshold as a parameter in the model In addition a Bayesian approach allows for the incorporation of internal and external observations in combination with expert opinion thereby providing a natural probabilistic framework to evaluate risk models This thesis presents a Bayesian inference framework for extremes We focus on a model proposed by Behrens et al 2004 where an analysis of extremes is performed using a mixture model that combines a parametric form for the centre and a Generalized Pareto Distribution GPD for the tail of the distribution Our approach accounts for all the information available in making inference about the unknown parameters from both distributions the threshold included A Bayesian analysis is then performed by using expert opinions to

determine the parameters for prior distributions posterior inference is carried out through Markov Chain Monte Carlo methods We apply this methodology to operational risk data to analyze its performance The contributions of this thesis can be outlined as follows Bayesian models have been barely explored in operational risk analysis In Chapter 3 we show how these models can be adapted to operational risk analysis using fraud data collected by different banks between 2007 and 2010 By combining prior information to the data we can estimate the minimum capital requirement and risk measures such as the Value at Risk VaR and the Expected Shortfall ES for each bank The use of expert opinion plays a fundamental role in operational risk modelling However most of time this issue is not addressed properly In Chapter 4 we consider the context of the problem and show how to construct a prior distribution based on measures that experts are familiar with including VaR and ES The purpose is to facilitate prior elicitation and reproduce expert judgement faithfully In Section 4 3 we describe techniques for the combination of expert opinions While this issue has been addressed in other fields it is relatively recent in our context We examine how different expert opinions may influence the posterior distribution and how to build a prior distribution in this case Results are presented on simulated and real data In Chapter 5 we propose several new mixture models with Gamma and Generalized Pareto elements Our models improve upon previous work by Behrens et al 2004 since the loss distribution is either continuous at a fixed quantile or it has continuous first derivative at the blend point We also consider the cases when the scaling is arbitrary and when the density is discontinuous Finally we introduce two nonparametric models The first one is based on the fact that the GPD model can be represented as a Gamma mixture of exponential distributions while the second uses a Dirichlet process prior on the parameters of the GPD model **Modelling Operational Risk Using Skew T-copulas and Bayesian Inference** Betty Johanna Garzon Rozo,2016 **Monte Carlo and Quasi-Monte Carlo Methods 2012** Josef Dick,Frances Y. Kuo,Gareth W. Peters,Ian H. Sloan,2013-12-05 This book represents the refereed proceedings of the Tenth International Conference on Monte Carlo and Quasi Monte Carlo Methods in Scientific Computing that was held at the University of New South Wales Australia in February 2012 These biennial conferences are major events for Monte Carlo and the premiere event for quasi Monte Carlo research The proceedings include articles based on invited lectures as well as carefully selected contributed papers on all theoretical aspects and applications of Monte Carlo and quasi Monte Carlo methods The reader will be provided with information on latest developments in these very active areas The book is an excellent reference for theoreticians and practitioners interested in solving high dimensional computational problems arising in particular in finance statistics and computer graphics *The Structural Modelling of Operational Risk Via Bayesian Inference* Pavel V. Shevchenko,2014 To meet the Basel II regulatory requirements for the Advanced Measurement Approaches the bank s internal model must include the use of internal data relevant external data scenario analysis and factors reflecting the business environment and internal control systems Quantification of operational risk cannot be based only on historical data but should involve scenario analysis Historical

internal operational risk loss data have limited ability to predict future behaviour moreover banks do not have enough internal data to estimate low frequency high impact events adequately Historical external data are difficult to use due to different volumes and other factors In addition internal and external data have a survival bias since typically one does not have data of all collapsed companies The idea of scenario analysis is to estimate frequency and severity of risk events via expert opinions taking into account bank environment factors with reference to events that have occurred or may have occurred in other banks Scenario analysis is forward looking and can reflect changes in the banking environment It is important to not only quantify the operational risk capital but also provide incentives to business units to improve their risk management policies which can be accomplished through scenario analysis By itself scenario analysis is very subjective but combined with loss data it is a powerful tool to estimate operational risk losses Bayesian inference is a statistical technique well suited for combining expert opinions and historical data In this paper we present examples of the Bayesian inference methods for operational risk quantification    *Scenario Analysis in Risk Management* Bertrand K. Hassani,2016-10-26 This book focuses on identifying and explaining the key determinants of scenario analysis in the context of operational risk stress testing and systemic risk as well as management and planning Each chapter presents alternative solutions to perform reliable scenario analysis The author also provides technical notes and describes applications and key characteristics for each of the solutions In addition the book includes a section to help practitioners interpret the results and adjust them to real life management activities Methodologies including those derived from consensus strategies extreme value theory Bayesian networks Neural networks Fault Trees frequentist statistics and data mining are introduced in such a way as to make them understandable to readers without a quantitative background Particular emphasis is given to the added value of the implementation of these methodologies    *Investment Risk Management* Harold Kent Baker,Greg Filbeck,2015 Investment Risk Management provides an overview of developments in risk management and a synthesis of research on the subject The chapters examine ways to alter exposures through measuring and managing risk exposures and provide an understanding of the latest strategies and trends within risk management    *Mathematical Control Theory and Finance* Andrey Sarychev,Albert Shiryaev,Manuel Guerra,Maria do Rosário Grossinho,2009-03-31 Control theory provides a large set of theoretical and computational tools with applications in a wide range of elds running from pure branches of mathematics like geometry to more applied areas where the objective is to nd solutions to real life problems as is the case in robotics control of industrial processes or nance The high tech character of modern business has increased the need for advanced methods These rely heavily on mathematical techniques and seem indispensable for competitiveness of modern enterprises It became essential for the nancial analyst to possess a high level of mathematical skills C versely the complex challenges posed by the problems and models relevant to nance have for a long time been an important source of new research topics for mathematicians The use of techniques from stochastic optimal control constitutes a well established and important branch of

mathematical nance Up to now other branches of control theory have found comparatively less application in n cial problems To some extent deterministic and stochastic control theories developed as di erent branches of mathematics However there are many points of contact between them and in recent years the exchange of ideas between these elds has intensi ed Some concepts from stochastic calculus e g rough paths havedrawntheattentionofthedeterministiccontroltheorycommunity Also some ideas and tools usual in deterministic control e g geometric algebraic or functional analytic methods can be successfully applied to stochastic c trol     Extreme Value Modeling and Risk Analysis Dipak K. Dey,Jun Yan,2016-01-06 Extreme Value Modeling and Risk Analysis Methods and Applications presents a broad overview of statistical modeling of extreme events along with the most recent methodologies and various applications The book brings together background material and advanced topics eliminating the need to sort through the massive amount of literature on the subje     **Quantification of Operational Risk Under Basel II** Imad A. Moosa,2008-10-31 The book presents arguments that are critical of the Basel II Accord particularly the advanced measurement approach to operational risk It is argued that the advanced measurement approach is not viable in terms of costs and benefits and is likely to distract financial institutions from the real task of managing operational risk     Risk ,2000-08     *Measuring Operational and Reputational Risk* Aldo Soprano,Bert Crielaard,Fabio Piacenza,Daniele Ruspantini,2009-04-20 How to apply operational risk theory to real life banking data Modelling Operational and Reputational Risks shows practitioners the best models to use in a given situation according to the type of risk an organization is facing Based on extensive applied research on operational risk models using real bank datasets it offers a wide range of various testing models and fitting techniques for financial practitioners With this book professionals will have a foundation for measuring and predicting these important intangibles Aldo Soprano Madrid Spain is Group Head of operational risk management at UniCredit Group     *Stochastic Claims Reserving Methods in Insurance* Mario V. Wüthrich,Michael Merz,2008-06-09 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

Multivariate Estimation for Operational Risk with Judicious Use of Extreme Value Theory Mahmoud El-Gamal,2006

*Bayesian Inference, Monte Carlo Sampling and Operational Risk* Gareth Peters,2017 Operational risk is an important quantitative topic as a result of the Basel II regulatory requirements Operational risk models need to incorporate internal and external loss data observations in combination with expert opinion surveyed from business specialists Following the Loss Distributional Approach this article considers three aspects of the Bayesian approach to the modelling of operational risk Firstly we provide an overview of the Bayesian approach to operational risk before expanding on the current literature through consideration of general families of non conjugate severity distributions g and h and GB2 distributions Bayesian model selection is presented as an alternative to popular frequentist tests such as Kolmogorov Smirnov or Anderson Darling We present a number of examples and develop techniques for parameter estimation for general severity and frequency distribution models from a Bayesian perspective Finally we introduce and evaluate recently developed stochastic sampling techniques and highlight their application to operational risk through the models developed **Advances in Operational Risk** ,2003 Building upon the seminal work established in the first best selling edition this fully revised multi contributor title brings you right up to date on all the latest issues and developments in the area of operational risk management and the regulatory environment Bayesian Inference and Maximum Entropy Methods in Science and Engineering Ali Mohammad-Djafari,2001-06-08 Bayesian inference and maximum entropy methods are central points of new scientific inference in mathematical physics and in all inverse problems in engineering and all probabilistic data analysis This volume contains peer reviewed selection of the papers presented at this international workshop Topics included are axiomatics and concepts bayesian parameter estimation algorithms for bayesian computation deconvolution and source separation quantum tomography tomographic imaging and image processing as well as bayesian inference in applications **Operational Risk Modeling in Financial Services** Patrick Naim,Laurent Condamin,2019-05-28 Transform your approach to oprisk modelling with a proven non statistical methodology Operational Risk Modeling in Financial Services provides risk professionals with a forward looking approach to risk modelling based on structured management judgement over obsolete statistical methods Proven over a decade s use in significant banks and financial services firms in Europe and the US the Exposure Occurrence Impact XOI method of operational risk modelling played an instrumental role in reshaping their oprisk modelling approaches in this book the expert team that developed this methodology offers practical in depth guidance on XOI use and applications for a variety of major risks The Basel Committee has dismissed statistical approaches to risk modelling leaving regulators

and practitioners searching for the next generation of oprisk quantification The XOI method is ideally suited to fulfil this need as a calculated coordinated consistent approach designed to bridge the gap between risk quantification and risk management This book details the XOI framework and provides essential guidance for practitioners looking to change the oprisk modelling paradigm Survey the range of current practices in operational risk analysis and modelling Track recent regulatory trends including capital modelling stress testing and more Understand the XOI oprisk modelling method and transition away from statistical approaches Apply XOI to major operational risks such as disasters fraud conduct legal and cyber risk The financial services industry is in dire need of a new standard a proven transformational approach to operational risk that eliminates or mitigates the common issues with traditional approaches Operational Risk Modeling in Financial Services provides practical real world guidance toward a more reliable methodology shifting the conversation toward the future with a new kind of oprisk modelling    *Introduction to Simulation and Risk Analysis* James Robert Evans,David Louis Olson,2002 Simulation fundamentals Introduction to Simulation Simulation Using Excel Probability and Statistics in Simulation Simulation in risk analysis Risk Analysis Using Crystal Ball Applications of Risk Analysis Building System Simulation Models Systems simulation Output Analysis and Experimentation for Systems Simulation Systems Simulation Using ProcessModel Applications of Systems Simulation Extensions of simulation Simulation in Forecasting and Optimization    *Dynamic Operational Risk* Gareth Peters,2014 In this paper we model dependence between operational risks by allowing risk profiles to evolve stochastically in time and to be dependent This allows for a flexible correlation structure where the dependence between frequencies of different risk categories and between severities of different risk categories as well as within risk categories can be modeled The model is estimated using Bayesian inference methodology allowing for combination of internal data external data and expert opinion in the estimation procedure We use a specialized Markov chain Monte Carlo simulation methodology known as Slice sampling to obtain samples from the resulting posterior distribution and estimate the model parameters

**Modelling Operational Risk Using Bayesian Inference** Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has be more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is actually remarkable. This extraordinary book, aptly titled "**Modelling Operational Risk Using Bayesian Inference**," published by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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**Modelling Operational Risk Using Bayesian Inference Introduction**

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web the males grow to around 5 ½ feet tall and weigh around 400 pounds the females grow to 4 ½ feet tall and weigh around 200 pounds gorillas have long arms even longer than their legs they use their long arms to knuckle walk this is where they use the knuckles on their hands to walk on all fours

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web the western lowland gorilla is the smallest subspecies of gorilla but still has exceptional size and strength this species of gorillas exhibits pronounced sexual dimorphism they possess no tails and have jet black skin along with coarse black hair that covers their entire body except for the face ears hands and feet

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web the largest of the great apes gorillas are stocky animals with broad chests and shoulders large human like hands and small eyes set into hairless faces the two gorilla species live in equatorial africa separated by about 560 miles of congo basin forest each has a lowland and upland subspecies

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web dec 29 2022 gorilla is the genus that is commonly used to refer to two species of great apes that are divided further into four total subspecies the western gorilla gorilla gorilla is split into the western lowland gorilla with the scientific name gorilla gorilla gorilla and the cross river gorilla gorilla gorilla diehli

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