

## Markov-functional interest rate models

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**Abstract.** We introduce a general class of interest rate models in which the value of pure discount bonds can be expressed as a functional of some (low-dimensional) Markov process. At the abstract level this class includes all current models of practical importance. By specifying these models in Markov-functional form, we obtain a specification which is efficient to implement. An additional advantage of Markov-functional models is the fact that the specification of the model can be such that the forward rate distribution implied by market option prices can be fitted exactly, which makes these models particularly suited for derivatives pricing. We give examples of Markov-functional models that are fitted to market prices of caps/floors and swaptions.

**Key words:** Yield curve modelling, derivatives pricing, Markov processes

**JEL Classification:** G13, E43

**Mathematics Subject Classification (1991):** 60G44, 60J25, 90A09

### 1 Introduction

Amongst practitioners in the interest rate derivatives market a consensus is starting to emerge as to the desirable and most important properties of an interest rate pricing model. These properties stem from the way these models are used in practice. To determine the prices of exotic derivatives, pricing models are used as 'extrapolation tools'. First the model parameters are chosen so that the model values of relevant liquid instruments agree with market prices, then the model is

The authors would like to thank an anonymous referee, Steve Shreve, Klaus Sandmann, participants at the fourth CAP Workshop on Mathematical Finance at Columbia University and participants at the 1998 Risk Global Summit meeting in London for their comments and suggestions.

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# Markov Functional Interest Rate Models Springer

**Dariusz Gatarek, Przemyslaw  
Bachert, Robert Maksymiuk**



## **Markov Functional Interest Rate Models Springer:**

The LIBOR Market Model in Practice Dariusz Gatarek, Przemyslaw Bachert, Robert Maksymiuk, 2007-01-30 The LIBOR Market Model LMM is the first model of interest rates dynamics consistent with the market practice of pricing interest rate derivatives and therefore it is widely used by financial institution for valuation of interest rate derivatives This book provides a full practitioner s approach to the LIBOR Market Model It adopts the specific language of a quantitative analyst to the largest possible level and is one of first books on the subject written entirely by quants The book is divided into three parts theory calibration and simulation New and important issues are covered such as various drift approximations various parametric and nonparametric calibrations and the uncertain volatility approach to smile modelling a version of the HJM model based on market observables and the duality between BGM and HJM models Co authored by Dariusz Gatarek the G in the BGM model who is internationally known for his work on LIBOR market models this book offers an essential perspective on the global benchmark for short term interest rates      **Global Derivatives: Products, Theory And Practice** Eric Benhamou, 2007-04-27 This book provides a broad description of the financial derivatives business from a practitioner s point of view with a particular emphasis on fixed income derivatives a specific development on fixed income derivatives and a practical approach to the field With particular emphasis on the concrete usage of mathematical models numerical methods and the pricing methodology this book is an essential reading for anyone considering a career in derivatives either as a trader a quant or a structurer      **Financial Derivatives in Theory and Practice** Philip Hunt, Joanne Kennedy, 2004-11-19 The term Financial Derivative is a very broad term which has come to mean any financial transaction whose value depends on the underlying value of the asset concerned Sophisticated statistical modelling of derivatives enables practitioners in the banking industry to reduce financial risk and ultimately increase profits made from these transactions The book originally published in March 2000 to widespread acclaim This revised edition has been updated with minor corrections and new references and now includes a chapter of exercises and solutions enabling use as a course text Comprehensive introduction to the theory and practice of financial derivatives Discusses and elaborates on the theory of interest rate derivatives an area of increasing interest Divided into two self contained parts the first concentrating on the theory of stochastic calculus and the second describes in detail the pricing of a number of different derivatives in practice Written by well respected academics with experience in the banking industry A valuable text for practitioners in research departments of all banking and finance sectors Academic researchers and graduate students working in mathematical finance      **Credit Risk Frontiers** Tomasz Bielecki, Damiano Brigo, Frederic Patras, 2011-02-08 A timely guide to understanding and implementing credit derivatives Credit derivatives are here to stay and will continue to play a role in finance in the future But what will that role be What issues and challenges should be addressed And what lessons can be learned from the credit mess Credit Risk Frontiers offers answers to these and other questions by presenting the latest research in this field and addressing important issues exposed

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**Stochastic Volatility Modeling** Lorenzo Bergomi,2015-12-16 Packed with insights Lorenzo Bergomi s Stochastic Volatility Modeling explains how stochastic volatility is used to address issues arising in the modeling of derivatives including Which trading issues do we tackle with stochastic volatility How do we design models and assess their relevance How do we tell which models are usable and when does c Financial Derivatives in Theory and Practice P. J. Hunt,J. E. Kennedy,2000-05-31 This text primarily discusses the pricing and hedging of derivatives and the determination of risks associated with writing options Part 4 includes a compendium of examples many providing solutions to problems set earlier in the text **The Journal of Computational Finance** ,2004 **Encyclopedia of Actuarial Science, 3 Volume Set** Jozef L. Teugels,Bjørn Sundt,2004-10-29 The Encyclopedia of Actuarial Science presents a timely and comprehensive body of knowledge designed to serve as an essential reference for the actuarial profession and all related business and financial activities as well as researchers and students in actuarial science and related areas Drawing on the experience of leading international editors and authors from industry and academic research the encyclopedia provides an authoritative exposition of both quantitative methods and practical aspects of actuarial science and insurance The cross disciplinary nature of the work is reflected not only in its coverage of key concepts from business economics risk probability theory and statistics but also by the inclusion of supporting topics such as demography genetics operations research and informatics **Handbooks in Operations Research and Management Science: Financial Engineering** John R. Birge,Vadim Linetsky,2007-11-16 The remarkable growth of financial markets over the past decades has been accompanied by an equally remarkable explosion in financial engineering the interdisciplinary field focusing on applications of mathematical and statistical modeling and computational technology to problems in the financial services industry The goals of financial engineering research are to develop empirically realistic stochastic models describing dynamics of financial risk variables such as asset prices foreign exchange rates and interest rates and to develop analytical computational and statistical methods and tools to implement the models and employ them to design and evaluate financial products and processes to manage risk and to meet financial goals This handbook describes the latest developments in this rapidly evolving field in the areas of modeling and pricing financial derivatives building models of interest rates and credit risk pricing and hedging in incomplete markets risk management and portfolio optimization Leading researchers in each of these areas provide their perspective on the state of the art in terms of

analysis computation and practical relevance The authors describe essential results to date fundamental methods and tools as well as new views of the existing literature opportunities and challenges for future research [Modern Risk Management](#) Peter Field,2003 Uniting the most eminent names within the risk industry this commemorative title chronicles the major historical developments within the derivatives industry whilst presenting a wealth of new insights perspectives and case studies on assorted risk management issues **Interest Rate Models: an Infinite Dimensional Stochastic Analysis Perspective** René Carmona,M R Tehranchi,2007-05-22 Interest Rate Models an Infinite Dimensional Stochastic Analysis Perspective studies the mathematical issues that arise in modeling the interest rate term structure These issues are approached by casting the interest rate models as stochastic evolution equations in infinite dimensional function spaces The book is comprised of three parts Part I is a crash course on interest rates including a statistical analysis of the data and an introduction to some popular interest rate models Part II is a self contained introduction to infinite dimensional stochastic analysis including SDE in Hilbert spaces and Malliavin calculus Part III presents some recent results in interest rate theory including finite dimensional realizations of HJM models generalized bond portfolios and the ergodicity of HJM models *Bulletin de L'Institut International de Statistique* ,2001 [Mathematical Reviews](#) ,2004 **Proceedings** ,2004 □□□□ ,2010 **Interest Rate Models Theory and Practice** Damiano Brigo,Fabio Mercurio,2013-04-17 The 2nd edition of this successful book has several new features The calibration discussion of the basic LIBOR market model has been enriched considerably with an analysis of the impact of the swaptions interpolation technique and of the exogenous instantaneous correlation on the calibration outputs A discussion of historical estimation of the instantaneous correlation matrix and of rank reduction has been added and a LIBOR model consistent swaption volatility interpolation technique has been introduced The old sections devoted to the smile issue in the LIBOR market model have been enlarged into several new chapters New sections on local volatility dynamics and on stochastic volatility models have been added with a thorough treatment of the recently developed uncertain volatility approach Examples of calibrations to real market data are now considered The fast growing interest for hybrid products has led to new chapters A special focus here is devoted to the pricing of inflation linked derivatives The three final new chapters of this second edition are devoted to credit Since Credit Derivatives are increasingly fundamental and since in the reduced form modeling framework much of the technique involved is analogous to interest rate modeling Credit Derivatives mostly Credit Default Swaps CDS CDS Options and Constant Maturity CDS are discussed building on the basic short rate models and market models introduced earlier for the default free market Counterparty risk in interest rate payoff valuation is also considered motivated by the recent Basel II framework developments [Encyclopedia of Actuarial Science](#) Jef L. Teugels,Bjørn Sundt,2004 The Encyclopedia of Actuarial Science presents a timely and comprehensive body of knowledge designed to serve as an essential reference for the actuarial profession and all related business and financial activities as well as researchers and students in actuarial science and related areas Drawing on the

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