Melnikov, Alexander
Risk analysis in finance and insurance. 2nd ed. (English) [Zbl 1219.91003]
Chapman & Hall/CRC Financial Mathematics Series. Boca Raton, FL: CRC Press (ISBN 978-1-4200-7052-1/hbk; 978-0-367-38286-5/pbk; 978-0-429-12595-9/ebook). x, 318 p. (2011).

From the cover: "Risk Analysis in Finance and Insurance ...presents an accessible yet comprehensive introduction to the main concepts and methods that transform risk management into a quantitative science. Taking into account the interdisciplinary nature of risk analysis, the author discusses many important ideas from mathematics, finance, and actuarial science in a simplified manner. He explores the interconnections among these disciplines and encourages readers toward further study of the subject."

The book starts with an introduction to financial risk management and the useful probabilistic tools. In the second chapter the binomial model is discussed comprehensively. This includes absence of arbitrage, European and American Options, and Merton's problem in the Cox-Ross-Rubinstein model as well as the Ho-Lee interest rate model. The chapter ends with the weak limit of the model to geometric Brownian motion, yielding the Black-Scholes formula and the corresponding differential equation.

The third chapter considers in addition models for incomplete markets in discrete time. Besides the fundamental theorems, the hedging problem is discussed; in particular, minimal risk and quadratic hedging.

In the next chapter, models in continuous time are considered. Of course, mostly the Black-Scholes model is discussed, but the author also focuses on generalisations. In the last part, quantile hedging is introduced and it is shown, how this problem can be solved. This leads then to risk measures; both coherent and convex ones.

Chapter five deals with bonds and interest rate models. It is explained how to price a payment stream. For stochastic interest rates, the Merton and the Vasicek model are discussed. A special case of the Heath-Jarrow-Morton model is also given. Unfortunately, the important Cox-Ingersoll-Ross model does not appear.

After a chapter on implementations of risk analysis, two chapters concentrate on applications in insurance. Risk transfer and modern life insurance contracts are discussed as well as ruin probabilities as a risk measure in non-life insurance. The book ends with an appendix with problems.

The book is suitable for mathematicians who want to learn about mathematical tools used in risk analysis and management. It contains also a lot of material that can be used in a course. Since the book contains many typos, it may be quite difficult to read for students. However, the book is kept at a simple level and the too technical proofs are left out. Instead of the technical arguments, often heuristic explanations are used to make the mathematics understandable. For example, Itô's formula is explained by using the Taylor expansion and the heuristics $(dW_t)^2 = dt$. Very helpful are also the many "worked examples" that help to understand the theory and the problems at the end the reader has to work out.

Reviewer: Hanspeter Schmidli (Köln)

MSC:

91-01	Introductory exposition (textbooks, tutorial papers, etc.) pertaining to game theory, economics, and finance	Cited in **2** Documents
91G20	Derivative securities (option pricing, hedging, etc.)	
91G10	Portfolio theory	
91B30	Risk theory, insurance (MSC2010)	

Keywords:

risk analysis; financial mathematics; interest rates; option theory; no arbitrage; utility theory; insurance models; risk management

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