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★ **Extreme financial risks.**

From dependence to risk management.

Springer-Verlag, Berlin, 2006. xvi+312 pp. \$69.95. ISBN 978-3-540-27264-9; 3-540-27264-X

This book clearly elucidates extreme financial risks associated with rare events such as financial crashes. The highlight of the book is the delineation of various copulas in conjunction with financial dependences among different assets of a portfolio. In particular, the insightful discussion on quadrant and orthant dependences casts new light on the connection between marginal models and financial dependence. The book contains rigorous mathematical derivations at the end of each chapter. It is very useful for researchers and graduate students working on financial mathematics.

Chapter 1 sets the scene with the basic concepts of risks, models and dependence structures in financial analyses. It consists of ideas such as coherent measures of risk and the arbitrage pricing theory. Chapter 2 enhances the introduction of Chapter 1 by addressing related terminologies in probability and statistics, such as the marginal distributions of stock returns in various models. It covers many general models in extreme value theory, for example, the Fréchet, Gumbel, Weibull, and Pareto models. The parametric densities involved in stock returns in Chapter 2 underpin the discussion in the following chapters. Chapter 2 contains the conventional Anderson-Darling method for the goodness of fit test, which is a very active research area in statistics. For example, newly published papers include the work of J. Beirlant, T. de Wet and Y. Goegebeur on the goodness of fit tests for Pareto-type models [*J. Comput. Appl. Math.* **186** (2006), no. 1, 99–116; [MR2190300](#)]. Also, extended references related to nonnormal models for stock returns include the book edited by M. G. Genton [*Skew-elliptical distributions and their applications*, Chapman & Hall/CRC, Boca Raton, FL, 2004; [MR2156754 \(2006b:62010\)](#)], as well as the work of T. J. Chen, A. K. Gupta and C. G. Troskie [*Comm. Statist. Theory Methods* **32** (2003), no. 8, 1541–1558; [MR1996794 \(2004e:62041\)](#)], among others.

Chapter 3 starts the bulk of the discussion by introducing the fundamental notation of copulas. It provides the main properties of copulas and various copula families. In fact, the material in this chapter may be enough to serve as an independent section beyond the analysis of the extreme financial risks. The detailed material on the theory of copulas in this section seems adequate for a graduate course generally involving the technique of copulas. One of the main applications of copulas is the dependence structure of risks, such as dependent default risks.

Chapter 4 discusses the dependence structures and measures of dependence including Kendall's tau, Spearman's rho and Gini's Gamma. This chapter contains one of the discernible features of the book, that is, the discussion on positively dependent structures (the quadrant and orthant dependences) in Section 4.4. Positive dependence structure is an interesting topic but has been neglected by many other books. Extended references on inequalities (to bound the survival copula) on orthant variables can be found in a review written by H. W. Block, T. M. Costigan and A. R. Sampson [in *Advances in the theory and practice of statistics*, 535–550, Wiley, New York, 1997;

[MR1481192 \(98f:60025\)](#)], as well as the multivariate product-type bounds of Block and T. J. Chen [J. Appl. Probab. **38** (2001), no. 2, 407–420; [MR1834750 \(2002c:60028\)](#)].

Chapters 5 and 6 discuss inferences on the fundamental concept of copulas using concepts delineated in the preceding chapters. Chapter 5 presents the estimation of copulas using nonparametric estimation, semi-parametric estimation and parametric estimation, as well as a description of financial dependence in terms of the Gaussian copula. Chapter 6 discusses methods of measuring extreme dependence. It includes various examples to illustrate dependence and conditional correlation coefficients such as the correlation conditioning on large (positive) returns. Extended references regarding inference on stock volatility conditioning of positive returns include the work of T. J. Chen and H. Chen [in *Development of modern statistics and related topics*, 129–139, World Sci. Publ., River Edge, NJ, 2003; [MR2039784 \(2004m:62223\)](#)].

The book concludes with Chapter 7, which synthesizes all the previous chapters and posts future directions of research in the exploration of extreme financial risks. It is well organized and systematically brings a vivid portrayal of the subject to researchers and graduate students in mathematics and statistics.

Reviewed by *John Tuhao Chen*

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