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REVIEWS

Quantitative Risk Management: Concepts, Techniques, Tools. By ALEXANDER J. MCNEIL, RÜDIGER FREY & PAUL EMBRECHTS (Princeton University Press, 2005)

I was pleased to be able to review the above book, which I assessed from the point of view of a practitioner in the field of risk management.

Customers of banks and insurance companies place substantial trust in these companies' ability to meet their promises. Whether a firm can meet its commitments or not depends on unpredictable future events. This is when you need a book like this. The book covers some simplified descriptions (models) of uncertain future events as set out in the following chapters.

Chapter 1. *Risk in Perspective*

This chapter discusses the concept of financial risk and how this relates to randomness. The chapter shows how emerging regulation, such as the Basel Accords, dovetails with modern day financial risk management and how quantitative risk management has evolved from our increasing need to measure and manage risk.

Chapter 2. *Basic Concepts in Risk Management*

The chapter considers the profit or loss on a security as a random variable. On this premise, pricing models and models for capital requirements arise. Only common approaches to dealing with these random variables are covered, concentrating on market risk and one-period measures, their strengths and weaknesses. Long-period measures are mentioned briefly.

Chapter 3. *Multivariate Models*

Following on from Chapter 2, various risk factors are discussed. The authors present some technical material on the modelling of individual risk factors with Gaussian models. The material extends to methods for modelling combinations of risk factors. The chapter looks at alternatives to Gaussian models, given their limitations. It also considers unwieldy, high-dimensional models, discussing ideas for reducing dimensionality. Examples include factor models and multivariate regression. The chapter follows examples from the authors' research though there is not always enough detail to allow a reader to reproduce these examples.

Chapter 4. *Financial Time Series*

This chapter offers some technical material on the behaviour of market prices (including indices and exchange rates) over long time intervals. There

is some background information on time series. The chapter examines observable properties of the log-return stochastic process, considering the merits and demerits of certain stylised facts. Attention is focused on GARCH-type models, which have gained widespread acceptance for modelling a range of financial processes. Some prior knowledge of time series may be an advantage for this section.

Chapter 5. *Copulas and Dependence*

The chapter discusses tools for modelling and measuring dependence in multivariate risk models — the copula of multivariate distributions. Such tools go beyond linear correlations, allowing multivariate models to be separated from the marginal behaviour of individual risk factors. Various dependence measures, such as rank correlations, are introduced. The copula approach is developed by looking at the writers' experimental work. However, graduate level understanding is required in order to replicate the examples given.

Chapter 6. *Aggregate Risk*

The risk capital required by a fund/company depends on its aggregate risk. Actuarial tools for modelling aggregate risk are discussed. Also in this chapter, methods of allocating capital to individual risks are examined.

Chapter 7. *Extreme Value Theory*

This chapter presents methods for modelling extreme values/events including multivariate tail models. The breadth is akin to textbook discussion but without detailed examples.

Chapter 8. *Credit Risk Management*

Credit risk is ubiquitous. Both technical and soft issues in the modelling of credit risk are covered, focusing on widely used models.

Chapter 9. *Dynamic Credit Risk Models*

Continuous-time credit risk models are considered, leading to the pricing of default risk on securities. The focus is on widely used models. The parallels between default contagion and particle mechanics and disease contagion are intriguing.

Chapter 10. *Operational Risk and Insurance Analytics*

The chapter looks at potential approaches to modelling loss frequency in operational risk. Operational risk is still in its infancy, so discussions concentrate on certain stylised facts. Most of these are based on established actuarial techniques. Still, there is sufficient material to provide impetus for further research in this area.

Overall, this book is a useful reference covering a broad range of risk management tools. It also discusses the limitations of some tools. It will be helpful, mostly, to researchers and industry practitioners who wish to test drive the tools discussed. The book also has a valuable use as a student textbook, though restricted by the high technical level of the mathematical development.

For researchers, this book describes the cutting edge tools in risk management. However, this is a highly technical area, and a strong technical background is needed to work with and develop the tools presented.

As a textbook for students, the qualitative discussions are easily accessible at all levels, but many of the examples and technical development would be more appropriate for graduate level courses. This could be a useful text for a Masters level project or for a technical paper, provided that you already know your Gaussian models from your student's t models.

For practitioners, the book presents a range of useful quantitative risk management tools: some are currently used by the industry; and some will be new. There are some worked examples, including examples from the authors' own empirical studies in Chapters 3 and 5. Insurers, bankers and other finance experts will all find material relevant for their respective disciplines. The more pertinent risks: market risk, credit risk and operational risk, dominate the pages.

Softer issues on risk management are also discussed, especially in the first two chapters, which managers will find useful. The book will stimulate discussions on non-technical aspects of risk management. However, the authors' focus is on the technical methodology.

The authors have added some topical examples from the finance world. In some cases the depth of information provided is too limited for a reader to reproduce the examples. However, the authors do direct readers to other sources for more information.

In summary, after using this book you will know more about different models which are used to measure and manage risk. You will be able to discuss the strengths and the limitations of some of these models. The book presumes a high level of understanding of the quantitative principles of risk management, but the authors will regularly point you in the right direction for more information. This will be a useful reference for a risk management practitioner to keep handy.

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