

Preface

Increasingly there are many sources of uncertainty in markets. These sources of uncertainty can have adverse effects on the evaluation of portfolio risk exposure. This uncertainty in the market variables is known as market risk which characterises the potential loss of value of an asset due to movements in market factors.

Quantitative techniques to analyse individual financial instruments and a portfolio of assets are essential for measuring market risk. Quantitative models seek to capture the trends and behaviours in the data which are then used to deduce future values. In this book, market risk is grouped into four main categories: volatility forecasting, option pricing, hedging and portfolio risk management.

When developing these quantitative methods in this book, the focus has been twofold: first, to build on the existing methodologies such as the GARCH and Black–Scholes models and second to develop approaches to overcome some of the disadvantages inherent in some of the models arising from some of the underlying assumptions which have been found to not properly reflect the behaviours inherent in the markets. For instance, a computation intelligence approach and more particularly a neural network is used to learn from data the Black–Scholes implied volatility. The implied volatility forecasts, generated from the neural net, are converted to option price using the Black–Scholes formula. The neural network option-pricing capabilities are shown to be superior to the Black–Scholes and the GARCH option-pricing model. The neural network has also shown that it is able to reproduce the implied volatility well into the future whereas the GARCH option-pricing model shows deterioration in the implied volatility with time. A new method for delta hedging using this approach is also presented. The book has been structured to provide a systematic study of the issues involved in market risk and its organisation reflects that.

Chapter 1 provides a broad introduction to some of the important concepts involved in market risk. Time series models are reviewed in Chap. 2. All financial time series models and concepts considered in this book are reviewed and explained. The weakness of each of the modelling techniques is highlighted and explained with reference to research.

Chapter 3 introduces options, existing option-pricing models and hedging.

Chapter 4 provides a review of neural networks. Then a comprehensive review is provided on the neural networks research in forecasting volatility, option pricing, hedging and value-at-risk. In this review, the strength(s) and weakness(es) of each approach are explained.

Chapter 5 outlines important problems in financial forecasting including volatility forecasting, options pricing and hedging. It provides a definition of important terms necessary to the considerations in the chapters that follow.

Volatility forecasting models are considered and evaluated in Chap. 6 including the GARCH, EGARCH and mixture density models. This is followed by the explanation of the method adopted in this book including results, discussion and evaluation.

Chapter 7 considers option-pricing models including GARCH Option-Pricing Model (GOPM), BSOPM model, implied volatility and existing neural net models. The method utilised in this book is explained, and results, discussions and evaluation are given.

Value-at-risk is considered in Chap. 8 including definitions and models.

Chapter 9 provides a recapitulation and conclusions.

The book can be used by advanced undergraduate students and graduate students in its entirety. It is also of considerable importance to practitioners in the field. We hope that you have an enjoyable and profitable time from studying the book.

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