IMPLEMENTING VALUE AT RISK

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Preface

This book came about through a series of speeches given at industry seminars on value at risk and stress testing. Participants and presenters often asked over coffee: Aren't these methods written down anywhere? The methods referred to are a framework for managing market risk using value at risk (VAR) and its companion stress testing. The objectives of this book are to explain:

- What VAR is – and isn't.
- How to calculate VAR – the three main methods.
- Why stress testing is needed alongside VAR.
- How to make stress testing effective.
- How to use VAR and stress testing to manage risk.
- How to use VAR to improve a bank's performance.
- VAR as a regulatory measure of risk and capital.

This book is aimed at risk management practitioners, general bank management, consultants, students and other people who have an interest in understanding VAR and its use in banks and, specifically, in trading. The book is intended to be accessible to non-mathematicians, even though all the key statistical concepts surrounding VAR are dealt with in sufficient detail to allow the reader to calculate VAR without further assistance. Therefore, the book is designed to be read without any prior knowledge of statistics. Care has been taken to provide a clear description of all mathematical notation used.

This book makes use of several worked examples which the reader may wish to replicate himself. Spreadsheets of all the major examples are provided with the book, showing exactly how each calculation in the text has been performed. It is suggested that the interested reader should try to replicate the examples initially without reference to the spreadsheets provided. The reader will gain more by working through the calculations himself and only using the spreadsheets when presented with an insurmountable problem, or, hopefully, to confirm a correct calculation.

The following is a brief overview of the contents of the book.

Introduction

A high-level introduction to risk in banking and particularly market risk. Pre-VAR market risk measures are described and explained, along with their pros and cons. Value at risk is then introduced. The remedies that VAR provides for some of the problems of pre-VAR risk measures are also explained. VAR is not the Holy Grail of risk measurement. Its strengths and weaknesses are introduced, leading on to a discussion of the need for stress testing.

Covariance

This chapter introduces the basic method of calculating VAR for linear positions. The building blocks of VAR: volatility, holding period and correlation are described. Example VAR calculations are presented for a single asset and then for a portfolio. The application of the covariance method to options is described and the problems this presents are discussed.

Calculating VAR using Simulation

The two other main methods of calculating VAR are described in this chapter: historical simulation and Monte Carlo simulation. Historical simulation faithfully reflects actual historical experience when calculating VAR. Monte Carlo simulation uses randomly generated price change events to model asset price change behaviour. There are now many methods of calculating VAR but all are combinations or variations on the three methods described in this book. This chapter also presents worked examples and compares the results produced by the three different methods.

Measurement of Volatility and Correlation

Volatility and correlations are included in all VAR calculation methods, either explicitly or implicitly. This chapter begins by explaining what volatility and correlation are. It then goes on to describe the most common volatility and correlation models used in the banking industry. The final part of the chapter presents the results of an empirical study of the effectiveness of different volatility models when calculating VAR at 95% and 99% confidence levels.

Implementing Value at Risk

With the different VAR calculation methods explained it is time to consider how VAR is implemented in practice. This chapter describes the overall approach to implementing VAR, describing the decisions and trade-offs that need to be made. The chapter then continues to describe an approach to implementing VAR for the main asset classes and product types encountered in trading organisations.

Stress Testing

Stress testing is an essential complement to VAR for managing market risk. This chapter explains why stress testing is so vital. Different methods of stress testing (e.g. scenarios analysis) are reviewed. The characteristics of effective stress testing are discussed and described.

Managing Risk with VAR

This chapter brings VAR and stress testing together into a single framework for managing market risk. The development of VAR and stress test limits is discussed along with a discussion of how to determine a bank's risk appetite in relation to VAR and stress testing.

Risk Adjusted Performance Measurement

This chapter explains how VAR fits into the overall management of a trading business. The concepts of shareholder value and the required return are introduced. Different measures of performance are then reviewed. The derivation of risk capital is discussed and illustrated with examples. The derivation of risk capital requires the introduction of measures of credit and operational risk. The chapter finishes with a description of the methods of allocating capital, again with examples.

Regulatory Reporting and VAR

The regulators have had a central role in the development of VAR, first responding to and then encouraging the banking industry to adopt VAR as a core measure of market risk. This chapter describes how regulators have adopted VAR and what banks must do to qualify to use VAR as their regulatory measure of market risk.

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