Finance

By providing a solid theoretical basis, this book introduces modern finance to readers, including students in science and technology, who already have a good foundation in quantitative skills. It combines the classical, decision-oriented approach and the traditional organization of corporate finance books with a quantitative approach that is particularly well suited to students with backgrounds in engineering and the natural sciences. This combination makes finance much more transparent and accessible than the definition-theorem-proof pattern that is common in mathematics and financial economics. The book's main emphasis is on investments in real assets and the real options attached to them, but it also includes extensive discussion of topics such as portfolio theory, market efficiency, capital structure and derivatives pricing. *Finance: A Quantitative Introduction* equips readers as future managers with the financial literacy necessary either to evaluate investment projects themselves or to engage critically with the analysis of financial managers.

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Finance

A Quantitative Introduction

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Acronyms

APT	Arbitrage Pricing Theory
APV	adjusted present value
BIS	Bank for International Settlements
caar	cumulative average abnormal return
CAPM	Capital Asset Pricing Model
CEO	chief executive officer
CFO	chief financial officer
CML	capital market line
DCF	discounted cash flow
EMH	Efficient Market Hypothesis
FV	future value
IPO	initial public offering
IRR	internal rate of return
Nasdaq	National Association of Securities Dealers Automated Quotations
NPV	net present value
NYSE	New York Stock Exchange
OCC	opportunity cost of capital
OECD	Organisation for Economic Cooperation and Development
OTC	over the counter
PV	present value
S&P	Standard & Poor's
SDE	stochastic differential equation
SEC	Securities and Exchange Commission
SML	security market line
VaR	value at risk
WACC	weighted average cost of capital

Preface

Finance has undergone spectacular changes in the last four decades, both as a profession and as a scientific discipline. Before 1973 there were no option exchanges and there was no generally accepted model to price options. Today, the worldwide trade in derivative securities represents a much larger money amount than the global production of goods and services. The famous Black and Scholes option-pricing formula and its descendants are used in financial markets all over the world where an enormous number of derivative securities are traded every day. Professionals in sectors like engineering, telecommunications and manufacturing regularly find that their projects are evaluated with techniques such as real options analysis. Understanding the basic concepts of finance is increasingly becoming a prerequisite for the modern work place.

Many scientific developments in finance are fuelled by the use of quantitative methods; finance draws heavily on mathematics and statistics. This gives students and professionals who are familiar with quantitative techniques an advantage in mastering the principles of finance. As the title suggests, this book gives an introduction to finance in a manner and 'language' that are attuned to an audience with quantitative skills. It uses mathematical notations and derivations where appropriate and useful. But the book's main orientation is conceptual rather than mathematical; it explains core financial concepts without formally proving them. Avoiding the definition-theorem-proof pattern that is common in mathematical finance allows the book to use the more natural order of first presenting an insight from financial economics, then demonstrating its empirical relevance and practical applicability, and concluding with a discussion of the necessary assumptions. This 'reversed order' reduces the scientific rigour but it greatly enhances the readability for novice students of finance. It also allows the more demanding parts to be skipped or made non-mandatory without loss of coherence.

The need for a book like this arose during the many years that I have been teaching finance to science and technology students. Their introductory years give these students a good working knowledge of quantitative techniques, so they are particularly well placed to study modern finance. However, almost all introductory textbooks in finance are written for MBA students, who have a much less quantitative background. In my experience, teaching finance to numerate students using an MBA textbook is an unfortunate combination. It forces the teacher to supply much additional material to allow students to use their analytical skills and to highlight the quantitative aspects that are severely understated in MBA textbooks. Of course, there are many textbooks in finance that are analytically more advanced, but these are usually written for a second or third course. They assume familiarity with the terminology and basic concepts of finance, which first-time readers

do not possess. This is also the case for introductory textbooks in financial economics, or the 'theory of finance'. In addition, many of these books are written in the definition-theorem-proof pattern, which makes them, in my opinion, less suitable for introductory courses. Students' first meeting with finance should be an appetizer that arouses their interest in finance as a science, shows them alternative uses for the quantitative techniques they have acquired, and welcomes them to the wonderful world of financial modelling. Formal proofs are not instrumental in that.

Readership

This book is primarily written for science and technology students who include a course in finance or project valuation in their study programmes. Most study programmes in mathematics, engineering, computer science and the natural sciences offer the opportunity to include such elective subjects; their typical place is late in the bachelor programme or early in the master programme. The book can be used as the only text for a course in finance or as one of several if other management aspects are included, such as project planning and organization. Given the limited room for these courses in most study programmes the book has to be concise, but it takes students from discounting to the Black and Scholes formula and its applications. To limit its size, the main emphasis is on investments in real assets and the real options attached to them. This is the area of finance that prospective natural scientists and engineers are most likely to meet later in their careers. Of course, a thorough analysis of such investments requires a theoretical basis in finance that includes portfolio theory and the pricing models based on it, market efficiency, capital structure, and derivatives pricing. Topics with a less direct connection with real assets are omitted, such as bond pricing, interest rate models, market microstructure, exotic options, cash and receivables management, etc.

I have also used the material in this book for intermediate courses in finance for business school students. The purpose of these courses is to deepen students' theoretical understanding of finance and to prepare them for more specialized subjects in, for example, continuous-time finance and derivatives pricing. The step from an introductory MBA book to a specialized text is often too large, and this book can fruitfully be used to bridge the gap. It introduces students to techniques that they will meet in later courses, but in a much more accessible and less formal way than is usual in the specialized literature. Greater accessibility is increasingly required because of the growing diversity in business school students' backgrounds. In my experience, students find the material in the book both interesting and demanding, but most students rise to the challenge and successfully complete the course.

A final use that I have made of the book's material is for a permanent education course aimed at professionals in science and technology and technical project leaders. After some years of work experience, many professionals feel the need for more knowledge about the way financial managers decide about projects, particularly how they value the flexibility in projects with real options analysis. The scope and depth of the book are sufficient to make such professionals competent discussion partners of financial managers in matters of project valuation, including the aspects of strategic value.

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