



FINANCIAL TIMES **Guides**

UNDERSTANDING FINANCE

A NO-NONSENSE COMPANION TO
FINANCIAL TOOLS AND TECHNIQUES

SECOND EDITION

JAVIER ESTRADA

PEARSON EDUCATION LIMITED

Edinburgh Gate
Harlow CM20 2JE
Tel: +44 (0)1279 623623
Fax: +44 (0)1279 431059
Website: www.pearsoned.co.uk

First published in Great Britain in 2005 as *Finance in a Nutshell: A no-nonsense companion to the tools and techniques of finance*

Second edition published 2011

© Pearson Education Limited 2005, 2011

The right of Javier Estrada to be identified as author of this work has been asserted by him in accordance with the Copyright, Designs and Patents Act 1988.

Pearson Education is not responsible for the content of third party internet sites.

ISBN: 978-0-273-73802-2

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data

Estrada, Javier, 1964-

The Financial Times guide to understanding finance : a no-nonsense companion to financial tools and techniques / Javier Estrada. -- 2nd ed.

p. cm.

Previously published under title: Finance in a nutshell.

Includes bibliographical references and index.

ISBN 978-0-273-73802-2 (pbk. : alk. paper) 1. Business enterprises--Finance--Handbooks, manuals, etc. 2. Corporations--Finance--Handbooks, manuals, etc. I. Title. II. Title: Guide to understanding finance.

HG4027.3.E88 2011

658.15--dc22

2011005720

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without either the prior written permission of the publisher or a licence permitting restricted copying in the United Kingdom issued by the Copyright Licensing Agency Ltd, Saffron House, 6–10 Kirby Street, London EC1N 8TS. This book may not be lent, resold, hired out or otherwise disposed of by way of trade in any form of binding or cover other than that in which it is published, without the prior consent of the publishers.

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold with the understanding that neither the authors nor the publisher is engaged in rendering legal, investing, or any other professional service. If legal advice or other expert assistance is required, the service of a competent professional person should be sought.

The publisher and contributors make no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any responsibility or liability for any errors or omissions that it may contain.

All trademarks used herein are the property of their respective owners. The use of any trademark in this text does not vest in the author or publisher any trademark ownership rights in such trademarks, nor does the use of such trademarks imply any affiliation with or endorsement of this book by such owners. Microsoft, Excel, and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

10 9 8 7 6 5 4 3 2 1

15 14 13 12 11

Typeset in 9.5/14pt ITC Stone Serif by 30

Printed and bound in Great Britain by Ashford Colour Press, Gosport, Hampshire.

Contents

Publisher's acknowledgments / vii

Preface to the second edition / ix

Preface to the first edition / xiii

part 1 Risk and return

- 1 Returns I: Basic concepts / 3
- 2 Returns II: Mean returns / 11
- 3 Risk I: Total risk / 23
- 4 Risk and return I: Portfolios / 33
- 5 Risk II: Diversification / 43
- 6 Risk III: Systematic risk / 55
- 7 Risk and return II: CAPM and the cost of capital / 65
- 8 Risk and return III: The three-factor model / 81
- 9 Risk IV: Downside risk / 95
- 10 Risk and return IV: Risk-adjusted returns / 109
- 11 Risk and return V: Portfolio optimization / 123
- 12 Risk and return VI: The long term / 137

part 2 Valuation

- 13 Stocks I: The dividend discount model / 155
- 14 Stocks II: The WACC model / 169
- 15 Stocks III: Other DCF models / 183

- 16 Stocks IV: Reverse valuation / 197
- 17 Stocks V: Relative valuation / 207
- 18 Bonds I: Prices and yields / 219
- 19 Bonds II: Default risk and market risk / 235
- 20 Bonds III: Duration and convexity / 247

part 3 Other important topics

- 21 NPV and IRR / 261
- 22 Real options / 277
- 23 Corporate value creation / 289
- 24 Options / 299
- 25 Futures and forwards / 311
- 26 Currencies / 325

part 4 Statistical background

- 27 Stats I: Summary statistics / 341
- 28 Stats II: Normality / 355
- 29 Stats III: Non-normality / 369
- 30 Stats IV: Regression analysis / 383

Index / 397

Excel examples

The Excel files to accompany this book can be downloaded from:

www.pearsoned.co.uk/estrada

Publisher's acknowledgments

We are grateful to the following for permission to reproduce copyright material:

Tables 7.1 and 12.1 adapted from DIMSON, ELROY; TRIUMPH OF THE OPTIMISTS, © 2002 Elroy Dimson, Paul Marsh, and Mike Staunton. Published by Princeton University Press. Reprinted by permission of Princeton University Press; Table 19.1 from 'Standard & Poor's Ratings Definitions', © August 2010, published by Standard & Poor's. Reproduced with permission of Standard & Poor's Financial Services LLC; Table 19.2 adapted from 'Defaults and Returns in the High-Yield Bond Market: The Year 2007 in Review and Outlook', Working Paper (Altman, E. and Karlin, B. 2008). Reproduced with permission of E. Altman.

In some instances we have been unable to trace the owners of copyright material, and we would appreciate any information that would enable us to do so.

Preface to the second edition

I had mixed feelings when I received the request to write a second edition of *Finance in a Nutshell*. On the one hand it made me happy. I thought that publishers ask authors to write a new edition of a book only when they make a positive evaluation of the previous edition and are bullish about the prospects of a follow-up. I also thought it was a good chance to clarify explanations, update the data, correct typos, and ultimately take a fresh look at all the material discussed in the first edition and improve it.

But on the other hand I was not so happy. Writing a book is fun, or at least it was to me; but rewriting it is not, or at least not nearly as much. I also had many more time constraints than I had when I wrote the first edition. So I did think long and hard about it, at times leaning one way and at other times leaning the other way.

It was a hard decision but in the end I accepted, as evidenced by the book you're holding in your hands. And I'm glad I did, because this edition retains all the positive characteristics of the first but also improves upon it in more than one way. If you liked *Finance in a Nutshell*, I have no doubt you'll like *The FT Guide to Understanding Finance* even more.

Why do I say this? Two reasons. First, I did not try to fix what was not broken. I received a lot of positive feedback about both the coverage and the style of the first edition. Readers found that the topics discussed properly reflected those they considered most relevant, and liked the conversational style in which those topics were discussed. Retaining both the topic selection and the style, then, was a no-brainer. Second, I tried to repair what was damaged. Very often when working on this second edition, I found things that I could have explained better. So, whatever readers thought was well done in the first edition, I'm sure it's better done in this one.

Which brings me to the following recommendation to whoever is considering buying this book. If you liked *Finance in a Nutshell*, you'll find *The FT Guide to Understanding Finance* to be an improved and updated version of the original. If you never read *Finance in a Nutshell* but heard a good thing or two about it, see for yourself why the original was well received. And if you never even heard about *Finance in a Nutshell*, well, give a chance to this book which at least is not nearly as expensive or heavy as the typical 900-page textbook!

This second edition is divided into the same 4 parts and 30 chapters as the first edition was. The first part consists of 12 chapters and tackles issues related to risk and return. It covers a wide range of topics such as different ways of calculating returns and mean returns; ways of assessing risk; diversification; the CAPM, the three factor-model, required returns, and the cost of capital; risk-adjusted returns; and portfolio optimization.

The second part consists of eight chapters and focuses on the valuation of stocks and bonds. It covers different models for stock valuation including four versions of the discounted cash flow model, reverse valuation, and multiples. It also discusses bonds, their valuation, their return, and the factors that affect their risk.

The third part consists of six chapters that, unlike those in the other three parts of the book, are not closely related to each other. These are topics that, in my view, no book of essential tools could afford not to cover, which include project evaluation through NPV, IRR, and real options; corporate value creation; derivatives such as options, futures, and forwards; and currencies.

Finally, the last part provides some statistical background. It covers some widely-used statistical terms, such as the mean, median, variance, standard deviation, covariance, and correlation; two widely-used distributions, the normal and the lognormal; and regression analysis.

Readers of *Finance in a Nutshell* will find that *The FT Guide to Understanding Finance* retains the same 30 topics (chapters) of the first edition. As already mentioned, I received positive feedback on the topic selection, which gave me no reason to fix what was not broken. But beyond that, my fresh look at the whole book did not bring to mind any topic that I considered essential and was missing.

Having said that, I did receive some requests from *Finance in a Nutshell* readers to include this or that topic in subsequent editions of the book. Some of those topics included market efficiency, capital structure, and dividend policy, to

name but a few. But, however important or interesting those topics are, this is *not* a corporate finance textbook. Such a book typically contains several topics not discussed here, but also omits several topics discussed in this book. In other words, they are very different books.

One of the reasons I strongly resist considering this book a textbook is because such books tend to have 900 pages, weigh 5 pounds, and have unbearably long chapters. *This book is a reaction to that!* I tried to make it short, light, and with chapters short enough that they can be read in one sitting, without falling asleep.

Yes, this book discusses many issues typically covered in a corporate finance textbook. But it also discusses many issues typically covered in an investments textbook. In fact, I think this book is much closer to the latter than to the former. But again, this is no textbook. Hold this book in your hand and curl your arm 10 times, or put it in your purse and walk around a few blocks; you probably can't do either with a textbook, but you can with this book!

Wide coverage, short chapters, conversational style, intuitive explanations, and real-world examples are the trademarks of this book. And that's why, as was the case with *Finance in a Nutshell*, I think *The FT Guide to Understanding Finance* will appeal to a wide range of current and future finance practitioners, as well as to all those who always wanted to know a bit more about finance but found it intimidating to begin with.

As was also the case with the first edition, this second edition shows how to implement in Microsoft Excel all the tools discussed. Which brings me to a couple of points you should keep in mind. First, I have used and described everything for the US version Excel 2007. Most of the commands discussed in this book are virtually identical across different versions of Excel, but if yours is not the 2007 version and you have trouble implementing something, keep this point in mind.

Second, if you want to reproduce precisely all the calculations discussed in this book, it's important that you use the data in the accompanying Excel file (on the book's website, www.pearsoned.co.uk/estrada). I have performed all calculations in spreadsheets, which remember many more decimal places than would be wise to report in a book. If you try to reproduce the calculations discussed in the following chapters, with the figures discussed in those chapters, you may find that your results are close but not exactly equal to

those reported. If you use the Excel file that contains the data I used instead, you should have no problem with rounding errors. Note also that dates are presented in the US style: month, day, year.

I wrote every word and crunched every number in this book, but that doesn't mean I didn't receive any help. First and foremost, I would like to thank students and executives in countless programs without whose encouragement this book would never have existed. I would also like to thank readers of *Finance in a Nutshell* for their comments, suggestions, feedback, and ideas; had I felt that the first edition of this book was ignored, I wouldn't have had the enthusiasm to write this second edition.

Last, but certainly not least, I would like to deeply thank my research assistant, Gabriela Giannattasio. Her *extremely* detailed comments on each and every chapter were of invaluable help. And because I know her attention to detail is such that she'd find any mistake I could have made, I had the peace of mind I needed to write this book. Needless to say, I'm the only one to blame for any mistakes that may remain in the following chapters.

Regardless of how many more books I write, *Finance in a Nutshell* will always be the first one. But as much as I'll always hold dear that first little guy, I have to admit that *The FT Guide to Understanding Finance* you hold in your hands is better.

Barcelona, November 2010

Preface to the first edition

I always thought I'd write a book but never quite knew when or on what topic. I never felt the need of doing it and, to be honest, I never set it as a goal for myself. But eventually I got to a point when I decided to surrender to the evidence: Too many people were asking for the same thing, and the market, in my opinion, had not delivered. So I thought I'd deliver it myself.

A brief history of this book

It happened many times. During the course of an executive education program, I'd come in to give a few sessions on finance topics. After finishing those sessions, someone would come to me and say something like, 'Listen, this was very interesting and, though my job is only marginally related to finance, I'd like to know more about it. What would you advise me to read?' Or something like, 'Hey, I work in finance but my job is so specialized that I feel I need to refresh my knowledge of the basics. Can you recommend some book that covers a wide range of essential topics?'

Depending on the topic I had discussed in the program and what the participant had asked, I usually did one (or both) of the following: Recommend a few short books that, when put together, would cover a wide range of topics; or recommend a textbook, which as you are well aware usually contains between 600 and 900 pages and chapters no less than 20 pages long. Often, I would show the recommended references to the inquiring participant.

And that's when I started getting the two standard replies. If I recommended the few short books, the reply would be something like, 'Well, all these books look very interesting, but isn't there *one* book that tackles all these topics?' If I recommended the textbook, the reaction would be something like, 'Listen, I'm sure this book is very good, but I really have no time to

read so many pages, or even half of them. Plus, you don't expect me to carry this book around with me, do you? They'd charge me for excess luggage at the airport!' (OK, I'm dramatizing a bit.) I can't really tell how many times I went through similar exchanges, but I do know that eventually there was a straw that broke the camel's back.

But wait, it wasn't then that I decided to write this book. In fact, it was then that I decided to do something that would take a lot less of my time: I decided to look for a book I could recommend to all these people. I made a mental list of the characteristics that were in high demand and started my search. And, to my surprise, such a book didn't exist. Or maybe I didn't find it. Either way, it was then, and only then, that I thought I had to write this book.

Distinctive features

The stylized story above happened many times, give or take a few details, in many executive programs. It also happened many times while teaching in MBA and executive MBA programs. And it happened often while talking with former students who needed to refresh or broaden their knowledge of finance. After failing in my search for a book to recommend, and starting to think that maybe I should write the book myself, I thought long and hard about the characteristics of the book the market had, in my opinion, failed to deliver. This was, more or less, my list:

- *The book needs to be comprehensive.* It doesn't have to address a few issues in depth; rather, it should cover a wide variety of topics, concepts, and tools that professionals forget, find hard to understand, and need or would like to know more about.
- *The book needs to be easy to read.* Professionals are put off by academic books written in academic style. There is a need for a book written in a way that sounds pretty much like having an instructor talking right in front of them.
- *The book needs to be relatively short.* Not an 800-page, 5-pound book, but one that could be easily taken around from the office to home, and from the hotel to the airport. Something that could be always at hand, like a desktop companion.
- *The book needs to have relatively short chapters.* Most professionals dislike starting a chapter and not being able to finish it after two or three

sittings. There is a need for a book with short chapters that can be read in one sitting. Short chapters would also make it easy for readers to quickly grasp the essentials of a concept or tool.

- *The book needs to contain some elementary theory and many real-world examples.* It's a lot easier to understand and remember concepts and tools when an elementary conceptual framework and its application are discussed together. And if the application is not hypothetical but about an actual situation the reader can quickly identify with, even better.
- *The book needs to explain how to implement things in Microsoft® Excel.* Spreadsheets have become an inseparable tool for finance, and the book needs to show how to implement in Excel all the concepts and tools discussed.
- *The book needs to have a few short problems at the end of each chapter.* Many books have them, to be sure, but this book would have just two or three that go to the heart of the issues discussed in the chapter.
- *The book needs to be self-contained.* Other than some elementary math, no other previous knowledge should be required.

Well, that's a long list! But I promised myself that I wouldn't start writing a book before making sure I could deliver one that had *all* of the characteristics above. I trust the book you have in your hands does. So, if I had to define this book in one paragraph, it would be this:

Many professionals have long forgotten some key financial concepts or tools; others never learned them properly; some need to broaden the scope of their financial knowledge; others need a desktop companion for quick reference; and most of them have neither the time nor the motivation to dig into either several books or an 800-page textbook. This book solves all these problems in 30 short, easy-to-read, very practical chapters full of real-world examples and applications in Excel.

Target audience and intended use

Let me tell you first what this book is *not*. First, it is not a textbook; I didn't write it as a required reference for a specific course. Second, it is not a specialized book; it's not for those who want to acquire a deep knowledge of one or two topics. And third, it is not a cookbook; I didn't write it for those

who want to blindly follow a few steps to solve a problem without understanding what's going on. If you're looking for a book to satisfy any of these needs, you've picked the wrong one.

The distinctive features of this book outlined above should give you an idea of who this book is for. Again, it was born as an answer to the demand of professionals who wanted to broaden their knowledge of finance; refresh their memory of some topics; learn other topics from scratch; or simply have a light desktop companion covering a wide range of essential topics in finance. And all that subject to the constraints of limited time and lack of patience to read an academic textbook.

I firmly believe that executives, professionals, and practitioners in different areas unrelated to finance will find this book useful. Their need to understand financial concepts and tools at the user level was constantly in my mind as I wrote this book. I also firmly believe that finance professionals such as investment bankers, portfolio managers, brokers and security analysts will find this book valuable. Their need for a reference book to quickly get up to speed on many different issues was also in my mind. In this regard, participants of executive education programs, MBA and executive MBA students, and former students, all of them in both finance and non-finance jobs, provided invaluable feedback.

I also trust the individual investor will find this book valuable. It provides the tools to value assets, assess risk, diversify and optimize portfolios, evaluate performance, and invest for retirement, to name just a few issues interesting to investors and covered in the book. And it discusses these and many other issues from scratch, showing how to implement everything in Excel.

Finally, I think that academics in finance and economics will find this book useful. It could be used as a complementary or recommended reference in many general courses such as corporate finance or investments; or in more specific courses dealing with asset pricing, stocks, bonds, and portfolio analysis, among other topics. I also think academics themselves will find the book useful as a personal desktop companion, a reference book to consult on a wide range of finance topics.

Organization of the book

The book is divided into four parts. The first, entitled ‘Risk and return,’ covers a wide range of issues that deal with different definitions of returns, different ways of assessing risk, different ways to put risk and return together, and the optimization of portfolios.

The second part, entitled ‘Valuation,’ focuses on stocks and bonds. It covers different models of stock valuation, including several versions of the DCF model, reverse valuation, and relative valuation. It also covers issues related to fixed-income securities, including pricing, sources of risk, duration, and convexity.

The third part, entitled ‘Other important topics,’ puts together several issues that no book of finance essentials could ignore. These include project evaluation through NPV, IRR, and real options, as well as derivatives such as options, futures, and forwards.

Finally, the fourth part, entitled ‘Statistical background,’ contains a refresher of essential statistical topics for practitioners, including summary statistics, the calculation of probabilities with the normal and lognormal distributions, and regression analysis. The discussion includes the implementation of all these concepts and tools in Excel.

How to read this book

I wrote the book thinking of professionals who needed to jump in for a specific issue. As a result, I wrote the chapters as independent of each other as possible. This means that this is not a book that you need to start reading at Chapter 1 and finish at Chapter 30. Some readers will not need to read the statistical background and others will find it essential reading. Some readers will be interested in stocks and others in bonds. Others may want to focus on issues related to investing or corporate finance.

Every chapter concludes with an Excel section and a Challenge section. The Excel sections aim to show how to implement in Excel the concepts and tools discussed in the chapter. These sections range from discussing some elementary functions, such as logs and exponentials, to more complex implementations, such as multiple regression analysis and portfolio

optimization programs. If you're not fully familiar with Excel, I think you will find these sections essential. And if you are familiar with Excel, these sections will probably take you a few steps further.

The Challenge sections aim to test the essential concepts and tools discussed in each chapter. The problems are few, short, and go straight to the key points. Most of them are based on data from well-known companies so that you can not only test what you've learned but also learn a bit about the companies too. Some people may find these sections useful and others will probably ignore them. It's your choice.

Finally, if you want to reproduce precisely all the calculations discussed in the book, it is important that you use the data in the accompanying Excel file (see www.pearsoned.co.uk/estrada). I have performed all calculations in Excel, which 'remembers' many more decimals than would be wise to report in a book. That's why you may find 'rounding errors,' particularly in calculations based on previous calculations. Similarly, if you go over the problems in the Challenge sections, you may want to use the data in the accompanying Excel file rather than that provided in the tables and exhibits.

Take a good look at the index and a quick look at the rest of the book. I trust you will find the scope comprehensive, the chapters short, the style engaging, the approach practical, and the discussions easy to follow. You will also find loads of information on many companies that are household names, which are used throughout to keep your feet firmly on the ground.

Acknowledgments

My deepest gratitude goes to the long list of participants in executive education programs, MBA students, executive MBA students, and former students who directly or indirectly encouraged me to write this book. Most of them did not actually ask me to write a book, but their search for a book that the market had not provided was the main reason for writing this one.

I'm also indebted to my research assistant, Alfred Prada, who read every chapter, checked every formula, double checked every table, and triple checked every calculation. He put up with all my demands, which were not few, and delivered every time he had to. Needless to say, he is in no way responsible for any errors that may remain in this book. Those are, of course, my sole responsibility.

Finally, I want to dedicate this book to my dad, who was alive when I started writing it but did not live to see me finish it. I know he would have been even prouder than I am for having written this, my first book. I'm sure he would have read it just because I wrote it, and I'm sure he would have told me that *even he* could understand what I was writing about. And of course, I also dedicate this book to my mom, who will most likely not read it, but will proudly and insistently show it to every single person that passes by within a mile of her house.

A final word

Time will tell whether I have delivered the book that so many people seem to have been looking for. I certainly hope so. And yet I'm also sure it can be improved. For this reason, if you have any comments or suggestions, feel absolutely free to send me an email at jestrada@iese.edu. I would be more than glad to know your opinion.

This concludes what for me has been a long journey. And as much as I wanted to finish, I now realize that I'll miss working on this book. It was, above all, a whole lot of fun. I certainly hope you enjoy reading it as much as I enjoyed writing it.

Barcelona, March 2005

3

Risk I: Total risk

- What is risk?
- The standard deviation of returns
- Interpretation of the standard deviation
- Mean returns and the standard deviation
- The big picture
- Excel section

In the previous chapter we discussed three ways to summarize return performance, but so much for the ‘good’ stuff; here comes the ‘bad’ stuff. In this chapter we’ll focus on one way to summarize risk. Keep this in mind, though: Risk can be defined in more than one way and we’ll explore other definitions later in the book.

What is risk?

Silly question, huh? Well, not really. The fact is that, simple as it may sound, academics and practitioners in finance have been wrestling with this definition for a very long time. And it gets worse. Nobody seems to have provided a definition that everybody else agrees with. In fact, it may well be the case that risk, like beauty, is in the eyes of the beholder.

Now, don’t throw your arms up in despair just yet. The fact that there is no universally accepted definition of risk doesn’t mean that risk cannot be quantified in a variety of more or less plausible ways. But before we get into definitions and formulas, take a look at Figure 3.1, which shows the annual returns of Intel and ExxonMobil in 2000–09.

Now, the concept of risk may be hard to pin down, but your eyes probably won’t fool you: Compared with ExxonMobil, Intel’s steep rises and falls have given investors quite a ride. At the same time that ExxonMobil’s returns fluctuated within a range of –15% to 40% (no small range, to be sure), Intel delivered losses in excess of 50% and gains larger than 100%. Just by looking at the graph, most people would agree that Intel appears to be a lot riskier (that is, more volatile or unpredictable) than ExxonMobil.

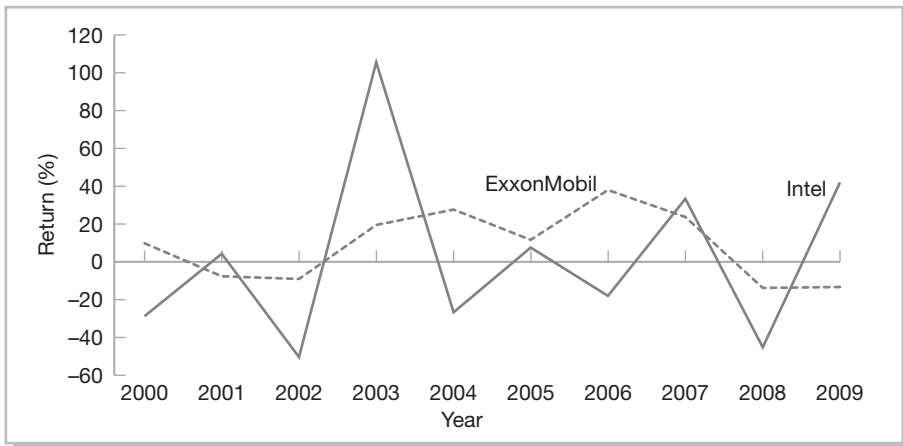


figure 3.1 Returns on Intel and ExxonMobil

So here's one informal way to think about risk: The more returns fluctuate over time, the greater the uncertainty about the prices and returns we'll observe in the future; and the greater that uncertainty, the greater the risk. Makes sense? Well, if it does, then read on so we can formalize this idea a bit.

The standard deviation of returns

One way to formally capture the uncertainty we just mentioned is to compute the **standard deviation of returns (SD)**, which is (hold on to your seat) the square root of the average quadratic deviation with respect to the arithmetic mean return. Read that again. Does it still sound like Sylvester Stallone speaking Chinese? If so, then stop reading this chapter and go to the stats review in Chapter 27. Otherwise, keep reading for more insight into this measure of risk.

The standard deviation of a series of returns, often referred to simply as **volatility**, is formally defined by the expression

$$SD = \sqrt{(1/T) \cdot \sum_{t=1}^T (R_t - AM)^2} \quad (3.1)$$

where R_t denotes returns in period t ; AM the (arithmetic) mean return of the series of returns; and T the number of observations. Note that sometimes the standard deviation is calculated by dividing the sum of quadratic deviations

by $T-1$ instead of by T . For practical purposes, you don't really have to worry about this distinction, but if you want to know a bit more about it, take a look at the (very) brief discussion on this issue in Chapter 27.

Just to make sure you understand the idea behind the calculation of this magnitude, let's go over a step-by-step calculation of the standard deviation of Intel's returns. Table 3.1 shows the returns of Intel (R) between 2000 and 2009; the arithmetic mean annual return (AM) during this period was 3.3%. The column ($R-AM$) shows the difference between each annual return and the mean annual return. And the last column shows the figures in the ($R-AM$) column, squared. The average of the numbers in the fourth column is the *variance of returns* (0.2059), but this is not widely used as a measure of risk largely because it is expressed in per cent squared. The number in the intersection between the last row and the last column, the square root of the variance, or the square root of the average quadratic deviation with respect to the mean, is the standard deviation of returns, which in the case of Intel is 45.4%. Although not shown in the table, over the same period the standard deviation of ExxonMobil's returns was just 17.9%.

table 3.1

<i>Year</i>	<i>R</i> (%)	<i>R-AM</i> (%)	<i>(R-AM)²</i>
2000	-26.9	-30.2	0.0912
2001	4.9	1.6	0.0002
2002	-50.3	-53.6	0.2878
2003	106.6	103.3	1.0667
2004	-26.6	-29.9	0.0894
2005	8.1	4.8	0.0023
2006	-17.2	-20.5	0.0421
2007	34.2	30.9	0.0954
2008	-43.5	-46.8	0.2191
2009	43.9	40.6	0.1646
Average	3.3%		0.2059
Square root			45.4%

Of course, you don't have to go through all these calculations to estimate a standard deviation; Excel calculates this magnitude in the blink of an eye and in just one cell. But the table helps you to see where the number that Excel calculates come from, and hopefully to understand what we're really calculating too.

Interpretation of the standard deviation

Let's think a bit about the interpretation of the standard deviation as a measure of risk. Here's an easy way to think about it: The larger this number, the riskier the asset. Not too difficult, huh?! Well, the best part of it is that, when assessing the risk of individual assets (that is, assets taken one at a time rather than combined in a portfolio), this is a perfectly correct way to interpret this magnitude. For informal confirmation, take another look at Figure 3.1, and recall that the standard deviation of returns of Intel and ExxonMobil are 45.4% and 17.9%. Doesn't a comparison of these two figures confirm what your eyes tell you about the relative risk of these two stocks? There you have it.

Now let's push it a bit further. Basically, a small standard deviation indicates that returns fluctuate closely around the mean return, and a large standard deviation indicates the opposite. In other words, the larger the standard deviation, the more that returns tend to depart from the mean return (both above and below), and therefore the higher is the uncertainty about the returns we'll obtain in the future.

Here's another (complementary) way to think about it. You may (or may not!) recall that, if the distribution of returns considered is normal, then approximately 68.3%, 95.4%, and 99.7% of the returns are clustered one, two, and three standard deviations around the (arithmetic) mean. Keeping this in mind, consider two hypothetical assets with a mean return of 20% and standard deviations of 5% (asset A) and 30% (asset B).

Note that there is roughly a 95% probability that the returns of asset A will fluctuate between 10% and 30%; that is, two standard deviations around the mean return. However, in the case of asset B, there is roughly 95% probability that returns will fluctuate between -40% and 80%, a range so large as to be useless. We could drive a train sideways between these two numbers!

This simple example illustrates another way to see why the standard deviation is a measure of risk: We can use it to estimate the interval within which returns will fluctuate with any chosen probability; the larger the interval, the larger the uncertainty, and therefore the riskier the asset. In fact, if you run a similar calculation for Intel and ExxonMobil (you should, it's easy!), you'll find that there's roughly a 95% probability that the returns of Intel will fluctuate between -87.4% and 94.1% , and those of ExxonMobil between -26.6% and 45.0% . So, given that the range between the low end and the high end of the interval is far larger in the case of Intel (181.5%) than in the case of ExxonMobil (71.5%), we have another way to see that Intel is far riskier.

Having said that, do keep in mind the following: The calculations we just ran are *exclusively* valid when the returns considered are normally distributed. This assumption, widely used and abused, may be plausible in some cases and implausible in some others. So, as long as you can safely determine that the returns of the asset you're considering are normally distributed, the intervals calculated as just discussed are plausible. If you don't know the type of distribution those returns follow, or do know that it is not normal, then stay away from running this type of calculation.

Mean returns and the standard deviation

We intuitively know that risk is 'bad,' and the discussion in the previous section attempts to explain why the standard deviation may be a plausible measure of how 'bad' an asset may be. Essentially, the standard deviation is a measure of variability and uncertainty, both of which most investors would agree are 'bad.'

Now we'll take another, usually less explored, look at why volatility is bad for investors. Consider the six hypothetical assets in Table 3.2, all of which have an arithmetic mean return (*AM*) of 10% but different volatility (*SD*). Note that as we move from asset A to asset F volatility increases; that is, as we move from left to right the assets become riskier.

table 3.2

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F (%)
1	10.0	12.0	15.0	20.0	25.0	40.0
2	10.0	8.0	5.0	0.0	-5.0	-20.0
3	10.0	12.0	15.0	20.0	25.0	40.0
4	10.0	8.0	5.0	0.0	-5.0	-20.0
5	10.0	12.0	15.0	20.0	25.0	40.0
6	10.0	8.0	5.0	0.0	-5.0	-20.0
7	10.0	12.0	15.0	20.0	25.0	40.0
8	10.0	8.0	5.0	0.0	-5.0	-20.0
9	10.0	12.0	15.0	20.0	25.0	40.0
10	10.0	8.0	5.0	0.0	-5.0	-20.0
AM (%)	10.00	10.00	10.00	10.00	10.00	10.00
SD (%)	0.00	2.00	5.00	10.00	15.00	30.00
GM (%)	10.00	9.98	9.89	9.54	8.97	5.83
GM-2 (%)	10.00	9.98	9.89	9.55	8.98	5.98
GM-3 (%)	10.00	9.98	9.87	9.50	8.88	5.50
TC (\$)	25,937	25,895	25,671	24,883	23,614	17,623

Now take a look at the geometric mean returns (GM). As we move from left to right, the arithmetic mean return remains constant, volatility increases, *and the geometric mean return decreases*. This is sometimes referred to as the ‘variance drag,’ which is just a fancy way of saying that volatility reduces mean compound returns.

As you hopefully remember from our discussion in the previous chapter, an investment does not compound over time at its arithmetic mean return but at its geometric mean return. So here we have another way to rationalize why volatility is bad: Because it lowers the compound return of an investment, thus reducing its terminal value.

The last row of the table shows the terminal capital (TC) that results from a \$10,000 investment in each of the six assets in the table at the beginning of the 10-year period considered. The six assets, remember, have the same arithmetic mean return of 10%. However, because as we move from asset A to asset F volatility increases, the geometric mean return decreases and so does the rate at which each asset compounds our money. Put differently, our terminal capital is negatively related to the volatility of the assets.

Formally, the relationship between the arithmetic mean, the geometric mean, and volatility is given by this expression

$$GM \approx \exp \left\{ \ln(1 + AM) - \frac{(1/2) \cdot SD^2}{(1 + AM)^2} \right\} - 1 \quad (3.2)$$

which holds well as an approximation for returns not much larger than $\pm 30\%$. The row labeled 'GM-2' in Table 3.2 shows the geometric mean return of the six assets considered calculated with this expression. If you compare these figures with those from the row above (the *exact* geometric mean returns), you can see that the approximation is in fact very good. You can also see that, as the size of the returns increases, the approximation becomes worse.

If you find the expression above intimidating, here comes the good news: There's a simpler approximation that works almost as well

$$GM \approx AM - (1/2) \cdot SD^2 \quad (3.3)$$

The row labeled 'GM-3' in Table 3.2 shows the geometric mean return of the six assets considered calculated with this expression. And once again, if you compare these figures with those of the exact geometric means you'll find that this approximation, though a bit worse than the previous one, is also pretty accurate.

The big picture

Risk is probably the most elusive concept in finance. One of the most widely accepted ways to assess it, however, is with the standard deviation of returns, usually also referred to as the volatility of an asset. This volatility can be thought of as uncertainty about future prices or returns, or as dispersion around the asset's arithmetic mean return.

Importantly, volatility is 'bad' not only because we use it as synonymous with risk. It is also 'bad' because it causes a drag on mean compound return, thus decreasing an asset's ability to compound our money over time.

Excel section

Just as in the Excel sections of the previous two chapters, the stuff in this section is straightforward.

- To calculate a square root in Excel you need to use the 'sqrt' function. Calculating the square root of any number x is as simple as typing
`=sqrt(x)`
and hitting Enter.

Calculating a standard deviation in Excel is also simple. Suppose you have ten returns in cells A1 through A10; then, you do the following:

- To calculate a standard deviation that divides the average of squared deviations from the mean by T , you type
`=stdevp(A1:A10)`
in cell A11 and hit Enter.
- To calculate a standard deviation that divides the average of squared deviations from the mean by $T-1$, type
`=stdev(A1:A10)`
in cell A11 and hit Enter.

Index

- 3FM *see* three-factor model
- Abbott 209, 210, 214, 215–16
- absolute frequencies 356–7
- absolute purchasing power parity 330, 331
- absolute valuation models *see* discounted cash flow (DCF) models
- active investors/strategy
 - dollar-weighted mean return 18, 19–21
 - geometric mean return 21
 - mean compound return 21
- adjusted present value (APV) model
 - 157, 184, 187–91
 - compared with WACC model 192
 - example 189–91
 - practical limitation 193–4
 - required return on unlevered equity 188–9, 190
 - when to use 193, 195
- alpha (Jensen's) 112–14
- American options 282
- Amgen 209
- Apple 59–61
- Argentina 240
- arithmetic mean 344
 - relationship with geometric mean and volatility 29–30
- arithmetic mean return 12–14
 - calculation 13
 - calculation using Excel 22
 - forecasting returns 13
 - and geometric mean return 16–17, 22
 - interpretation 13–14
- arithmetic returns 5
 - see also* simple returns
- assets, volatile 16, 17
- AT&T 34–5, 36, 37–8
- Bank of America 34–5, 36, 37–8, 76, 77
- bearer bonds 221
- benchmarks
 - relative valuation 210–13
 - historical (temporal) 211, 212, 214
 - peer-based (cross-sectional) 211, 212–13, 214
 - theoretical 211, 213
- beta of asset/stock 61, 62, 64, 68, 69–70, 82
 - definition 68
 - estimating
 - and CAPM 74–6
 - time period 75
 - as measure of relative volatility 70
- bills (USA) 221, 222
- binomial model 304–5
- Black–Scholes model 284, 285, 304–6, 310
- Boeing 49–52
- bonds
 - bearer 221
 - call protected 222
 - callable 222
 - consols 222, 224
 - convertible 221
 - convexity 254–7
 - coupons 223

- bonds (*continued*)
 - and duration 251, 252, 253
 - size and market risk 245
- current yield 228
- description 220
- discount rate
 - compared with interest rate 223, 224–6
 - and duration 251, 252, 253
- duration
 - calculation – example 249–51
 - calculation using Excel 258
 - definition 249
 - description 257
 - determinants 251–3
 - formula 250–1
 - and market risk 253
 - and maturity 248–9, 251
 - modified 253, 254, 255, 256, 257–8
- face value 220, 222
- finding buyer 237
- floating-rate 221
- high-yield (junk) 240
- immunization strategies 256–7
- indenture 220
- inflation-protected 221
- interest rates 220, 221
 - compared with discount rates 223, 224–6
 - immunization from changing 257
- intrinsic value 230
 - Excel calculation 231–2
- investment grade 240
- issue 220–1
- lifetime 248–9
- Macauley's duration 253
- market risk, assessment 257–8
- maturity
 - date 220
 - definition 248
 - and duration 248–9, 251
 - and market risk 244–5
- mean annual compound return 227
- price 231
- principal or face value 220, 222
- rating agencies 240–3
- registered 221
- return 231
 - see also* risk and return *below*
- risk
 - default 236, 239–43, 246
 - inflation 237, 246
 - liquidity 237, 246
 - market/interest rate 237, 243–6, 246
 - reinvestment 238–9, 246
 - sources 236–8
- risk and return compared with stock
 - 138–52
 - investment horizon 140–2
 - mean reversion 143–5, 151–2
 - time diversification 143–5, 151–2
- sale at discount 222
- sale at par 222
- sale at premium 222
- secured 221
- semi-annual coupon payments
 - 228–30
- semiannual yield, Excel calculation
 - 232
- unsecured 221
- USA 221
- valuation 222–4
- yield and credit rating 242–3
- yield curve 228
- yield (discount rate) and market risk
 - 245–6
- yield to maturity 226–8, 230, 231, 237, 238–9
 - Excel calculation 231, 232–3
 - zero-coupon 222, 224
- book-to-market ratio 82
 - and returns 84
- Bowie, David 221
- Brazil 104, 105
- Bristol Myers Squibb 209
- call option 281–2, 284, 285, 300
- callable bonds 222
- capital asset pricing model (CAPM)
 - see* CAPM

- capital charge 293
- capital gains and losses 5
- capital-free cash flow (CFCF) 171–3
 - compared with equity-free cash flow (EFCF) 184–5
 - estimation using WACC 176–8
- CAPM 65–80, 113, 159
 - application 76–7
 - beta – estimation 74–6
 - beta as source of risk 82–3
 - calculation of required return on equity 76, 78
 - compared with three-factor model 91–2, 93
 - elimination of risk premium 69
 - Excel calculations 80
 - interpretation 69–70
 - market risk premium – estimating 72–4
 - use of arithmetic average 73–4
 - use of geometric average 73–4
 - overview 67–8
 - popularity 82
 - required or expected return on stock 68
 - review of 82–3
 - risk premium of stock 68
 - risk-free rate, estimating 71–2
- cash flow
 - capital-free cash flow (CFCF) 171–3
 - compared with earnings 170–1
 - equity-free cash flow (EFCF) 171–3
 - terminal value 158, 174
- cash flow from return on investment (CFROI) 297
- cash value added (CVA) 297
- cash values, forecasting 158
- China 104, 105
- coefficient of kurtosis 373, 374
- coefficient of skewness 372, 374
 - Excel calculation 372, 379–80
- consols 222, 224
- continuously compounded returns 6–7
 - calculation 6
 - using Excel 377, 380–1
 - using lognormal distribution 375–7
- calculation of probabilities 377–9
- compared with simple returns 7
 - as function of simple return 6
 - multi-period, calculation 7–9
- convertible bonds 221
- convexity 254–7
- corporate value creation *see* value creation – measurement
- correlation coefficient 46–8, 351–2
 - Excel calculation 42, 353
- cost of capital 77–9
 - estimation using WACC 178–80
 - as hurdle rate 79
 - weighted, formula 77–8
- cost of debt 87
- cost of equity 87, 159
- coupons of bonds 223, 245, 251, 252, 253
- covariance 349–51
 - and correlation coefficient 351–2
 - disadvantages 350–1
 - Excel calculation 353
- credit rating *see* rating agencies
- currencies 325–38
 - appreciation 327
 - depreciation 327
 - exchange rate 326–8
 - definition 327
 - international Fisher effect 334–5, 338
 - nominal 327
 - forward parity 337, 338
 - interest rate parity 335–7, 338
 - international parity conditions 337–8
 - law of one price 328–30
 - PPP exchange rate 332
 - purchasing power parity 330–2, 338
 - absolute 330, 331
 - definition 331
- debentures 221
- debt, cost of 87
- default risk 246
 - bonds 236, 239–43
- derivatives 300

- derivatives (*continued*)
 - see also* financial options; forwards; futures; options on company's stock
- Descartés rule 269
- discounted cash flow (DCF) models
 - 157, 158
 - adjusted present value (APV) model 184, 187–91
 - consistency across models 181, 191, 192
 - flows to equity model 184–7
 - selection of model 192–3
 - ultimate goal 170
 - versions 157
 - see also*
 - adjusted present value (APV) model
 - dividend discount model (DDM)
 - flows-to-equity (FTE) model
 - present value
 - weighted-average cost of capital (WACC) model
- discounting 263
 - see also* net present value (NPV); present value
- distributions
 - kurtosis 370, 373
 - lognormal 375–7
 - moments *see* moments of a distribution
 - skewness 370, 371–3
 - see also* normal distribution
- diversifiable risk 58
- diversification 43–53, 57
 - international 63–4
 - and risk reduction 58–62
 - role of funds 52–3
 - use of financial instruments 52–3
 - views on 48–51
- dividend discount model (DDM)
 - 155–67, 157, 173
 - compared with flows-to-equity (FTE) model 192
 - compared with WACC model 181
 - constant growth 160–1, 164–5, 167
 - definition 159
 - estimating discount rate 159, 163
 - example 162–6
 - forecasting period 159
 - no growth 160, 163–4
 - reinvestment of earnings not paid out as dividends 167
 - requirements for accurate estimate of intrinsic value 167
 - terminal value as multiple 165–6
 - theory 158–9
 - two stages of growth 161–2, 165
- dividend yield 5
- dividends
 - as cash flows 158
 - expected, company's statement on policy 160
- dollar-weighted mean return 17–21
 - active investors 18, 19–21
 - calculation 19
 - passive investors 18–19
- downside risk 95–107
 - semideviation 99–102, 106–7
 - value at risk (VaR) 102–6
- duration of bond *see* bonds, duration
- earnings, compared with cash flow 170–1
- economic profit *see* residual income
- economic value added (EVA) 296, 297, 298
 - compared with residual income 296
- Eli Lilly 209
- Enron 48, 240
- equity, cost of 87, 159
- equity charge 293, 294
- equity risk premium 140
- equity-free cash flow (EFCF) 171–3
 - compared with capital-free cash flow 184–5
- European options 282
- evaluation of active portfolio
 - managers' performance, using 3FM 92
- Excel calculations
 - arithmetic mean return 22
- bonds

- duration 258
- intrinsic value 231–2
- semiannual yield 232
- yield to maturity 231, 232–3
- CAPM 80
- coefficient of kurtosis 373, 379–80
- coefficient of skewness 372, 379–80
- continuously compounded returns 377, 380–1
- correlation coefficient 42, 353
- covariance 42, 353
- geometric mean return 22
- internal rate of return 274–5
- mean 353
- median 353
- mode 353
- net present value (NPV) 274–5
- portfolio optimization 130–5
- probabilities
 - forecasting 152
 - lognormal distribution 152
 - normal distribution 152, 361–2, 365
 - standard normal distribution 366
- regression analysis 394–5
- semideviation 102, 106–7
- square root 31
- standard deviation 27, 31, 353
 - n*-asset portfolio 41
- sum elements in matrix 42
- variance 353
- exchange rate 326–8
 - appreciation in currency 327
 - definition 327
 - depreciation in currency 327
 - international Fisher effect 334–5, 338
 - nominal 327
- expected return
 - definition 125
 - maximizing subject to target level of risk 125, 127–8
- ExxonMobil 24–5, 28
- Fama, Eugene 87
- fat tails 106
- FBGRX *see* Fidelity Blue Chip Growth (FBGRX)
- FDCAX *see* Fidelity Capital Appreciation (FDCAX)
- feasible set, portfolios – risk and return 37–8, 40, 41, 42
- Fed Model 213
- Fidelity Blue Chip Growth (FBGRX) 112, 113, 114, 115, 118, 120–1
- Fidelity Capital Appreciation (FDCAX) 112, 114, 119
- Fidelity Magellan 117, 216
- Fidelity Select Banking (FSRBX) 112, 114, 115–17
- Fidelity Select Utilities Portfolio (FSUTX) 112, 114
- financial instruments, and diversification 52–3
- financial options 298–310
 - American 300
 - call option 300
 - at the money 301
 - in the money 300
 - out of the money 300
 - European 300
 - exercise (or strike) price 300
 - expiration date 300
 - issue 301
 - premium/price 301
 - put option 300
 - at the money 301
 - in the money 300–1
 - out of the money 301
 - valuation 284, 285
 - at expiration 301–2
 - Black–Scholes model 284, 285
 - see also* options on company's stock
- Fisher effect 333, 338
 - international 334–5, 338
- FKUTX *see* Franklin Utilities A (FKUTX)
- flexibility 281
 - real options 283
- flows-to-equity (FTE) model 157, 184–7
 - compared with dividend discount model (DDM) 192

- flows-to-equity (FTE) model (*continued*)
 - compared with WACC model 192
 - example 185–7
 - when to use 193, 195
- forecasting probabilities 149–51
 - using Excel 152
- forecasting returns 145–9
 - Returns Decomposition Model (RDM) 146–8
- forward parity 337, 338
- forwards 311–14
 - compared with futures 313
 - compared with options 312
 - definition 313, 335
 - hedgers 313, 314
 - long position 313
 - participants 313–14
 - pricing 316
 - role of market 323
 - settlement 314
 - short position 313
 - speculators 313
- Franklin Utilities A (FKUTX) 112, 114, 115–17, 119
- French, Kenneth 87
- FSRBX *see* Fidelity Select Banking (FSRBX)
- FSUTX *see* Fidelity Select Utilities Portfolio (FSUTX)
- futures 311–23
 - compared with forwards 313
 - compared with options 312
 - definition 313
 - hedgers 313, 314
 - hedging 319–23
 - dynamic hedge 319
 - long hedges 319
 - perfect hedges 319
 - reasons for 322–3
 - short hedges 319
 - static hedge 319
 - leverage 315
 - long position 313
 - margin account 314
 - initial margin 314
 - maintenance margin 314
 - margin call 314
 - marked to market 314
 - participants 313–14
 - pricing 316–19
 - consumption assets 318–19
 - contango 317
 - convenience yield 317
 - cost-of-carry model 316
 - examples 317–19
 - role of market 323
 - short position 313
 - speculators 313
- GARP (growth at a reasonable price) 216
- General Electric (GE) 162–6
- General Motors 296
- geometric mean 130
 - relationship with arithmetic mean and volatility 29–30
- geometric mean return 15–17, 227
 - and arithmetic mean return 16–17, 22
- calculation 15
 - using Excel 22
- interpretation 15–16
- GlaxoSmithKline (GSK) 209, 210, 211, 214, 215–16
- Google 20–1
- growing perpetuity 158, 161
- growth at reasonable price (GARP) 216
- growth stocks 84
- hedging
 - reasons for 322–3
 - see also* futures, hedging
- Hewlett Packard 59–61
- high-yield (junk) bonds 240
- histogram 357–8
- holding-period returns 5
 - see also* simple returns
- Holt Associates 297
- hurdle rate, use of cost of capital 79
- hypothesis testing 386–8
 - alternative hypothesis 387

- level of significance 387
 - null hypothesis 387
 - one-tailed test 387
 - p-value 387, 390, 391, 393
 - rejection of hypothesis 388
 - t-statistic 387, 393
 - two-tailed test 387
- IBM 49–52
- immunization strategies 256–7
- income, immunization strategies 257
- income statement 170–1
- inflation 262
- inflation risk, bonds 237, 246
- Intel 24–5, 26, 28
- interest rate parity 335–7, 338
- interest rate risk *see* market risk
- interest rates
 - changing, immunization of bond
 - from 257
 - Fisher effect 333, 338
 - international Fisher effect 334–5, 338
 - nominal 333
 - real 333
- internal rate of return (IRR) 79, 266–7
 - application 268
 - conflict with NPV 268, 271
 - Excel calculation 274–5
 - formula 266
 - problems of approach 268–73
 - lending versus borrowing 270–1
 - multiple IRRs 269–70
 - no IRR 270
 - size 271
 - time-varying discount rates 273
 - timing 272
 - as tool for project evaluation 239
- international diversification, portfolio risk 63–4
- international parity conditions 326, 337–8
- intrinsic value 156, 157, 167, 195
- investment grade bonds 240
- IRR *see* internal rate of return (IRR)
- Jackson, Michael 220–1, 240
- Japan 104, 105
- Jensen's alpha 112–14
- Johnson & Johnson 209
- JP Morgan 102
- kurtosis 370, 373
 - coefficient of 373, 374
 - Excel calculation 373, 379–80
 - leptokurtic distribution 373
 - platykurtic distribution 373
- law of one price, currencies 328–30
- Lehman Brothers 240
- leptokurtic distribution 373
- leverage
 - futures 315
 - use of options 308–9
- levered cash flow *see* equity-free cash flow (EFCF)
- linear regression, estimation of slope
 - using Excel 80
- liquidity risk, bonds 237, 246
- logarithmic returns 7
 - see also* continuously compounded returns
- lognormal distribution 375–7
 - calculation of continuously compounded returns 375–7
 - mean 377, 378
 - probabilities – calculation 377
 - variance 377, 378
- long term returns 137–52
- luck 110–11
- Lynch, Peter 216
- Macaulay's duration 253
- management goals 290–1
- market capitalization 82
 - and returns 83
- market portfolio 68, 73
- market risk, bonds 237, 243–6, 246
- market risk premium 85, 87, 88, 89, 140
 - comparison of various countries 74

- market risk premium (*continued*)
 - estimating, and CAPM 72–4
 - see also* three-factor model
- market value added (MVA) 296–7
- mean 344–5, 370, 374
 - Excel calculation 353
 - lognormal distribution 377, 378
- mean compound return *see* geometric mean return
- mean returns 12–22
 - arithmetic mean return 12–14
 - dollar-weighted 17–21
 - geometric 15–17
 - and standard deviation 28–30
- mean reversion 143–5, 151–2
- median 345–6
 - Excel calculation 353
- Merck 209, 210
- Microsoft 59–61, 101
- minimum variance portfolio 38, 40, 41–2, 50, 126
- mode 346–7
 - Excel calculation 353
- Modigliani, Franco 118
- Modigliani, Leah 118
- moments of a distribution 370
 - see also* kurtosis; mean; skewness; variance
- Moody's 240, 241
- Morningstar 121
- MSCI Emerging Markets Index 48, 388
- multicollinearity 391
- multi-period returns 7–9
- multiple linear regression model 385
- multiples 157, 208–10
 - denominator 209
 - numerator 209
 - reasons for name 209
 - versions 157
 - see also*
 - price-to-book (P/B) ratio
 - price-to-cash flow (P/CF) ratio
 - price-to-dividend (P/D) ratio
 - price-to-earnings (P/E) ratio
- net income 291
- net operating profit after taxes (NOPAT) 292, 297
- net present value (NPV) 79, 265–6
 - application 267–8
 - conflict with IRR 268, 271
 - disadvantages 279–81, 287
 - Excel calculation 274–5
 - formula 265
 - and real options 286
- nominal exchange rate 327
- non-normality 369–81
- NOPAT 292
- normal distribution 358–60
 - expression 358
 - probabilities – calculation 360–3
 - using Excel 361–2, 365
 - standard
 - cumulative distribution function table 364, 366–7
 - probabilities – calculation 363–4, 367
- normality 355–68
 - whether appropriate assumption 365
- Novartis 209
- NPV *see* net present value (NPV)
- objective function 124
- options
 - compared with forwards and futures 312
 - financial *see* financial options; options on a company's stock
 - real *see* real options
- options on company's stock
 - reasons for buying and selling 308–10
 - leverage 308–9
 - protection 309
- valuation
 - Black–Scholes model 304–6, 310
 - calls 302, 303, 305–8
 - put-call parity 306–8
 - puts 301, 303–4, 306–8
 - valuation at expiration 301–2

- valuation before expiration 302–4
 - exercise price 302, 303
 - risk-free rate 302, 303
 - time to expiration 302, 303
 - value of underlying asset 302, 303
 - volatility in value of underlying asset 302, 303, 310*see also* financial options
- Oracle 97–101, 105
- ordinary least squares 385
- passive investors/strategy
 - dollar-weighted mean return 18–19
 - geometric annual compound return 20, 21
 - internal rate of return 19
 - mean annual compound return 20, 21
- PEG ratio 215–16
- performance measurement *see* value creation – measurement
- perpetuity, growing 158, 161
- Pfizer 209
- pharmaceutical industry 208–9
- platykurtic distribution 373
- population 386
 - definition 343
- portfolio optimization 52, 123–35
 - inputs and output 125–6
 - maximizing expected return subject to target level of risk 125, 127–8
 - maximizing geometric mean 130
 - maximizing risk-adjusted returns 125, 128–9
 - maximizing Sortino ratio 130
 - minimizing risk 125, 126
 - subject to target return 125, 127
 - notation 125
 - restrictions 129
 - semideviation 129
 - Sharpe ratio 128–9
 - using Excel 130–5
 - variations of standard problems 129–30
- portfolios
 - definition 125
- diversification 37
 - requirements for properly-diversified 64
- expected return 36
- feasible set, efficient set 38–9
- international diversification 63–4
- n assets 40–2
 - efficient set 41, 42
 - feasible set 41, 42
 - minimum variance portfolio 41–2
 - standard deviation 40–1
- return of portfolio, calculation 35–6
- risk
 - calculation 36
 - covariances 62
 - and return 33–42
 - standard deviation 36
 - systematic risk 55–64
- three assets 39–40
 - efficient set 40
 - feasible set 40
 - minimum variance portfolio 40
 - variance term 39
- two assets 34–9
 - diversification benefits 43–53, 57
 - feasible set 37–8
 - minimum variance portfolio 38, 50
 - variance 41
 - volatility 36
- present value 158, 263–5
 - formula 265
 - see also* net present value (NPV)
- price
 - compared with value 156, 157
 - immunization strategies 257
- price-to-book (P/B) ratio 157
- price-to-cash flow (P/CF) ratio 157
- price-to-dividend (P/D) ratio 157
- price-to-earnings (P/E) ratio 157, 209–10
 - forward 209–10
 - trailing 209–10
- probabilities
 - calculation

- probabilities (*continued*)
 - continuously compounded annual returns 377–9
 - using normal distribution 360–3, 365
 - using standard normal distribution 363–4
- calculation using Excel 152
 - lognormal distribution 377
 - normal distribution 361–2, 365
- forecasting 149–51
- profitability
 - measurement 291–3
 - net income 291
 - net operating profit after taxes 292, 297
- project evaluation, tools *see* internal rate of return (IRR); net present value (NPV); real options
- protection, use of options 309
- purchasing power 333
- purchasing power parity 330–2, 338
 - absolute 330, 331
 - definition 331
- put option 282, 284, 285, 300
- put-call parity 306–8
- random variables 342
 - continuous 342
 - discrete 342
- rankings of mutual funds 110–22
 - Jensen's alpha 112–14
 - risk-adjusted performance (RAP) 118–20
 - Sharpe ratio 117–18, 120, 121
 - Sortino ratio 120–1
 - Treynor index 114–17, 118, 121
- RAP *see* risk-adjusted performance (RAP)
- rating agencies 240–3
- real options
 - American 282
 - American call 283
 - American put 283
 - call option 281–2, 284, 285
 - exercising 282
 - definition 282
 - description 281–3
 - European 282
 - exercise (strike) price 282
 - expiration date 282, 285
 - flexibility 283
 - misuses 286
 - and net present value 286
 - put option 282, 284, 285
 - exercising 282
 - to abandon 283
 - to delay 283
 - to expand 283
 - types 283
 - valuation 284–6
 - and exercise price 284
 - and expiration date 285
 - problems with 285–6
 - and risk-free rate 285
 - and volatility 284, 285
- registered bonds 221
- regression analysis 383–95
 - adjusted-R² 391–2
 - advantages 394
 - beta as only explanatory variable 390, 392
 - cross-sectional analysis 384–5
 - dependent variable 384
 - forecasting 392–3
 - hypothesis testing 386–8
 - independent variable 384
 - multicollinearity 391
 - multiple explanatory variables 390–1
 - multiple linear regression model 385
 - ordinary least squares 385
 - overview 384–6
 - study or risk and returns in emerging markets 388–9
 - volatility 389, 390
 - time-series analysis 385
 - use of Excel 394–5
 - volatility and beta as explanatory variables 390–1, 392
- reinvestment risk, bonds 238–9, 246

- relative frequencies 356–7
- relative valuation 207–17
 - benchmarks 210–13
 - determining 208
 - historical (temporal) 211, 212, 214
 - and multiple – reasons for
 - difference 213–15
 - peer-based (cross-sectional) 211, 212–13, 214
 - theoretical 211, 213
 - implementation 208
 - multiples, and benchmarks – reasons
 - for difference 213–15
 - multiples (ratios) 208–10
 - PEG ratio 215
- required returns 66–7
 - CAPM 68, 76, 78, 82
 - definition 67
 - on equity *see* CAPM
 - as forward-looking factor 70–1
 - and risk 66–7
 - risk-free investment 66
 - three-factor model *see separate entry*
 - see also* expected return
- research and development (R&D) 296
- residual income 293–6, 298
 - compared with economic value
 - added (EVA) 296
- returns
 - arithmetic 5
 - continuously compounded *see* continuously compounded returns
 - forecasting 145–9
 - Returns Decomposition Model (RDM) 146–8
 - holding-period 5
 - logarithmic 7
 - long term 137–52
 - multiperiod 7–9
 - portfolios *see* portfolio optimization; portfolios, return
 - and risk-taking 111
 - see also* risk-adjusted returns
 - simple *see* simple returns
 - use of term (in book) 7
 - see also* mean returns
- Returns Decomposition Model (RDM) 146–8
- reverse valuation 197–206
 - caveats 205
 - examples
 - realistic 200–2
 - simple 199–200
 - Yahoo! 202–5
- risk
 - bonds *see under* bonds
 - covariances 62–3
 - default 236, 239–43, 246
 - defining 24–5
 - and diversification 43–53
 - inflation 237, 246
 - liquidity 237, 246
 - market 237, 243–6, 246
 - minimization *see* portfolio optimization
 - portfolios *see* portfolios, risk
 - and present value 264
 - reinvestment 238–9, 246
 - and required return 66–7
 - standard deviation as measure 27–8, 96–9
 - limitations 97–9
 - systematic *see* systematic risk
 - see also* downside risk
- risk of asset within portfolio
 - absolute and relative contributions 59–62
 - calculation 59–62
 - description 59
 - see also* portfolios, risk
- risk premium
 - elimination under CAPM 69
 - estimating 82
- risk and return
 - stock compared with bonds 138–52
 - investment horizon 140–2
 - mean reversion 143–5, 151–2
 - time diversification 143–5, 151–2
 - study of emerging markets using
 - regression analysis 388–9

- risk-adjusted performance (RAP) 118–20
 - definition 118
- risk-adjusted return on capital (RAROC) 298
- risk-adjusted returns 49, 51–2, 109–22
 - definition 51
 - Jensen's alpha 112–14
 - risk-adjusted performance (RAP) 118–20
 - Sharpe ratio 117–18, 120, 121
 - Sortino ratio 120–1
 - Treynor index 114–17, 118, 121
- risk-free investment, required return 66
- risk-free rate, and CAPM 67, 69, 71–2
- Russia 12–13, 14–15, 16, 17
- S&P 500 73, 113, 114
- sample 386
 - definition 343
- sampling error 386
- Sanofi Aventis 209
- secured bonds 221
- securities market line 116
- semideviation 99–102, 106, 129
 - Excel calculation 102, 106–7
- sensitivity analysis 195
- shareholder value 290
 - maximization 291
 - see also* value creation
- shareholder value added (SVA) 298
- Sharpe ratio 117–18, 120, 121, 128–9
- short-selling 38
- shortfall probability 140
- shortfall risk 140
- Siegel, Jeremy 138
- simple returns 4–5, 376
 - calculation 5
 - capital gain or loss 5
 - compared with continuously compounded returns 7
 - definition 5
 - dividend yield 5
 - as function of continuously compounded return 6
 - multiperiod, calculation 7–9
- size premium 83, 84, 86, 87, 88, 89, 91
 - see also* three-factor model
- skewness 370, 371–3
 - coefficient of 372, 374
 - Excel calculation 372
 - negative (left) 371, 372
 - positive (right) 371, 372–3
- Sortino ratio 120–1, 130
- Standard & Poor's (S&P) 240, 241, 242
- standard deviation 25–30, 106, 349, 374
 - calculation 25–7
 - using Excel 27, 31, 353
 - formula 25
 - and mean returns 28–30
 - as measure of risk 27–8, 96–9
 - limitations 97–9
 - as measure of total volatility 70
- n*-asset portfolio 40–1
 - Excel calculations 41
- portfolio 36
- standard normal distribution
 - cumulative distribution function
 - table 364, 366–7
 - probabilities – calculation 363–4
 - using Excel 366
- Starbucks 175–80, 185–7, 189–91
- Stern Stewart 296, 297
- stock price, factors affecting 56–7
- stocks
 - risk and return compared with bonds 138–52
 - investment horizon 140–2
 - mean reversion 143–5, 151–2
 - time diversification 143–5, 151–2
- Switzerland 12, 17
- systematic factors, definition 57
- systematic risk 55–64
- terminal value 158, 174, 195
- The Economist*, Big Mac index 332
- three assets *see under* portfolios
- three-by-three box 121
- three-factor model 79, 82, 84, 85–94
 - application 89–92

- compared with CAPM 91–2, 93
- evaluation of active portfolio managers' performance 92
- implementation 86–8
- overview 85–6
- see also* market risk premium; size premium; value premium
- time diversification 143, 151–2
 - under mean reversion 143–5, 151–2
- total business return (TBR) 298
- total shareholder return (TSR) 298
- Treasury Inflation Protected Securities (TIPS) 221
- Treynor index 114–17, 118, 121
- two assets *see under* portfolios
- UK 104, 105
- undiversifiable risk *see* systematic risk
- unlevered cash flow *see* capital-free cash flow (CFCF)
- unsecured bonds 221
- unsystematic factors, definition 57
- unsystematic risk 58
- USA
 - corporate bonds 221
 - government bonds 221
 - Treasury bills 222
 - risks 236
- valuation
 - absolute models *see* discounted cash flow models
 - dividend discount model (DDM) 155–67
 - fundamental analysis 157
 - relative *see* multiples; relative valuation
 - reverse *see* reverse valuation
 - technical analysis 157
 - value compared with price 156, 157
 - weighted-average cost of capital (WACC) model 169–81
- value
 - intrinsic 156, 157, 167, 195
 - terminal 158, 174, 195
 - value at risk (VaR) 102–6
 - definition 103
 - value creation – measurement 289–98
 - accounting profits 291, 292
 - cash flow from return on investment (CFROI) 297
 - cash value added (CVA) 297
 - economic profits 291, 292, 298
 - economic value added (EVA) 296, 297, 298
 - market value added (MVA) 296–7
 - net income 291
 - residual income 293–6
 - risk-adjusted return on capital (RAROC) 298
 - shareholder value added (SVA) 298
 - total business return (TBR) 298
 - total shareholder return (TSR) 298
 - value drivers 157
 - value premium 84, 86, 88, 89
 - see also* three-factor model
 - value stocks 84
 - Vanguard 500 117
 - variables, random 342
 - variance 26, 346–9, 370
 - Excel calculation 353
 - lognormal distribution 377, 378
 - of portfolio 41
 - variance drag 29
 - volatile assets, mean returns 21
 - volatility 16
 - and correlation coefficient 46–8
 - formula 25
 - options on a company's stock 302, 303, 310
 - portfolios 36, 46–8
 - relationship with arithmetic mean and geometric mean 29–30
 - relative – beta as measure of 70
 - risk and returns in emerging markets 389, 390
 - stock prices 56
 - total – standard deviation as measure of 70
 - why bad for investors 28–30

- WACC *see* weighted-average cost of capital (WACC) model
- Wal-Mart 76, 77
- weighted-average cost of capital (WACC) model 79, 157, 169–81
 - compared with adjusted present value (APV) model 192
 - compared with dividend discount model (DDM) 181
 - compared with flows-to-equity (FTE) model 192
 - cost of capital estimation 178–80
 - definition 174
 - example 175–80
 - formula 77–8
 - free cash flow estimation 176–8
 - market value weights and target weights 194
 - overview 173–5
 - standard implementation 174–5
 - when to use 193
- Yahoo! 202–5
- zero-coupon bonds 222, 224