Preface xix

Chapter 1
Introduction to Derivatives 1

1.1 What Is a Derivative? 2
1.2 An Overview of Financial Markets 2
    Trading of Financial Assets 3
    Measures of Market Size and Activity 4
    Stock and Bond Markets 5
    Derivatives Markets 6
1.3 The Role of Financial Markets 11
    Financial Markets and the Averages 11
    Risk Sharing 12
1.4 Ways to Think about Derivatives 14
    Uses of Derivatives 15
    Perspectives on Derivatives 16
    Financial Engineering and Security Design 16
1.5 Buying and Short-Selling Financial Assets 17
    Transaction Costs and the Bid-Ask Spread 17
    Ways to Buy or Sell 18
    Short-Selling 19
    The Lease Rate of an Asset 21

Chapter Summary 22
Further Reading 23
Problems 23
## Contents

3.3 Spreads and Collars 72
- Bull and Bear Spreads 73
- Box Spreads 74
- Ratio Spreads 75
- Collars 76

3.4 Speculating on Volatility 79
- Straddles 79
- Butterfly Spreads 82

3.5 Application: Equity-Linked CDs 84
- Graphing the Payoff on the CD 85
- Economics of the CD 85
- Why Equity-Linked CDs? 86

Chapter Summary 87
Further Reading 89
Problems 89

### Chapter 4

**Introduction to Risk Management** 93

4.1 Basic Risk Management: The Producer's Perspective 93
- Hedging with a Forward Contract 94
- Insurance: Guaranteeing a Minimum Price with a Put Option 96
- Insuring by Selling a Call 97
- Adjusting the Amount of Insurance 99

4.2 Basic Risk Management: The Buyer's Perspective 100
- Hedging with a Forward Contract 101
- Insurance: Guaranteeing a Maximum Price with a Call Option 101

4.3 Why Do Firms Manage Risk? 103
- Reasons to Hedge 104
- Reasons Not to Hedge 106
- Empirical Evidence on Hedging 107

4.4 Golddiggers Revisited 108
- Selling the Gain: Collars 109
- Other Collar Strategies 113
- Paylater Strategies 113

4.5 Basis Risk 114
- Hedging Jet Fuel with Crude Oil 115
- Stack and Strip Hedges 115

Chapter Summary 117
Further Reading 118
Problems 119
PART TWO
Forwards, Futures, and Swaps 123

Chapter 5
Financial Forwards and Futures 125

5.1 Alternative Ways to Buy a Stock 125
5.2 Prepaid Forward Contracts on Stock 127
   Pricing the Prepaid Forward by Analogy 127
   Pricing the Prepaid Forward by Discounted Present Value 127
   Pricing the Prepaid Forward by Arbitrage 128
   Pricing Prepaid Forwards with Dividends 129
5.3 Forward Contracts on Stock 132
   Creating a Synthetic Forward Contract 133
   Synthetic Forwards in Market-Making and Arbitrage 135
   No-Arbitrage Bounds with Transaction Costs 136
   Quasi-Arbitrage 137
   Does the Forward Price Predict the Future Price? 137
   An Interpretation of the Forward Pricing Formula 139
5.4 Futures Contracts 139
   The S&P 500 Futures Contract 140
   Margins and Marking-to-Market 142
   Comparing Futures and Forward Prices 145
5.5 Uses of Index Futures 145
   Asset Allocation 146
   Cross-Hedging with Index Futures 147

Chapter Summary 150
Further Reading 151
Problems 152

Chapter 6
The Wide World of Futures Contracts 157

6.1 Currency Contracts 157
   Currency Prepaid Forward 157
   Currency Forward 159
   Covered Interest Arbitrage 159
6.2 Eurodollar Futures 160
6.3 An Introduction to Commodity Futures 164
   Seasonality and Storage Costs 164
   The Forward Price and the Expected Commodity Price 166
   The Commodity Lease Rate 166
The Swap Counterparty 223
The Market Value of a Swap 225

8.2 Interest Rate Swaps 227
A Simple Interest Rate Swap 227
Pricing and the Swap Counterparty 229
Computing the Swap Rate in General 230
Deferred Swaps 232
The Swap Curve 233
Amortizing and Accreting Swaps 234

8.3 Currency Swaps 235
Currency Swap Formulas 238
Other Currency Swaps 239

8.4 Swaptions 240

8.5 Total Return Swaps 241

Chapter Summary 244
Further Reading 244
Problems 245

PART THREE
Options 247

Chapter 9
Parity and Other Option Relationships 249

9.1 Put-Call Parity 250
Options on Stocks 251
Options on Currencies 254
Options on Bonds 254

9.2 Generalized Parity and Exchange Options 255
Options to Exchange Stock 256
What Are Calls and Puts? 257
Currency Options 258

9.3 Comparing Options with Respect to Style, Maturity, and Strike 260
European Versus American Options 260
Maximum and Minimum Option Prices 261
Early Exercise for American Options 262
Time to Expiration 264
Different Strike Prices 265

Chapter Summary 270
Further Reading 271
Problems 272
Chapter 10

Binomial Option Pricing 277

10.1 A One-Period Binomial Tree 277
   Computing the Option Price 278
   The Binomial Solution 280
   Arbitraging a Mispriced Option 282
   A Graphical Interpretation of the Binomial Formula 283
   Pricing with Dividends 283
   Risk-Neutral Pricing 285
   Constructing a Binomial Tree 286
   Another One-Period Example 287
   Summary 288

10.2 Two or More Binomial Periods 288
   A Two-Period European Call 289
   Many Binomial Periods 291

10.3 Put Options 293
   European Put 293
   American Put 294

10.4 American Options 294

10.5 Options on Other Assets 295
   Option on a Stock Index 295
   Options on Currencies 297
   Options on Futures Contracts 297
   Summary 299

Chapter Summary 301
Further Reading 301

Problems 301

10.A Lognormality and the Binomial Model 304
   The Cox-Ross-Rubinstein Binomial Tree 307
   The Jarrow-Rudd Tree 308

Chapter 11

The Black-Scholes Formula 309

11.1 Introduction to the Black-Scholes Formula 309
   Call Options 310
   Put Options 313
   What Assumptions Underlie the Black-Scholes Formula? 314

11.2 Applying the Formula to Other Assets 314
   Options on Stocks with Discrete Dividends 315
   Options on Currencies 316
   Options on Futures 316
11.3 Option Greeks 317
   Definition of the Greeks 317
   Greek Measures for Portfolios 324
   Option Elasticity 325
11.4 Delta-Hedging 330
   Option Risk in the Absence of Hedging 330
   An Example of Delta-Hedging 331
   Interpreting Market-Maker Profit 333
11.5 Volatility 335
   Historical Volatility 335
   Implied Volatility 336
   Trading Volatility 339

Chapter Summary 341
Further Reading 342
Problems 342

PART FOUR
Financial Engineering and Applications 347

Chapter 12
Financial Engineering and Security Design 349
  12.1 The Modigliani-Miller Theorem 349
  12.2 Structured Notes Without Options 350
     Zero-Coupon Bonds Paying Cash 351
     Coupon Bonds Paying Cash 351
     Equity-Linked Bonds 352
     Commodity-Linked Bonds 355
     Currency-Linked Bonds 357
  12.3 Structured Notes with Options 358
     Coupon Bonds with Options 358
     Equity-Linked Notes with Options 359
     Valuing and Structuring an Equity-Linked CD 361
     Alternative Structures 363
     Application: Variable Prepaid Forwards 364
  12.4 Engineered Solutions for Golddiggers 366
     Gold-Linked Notes 366
     Notes with Embedded Options 367
Chapter 13
Corporate Applications 383

13.1 Equity, Debt, and Warrants 383
   Debt and Equity as Options 383
   Valuing Credit Guarantees 386
   Leverage and the Expected Return on Debt and Equity 388
   Multiple Debt Issues 392
   Warrants 393
   Convertible Bonds 394
   Callable Bonds 397
   Bond Valuation Based on the Stock Price 401
   Put Warrants 402

13.2 Compensation Options 403
   Whose Valuation? 406
   Valuation Inputs 406
   Level 3 Communications 409

13.3 The Use of Collars in Acquisitions 412
   The Northrop Grumman–TRW Merger 413

Chapter Summary 417
Further Reading 417
Problems 418

Chapter 14
Real Options 423

14.1 DCF and Option Valuation for a Single Cash Flow 424
   Project 1 424
   Project 2 428
   Project 3 431
   Summary 432

14.2 Multiperiod Valuations 433
   Project 1 434
   Project 2 436