

An Introduction to Derivatives and Risk Management

9TH EDITION

DON M. CHANCE Louisiana State University

ROBERT BROOKS

University of Alabama



Australia • Brazil • Japan • Korea • Mexico • Singapore • Spain • United Kingdom • United States

Copyright 2012 Cengage Learning. All Rights Reserved. May not be copied, scanned, or duplicated, in whole or in part. Due to electronic rights, some third party content may be suppressed from the eBook and/or eChapter(s). Editorial review has deemed that any suppressed content does not materially affect the overall learning experience. Cengage Learning reserves the right to remove additional content at any time if subsequent rights restrictions require it



	Preface xvii
CHAPTER 1	Introduction 1
PART	Options 27
CHAPTER 2	Structure of Options Markets 28
CHAPTER 3	Principles of Option Pricing 61
CHAPTER 4	Option Pricing Models: The Binomial Model 99
CHAPTER 5	Option Pricing Models: The Black-Scholes-Merton Model 133
CHAPTER 6	Basic Option Strategies 189
CHAPTER 7	Advanced Option Strategies 225
PART I	Forwards, Futures, and Swaps 257
CHAPTER 8	The Structure of Forward and Futures Markets 258
CHAPTER 9	Principles of Pricing Forwards, Futures, and Options on Futures 293
CHAPTER 10	Futures Arbitrage Strategies 333
CHAPTER 11	Forward and Futures Hedging, Spread, and Target Strategies 361
CHAPTER 12	Swaps 413
PART III	Advanced Topics 455
CHAPTER 13	Interest Rate Forwards and Options 456
CHAPTER 14	Advanced Derivatives and Strategies 493
CHAPTER 15	Financial Risk Management Techniques and Applications 533
CHAPTER 16	Managing Risk in an Organization 576
Appendix A Appendix B Appendix C	References 607

Contents

Preface	vii
CHAPTER 1	
Introduction	.1
Derivative Markets and Instruments 3 Derivatives Markets 4 Options 4 Forward Contracts 5 Futures Contracts 6 Swaps and Other Derivatives 6	
The Underlying Asset 7	
Important Concepts in Financial and Derivative Markets 7 Presuppositions for Financial Markets 7 Risk Preference 8 Short Selling 8 Repurchase Agreements 9 Return and Risk 9 Market Efficiency and Theoretical Fair Value 11	
Making the Connection Risk and Return and Arbitrage 12	
Fundamental Linkages Between Spot and Derivative Markets13Arbitrage and the Law of One Price13The Storage Mechanism: Spreading Consumption across Time14Delivery and Settlement15	
Role of Derivative Markets 15 Risk Management 15	
Making the Connection Jet Fuel Risk Management at Southwest Airlines 16 Price Discovery 16 Operational Advantages 17 Market Efficiency 17	
Criticisms of Derivative Markets 17	
Misuses of Derivatives 18	
Derivatives and Ethics 19	
Derivatives and Your Career 20	
Sources of Information on Derivatives 20	
Book Overview21Organization of the Book21Key Features of the Book21Specific New Features of the Ninth Edition23Use of the Book23	

0.810

Summary24Key Terms24Further Reading24Concept Checks25Questions and Problems25

PART | Options

CHAPTER 2 Structure of Options Markets
Development of Options Markets 29
Call Options 30
Put Options 31
Over-the-Counter Options Market 31
Exchange-Listed Option Trading 34 Derivatives Exchanges 34 Listing Requirements 35 Contract Size 35 Exercise Prices 36 Expiration Dates 36 Position and Exercise Limits 37 Market Participants 37 Other Option Trading Systems 39 Off-Floor Option Traders 40
Mechanics of Trading40Placing an Opening Order40Role of the Clearinghouse41Placing an Offsetting Order42Exercising an Option43
Option Price Quotations 44
Making the Connection Reading Option Price Quotations 45
Types of Options46Stock Options46Index Options46Currency Options47Other Types of Options47Real Options48
Transaction Costs in Option Trading49Floor Trading and Clearing Fees49Commissions49Bid-Ask Spread50Other Transaction Costs50
Regulation of Options Markets 51
Making the ConnectionSuspicious Put Option Trading and Bear Stearns & Co., Inc. Implosion52Summary53
Key Terms53Further Reading53

Concept Checks 54 **Questions and Problems** 54 **Appendix 2.A: Margin Requirements** 55 Margin Requirements on Stock Transactions 55 Margin Requirements on Option Purchases 55 Margin Requirements on the Uncovered Sale of Options 55 Margin Requirements on Covered Calls 56 Questions and Problems 56 Appendix 2.B: Taxation of Option Transactions 57 Taxation of Long Call Transactions 57 Taxation of Short Call Transactions 57 Taxation of Long Put Transactions 58 Taxation of Short Put Transactions 58 Taxation of Non-Equity Options 58 Wash and Constructive Sales 59 59 Questions and Problems CHAPTER 3 **Basic Notation And Terminology** 62 Principles of Call Option Pricing 64 Minimum Value of a Call 64 Maximum Value of a Call 65 Value of a Call at Expiration 66 Effect of Time to Expiration 67 Effect of Exercise Price 69 Lower Bound of a European Call 72 Making the Connection Asynchronous Closing Prices and Apparent Boundary Condition Violations 74 American Call versus European Call 75 Early Exercise of American Calls on Dividend-Paying Stocks 76 Effect of Interest Rates 77 Effect of Stock Volatility 77 Principles of Put Option Pricing 78 Minimum Value of a Put 78 Maximum Value of a Put 80 Value of a Put at Expiration 80 Effect of Time to Expiration 81 The Effect of Exercise Price 82 Lower Bound of a European Put 84 American Put versus European Put 86 Early Exercise of American Puts 86 Put-Call Parity 87 Effect of Interest Rates 90 Effect of Stock Volatility 90 Making the Connection Put-Call Parity Arbitrage 91 Summary 92

Key Terms 93

Further Reading 93	3	
Concept Checks 94	L .	
Questions and Proble	ems 94	
Appendix 3: Dynamic	cs of Option Boundary Conditions: A Learning Exercise 97	
CHAPTER 4 Option Pricing Mo	dels: The Binomial Model	99
One-Period Binomial Illustrative Exampl Hedge Portfolio	I Model 99 le 103 104 105	
Two-Period Binomial	l Model 106	
Illustrative Exampl Hedge Portfolio	ricing, Risk Premiums, and Probabilities 108 e 108	
Foreign Currency (Illustrative Exampl Extending the Binc Behavior of the Bin Alternative Specific	ns 113 I Early Exercise 115 an Calls, American Calls, and Early Exercise 115 Options 120	
Making the Connection		
Software Demonstrat	ion 4.1	
5	nomial Price with the Excel Spreadsheet BSMbin9e.xls 128	
Summary 129 Key Terms 129		
•	30	
Concept Checks 13		
Questions and Proble		
CHAPTER 5 Option Pricing Mo	dels: The Black-Scholes-Merton Model	133
Origins of the Black-	Scholes-Merton Formula 133	
Black-Scholes-Merton	n Model as the Limit of the Binomial Model 134	
Making the Connection Logarithms, Expor	on nentials, and Finance 136	
Stock Prices Behav Risk-Free Rate and	Black-Scholes-Merton Model 137 re Randomly and Evolve According to a Lognormal Distribution I Volatility of the Log Return on the Stock Are Constant e Option's Life 140 section Costs 141	137

Stock Pays No Dividends 141

```
Options Are European 141
A Nobel Formula
                 141
  Digression on Using the Normal Distribution 142
  Numerical Example 144
  Characteristics of the Black-Scholes-Merton Formula 145
Software Demonstration 5.1
  Calculating the Black-Scholes-Merton Price with the Excel Spreadsheet BSMbin9e.xls
                                                                                146
Variables in the Black-Scholes-Merton Model
                                          149
  Stock Price 149
  Exercise Price 153
  Risk-Free Rate 153
  Volatility (or Standard Deviation)
                                 155
  Time to Expiration
                    156
Black-Scholes-Merton Model When the Stock Pays Dividends
                                                         158
  Known Discrete Dividends 159
  Known Continuous Dividend Yield 159
  Black-Scholes-Merton Model and Currency Options
                                                 161
Black-Scholes-Merton Model and Some Insights into American Call Options
                                                                      161
  Estimating the Volatility 162
  Historical Volatility 162
  Implied Volatility 165
Software Demonstration 5.2
  Calculating the Historical Volatility with the Excel Spreadsheet Hisv9e.xls
                                                                      165
Making the Connection
  Smiles, Smirks, and Surfaces 171
Put Option Pricing Models
                         173
Managing the Risk of Options
                             175
  When the Black-Scholes-Merton Model May and May Not Hold 180
Summary
           182
Key Terms
            183
Further Reading
                 183
Concept Checks
                 184
Questions and Problems
                        184
Appendix 5: A Shortcut to the Calculation of Implied Volatility
                                                           187
CHAPTER 6
Terminology and Notation
                          190
  Profit Equations 190
  Different Holding Periods 191
  Assumptions 192
Stock Transactions
                   193
  Buy Stock 193
  Short Sell Stock 193
                         194
Call Option Transactions
  Buy a Call 194
  Write a Call 198
Put Option Transactions
                        201
  Buy a Put 201
  Write a Put 204
```

Calls and Stock: The Covered Call 207 Some General Considerations with Covered Calls 210 Making the Connection Alpha and Covered Calls 211 Puts and Stock: The Protective Put 212 Making the Connection Using the Black-Scholes-Merton Model to Analyze the Attractiveness of a Strategy 215 Synthetic Puts and Calls 216 Software Demonstration 6.1 Analyzing Option Strategies with the Excel Spreadsheet Stratlyz9e.xls 219 Summary 222 Key Terms 222 Further Reading 222 **Concept Checks** 222 **Questions and Problems** 223 **CHAPTER 7 Option Spreads: Basic Concepts** 225 Why Investors Use Option Spreads 226 Notation 226 Money Spreads 227 Bull Spreads 227 Making the Connection Spreads and Option Margin Requirements 230 Bear Spreads 231 A Note about Call Bear Spreads and Put Bull Spreads 233 Collars 233 Butterfly Spreads 236 Making the Connection Designing a Collar for an Investment Portfolio 237 Calendar Spreads 241 Time Value Decay 242 Ratio Spreads 244 Straddles 246 Box Spreads 250 Summary 252 Key Terms 253 **Further Reading** 253 **Concept Checks** 253 **Questions and Problems** 253

PART II Forwards, Futures, and Swaps

Copyright 2012 Cengage Learning. All Rights Reserved. May not be copied, scanned, or duplicated, in whole or in part. Due to electronic rights, some third party content may be suppressed from the eBook and/or eChapter(s). Editorial review has deemed that any suppressed content does not materially affect the overall learning experience. Cengage Learning reserves the right to remove additional content at any time if subsequent rights restrictions require it.

Chicago Futures Markets 259 Development of Financial Futures 260 Development of Options on Futures Markets 262 Parallel Development of Over-the-Counter Markets 262

Over-the-Counter Forward Market 263

Organized Futures Trading 265

Contract Development 266 Contract Terms and Conditions 267 Delivery Terms 268 Daily Price Limits and Trading Halts 268 Other Exchange Responsibilities 268 Derivatives Exchanges 269

Futures Traders 269

General Classes of Futures Traders269Classification by Trading Strategy270Classification by Trading Style271Off-Floor Futures Traders271Forward Market Traders272

Mechanics of Futures Trading 272

Placing an Order 272 Role of the Clearinghouse 273 Daily Settlement 274

Making the Connection

How Clearinghouses Reduce Credit Risk 275 Delivery and Cash Settlement 278

Futures Price Quotations 280

Types of Futures Contracts 280

Agricultural Commodities 280 Natural Resources 281 Miscellaneous Commodities 281 Foreign Currencies 281 Federal Funds and Eurodollars 281 Treasury Notes and Bonds 282 Swap Futures 282 Equities 282

Making the Connection

Reading Futures Price Quotations283Managed Funds284Hedge Funds285Options on Futures285

Transaction Costs in Forward and Futures Trading 285

Commissions286Bid-Ask Spread286Delivery Costs286

Regulation of Futures and Forward Markets 287

OTC Central Clearing 288

Summary289Key Terms289

Further Reading 289

Concepts Checks 290

Questions and Problems 290

	8: Taxation of Futures Transactions in the United States 292 ns and Problems 292
2	
CHAPTE Principles	R 9 s of Pricing Forwards, Futures, and Options on Futures
Concep Value o Price of	arry Arbitrage 294 t of Price versus Value 294 f a Forward Contract 295 F a Forward Contract 297 f a Futures Contract 297
When I Price of	e Connection Forward and Futures Contracts Are the Same 298 F a Futures Contract 300 I versus Futures Prices 300
Stock In Foreign	itrage When Underlying Generates Cash Flows 301 ndices and Dividends 301 Currencies and Foreign Interest Rates: Interest Rate Parity 304 odities and Storage Costs 306
Pricing Mo Spot Pr Forward Futures	odels and Risk Premiums 306 ices, Risk Premiums, and Carry Arbitrage for Generic Assets 307 d/Futures Pricing Revisited 308 Prices and Risk Premia 313 l-Forward/Futures Parity 318
Intrinsi Lower I Put-Cal Early E	otions on Futures319c Value of an American Option on Futures319Bound of a European Option on Futures320l Parity of Options on Futures322xercise of Call and Put Options on Futures323utures Option Pricing Model325
Summary	327
Key Terms	3 29
Further Re Concept C	•
-	and Problems 330
CHAPTE Futures A	R 10 Arbitrage Strategies
Carry A Federal	n Interest Rate Arbitrage 333 arbitrage and the Implied Repo Rate 333 Funds Futures Carry Arbitrage and the Implied Repo Rate 335 llar Arbitrage 337
Determ Deliver	tte- and Long-Term Interest Rate Arbitrage 338 ining the Cheapest-to-Deliver Bond on the Treasury Bond Futures Contract 340 y Options 343 Repo, Carry Arbitrage, and Treasury Bond Futures 346
	Demonstration 10.1 /ing the Cheapest-to-Deliver Bond with the Excel Spreadsheet CTD9e.xlsc 346
	Bond Futures Spreads and the Implied Repo Rate 348
	x Arbitrage 349
	schange Arbitrage 352

```
Making the Connection
  Currency-Hedged Cross-Border Index Arbitrage 354
Summary
          355
Key Terms
           355
Further Reading
               356
Concept Checks
               356
Questions and Problems
                      356
Appendix 10: Determining the CBOT Treasury Bond Conversion Factor
                                                             359
Software Demonstration 10.2
  Determining the CBOT Conversion Factor with the Excel Spreadsheet CF9e.xls
                                                                     360
CHAPTER 11
Why Hedge?
            362
Hedging Concepts
                 363
  Short Hedge and Long Hedge 363
  The Basis 364
  Some Risks of Hedging
                      368
  Contract Choice
                 369
  Margin Requirements and Marking to Market 372
Determination of the Hedge Ratio
                              373
  Minimum Variance Hedge Ratio
                              373
  Price Sensitivity Hedge Ratio 375
  Stock Index Futures Hedging 377
Hedging Strategies
                 378
  Foreign Currency Hedges 379
  Intermediate- and Long-Term Interest Rate Hedges
                                           381
Making the Connection
  Hedging Contingent Foreign Currency Risk 382
Making the Connection
  Using Derivatives in Takeovers
                             389
Spread Strategies
                391
  Intramarket Spreads
                    391
  Intermarket Spreads
                    394
Target Strategies
                396
  Target Duration with Bond Futures
                               396
  Alpha Capture 398
  Target Beta with Stock Index Futures 401
  Tactical Asset Allocation Using Stock and Bond Futures 402
Summary
          406
Key Terms
           407
Further Reading
               407
Concept Checks
               407
Questions and Problems
                      407
Appendix 11: Taxation of Hedging
                              412
CHAPTER 12
Interest Rate Swaps
                  416
```

Structure of a Typical Interest Rate Swap 416 Pricing and Valuation of Interest Rate Swaps 419

Making the Connection

LIBOR and the British Bankers' Association 424

Interest Rate Swap Strategies 426

Making the Connection

United States Municipal Finance and Interest Rate Swaps 430

Currency Swaps 431

Structure of a Typical Currency Swap 431 Pricing and Valuation of Currency Swaps 433 Currency Swap Strategies 437

Making the Connection

Valuing a Currency Swap as a Series of Currency Forward Contracts 438

Equity Swaps 440

Structure of a Typical Equity Swap 441 Pricing and Valuation of Equity Swaps 443 Equity Swap Strategies 446

Some Final Words About Swaps 448

Summary 448

Key Terms 449

Further Reading 449

Concept Checks 450

Questions and Problems 450

PART III Advanced Topics

CHAPTER 13

Forward Rate Agreements 458 Structure and Use of a Typical FRA 459 Pricing and Valuation of FRAs 460 Applications of FRAs 463 **Interest Rate Options** 466 Structure and Use of a Typical Interest Rate Option 466 Pricing and Valuation of Interest Rate Options 467 Interest Rate Option Strategies 468 Interest Rate Caps, Floors, and Collars 473 Interest Rate Options, FRAs, and Swaps 478 Interest Rate Swaptions and Forward Swaps 480 Making the Connection Binomial Pricing of Interest Rate Options 481 Structure of a Typical Interest Rate Swaption 482 Equivalence of Swaptions and Options on Bonds 484 Pricing Swaptions 484 Forward Swaps 484 Applications of Swaptions and Forward Swaps 486 Summary 488 Key Terms 488 **Further Reading** 489

Concept Checks 489 **Questions and Problems** 489 **CHAPTER 14** Advanced Equity Derivatives and Strategies 493 Portfolio Insurance 494 Equity Forwards 500 Making the Connection Portfolio Insurance in a Crashing Market 502 Equity Warrants 503 Equity-Linked Debt 504 Advanced Interest Rate Derivatives 504 Structured Notes 504 Mortgage-Backed Securities 506 Exotic Options 511 Digital and Chooser Options 512 Path-Dependent Options 515 Other Exotic Options 522 Making the Connection Accumulator Contracts 523 Some Unusual Derivatives 523 Electricity Derivatives 524 Weather Derivatives 524 Summary 525 Key Terms 526 **Further Reading** 526 **Concepts Checks** 527 **Questions and Problems** 527 **Appendix 14: Monte Carlo Simulation** 530 **CHAPTER 15** Why Practice Risk Management? 534 Impetus for Risk Management 534 Benefits of Risk Management 535 Managing Market Risk 536 Delta Hedging 538 Gamma Hedging 539 Vega Hedging 541 Value at Risk (VAR) 543 A Comprehensive Calculation of VAR 549 Benefits and Criticisms of VAR 551 Extensions of VAR 552 Managing Credit Risk 553 Credit Risk as an Option 554 Credit Risk of Derivatives 555 Netting 557 Making the Connection What Derivatives Tell Us About Bonds 558

Making the Connection Unfunded Synthet	
Other Types of Risks	567
Perspectives on Finar	ncial Risk Management 570
Summary 571	
Key Terms 572	
Further Reading 57	72
Concepts Checks 5	73
Questions and Proble	ems 573
CHAPTER 16 Managing Risk in a	an Organization
End Users 577 Dealers 577	Risk Management Industry 576 in the Risk Management Industry 578
_	Management Function in a Company 578
Making the Connection Professional Orga	nizations in Risk Management: GARP and PRMIA 579
Disclosure 588 Avoiding Derivativ Metallgesellschaft: Orange County, Ca Barings PLC: How	584 585 t Hedges 587 the Application of FAS 133 587 es Losses 588 To Hedge or Not to Hedge? 589 alifornia: Playing the Odds 590 One Man Blew Up a Bank 592 Going Up in Suds 593
Responsibilities of Se	
Summary 597	C C
Key Terms 597	
Further Reading 59	97
Concepts Checks 5	98
Questions and Proble	ems 598
Appendix A List of Appendix B Refere	f Important Formulas 6 nces 6 ons to Concept Checks 6

Credit Derivatives 560