

Contents

I	FINANCIAL MARKETS	1
1	Introduction to Financial Markets	3
1.1	Typology of financial markets	4
1.2	Participants	4
1.3	Financial assets	5
1.4	Margins	7
2	Valuation	9
2.1	Basic principles	10
2.2	Stochastic processes	13
2.3	Discrete-time models	19
3	Financial Derivatives	25
3.1	Forwards	26
3.2	Futures	31
3.3	Options	31
3.4	Exotic options	35
II	BASIC MODELS	43
4	Binomial model	45
4.1	CRR – single period model	46
4.2	CRR – multiperiod model	49
4.3	Dividend yield	51
4.4	Exercises	53
5	More advanced models	59
5.1	Trinomial model	60
5.2	Model with variable parameters	62
5.3	Model for more variables	63
5.4	Model with skewness and kurtosis	66

6	Convergence to continuous-time models	69
6.1	European options	70
6.2	American options	72
III	MARKET IMPERFECTIONS	77
7	Typology of market constraints	79
7.1	Typology of replication methods	80
7.2	Review of market imperfections	83
7.3	Models with transaction costs	85
8	Volatility	91
8.1	Volatility specified by its extremes	92
8.2	Volatility as a fuzzy number	96
8.3	Exercises	98
9	Transaction costs	103
9.1	Single period model with symmetric k	104
9.2	Multiperiod extensions	111
9.3	The portfolio effect	115
9.4	Several generalizations	115
9.5	Exercises	115
IV	Appendix	121
	BS model	123
	Fuzzy number	125
	List of Figures	128
	List of Tables	129
	References	131

List of Figures

2.1	Binomial process of asset price evolution	20
2.2	Binomial model for more periods I	22
2.3	Binomial model for more periods II	22
3.1	Payoff of a forward at maturity time	26
3.2	Plain vanilla payoff function	33
3.3	Time value of an option	34
3.4	Typology of barrier options	38
4.1	Multiperiod binomial model	50
4.2	Binomial model with proportional payments	53
4.3	Binomial model with cash payments	54
5.1	Trinomial model for more periods	61
5.2	Two variables modeled separately	64
5.3	Two variables within multinomial model	64
5.4	Two variables within complete multinomial model	66
6.1	Binomial and trinomial model of asset price evolution	69
6.2	Convergence of various specifications of the binomial model of CRR	73
6.3	Call option convergence within the binomial and trinomial models	74
6.4	Call and put option convergence for low volatility, σ_3	75
6.5	American put option convergence for σ_1 (<i>left</i>) and σ_2 (<i>right</i>)	76
7.1	Histograms of replication error with zero mean	81
8.1	Boundary values of $\mathcal{S}$	93
8.2	Boundary values of $\mathcal{S}$ for two-period model	96
8.3	Fuzzy volatility levels and up and down indices	99
8.4	Fuzzy probability levels	100
8.5	Fuzzy option values	101
8.6	Fuzzy-hedged portfolio	102
9.1	Bid/Ask spread for TTC single period model	109
9.2	Bid/Ask spread for BV single period model	111

9.3	Convergence of binomial model of CRR and BV	118
9.4	Convergence of portfolio value within CRR, BV and TTC models . .	119