

1	Introduction	1
	References	8
2	The Time Series Toolbox for Financial Returns	11
2.1	Stylized Facts	11
2.1.1	Stationarity, Ergodicity and Autocorrelation	12
2.1.2	Time-Varying Volatility and Leverage Effects	15
2.1.3	Semi Fat-Tailed Distributions	16
2.2	Symmetric GARCH Models	18
2.2.1	From Linear to Non-linear Models	18
2.2.2	Definitions	21
2.2.3	Stationarity Properties	23
2.2.4	Covariance Structure of the Squares	27
2.2.5	Why We Need More: Kurtosis and Asymmetry in a GARCH(1,1) Model	31
2.3	Asymmetric Extensions	33
2.3.1	GJR Model	35
2.3.2	EGARCH Model	37
2.3.3	APARCH Model	39
2.3.4	Concluding Remarks	41
2.4	Conditional Distribution of Returns	42
2.4.1	Generalized Hyperbolic Distributions	42
2.4.2	Mixture of Two Gaussian Distributions	45
2.4.3	Some Practical Remarks	47
2.5	GARCH in Mean	48
2.6	Dealing with the Estimation Challenge	49
2.6.1	Maximum Likelihood	50
2.6.2	Quasi Maximum Likelihood	51
2.6.3	Recursive Estimation	52
2.6.4	Empirical Finite Sample Properties of the Three Estimation Methodologies	53

2.7	From GARCH Processes to Continuous Diffusions	58
2.7.1	Convergence Toward Hull and White (1987) Diffusions	59
2.7.2	Convergence Toward Diffusions with Deterministic Volatilities	61
2.7.3	Convergence Toward the Heston (1993) Model	61
	References	62
3	From Time Series of Returns to Option Prices:	
	The Stochastic Discount Factor Approach	67
3.1	Description of the Economy Under the Historical Probability	68
3.2	Option Pricing in Discrete Time	70
3.2.1	Arbitrage-Free Price of a European Contingent Claim	70
3.2.2	The Stochastic Discount Factor	73
3.2.3	Economic Interpretation: The CCAPM Model	75
3.3	The Extended Girsanov Principle	80
3.3.1	Definition and Properties	80
3.3.2	Risk-Neutral Dynamics for Classical Distributions	83
3.4	The Conditional Esscher Transform	84
3.4.1	Definition and Properties	84
3.4.2	Risk-Neutral Dynamics for Classical Distributions	89
3.5	Second Order Esscher Transform	95
3.6	The Empirical Martingale Simulation Method	99
3.7	Remarks on Closed-Form Option Pricing Formulas	101
3.8	Proofs of Chapter 3	103
	References	111
4	Empirical Performances of Discrete Time Series Models	115
4.1	Historical Dynamics of Option Prices	116
4.2	The Heston and Nandi Case: Calibration vs. Estimation	129
4.3	Empirical Performances of Heavy Tailed Models	149
4.3.1	Estimation Strategies	149
4.3.2	Pricing Performances	162
4.4	Conclusion	172
	References	173
	Mathematical Appendix	175
	Gaussian Random Variables	175
	Conditional Expectation	176
	Monte Carlo Methods	180
	Convergence of Discrete Time Markov Processes to Diffusions	183
	From Moment Generating Functions to Option Prices	184
	References	185
	Index	187