

---

## Bibliography

- [1] C. Alexander, Principal component analysis of implied volatility and skews, ISMA Centre Discussion Paper in Finance 2000–10
- [2] C. Alexander, *Market Models: a Guide to Financial Data Analysis*, Wiley, 2001
- [3] L. Anderson, A simple approach to the pricing of Bermudan swaptions in the multi-factor LIBOR market model, *J. Computational Finance* **3**(2), 5–32, Winter 1999/2000
- [4] L. Andersen, J. Andreasen, Volatility skews and extensions of the LIBOR market model, *Mathematical Finance* **7**, 1–32, 2000
- [5] L. Andersen, J. Andreasen, Jumping smiles, *Risk* **12**, (November), 65–68, 1999
- [6] L. Andersen, J. Andreasen, Jump diffusion processes: volatility smile fitting and numerical methods for pricing, Gen Re working paper, 1999
- [7] L. Andersen, J. Andreasen, Factor dependence of Bermudan swaptions: fact or fiction, Gen Re working paper, October 2000
- [8] L. Andersen, M. Broadie, A primal-dual simulation algorithm for pricing multi-dimensional American options, preprint 2001
- [9] G. Baker, G.D. Smith, *The New Financial Capitalists*, Cambridge University Press, 1998
- [10] G. Bakshi, C. Cao, Z. Chen, Empirical performance of alternative option pricing models, *J. Finance* **52**(5), 2003–2049, 1997
- [11] G. Bakshi, C. Cao, Z. Chen, Do call prices and the underlying stock always move in the same direction, *Review of Financial Studies* **13**(3), 549–584, 2000
- [12] M. Baxter, A. Rennie, *Financial Calculus*, Cambridge University Press, 1999
- [13] N. Bellamy, M. Jeanblanc, Incompleteness of markets driven by a mixed diffusion, *Finance and Stochastics* **4**(2), February 2000.
- [14] E. Benhamou, A. Duguet, Volatility and model risk for discrete Asian options, preprint 2001
- [15] Y.Z. Bergman, Pricing path contingent claims, *Research in finance* **5**, 229–241, 1985.
- [16] P.L. Bernstein, *Against the Gods: the Remarkable Story of Risk*, Wiley, 1998
- [17] T. Björk, *Arbitrage Theory in Continuous Time*, Oxford University Press, 1998
- [18] F. Black, The pricing of commodity contracts, *J. Financial Economics* **3**, 167–179, 1976
- [19] F. Black, M. Scholes, The pricing of options and corporate liabilities, *J. Political Economy* **81**, 637–654, 1973

- [20] A. Brace, D. Gatarek, M. Musiela, The market model of interest-rate dynamics, *Mathematical Finance* **7**, 127–155, 1997
- [21] D. Breeden, R. Litzenberger, Prices of state-contingent claims implicit in option prices, *J. Business* **51**, 621–651, 1978
- [22] D. Brigo, F. Mercurio, *Interest Rate Models – Theory and Practice*, Springer Verlag, 2001
- [23] M. Britten-Jones, A. Neuberger, Option Prices, Implied Price Processes and Stochastic Volatility, *J. Finance* **55**(2), 839–866, April 2000.
- [24] M. Broadie, P. Glasserman, Estimating security derivative prices by simulation, *Management Science* **42**, 269–285, 1996.
- [25] M. Broadie, P. Glasserman, Pricing American-style securities using simulation, *J. Economic Dynamics and Control* **21**(8/9), 1323–1352, 1997
- [26] M. Broadie, P. Glasserman, A stochastic mesh method for pricing high-dimensional American securities, working paper, Columbia University, 1997
- [27] O. Brockhaus, M. Farkas, A. Ferraris, D. Long, M. Overhaus, *Equity Derivatives and Market Risk Models*, Risk Books, 2000
- [28] H. Brown, D. Hobson, L.C.G. Rogers, Robust hedging of barrier options, *Mathematical Finance* **11**, 285–314, 2001
- [29] J.Y. Campbell, A.W. Lo, A.C. MacKinlay, *The Econometrics of Financial Markets*, Princeton University Press, 1997
- [30] P. Carr, K. Ellis, V. Gupta, Static hedging of exotic options, *J. Finance* **53**, 1165–1191, 1998
- [31] T. Chan, Pricing contingent claims on stocks driven by Levy processes, *Annals of Applied Probability* **9**(2), 504–528, 1999.
- [32] W. Cheney, D. Kincaid, *Numerical Analysis: Mathematics of Scientific Computing*, Brooks/Cole, 2001
- [33] L. Cleelow, C. Strickland, *Implementing Derivatives Models*, Wiley, 1998
- [34] L. Cleelow, C. Strickland, *Exotic Options: the State of the Art*, Thompson International Press, 1997
- [35] J.H. Cochrane, *Asset Pricing*, Princeton University Press, 2001
- [36] J.C. Cox, S. Ross, M. Rubinstein, Option Pricing: a simplified approach, *J. Financial Economics* **7**, 229–263, 1979
- [37] M. Curran, Beyond average intelligence, *Risk* **5**, 60, 1992
- [38] M. Curran, Valuing Asian and portfolio options by conditioning on the geometric mean price, *Management Science* **40**, 1705–1711, 1994
- [39] F. Delbaen, W. Schachermayer, A general version of the fundamental theorem of asset pricing, *Mathematische Annalen* **300**, 463–520, 1997
- [40] E. Derman, Regimes of volatility: some observations on the variation of S&P implied volatilities, Goldman Sach Quantitative Strategy Research Note, January 1999
- [41] E. Derman, I. Kani, Riding on a smile, *Risk* **7**, 32–39, 1994
- [42] D. Duffie, *Dynamic Asset Pricing Theory*, third edition, Princeton University Press, 2002
- [43] D. Duffie, J. Pan, K. Singleton, Transform analysis and asset pricing for affine jump-diffusions, *Econometrica* **68**, 1343–1376, 2000
- [44] B. Dupire, Pricing with a smile, *Risk* **7**, 18–20, 1994

- [45] B. Dupire, *Monte Carlo: Methodologies and Applications for Pricing and Risk Management*, Risk Books, 1998
- [46] E. Fournie, J.-M. Lasry, J. Lebuchoux, P.-L. Lions, N. Touzi, Application of Malliavin calculus to Monte Carlo methods in finance, *Finance and Stochastics* **3**, 391–412, 1999
- [47] J.-P. Fouque, G. Papanicolaou, K.R. Sircar, *Derivatives in Financial Markets with Financial Volatility*, Cambridge University Press, 2000
- [48] M.C. Fu, S.B. Laprise, D.B. Madan, Y. Su, R. Wu, Pricing American options: a comparison of Monte Carlo simulation approaches, *J. Computational Finance* **4**(3), 39–88, 2001
- [49] J.K. Galbraith, *The Great Crash*, Houghton Mifflin, 1997
- [50] P. Glasserman, S.G. Kou, The term structure of simple forward rates with jump risk, working paper, Columbia University, 1999
- [51] P. Glasserman, N. Merener, Cap and swaption approximations in LIBOR market models with jumps, preprint, Columbia University, 2001
- [52] P. Glasserman, X. Zhao, Arbitrage-Free Discretization of Lognormal Interest Rate Models, *Finance and Stochastics* **4**, 35–69, 2000.
- [53] G. Grimmett, D. Stirzaker, *Probability and Random Processes*, Second edition, Oxford University Press, 1992
- [54] H. Geman, M. Yor, Bessel processes, Asian options and perpetuities, *Mathematical finance* **3**, 349–375, 1993
- [55] E. Haug, *The Complete Guide to Option Pricing Formulas*, Irwin, 1997
- [56] M.B. Haugh, L. Kogan, Pricing American Options: A Duality Approach, forthcoming in *Operations Research*
- [57] J.M. Harrison, D.M. Kreps, Martingales and arbitrage in multi-period securities markets, *J. Economic Theory* **20**, 381–408, 1979
- [58] J.M. Harrison, S.R. Pliska, Martingales and stochastic integration in the theory of continuous trading. *Stochastic processes and applications* **11**, 215–260, 1981
- [59] J.M. Harrison, S.R. Pliska, Martingales and stochastic integration in the theory of continuous trading. *Stochastic processes and applications* **13**, 313–316, 1983
- [60] D. Heath, R. Jarrow, A. Morton, Bond pricing and the term structure of interest rates: a new methodology for contingent claims valuation, *Econometrica* **60**, 77–105, 1992
- [61] S. Heston, A closed-form solution for options with stochastic volatility with applications to bond and currency options, *Review of Financial Studies* **6**(2), 327–343, 1993
- [62] S. Hodges, A. Neuberger, Rational bounds for exotic options, preprint, 19XX
- [63] J. Hoogland, D. Neumann, Local scale invariance and contingent claim pricing, *International J. Theoretical and Applied Finance* **4**(1), 1–21, 2001
- [64] J. Hull, A. White, The pricing of options on assets with stochastic volatilities, *J. Finance* **42**(2), 281–300, 1987
- [65] C. Hunter, P. Jäckel, M. Joshi, Getting the drift, *Risk*, July 2001
- [66] I.E. Ingersoll, *Theory of Financial Decision Making*, Rowman and Littlefield, 1987
- [67] F. Jamishidian, LIBOR and swap market models and measures, *Finance and Stochastics* **1**, 293–330, 1997

- [68] P. Jäckel, *Monte Carlo methods in Finance*, Wiley, 2002
- [69] P. Jäckel, Using a non-recombining tree to design a new pricing method for Bermudan swaptions, QUARC Royal Bank of Scotland working paper, 2000
- [70] P. Jäckel, R. Rebonato, Valuing American options in the presence of user-defined smiles and time-dependent volatility: scenario analysis, model stress and lower-bond pricing applications, *J. Risk* **4**(1), 35–61, 2001
- [71] P. Jäckel, R. Rebonato, Accurate and optimal calibration to co-terminal swaptions European swaptions in a FRA-based BGM framework, QUARC, Royal Bank of Scotland working paper, 2000
- [72] T.C. Johnson, Volatility, momentum and time-varying skewness in foreign exchange returns, preprint, 2001
- [73] C.S. Jones, The dynamics of stochastic volatility, preprint, 2000
- [74] M. Joshi, Pricing path-dependent exotic options using replication methods, QUARC, Royal Bank of Scotland working paper, 2001
- [75] M. Joshi, Log-type models, homogeneity of options prices and convexity, QUARC, Royal Bank of Scotland working paper, 2001
- [76] M. Joshi, R. Rebonato, A stochastic-volatility displaced-diffusion extension of the LIBOR market model, QUARC, Royal Bank of Scotland working paper, 2001
- [77] M. Joshi, J. Theis, Bounding Bermudan swaptions in a swap-rate market model, *Quantitative Finance* **2**, 370–377, 2002
- [78] I. Karatzas, E. Shreve, *Brownian Motion and Stochastic Calculus*, Second edition, Springer Verlag, 1997
- [79] I. Karatzas, E. Shreve, *Methods of Mathematical Finance*, Springer Verlag, 1998
- [80] S.G. Kou, A jump-diffusion model for option pricing with three properties: leptokurtic feature, volatility smile and analytical tractability, Contributed Paper to the Econometric Society World Congress 2000.
- [81] D. Lamberton, B. Lapeyre, *Introduction to Stochastic Calculus Applied to Finance*, CRC Press, 1996
- [82] H.E. Leland, Option pricing and replication with transaction costs, *J. Finance* **40**, 1283–1301, 1985
- [83] A.L. Lewis, *Option Valuation under Stochastic Volatility*, Finance Press, 2000
- [84] A.L. Lewis, A simple option formula for general jump-diffusion and other exponential Levy processes, preprint [www.optioncity.net](http://www.optioncity.net), 2001
- [85] Y. Li, A new algorithm for constructing implied binomial trees: does the implied model fit any volatility smile?, *J. Computational Finance* **4**(2), 69–95, 2000
- [86] F. Longstaff, E. Santa-Clara, E. Schwartz, Throwing away a billion dollars: the cost of suboptimal exercise in the swaptions market, UCLA working paper, 2000
- [87] R. Lowenstein, *Buffett: the Making of an American Capitalist*, Orion, 1995
- [88] D. Madan, E. Seneta, The Variance Gamma model for share market returns, *J. Business* **63**, 511–524, 1990.
- [89] D. Madan, F. Milne, Option pricing with V.G. martingale components, *Mathematical Finance* **1**(4), 39–55, 1991
- [90] D. Madan, P. Carr, E.C. Chang, The Variance Gamma process and option pricing, *European Finance Review* **2** (1), 1998
- [91] W. Margrabe, The value of an option to exchange one asset for another, *J. Finance* **7**, 77–91, 1978

- [92] D. Marris, *Financial Option Pricing and Skewed Volatility*, M. Phil Thesis, Statistical Laboratory, University of Cambridge, 1999
- [93] B. Moro, The full monte, *Risk* **8**(2), 53–57, 1995
- [94] R. Merton, *Continuous-Time Finance*, Blackwell, 1998
- [95] R. Merton, Option pricing when underlying stock returns are discontinuous, *J. Financial Economics* **3**, 125–144, 1976
- [96] M. Musiela, M. Rutowski, *Martingale Methods in Financial Modelling*, Springer Verlag, 1997.
- [97] M. Musiela, M. Rotowski, Continuous-time term structure models: forward measure approach, *Finance and Stochastics* **1**, 261–291, 1997
- [98] L.A. McCarthy, N.J. Webber, Pricing in three-factor models using icosahedral lattices, *Journal of Computational Finance* **5**(2), 1–37, 2001/2002
- [99] S.N. Neftci, *An Introduction to the Mathematics of Financial Derivatives*, Academic Press, 1996
- [100] S. Nielsen, J. Overgaard Olesen, Regime-switching stock returns and mean reversion, Copenhagen Business School working paper 11–2000
- [101] B. Oksendal, *Stochastic Differential Equations*, Springer Verlag, 1998.
- [102] F. Partnoy, *F.I.A.S.C.O.*, Profile Books, 1998
- [103] A. Pelsser, *Efficient Methods for Valuing Interest Rate Derivatives*, Springer Verlag, 2001
- [104] H. Pham, Optimal stopping, free boundary and American option in a jump diffusion model, *Appl. Math. Optim.* **35**, 145–164, 1997.
- [105] W.H. Press, S.A. Teutolsky, W.T. Vetterling, B.P. Flannery, *Numerical Recipes in C++*, Cambridge University Press, 2002
- [106] R. Rebonato, *Interest Rate Option Models*, Wiley, 1998
- [107] R. Rebonato, *Volatility and Correlation in the Pricing of Equity, FX and Interest-Rate Options*, Wiley, 1999
- [108] R. Rebonato, *The Modern Approach to Interest Rate Derivative Pricing*, Princeton University Press, 2002
- [109] R. Rebonato, On the Pricing Implications of the Joint Lognormal Assumption for the Swaption and Cap Market, *J. Computational Finance* **3**, 57–76, 1999
- [110] E. Reiner, Understanding skew and smile behaviour in the context of jump processes and applying these results to the pricing and hedging of exotic options, Global Derivatives Conference 1998.
- [111] L.C.G. Rogers: Monte Carlo valuation of American options, preprint, University of Bath, 2001.
- [112] L.C.G. Rogers, Z. Shi, The value of an Asian option, *The J. Applied Probability* **32**(4), 1077–1088, 1995
- [113] W. Rudin, *Principles of Mathematical Analysis*, McGraw Hill, 1976
- [114] P.J. Schönbucher, A market model for stochastic implied volatility, *Phil. Trans. Roy. Soc.* **A357**(1758), 2071–2092, 1999
- [115] H.M. Soner, S.E. Shreve, J. Cvitanic, There is no non-trivial hedging portfolio for option pricing with transaction costs. *Annals of Applied Probability* **5**, 327–355, 1995
- [116] J.A. Tilley, Valuing American options in a path simulation model, *Trans. Soc. Actuaries* **45**, 83–104, 1993

- [117] S.M. Turnbull, L.N. Wakeman, A quick algorithm for pricing European average options, *J. Financial and Quantitative Analysis* **26**, 377–389, 1991
- [118] J. Walmsley, *New Financial Instruments*, Wiley, 1998
- [119] P. Wilmott, *Derivatives: the Theory and Practice of Financial Engineering*, Wiley, 1999
- [120] P. Wilmott, S. Howison, J. Dewynne, *The Mathematics of Financial Derivatives*, Cambridge University Press, 1995
- [121] C. Zhou, Path-dependent option valuation when the underlying path is discontinuous, working paper, Federal Reserve Board, 1997
- [122] C. Zuhlsdorff, Extended Libor market models with affine and quadratic volatility, Department of Statistics, University of Bonn, 2000
- [123] P.L. Zweig, *Walter Wriston, Citibank, and the Rise and Fall of American Financial Supremacy*, Crown, 1995

---

# Index

- $N$ , 69
- $N(0, 1)$ , 62
- $N(\mu, \sigma^2)$ , 100
- $\sigma$ -field, 473
  
- accreting notional, 442
- admissible exercise strategy, *see* exercise strategy, admissible
- almost, 257
- almost surely, 102
- American, 11
- American option, *see* option, American
- amortising notional, 442
- annualized rates, 303
- annuity, 310
- anti-thetic sampling, 190
- arbitrage, 21–22, 29–32, 442
  - and bounding option prices, 32–43
- arbitrage-free price, 48, 49
- arbitrageur, 13–14, 19
- at-the-forward, 33
- at-the-money, 33, 69
- auto cap, 442
  
- bank, 13
- barrier option, *see* option, barrier
- basis point, 442
- basket option, 262
- Bermudan option, *see* option, Bermudan
- Bermudan swaption, *see* swaption, Bermudan
- BGM, 442
  - implementation of, 464–468
- BGM model, 324–359
  - automatic calibration to co-terminal swaptions, 346
  - long steps, 341
  - running a simulation, 341–346
- BGM/J, 442
- BGM/J model, *see* BGM model
- bid-offer spread, 23
- Black formula, 312–313
  - approximate linearity, 361
  - approximation for swaption pricing under BGM model, 346
- Black–Scholes formula, *see* option, call, Black–Scholes formula for
- Black–Scholes density, 185
- Black–Scholes equation, 74, 161
  - for options on dividend-paying assets, 123
  - higher-dimensional, 271–272
  - informal derivation of, 115–116
  - rigorous derivation, 116–119
  - solution of, 119–122
  - with time-dependent parameters, 165
- Black–Scholes model, 79, 114, 443
- Black–Scholes price, 20
- Black-Scholes formula, 69
- Black-Scholes model, 81
- bond, 5–6, 443
  - callable, 302
  - convertible, 8, 443
  - corporate, 8
  - government, 1
  - premium, 2
  - riskless, 5, 8
  - zero-coupon, 5, 26–28, 30, 304, 446
- Brownian bridge, 230
- Brownian motion, 99–102, 107, 143, 261, 443
  - correlated, 264
  - higher-dimensional, 262–264
- Buffett, Warren, 3
- bushy tree, *see* non-recombining tree
  
- calibration
  - to vanilla options using jump-diffusion, 384
- call, 302
- call option, *see* option, call
- callable bond, *see* bond, callable
- cap, 311, 443
- caplet, 311–313, 443
  - strike of, 311
- caption, 329, 443
- cash bond, 28, 443
- Central Limit theorem, 61, 66, 68, 279, 479
- central method, 238