

More mathematical finance

Mark S. Joshi

Contents

| | |
|--|----|
| Chapter 1. Asymmetry in option pricing | 3 |
| 1.1. Introduction | 3 |
| 1.2. American optionality | 3 |
| 1.3. Incomplete markets | 7 |
| 1.4. Transaction costs | 9 |
| 1.5. Key points | 10 |
| 1.6. Further reading | 10 |
| Chapter 2. A perfect model? | 13 |
| 2.1. Introduction | 13 |
| 2.2. The vanilla options trader | 14 |
| 2.3. Dynamic hedging with a perfect model | 15 |
| 2.4. The portfolio | 16 |
| 2.5. The exotics trader | 17 |
| 2.6. Key points | 17 |
| 2.7. Further reading | 18 |
| Chapter 3. The fundamental theorem of asset pricing. | 19 |
| 3.1. Introduction | 19 |
| 3.2. The easy direction | 20 |
| 3.3. The hard direction in the discrete case | 21 |
| 3.4. Attaining the minimal price | 24 |
| 3.5. Key points | 26 |
| 3.6. Further reading | 26 |
| 3.7. Exercises | 26 |
| Chapter 4. Early exercise and Monte Carlo | 27 |
| 4.1. Introduction | 27 |
| 4.2. A sketch of the Longstaff–Schwartz method | 28 |
| 4.3. The details of the Longstaff–Schwartz algorithm | 28 |
| 4.4. Carrying out the regression | 30 |
| 4.5. Breaking a contract | 31 |
| 4.6. Upper bounds and the seller’s price | 33 |
| 4.7. Never exercise sub-optimally | 35 |
| 4.8. Recharacterising the optimal hedge | 36 |

| | |
|--|----|
| 4.9. Numerical results | 37 |
| 4.10. Key points | 37 |
| 4.11. Further reading | 38 |
| Chapter 5. Volatility derivatives and model-free dynamic replication | 39 |
| 5.1. Introduction | 39 |
| 5.2. Variance swaps | 40 |
| 5.3. Pricing general volatility derivatives | 42 |
| 5.4. Hedging a volatility derivative | 44 |
| 5.5. Key points | 45 |
| Chapter 6. Deriving the delta | 47 |
| 6.1. Introduction | 47 |
| 6.2. The stock measure | 47 |
| 6.3. Homogeneity | 48 |
| 6.4. Other cases | 49 |
| 6.5. Key points | 50 |
| Chapter 7. Optionality, convexity and volatility | 51 |
| 7.1. Introduction | 51 |
| 7.2. Volatility and convexity | 51 |
| 7.3. Convexity and optionality | 53 |
| 7.4. Is convexity necessary? | 56 |
| 7.5. Key points | 57 |
| 7.6. Exercises | 57 |
| Chapter 8. The Brownian bridge | 59 |
| 8.1. Introduction | 59 |
| 8.2. Reducing to the driftless case | 59 |
| 8.3. The law of the minimum for a Brownian bridge | 60 |
| 8.4. The distribution at intervening times | 62 |
| 8.5. Using the Brownian bridge for path generation | 64 |
| 8.6. The geometric bridge | 65 |
| 8.7. Key points | 66 |
| 8.8. Further reading | 67 |
| Chapter 9. Pricing barrier options in a jump-diffusion model | 69 |
| 9.1. Introduction | 69 |
| 9.2. The Merton jump-diffusion model | 71 |
| 9.3. Importance sampling | 72 |
| 9.4. The price conditional on no jumps occurring | 73 |
| 9.5. The algorithm | 74 |
| 9.6. Numerical results | 76 |

| | |
|---|-----|
| 9.7. Key points | 80 |
| 9.8. Further reading | 80 |
| Chapter 10. Drifts again | 81 |
| 10.1. Introduction | 81 |
| 10.2. Rapid computation of drifts | 81 |
| 10.3. Evolving the bond | 83 |
| 10.4. Predictor corrector | 85 |
| 10.5. Stopping predictor corrector | 86 |
| 10.6. Pietersz-Pelsser-Regenmortel | 88 |
| 10.7. Numerical comparisons of drift methods | 90 |
| 10.8. Key points | 90 |
| 10.9. Further reading | 91 |
| Chapter 11. Swap-rate market models | 93 |
| 11.1. Introduction | 93 |
| 11.2. Deducing the bond-ratios | 94 |
| 11.3. Cross-variation | 94 |
| 11.4. Swap-rate drift computations | 96 |
| 11.5. Constant maturity market models | 98 |
| 11.6. Co-initial swap-rates | 100 |
| 11.7. Incremental market models | 101 |
| 11.8. Calibrating the co-terminal swap-rate market model | 104 |
| 11.9. LIBOR versus swap-rate market models | 106 |
| 11.10. Displaced diffusion | 107 |
| 11.11. Key points | 108 |
| 11.12. Further reading | 108 |
| Chapter 12. Credit derivatives | 109 |
| 12.1. Introduction | 109 |
| 12.2. The basic instruments | 110 |
| 12.3. The philosophy of pricing credit derivatives | 116 |
| 12.4. Hazard rates | 116 |
| 12.5. Pricing simple credit instruments | 118 |
| 12.6. Key points | 119 |
| 12.7. Further reading | 119 |
| Chapter 13. The Monte Carlo pricing of portfolio credit derivatives | 121 |
| 13.1. Introduction | 121 |
| 13.2. The Li model | 122 |
| 13.3. Importance sampling for basket default swaps | 124 |
| 13.4. Tranched CDOs by Monte Carlo | 126 |

| | | |
|-------------|---|-----|
| 13.5. | The default density in the Li Model | 129 |
| 13.6. | The likelihood ratio method for basket credit derivatives | 131 |
| 13.7. | The pathwise method for n th-to-default swaps | 132 |
| 13.8. | Key points | 134 |
| 13.9. | Further reading | 135 |
| Chapter 14. | Quasi-analytic methods for pricing portfolio credit derivatives | 137 |
| 14.1. | Introduction | 137 |
| 14.2. | The loss distribution for independent defaults | 138 |
| 14.3. | Computing the loss distribution in a single-factor model | 139 |
| 14.4. | Turning loss distributions into prices | 140 |
| 14.5. | Stochastic recovery rates | 141 |
| 14.6. | Bucketing | 142 |
| 14.7. | Key points | 143 |
| 14.8. | Further reading | 144 |
| Chapter 15. | Implied correlation for portfolio credit derivatives | 145 |
| 15.1. | Introduction | 145 |
| 15.2. | Implied correlations | 146 |
| 15.3. | Base correlation | 150 |
| 15.4. | Mapping methodologies | 152 |
| 15.5. | Hedging and the computation of Greeks | 154 |
| 15.6. | Key points | 156 |
| 15.7. | Further reading | 156 |
| Chapter 16. | Alternate models for portfolio credit derivatives | 157 |
| Chapter 17. | Mixture models | 159 |
| 17.1. | Introduction | 159 |
| 17.2. | Uncertain parameter models | 160 |
| 17.3. | As a smoothing methodology | 163 |
| 17.4. | The advantages and disadvantages | 163 |
| 17.5. | Key points | 164 |
| 17.6. | Further reading | 165 |
| | Bibliography | 167 |
| | Index | 175 |