

WILEY FINANCE

FRONTIERS IN QUANTITATIVE FINANCE

Volatility and Credit Risk Modeling

RAMA CONT, Editor

Contents

Preface	ix
About the Editor	xiii
About the Contributors	xv

PART ONE

Option Pricing and Volatility Modeling

CHAPTER 1

A Moment Approach to Static Arbitrage **3**

Alexandre d'Aspremont

1.1 Introduction	3
1.2 No-Arbitrage Conditions	7
1.3 Example	15
1.4 Conclusion	16

CHAPTER 2

On Black-Scholes Implied Volatility at Extreme Strikes **19**

Shalom Benaim, Peter Friz, and Roger Lee

2.1 Introduction	19
2.2 The Moment Formula	20
2.3 Regular Variation and the Tail-Wing Formula	24
2.4 Related Results	27
2.5 Applications	33
2.6 CEV and SABR	35

CHAPTER 3

Dynamic Properties of Smile Models **47**

Lorenzo Bergomi

3.1 Introduction	48
3.2 Some Standard Smile Models	50

3.3	A New Class of Models for Smile Dynamics	65
3.4	Pricing Examples	81
3.5	Conclusion	87

CHAPTER 4

A Geometric Approach to the Asymptotics of Implied Volatility **89**

Pierre Henry-Labordère

4.1	Volatility Asymptotics in Stochastic Volatility Models	91
4.2	Heat Kernel Expansion	92
4.3	Geometry of Complex Curves and Asymptotic Volatility	100
4.4	λ -SABR Model and Hyperbolic Geometry	106
4.5	SABR Model with $\beta = 0, 1$	117
4.6	Conclusions and Future Work	122
4.7	Appendix A: Notions in Differential Geometry	122
4.8	Appendix B: Laplace Integrals in Many Dimensions	125

CHAPTER 5

Pricing, Hedging, and Calibration in Jump-Diffusion Models **129**

Peter Tankov and Ekaterina Voltchkova

5.1	Overview of Jump-Diffusion Models	131
5.2	Pricing European Options via Fourier Transform	137
5.3	Integro-differential Equations for Barrier and American Options	140
5.4	Hedging Jump Risk	147
5.5	Model Calibration	153

PART TWO

Credit Risk

CHAPTER 6

Modeling Credit Risk **163**

L. C. G. Rogers

6.1	What Is the Problem?	163
6.2	Hazard Rate Models	166
6.3	Structural Models	175
6.4	Some Nice Ideas	179
6.5	Conclusion	181

CHAPTER 7**An Overview of Factor Modeling for CDO Pricing 185***Jean-Paul Laurent and Areski Cousin*

- 7.1 Pricing of Portfolio Credit Derivatives 185
- 7.2 Factor Models for the Pricing of CDO Tranches 189
- 7.3 A Review of Factor Approaches to the Pricing of CDOs 198
- 7.4 Conclusion 212

CHAPTER 8**Factor Distributions Implied by Quoted CDO Spreads 217***Erik Schlögl and Lutz Schlögl*

- 8.1 Introduction 217
- 8.2 Modeling 220
- 8.3 Examples 224
- 8.4 Conclusion 231
- 8.5 Appendix: Some Useful Results on Hermite Polynomials under Linear Coordinate Transforms 232

CHAPTER 9**Pricing CDOs with a Smile: The Local Correlation Model 235***Julien Turc and Philippe Very*

- 9.1 The Local Correlation Model 236
- 9.2 Simplification under the Large Pool Assumption 240
- 9.3 Building the Local Correlation Function without the Large Pool Assumption 243
- 9.4 Pricing and Hedging with Local Correlation 247

CHAPTER 10**Portfolio Credit Risk: Top-Down versus Bottom-Up Approaches 251***Kay Giesecke*

- 10.1 Introduction 251
- 10.2 Portfolio Credit Models 251
- 10.3 Information and Specification 253
- 10.4 Default Distribution 259
- 10.5 Calibration 264
- 10.6 Conclusion 265

CHAPTER 11**Forward Equations for Portfolio Credit Derivatives 289***Rama Cont and Ioana Savescu*

- 11.1 Portfolio Credit Derivatives 270
- 11.2 Top-Down Models for CDO Pricing 273

11.3	Effective Default Intensity	275
11.4	A Forward Equation for CDO Pricing	278
11.5	Recovering Forward Default Intensities from Tranche Spreads	282
11.6	Conclusion	288