

# Contents

	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
	12
	13
	14
	15
<b>Preface</b>	<b>xi</b>
	16
	17
<b>Acknowledgements</b>	<b>xiii</b>
	18
	19
<b>PART I: INTRODUCTION</b>	<b>20</b>
	21
<b>1 An Introduction to Credit Risk</b>	<b>3</b>
	22
1.1 Credit Risk	3
1.1.1 Historical and Risk-Neutral Probabilities	4
1.1.2 Bond Prices and Default Probability	6
1.2 Credit Risk Modelling	8
1.3 Credit Derivatives	11
1.4 Modelling Assumptions	13
1.4.1 Probability Space and Filtrations	13
1.4.2 The Risk-Free Asset	15
	30
	31
	32
<b>2 An Introduction to Lévy Processes</b>	<b>17</b>
	33
2.1 Brownian Motion	17
2.2 Lévy Processes	20
2.3 Examples of Lévy Processes	23
2.3.1 Poisson Process	23
2.3.2 Compound Poisson Process	25
2.3.3 The Gamma Process	27
2.3.4 Inverse Gaussian Process	29
2.3.5 The CMY Process	31
2.3.6 The Variance Gamma Process	32
2.4 Ornstein–Uhlenbeck Processes	37
2.4.1 The Gamma-OU Process	39
2.4.2 The Inverse Gaussian-OU Process	40
	45

PART II: SINGLE-NAME MODELLING		1
<b>3 Single-Name Credit Derivatives</b>	<b>45</b>	2
3.1 Credit Default Swaps	45	3
3.1.1 Credit Default Swaps Pricing	47	4
3.1.2 Calibration Assumptions	49	5
3.2 Credit Default Swap Forwards	50	6
3.2.1 Credit Default Swap Forward Pricing	50	7
3.3 Constant Maturity Credit Default Swaps	51	8
3.3.1 Constant Maturity Credit Default Swaps Pricing	52	9
3.4 Options on CDS	54	10
		11
		12
<b>4 Firm-Value Lévy Models</b>	<b>57</b>	13
4.1 The Merton Model	57	14
4.2 The Black–Cox Model with Constant Barrier	60	15
4.3 The Lévy First-Passage Model	62	16
4.4 The Variance Gamma Model	63	17
4.4.1 Sensitivity to the Parameters	66	18
4.4.2 Calibration on CDS Term Structure Curve	69	19
4.5 One-Sided Lévy Default Model	71	20
4.5.1 Wiener–Hopf Factorization and Default Probabilities	71	21
4.5.2 Illustration of the Pricing of Credit Default Swaps	75	22
4.6 Dynamic Spread Generator	77	23
4.6.1 Generating Spread Paths	77	24
4.6.2 Pricing of Options on CDSs	80	25
4.6.3 Black’s Formulas and Implied Volatility	81	26
Appendix: Solution of the PDIE	83	27
		28
		29
<b>5 Intensity Lévy Models</b>	<b>87</b>	30
5.1 Intensity Models for Credit Risk	87	31
5.1.1 Jarrow–Turnbull Model	87	32
5.1.2 Cox Models	91	33
5.2 The Intensity-OU Model	92	34
5.3 Calibration of the Model on CDS Term Structures	94	35
		36
PART III: MULTIVARIATE MODELLING		37
<b>6 Multivariate Credit Products</b>	<b>101</b>	38
6.1 CDOs	101	39
6.2 Credit Indices	105	40
		41
<b>7 Collateralized Debt Obligations</b>	<b>109</b>	42
7.1 Introduction	109	43
7.2 The Gaussian One-Factor Model	110	44
		45

Contents	ix
7.3 Generic One-Factor Lévy Model	111 1
7.4 Examples of Lévy Models	115 2
7.5 Lévy Base Correlation	117 3
7.5.1 The Concept of Base Correlation	117 4
7.5.2 Pricing Non-Standard Tranches	119 5
7.5.3 Correlation Mapping for Bespoke CDOs	121 6
7.6 Delta-Hedging CDO tranches	122 7
7.6.1 Hedging with the CDS Index	122 8
7.6.2 Delta-Hedging with a Single-Name CDS	122 9
7.6.3 Mezz-Equity hedging	124 10
	11
<b>8 Multivariate Index Modelling</b>	<b>125</b> 12
	13
8.1 Black's Model	125 14
8.2 VG Credit Spread Model	127 15
8.3 Pricing Swaptions using FFT	128 16
8.4 Multivariate VG Model	130 17
	18
PART IV: EXOTIC STRUCTURED CREDIT RISK PRODUCTS	19
<b>9 Credit CPPIs and CPDOs</b>	<b>137</b> 20
9.1 Introduction	137 21
9.2 CPPIs	137 22
9.3 Gap Risk	143 23
9.4 CPDOs	145 24
	25
<b>10 Asset-Backed Securities</b>	<b>149</b> 26
10.1 Introduction	149 27
10.2 Default Models	150 28
10.2.1 Generalized Logistic Default Model	150 29
10.2.2 Lévy Portfolio Default Model	152 30
10.2.3 Normal One-Factor Default Model	153 31
10.2.4 Generic One-Factor Lévy Default Model	155 32
10.3 Prepayment Models	156 33
10.3.1 Constant Prepayment Model	157 34
10.3.2 Lévy Portfolio Prepayment Model	157 35
10.3.3 Normal One-Factor Prepayment Model	158 36
10.4 Numerical Results	158 37
	160 38
<b>Bibliography</b>	<b>167</b> 39
	40
<b>Index</b>	<b>173</b> 41
	42
	43
	44
	45

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45

UNCORRECTED PROOFS