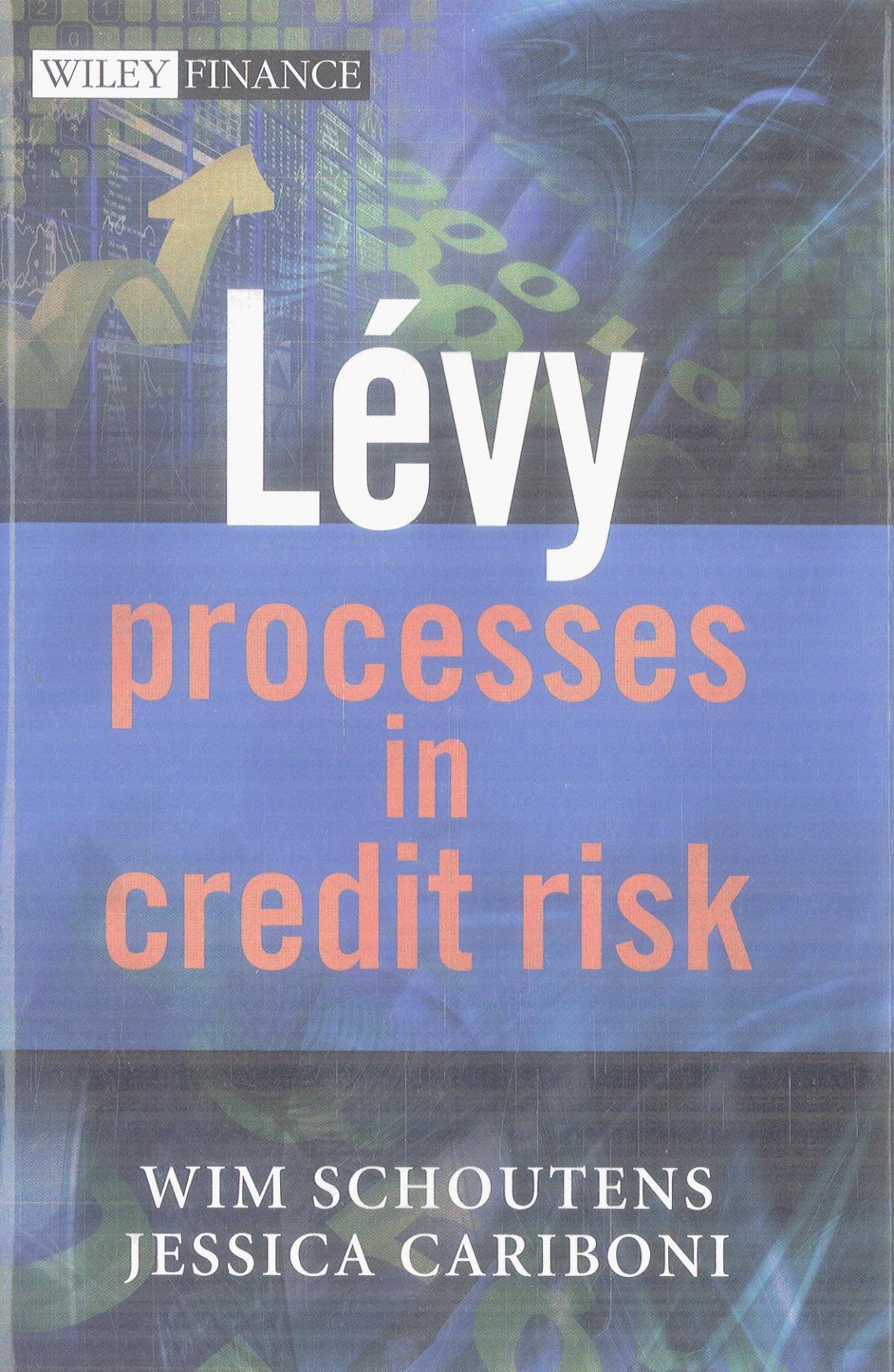


WILEY FINANCE



Lévy processes in credit risk

WIM SCHOUTENS
JESSICA CARIBONI

Contents

Preface	xii
Acknowledgements	xiii
PART I: INTRODUCTION	
1 An Introduction to Credit Risk	3
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
2 An Introduction to Lévy Processes	17
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

PART II: SINGLE-NAME MODELLING

3 Single-Name Credit Derivatives	45
3.1 Credit Default Swaps	45
3.1.1 Credit Default Swaps Pricing	47
3.1.2 Calibration Assumptions	49
3.2 Credit Default Swap Forwards	50
3.2.1 Credit Default Swap Forward Pricing	50
3.3 Constant Maturity Credit Default Swaps	51
3.3.1 Constant Maturity Credit Default Swaps Pricing	52
3.4 Options on CDS	54
4 Firm-Value Lévy Models	57
4.1 The Merton Model	57
4.2 The Black–Cox Model with Constant Barrier	60
4.3 The Lévy First-Passage Model	62
4.4 The Variance Gamma Model	63
4.4.1 Sensitivity to the Parameters	66
4.4.2 Calibration on CDS Term Structure Curve	69
4.5 One-Sided Lévy Default Model	71
4.5.1 Wiener–Hopf Factorization and Default Probabilities	71
4.5.2 Illustration of the Pricing of Credit Default Swaps	75
4.6 Dynamic Spread Generator	77
4.6.1 Generating Spread Paths	77
4.6.2 Pricing of Options on CDSs	79
4.6.3 Black’s Formulas and Implied Volatility	80
Appendix: Solution of the PDE	82
5 Intensity Lévy Models	87
5.1 Intensity Models for Credit Risk	87
5.1.1 Jarrow–Turnbull Model	87
5.1.2 Cox Models	91
5.2 The Intensity OU Model	92
5.3 Calibration of the Model on CDS Term Structures	95
PART III: MULTIVARIATE MODELLING	
6 Multivariate Credit Products	101
6.1 CDOs	101
6.2 Credit Indices	105
7 Collateralized Debt Obligations	109
7.1 Introduction	109
7.2 The Gaussian One-Factor Model	110

7.3	Generic One-Factor Lévy Model	111
7.4	Examples of Lévy Models	115
7.5	Lévy Base Correlation	117
7.5.1	The Concept of Base Correlation	117
7.5.2	Pricing Non-Standard Tranches	119
7.5.3	Correlation Mapping for Bespoke CDOs	121
7.6	Delta-Hedging CDO tranches	122
7.6.1	Hedging with the CDS Index	122
7.6.2	Delta-Hedging with a Single-Name CDS	122
7.6.3	Mezz-Equity hedging	124
8	Multivariate Index Modelling	125
8.1	Black's Model	126
8.2	VG Credit Spread Model	127
8.3	Pricing Swaptions using FFT	128
8.4	Multivariate VG Model	130
PART IV: EXOTIC STRUCTURED CREDIT RISK PRODUCTS		
9	Credit CPPIs and CPDOs	137
9.1	Introduction	137
9.2	CPPIs	137
9.3	Gap Risk	143
9.4	CPDOs	145
10	Asset-Backed Securities	149
10.1	Introduction	149
10.2	Default Models	150
10.2.1	Generalized Logistic Default Model	150
10.2.2	Lévy Portfolio Default Model	152
10.2.3	Normal One-Factor Default Model	153
10.2.4	Generic One-Factor Lévy Default Model	155
10.3	Prepayment Models	156
10.3.1	Constant Prepayment Model	157
10.3.2	Lévy Portfolio Prepayment Model	158
10.3.3	Normal One-Factor Prepayment Model	158
10.4	Numerical Results	160
Bibliography		167
Index		173