

Contents

Preface to the 2nd edition	xi
Preface to the 1st edition	xiii
Some Hints for Troubleshooting	xv
1 Estimating Credit Scores with Logit	1
Linking scores, default probabilities and observed default behavior	1
Estimating logit coefficients in Excel	4
Computing statistics after model estimation	8
Interpreting regression statistics	10
Prediction and scenario analysis	12
Treating outliers in input variables	16
Choosing the functional relationship between the score and explanatory variables	20
Concluding remarks	25
Appendix	25
Logit and probit	25
Marginal effects	25
Notes and literature	26
2 The Structural Approach to Default Prediction and Valuation	27
Default and valuation in a structural model	27
Implementing the Merton model with a one-year horizon	30
The iterative approach	30
A solution using equity values and equity volatilities	35
Implementing the Merton model with a T -year horizon	39
Credit spreads	43
CreditGrades	44
Appendix	50
Notes and literature	52
Assumptions	52
Literature	53

3	Transition Matrices	55
	Cohort approach	56
	Multi-period transitions	61
	Hazard rate approach	63
	Obtaining a generator matrix from a given transition matrix	69
	Confidence intervals with the binomial distribution	71
	Bootstrapped confidence intervals for the hazard approach	74
	Notes and literature	78
	Appendix	78
	Matrix functions	78
4	Prediction of Default and Transition Rates	83
	Candidate variables for prediction	83
	Predicting investment-grade default rates with linear regression	85
	Predicting investment-grade default rates with Poisson regression	88
	Backtesting the prediction models	94
	Predicting transition matrices	99
	Adjusting transition matrices	100
	Representing transition matrices with a single parameter	101
	Shifting the transition matrix	103
	Backtesting the transition forecasts	108
	Scope of application	108
	Notes and literature	110
	Appendix	110
5	Prediction of Loss Given Default	115
	Candidate variables for prediction	115
	Instrument-related variables	116
	Firm-specific variables	117
	Macroeconomic variables	118
	Industry variables	118
	Creating a data set	119
	Regression analysis of LGD	120
	Backtesting predictions	123
	Notes and literature	126
	Appendix	126
6	Modeling and Estimating Default Correlations with the Asset Value Approach	131
	Default correlation, joint default probabilities and the asset value approach	131
	Calibrating the asset value approach to default experience: the method of moments	133
	Estimating asset correlation with maximum likelihood	136
	Exploring the reliability of estimators with a Monte Carlo study	144
	Concluding remarks	147
	Notes and literature	147

7 Measuring Credit Portfolio Risk with the Asset Value Approach	149
A default-mode model implemented in the spreadsheet	149
VBA implementation of a default-mode model	152
Importance sampling	156
Quasi Monte Carlo	160
Assessing Simulation Error	162
Exploiting portfolio structure in the VBA program	165
Dealing with parameter uncertainty	168
Extensions	170
First extension: Multi-factor model	170
Second extension: t -distributed asset values	171
Third extension: Random LGDs	173
Fourth extension: Other risk measures	175
Fifth extension: Multi-state modeling	177
Notes and literature	179
8 Validation of Rating Systems	181
Cumulative accuracy profile and accuracy ratios	182
Receiver operating characteristic (ROC)	185
Bootstrapping confidence intervals for the accuracy ratio	187
Interpreting caps and ROCs	190
Brier score	191
Testing the calibration of rating-specific default probabilities	192
Validation strategies	195
Testing for missing information	198
Notes and literature	201
9 Validation of Credit Portfolio Models	203
Testing distributions with the Berkowitz test	203
Example implementation of the Berkowitz test	206
Representing the loss distribution	207
Simulating the critical chi-square value	209
Testing modeling details: Berkowitz on subportfolios	211
Assessing power	214
Scope and limits of the test	216
Notes and literature	217
10 Credit Default Swaps and Risk-Neutral Default Probabilities	219
Describing the term structure of default: PDs cumulative, marginal and seen from today	220
From bond prices to risk-neutral default probabilities	221
Concepts and formulae	221
Implementation	225
Pricing a CDS	232
Refining the PD estimation	234

Market values for a CDS	237
Example	239
Estimating upfront CDS and the ‘Big Bang’ protocol	240
Pricing of a pro-rata basket	241
Forward CDS spreads	242
Example	243
Pricing of swaptions	243
Notes and literature	247
Appendix	247
Deriving the hazard rate for a CDS	247
11 Risk Analysis and Pricing of Structured Credit: CDOs and First-to-Default Swaps	249
Estimating CDO risk with Monte Carlo simulation	249
The large homogeneous portfolio (LHP) approximation	253
Systemic risk of CDO tranches	256
Default times for first-to-default swaps	259
CDO pricing in the LHP framework	263
Simulation-based CDO pricing	272
Notes and literature	281
Appendix	282
Closed-form solution for the LHP model	282
Cholesky decomposition	283
Estimating PD structure from a CDS	284
12 Basel II and Internal Ratings	285
Calculating capital requirements in the Internal Ratings-Based (IRB) approach	285
Assessing a given grading structure	288
Towards an optimal grading structure	294
Notes and literature	297
Appendix A1 Visual Basics for Applications (VBA)	299
Appendix A2 Solver	307
Appendix A3 Maximum Likelihood Estimation and Newton’s Method	313
Appendix A4 Testing and Goodness of Fit	319
Appendix A5 User-defined Functions	325
Index	333