

Contents

Preface to the Second Edition	xi
Preface to the First Edition	xiii
1 The History and Philosophy of Credit Scoring	1
1.1 Introduction: What is credit scoring?	1
1.2 History of credit	2
1.3 History of credit scoring	3
1.4 Philosophical approach to credit scoring	6
1.5 Credit scoring and data mining	8
1.6 Definition of a credit score	10
2 The Practice of Credit Scoring	11
2.1 Introduction	11
2.2 Credit assessment and how scoring is used in it	11
2.3 What data are needed?	17
2.4 Data availability, accuracy, and reliability	18
2.5 Credit bureaus in different countries	20
2.6 Validating the scorecard	21
2.7 Application form	21
2.8 Overrides and manual intervention	22
2.9 Monitoring and tracking	22
2.10 Relationship with a portfolio of lender's products	23
2.11 Who are the scorecard developers?	24
3 Common Methods for Building Scorecards	25
3.1 Introduction	25
3.2 Naive Bayes method	26
3.3 Linear regression	30
3.4 Logistic regression	36
3.5 Other nonlinear regression approaches	38
3.6 Maximizing divergence	39
3.7 Classification trees (recursive partitioning approach)	40
3.8 Multiple-type discrimination	47
4 Alternative Methods of Building Scorecards	49
4.1 Introduction	49
4.2 Linear programming	50
4.3 Integer programming	54

4.4	Neural networks	57
4.5	Support vector machines	66
4.6	Rule extraction techniques	70
4.7	Genetic methods	74
4.8	Nearest neighbor approach	80
4.9	Bayesian networks	82
4.10	Ensemble methods	88
4.11	Comparison of approaches	92
5	Survival Methods	99
5.1	Introduction	99
5.2	Basic concepts of survival analysis; survival function and hazard function	101
5.3	Cox's proportional hazards model	103
5.4	Competing risks	107
5.5	Discrete time models	109
5.6	Time-varying characteristics including economic variables	111
5.7	Intensity models	112
5.8	Using survival analysis to model loss given default and exposure at default	114
6	Managing the Data in Scorecard Development	117
6.1	Introduction	117
6.2	Selecting the sample	117
6.3	Definitions of Good and Bad	120
6.4	Characteristics available	122
6.5	Credit bureau characteristics	125
6.6	Determining subpopulations	129
6.7	Coarse classifying the characteristics	130
6.8	Choosing characteristics	137
6.9	Reject inference	141
6.10	Overrides and their effect in the scorecards	149
6.11	Setting the cutoff	150
6.12	Aligning and recalibrating scorecards	154
7	Behavioral Scoring	157
7.1	Introduction	157
7.2	Characteristics in behavioral scorecards	158
7.3	Variations and uses of classification behavioral scoring systems	160
7.4	Behavioral scoring: Orthodox Markov chain approach	162
7.5	Markov decision process approach to behavioral scoring	166
7.6	Validation and variations of Markov chain models	169
7.7	Behavioral scoring: Bayesian Markov chain approach	173
8	Measuring Scorecard Performance	179
8.1	Introduction	179
8.2	Holdout samples	180
8.3	Cross-validation for small samples	181

8.4	Bootstrapping	182
8.5	Discrimination using separation measures: Divergence, information value, and Mahalanobis distance	183
8.6	ROC curves, AUROC, Gini coefficients, KS statistic, and H statistic	186
8.7	Correctness of categorical predictions	192
8.8	Measures of probability prediction calibration	195
9	Implementation and Areas of Application	199
9.1	Introduction	199
9.2	Operational implementation of a scorecard	199
9.3	Introduction to monitoring and tracking of a scorecard	201
9.4	Monitoring analyses	202
9.5	Tracking of a scorecard	209
9.6	When are scorecards too old?	219
9.7	Improving a scorecard	222
9.8	Champion vs. challenger	225
9.9	Other application areas	229
10	Economic Issues	235
10.1	Introduction	235
10.2	Changes in credit over time	235
10.3	Microeconomic issues	238
10.4	Macroeconomic issues	246
10.5	Default behavior	254
10.6	Overindebtedness	258
10.7	Affordability	261
11	Capital Requirements and the Basel Accords	265
11.1	Introduction	265
11.2	History of the Basel Accords	266
11.3	Summary of the requirements of the Basel II Accord	269
11.4	Pillar 1 minimum capital requirements	269
11.5	Basel III	297
11.6	Stress testing	301
11.7	Evaluation of Basel III	305
12	Securitization and the Subprime Mortgage Crisis	307
12.1	Introduction	307
12.2	Securitization	307
12.3	Causes of the subprime crisis	311
12.4	Performance of credit scorecards in the crisis	315
12.5	The performance of rating agencies and mortgage-backed securities models in the crisis	316
12.6	Impact and consequences of global financial crisis	320
13	Variable Pricing and Risk-Based Pricing	323
13.1	Introduction	323
13.2	Response rates and take probabilities	324

13.3	Simple profitability model and optimal risk-based pricing with rate-only dependent response rates	328
13.4	Profitability models with Basel capital requirements and risk-based response rates	332
13.5	Adverse selection and the winner's curse in variable pricing	337
Bibliography		341
Index		369