

Contents

<i>List of Figures</i>	<i>page</i> xi
<i>List of Tables</i>	xiii
<i>Preface to the Second Edition</i>	xv
<i>Preface to the First Edition</i>	xvii

Part I Fundamentals of Bayesian Inference

1 Introduction	3
1.1 Econometrics	3
1.2 Overview of the Book	4
1.3 Historical Note and Further Reading	5
2 Basic Concepts of Probability and Inference	7
2.1 Probability	7
2.1.1 Frequentist Probabilities	8
2.1.2 Subjective Probabilities	9
2.2 Prior, Likelihood, and Posterior	12
2.3 Summary	18
2.4 Further Reading and References	19
2.5 Exercises	19
3 Posterior Distributions and Inference	21
3.1 Properties of Posterior Distributions	21
3.1.1 The Likelihood Function	21
3.1.2 Vectors of Parameters	23
3.1.3 Bayesian Updating	25
3.1.4 Large Samples	27
3.1.5 Identification	29

vi	<i>Contents</i>	
3.2	Inference	30
3.2.1	Point Estimates	30
3.2.2	Interval Estimates	32
3.2.3	Prediction	33
3.2.4	Model Comparison	34
3.3	Summary	39
3.4	Further Reading and References	39
3.5	Exercises	40
4	Prior Distributions	43
4.1	Normal Linear Regression Model	43
4.2	Proper and Improper Priors	45
4.3	Conjugate Priors	46
4.4	Subject-Matter Considerations	49
4.5	Exchangeability	52
4.6	Hierarchical Models	54
4.7	Training Sample Priors	55
4.8	Sensitivity and Robustness	56
4.9	Conditionally Conjugate Priors	56
4.10	A Look Ahead	59
4.11	Further Reading and References	60
4.12	Exercises	60
Part II	Simulation	
5	Classical Simulation	65
5.1	Probability Integral Transformation Method	65
5.2	Method of Composition	67
5.3	Accept-Reject Algorithm	68
5.4	Importance Sampling	72
5.5	Multivariate Simulation	74
5.6	Using Simulated Output	75
5.7	Further Reading and References	77
5.8	Exercises	77
6	Basics of Markov Chains	79
6.1	Finite State Spaces	79
6.2	Countable State Spaces	84
6.3	Continuous State Spaces	88
6.4	Further Reading and References	89
6.5	Exercises	90

	<i>Contents</i>	vii
7	Simulation by MCMC Methods	93
7.1	Gibbs Algorithm	94
7.1.1	Basic Algorithm	94
7.1.2	Calculation of Marginal Likelihood	97
7.2	Metropolis-Hastings Algorithm	99
7.2.1	Basic Algorithm	99
7.2.2	Calculation of Marginal Likelihood	104
7.3	Numerical Standard Errors and Convergence	105
7.4	Further Reading and References	108
7.5	Exercises	109
Part III Applications		
8	Linear Regression and Extensions	115
8.1	Continuous Dependent Variables	115
8.1.1	Normally Distributed Errors	115
8.1.2	Student- <i>t</i> Distributed Errors	118
8.2	Limited Dependent Variables	121
8.2.1	Tobit Model for Censored Data	121
8.2.2	Binary Probit Model	126
8.2.3	Binary Logit Model	130
8.2.4	Ordinal Probit Model	133
8.3	Latent Variable Models	138
8.3.1	Item Response Model	138
8.3.2	Factor Analysis Models	141
8.4	Further Reading and References	143
8.5	Exercises	146
9	Semiparametric Regression	148
9.1	Flexible Forms for the Conditional Mean Function	148
9.1.1	LS Basis	149
9.1.2	Identification	152
9.1.3	Prior Distributions	153
9.1.4	MCMC Algorithm for the Cubic Spline Approximation	155
9.1.5	Marginal Likelihood Calculation	156
9.1.6	Examples	158
9.2	Flexible Error Distributions	161
9.2.1	Introduction to Dirichlet Process Mixtures	161
9.2.2	Inference for Dirichlet Process Mixtures	164
9.2.3	Examples	165

viii	<i>Contents</i>	
9.3	Further Reading and References	167
9.4	Exercises	168
10	Multivariate Responses	169
10.1	SUR Model	169
10.2	Multivariate Probit Model	174
10.3	Panel Data	178
10.4	Further Reading and References	184
10.5	Exercises	186
11	Time Series	187
11.1	Autoregressive Models	187
11.2	Regime-Switching Models	193
11.3	Time-Varying Parameters	196
11.4	Time Series Properties of Models for Panel Data	199
11.5	Time-Varying Variances	201
11.5.1	ARCH–GARCH Models	201
11.5.2	Stochastic Volatility Models	202
11.6	Further Reading and References	204
11.7	Exercises	205
12	Endogenous Covariates and Sample Selection	206
12.1	Treatment Models	206
12.2	Unobserved Covariates	212
12.3	Incidental Truncation	215
12.4	Further Reading and References	221
12.5	Exercises	222
A	Probability Distributions and Matrix Theorems	223
A.1	Probability Distributions	223
A.1.1	Bernoulli	223
A.1.2	Binomial	223
A.1.3	Negative Binomial	224
A.1.4	Multinomial	224
A.1.5	Poisson	224
A.1.6	Uniform	225
A.1.7	Gamma	225
A.1.8	Inverted or Inverse Gamma	225
A.1.9	Beta	226
A.1.10	Pareto	227
A.1.11	Dirichlet	227
A.1.12	Normal or Gaussian	227

<i>Contents</i>	ix
A.1.13 Truncated Normal	227
A.1.14 Multivariate Normal or Gaussian	228
A.1.15 Matricvariate Normal or Matrix Normal	229
A.1.16 Univariate Student- <i>t</i>	230
A.1.17 Multivariate <i>t</i>	230
A.1.18 Wishart	231
A.1.19 Inverted or Inverse Wishart	231
A.1.20 Multiplication Rule of Probability	232
A.2 Matrix Theorems	232
B Computer Programs for MCMC Calculations	234
<i>Bibliography</i>	237
<i>Author Index</i>	245
<i>Subject Index</i>	247