

Contents

Preface	VII
1 Introduction	1
1.1 Poisson Regression Model	2
1.2 Some Thoughts on Methodology	3
1.3 Examples	4
1.4 Organization of the Book	6
2 Probability Models for Count Data	7
2.1 Introduction	7
2.2 Poisson Distribution	8
2.2.1 Definitions and Properties	8
2.2.2 Genesis of the Poisson Distribution	12
2.2.3 Poisson Process	12
2.2.4 Generalizations of the Poisson Process	15
2.2.5 Poisson Distribution as a Binomial Limit	16
2.2.6 Exponential Interarrival Times	18
2.2.7 Non-Poissonness	19
2.3 Further Distributions for Count Data	22
2.3.1 Negative Binomial Distribution	22
2.3.2 Binomial Distribution	27
2.3.3 Logarithmic Distribution	29
2.3.4 Summary	30
2.4 Modified Count Data Distributions	33
2.4.1 Truncation	33
2.4.2 Censoring and Grouping	34
2.4.3 Altered Distributions	34
2.5 Generalizations	35
2.5.1 Mixture Distributions	36
2.5.2 Compound Distributions	39
2.5.3 Birth Process Generalizations	41

2.5.4	Katz Family of Distributions	42
2.5.5	Linear Exponential Families	44
2.5.6	Additive Log-Differenced Probability Models	47
2.5.7	Summary	48
2.6	Duration Analysis and Count Data	48
2.6.1	Distributions for Interarrival Times	49
2.6.2	Renewal Processes	52
2.6.3	Duration Dependence and Dispersion	52
2.6.4	Gamma Count Distribution	53
2.6.5	Duration Mixture Models	56
3	Econometric Modeling – Basic Issues	61
3.1	Poisson Regression Model	61
3.1.1	Specification of the Poisson Regression Model	61
3.1.2	Ordinary Least Squares and Other Alternatives	63
3.1.3	Generalized Linear Model	67
3.1.4	Interpretation of the Parameters	68
3.1.5	Period at Risk	71
3.2	Estimation	74
3.2.1	Maximum Likelihood Estimation	74
3.2.2	Pseudo-Maximum Likelihood	81
3.2.3	Generalized Method of Moments	83
3.2.4	Bias Reduction Techniques	85
3.3	Sources of Misspecification	88
3.3.1	Mean Function	89
3.3.2	Unobserved Heterogeneity	89
3.3.3	Measurement Error	92
3.3.4	Dependent Process	94
3.3.5	Selectivity	94
3.3.6	Simultaneity and Endogeneity	95
3.3.7	Underreporting	96
3.3.8	Excess Zeros	96
3.3.9	Variance Function	97
3.4	Testing for Misspecification	99
3.4.1	Classical Specification Tests	100
3.4.2	Regression Based Tests	105
3.4.3	Goodness-of-Fit Tests	106
3.4.4	Tests for Non-Nested Models	107
4	Econometric Modeling – Extensions	113
4.1	Introduction	113
4.2	Unobserved Heterogeneity	115
4.2.1	Parametric Mixture Models	116
4.2.2	Negative Binomial Models	119
4.2.3	Semiparametric Mixture Models	124

4.2.4	Finite Mixture Models	125
4.3	Dependent Count Process	127
4.4	Censoring and Truncation	128
4.4.1	Truncated Count Data Models	129
4.4.2	Endogenous Sampling	129
4.4.3	Censored Count Data Models	131
4.4.4	Grouped Poisson Regression Model	132
4.5	Incidental Censoring and Truncation	132
4.5.1	Bivariate Normal Distribution	133
4.5.2	Incidental Censoring	136
4.5.3	Incidental Truncation	137
4.6	Hurdle Count Data Models	138
4.6.1	Hurdle Poisson Model	141
4.6.2	Marginal Effects	142
4.6.3	Hurdle Negative Binomial Model	143
4.6.4	Nonnested Hurdle Models	144
4.6.5	Unobserved Heterogeneity in Hurdle Models	145
4.6.6	Finite Mixture Versus Hurdle Models	146
4.6.7	Correlated Hurdle Models	147
4.7	Zero-Inflated Count Data Models	148
4.8	Underreporting	151
4.8.1	Poisson-Logistic Regression	151
4.8.2	Count Amount Model	153
4.8.3	Endogenous Underreporting	154
4.9	Endogenous Regressors	156
4.9.1	Instrumental Variable Estimation	157
4.9.2	Simultaneous Equations	159
4.9.3	Binary Endogenous Variables	161
4.9.4	Mixed Discrete-Continuous Models	165
4.10	Generalized Variance Models	166
4.10.1	Generalized Event Count Model	166
4.10.2	Generalized Poisson Regression	168
4.10.3	Robust Poisson Regression	170
4.10.4	Non-Parametric Variance Estimation	175
4.11	Quantile Regression for Count Data	177
5	Correlated Count Data	181
5.1	Multivariate Count Data	181
5.1.1	Multivariate Poisson Distribution	183
5.1.2	Multivariate Negative Binomial Model	188
5.1.3	Multivariate Poisson-Gamma Mixture Model	190
5.1.4	Multivariate Poisson-Log-Normal Model	191
5.1.5	Latent Poisson-Normal Model	194
5.1.6	Moment-Based Methods	195
5.2	Panel Data Models	197

5.2.1	Fixed Effects Poisson Model	198
5.2.2	Fixed Effects Negative Binomial Model.....	203
5.2.3	Random Effects Count Data Models	204
5.2.4	Moment-Based Methods.....	205
5.2.5	Dynamic Panel Count Data Models.....	205
5.3	Time-Series Count Data Models	208
6	Bayesian Analysis of Count Variables	217
6.1	Bayesian Analysis of the Poisson Model	218
6.2	A Poisson Model with Underreporting	221
6.3	Estimation of the Multivariate Poisson-Log-Normal Model by MCMC.....	223
6.4	Estimation of a Random Coefficients Model by MCMC.....	224
7	Applications	227
7.1	Accidents.....	227
7.2	Crime.....	228
7.3	Trip Frequency.....	228
7.4	Health Economics	230
7.5	Demography	233
7.6	Marketing and Management	236
7.7	Labor Mobility	237
7.7.1	Economics Models of Labor Mobility.....	238
7.7.2	Previous Literature	239
7.7.3	Data and Descriptive Statistics.....	241
7.7.4	Regression Results.....	245
7.7.5	Model Performance	248
7.7.6	Marginal Probability Effects	250
7.7.7	Structural Inferences.....	254
A	Probability Generating Functions	257
B	Gauss-Hermite Quadrature	261
C	Software	265
D	Tables	267
	References.....	275
	Author's Index	295
	Subject Index	299