Contents

Pre	face	to the T	hird Edition	page xvii	
Pre	face	to the S	econd Edition	xix	
Pre	face	to the F	ïrst Edition	xxi	
1	Introduction			1	
	1.1	1			
	1.2	.2 Advantages of Panel Data			
	1.3 Issues Involved in Utilizing Panel Data			10	
		1.3.1	Unobserved Heterogeneity across Individuals and		
			over Time	10	
		1.3.2	Incidental Parameters and Multidimensional		
			Statistics	13	
		1.3.3	Sample Attrition	13	
	1.4	Outlin	e of the Monograph	14	
2	Hon	nogenei	ty Tests for Linear Regression Models		
	(An	17			
	2.1	.1 Introduction			
	2.2	Analy	18		
	2.3 An Example		24		
3	Simple Regression with Variable Intercepts			31	
	3.1	3.1 Introduction			
	3.2	3.2 Fixed-Effects Models: Least-Squares Dummy			
		Variab	le Approach	34	
	3.3	3.3 Random Effects Models: Estimation of Variance-			
		Comp	onents Models	39	
		3.3.1	Covariance Estimation	40	
		3.3.2	Generalized Least-Squares (GLS) Estimation	41	
		3.3.3	Maximum-Likelihood Estimation	45	

	34	Fixed	Effects or Random Effects	47		
	5.1	341	An Example	47		
		317	Conditional Inference or Unconditional (Marginal)			
		J. T .2	Inference	48		
	25	Toete f	for Missnecification	56		
	3.5 2.6	Madal	lo with Time, and/or Individual-Invariant Explanatory			
	3.0	Model	is and Poth Individual- and Time-Specific Effects	58		
			Estimation of Models with Individual-Specific			
		3.0.1	Estimation of Models with Individual Speeme	58		
		260	variables			
		3.6.2		61		
	~ -		Time Effects	61		
	3.7	Hetero	oscedasticity and Autocorrelation	64		
		3.7.1	Heteroscedasticity	04		
		3.7.2	Models with Serially Correlated Errors	65		
		3.7.3	Heteroscedasticity Autocorrelation Consistent			
			Estimator for the Covariance Matrix of the CV			
			Estimator	68		
	3.8	Model	ls with Arbitrary Error Structure – Chamberlain			
		π-App	proach	69		
	Appendix 3A: Consistency and Asymptotic Normality of the					
	Minimum-Distance Estimator					
	Appendix 3B: Characteristic Vectors and the Inverse of the					
	V	ariance-	-Covariance Matrix of a Three-Component Model	77		
4	Dyn	amic M	fodels with Variable Intercepts	80		
	4.1	Introd	uction	80		
	4.2	The C	V Estimator	82		
	4.3	Rando	om-Effects Models	84		
		4.3.1	Bias in the OLS Estimator	85		
		4.3.2	Model Formulation	86		
		4.3.3	Estimation of Random-Effects Models	89		
		4.3.4	Testing Some Maintained Hypotheses on Initial			
			Conditions	106		
		4.3.5	Simulation Evidence	100		
	4.4	An Ex	ample	107		
	4.5	Fixed	Effects Models	106		
		4.5.1	Transformed Likelihood Approach	111		
		4.5.2	Minimum Distance Estimator	112		
		4.5.3	Relations between the Likelihood Based R	114		
			and the GMM			
		4.54	Issues of Pandom versus Engl Dec. 1 and and the	116		
			rised-Effects Specification	119		

	4.6	Estimation of Dynamic Models with Arbitrary Serial				
		Correl	lations in the Residuals	121		
	4.7	Models with Both Individual- and Time-Specific Additive				
		Effect	S	122		
	Appendix 4A: Derivation of the Asymptotic Covariance Matrix of					
	F	easible	MDE	129		
	Арр	endix 4	B: Large N and T Asymptotics	130		
5	Stat	ic Simu	ltaneous-Equations Models	136		
	5.1	Introd	uction	136		
	5.2	Joint (Generalized Least-Squares Estimation Technique	140		
	5.3	Estim	ation of Structural Equations	144		
		5.3.1	Estimation of a Single Equation in the Structural			
			Model	144		
		5.3.2	Estimation of the Complete Structural System	149		
	5.4	Triang	gular System	152		
		5.4.1	Identification	153		
		5.4.2	Estimation	155		
		5.4.3	An Example	162		
	Арр	endix 5.	A	164		
6	Vari	able-Co	befficient Models	167		
	6.1	Introd	uction	167		
	6.2	Coeffi	cients that Vary over Cross-Sectional Units	170		
		6.2.1	Fixed-Coefficient Model	170		
		6.2.2	Random-Coefficient Model	172		
	6.3	Coeffi	cients that Vary over Time and Cross-Sectional Units	180		
		6.3.1	The Model	180		
		6.3.2	Fixed-Coefficient Model	182		
		6.3.3	Random-Coefficient Model	183		
	6.4	Coeffi	cients that Evolve over Time	186		
		6.4.1	The Model	186		
		6.4.2	Predicting β_t by the Kalman Filter	188		
		6.4.3	Maximum-Likelihood Estimation	191		
		6.4.4	Tests for Parameter Constancy	192		
	6.5	.5 Coefficients that Are Functions of Other Exogenous Variables		193		
	6.6	A Mix	ed Fixed- and Random-Coefficients Model	196		
		6.6.1	Model Formulation	196		
		6.6.2	A Bayes Solution	198		
		6.6.3	Random or Fixed Differences?	201		
	6.7	5.7 Dynamic Random-Coefficients Models				
	6.8	Two Examples				

		6.8.1	Liquidity Constraints and Firm Investment	
			Expenditure	212
		6.8.2	Aggregate versus Disaggregate Analysis	217
	6.9	Correl	ated Random-Coefficients Models	220
		6.9.1	Introduction	220
		6.9.2	Identification with Cross-Sectional Data	221
		6.9.3	Estimation of the Mean Effects with Panel Data	223
	App	endix 64	A: Combination of Two Normal Distributions	228
7	Disc	rete Da	ıta	230
	7.1	Introd	uction	230
	7.2	Some	Discrete-Response Models for Cross-Sectional Data	230
	7.3	Param	etric Approach to Static Models with Heterogeneity	235
		7.3.1	Fixed-Effects Models	236
		7.3.2	Random-Effects Models	242
	7.4	Semip	arametric Approach to Static Models	246
		7.4.1	Maximum Score Estimator	247
		7.4.2	A Root-N Consistent Semiparametric Estimator	249
	7.5	Dynan	nic Models	250
		7.5.1	The General Model	250
		7.5.2	Initial Conditions	252
		7.5.3	A Conditional Approach	255
		7.5.4	State Dependence versus Heterogeneity	261
		7.5.5	Two Examples	264
	7.6	Altern	ative Approaches for Identifying State Dependence	270
		7.6.1	Bias-Adjusted Estimator	270
		7.6.2	Bounding Parameters	274
		7.6.3	Approximate Model	276
8	Sam	ple Tru	ncation and Sample Selection	281
	8.1	Introd	uction	281
	8.2	An Ex	ample – Nonrandomly Missing Data	292
		8.2.1	Introduction	292
		8.2.2	A Probability Model of Attrition and Selection Bias	292
		8.2.3	Attrition in the Gary Income-Maintenance	
			Experiment	296
	8.3	Tobit	Models with Random Individual Effects	298
	8.4	Fixed-	Effects Estimator	299
		8.4.1	Pairwise Trimmed Least-Squares and Least Absolute	
			Deviation Estimators for Truncated and Censored	
			Regressions	299

		8.4.2	A Semiparametric Two-Step Estimator for the		
			Endogenously Determined Sample Selection Model	311	
	8.5	An Exa	ample: Housing Expenditure	313	
	8.6	Dynam	nic Tobit Models	317	
		8.6.1	Dynamic Censored Models	317	
		8.6.2	Dynamic Sample Selection Models	324	
9	Cros	s-Sectio	onally Dependent Panel Data	327	
	9.1	Issues of	of Cross-Sectional Dependence	327	
	9.2	Spatial	Approach	329	
		9.2.1	Introduction	329	
		9.2.2	Spatial Error Model	332	
		9.2.3	Spatial Lag Model	333	
		9.2.4	Spatial Error Models with Individual-Specific Effects	334	
		9.2.5	Spatial Lag Model with Individual-Specific Effects	335	
		9.2.6	Spatial Dynamic Panel Data Models	336	
	9.3	Factor	Approach	337	
	9.4	Group	Mean Augmented (Common Correlated Effects)		
		Approa	ach to Control the Impact of Cross-Sectional		
		Depend	dence	342	
	9.5	Test of	Cross-Sectional Independence	344	
		9.5.1	Linear Model	344	
		9.5.2	Limited Dependent-Variable Model	348	
		9.5.3	An Example – A Housing Price Model of China	350	
	9.6	A Pane	el Data Approach for Program Evaluation	352	
		9.6.1	Introduction	352	
		9.6.2	Definition of Treatment Effects	352	
		9.6.3	Cross-Sectional Adjustment Methods	354	
		9.6.4	Panel Data Approach	359	
10	Dynamic System				
	10.1	Panel V	Vector Autoregressive Models	370	
		10.1.1	"Homogeneous" Panel VAR Models	370	
		10.1.2	Heterogeneous Vector Autoregressive Models	377	
	10.2	Cointeg	grated Panel Models and Vector Error Correction	379	
		10.2.1	Properties of Cointegrated Processes	379	
		10.2.2	Estimation	381	
	10.3	Unit R	oot and Cointegration Tests	386	
		10.3.1	Unit Root Tests	386	
		10.3.2	Tests of Cointegration	394	
	10.4	Dynam	nic Simultaneous Equations Models	397	
		10.4.1	The Model	397	

		10/2	Likelihood Approach	398	
		10.4.2	Method of Moments Estimator	401	
		10.4.5	Method of Moments Zournand	402	
11	Inco	mplete l	Panel Data	403	
	11.1	Rotatin	g or Randomly Missing Data	403	
	11.2 Pseudo-Panels (or Repeated Cross-Sectional Data)				
	11.3	Pooling	g of Single Cross-Sectional and Single Time Series		
		Data		411	
		11.3.1	Introduction	411	
		11.3.2	The Likelihood Approach to Pooling		
			Cross-Sectional and Time Series Data	413	
		11.3.3	An Example	416	
	11.4	Estima	ting Distributed Lags in Short Panels	418	
		11.4.1	Introduction	418	
		11.4.2	Common Assumptions	419	
		11.4.3	Identification Using Prior Structure on the Process of		
			the Exogenous Variable	421	
		11.4.4	Identification Using Prior Structure on the Lag		
			Coefficients	425	
		11.4.5	Estimation and Testing	428	
12	Miscellaneous Topics				
	12.1	Duratio	on Model	430	
	12.2	Count	Data Model	438	
	12.3	Panel (Quantile Regression	445	
	12.4	Simula	tion Methods	448	
	12.5	vith Multilevel Structures	453		
	12.6	Errors	of Measurement	455	
	12.7	Nonpa	rametric Panel Data Models	461	
13	A Summary View				
	13.1	Benefi	ts of Panel Data	464	
		13.1.1	Increasing Degrees of Freedom and Lessening the		
			Problem of Multicollinearity	464	
		13.1.2	Identification and Discrimination between		
			Competing Hypotheses	465	
		13.1.3	Reducing Estimation Bias	467	
		13.1.4	Generating More Accurate Predictions for Individual		
		1315	Droviding Information	468	
		15.1.5	Aggregation		
		1316	Simplifying Computation 1.2 and 1.2	468	
		15.1.0	Simplifying Computation and Statistical Inference	469	

13.2	Challenges for Panel Data Analysis		469	
	13.2.1	Modeling Unobserved Heterogeneity	469	
	13.2.2	Controlling the Impact of Unobserved Heterogeneity		
		in Nonlinear Models	470	
	13.2.3	Modeling Cross-Sectional Dependence	471	
	13.2.4	Multidimensional Asymptotics	472	
	13.2.5	Sample Attrition	472	
13.3	A Cone	cluding Remark	473	
Reference	References			
Author Index				
Subject Index				