

# Econometric Methods

## 2nd Edition

J. Johnston

*Stanley Jevons Professor of Econometrics, University of Manchester,  
England*

INTERNATIONAL STUDENT EDITION



McGRAW-HILL KOGAKUSHYA, LTD.

Tokyo Auckland Bogota Guatemala Hamburg Johannesburg  
Lisbon London Madrid Mexico New Delhi Panama  
Paris San Juan São Paulo Singapore Sydney

# **Contents**

**Preface to the Second Edition**      vii

**Preface to the First Edition**      ix

<b>1</b>	<b>The Nature of Econometrics</b>	<b>1</b>
1-1	Relationships between Variables	1
1-2	Economic Models	2
1-3	Example of a Simple Macro-model	2
1-4	The Role of Econometrics	5
<b>2</b>	<b>The Two-variable Linear Model</b>	<b>8</b>
2-1	Assumptions	8
2-2	Least-squares Estimators	14
2-3	The Correlation Coefficient	32
2-4	The Analysis of Variance in Regression	35
2-5	Prediction	38
<b>3</b>	<b>Extensions of the Two-variable Linear Model</b>	<b>47</b>
3-1	Two-variable Nonlinear Relationships	47

3-2	Relations between Three Variables	55
3-3	Fitting the Regression Plane	59
3-4	The Coefficient of Multiple Correlation	60
3-5	Partial Correlation Coefficients	61
3-6	Summary of Calculations for the Three-variable Case	64
<b>4</b>	<b>Elements of Matrix Algebra</b>	<b>68</b>
4-1	Matrices	69
4-2	Determinants	78
4-3	Partitioned Matrices	90
4-4	Linear Dependence, Rank and the Solution of Homogeneous Equations	95
4-5	Characteristic Roots and Vectors	102
4-6	Quadratic Forms and Positive Definite Matrices	105
4-7	Differential Calculus in Matrix Notation	114
<b>5</b>	<b>The General Linear Model</b>	<b>121</b>
5-1	Assumptions	121
5-2	Least-squares Estimators	123
5-3	The Correlation Matrix, Partial Correlation Coefficients, and Regression Coefficients	132
5-4	Significance Tests and Confidence Intervals	135
5-5	Prediction	152
5-6	Linear Restrictions	155
5-7	Multicollinearity	159
5-8	Specification Error	168
<b>6</b>	<b>Extensions of the General Linear Model</b>	<b>176</b>
6-1	Dummy Variables	176
6-2	Seasonal Adjustment	186
6-3	Covariance Analysis	192
<b>7</b>	<b>Generalized Least-squares</b>	<b>208</b>
7-1	The Generalized Least-squares (Aitken) Estimator	208
7-2	Prediction	212
7-3	Heteroscedastic Disturbances	214
7-4	Pure and Mixed Estimation	221
7-5	Grouping of Observations	228
7-6	Grouping of Equations	238
<b>8</b>	<b>Autocorrelation</b>	<b>243</b>
8-1	Nature of Autocorrelation	243
8-2	Consequences of Autocorrelated Disturbances	246

CONTENTS

8-3	Conventional Tests for Autocorrelation	249
8-4	Theil BLUS Procedure	254
8-5	Estimation	259
8-6	Prediction	265
<b>9</b>	<b>Stochastic Regressors, Instrumental Variables, and Errors in Variables</b>	<b>267</b>
9-1	Definitions	268
9-2	Stochastic Regressors	274
9-3	Instrumental Variables	278
9-4	Errors in Variables	281
<b>10</b>	<b>Lagged Variables</b>	<b>292</b>
10-1	Lagged Explanatory Variables	292
10-2	Lagged Dependent Variables	300
10-3	Estimation	303
<b>11</b>	<b>Other Multivariate Methods</b>	<b>322</b>
11-1	Principal Components	322
11-2	Canonical Correlations	331
11-3	Discriminant Analysis	334
<b>12</b>	<b>Simultaneous-equation Methods: Identification</b>	<b>341</b>
12-1	Simultaneous-equation Systems	341
12-2	The Identification Problem	352
12-3	Restrictions on Structural Parameters	356
12-4	Restrictions on Variances and Covariances	365
<b>13</b>	<b>Simultaneous-equation Methods: Estimation</b>	<b>376</b>
13-1	Recursive Systems	377
13-2	Two-stage Least-squares (2SLS) Estimators	380
13-3	Limited-information (Least Variance Ratio) Estimators	384
13-4	<i>k</i> -Class Estimators	388
13-5	2SLS and Principal Components	393
13-6	Three-stage Least-squares (3SLS) and Full-information Maximum-likelihood (FIML)	395
13-7	Prediction and Simultaneous Confidence Intervals	400
13-8	Monte Carlo Studies	408
<b>Appendix</b>	<b>424</b>	
<b>Index</b>	<b>434</b>	