

Introductory Econometrics

Arthur S. Goldberger

Harvard University Press
Cambridge, Massachusetts
London, England
1998



Contents

Preface

xi

1 Empirical Relations

Introduction 1	Other Resources 9
Data Sets 7	Exercises 10

2 Fitting the Data

The Data 11	Other Least-Squares Problems 19
Least-Squares Fitting 12	Exercises 20
Useful Algebra 16	

3 Univariate Populations

Probability Distributions 22	Continuous Probability Distributions 28
Expected Values 23	Normal Distributions 29
Linear Function Rules 25	Exercises 30
Prediction Problem 26	

4 Bivariate Populations

Bivariate Probability Distributions 32	Prediction 36
Derived Distributions 34	Other Features 38
Additional Linear Function Rules 35	Exercises 40

5	<i>Inference about a Population Mean</i>	43
	Sampling Distributions 43	Sample Variance 50
	Sample Mean Theorem 45	Further Inference 50
	Estimation 45	Practical Inference 54
	Asymptotic Distributions 48	Exercises 56
6	<i>Classical Regression Model</i>	58
	Introduction 58	Estimation 63
	Sampling 60	Violations 66
	Classical Regression Model 61	Exercises 66
7	<i>Inference in the Classical Model</i>	68
	Introduction 68	Hypothesis Testing 72
	Standard Errors 70	Functional Form 73
	Practical Inference 71	Exercises 75
8	<i>Prediction and Fit</i>	80
	Prediction 80	Prediction Revisited 85
	Coefficient of Determination 81	Exercises 87
	Using R^2 83	
9	<i>Multiple Regression: Preliminaries</i>	89
	Introduction 89	Coefficient of Determination 96
	Fitting the Data 89	Trivariate Population 97
	Interpretation 94	Exercises 100
10	<i>Multiple Regression: Classical Model</i>	103
	Model 103	Short versus Long Regression 108
	Estimation 105	Exercises 108
	Inference 107	
11	<i>Multiple Regression: Applications</i>	110
	Introduction 110	Both Slopes Zero Null
	Short versus Long Regression 111	Hypothesis 114
	Zero-Slope Null Hypothesis 111	Paradox? 116
	Allocating R^2 113	Exercises 117
	Relative Importance 113	

12 Multiple Regression: General Case	118
Fitting the Data	118
Model	120
Estimation	120
Functional Form	121
Hypothesis Testing	123
Other Linear Hypotheses	126
Exercises	128
13 Relaxing the Assumptions of the Classical Model	131
Background	131
Quadratic Regression	132
Heteroskedasticity	133
Autocorrelation	134
Random Sampling	134
Arbitrary Population	136
Exercises	138
14 Heteroskedasticity	140
Introduction	140
Model	142
Least Squares	142
Weighted Least Squares	145
Knowledge of Variances	147
Practical Considerations	148
Exercises	149
15 Autocorrelation: Preliminaries	152
Introduction	152
Model	154
Least-Squares Regression	154
Autocorrelated Data	155
Sample Autoregressions	159
Stochastic Processes	164
Caution	166
Exercises	168
16 Regression with Autocorrelation	171
Introduction	171
Special Cases	172
Correcting Standard Errors	173
Generalized Difference Method	175
Practical Considerations	177
Testing against Autocorrelation	178
Caution	179
Lagged Dependent Variable	180
Exercises	181
17 Binary Response Models	183
Binary Dependent Variable	183
Probability Distributions	183
Binary Response Model	186
Logistic Model	188
Probit Model	189
Interpretation	191
Goodness of Fit	193
Exercises	193
Appendix: Maximum-Likelihood Principle	196

<i>18 Simultaneity: Preliminaries</i>	<i>200</i>
Simultaneous-Equation Models 200	Estimation 206 Interpretation 207 Exercises 209
A Supply-Demand Model 201	
A Keynesian Model 204	
<i>19 Models of Demand and Supply</i>	<i>210</i>
Introduction 210	Variants of the Model 215
Structural Form 210	Order Condition 217
Reduced Form 211	Caution 218
Identification 212	Exercises 219
Identification Revisited 213	
<i>20 Estimation of Simultaneous-Equation Models</i>	<i>220</i>
Introduction 220	Empirical Example 224
Indirect Least Squares 220	Rationale for Two-Stage Least
Two-Stage Least Squares 222	Squares 226
Caution 224	Exercises 229
<i>Appendix: Statistical Tables</i>	<i>234</i>
<i>References</i>	<i>238</i>
<i>Index</i>	<i>239</i>