

NONLINEAR METHODS IN ECONOMETRICS

STEPHEN M. GOLDFELD

and

RICHARD E. QUANDT

Princeton University

with a contribution by

Dennis E. Smallwood



1972

NORTH-HOLLAND PUBLISHING COMPANY
AMSTERDAM • LONDON

TABLE OF CONTENTS

Preface	vii
CHAPTER 1. NUMERICAL OPTIMIZATION	1
1.1. Introduction	1
1.2. Ordinary gradient methods	3
1.3. Conjugate gradient methods	13
1.4. Direct search methods	16
1.5. Iteration methods for systems of equations	17
1.6. The use of derivatives	18
1.7. Global maxima	21
1.8. Concluding remarks	25
Appendix A: Comparison of maximization algorithms: some numerical results	27
CHAPTER 2. LEAST SQUARES THEORY, CONFIDENCE INTERVALS, AND MAXIMUM LIKELIHOOD ESTIMATION	39
2.1. Introduction	39
2.2. Linear models	40
2.3. Nonlinear models	49
2.4. The maximum likelihood approach	57
2.5. Overview of remaining chapters	74
CHAPTER 3. ANALYSES OF HETEROSCEDASTICITY	78
3.1. Introduction	78
3.2. Statement of the problem	78
3.3. Testing and estimation	85
3.4. Sampling experiments	96
3.5. Concluding remarks	118
Appendix B: The peak-test of heteroscedasticity	120

CHAPTER 4. ESTIMATION OF REGRESSIONS WITH DUMMY DEPENDENT VARIABLES	124
4.1. Introduction	124
4.2. Some alternative models and estimation methods	125
4.3. Estimation in the uniform and probit models; some sampling experiments	129
4.4. Some results	130
4.5. Conclusions	134
CHAPTER 5: THE ESTIMATION OF COBB-DOUGLAS TYPE FUNCTIONS WITH MULTIPLICATIVE AND ADDITIVE ERRORS	135
5.1. Introduction	135
5.2. Testing disparate families of hypotheses	137
5.3. Estimation of a mixed model	140
5.4. Some concrete examples	143
5.5. Conclusion	145
Appendix C: The density function for dependent error structures	146
CHAPTER 6. ESTIMATOR BEHAVIOR FOR A NONLINEAR MODEL OF PRODUCTION	147
6.1. Introduction	147
6.2. The fixed proportions vintage model	148
6.3. Problems of indeterminacy with the fixed proportions vintage model	157
6.4. Linear and quadratic variance approximations	161
6.5. Computed covariance matrices	169
6.6. Alternative estimator specifications	170
6.7. Summary of the calculations	174
6.8. General conclusions	176
CHAPTER 7. AUTOCORRELATION IN SIMULTANEOUS EQUATION SYSTEMS	178
7.1. Introduction	178
7.2. Estimation with autocorrelated errors	180
7.3. Some sampling experiments	189
7.4. Summary and conclusions	213
Appendix D: Additional tables for sampling experiments	215

CHAPTER 8. NONLINEAR SIMULTANEOUS EQUATIONS	219
8.1. Introduction	219
8.2. Identification in nonlinear systems	221
8.3. Estimation in nonlinear systems	232
8.4. Models and design of experiments	236
8.5. Analysis of results	241
8.6. Conclusions	255
 CHAPTER 9. ESTIMATION OF DISCONTINUOUS PARAMETER CHANGES	 258
9.1. Introduction	258
9.2. A generalized approach	262
9.3. An economic example	269
9.4. Extensions and concluding comments	273
9.5. Some general conclusions	276
 INDEX	 278