

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Generalized Method of Moments in Econometrics	1
1.2	Population Moment Conditions and the Statistical Antecedents of GMM	5
1.3	Five Examples of Moment Conditions in Economic Models	15
1.3.1	Consumption-Based Asset Pricing Model	15
1.3.2	Evaluation of Mutual Fund Performance	17
1.3.3	Conditional Capital Asset Pricing Model	20
1.3.4	Inventory Holdings by Firms	22
1.3.5	Stochastic Volatility Models of Exchange Rates	24
1.4	Review of Statistical Theory	26
1.4.1	Properties of Random Sequences	27
1.4.2	Stationary Time Series, the Weak Law of Large Numbers and the Central Limit Theorem	29
1.5	Overview of Later Chapters	31
<b>2</b>	<b>The Instrumental Variable Estimator in the Linear Regression Model</b>	<b>33</b>
2.1	The Population Moment Condition and Parameter Identification	34
2.2	The Estimator and a Fundamental Decomposition	36
2.3	Asymptotic Properties	39
2.4	The Optimal Choice of Weighting Matrix	43
2.5	Specification Error: Consequences and Detection	44
2.6	Summary	47
<b>3</b>	<b>GMM Estimation in Correctly Specified Models</b>	<b>49</b>
3.1	Population Moment Condition and Parameter Identification	50
3.2	The Estimator and Numerical Optimization	57
3.3	The Identifying and Overidentifying Restrictions	64
3.4	Asymptotic Properties	66
3.4.1	Consistency of the Parameter Estimator	67
3.4.2	Asymptotic Normality of the Parameter Estimator	69
3.4.3	Asymptotic Normality of the Estimated Sample Moment	73
3.5	Long Run Covariance Matrix Estimation	74

3.5.1	Serially Uncorrelated Sequences	76
3.5.2	VARMA Processes	76
3.5.3	Heteroscedasticity and Autocorrelation Covariance Matrix Estimators	79
3.6	The Optimal Choice of Weighting Matrix	88
3.7	Transformations, Normalizations and the Continuous Updating GMM Estimator	94
3.8	GMM as a Unifying Principle of Estimation	108
3.8.1	Single Step Estimators	109
3.8.2	Sequential Estimators	112
3.9	Summary	114
<b>4</b>	<b>GMM Estimation in Misspecified Models</b>	<b>117</b>
4.1	Probability Limit of the First Step Estimator	120
4.2	Asymptotic Distribution Theory for the First Step Estimator	121
4.3	Long Run Covariance Matrix Estimation	125
4.4	The Two Step or Iterated GMM Estimator	128
4.4.1	Estimation with $W_T = \hat{S}_{SU}^{-1}$ or $W_T = \hat{S}_{SU,\mu}^{-1}$	128
4.4.2	Estimation with $W_T = \hat{S}_{HAC}^{-1}$ or $W_T = \hat{S}_{HAC,\mu}^{-1}$	131
4.4.2.1	Estimation with $W_T = \hat{S}_{HAC,\mu}^{-1}$	131
4.4.2.2	Estimation with $W_T = \hat{S}_{HAC}^{-1}$	135
4.5	The Estimated Sample Moment	138
4.6	Summary of Consequences of Misspecification for GMM Estimation	139
<b>5</b>	<b>Hypothesis Testing</b>	<b>141</b>
5.1	The Overidentifying Restrictions Test	143
5.1.1	The Statistic and its Asymptotic Distribution in Correctly Specified Models	144
5.1.2	Non-Local Misspecification	145
5.1.3	Local Misspecification	148
5.1.4	The Parallels Between Non-Local and Local Analysis	151
5.2	Testing Hypotheses about Subsets of $E[f(v_t, \theta_0)]$	153
5.2.1	Technical Details	158
5.3	Testing Hypotheses About the Parameter Vector	161
5.3.1	GMM Estimation Subject to Nonlinear Restrictions on $\theta_0$ and Other Technical Details	165
5.4	Testing Hypotheses About Structural Stability	170
5.4.1	Known Break Point Case	171
5.4.2	Unknown Break Point Case	178
5.4.2.1	Technical Details	187
5.4.3	Other Types of Structural Instability	193
5.5	Other Hypothesis Tests	194
5.5.1	Non-Nested Hypothesis Tests	194
5.5.2	Hausman Tests	197

5.5.3	Conditional Moment Tests	198
5.6	Summary	199
<b>6</b>	<b>Asymptotic Theory and Finite Sample Behaviour</b>	<b>202</b>
6.1	The Impact of the Degree of Overidentification on the Asymptotic Behaviour of the Estimator	203
6.1.1	Finite Increase in the Degree of Overidentification	204
6.1.2	Redundant Moment Conditions	205
6.1.3	The Degree of Overidentification Increases with the Sample Size	206
6.2	Finite Sample Theory for Static Models	208
6.2.1	Exact Results for the IV Estimator in the Linear Simultaneous Equations Models	208
6.2.2	Higher Order Approximations	212
6.3	Simulation Evidence from Nonlinear Dynamic Models	217
6.4	Summary and Link to Following Chapters	230
<b>7</b>	<b>Moment Selection in Theory and in Practice</b>	<b>232</b>
7.1	Preliminaries	234
7.2	The Optimal Instrument	237
7.2.1	Static Models	238
7.2.2	Dynamic Models	245
7.2.3	Efficiency Comparison with Maximum Likelihood	251
7.3	Moment Selection in Practice	252
7.3.1	Selection Based on the Orthogonality Condition	253
7.3.2	Selection Based on the Relevance Condition	259
7.3.3	A Combined Strategy	262
7.3.4	Other Methods of Instrument Selection	264
7.4	Summary	267
<b>8</b>	<b>Alternative Approximations to Finite Sample Behaviour</b>	<b>270</b>
8.1	The Bootstrap	271
8.1.1	Background and Intuition	271
8.1.2	Nonlinear Dynamic Models	277
8.1.2.1	Generation of Bootstrap Sample When the Data are Dependent	279
8.1.2.2	Calculation of the GMM Estimator and Related Statistics in the Bootstrap Samples	282
8.1.2.3	Choosing the Number of Replications	287
8.1.2.4	Summary of Bootstrap Calculations	290
8.2	Inference in the Presence of Weak Identification	294
8.2.1	The Limiting Behaviour of the GMM Estimator	297
8.2.2	Inference in the Presence of Weak Identification	300
8.2.3	The Detection of Weak Identification	302
8.3	Inference When the Long Run Variance is Estimated by an HAC Estimator with $b_T = T$	305
8.4	Summary	310

<b>9 Empirical Examples</b>	<b>312</b>
9.1 Mutual Fund Performance Evaluation	313
9.2 Conditional Capital Asset Pricing Model	318
9.3 Inventory Holdings by Firms	325
9.4 Stochastic Volatility Model of Exchange Rates	334
<b>10 Related Methods of Estimation</b>	<b>342</b>
10.1 Simulation Based Estimation	342
10.1.1 Simulated Method of Moments	343
10.1.2 Indirect Inference	347
10.2 Empirical Likelihood	350
<b>Appendix A Mixing Processes and Nonstationarity</b>	<b>354</b>
A.1 Mixing processes	354
A.2 Nonstationarity	357
Bibliography	359
Author Index	389
Subject Index	396