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978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Péguin-Feissolle

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Econometric Modeling and Inference

The goal of this book is to present the main statistical tools of econometrics, focusing specifically on modern econometric methodology. The authors unify the approach by using a small number of estimation techniques, mainly generalized method of moments (GMM) estimation and kernel smoothing. The choice of GMM is explained by its relevance in structural econometrics and its prominent position in econometrics overall. The book is in four parts. Part I explains general methods. Part II studies statistical models that are best suited for microeconomic data. Part III deals with dynamic models that are designed for macroeconomic and financial applications. In Part IV the authors synthesize a set of problems that are specific to statistical methods in structural econometrics, namely identification and overidentification, simultaneity, and unobservability. Many theoretical examples illustrate the discussion and can be treated as application exercises. Nobel Laureate James J. Heckman offers a foreword to the work.

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Frontmatter

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Frontmatter

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ECONOMETRIC MODELING AND INFERENCE

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Frontmatter

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To Nicole

To Cathy

To Denis

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Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

Contents

Foreword	<i>page</i> xvii
Preface	xix
I Statistical Methods	1
1 Statistical Models	3
1.1 Introduction	3
1.2 Sample, Parameters, and Sampling Probability Distributions	3
1.3 Independent and Identically Distributed Models	6
1.4 Dominated Models, Likelihood Function	8
1.5 Marginal and Conditional Models	10
2 Sequential Models and Asymptotics	17
2.1 Introduction	17
2.2 Sequential Stochastic Models and Asymptotics	17
2.3 Convergence in Probability and Almost Sure Convergence – Law of Large Numbers	21
2.4 Convergence in Distribution and Central Limit Theorem	25
2.5 Noncausality and Exogeneity in Dynamic Models	27
2.5.1 Wiener-Granger Causality	28
2.5.2 Exogeneity	30
3 Estimation by Maximization and by the Method of Moments	33
3.1 Introduction	33
3.2 Estimation	33
3.3 Moment Conditions and Maximization	39
3.4 Estimation by the Method of Moments and Generalized Moments	44
3.5 Asymptotic Properties of Estimators	48
	ix

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

x

Contents

4 Asymptotic Tests	61
4.1 Introduction	61
4.2 Tests and Asymptotic Tests	62
4.3 Wald Tests	65
4.4 Rao Test	69
4.5 Tests Based on the Comparison of Minima	73
4.6 Test Based on Maximum Likelihood Estimation	76
4.7 Hausman Tests	78
4.8 Encompassing Test	82
5 Nonparametric Methods	87
5.1 Introduction	87
5.2 Empirical Distribution and Empirical Distribution Function	87
5.3 Density Estimation	91
5.3.1 Construction of the Kernel Estimator of the Density	91
5.3.2 Small Sample Properties of the Kernel Estimator and Choices of Window and Kernel	93
5.3.3 Asymptotic Properties	96
5.4 Semiparametric Methods	98
6 Simulation Methods	103
6.1 Introduction	103
6.2 Random Number Generators	103
6.2.1 Inversion of the Distribution Function	104
6.2.2 Rejection Method	105
6.2.3 Random Vector Generators	106
6.3 Utilization in Calculation Procedures	107
6.3.1 Monte Carlo Integration	107
6.3.2 Simulation-Based Method of Moments	109
6.4 Simulations and Small Sample Properties of Estimators and Tests	116
6.5 Bootstrap and Distribution of the Moment Estimators and of the Density	120
II Regression Models	127
7 Conditional Expectation	129
7.1 Introduction	129
7.2 Conditional Expectation	129
7.3 Linear Conditional Expectation	134

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

Contents	xi
8 Univariate Regression	141
8.1 Introduction	141
8.2 Linear Regression	142
8.2.1 The Assumptions of the Linear Regression Model	142
8.2.2 Estimation by Ordinary Least Squares	144
8.2.3 Small Sample Properties	148
8.2.4 Finite Sample Distribution Under the Normality Assumption	151
8.2.5 Analysis of Variance	156
8.2.6 Prediction	159
8.2.7 Asymptotic Properties	160
8.3 Nonlinear Parametric Regression	165
8.4 Misspecified Regression	169
8.4.1 Properties of the Least Squares Estimators	170
8.4.2 Comparing the True Regression with Its Approximation	172
8.4.3 Specification Tests	174
9 Generalized Least Squares Method, Heteroskedasticity, and Multivariate Regression	179
9.1 Introduction	179
9.2 Allowing for Nuisance Parameters in Moment Estimation	181
9.3 Heteroskedasticity	184
9.3.1 Estimation	185
9.3.2 Tests for Homoskedasticity	196
9.4 Multivariate Regression	199
10 Nonparametric Estimation of the Regression	213
10.1 Introduction	213
10.2 Estimation of the Regression Function by Kernel	214
10.2.1 Calculation of the Asymptotic Mean Integrated Squared Error	216
10.2.2 Convergence of AMISE and Asymptotic Normality	221
10.3 Estimating a Transformation of the Regression Function	223
10.4 Restrictions on the Regression Function	228
10.4.1 Index Models	228
10.4.2 Additive Models	231
11 Discrete Variables and Partially Observed Models	234
11.1 Introduction	234
11.2 Various Types of Models	235

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

xii	Contents	
	11.2.1 Dichotomous Models	235
	11.2.2 Multiple Choice Models	237
	11.2.3 Censored Models	239
	11.2.4 Disequilibrium Models	243
	11.2.5 Sample Selection Models	244
11.3	Estimation	248
	11.3.1 Nonparametric Estimation	248
	11.3.2 Semiparametric Estimation by Maximum Likelihood	250
	11.3.3 Maximum Likelihood Estimation	251
III	Dynamic Models	259
12	Stationary Dynamic Models	261
	12.1 Introduction	261
	12.2 Second Order Processes	262
	12.3 Gaussian Processes	264
	12.4 Spectral Representation and Autocovariance Generating Function	265
	12.5 Filtering and Forecasting	267
	12.5.1 Filters	267
	12.5.2 Linear Forecasting – General Remarks	270
	12.5.3 Wold Decomposition	272
	12.6 Stationary <i>ARMA</i> Processes	273
	12.6.1 Introduction	273
	12.6.2 Invertible <i>ARMA</i> Processes	274
	12.6.3 Computing the Covariance Function of an <i>ARMA</i> (p, q) Process	277
	12.6.4 The Autocovariance Generating Function	278
	12.6.5 The Partial Autocorrelation Function	280
	12.7 Spectral Representation of an <i>ARMA</i> (p, q) Process	282
	12.8 Estimation of <i>ARMA</i> Models	283
	12.8.1 Estimation by the Yule-Walker Method	283
	12.8.2 Box-Jenkins Method	286
	12.9 Multivariate Processes	289
	12.9.1 Some Definitions and General Observations	289
	12.9.2 Underlying Univariate Representation of a Multivariate Process	292
	12.9.3 Covariance Function	294
	12.10 Interpretation of a <i>VAR</i> (p) Model Under Its <i>MA</i> (∞) Form	294
	12.10.1 Propagation of a Shock on a Component	294
	12.10.2 Variance Decomposition of the Forecast Error	295

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

Contents	xiii
12.11 Estimation of $VAR(p)$ Models	296
12.11.1 Maximum Likelihood Estimation of Π	298
12.11.2 Maximum Likelihood Estimation of Ω	300
12.11.3 Asymptotic Distribution of $\hat{\Pi}$ and of $\hat{\Omega}$	301
13 Nonstationary Processes and Cointegration	304
13.1 Introduction	304
13.2 Asymptotic Properties of Least Squares Estimators of $I(1)$ Processes	306
13.3 Analysis of Cointegration and Error Correction Mechanism	325
13.3.1 Cointegration and MA Representation	326
13.3.2 Cointegration in a VAR Model in Levels	327
13.3.3 Triangular Representation	329
13.3.4 Estimation of a Cointegrating Vector	330
13.3.5 Maximum Likelihood Estimation of an Error Correction Model Admitting a Cointegrating Relation	335
13.3.6 Cointegration Test Based on the Canonical Correlations: Johansen's Test	338
14 Models for Conditional Variance	341
14.1 Introduction	341
14.2 Various Types of ARCH Models	341
14.3 Estimation Method	346
14.4 Tests for Conditional Homoskedasticity	357
14.5 Some Specificities of ARCH-Type Models	361
14.5.1 Stationarity	361
14.5.2 Leptokurticity	362
14.5.3 Various Conditional Distributions	363
15 Nonlinear Dynamic Models	366
15.1 Introduction	366
15.2 Case Where the Conditional Expectation Is Continuously Differentiable	367
15.2.1 Definitions	367
15.2.2 Conditional Moments and Marginal Moments in the Homoskedastic Case: Optimal Instruments	368
15.2.3 Heteroskedasticity	372
15.2.4 Modifying of the Set of Conditioning Variables: Kernel Estimation of the Asymptotic Variance	373

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

xiv

Contents

15.3	Case Where the Conditional Expectation Is Not Continuously Differentiable: Regime-Switching Models	376
15.3.1	Presentation of a Few Examples	377
15.3.2	Problem of Estimation	379
15.4	Linearity Test	383
15.4.1	All Parameters Are Identified Under H_0	383
15.4.2	The Problem of the Nonidentification of Some Parameters Under H_0	387
IV	Structural Modeling	393
16	Identification and Overidentification in Structural Modeling	395
16.1	Introduction	395
16.2	Structural Model and Reduced Form	396
16.3	Identification: The Example of Simultaneous Equations	398
16.3.1	General Definitions	398
16.3.2	Linear i.i.d. Simultaneous Equations Models	401
16.3.3	Linear Dynamic Simultaneous Equations Models	407
16.4	Models from Game Theory	410
16.5	Overidentification	414
16.5.1	Overidentification in Simultaneous Equations Models	417
16.5.2	Overidentification and Moment Conditions	418
16.5.3	Overidentification and Nonparametric Models	419
17	Simultaneity	421
17.1	Introduction	421
17.2	Simultaneity and Simultaneous Equations	422
17.3	Endogeneity, Exogeneity, and Dynamic Models	425
17.4	Simultaneity and Selection Bias	428
17.5	Instrumental Variables Estimation	431
17.5.1	Introduction	431
17.5.2	Estimation	433
17.5.3	Optimal Instruments	437
17.5.4	Nonparametric Approach and Endogenous Variables	439
17.5.5	Test of Exogeneity	442
18	Models with Unobservable Variables	446
18.1	Introduction	446
18.2	Examples of Models with Unobservable Variables	448

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

Contents	xv
18.2.1 Random-Effects Models and Random-Coefficient Models	448
18.2.2 Duration Models with Unobserved Heterogeneity	450
18.2.3 Errors-in-Variables Models	453
18.2.4 Partially Observed Markov Models and State Space Models	454
18.3 Comparison Between Structural Model and Reduced Form	456
18.3.1 Duration Models with Heterogeneity and Spurious Dependence on the Duration	457
18.3.2 Errors-in-Variables Model and Transformation of the Coefficients of the Linear Regression	459
18.3.3 Markov Models with Unobservable Variables and Spurious Dynamics of the Model	460
18.4 Identification Problems	461
18.5 Estimation of Models with Unobservable Variables	462
18.5.1 Estimation Using a Statistic Independent of the Unobservables	462
18.5.2 Maximum Likelihood Estimation: EM Algorithm and Kalman Filter	464
18.5.3 Estimation by Integrated Moments	469
18.6 Counterfactuals and Treatment Effects	470
Bibliography	477
Index	493

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Vêlayoudom Marimoutou and Anne Péguin-Feissolle

Frontmatter

[More information](#)

Foreword

Jean-Pierre Florens, Vêlayoudom Marimoutou, and Anne Péguin-Feissolle have done economics a great service by writing this basic contribution to the teaching of econometrics. Econometrics is a major research tool for empirical economics. It unites economics with statistics and extends statistical methods to apply to economic problems and economic data.

Many introductory econometrics textbooks for graduate students have a cook-book quality. They summarize existing knowledge useful for particular problems without laying the foundations for extending existing knowledge. Rules are given without reasons and general principles. Readers who do not know the basic principles have trouble adapting existing knowledge to fit their application.

This book provides an introduction to current econometric knowledge that focuses on teaching the reader foundational statistical principles. It exposites the basic statistical principles underlying modern econometrics. This keeps alive and rejuvenates the tradition of Haavelmo (1944), who, in his Nobel Prize-winning contribution, first synthesized economic statistics with rigorous probability theory. It surveys a large array of econometric models and gives the reader the foundations required to adapt and extend those models to fit their applications. This book is wide ranging in that it covers classical econometric methods associated with linear regression and modern semiparametric cross-section and time series methods. It provides the reader with a useful introduction to a powerful set of tools and a guide to where to go to read the more advanced literature on a variety of topics useful in many fields of economics. Rigorous probability foundations are given and problems of inference and estimation are also discussed.

Readers of this book, be they graduate students or professional economists, will benefit from its depth and range. There is much value in learning modern empirical methods unified by rigorous statistical principles.

James J. Heckman
Nobel Laureate in Economic Science
Chicago, USA
July 2004

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

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Frontmatter

[More information](#)

Preface

The objective of econometrics is to study economic phenomena using statistical observations. Econometrics formalizes the economic theory in the form of relationships (models) whose unknown elements are determined by the available data. Econometrics quantifies and tests economic theories and makes those theories operational through forecasting or simulation of the impact of political or economic decisions.

Historically, econometricians studied first the macroeconomic relationships between large aggregates that describe economic activity at the national level. They then analyzed individual behaviors of consumers and producers. The domain of application later extended to finance, the study of developing countries, education, game theory, and so on.

The aim of econometric research is to discover regular features within the set of variables generated by mechanisms that involve economic components. Hence, it is by nature an applied field, and an econometrics book should provide reliable information on the values of the essential parameters of the economic laws. Reaching this goal is difficult: social phenomena contain few universal laws and each result is limited by the specific conditions in which the phenomenon occurred. Thus, econometrics is essentially a means for the systematic analysis of economic facts and may then be used for forecasting.

The econometric methodology rests on two elements: first, the economic theory that allows us to select the variables, to define the relevant magnitudes to estimate, and to limit the class of models that may be used; second, the statistical techniques for estimating, testing, and forecasting.

The statistical methods used in econometrics have become more and more diverse. Econometrics is built on the analysis of linear regression by the least squares method, but it has developed a larger range of tools for its usage. Because it poses specific questions, it has required original statistical developments. Econometrics draws its specificity from the nature of economic data. On one hand, it is essentially a nonexperimental field that analyzes facts that are unique, nonreproducible, and where the observation conditions are not controlled

Cambridge University Press

978-0-521-87640-7 - Econometric Modeling and Inference

Jean-Pierre Florens, Velayoudom Marimoutou and Anne Peguin-Feissolle

Frontmatter

[More information](#)

xx

Preface

by the econometrician. It seeks to extract some stable relationships between variables. On the other hand, econometrics adopts a structural approach based on economic theory. The observed magnitudes are considered as the equilibrium values resulting from the interaction between several phenomena, and the econometrician strives to recover from the observation of these equilibria the elementary behavior that generated them. This approach poses an identification problem and leads the econometrician to take an interest in parameters that are not natural for a statistician but are relevant for economic theory. Another important characteristic of econometrics is the unobservability of some important magnitudes (unobserved heterogeneity of individuals, hidden characteristics of the business cycle), which, if not taken into account, induce a bias in the estimation of the structural parameters.

The goal of this book is to present the main statistical tools of econometrics, while focusing on the specificity of the econometric methodology.

Part I of the book explains general methods. Two chapters describe the basic cross-sectional and dynamic models (Chapters 1 and 2), while the usual parametric statistics and tests are the subject of Chapters 3 and 4. The chosen point of view now dominating in econometrics is that of the Generalized Method of Moments (GMM), whereas maximum likelihood is considered only as a special case of this method. The choice of GMM is explained by its relevance in structural econometrics. Chapter 5 on nonparametric methods and Chapter 6 on simulation methods complete this statistical overview.

Parts II and III consider classes of models. Part II studies statistical models that are best suited for microeconomic data and mainly focuses on the study of the conditional expectation that is defined from a probabilistic point of view in Chapter 7. Then, Chapters 8 and 9 examine the estimation by ordinary and generalized least squares, respectively. Chapter 10 studies the nonparametric regression and Chapter 11 considers the case of partially observed data from a parametric and a nonparametric perspective.

Part III deals with dynamic models that are designed for macroeconomic and financial applications. Chapter 12 examines univariate and multivariate stationary linear models and Chapter 13 covers nonstationarity and cointegration. This part is completed by Chapter 14, on the models involving conditional heteroskedasticity, and Chapter 15, on nonlinear dynamic models including switching regressions.

We tried the difficult exercise of synthesizing in the fourth part a set of problems specific to the statistical approach in structural econometrics. Thus, three chapters deal with identification and overidentification (Chapter 16), simultaneity (Chapter 17), and unobservability (Chapter 18).

This quick overview shows that we have tried to reach the ambitious objective of covering almost all the econometric methodology. However, we tried to unify the approach by choosing a small number of estimation techniques, mainly GMM and kernel smoothing. This choice led us to sacrifice the Bayesian

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978-0-521-87640-7 - Econometric Modeling and Inference

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Frontmatter

[More information](#)**Preface**

xxi

approach, sieves estimator, extreme values, efficiency frontiers, and other methods. Although the bootstrap is mentioned, its place is certainly insufficient in regard to the importance of this method.

This book is not an applied econometrics book, as it contains no economic or even numerical examples. In contrast, many theoretical examples illustrate our discussion and can be considered as application exercises.

The three authors of this text have taught econometrics at the undergraduate and graduate levels for many years, mainly at the French universities of Aix-Marseille, Bordeaux, and Toulouse. Hence, their thanks go first to their students who helped them improve the presentation of this book.

A special thought goes to Louis-André Gérard-Varet and to Jean-Jacques Laffont, whose disappearances are still felt with much sorrow; these exceptional personalities have deeply marked the authors in their scientific approach.

We are also particularly grateful to Marine Carrasco and Josef Perktold; indeed, they not only translated this book into English but also, by their always relevant remarks, largely contributed to correct its multiple errors and thus to improve its quality and readability.

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