

Applied Econometrics Using Matlab Boston College

This book offers an in-depth and up-to-date review of different statistical tools that can be used to analyze and forecast the dynamics of two crucial for every energy company processes—electricity prices and loads. It provides coverage of seasonal decomposition, mean reversion, heavy-tailed distributions, exponential smoothing, spike preprocessing, autoregressive time series including models with exogenous variables and heteroskedastic (GARCH) components, regime-switching models, interval forecasts, jump-diffusion models, derivatives pricing and the market price of risk. Modeling and Forecasting Electricity Loads and Prices is packaged with a CD containing both the data and detailed examples of implementation of different techniques in Matlab, with additional examples in SAS. A reader can retrace all the intermediate steps of a practical implementation of a model and test his understanding of the method and correctness of the computer code using the same input data. The book will be of particular interest to the quants employed by the utilities, independent power generators and marketers, energy trading desks of the hedge funds and financial institutions, and the executives attending courses designed to help them to brush up on their technical skills. The text will be also of use to graduate students in electrical engineering, econometrics and finance wanting to get a grip on advanced statistical tools applied in this hot area. In fact, there are sixteen Case Studies in the book making it a self-contained tutorial to electricity load and price modeling and forecasting.

Tap into the power of the most popular stochastic volatility model for pricing equity derivatives Since its introduction in 1993, the Heston model has become a popular model for pricing equity derivatives, and the most popular stochastic volatility model in financial engineering. This vital resource provides a thorough derivation of the original model, and includes the most important extensions and refinements that have allowed the model to produce option prices that are more accurate and volatility surfaces that better reflect market conditions. The book's material is drawn from research papers and many of the models covered and the computer codes are unavailable from other sources. The book is light on theory and instead highlights the implementation of the models. All of the models found here have been coded in Matlab and C#. This reliable resource offers an understanding of how the original model was derived from Riccati equations, and shows how to implement implied and local volatility, Fourier methods applied to the model, numerical integration schemes, parameter estimation, simulation schemes, American options, the Heston model with time-dependent parameters, finite difference methods for the Heston PDE, the Greeks, and the double Heston model. A groundbreaking book dedicated to the exploration of the Heston model—a popular model for pricing equity derivatives Includes a companion website, which explores the Heston model and its extensions all coded in Matlab and C# Written by Fabrice Douglas Rouah a quantitative analyst who specializes in financial modeling for derivatives for pricing and risk management Engaging and informative, this is the first book to deal exclusively with the Heston Model and includes code in Matlab and C# for pricing under the model, as well as code for parameter estimation, simulation, finite difference methods, American options, and more.

An Introduction to Statistical Learning provides an accessible overview of the field of statistical learning, an essential toolset for making sense of the vast and complex data sets that have emerged in fields ranging from biology to finance to marketing to astrophysics in the past twenty years. This book presents some of the most important modeling and prediction techniques, along with relevant applications. Topics include linear regression, classification, resampling methods, shrinkage approaches, tree-based methods, support vector machines, clustering, and more. Color graphics and real-world examples are used to illustrate the methods presented. Since the goal of this textbook is to facilitate the

use of these statistical learning techniques by practitioners in science, industry, and other fields, each chapter contains a tutorial on implementing the analyses and methods presented in R, an extremely popular open source statistical software platform. Two of the authors co-wrote *The Elements of Statistical Learning* (Hastie, Tibshirani and Friedman, 2nd edition 2009), a popular reference book for statistics and machine learning researchers. *An Introduction to Statistical Learning* covers many of the same topics, but at a level accessible to a much broader audience. This book is targeted at statisticians and non-statisticians alike who wish to use cutting-edge statistical learning techniques to analyze their data. The text assumes only a previous course in linear regression and no knowledge of matrix algebra.

The last decade has brought dramatic changes in the way that researchers analyze economic and financial time series. This book synthesizes these recent advances and makes them accessible to first-year graduate students. James Hamilton provides the first adequate text-book treatments of important innovations such as vector autoregressions, generalized method of moments, the economic and statistical consequences of unit roots, time-varying variances, and nonlinear time series models. In addition, he presents basic tools for analyzing dynamic systems (including linear representations, autocovariance generating functions, spectral analysis, and the Kalman filter) in a way that integrates economic theory with the practical difficulties of analyzing and interpreting real-world data. *Time Series Analysis* fills an important need for a textbook that integrates economic theory, econometrics, and new results. The book is intended to provide students and researchers with a self-contained survey of time series analysis. It starts from first principles and should be readily accessible to any beginning graduate student, while it is also intended to serve as a reference book for researchers.

Quantitative finance is a combination of economics, accounting, statistics, econometrics, mathematics, stochastic process, and computer science and technology. Increasingly, the tools of financial analysis are being applied to assess, monitor, and mitigate risk, especially in the context of globalization, market volatility, and economic crisis. This two-volume handbook, comprised of over 100 chapters, is the most comprehensive resource in the field to date, integrating the most current theory, methodology, policy, and practical applications. Showcasing contributions from an international array of experts, the *Handbook of Quantitative Finance and Risk Management* is unparalleled in the breadth and depth of its coverage. Volume 1 presents an overview of quantitative finance and risk management research, covering the essential theories, policies, and empirical methodologies used in the field. Chapters provide in-depth discussion of portfolio theory and investment analysis. Volume 2 covers options and option pricing theory and risk management. Volume 3 presents a wide variety of models and analytical tools. Throughout, the handbook offers illustrative case examples, worked equations, and extensive references; additional features include chapter abstracts, keywords, and author and subject indices. From "arbitrage" to "yield spreads," the *Handbook of Quantitative Finance and Risk Management* will serve as an essential resource for academics, educators, students, policymakers, and practitioners.

The new edition of this influential textbook, geared towards graduate or advanced undergraduate students, teaches the statistics necessary for financial engineering. In doing so, it illustrates concepts using financial markets and economic data, R Labs with real-data exercises, and graphical and analytic methods for modeling and diagnosing modeling errors. These methods are critical because financial engineers now have access to enormous quantities of data. To make use of this data, the powerful methods in this book for working with quantitative information, particularly about volatility and risks, are essential. Strengths of this fully-revised edition include major additions to the R code and the advanced topics covered. Individual chapters cover, among other topics, multivariate distributions, copulas, Bayesian computations, risk management, and cointegration. Suggested prerequisites are basic knowledge of statistics and probability, matrices and linear algebra,

and calculus. There is an appendix on probability, statistics and linear algebra. Practicing financial engineers will also find this book of interest.

The financial systems in most developed countries today build up a large amount of model risk on a daily basis. However, this is not particularly visible as the financial risk management agenda is still dominated by the subprime-liquidity crisis, the sovereign crises, and other major political events. Losses caused by model risk are hard to identify and even when they are internally identified, as such, they are most likely to be classified as normal losses due to market evolution. Model Risk in Financial Markets: From Financial Engineering to Risk Management seeks to change the current perspective on model innovation, implementation and validation. This book presents a wide perspective on model risk related to financial markets, running the gamut from financial engineering to risk management, from financial mathematics to financial statistics. It combines theory and practice, both the classical and modern concepts being introduced for financial modelling. Quantitative finance is a relatively new area of research and much has been written on various directions of research and industry applications. In this book the reader gradually learns to develop a critical view on the fundamental theories and new models being proposed. Contents: Introduction Fundamental Relationships Model Risk in Interest Rate Modelling Arbitrage Theory Derivatives Pricing Under Uncertainty Portfolio Selection Under Uncertainty Probability Pitfalls of Financial Calculus Model Risk in Risk Measures Calculations Parameter Estimation Risk Computational Problems Portfolio Selection Using Sharpe Ratio Bayesian Calibration for Low Frequency Data MCMC Estimation of Credit Risk Measures Last But Not Least. Can We Avoid the Next Big Systemic Financial Crisis? Notations for the Study of MLE for CIR Process Readership: Graduate students, researchers, practitioners, senior managers in financial institutions and hedge-funds, regulators and risk managers, who are keen to understand the pitfalls of financial modelling, and also those who are looking for a career in model validation, product control and risk management functions. Key Features: Some innovative results are presented for the first time Covers a wide range of models, results and applications in financial markets to demonstrate that model risk is generally spread Keywords: Model Risk; Risk Management; Financial Engineering; Financial Markets

The developments within the computationally and numerically oriented areas of Operations Research, Finance, Statistics and Economics have been significant over the past few decades. Each area has been developing its own computer systems and languages that suit its needs, but there is relatively little cross-fertilization among them yet. This volume contains a collection of papers that each highlights a particular system, language, model or paradigm from one of the computational disciplines, aimed at researchers and practitioners from the other fields. The 15 papers cover a number of relevant topics: Models and Modelling in Operations Research and Economics, novel High-level and Object-Oriented approaches to programming, through advanced uses of Maple and MATLAB, and applications and solution of Differential Equations in Finance. It is hoped that the material in this volume will whet the reader's appetite for discovering and exploring new approaches to old problems, and in the longer run facilitate cross-fertilization among the fields. We would like to thank the contributing authors, the reviewers, the publisher, and last, but not least, Jesper Saxtorph, Anders Nielsen, and Thomas Stidsen for invaluable technical assistance.

This book is a printed edition of the Special Issue "Unit Roots and Structural Breaks" that was published in Econometrics This book shows how current and recent market prices convey information about the probability distributions that govern future prices. Moving beyond purely theoretical models, Stephen Taylor applies methods supported by empirical research

of equity and foreign exchange markets to show how daily and more frequent asset prices, and the prices of option contracts, can be used to construct and assess predictions about future prices, their volatility, and their probability distributions. Stephen Taylor provides a comprehensive introduction to the dynamic behavior of asset prices, relying on finance theory and statistical evidence. He uses stochastic processes to define mathematical models for price dynamics, but with less mathematics than in alternative texts. The key topics covered include random walk tests, trading rules, ARCH models, stochastic volatility models, high-frequency datasets, and the information that option prices imply about volatility and distributions. *Asset Price Dynamics, Volatility, and Prediction* is ideal for students of economics, finance, and mathematics who are studying financial econometrics, and will enable researchers to identify and apply appropriate models and methods. It will likewise be a valuable resource for quantitative analysts, fund managers, risk managers, and investors who seek realistic expectations about future asset prices and the risks to which they are exposed.

This book addresses both theoretical developments in and practical applications of econometric techniques to finance-related problems. It includes selected edited outcomes of the International Econometric Conference of Vietnam (ECONVN2018), held at Banking University, Ho Chi Minh City, Vietnam on January 15-16, 2018. Econometrics is a branch of economics that uses mathematical (especially statistical) methods to analyze economic systems, to forecast economic and financial dynamics, and to develop strategies for achieving desirable economic performance. An extremely important part of economics is finances: a financial crisis can bring the whole economy to a standstill and, vice versa, a smart financial policy can dramatically boost economic development. It is therefore crucial to be able to apply mathematical techniques of econometrics to financial problems. Such applications are a growing field, with many interesting results – and an even larger number of challenges and open problems.

This impressive Handbook presents the quantitative techniques that are commonly employed in empirical finance research together with real-world, state-of-the-art research examples. Written by international experts in their field, the unique approach describes a question or issue in finance and then demonstrates the methodologies that may be used to solve it. All of the techniques described are used to address real problems rather than being presented for their own sake, and the areas of application have been carefully selected so that a broad range of methodological approaches can be covered. The Handbook is aimed primarily at doctoral researchers and academics who are engaged in conducting original empirical research in finance. In addition, the book will be useful to researchers in the financial markets and also advanced Masters-level students who are writing dissertations.

Although the theme of the monograph is primarily related to “Applied Econometrics”, there are several theoretical contributions that are associated with empirical examples, or directions in which the novel theoretical ideas might be

applied. The monograph is associated with significant and novel contributions in theoretical and applied econometrics; economics; theoretical and applied financial econometrics; quantitative finance; risk; financial modeling; portfolio management; optimal hedging strategies; theoretical and applied statistics; applied time series analysis; forecasting; applied mathematics; energy economics; energy finance; tourism research; tourism finance; agricultural economics; informatics; data mining; bibliometrics; and international rankings of journals and academics.

Empirical likelihood provides inferences whose validity does not depend on specifying a parametric model for the data. Because it uses a likelihood, the method has certain inherent advantages over resampling methods: it uses the data to determine the shape of the confidence regions, and it makes it easy to combine data from multiple sources. It also facilitates incorporating side information, and it simplifies accounting for censored, truncated, or biased sampling. One of the first books published on the subject, *Empirical Likelihood* offers an in-depth treatment of this method for constructing confidence regions and testing hypotheses. The author applies empirical likelihood to a range of problems, from those as simple as setting a confidence region for a univariate mean under IID sampling, to problems defined through smooth functions of means, regression models, generalized linear models, estimating equations, or kernel smooths, and to sampling with non-identically distributed data. Abundant figures offer visual reinforcement of the concepts and techniques. Examples from a variety of disciplines and detailed descriptions of algorithms-also posted on a companion Web site at-illustrate the methods in practice. Exercises help readers to understand and apply the methods. The method of empirical likelihood is now attracting serious attention from researchers in econometrics and biostatistics, as well as from statisticians. This book is your opportunity to explore its foundations, its advantages, and its application to a myriad of practical problems.

This is a book on the basics of mathematics and computation and their uses in economics for modern day students and practitioners. The reader is introduced to the basics of numerical analysis as well as the use of computer programs such as Matlab and Excel in carrying out involved computations. Sections are devoted to the use of Maple in mathematical analysis. Examples drawn from recent contributions to economic theory and econometrics as well as a variety of end of chapter exercises help to illustrate and apply the presented concepts.

Technological improvements continue to push back the frontier of processor speed in modern computers. Unfortunately, the computational intensity demanded by modern research problems grows even faster. Parallel computing has emerged as the most successful bridge to this computational gap, and many popular solutions have emerged based on its concepts

La cartilla va dirigida a estudiantes y profesionales de Ingeniería, Finanzas, Administración y Economía que deseen adquirir conocimientos

respecto al uso de Matlab y primordialmente, en la implementación de modelos de volatilidad con esta herramienta. El libro busca responder a una necesidad latente relacionada con la dificultad de enlazar la teoría y la práctica del análisis de volatilidad, pues que además de los conceptos teóricos se presentan los fundamentos de implementación de los modelos tradicionales Arch y Garch por medio de una herramienta de amplia difusión como lo es MatLab. El libro es importante desde el punto de vista teórico pues se hace una congregación de las primordiales técnicas de modelamiento de volatilidad a través de modelos Arch y Garch, tanto univariados como multivariados; y desde el punto de vista práctico, pues dichos modelos teóricos se implementan por medio de Matlab.

This textbook is designed for students and industry practitioners for a first course in optimization integrating MATLAB® software.

Applied Linear Statistical Models 5e is the long established leading authoritative text and reference on statistical modeling. For students in most any discipline where statistical analysis or interpretation is used, ALSM serves as the standard work. The text includes brief introductory and review material, and then proceeds through regression and modeling for the first half, and through ANOVA and Experimental Design in the second half. All topics are presented in a precise and clear style supported with solved examples, numbered formulae, graphic illustrations, and "Notes" to provide depth and statistical accuracy and precision. Applications used within the text and the hallmark problems, exercises, and projects are drawn from virtually all disciplines and fields providing motivation for students in virtually any college. The Fifth edition provides an increased use of computing and graphical analysis throughout, without sacrificing concepts or rigor. In general, the 5e uses larger data sets in examples and exercises, and where methods can be automated within software without loss of understanding, it is so done.

Graduate Econometrics Lecture Notes By Michael Creel

Palgrave Handbook of Econometrics Volume 2: Applied Econometrics Springer

Handbook of Computational Econometrics examines the state of the art of computational econometrics and provides exemplary studies dealing with computational issues arising from a wide spectrum of econometric fields including such topics as bootstrapping, the evaluation of econometric software, and algorithms for control, optimization, and estimation. Each topic is fully introduced before proceeding to a more in-depth examination of the relevant methodologies and valuable illustrations. This book: Provides self-contained treatments of issues in computational econometrics with illustrations and invaluable bibliographies. Brings together contributions from leading researchers. Develops the techniques needed to carry out computational econometrics. Features network studies, non-parametric estimation, optimization techniques, Bayesian estimation and inference, testing methods, time-series analysis, linear and nonlinear methods, VAR analysis, bootstrapping developments, signal extraction, software history and evaluation. This book will appeal to econometricians, financial statisticians, econometric researchers and students of econometrics at both graduate and advanced undergraduate levels.

This paper studies the transmission of crime shocks to the economy in a sample of 32 Mexican states over the period from 1993 to 2012. The paper uses a panel structural VAR approach which accounts for the heterogeneity of the dynamic state level responses in GDP, FDI and international migration flows, and measures the transmission via the impulse response of homicide rates. The approach also allows the study of the pattern of economic responses among states. In particular, the percentage of GDP devoted to new construction and the perception of public security are characteristics that are shown to be associated with the sign and magnitude of the responses of economic variables to crime shocks.

This book gives an authoritative overview of the literature on non-stationarity, integration and unit roots, providing direction and guidance. It

also provides detailed examples to show how the techniques can be applied in practical situations and the pitfalls to avoid.

This book describes the new generation of discrete choice methods, focusing on the many advances that are made possible by simulation. Researchers use these statistical methods to examine the choices that consumers, households, firms, and other agents make. Each of the major models is covered: logit, generalized extreme value, or GEV (including nested and cross-nested logits), probit, and mixed logit, plus a variety of specifications that build on these basics. Simulation-assisted estimation procedures are investigated and compared, including maximum simulated likelihood, method of simulated moments, and method of simulated scores. Procedures for drawing from densities are described, including variance reduction techniques such as antithetics and Halton draws. Recent advances in Bayesian procedures are explored, including the use of the Metropolis-Hastings algorithm and its variant Gibbs sampling. The second edition adds chapters on endogeneity and expectation-maximization (EM) algorithms. No other book incorporates all these fields, which have arisen in the past 25 years. The procedures are applicable in many fields, including energy, transportation, environmental studies, health, labor, and marketing.

This book surveys big data tools used in macroeconomic forecasting and addresses related econometric issues, including how to capture dynamic relationships among variables; how to select parsimonious models; how to deal with model uncertainty, instability, non-stationarity, and mixed frequency data; and how to evaluate forecasts, among others. Each chapter is self-contained with references, and provides solid background information, while also reviewing the latest advances in the field. Accordingly, the book offers a valuable resource for researchers, professional forecasters, and students of quantitative economics. Following these seminal Palgrave Handbook of Econometrics: Volume I, this second volume brings together the finest academics working in econometrics today and explores applied econometrics, containing contributions on subjects including growth/development econometrics and applied econometrics and computing.

In addition to econometric essentials, this book covers important new extensions as well as how to get standard errors right. The authors explain why fancier econometric techniques are typically unnecessary and even dangerous.

This book introduces methods of robust optimization in multivariate adaptive regression splines (MARS) and Conic MARS in order to handle uncertainty and non-linearity. The proposed techniques are implemented and explained in two-model regulatory systems that can be found in the financial sector and in the contexts of banking, environmental protection, system biology and medicine.

The book provides necessary background information on multi-model regulatory networks, optimization and regression. It presents the theory of and approaches to robust (conic) multivariate adaptive regression splines - R(C)MARS – and robust (conic) generalized partial linear models – R(C)GPLM – under polyhedral uncertainty. Further, it introduces spline regression models for multi-model regulatory networks and interprets (C)MARS results based on different datasets for the implementation. It explains robust optimization in these models in terms of both the theory and methodology. In this context it studies R(C)MARS results with different uncertainty scenarios for a numerical example. Lastly, the book demonstrates the implementation of the method in a number of applications from the financial, energy, and environmental sectors, and provides an outlook on future research.

This volume contains forty-one selected full-text contributions from the Fourth European Conference on Geostatistics for Environmental Applications, geoENV IV, held in Barcelona, Spain, November 2002. The objective of the editors was to compile a set of papers from which the reader could perceive how geostatistics is applied within the environmental sciences. A few selected theoretical contributions are also included. The papers are organized in the following sections: -Air pollution and satellite images, -Ecology and environment, -Hydrogeology, -Climatology and rainfall, -Oceanography, -Soil science, -Methodology. Applications of geostatistics vary from particle matter analysis, land cover classification, space-time ozone mapping, downscaling of precipitation, contaminant transport in the subsurface, aquifer reclamation, analysis of Iberian hare or phytoplankton abundance, coastal current patterns, to soil pollution by heavy metals or dioxins. At the back of the book nineteen posters presented at the congress are included. The combination of full texts and posters provides a picture of the tendencies that can presently be found in Europe regarding the applications of geostatistics for environmentally related problems. Audience: After four editions the geoENV Congress Series has established itself as a 'must' to all scientists working in the field of geostatistics for environmental applications. Each geoENV congress covers the developments which have occurred during the preceding two years, but always with a highly applied focus. It is precisely this focus on the applications to environmental sciences which makes the geoENV volumes unique and of great interest and practical value to geostatisticians working both in academia and in industry.

This best-selling textbook addresses the need for an introduction to econometrics specifically written for finance students. Key features:

- Thoroughly revised and updated, including two new chapters on panel data and limited dependent variable models
- Problem-solving approach assumes no prior knowledge of econometrics emphasising intuition rather than formulae, giving students the skills and confidence to estimate and interpret models
- Detailed examples and case studies from finance show students how techniques are applied in real research
- Sample instructions and output from the popular computer package EViews enable students to implement models themselves and understand how to interpret results
- Gives advice on planning and executing a project in empirical finance, preparing students for using econometrics in practice
- Covers important modern topics such as time-series forecasting, volatility modelling, switching models and simulation methods
- Thoroughly class-tested in leading finance schools. Bundle with EViews student version 6 available. Please contact us for more details.

Spatial econometrics deals with spatial dependence and spatial heterogeneity, critical aspects of the data used by regional scientists. These characteristics may cause standard econometric techniques to become inappropriate. In this book, I combine several recent research results to construct a comprehensive approach to the incorporation of spatial effects in econometrics. My primary focus is to demonstrate how these spatial effects can be considered as special cases of general frameworks in standard econometrics, and to outline how they necessitate a separate set of methods and techniques, encompassed within the field of spatial econometrics. My viewpoint differs from that taken in the discussion of spatial autocorrelation in spatial statistics - e.g., most recently by Cliff and Ord (1981) and Upton and Fingleton (1985) - in that I am mostly concerned with the relevance of spatial effects on model specification, estimation and other inference, in what I call a model-driven approach, as opposed to a data-driven

approach in spatial statistics. I attempt to combine a rigorous econometric perspective with a comprehensive treatment of methodological issues in spatial analysis.

The rising trend in the global energy demand poses new challenges to humankind. The energy and mechanical engineering sectors are called to develop new and more environmentally friendly solutions to harvest residual energy from primary production processes. The Organic Rankine Cycle (ORC) is an emerging energy system for power production and waste heat recovery. In the near future, this technology can play an increasing role within the energy generation sectors and can help achieve the carbon footprint reduction targets of many industrial processes and human activities. This Special Issue focuses on selected research and application cases of ORC-based waste heat recovery solutions. Topics included in this publication cover the following aspects: performance modeling and optimization of ORC systems based on pure and zeotropic mixture working fluids; applications of waste heat recovery via ORC to gas turbines and reciprocating engines; optimal sizing and operation of ORC under combined heat and power and district heating application; the potential of ORC on board ships and related issues; life cycle analysis for biomass application; ORC integration with supercritical CO₂ cycle; and the proper design of the main ORC components, including fluid dynamics issues. The current state of the art is considered and some cutting-edge ORC technology research activities are examined in this book.

The geography of networks and R&D collaborations, in particular the spatial dimension of interactions between organisations performing joint R&D, have attracted a burst of attention in the last decade, both in the scientific study of the networks and in the policy sector. The volume is intended to bring together a selection of articles providing novel theoretical and empirical insights into the geographical dynamics of such networks and R&D collaborations, using new, systematic data sources and employing cutting-edge spatial analysis and spatial econometric techniques. It comprises a section on analytic advances and methodology and two thematic sections on structure and spatial characteristics of R&D networks and the impact of R&D networks and policy implications. The edited volume provides a collection of high-level research contributions with an aim to contribute to the recent debate in economic geography and regional science on how the structure of formal and informal networks modifies and influences the spatial and temporal diffusion of knowledge.

A unified and comprehensive introduction to the analytical and numerical tools for solving dynamic economic problems; substantially revised for the second edition. This book offers a unified, comprehensive, and up-to-date treatment of analytical and numerical tools for solving dynamic economic problems. The focus is on introducing recursive methods—an important part of every economist's set of tools—and readers will learn to apply recursive methods to a variety of dynamic economic problems. The book is notable for its combination of theoretical foundations and numerical methods. Each topic is first described in theoretical terms, with explicit definitions and rigorous proofs; numerical methods and computer codes to implement these methods follow. Drawing on the latest research, the book covers such cutting-edge topics as asset price bubbles, recursive utility, robust control, policy analysis in dynamic New Keynesian models with the zero lower bound on interest rates, and Bayesian estimation of dynamic

stochastic general equilibrium (DSGE) models. This second edition has been substantially updated. Responding to renewed interest in modeling with multiple equilibria, it incorporates new material on this topic throughout. It offers an entirely new chapter on deterministic nonlinear systems, and provides new material on such topics as linear planar systems, chaos, bifurcations, indeterminacy and sunspot solutions, pruning nonlinear solutions, the bandit problem, rational inattention models, bequests, self-fulfilling prophecies, the cyclical behavior of unemployment and vacancies, and the long-run risk model. The exposition of each chapter has been revised and improved, and many new figures, Matlab codes, and exercises have been added. A student solutions manual can be purchased separately.

Although interest in spatial regression models has surged in recent years, a comprehensive, up-to-date text on these approaches does not exist. Filling this void, *Introduction to Spatial Econometrics* presents a variety of regression methods used to analyze spatial data samples that violate the traditional assumption of independence between observations. It explores a wide range of alternative topics, including maximum likelihood and Bayesian estimation, various types of spatial regression specifications, and applied modeling situations involving different circumstances. Leaders in this field, the authors clarify the often-mystifying phenomenon of simultaneous spatial dependence. By presenting new methods, they help with the interpretation of spatial regression models, especially ones that include spatial lags of the dependent variable. The authors also examine the relationship between spatiotemporal processes and long-run equilibrium states that are characterized by simultaneous spatial dependence. MATLAB® toolboxes useful for spatial econometric estimation are available on the authors' websites. This work covers spatial econometric modeling as well as numerous applied illustrations of the methods. It encompasses many recent advances in spatial econometric models—including some previously unpublished results.

This publication contains a substantial amount of detail about the broad history of the development of econometric software based on the personal recollections of many people. For economists, the computer has increasingly become the primary applied research tool, and it is software that makes the computer work. It matters that this software should be the best that it can be, for not only does it permit necessary calculations to be performed but it also determines, for better or worse over time, how easy or how difficult the applied research process will be for each succeeding generation of economists. This assertion assumes of course the availability of the necessary data, and that observations can be obtained relatively easily but in the day of the Internet, data distribution is also a matter of software. And, in addition, there is the consideration that both the quality and the amount of possible research, as a matter of time spent, may be crucially dependent on just how good that software is, both in its computational properties and as a time saver. This publication includes revealing descriptions of computer-based research that illustrates the role of the computer in the progress of econometric theory and economic research and aspects of the development of econometric software, starting from the hand calculation era and continuing to relatively modern times.

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