

## Spatial Econometrics Methods And Models

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.

This is an introductory textbook on spatial analysis and spatial statistics through GIS. Each chapter presents methods and metrics, explains how to interpret results, and provides worked examples. Topics include: describing and mapping data through exploratory spatial data analysis; analyzing geographic distributions and point patterns; spatial autocorrelation; spatial clustering; geographically weighted regression and OLS regression; and spatial econometrics. The worked examples link theory to practice through a single real-world case study, with software and illustrated guidance. Exercises are solved twice: first through ArcGIS, and then GeoDa. Through a simple methodological framework the book describes the dataset, explores spatial relations and associations, and builds models. Results are critically interpreted, and the advantages and pitfalls of using various spatial analysis methods are discussed. This is a valuable resource for graduate students and researchers analyzing geospatial data through a spatial analysis lens, including those using GIS in the environmental sciences, geography, and social sciences.

Advances in Econometrics 37 highlights key research in econometrics in a user friendly way for economists who are not econometricians.

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 field of spatial econometrics has come to include the methods and models that deal with estimation and testing problems encountered when attempting to implement regional economic models. Those problems are often characterized by the difficulties associated with assessing the importance of spatial dependence and spatial heterogeneity. This book includes contributions on spatial proximity, spatial patterning and in particular the spatial association (dependence) contained in local map patterns.

Applied Spatial Data Analysis with R, second edition, is divided into two basic parts, the first presenting R packages, functions, classes and methods for handling spatial data. This part is of interest to users who need to access and visualise spatial data. Data import and export for many file formats for spatial data are covered in detail, as is the interface between R and the open source GRASS GIS and the handling of spatio-temporal data. The second part showcases more specialised kinds of spatial data analysis, including spatial point pattern analysis, interpolation and geostatistics, areal data analysis and disease mapping. The coverage of methods of spatial data analysis ranges from standard techniques to new developments, and the examples used are largely taken from the spatial statistics literature. All the examples can be run using R contributed packages available from the CRAN website, with code and additional data sets from the book's own website. Compared to the first edition, the second edition covers the more systematic approach towards handling spatial data in R, as well as a number of important and widely used CRAN packages that have appeared since the first edition. This book will be of interest to researchers who intend to use R to handle, visualise, and analyse spatial data. It will also be of interest to spatial data analysts who do not use R, but who are interested in practical aspects of implementing software for spatial data analysis. It is a suitable companion book for introductory spatial statistics courses and for applied methods courses in a wide range of subjects using spatial data, including human and physical geography, geographical information science and geoinformatics, the environmental sciences, ecology, public health and disease control, economics, public administration and political science. The book has a website where complete code examples, data sets, and other support material may be found: <http://www.asdar-book.org>. The authors have taken part in writing and maintaining software for spatial data handling and analysis with R in concert since 2003.

This book is concerned with spatial dependence in econometric models, offering a work of reference to the applied researcher. In economics, spatial aspects are usually somewhat disregarded, which - as is shown and quantified here - may seriously impair research results. It presents the basic tool kit of treating cross sectional dependence, which typically occurs between spatial observations. The methods are introduced as straightforward enhancement of standard econometric models and methods, placing emphasis on the practical aspects of their features.

Panel data econometrics has evolved rapidly over the past three decades. The field is of both theoretical and practical importance, and methods to deal with micro- and macroeconomic panel data are in high demand from practitioners. Applications in finance, development, trade, marketing, health, labor, and consumer economics attest to the usefulness of these methods in applied economics. This book is a comprehensive source on panel data. It contains 20 chapters edited by Professor Badi Baltagi--one of the leading econometricians in the area of panel data econometrics--and authored by renowned experts in the field. The chapters are divided into two sections. Part I examines new

developments in theory. It includes panel cointegration, dynamic panel data models, incidental parameters and dynamic panel modeling, and panel data models for discrete choice. The chapters in Part II target applications of panel data, including health, labor, marketing, trade, productivity and macro applications in panels.

This book aims at meeting the growing demand in the field by introducing the basic spatial econometrics methodologies to a wide variety of researchers. It provides a practical guide that illustrates the potential of spatial econometric modelling, discusses problems and solutions and interprets empirical results.

World-renowned experts in spatial statistics and spatial econometrics present the latest advances in specification and estimation of spatial econometric models. This includes information on the development of tools and software, and various applications. The text introduces new tests and estimators for spatial regression models, including discrete choice and simultaneous equation models. The performance of techniques is demonstrated through simulation results and a wide array of applications related to economic growth, international trade, knowledge externalities, population-employment dynamics, urban crime, land use, and environmental issues. An exciting new text for academics with a theoretical interest in spatial statistics and econometrics, and for practitioners looking for modern and up-to-date techniques.

A Companion to Theoretical Econometrics provides a comprehensive reference to the basics of econometrics. This companion focuses on the foundations of the field and at the same time integrates popular topics often encountered by practitioners. The chapters are written by international experts and provide up-to-date research in areas not usually covered by standard econometric texts. Focuses on the foundations of econometrics. Integrates real-world topics encountered by professionals and practitioners. Draws on up-to-date research in areas not covered by standard econometrics texts. Organized to provide clear, accessible information and point to further readings.

?This book provides an overview of three generations of spatial econometric models: models based on cross-sectional data, static models based on spatial panels and dynamic spatial panel data models. The book not only presents different model specifications and their corresponding estimators, but also critically discusses the purposes for which these models can be used and how their results should be interpreted.

Spatial Regression Models illustrates the use of spatial analysis in the social sciences within a regression framework and is accessible to readers with no prior background in spatial analysis. The text covers different modeling-related topics for continuous dependent variables, including mapping data on spatial units, creating data from maps, analyzing exploratory spatial data, working with regression models that have spatially dependent regressors, and estimating regression models with spatially correlated error structures.

Using social science examples based on real data, the authors illustrate the concepts discussed, and show how to obtain and interpret relevant results. The examples are presented along with the relevant code to replicate all the analysis using the R package for statistical computing. Users can download both the data and computer code to work through all the examples found in the text. New to the Second Edition is a chapter on mapping as data exploration and its role in the research process, updates to all chapters based on substantive and methodological work, as well as software updates, and information on estimation of time-series, cross-sectional spatial models. Available with Perusall—an eBook that makes it easier to prepare for class Perusall is an award-winning eBook platform featuring social annotation tools that allow students and instructors to collaboratively mark up and discuss their SAGE textbook. Backed by research and supported by technological innovations developed at Harvard University, this process of learning through collaborative annotation keeps your students engaged and makes teaching easier and more effective. Learn more.

Tools such as GIS and remote sensing are increasingly being used in monitoring agricultural resources. As a result, there is need for effective methods for the collection and analysis of agricultural data with particular reference to space. Since land is a key resource in agriculture, most of the data collected are of spatial nature or can be related to a map through geo-referencing techniques of the statistical units. It is now a common practice in many countries that the state statistical agency geo-references typical sampling frames of physical or administrative bodies used in agricultural surveys, not only according to the codes of a geographical nomenclature, but also adding information regarding the exact, or estimated, position of each record. This information is used in agricultural economics to develop advanced models in spatial econometrics. The developments in GIS technology offer growing opportunities to agricultural economists to deal with large and detailed spatial databases, making it possible to combine spatial information from different sources and to produce different models, tabular, and graphic outputs. These tools allow the application of a wide range of operations to spatial information derived from different sources; though without considering the specific nature of the different typology of spatial data. Thus, such an automated process appears to be responsible for the tendency of many practitioners to neglect particularities of spatial data with respect to data stored in conventional databases. This book attempts to describe the main typology of agricultural data, the most appropriate methods for the analysis together with a detailed description of the available data sources and their collection methods. Topics such as spatial interpolation, point patterns, spatial autocorrelation, survey data analysis, small area estimation, regional data modeling, and spatial econometrics techniques are covered jointly with issues arising from the integration of several data types.

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.

Spatial Econometrics provides a modern, powerful and flexible skillset to early career researchers interested in entering this rapidly expanding discipline. It articulates the principles and current practice of modern spatial econometrics and spatial statistics, combining rigorous depth of presentation with unusual depth of coverage. Introducing and formalizing the principles of, and 'need' for, models which define spatial interactions, the book provides a comprehensive framework for almost every major facet of modern science. Subjects covered at length include spatial regression models, weighting matrices, estimation procedures and the complications associated with their use. The work particularly focuses on models of uncertainty and estimation under various complications relating to model specifications, data problems, tests of hypotheses, along with systems and panel data extensions which are covered in exhaustive detail. Extensions discussing pre-test procedures and Bayesian methodologies are provided at length. Throughout, direct applications of spatial models are described in detail, with copious illustrative empirical examples demonstrating how readers might implement spatial analysis in research projects. Designed as a textbook and reference companion, every chapter concludes with a set of questions for formal or self--study. Finally, the book includes extensive supplementing information in a large sample theory in the R programming language that supports early career econometricians interested in the implementation of statistical procedures covered. Combines advanced theoretical foundations with cutting-edge computational developments in R Builds from solid foundations, to more sophisticated extensions that are intended to jumpstart research careers in spatial econometrics Written by two of the most accomplished and extensively published econometricians working in the discipline Describes fundamental principles intuitively, but without sacrificing rigor Provides empirical illustrations for many spatial methods across diverse field Emphasizes a modern treatment of the field using the generalized method of moments (GMM) approach Explores sophisticated modern research methodologies, including pre-test procedures and Bayesian data analysis

Spatial Econometrics is a rapidly evolving field born from the joint efforts of economists, statisticians, econometricians and regional scientists. The book provides the reader with a broad view of the topic by including both methodological and application papers. Indeed the application papers relate to a number of diverse scientific fields ranging from hedonic models of house pricing to demography, from health care to regional economics, from the analysis of R&D spillovers to the study of retail market spatial characteristics. Particular emphasis is given to regional economic applications of spatial econometrics methods with a number of contributions specifically focused on the spatial concentration of economic activities and agglomeration, regional paths of economic growth, regional convergence of income and productivity and the evolution of regional employment. Most of the papers appearing in this book were solicited from the International Workshop on Spatial Econometrics and Statistics held in Rome (Italy) in 2006.

This book provides the most comprehensive treatment to date of microeconometrics, the analysis of individual-level data on the economic behavior of individuals or firms using regression methods for cross section and panel data. The book is oriented to the practitioner. A basic understanding of the linear regression model with matrix algebra is assumed. The text can be used for a microeconometrics course, typically a second-year economics PhD course; for data-oriented applied microeconometrics field courses; and as a reference work for graduate students and applied researchers who wish to fill in gaps in their toolkit. Distinguishing features of the book include emphasis on nonlinear models and robust inference, simulation-based estimation, and problems of complex survey data. The book makes frequent use of numerical examples based on generated data to illustrate the key models and methods. More substantially, it systematically integrates into the text empirical illustrations based on seven large and exceptionally rich data sets. The promising new directions for research and applications described here include alternative model specifications, estimators and tests for regression models and new perspectives on dealing with spatial effects in models with limited dependent variables and space-time data.

Among the many uses of hierarchical modeling, their application to the statistical analysis of spatial and spatio-temporal data from areas such as epidemiology And environmental science has proven particularly fruitful. Yet to date, the few books that address the subject have been either too narrowly focused on specific aspects of spatial analysis,

This book is the definitive user's guide to the spatial regression functionality in the software packages GeoDa and GeoDaSpace, as well as the spreg module in the PySAL library --all developed at the GeoDa Center for Geospatial Analysis and Computation. The book provides the techniques to test for and estimate spatial effects in linear regression models, addressing both spatial dependence (spatial autoregressive models) as well as spatial heterogeneity (spatial regimes models). The book also serves as an introduction and a practical guide to spatial econometrics in that it covers the methodological principles and formal results that underlie the various estimation methods, test procedures and model characteristics computed by the software. While the classical maximum likelihood estimation is included, the book's coverage emphasizes modern techniques based on the principle of generalized method of moments (GMM).

Specially selected from The New Palgrave Dictionary of Economics 2nd edition, each article within this compendium covers the fundamental themes within the discipline and is written by a leading practitioner in the field. A handy reference tool.

Modern tools, such as GIS and remote sensing, are increasingly used in the monitoring of agricultural resources. The developments in GIS technology offer growing opportunities



to agricultural economics analysts dealing with large and detailed spatial databases, allowing them to combine spatial information from different sources and to produce different models. The availability of these valuable sources of information makes the advanced models suggested in the spatial statistic and econometric literature applicable to agricultural economics. This book aims at supporting stakeholders to design spatial surveys for agricultural data and/or to analyse the geographically collected data. This book attempts to describe the main typology of agricultural data and the most appropriate methods for the analysis, together with a detailed description of the available data sources and their collection methods. Topics such as spatial interpolation, point patterns, spatial autocorrelation, survey data analysis, small area estimation, regional data modelling, and spatial econometrics techniques are covered jointly with issues arising from the integration of several data types. The theory of spatial methods is complemented by real and/or simulated examples implemented through the open-source software R.

This book shows how to model the spatial interactions between actors that are at the heart of the social sciences.

The availability of spatial databases and widespread use of geographic information systems has stimulated increasing interest in the analysis and modelling of spatial data. Spatial data analysis focuses on detecting patterns, and on exploring and modelling relationships between them in order to understand the processes responsible for their emergence. In this way, the role of space is emphasised, and our understanding of the working and representation of space, spatial patterns, and processes is enhanced. In applied research, the recognition of the spatial dimension often yields different and more meaningful results and helps to avoid erroneous conclusions. This book aims to provide an introduction into spatial data analysis to graduates interested in applied statistical research. The text has been structured from a data-driven rather than a theory-based perspective, and focuses on those models, methods and techniques which are both accessible and of practical use for graduate students. Exploratory techniques as well as more formal model-based approaches are presented, and both area data and origin-destination flow data are considered.

This restructured, updated Third Edition provides a general overview of the econometrics of panel data, from both theoretical and applied viewpoints. Readers discover how econometric tools are used to study organizational and household behaviors as well as other macroeconomic phenomena such as economic growth. The book contains sixteen entirely new chapters; all other chapters have been revised to account for recent developments. With contributions from well known specialists in the field, this handbook is a standard reference for all those involved in the use of panel data in econometrics.

Showcasing fresh methodological and empirical research on the econometrics of networks, and comprising both theoretical, empirical and policy papers, the authors in this volume bring together a wide range of perspectives to facilitate a dialogue between academics and practitioners for better understanding this groundbreaking field.

Presents 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 preeminent position in econometrics overall. Split into 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 over-identification, simultaneity, and unobservability. Many theoretical examples illustrate the discussion and can be treated as application exercises. Nobel Laureate James A. Heckman offers a foreword to the work.

Focusing on econometric models that confront estimation and inference issues occurring when sample data exhibit spatial or spatiotemporal dependence, this volume features contributions that provide details regarding estimation and inference based on a variety of econometric methods. provides an overview of spatial econometric models and methods.

Spatial econometrics can be defined in a narrow and in a broader sense. In a narrow sense it refers to methods and techniques for the analysis of regression models using data observed within discrete portions of space such as countries or regions. In a broader sense it is inclusive of the models and theoretical instruments of spatial statistics and spatial data analysis to analyze various economic effects such as externalities, interactions, spatial concentration and many others. Indeed, the reference methodology for spatial econometrics lies on the advances in spatial statistics where it is customary to distinguish between different typologies of data that can be encountered in empirical cases and that require different modelling strategies. A first distinction is between continuous spatial data and data observed on a discrete space. Continuous spatial data are very common in many scientific disciplines (such as physics and environmental sciences), but are still not currently considered in the spatial econometrics literature. Discrete spatial data can take the form of points, lines and polygons. Point data refer to the position of the single economic agent observed at an individual level. Lines in space take the form of interactions between two spatial locations such as flows of goods, individuals and information. Finally data observed within polygons can take the form of predefined irregular portions of space, usually administrative partitions such as countries, regions or counties within one country.

What do economists know about land-and how they know? The Oxford Handbook of Land Economics describes the latest developments in the fields of economics that examine land, including natural resource economics, environmental economics, regional science, and urban economics. The handbook argues, first, that land is a theme that integrates these fields and second, that productive integration increasingly occurs not just within economics but also across disciplines. Greater recognition and integration stimulates cross-fertilization among the fields of land economics research. By providing a comprehensive survey of land-related work in several economics fields, this handbook provides the basic

tools needed for economists to redefine the scope and focus of their work to better incorporate the contemporary thinking from other fields and to push out the frontiers of land economics. The first section presents recent advances in the analysis of major drivers of land use change, focusing on economic development and various land-use markets. The second section presents economic research on the environmental and socio-economic impacts of land use and land use change. The third section addresses six cutting-edge approaches for land economics research, including spatial econometric, simulation, and experimental methods. The section also includes a synthetic chapter critically reviewing methodological advances. The fourth section covers policy issues. Four chapters disentangle the economics of land conservation and preservation, while three chapters examine the economic analysis of the legal institutions of land use. These chapters focus on law and economic problems of permissible government control of land in the U.S. context. *Spatial Analysis Using Big Data: Methods and Urban Applications* helps readers understand the most powerful, state-of-the-art spatial econometric methods, focusing particularly on urban research problems. The methods represent a cluster of potentially transformational socio-economic modeling tools that allow researchers to capture real-time and high-resolution information to potentially reveal new socioeconomic dynamics within urban populations. Each method, written by leading exponents of the discipline, uses real-time urban big data to solve research problems in spatial science. Urban applications of these methods are provided in unsurpassed depth, with chapters on surface temperature mapping, view value analysis, community clustering and spatial-social networks, among many others. Reviews some of the most powerful and challenging modern methods to study big data problems in spatial science Provides computer codes written in R, MATLAB and Python to help implement methods Applies these methods to common problems observed in urban and regional economics

This work examines theoretical issues, as well as practical developments in statistical inference related to econometric models and analysis. This work offers discussions on such areas as the function of statistics in aggregation, income inequality, poverty, health, spatial econometrics, panel and survey data, bootstrapping and time series.

This contributed volume applies spatial and space-time econometric methods to spatial interaction modeling. The first part of the book addresses general cutting-edge methodological questions in spatial econometric interaction modeling, which concern aspects such as coefficient interpretation, constrained estimation, and scale effects. The second part deals with technical solutions to particular estimation issues, such as intraregional flows, Bayesian PPML and VAR estimation. The final part presents a number of empirical applications, ranging from interregional tourism competition and domestic trade to space-time migration modeling and residential relocation.

This textbook is a comprehensive introduction to applied spatial data analysis using R. Each chapter walks the reader through a different method, explaining how to interpret the results and what conclusions can be drawn. The author team showcases key topics, including unsupervised learning, causal inference, spatial weight matrices, spatial econometrics, heterogeneity and bootstrapping. It is accompanied by a suite of data and R code on Github to help readers practise techniques via replication and exercises. This text will be a valuable resource for advanced students of econometrics, spatial planning and regional science. It will also be suitable for researchers and data scientists working with spatial data.

*Spatial Econometrics: Methods and Models* Springer Science & Business Media

-The objective of this book is to make a link between existing quantitative approaches... and the manner in which we can generalize these approaches to cases where the available data for analysis have a spatial dimension.---

*Spatial Microeconometrics* introduces the reader to the basic concepts of spatial statistics, spatial econometrics and the spatial behavior of economic agents at the microeconomic level. Incorporating useful examples and presenting real data and datasets on real firms, the book takes the reader through the key topics in a systematic way. The book outlines the specificities of data that represent a set of interacting individuals with respect to traditional econometrics that treat their locational choices as exogenous and their economic behavior as independent. In particular, the authors address the consequences of neglecting such important sources of information on statistical inference and how to improve the model predictive performances. The book presents the theory, clarifies the concepts and instructs the readers on how to perform their own analyses, describing in detail the codes which are necessary when using the statistical language R. The book is written by leading figures in the field and is completely up to date with the very latest research. It will be invaluable for graduate students and researchers in economic geography, regional science, spatial econometrics, spatial statistics and urban economics.

*Modelling Spatial and Spatial-Temporal Data: A Bayesian Approach* is aimed at statisticians and quantitative social, economic and public health students and researchers who work with spatial and spatial-temporal data. It assumes a grounding in statistical theory up to the standard linear regression model. The book compares both hierarchical and spatial econometric modelling, providing both a reference and a teaching text with exercises in each chapter. The book provides a fully Bayesian, self-contained, treatment of the underlying statistical theory, with chapters dedicated to substantive applications. The book includes WinBUGS code and R code and all datasets are available online. Part I covers fundamental issues arising when modelling spatial and spatial-temporal data. Part II focuses on modelling cross-sectional spatial data and begins by describing exploratory methods that help guide the modelling process. There are then two theoretical chapters on Bayesian models and a chapter of applications. Two chapters follow on spatial econometric modelling, one describing different models, the other substantive applications. Part III discusses modelling spatial-temporal data, first introducing models for time series data. Exploratory methods for detecting different types of space-time interaction are presented followed by two chapters on the theory of space-time separable (without space-time interaction) and inseparable (with space-time interaction) models. An applications chapter includes: the evaluation of a policy intervention; analysing the temporal dynamics of crime hotspots; chronic disease surveillance; and testing for evidence of spatial spillovers in the spread of an infectious disease. A final chapter suggests some future directions and challenges.

The Handbook is written for academics, researchers, practitioners and advanced graduate students. It has been designed to be read by those new or starting out in the field of spatial analysis as well as by those who are already familiar with the field. The chapters have been written in such a way that readers who are new to the field will gain important overview and insight. At the

same time, those readers who are already practitioners in the field will gain through the advanced and/or updated tools and new materials and state-of-the-art developments included. This volume provides an accounting of the diversity of current and emergent approaches, not available elsewhere despite the many excellent journals and textbooks that exist. Most of the chapters are original, some few are reprints from the Journal of Geographical Systems, Geographical Analysis, The Review of Regional Studies and Letters of Spatial and Resource Sciences. We let our contributors develop, from their particular perspective and insights, their own strategies for mapping the part of terrain for which they were responsible. As the chapters were submitted, we became the first consumers of the project we had initiated. We gained from depth, breadth and distinctiveness of our contributors' insights and, in particular, the presence of links between them.

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