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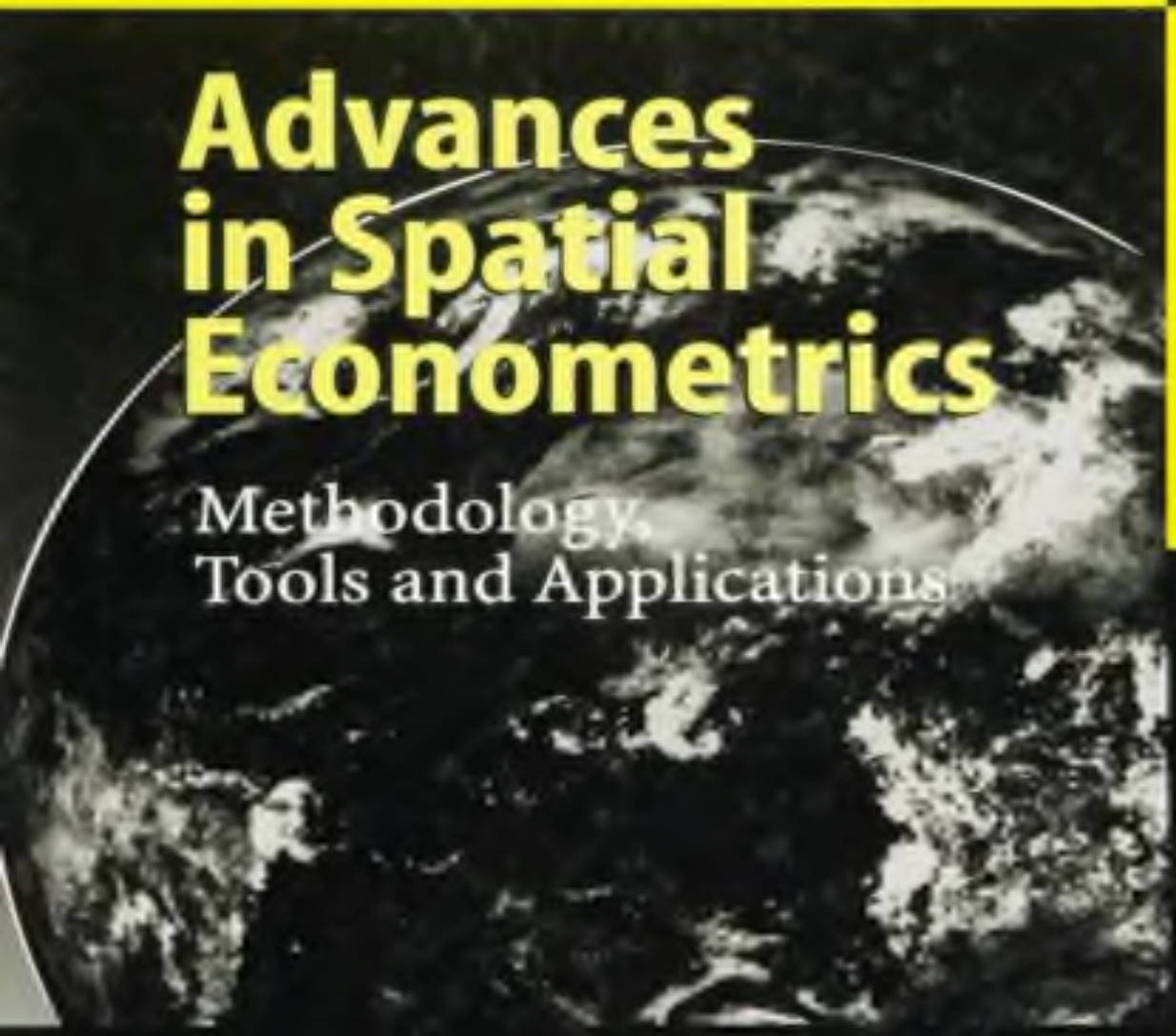
Advances in Spatial Econometrics

Methodology, Tools and Applications



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With 41 Figures
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To Jean Paelinck

Preface

The volume on *New Directions in Spatial Econometrics* appeared in 1995 as one of the first in the then new Springer series on *Advances in Spatial Sciences*. It very quickly became evident that the book satisfied a pent up demand for a collection of advanced papers dealing with the methodology and application of spatial econometrics. This emerging subfield of applied econometrics focuses on the incorporation of location and spatial interaction in the specification, estimation and diagnostic testing of regression models.

The current effort is a follow up to the *New Directions* volume. Even though the number of empirical and theoretical journal articles dealing with various aspects of spatial econometrics has grown tremendously in the recent past, the need remained to bring together an advanced collection on methodology, tools and applications. This volume contains several papers that were presented at special sessions on spatial econometrics organized as part of a number of conferences of the Regional Science Association International. In addition, a few papers were invited for submission. All papers were refereed.

The focus in the volume reflects the advances made in the field in recent years. In terms of methodology, attention has moved to models for discrete dependent variables, endogeneity in systems of equations and advanced diagnostic tests for multiple sources of misspecification. In addition, the Bayesian and non-parametric perspectives on spatial analysis are becoming increasingly important parts of the methodological toolbox. Applications reflect topical interests in regional science and the new economic geography, centered around the concepts of externalities, agglomeration economies, and economic growth and convergence. New software tools have been developed as well, facilitating the dissemination of existing methods and the stimulation of new ones.

The growing appreciation for the role of a spatial perspective in social science research is evidenced in the United States by the establishment of the Center for Spatially Integrated Social Science, funded by the U.S. National Science Foundation under grant BCS-9978058. CSISS has supported the editorial efforts behind this volume and has included it as a part of its *best practices* program. Prof. Michael Goodchild, the Director of CSISS, authored the Foreword.

A volume such as this could not have come to be without the assistance of many individuals. We gratefully acknowledge the time (patience) and effort spent by all authors and referees, and the editorial guidance provided by Marianne Bopp at Springer Verlag. We particularly appreciate the technical typesetting prowess of Mark Janikas of the Geography Department at San Diego State University, who served as the LaTeX guru on the project, and without whose tremendous effort and dedication this volume would not have existed. We also thank students in the Spatial Econometrics course at the University of Illinois, Urbana-Champaign, who reviewed and commented on draft copies of various chapters. We are extremely grate-

ful to Carolyn (Dong) Guo of REAL at the University of Illinois, who proof-read the complete manuscript and suggested several useful corrections.

The Bruton Center at the University of Texas at Dallas provided institutional support in the early stages of the editorial project. In addition, we are grateful for the open source software movement, which has given us tools such as TeX, LaTeX, Vim and Python that were instrumental in facilitating the technical aspects of typesetting and indexing.

Finally, we would like to dedicate this volume to Jean Paelinck, who coined the term *spatial econometrics* in the early 1970s and has remained a strong and active force behind the growth of the field throughout the years.

Urbana, IL, USA
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March 2004

Foreword

Space is an essential part of human experience: along with time it frames events, since everything that happens happens *somewhere* in space and time. The power of science lies in its ability to discover general truths that are independent of space and time, and can therefore be expressed economically, and applied anywhere, at any time, to solve problems of human importance. So it is not at all obvious that space is important to science, except as a complication to be removed during the process of generalization.

This book is about advances in spatial econometrics, a discipline founded on the principle that space *is* important to our understanding of economic and other social processes operating in human societies, distributed over the surface of the Earth. It has strong links with the older disciplines of geography and regional science, and of course economics. It takes a quantitative approach, modeling the interactions that occur across space and that influence economies, labor markets, housing markets, and a myriad of forms of economic and social activity. Spatial variables such as distance appear explicitly in spatial econometric models, to capture these interactions and their response to location. Space is thus an inherent part of the scientific generalizations that result from spatial econometric analysis, but in an abstracted form, typically as a matrix of interactions W, rather than as locations *per se*. Such models are therefore invariant under a range of spatial operations, including rotation, translation, and inversion. The interaction matrix captures *relative* location only, *absolute* location being irrelevant to most spatial econometric theory.

Two arguments underlie this approach, the first behavioral and the second artifactual. Human societies interact in numerous ways, through migration, journeys to work, telephone and mail communication, transportation of goods, and flows of information. In all of these forms interaction tends to react to distance, because interaction cost is a function of distance, or because human acquaintance networks depend in part on face-to-face contact, or because it takes time to overcome distance. Thus space, in the form of distance, becomes a direct causal factor in processes that are impacted by interaction. Recently, of course, there has been much speculation over the distance-conquering effects of the Internet on flows of information.

The second argument results from the tendency of human societies to impose largely arbitrary boundaries on what is in many respects a continuous surface, in part to preserve confidentiality, and in part for economy. Statistical reporting agencies assemble data for bounded zones, masking within-zone variation, and limiting social scientists to the study of between-zone variation. This would be fine if zones behaved as independent social aggregates, but of course they do not; if there are such things as independent social aggregates on the Earth's surface, they are almost certainly cut frequently by zone boundaries. Thus models must include space, again in the form of a matrix of interactions, to deal with what is in essence an inability of data-gathering practice to provide data in a theoretically coherent form.