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Tomas de la Barra

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INTEGRATED LAND USE AND TRANSPORT MODELLING

Decision Chains and Hierarchies

TOMÁS DE LA BARRA

Institute of Urbanism, Central University of Venezuela



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Preface

This book has a dual character. On the one hand, it is structured in the form of a textbook. Subjects are treated in a sequence such that the reader can follow from basics to more elaborate formulations; most of the elements required for its proper comprehension are given, making it self sufficient; references are deliberately kept to a minimum. On the other hand, the book is the result of extensive research, and the knowledgeable reader will find many stimulating propositions, some more novel than others, and some probably more pertinent than others.

Integrated land use and transport modelling is an area of research that reached a high peak in Britain in the early seventies, mainly with an academic interest. Real-world applications in industrialised nations, however, have been limited mainly because of the slow rate of growth of the cities of Europe. The second half of the seventies and the first half of the eighties have seen considerable advances in the development of theories and operational models in the area of transport. Most cities in Europe and the USA regularly use stand-alone transport models for their everyday planning practice, considering the location of activities and other socio-economic variables as a relatively stable set of given inputs. The situation in third world countries, however, is quite different; since cities grow so rapidly, the interaction between the location of activities and the transport system becomes a dominant issue. It is not surprising, then, that the research contained in this book is supported by applications mostly carried out in Venezuela. It is argued that this area of research will see new light, at least in Europe, because of its potential for the evaluation of energy use in cities and regions.

The idea of writing this book originated in a PhD thesis for the University of Cambridge. The aim of the thesis and of this book is to propose a general and consistent theoretical framework for land use and transport analysis. There are many advantages in presenting a unified explanation for most of the urban phenomena, and the purpose of this book is to lay this out as clearly as possible. This book, however, differs from the original thesis in many ways. Firstly, several years of research and development in the area of integrated land use and transport modelling modified substantially many of the original propositions. Next, a large number of real-world applications of the proposed methods have lead to numerous improvements. Lastly, a decade of post-graduate teaching in the Universidad Central de Venezuela has enabled the

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author to present matters in different logical orders, hopefully making them more comprehensible to the reader.

The first chapter of the book is devoted to the epistemology of social sciences and to models in particular. Although it is not intended to be a full treatment of this subject, it is covered to a certain length, because there are a number of frequent misunderstandings with respect to the scientific method in social sciences. In particular, the role of models has not been covered adequately by the literature. Much more work must be devoted to this subject, mainly because social scientists are going through so many methodological changes, and models are bound to play an increasingly important role.

The second chapter deals with theories and models based on micro-economic theory. They not only represent the beginning of land use and transport modelling in historical terms, but also present basic concepts that are used in the rest of the book. A third chapter reviews spatial interaction models, from their gravitational origin to entropy maximising types. At the end of this chapter a comparison between micro-economic models and the spatial interaction approach is made, not only from a theoretical point of view, but also from the point of view of their mathematical representation, a matter of great importance.

Chapter 4 discusses random utility theory, presented as the bridge between micro-economics and spatial interaction, allowing the integration between the principles of the former and the discrete, aggregated formulation of the latter. This represents the theoretical backbone for the subjects in the remaining chapters. From this starting point, chapter 5 looks at macro-economic theories, particularly the input–output model, establishing a close relation with spatial interaction. The broad theoretical framework provided by input–output analysis can be used for the representation of cities and/or regions, and if prices and elasticities are incorporated, together with random utility theory, markets can also be represented.

Chapter 6 presents a number of issues related to land use, the location of activities in space, demand and supply of floorspace and the formation of property markets. Chapter 7 covers the transportation system, its relation to land use, and the supply/demand relationships that prevail. Only those aspects of supply that affect demand analysis are treated.

Finally, chapter 8 acts as an appendix to the theoretical chapters, presenting an operative land use and transport model that has been developed by the author and Beatriz Perez. The idea in presenting such a model, code-named TRANUS, is to illustrate the practical implications of the theory. The model is first outlined, and finally a number of specific real applications are described to further illustrate its usefulness.

In the theoretical chapters, the reader will find references to specific computer programs that have been developed by the author to illustrate particular issues. In fact, some of these programs have been used in this book to produce numerical examples. Details of the programs are included in an appendix.

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