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Empirical Models of Urban Land Use: Suggestions on Research Objectives and Organization

NATIONAL BUREAU OF ECONOMIC RESEARCH

Exploratory Report 6

Empirical Models of Urban Land Use: Suggestions on Research Objectives and Organization

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(Resolution adopted October 25, 1926, and revised February 6, 1933, February 24, 1941, and April 20. 1968)

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Foreword

DURING THE PAST fifteen years or so the United States has experienced a burgeoning interest in metropolitan land-use–transportation studies. Virtually every major metropolitan area in the United States has undertaken such a study. Several areas have undertaken more than one.

The very first of these models were fairly primitive: forecasts of the demand for transportation facilities often were made by simply "factoring up" (i.e., increasing) observed demands for existing facilities. Slowly, the realization set in that patterns of metropolitan land use depended upon the design and extent of the transportation system; this led to studies of increasing complexity and cost. Today these efforts commonly cost several millions of dollars, and the national investment in them is consequently great. Many talented people and sophisticated techniques have been employed. It is an understatement to say that the techniques are evolving. Thus, in the six studies examined in this survey, a diversity and increasing sophistication of techniques is quite evident.

In this environment of rapid change, a survey of current developments seems warranted. As the authors of this survey point out, there has been an unfortunate lack of candid and complete communication among the persons involved. In part this is the result of the institutional structure within which these modeling efforts are carried out. An equally important explanation, however, has been the comparative newness of these studies and the great number of innovations they embody. Communication under conditions of extremely rapid and independent development is almost never satisfactory. Given the great investments in these models themselves, not to mention the much greater investments affected by their outputs, this lack of adequate criticism and understanding potentially could be enormously expensive.

Empirical tests of the adequacy of the models as simulations of the

real world have also been insufficient—in fact, largely impossible. For practical reasons, discussion and criticism of the models, therefore, have had to be a priori.

Criticism of land-use–transportation models is too varied and abundant to be effectively summarized in the space of these comments. The authors concentrate primarily on an obvious weakness of current land-use modeling efforts: lack of convincing behavioral content. As the authors suggest, current models have been created in a policy planning environment which places enormous emphasis on producing forecasts. Adequate basic research on the processes underlying and creating the patterns being forecast has not been encouraged to any large extent. Understandably, in this environment basic research has remained by and large inadequate. The resulting models are mechanistic; their logic and theoretical bases are often impenetrable.

As with the earlier exploratory reports issued by the National Bureau,[1] this report should be regarded as simply suggestive and not as a final program of research. The survey reported in this volume is both the rationalization and the first product of an effort at the National Bureau to undertake some of the basic research necessary to the development of satisfactory metropolitan land-use–transportation models. Several interrelated studies are now under way at the Bureau in the area of urban economics, research that we hope will eventually result in a much more complete understanding of the metropolitan area as an economic unit. An example of these studies is a large-scale econometric analysis of household residential choice. In this the effects of many factors are being studied—workplace location, income, demographic variables (including racial characteristics), and the design of transportation systems—on the choice by households of residence type, neighborhood type, and location. On the basis of the econometric estimations of these relationships, we hope to construct a computer simulation model of this process. Others at the Bureau are studying the determinants of intrametropolitan manufacturing location choices, using time-series data which allow cohort analysis. Still others are investigating the effects of different fiscal arrangements on the behavior of local governments. Effort is also being directed at achieving a better understanding of urban labor markets and their operation, including a study of the participation of minority groups in these labor markets. In all, these

[1] *Research in Securities Markets* (1946); *Research in the Capital and Securities Markets* (1954); *Suggestions for Research in the Economics of Pensions* (1957); *The Comparative Study of Economic Growth and Structure: Suggestions on Research Objectives and Organization* (1959); *Research in the Capital Markets* (1964).

studies range from investigations of patterns of migration to and among urban areas to studies of specifically intraurban phenomena.

This preliminary report or survey has been done by the staff specifically involved in the land-use modeling. It has benefited from the insights and cooperation of many researchers active in the field. Its audience should be, I think, not only men technically involved in this type of modeling but all those interested in current research into the determinants of the form of metropolitan change and growth. We hope that it can be of significant value to both researchers technically involved and sophisticated in this field and to interested lay observers.

JOHN R. MEYER

Acknowledgments

THIS MONOGRAPH WAS a product of the initial stages of a research project done at the National Bureau with the support of the U.S. Department of Housing and Urban Development. The aim of the project was the development of experimental models of the spatial relationships of urban land-use activities. Compiling this survey and critique seemed to us, and to the Department of Housing and Urban Development, a natural adjunct to our modeling activities.

It is impossible to separately identify the contributions of individual authors. Each of us was involved in the development of every part of the monograph. However, some suggestion of the general demarcation of responsibilities may be useful, both for the record and for the reader. Mahlon Straszheim made major contributions to Chapter 1, in which a general introduction to the structure of transportation planning models is given. James Brown and Franklin James concentrated their efforts on Chapters 2 through 8, where summaries of the structures of the six models surveyed are presented. John Kain contributed greatly to Chapter 9, which offers criticisms and suggestions for improvement in the techniques of land-use modeling. Royce Ginn made important contributions to all areas of the monograph.

Of course, the authors owe a great deal to a great many people. Special thanks are due to Raymond J. Struyk, Stephen P. Dresch, Gregory K. Ingram, and Irving R. Silver of the NBER staff reading committee, whose criticisms and suggestions were invaluable to the authors; and to the members of the Board of Directors' reading committee for this study: Wallace J. Campbell, J. Irwin Miller, and Boris Shishkin. In addition, William Goldner and Joseph Nathanson of the Bay Area Transportation Study, T. R. Lakshmanan and D. D. Lamb of the Consad Research Corporation, and I. J. Rubin and S. Thyagarajan of the Detroit Regional Transportation and Land-Use Study (TALUS) de-

serve thanks for the patience and tolerance they showed while introducing us to their modeling efforts. In addition, we owe special thanks to Gnomi Schrift Gouldin and Hedy D. Jellinek for their editing of the manuscript, to H. Irving Forman for the charts, and to Mrs. Mary Parker for excellent typing. Her skill and dependability made our work much easier.

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