

SPATIAL DECISION SUPPORT FOR SUBSIDIZED HOUSING LOCATION AND RESIDENTIAL MOBILITY

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Summary

Traditional planning methods for the location of residential subsidized housing rely heavily on expert opinion and political concerns. Location of market-rate residential housing confronts a disjunction between very detailed spatial interaction models of most interest to researchers, and heuristic applications of marketing data by practitioners that are difficult to formalize. After a survey of methods of subsidized housing location in the research literature based on spatial decision support systems, that is, quantitative planning models, databases and geographic information systems, it is argued that these methodologies have the potential to serve planners interested in siting residential housing, whether subsidized or market-rate. Moreover, these methodologies may address the concerns of multiple affected stakeholders in the planning process in such a way as to identify most-preferred policy according to a variety of monetary and nonmonetary characteristics and to implement that policy successfully.

1. Introduction

Location of residential housing is a conceptually simple problem that masks profound theoretical issues encompassing urban planning, public policy, economics, statistics, marketing, management science, and engineering. A problem of current interest is

location of residential subsidized housing in urbanized areas of developed countries. The goal is to identify planning models and decision support mechanisms that allow government agencies, nongovernmental organizations, potential residents of subsidized housing, and other interested bodies to design configurations of housing that can serve as the basis for specific policy actions.

Such research is inspired by subsidized housing policy initiatives that are quite specific to the United States, yet may be generalized to a variety of cultural contexts. In the United States, subsidized housing has generally been viewed as a shelter of last resort for the poorest segments of the population, and this housing has traditionally been disproportionately concentrated in racially segregated and economically deprived portions of central cities. Indeed, between 1970 and 1990 the number of people in the United States living in high-poverty neighborhoods (defined as Census tracts with poverty rates of at least 40%) nearly doubled, while the proportion of poor citizens living in high-poverty neighborhoods increased by nearly half. On the other hand, a recent picture of subsidized housing in the United States indicates that the population served by subsidized housing is disproportionately low-income and concentrated in large developments within large metropolitan areas.

The landmark Gautreaux Assisted Housing Program in Chicago, IL, the Yonkers (NY) public housing relocation program and the nationwide Moving to Opportunity for Fair Housing demonstration program have demonstrated that it is possible to use policy initiatives to deconcentrate poverty. That is, effective policies exist to provide low-income residents of public housing the opportunity to live in more-advantaged communities with little of the overt class-based and race-based opposition that has traditionally accompanied efforts at residential integration.

However, it is not clear whether, or how, these programs could be replicated at the national level. Current research indicates that quantitative planning techniques can be used to design and implement decision support tools for public housing authorities (PHAs) and other stakeholder groups, to locate affordable housing in a metropolitan area, to ensure access to economic opportunity on the part of low-income families, and minimize political opposition to the presence of such families in affluent communities. These quantitative planning techniques encompass geographic information systems (GIS), database management systems (DBMS), operations research/management science (OR/MS) planning models, and Internet technologies. (For a discussion on other planning applications using GIS see *Advanced Geographic Information Systems*.)

Further, two complementary classes of subsidized housing planning methods are presented: aggregate planning and individual-level planning. While aggregate planning is concerned with alternative configurations of housing units, individual planning addresses the actual relocation decision process of individual families. It is argued that sufficient research exists to justify further investigation and real-world implementation of these models, and that these models, especially the aggregate planning model, are well suited for use in multi-stakeholder negotiation support systems. This latter system represents an opportunity for planners to generate policy initiatives, gain stakeholder approval for a most-preferred policy, and finally to design economic incentives to make certain desired outcomes come about.

Section 2 presents traditional methods for residential housing planning in the urban planning, urban economics, and real estate traditions. These methods are contrasted for market-rate housing and subsidized housing. Section 3 presents the aggregate and individual-level planning paradigms for subsidized housing. Section 4 presents a novel multi-stakeholder negotiation support perspective that encompasses both planning approaches presented in the previous section. Section 5 addresses linkages between these partial-equilibrium OR/MS-based approaches and traditional full-equilibrium models. Section 6 concludes and lists a number of issues for further research.

2. Traditional Planning Methods for Residential Housing

2.1. Introduction

Urban planning is concerned with the identification of appropriate uses of land to meet human needs such as shelter, employment, transportation, and recreation. Within urban planning, the specific focus is on *housing* as an object of planning and implementation. Housing is distinguished from other land uses because it serves a fundamental need, embodies aspects of public and private goods, can generate significant local externalities, and is a vehicle for a variety of government policies intended to increase social welfare. It is useful to distinguish between “market-rate housing,” that is, housing built largely without government subsidy and sold at prevailing market prices, and “subsidized housing,” that is, housing built and/or operated with significant government subsidy and (usually) rented to lower-income families at a fraction of its market value. The remainder of this section is devoted to planning models for these two types of residential housing.

2.2. Market-Rate Housing

The problem of market-rate residential housing location has traditionally been approached using two different methods. Urban planners and regional scientists have since the late 1960s developed housing market equilibrium models that calculate the number of families of particular income types, living in particular types of housing units and working in particular locations, as a function of:

1. The number of units of particular housing units of various types in particular locations,
2. The number of jobs of particular income types in various locations, and
3. Transport costs between home and work.

Such models may be modified by incorporating the choice of transport mode, and by addressing the multi-period nature of actual regional economies.

These models, while certainly useful at the aggregate level, are of most interest to researchers seeking to understand the underlying dynamics of simultaneous housing, employment, and transport choice in metropolitan areas. Current research is focused on integrating housing market equilibrium models, DBMS and GIS into an urban development decision support system (UDDSS).

Real estate practitioners, on the other hand, generally bring a great deal of practical knowledge to bear on the problem of locating residential housing, in particular awareness of regional employment growth trends, demand for various types of housing, zoning and land use restrictions, engineering and construction, and housing finance. With some analytical support in the form of marketing studies, practitioners often perform quick and informal analyses to select a few candidate sites in a small portion of the metropolitan area, and perform more in-depth analyses to choose the type and mix of housing likely to be financially viable. The remainder of their work is focused on negotiations with various stakeholders, including banks, government bodies and architects, to actually construct the development.

In practice, in the United States, there has been insufficient communication between researchers, using computationally intensive, model-based planning approaches, and practitioners, relying extensively on expert knowledge. One result of this lack of communication has been a history of opportunistic residential real estate development that has been environmentally wasteful, dependent on private automobile transportation, and highly concentrated by class and race.

2.3. Subsidized Housing

Location of subsidized housing in the United States has, for the most part, not been a focus of scholarly research, and in traditional practice, has been performed using a somewhat restrictive variant of the real estate practitioners' approach. That is, public housing authorities, acting somewhat as private-sector real estate practitioners, have selected sites, designed developments, and built and managed housing, but under the additional constraint that such housing be located, for the most part, in areas where poor families already live or on the least valuable land in the metropolitan area. The long-term negative impacts, both on these public housing communities, and on the financial resources that support them, of this type of subsidized housing location have been well known for over 30 years.

As a result, two primary policy initiatives have been developed, and have gained strength in recent years in reaction to the reform of the US welfare (social support) and subsidized housing systems. The first policy initiative has been "tenant-based housing subsidies." Known in the United States as the "housing choice voucher program" (formerly "Section 8"), tenant-based subsidies, or vouchers, represent a demand-side economic device that allows participating families to choose market-rate rental housing anywhere they please throughout a metropolitan area, given restrictions on the asking rent for units of various sizes. In practice, families with housing choice subsidies face greatly reduced housing options compared with more affluent families, but have generally managed to choose neighborhoods that are more advantaged than very low-income communities from which they have originated. The second policy initiative has been "mixed-income project-based housing." This policy, given increased prominence by the US "HOPE VI" redevelopment program, requires PHAs to construct new public housing that is rented to tenants of varying economic backgrounds. In addition, this housing is intended to be either located in more affluent communities than those in which public housing has traditionally been located or located in low-income communities undergoing intensive economic revitalization, for example, the

introduction of employment opportunities, and commercial activity and infrastructure improvements.

There is no doubt that, especially recently, well-trained and well-intentioned PHA planners in the United States have done good work to design policies governing tenant-based and project-based housing. However, it is equally clear that significant inefficiencies remain in the design and implementation of subsidized housing policy, and that scholarly research has not given as much attention to planning for subsidized housing planning as it has for market-rate housing. In the next section quantitative planning models for subsidized housing that might meet this need are presented and evaluated.

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Biographical Sketch

Dr. **Michael P. Johnson** is an Assistant Professor of Management Science and Urban Affairs in the H. John Heinz III School of Public Policy and Management at Carnegie Mellon University, Pittsburgh, PA. His research interests lie primarily in operations research/management science planning models for public-sector facility location and service delivery, with applications to location of subsidized housing and home-delivered meals to the elderly/infirm. He is also interested in applying benefit-cost methodology to estimate the impacts to various stakeholders of specific facility location and service delivery alternatives, in spatial, multi-stakeholder decision support systems to design policy based on quantitative planning models, and in more general issues of housing policy and urban planning. Recently Dr. Johnson has explored the design and implementation of decision support systems for the practice of evidence-based medicine in a clinical setting. Dr. Johnson received his Ph.D. in operations research from Northwestern University in 1997, a M.S. in operations research from University of California, Berkeley in 1990, a M.S. in electrical engineering from Georgia Institute of Technology in 1987, and a B.S. in mathematics and French from Morehouse College in 1987. His work has appeared, or is scheduled to appear, in *Annals of Operations Research*, *Environment and Planning A*, *Housing Studies*, *Journal of Geographic Systems*, *Journal of Housing Research*, *Location Science*, *Management Science*, *Papers of the Regional Science Association* and *Socio-Economic Planning Sciences*. Dr. Johnson is a member of the Institute for Operations Research and the Management Sciences, the Regional Science Association, and the Association for Public Policy Analysis and Management. He is a research affiliate with the Northwestern University/University of Chicago Joint Center for Poverty Research, a Faculty Development Fellow of the National Consortium of Violence Research currently participating in the Crime and Public Housing discussion group and a US Department of Housing and Urban Development Urban Scholars Postdoctoral Fellow.