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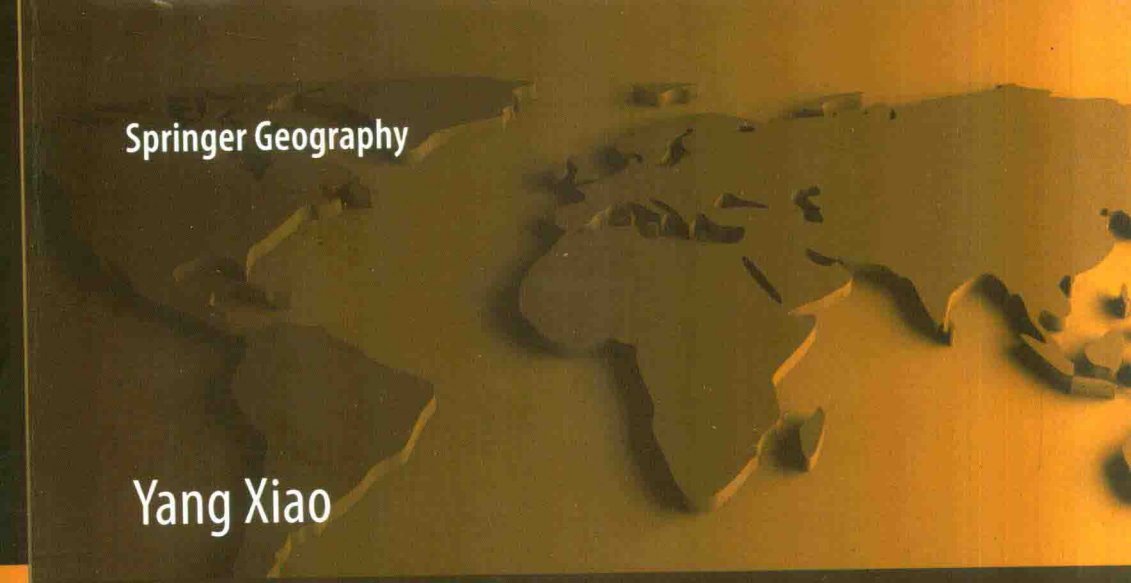

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Urban Morphology and Housing Market

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Urban Morphology and Housing Market

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Abstract

Urban morphology has been a long-standing field of interest for geographers but without adequate focus on its economic significance. From an economic perspective, urban morphology appears to be a fundamental determinant of house prices since morphology influences accessibility. This book investigates the question of how the housing market values urban morphology. Specifically, it investigates people's revealed preferences for street patterns. The research looks at two distinct types of housing market, one in the UK and the other in China, exploring both static and dynamic relationships between urban morphology and house price. A network analysis method known as space syntax is employed to quantify urban morphology features by computing systemic spatial accessibility indices from a model of street network of a city. Three research questions are empirically tested. Firstly, does urban configuration influence property value, measured at either individual or aggregate (census output area) level, using the Cardiff housing market as a case study? The second empirical study investigates whether urban configurational features can be used to better delineate housing submarkets. Cardiff is again used as the case study. Thirdly, the research aims to find out how continuous change to the urban street network influences house price volatility at a micro-level. Data from Nanjing, China, are used to investigate this dynamic relationship. The results show that urban morphology does, in fact, have a statistically significant impact on housing price in these two distinctly different housing markets. Urban network morphology features can have both positive and negative impacts on housing price. By measuring different types of connectivity in a street network, it is possible to identify which parts of the network are likely to have negative accessibility premiums (locations likely to be congested) and which parts are likely to have positive premiums (locations highly connected to destination opportunities). In the China case study, the author finds that this relationship holds dynamically as well as statically, showing evidence that price change is correlated with some aspects of network change.

Contents

Chapter 1
Introduction

We shape our buildings, and afterwards our buildings shape us.
—Winston Churchill.

1.1 Background

Over the years, numerous conceptual, theoretical, and empirical studies have attempted to formulate, model, and quantify how the built environment is valued by people. However, studies of the valuation of urban morphology are rare, due to the lack of a powerful methodology to quantify the urban form accurately. In addition, neoclassical economic theories have emphasized location with respect to the city center as the major spatial determinant of land value, but this has become weaker or even insignificant according to the findings of some current studies of mega cities, such as Los Angeles (Heikkila et al. 1989). Urban street networks contain spatial information on the arrangement of spaces, land use, building density, and patterns of movement and therefore give each location (or street segment) in the city a value in terms of accessibility. Thus, people can be thought of as paying for certain characteristics of the accessibility of the location of their choice. Moreover, they are likely to pay different amounts of money according to the different demand levels.

The main motivation in this book is to investigate how urban morphology is valued. This is done through estimating its impact on the urban housing market, using the method of hedonic pricing. More specifically, the aim of this book was to examine whether street layout as an element of the urban form can provide extra spatial information in explaining the variance of housing price in a city, using both static and dynamic models.

It is well known that commodity goods are heterogeneous, but that the unit of certain attributes or characteristics of the commodity good is treated as homogeneous (Lancaster 1966). Thus, people buy and consume residential properties as a bundle of "housing characteristics," such as location, neighborhood, and environmental characteristics. Hedonic analysis studies how the marginal price people are willing to pay for characteristics of that product. Rosen (1974) pointed out that in theory in an equilibrium market, the implicit price estimated by a hedonic model is

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equal to the price per unit of a characteristic of the housing property for which people are willing to pay. There are many studies that have followed Rosen's approach in order to identify and value the characteristics that have an impact on housing price, including structural, locational, neighboring, and environmental characteristics (see for instance Sheppard 1999; Orford 2000, 2002).

Hedonic price models are widely used for property appraisal and property tax assessment purposes, as well as for constructing house price indices. Furthermore, hedonic price models can be used for explanatory purposes (e.g., to identify the housing price premium associated with a particular neighborhood or design feature), and for policy evaluation or simulation purposes (e.g., to explore how the location of a new transit train might affect the property value, or whether the price premium associated with a remodeled kitchen will exceed the remodeling cost).

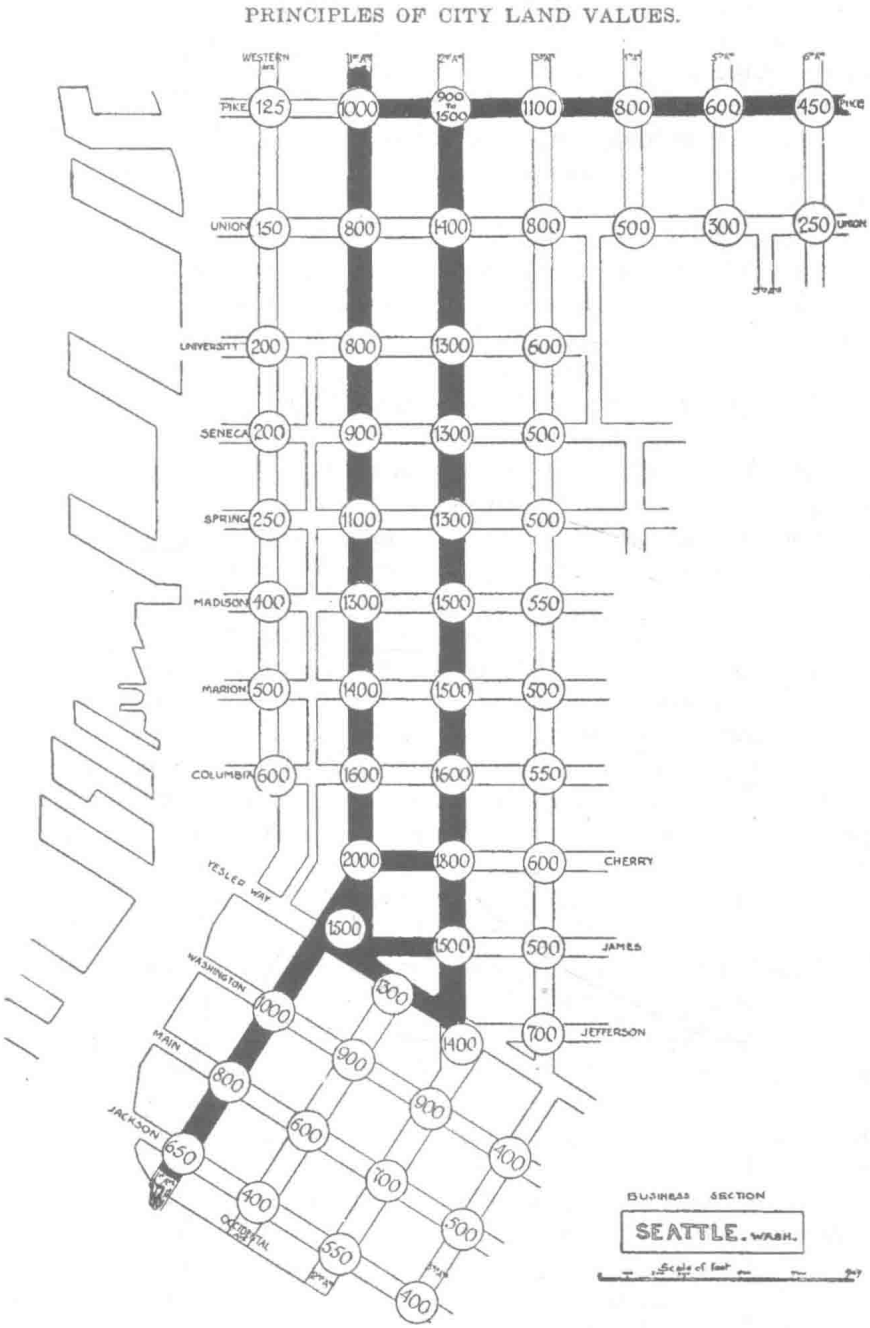
Orford (2002) notes that many hedonic studies are built upon the monocentric model of Alonso (1964) and Evans (1985), which underlined the importance of CBD as the major influence of land value and in which a bid rent curve is translated into a negative house price curve (distance decay). Furthermore, in the early urban housing literature, the property value is based on its location and different sized units of homogenous housing units in a single market (Goodman and Thibodeau 1998). Thus, locational attributes (as the major determinant of land value) were the most important measure of hedonic housing price models. However, the monocentric model has inherent limitations and has increasingly been criticized by researchers as both an overly simplistic modeling abstraction and an empirically historical phenomenon (e.g., Boarnet 1994). The monocentric model excludes non-transportation factors, such as cases where persons do not choose their residential location based on the wish to minimize their commuting costs to their workplace. Moreover, when metropolitan areas are in a state of restructuring, and suburban employment centers exist, numerous studies have shown that the impact of distance to CBD becomes weaker, unstable, or even insignificant (Heikkila et al. 1989; Richardson et al. 1990; Adair et al. 2000). Cheshire and Sheppard (1997) also argued that much of the data used in hedonic analyses still lacks land and location information. Moreover, hedonic modeling studies ignore the potentially rich source of information in a city's road grid pattern. In order to understand people's preferences for different locations, the author finds that urban morphology seems to have the potential of a theoretical and methodological breakthrough, since it has the ability to capture numerically and mathematically both the form and the process of human settlements.

With regard to the study of urban morphology, frequently referred to urban form, urban landscape, and townscape, it grows and shapes in the later of the nineteenth century, and is characterized by a number of different perspectives, such as those taken by geography and architecture (Sima and Zhang 2009). The studies of urban form in Britain have been heavily influenced by M.R.G. Conzen. The Conzenian approach is more focused on the description, classification, and exemplification of the characteristics of the present townscapes based on the survey results, an approach that could be termed as an "indigenous British geographical tradition." Later, this tended to shift from metrological analyses of plots to a wider plan

analysis (Sheppard 1974; Slater 1981). Recently, the urban morphologists have come to examine the individuals, organizations, and the process involved in shaping a particular element of urban form (Larkham 2006). In contrast, European traditions (e.g., Muratori 1959; Muratori, di Storia Urbanistica 1963) take an architectural approach, stressing that elements, structures of elements, and organism of structures are the components of urban form, which can also be called "procedural typology" (Moudon 1997).

However, studies of urban morphology from the perspective of both geographers and urban economists are mainly focused on how and why individual households and businesses prefer certain locations, and how those individual decisions add up to a consistent spatial pattern of land uses, personal and business transaction, and travel behavior. For example, Hurd (1903) first highlighted land value is not homogenous on topography on the street layout. He argued that one of advantages of irregular street layout is to protect central growth rather than axial growth, which allows people a quick access to or from the business center. A rectangular street layout permits free movement throughout a city, and the effect will be promoted by the addition of long diagonal streets. In his study, Washington as a political city in the USA provides a typical example of diagonal streets, where the large proportion of space is taken up by streets and squares, while it is not a mode for a business city. Another contribution Hurd made is mapping the price per frontage foot of a ground plan for several cities in the USA, showing the scale of average value (width and depth) (see the example of Seattle shown in Fig. 1.1). Although he explained that the ground rent is a premium paid solely for location and all rent is based on the location's utility, the questions that why the high rental price located along linear as an axis, that why there is bigger differentness of rental price despite how the streets approach to each other in the same area, and how to control the scale effects are not addressed.

Webster (2010) takes an economist's approach and pointed out several important issues that Hurd did not address. Street layout as the most essential element of urban form provides a basic geometry for accessibility, determining how street segments arrange possibilities and patterns of movement and transactional opportunities through "spatial configuration." The network gives each location (or street segment) in the city a particular connectivity value, and each part of the city, each road, each plot of land, and each building has its own value as a point of access to other places, people, and organizations. The general (connectivity to everywhere else) value of any point in the grid is also a significant economic value signifying access to opportunities for cooperative acts of exchange between one specialist skill and all others within the urban economy. Put it another way, the street grid shapes the cost of transactions for an urban labor force: It spatially allocates the economic division of labor. Thus, the geometric accessibility created by an urban grid is the most fundamental of all urban public goods. This being so, if it could be priced, it should be possible to allocate accessibility more efficiently. Measuring network-derived accessibility is the first step to doing so. It also allows for greater efficiencies in the design and planning of cities by governments and private developers when they build new infrastructure.



Seattle, Wash. Business section. Figures represent value of corners, for lot of average width and depth, in dollars per front foot.

Fig. 1.1 Rent price pattern in Seattle [*Source* Hurd (1903)]

In spite of the crucial role of urban morphology to the urban economy, morphological studies are not a part of the mainstream planning literature, because verbal descriptions of properties cannot easily be translated into geometric abstractions and theories. In other words, it lacks a sound scientific methodology for quantifying the urban form coherently. Early attempts were limited by the availability of software and hardware that could operate standard statistical approaches such as cluster analysis in order to research aspects of urban form (Openshaw 1973). The problems of establishing standard definitions in urban morphology and the perception that much of the information on urban form is not readily converted into "data" hindered the large-scale use of computers in storing and processing information. Alexander (1964) first introduced formal mathematical concepts into the debate in 1964.

A range of early works in formal urban morphology explored how mathematical formalism such as graph theory and set theory could work in the urban design arena (e.g., March and Steadman 1971; Martin and March 1972; Steadman 1983). By the end of the twentieth century, one innovative system of theories and techniques has emerged, known as "space syntax." It is an approach to urban form which is quite different from the British geographical tradition.

Space syntax originated as a quantified approach for spatial representation, which was developed in the 1970s at University of London. It was used as a scientific and systematic way to study the interaction of people's movement and building environment. In the book of *The Social Logic of Space*, Hillier and Hanson (1984) noted that the exploration of spatial layout or structure has great impact on human social activities. Recently, the approach has been refined by Hillier (1996), Penn (2003), and Hillier and Penn (2004), with particular focus on the arrangement of spaces and possibilities and the patterns of movement through "spatial configuration." Over the past two decades, space syntax theory has provided computational support for the development of urban morphological studies, revealing the characteristics of spaces in terms of movement and potential use. Space syntax has attempted to define the elements of urban form by measuring geometric accessibility, measuring the relationships between street segments by a series of measurements, such as connectivity, control, closeness, and betweenness (Jiang and Claramunt 2002).

This book extends this tradition by employing space syntax methodology to refine hedonic price modeling. By doing so, it attempts to make a significant contribution to urban scholarship by exploring how finely measured urban morphology is associated with a number of housing market issues. In particular, I conduct a number of statistical experiments to find out how many people are willing to pay for different urban morphological attributes or, put another way, for different kinds of accessibility.