Spatial effect of river landscape on housing price: An empirical study on the Grand Canal in Hangzhou, China

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ABSTRACT

Urban landscape has an implicit amenity value and provides sites of leisure and entertainment for residents. Evaluating the external effects of landscape variables on property prices has become an important issue for scholars. This study regards the Grand Canal as an example, constructs hedonic price and spatial econometric models with the housing market data of Hangzhou in 2015, and empirically analyzes the spatial effects of waterscape on housing prices. The accessibility of the Grand Canal significantly affects housing price. Specifically, every 1% increase in the distance of the Grand Canal to a community will result in a 0.016% decrease in housing price. The difference-in-difference method reveals that the effects of the Grand Canal on property price demonstrate the distance heterogeneity and regional heterogeneity. The Grand Canal also exerts double effects on adjacent housing prices, and the negative effect is smaller than the positive effect within 1.5 km from the canal. The comparison of multiple models in this study also reveals that spatial econometric models can optimize traditional hedonic price models to obtain highly robust results. These findings can help the government establish necessary policies.

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1. Introduction

As an urban public good, natural landscape can significantly improve the quality of a city. With the fast development of the society, people pursue a high-quality living environment and are willing to pay a premium price for the amenity value of an urban landscape. For instance, rivers, lakes, and other urban water features have an amenity value because they have reduced amounts of wind and sand, brought moist clean air, and provided residents with open space characterized by low density and wide views. People prefer to live near rivers and lakes because of the high amenity value of these areas (Loomis & Feldman, 2003). Living near water can ease people's stress and instill peace. However, the amenity value of a landscape is a non-market value and cannot be traded in the market; thus, it is difficult to measure directly (Sengupta & Osgood, 2003; Wen & Jia, 2004). Assessing the implicit value of waterscapes, such as rivers and lakes, has become one of the most important issues investigated by scholars. Economic evaluation of the external effects of urban landscapes can also support urban planning, natural protection, and urban development (Jim & Chen, 2006).

Many studies have analyzed the amenity effect of urban landscapes on housing prices through the hedonic price model. Several researchers have analyzed how the lake landscape affects housing price (Ara, Irwin, & Haab, 2006; Luttik, 2000; Loomis & Feldman, 2003; Wen, Bu, & Qin, 2014). Mahan and Adams (2000) found that wetlands can affect the value of urban housing. Jiao and Liu (2010) studied the effect of the Yangtze River on housing prices in Wuhan, China. Given the heterogeneity of housing, housing prices are mainly determined by the degree of people's satisfaction with the utility provided by housing characteristics. As an important factor of housing price, urban landscape can be estimated by constructing a hedonic price model. The capitalization effect of landscape can then be assessed indirectly.

Hangzhou is a famous tourist city in China, with two large water features of the West Lake and the Grand Canal in the city. Wen, Bu, et al. (2014) have studied the amenity value of the West Lake, which is known as the most attractive freshwater lake in China. The results demonstrate that the West Lake has a significant external

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effect, and the amenity effect of the West Lake on housing prices shows distance heterogeneity and directional heterogeneity. Similar to the West Lake, the Grand Canal is another important waterscape in Hangzhou, and is also a world cultural heritage. However, the Grand Canal, which crosses the main city of Hangzhou from north to south, has a different spatial pattern compared with the West Lake. Whether the spatial heterogeneity exists in the amenity effect of the Grand Canal on housing prices is a topic worthy of in-depth study. Using the data of 538 communities in Hangzhou housing market, this study sets up hedonic price and spatial econometric models to assess the amenity effect of the river landscape on housing price. We address the following questions. (1) Does the Grand Canal have an external effect on housing price? If so, (2) what is the extent of the amenity effect? (3) Does the amenity effect demonstrate spatial heterogeneity? The contribution of this study is mainly reflected in two aspects.

First, to our knowledge, this study is among the first to assess quantitatively the amenity effect of the Grand Canal on the housing price in Hangzhou. Although many scholars have studied the effects of parks, green spaces, lakes, mountains, and other urban landscapes on housing price (Lansford & Jones, 1995; Kong, Yin, & Nakagoshi, 2007; Waltert & Schläpfer, 2010; Gibbons et al., 2014), only a few have quantitatively examined the amenity values of urban rivers. Only a few empirical studies have been conducted in China because of the difficulty in obtaining data. Jiao and Liu (2010) and Wen, Zhang, and Zhang (2015) conducted exploratory research on the Yangtze River in Wuhan and the Qian Tang River in Hangzhou. This study tests the spatial effects of the Grand Canal on housing prices through hedonic price models, and the findings may provide a favorable reference for researchers to conduct similar investigations in other Chinese cities.

Second, this study utilizes the difference-in-difference (DID) method and a spatial econometric model to optimize the traditional hedonic price model and obtain highly robust results. Previous studies often used the price elasticity and marginal price estimated by the hedonic price model to analyze the relationship between urban landscape and housing price as well as reveal how housing prices change with distance and other characteristics (Anderson & West, 2006; Jim & Chen, 2010; Sander & Polasky, 2009). Apart from the accessibility index, this study analyzes the price gradient of the Grand Canal that affects housing price according to different distance segments. The communities are divided into nine areas according to the spatial trend of the Grand Canal in Hangzhou, and DID models are utilized to test whether the amenity effect of the canal demonstrates spatial heterogeneity. Housing price usually exhibits a spatial auto-correlation because adjacent houses have similar structural characteristics and enjoy similar landscapes (Anselin, 1988; Dubin, 1998). During modeling, the traditional hedonic price model disregards the effect of spatial dependence, and the results estimated with the ordinary least squares method may exhibit some deviation (Basu & Thibodeau, 1998). This study compares and analyzes multiple models to obtain stable and reliable results, and spatial econometric models are used to explain the spatial dependence of housing price.

The rest of this paper is constructed as follows. The second part provides a review of related studies on the capitalization of urban landscape and spatial heterogeneity. The third part presents the data sources, definitions of variables, and model specifications. The fourth part provides the empirical results. The fifth part presents the conclusion.

2. Literature review

As an attractive environment, urban landscape provides an implicit amenity value for residents. Although this value is difficult to measure from the market directly, scholars believe that the value of natural landscape and other urban public goods has been capitalized into housing price through the housing market. Therefore, landscape value can be estimated by modeling housing price (Sander & Polasky, 2009; Wen et al., 2015). Many studies have indicated that urban landscapes, such as green spaces, parks, lakes, forests, and sea views affect housing price significantly and positively (Hammer, Coughlin, & IV, 1974; Major & Lusht, 2004; Peiser & Schwann, 1993; Shi & Zhang, 2010; Tyrväinen, 1997; Zhong, Zhang, & Cai, 2009). The degree of this amenity effect varies with the type, quantity, and quality of the urban landscape. For example, Wen, Li, and Zhang (2012) found that housing prices in Hangzhou are negatively correlated with the distance of houses from the West Lake and the park but are positively correlated with the area of the park. Squares, mountains, the Qian Tang River, and other landscapes significantly increase the prices of the surrounding houses. Gibbons et al. (2014) estimated the amenity value of natural landscapes in England with the hedonic price model. They examined one million housing transactions between 1996 and 2008 and considered numerous environmental characteristics. They found that gardens, green spaces, and waterscapes positively affect housing price. Increasing distance from urban landscapes, such as parks, rivers and tourist spots, is associated with decreasing housing prices. Schlapfer et al. (2015) found that lakes, wetlands, tourist attractions and recreational facilities positively affect housing rents in Switzerland, whereas several disamenities, such as noise, negatively affect housing rents. However, the amenity effects of natural landscapes vary in these studies and are difficult to compare directly because these studies used different methods and focused on different time periods and regions. Therefore, scholars conducted in-depth studies by constructing several models to compare the price elasticity or semi-elasticity of urban landscapes. For example, Jim and Chen (2006) found that proximity to water bodies and view of green spaces increase the housing price by 13.2% and 7.1%, respectively, whereas proximity to woodlands without public access and exposure to traffic noise have no significant effects on housing price. Chen and Jim (2010) assessed the effect of different landscapes on housing prices with a 3D model (availability, accessibility, and visibility) and identified parks as the most attractive landscapes; they can increase housing prices by 17.2%. Urban villages have disamenity effects, among which visibility and availability decrease the housing price by 3.72% and 2.5%, respectively. The visibility of a landscape is more valued than its accessibility.

Many studies have also compared the effects of different urban landscapes on housing price. For example, Sander and Polasky (2009) found that the price of houses adjacent to parks, trails, lakes, and streams is high. Proximity to lakes exerts the greatest effect on housing price, followed by parks, trails, and streams. Increased view area and amount of water and grassy land covers can also increase housing prices, whereas increased abundance of different land cover types within a view can reduce housing prices. Waltert and Schläpfer (2010) found that land cover and natural reserves diversity have the greatest positive effect on the housing price, followed by open spaces, forests, and farmlands. These findings indicate that the value of urban landscape has been capitalized into housing price. Homebuyers are willing to pay a high price for a house with a comfortable landscape. The difference in housing prices reflects the implicit amenity value of urban landscape.

Previous studies on the amenity effects of urban waterscapes revealed that houses will have an added value due to adjacent to water features, and this value varies with the type and size of the