Spatial and temporal effects of urban wetlands on housing prices: Evidence from Hangzhou, China

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A B S T R A C T

Identifying urban wetland's impact on housing prices and its amenity value has attracted much attentions. We estimate the heterogeneous price effects and amenity value of urban wetland for the Xixi National Wetland in Hangzhou, China, using the hedonic price method. By controlling for locational and community attributes, spatial and temporal effects, we found significant and heterogeneous amenity values for proximity to urban wetland. Urban wetland significantly increases housing values within the surrounding 5 km, and most significantly within 1 km. Proximity to the urban wetland by 1 km averagely increases housing prices by 195 yuan per square meter. Furthermore, proximity values for urban wetland have overall been increasing over the years, but vary throughout the housing market cycle.

1. Introduction

In the previous 30 years, China has created unprecedented economic growth, but has also experienced a sharp environmental deterioration. Rapid dwindling wetlands and continuous decline in air quality have increased residents' awareness of environmental amenities and increased the demand for urban amenities, such as green spaces and better access to natural landscapes. Urban wetlands are an important part of urban environmental amenities and ecological infrastructure. Compared with other urban green spaces, urban wetlands are unique for protecting the urban natural environment and for providing more ecosystem services, therefore its amenity values are appreciated by local residents (Franco and Luiselli, 2014; Conway et al., 2010).

Urban wetlands play an important role in providing a variety of benefits, including recreational and landscape space, an enhanced view of natural scenic beauty, maintenance of biodiversity and buffering against noise and pollution (Irwin et al., 2014; Ahlfeldt and Maennig, 2010; Irwin, 2002). As wetlands provide such benefits and positive amenities for neighboring residents, it influences the value of nearby housing (Netusil, 2013; Conway et al., 2010; Mahan et al., 2000).

Despite a growing recognition of their environmental amenities, recent losses of wetlands have been significant under the rapid urbanization in China. According to the second national wetlands resources survey, China has 53.6026 million hectares of wetlands in 2014, accounting for 5.58% of China's total land, and about 10% of the world's wetlands. The United States of America also experienced dramatic

wetlands loss from 1970 to 1990, and thus adopted a "no net loss" wetlands protection policy in 1993 (Mahan et al., 2000).

Increasing attention has been paid to urban wetlands' amenity value, which varies across geographic space (Hui and Liang, 2016; Tapsuwan et al., 2009; Mahan et al., 2000). In addition to the spatial effects of urban wetland amenities, there are also significant temporal effects. That is, the amenity value of urban wetlands can vary over time or over the housing market cycle (Fan et al., 2016; Chadourne et al., 2013). Moreover, the effects of urban wetlands on housing prices may be determined by the types and functions of wetlands (Netusil, 2013; Netusil, 2005; Doss and Taff, 1996).

Identifying the amenity value of urban wetlands could guide city planners and policy makers towards better land use, urban planning, and development decisions. The amenity value of wetlands could also provide information and implications for urban wetlands and green infrastructure protection decision (Votsis, 2017; Netusil et al., 2014), especially under the rapid urbanization process in developing counties. Revealing the economic value of wetlands will also guide consumers to make optimal housing purchasing decisions. However, there is still limited research on the amenity value of urban wetlands, especially from developing countries.

Hangzhou is one of most rapid growth and densely populated cities in China, 2165 persons per km². It is well known for urban wetlands, including Xixi National Wetland Park and West Lake (Du and Huang, 2017). During the past decade, Hangzhou's real estate market has experienced a rapid development under rapid urbanization and is famous

for its high housing price in China (Huang et al., 2015b). Compared to West Lake, Xixi National Wetland Park is newly developed and is famous for its original ecological culture and open space function, while West Lake has long been famous for its lake view. Many real estate projects developed close to Xixi National Wetland Park for better taking advantages to this urban amenity. With the rapid economic development, people's demand for urban amenity such as urban wetlands and parks have increased. The accessibility of urban amenity is also regarded as an important factor of people's housing purchasing decision, and thus has implications for housing prices. The property prices rise rapidly after the opening of proximity to Xixi National Wetland Park in the past years.

Our study attempts to reveal the amenity value of urban wetland park based on the case of Xixi National Wetland Park, in Hangzhou city, China. We employ the hedonic price method to estimate the price effects of urban wetland on housing prices and its amenity value. More specifically, we examine the heterogeneous spatial effects of urban wetland on housing prices. We also investigate the temporal effects of amenity value of urban wetland over time and housing cycle.

Our study's contribution to the literature are threefold. First, we provides new evidences about the amenity values of urban wetland from China, world's biggest developing country. Few studies have investigated the amenity value of new developed urban wetlands,although many research have tested the effect of open spaces or parks onhousing prices (Wen et al., 2014; Hui and Liang, 2016; Irwin, 2002) but provided limited information about the amenity values. Second, we investigate the spatial and temporal heterogeneous price effects of urban wetland on housing prices, especially estimating the willingness to pay for urban wetlands' amenity during housing market cycles. Few research have studied the amenity-pricing effects during housing market cyclesto understand the impact of amenity on real estate price formation. Withoutconsidering housing market cycle would induce the biased estimate of willingness to pay for amenity (Kuminoff and Pope, 2013; Frey et al., 2013; Ihlanfeldt and Mayock, 2014). Third, we also explore the channels through which local public goods affect the amenity value of wetland. Arecent literature examined housing demand and housing market dynamics over the business cycle (Gabriel et al., 2016; Fan et al., 2016; Coulson and Zabel, 2013), we also contributes to this literature by focusing the impact of local public goods on real estate prices.

The next section reviews the literature review about urban wetlands and housing value. Section 3 describes our method and data. Section 4 provides our estimation results and discussion. The final section concludes the paper.

2. Literature review

An increasing amount of empirical studies in environmental, urban and housing economics have examined the value or capitalization effects of urban amenities (Fan et al., 2016; Gibbons et al., 2014; Tapsuwan et al., 2009). Brander et al. (2006) provides a comprehensive analysis of literature on the empirics of wetlands valuation.

Estimating wetlands' value is difficult, as most services and benefits from wetlands are not traded via a market. Nonmarket valuation approaches, including revealed and stated preference methods, has been applied to estimate wetlands' amenity value. The hedonic price method, a revealed preference method, has been successfully applied to estimate environmental amenity values. Most research using the hedonic price method to value environmental goods has been based on Rosen's (1974) theoretical model. Rosen illustrated how willingness to pay for an amenity could be inferred from the estimated relationship between amenity attributes and housing prices based on the hedonic price model. Given spatial equilibrium in housing markets, housing prices reflect the marginal implicit prices of heterogeneous attributes, including urban amenities, associated with housing prices. The hedonic price method was successfully applied to identify the amenity value of

wetlands, as housing prices near urban wetlands include a capitalized amenity value based on wetlands' proximity. However, two issues commonly facing hedonic price method are misspecification errors and omitted variable biases (Kuminoff et al., 2010).

Recent studies have focused on estimating the amenity of urban wetlands in developed countries (Boyer and Polasky, 2004). Mahan et al. (2000) found that decreasing the distance to wetlands by 1000 feet raised the housing value by US$436, based on case study in Portland, Oregon. Doss and Taff (1996) estimated the proximity value of wetlands in Ramsey County, Minnesota, and found that a 10 m decrease in the distance to open-water wetlands increases housing prices by US$99. Tapsuwan et al. (2009) found that 1 m moving closer to a wetland increases the housing prices by AU$42.40 in Australia. Netusil (2013) studied the impact of ownership of urban environmental amenities on nearby housing prices in Portland, Oregon, and found a negative effect of privately owned land with wetlands on nearby properties' price. However, few studies estimated the amenity value of urban wetlands in developing countries. Therefore, the following question arises: What are residents in developing countries willing to pay for proximity to urban wetlands?

Compared to American and European countries, there is still limited research on valuing wetlands and urban amenities in China. Wen et al. (2014) studied lake landscapes' effects on housing prices in Hangzhou, China, and found these landscapes significantly influence housing prices. Hui and Liang (2016) estimated the impact of urban landscapes on property prices in Guangzhou, China, and found a significant proximity effect of such views on housing prices. Similarly, Hui et al. (2012) studied the impact of various landscape views on housing prices in Hong Kong, and discovered garden views significantly influence housing prices. However, while these studies examined the price effects of urban amenities, they did not provide direct estimates of willingness to pay for amenity values.

Recent studies have also examined the temporal effect of amenity values or the heterogeneous amenity values during the housing market cycle (Fan et al., 2016; Coulson and Zabel, 2013; Chadourne et al., 2013). These studies found that environmental amenity values vary during the housing market cycle and are higher during boom periods. For example, Chadourne et al. (2013) examined amenity values over the housing cycle and found that the value drops by 13% during a recession. Fan et al. (2016) found that proximity values of parks and golf courses decrease by over 20% during a housing bust period. These empirical studies imply that hedonic estimates of amenity values should consider the temporal effects of the housing market cycle, or estimated coefficients could be biased (Coulson and Zabel, 2013; Fan et al., 2016). However, few researches have studied the amenity-pricing effects of urban wetlands during the recent housing market cycle, especially from China.

In addition, housing supply constraints would influence the hedonic equilibrium, affect the demand for amenities, and thus impact amenity values (Glaeser and Gottlieb, 2009; Walsh, 2007). Irwin et al. (2014) found, based on a case study of Michigan, that housing supply constraints associated with open space preservation contribute to higher housing prices and offset their amenity value. Ihlanfeldt and Mayock (2014) revealed that housing prices increase less during boom periods for larger supply elasticity, but are unaffected during bust periods. However, housing prices in urban fringes with fewer supply constraints experienced more volatility throughout the housing market cycle (Kuminoff and Pope, 2013). Housing supply constraints may be related to local public goods (Taylor and Smith, 2000); that is, local public goods (services), such as schools, buses, and amenities, influence the value of natural amenities as there is a complementary effect between these two attributes.

Stated preference method, including contingent valuation and choice experiment approach, are another type of non-market valuation method for valuing urban wetlands. It was widely applied to estimate the willingness to pay for wetland in a hypothetical market (Franco and