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# *The Impact of Urban Forests on Housing Prices*

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***Abstract:*** The beautiful urban forest is a place for people's daily leisure and entertainment, which brings people psychological pleasure and comfort, and also has an important impact on the quality of the city. Since most of the landscape benefits are recessive and its comfort value is difficult to directly measure with currency prices, scholars at home and abroad have widely adopted the characteristic price method for empirical research. Taking Hangzhou as an example, this paper selects 25 explanatory variables from the four dimensions of architecture, neighborhood, location, and landscape to construct a characteristic price model, and quantitatively evaluates the impact of various landscapes within the city on residential prices. The empirical results show that the housing price is negatively correlated with the distance to the West Lake and the park, but positively correlated with the park area: among them, for every 1% increase in the distance to the West Lake and the nearest park, the housing price will drop by 0.240%. And 0.036%; for every 1% increase in the area of the park, the price of nearby houses will increase by 0.012%; landscapes such as squares, mountain views, and Qiantang River also have a significant effect on housing prices within a certain range.

## 1. Introduction

With the continuous development of the socio-economic level, urban residents pay more and more attention to the quality of the living environment, and the beautiful landscape brings spiritual pleasure and physical benefits to people. The landscape in the usual sense is a certain visual object that can make people feel pleasant, fresh, or have a specific humanistic meaning. Urban landscapes can be divided into mountain views, lake views, sea views, river views, parks and green spaces, and leisure squares. These landscapes are the most accepted and vibrant parts of the city. Beautiful landscape represents a kind of comfort associated with residential location. Many studies have shown that comfort has inherent value, and renters or buyers are willing to pay an additional price for the adjacent landscape of the residence[1, 2]. However, the comfort of the landscape refers to the degree of satisfaction that the landscape provides to people. Its economic value is hidden and it is difficult to directly measure it with currency prices.

How to measure the hidden value of the landscape, the characteristic price method is currently the most widely used in foreign countries, that is, by quantifying the additional value that residents are willing to pay for the comfort of the living environment, analyzing the impact of the landscape on the housing price, thereby externalizing the intrinsic value of the landscape . The characteristic price theory believes that heterogeneous commodities have a series of characteristics, and the utility of these characteristics to people determines the price of commodities. Its core lies in evaluating the

implicit price of each attribute by fitting market transaction data, and establishing a functional model of the relationship between price and each attribute characteristic to reveal the influence of each attribute characteristic on its value.

Research in this area can be traced back to Darling's analysis of the external benefits of urban water parks in 1973. Some early studies have shown that landscape has a significant effect on housing prices. For example, studies by Platner and others have shown that lake views increase the value of houses, which is 4-12% higher than that of houses without lake views; Gilard research shows that houses located in landscape areas the price is about 9.2% higher than that of a house without a view. Rodriguez et al. classified the houses according to whether there are landscapes around the houses and found that high-quality landscapes increase the price of houses by about 8%. However, limited by data acquisition and quantification methods, fewer samples have become a major flaw in early research.

With the development of measurement technology and the convenience of data collection, many scholars have conducted more detailed studies on the external benefits of urban forests, parks, green spaces, wetlands, and lake views. For example, Lisa chooses the distance to the nearest park and green space, the distance to the nearest forest and green belt, and the number and area of green space around the house as landscape feature variables. The results show that urban forest area is a preferred feature of people and has a positive impact on housing prices.

Urban landscape plays a vital role in the sustainable development of cities and people's quality of life. However, as a public good, the economic benefit value added by forest has not been manifested, and it is often at a disadvantage in the government's land use and urban layout planning decisions. Evaluating the external economic value of urban forests to measure the degree of its impact on housing prices can determine people's preferences when choosing residential locations, and can provide important reference suggestions for urban planning and real estate development decisions. Therefore, exploring the quantitative evaluation of the hidden benefits of urban forests has very important theoretical and practical significance.

## 2. Data sources and research methods

For listing data, since the time span of the data is very small, the impact of time on price can be ignored[2]. The data sample takes multi-story, small high-rise and high-rise residential buildings as the research objects, and excludes building types such as row houses and villas to make houses prices comparable. In addition, using the data of 653 residential pairing samples in the same period, the regression equation between the average listing price and the average transaction price was constructed, and the listing price was calculated. Corrected. In addition, from June 21, 2018 to July 13, 2018, field investigations were conducted on 660 residential communities in the study area to confirm and supplement community-related information not provided by the intermediary company (such as the internal environment and public facilities of the community, property management Quality, surrounding environment and living facilities of the community, etc.) to make the data more accurate and complete. The distribution of sample cells is shown in Figure 1.

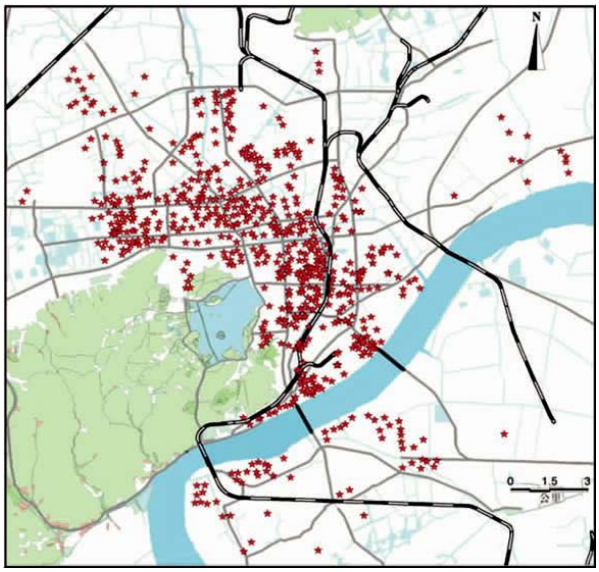

*Figure. 1 Location distribution of sample plots*

Linear, semi-logarithmic and logarithmic forms are the three commonly used functional forms in characteristic price models[3]. After continuous experimentation and comparison, this paper uses logarithmic form to establish the model, taking the natural logarithm of the house price as the dependent variable, and the continuous variables such as distance, area and house age among the independent variables use logarithmic form, while dummy variables and grade variables use linear form. The specific function form is as follows:

$$\ln P = \beta_0 + \sum \beta i \ln Xi + \sum \beta j X_j + \varepsilon \quad (1)$$

In the formula, P is the house price, Xi is the continuous characteristic variable; Xj is the discontinuous characteristic variable; β0, βi, βj are the coefficients to be estimated; ε is the error term.

## 3. Result analysis

Using SPSS software, the least squares method is used to perform regression analysis on the characteristic variables that affect residential prices and residential prices, and the regression results of the model are obtained[4]. The F value of the analysis of variance is 1248.182, and its significance level is less than 0.001, which shows that the regression equation has a good overall effect. It rejects all the hypotheses that the coefficient is 0, indicating that the logarithmic function established for housing prices and housing characteristics can be established. The adjusted R2 value is 0.918, and the percentage of the difference in dependent variables explained by the model is 91.8%, indicating that the model has a better fit. The residential characteristic variables entered into the model have a significant impact on housing prices and have good explanatory power. In the collinearity test, the value of the variance expansion factor of all variables is between 1.028 and 3.805, which is far less than 10. Therefore, it is considered that the degree of collinearity between the independent variables is not serious.

### 3.1 Price elasticity analysis of urban forest characteristics

In the logarithmic model, the unstandardized regression coefficient corresponds to the price

elasticity coefficient or semi-elasticity coefficient of residential characteristics. The regression coefficient of the continuous variable corresponds to the price elasticity of the corresponding housing characteristics, that is, the percentage of the change in housing price when a variable changes by 1% under the condition of the other variables unchanged; the semi-elasticity coefficient is because the independent variable is not For continuous variables, the unstandardized coefficients of regression cannot be directly used, and need to be derived from the antilog of the regression coefficients.

The analysis of the price elasticity of forest characteristics is as follows: (1) As a world-famous landscape, West Lake has the greatest impact on the price of residential houses in the city. For every 1% increase in the distance to West Lake, the price of houses will drop by as much as 0.240%; (2) ) For every 1% increase in the distance to the nearest park, the house price will drop by 0.036%. The area from the nearest park has a positive effect on the house price. For every increase of 1%, the house price will increase by 0.012%; (3) ) There is a lake-type (non-West Lake) landscape within 1 km of the residential area, which can bring 7.46% value-added to the residence, and having a leisure square and green space within 500m of the surrounding will increase the housing price by 6.08%; (4)" The variable meaning of “near the Qiantang River” and “near the canal” is whether the shortest distance to the Qiantang River and the large canal is within 1 km, which shows the degree of accessibility of residents to the Qiantang River and the canal. The houses within 1km of the canal should be about 3.05% and 1.51% higher than the prices of ordinary houses, respectively; (5) The residential quarters have mountain views or are built near the river, indicating that the communities have better views of the scenery and convenience. Resting comfort can bring about 5.02% and 1.51% of value-added to the residence respectively.

### 3.2 Marginal price analysis of urban forest characteristics

Based on the average value of the total price of each house and the forest characteristics, the marginal price of the forest characteristics is analyzed, that is, the monetary price value that the total price will increase for each additional unit of each forest characteristic variable. According to descriptive statistics, the average value of the total price of the data sample is 237,200 yuan. The marginal price of the logarithmic form variable is calculated according to the elastic coefficient, while the marginal price of the non-logarithmic form variable is derived according to the semi-elasticity coefficient. (1) For every kilometer increase in the distance to the West Lake and the park, the total housing price will be reduced by 14.354 million yuan and 100.8 million yuan respectively;An increase of 1 hectare will increase the total housing price by 0.494 million yuan; (2) The Qiantang River and the canal landscape can bring an average increase of 71.18 million yuan and 35,32 million yuan to the housing prices within the 1km watershed respectively. (3) The total price of houses in the communities with mountain views and Linhe is 11.73 million yuan and 35.32 million yuan higher than those of ordinary houses, and the lake and square green space bring 17 houses to the surrounding 1km and 500m respectively. .4.49 million yuan and 14.20.5 million yuan in appreciation.

## 4. Conclusion and discussion

Taking Hangzhou as an example, this paper establishes a characteristic price model by collecting data on housing prices and other characteristics in six main urban areas to quantitatively evaluate the impact of various types of landscapes in Hangzhou on housing prices. Research indicates:

(1) Various landscapes have a certain degree of pleasantness, which can bring comfort to nearby residents. As far as Hangzhou is concerned, the West Lake, the canal, and the Qiantang River determine the overall landscape of the city. Parks, squares, rivers, lake views, and mountain views

are regional landscapes, all of which have a positive impact on residential prices. It shows that people have strong landscape preferences and are willing to pay additional prices for the comfort of the living environment.

(2) The comfort that the landscape brings to people is different due to different types and qualities, so the degree of impact on residential prices is also different. Sorted according to the standardized coefficients, the degree of influence of landscape variables on housing prices in descending order is: West Lake, parks, squares, mountain views, lake views, Qiantang River, canals, and rivers. Among them, West Lake, as a large-scale landmark landscape in Hangzhou, has the strongest impact on residential prices.

(3) There is a significant negative correlation between West Lake distance, park distance and residential prices. For every 1% increase in the distance to the West Lake, the price of residential houses will drop by 0.240%, and the price of standard houses will drop by RMB 143,400; for every 1% increase in the distance from the park, the price of dwellings will decrease.Home prices fall0.036%, Standard house prices fall10.008Ten thousand yuan.

(4) The Qiantang River, canal, Mountain View, square, lake view, river and other landscapes have a significant appreciation effect on surrounding residential buildings. On average, Qiantang River, Canal, and Lake View have brought about 71,18 million yuan, 35,32 million yuan, and 17.449 million yuan to residential prices within 1 km of nearby areas, respectively; the square increases the value of housing prices within 500m of the surrounding area. The price of residential houses rose by an average of 142.5 million yuan; the prices of residential houses in the districts with mountain views and Linhe were higher than ordinary residential houses by 11.738 million yuan and 35,320 yuan respectively.

This study has the following shortcomings: First of all, in terms of sample data collection, because the source of actual residential transaction data is difficult to obtain and contains fewer residential characteristics, this paper uses residential listing data, although the listing price is used in the modeling. Correction, but there may still be a certain error in reflecting the residents' willingness to pay; secondly, for the Qiantang River landscape, it is relatively simple to study whether the dummy variable is within 1km. Although a significant positive result is obtained, it is not accurately measured. The scope of the watershed affected; third, this article also includes multiple types of landscapes for comprehensive research, and the analysis of the main landscapes of cities such as the West Lake and the canal can be further deepened, such as collecting multi-year data for time-space effects research. All these shortcomings need to be remedied in the future.

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