Research on Spatial Differentiation of housing Price and Its Influencing Factors from the Perspective of Aging

——A Hedonic Analysis in Guangzhou

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Abstract-The architectural characteristics of the house itself determine the basic value of the house, and the house price is also often tied to resources such as education, medical care, transportation, and environment, etc. Under the trend of population aging, the aging transformation of living environment has become the focus of social attention. Using Hedonic Model, the paper built an Overall Housing Price Model and two Sub Models in order to examine the impact of the characteristics related to aging suitability on housing price. Then the paper compared the Sub models to the Overall Model to explore the spatial heterogeneity of housing price. Based on the statistical results, some suggestions were finally put forward for the construction of suitable old living environment.

Keywords-housing price; Hedonic Price Model; spatial differentiation; aging suitability

1 INTRODUCTION

According to the data of the seventh census, by the end of 2020, China has 18.70% of the population aged 60 and over, and is about to enter a moderately aging society. As is known to all, a safe, comfortable, and convenient age-friendly living environment plays an important role in ensuring the physical and mental health of the elderly. Unfortunately, lots of existing houses and communities were focused on young and middle-aged people during the design and planning, and the problem of adaptation to aging is difficult to solve for the time being. Therefore, from the perspective of aging, this paper takes the housing price in Guangzhou as the research object to explore the impact of some basic aging related housing characteristics.

The house itself is a commodity full of heterogeneity. There are great differences between the different characteristic elements that make significant influence on housing price, including structure characteristics, neighborhood characteristics and location characteristics, etc. To

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clearly identify the factors, both domestic and overseas scholars of use the Hedonic Price Model (HPM).

Hedonic Price Model originated in the 20th century, combining the Consumer Theory of Lancaster [1] with the Market Equilibrium Model from Rosen [2]. Hedonic Price Model reflects the preference of consumers and the key characteristics affecting the housing price. Therefore, housing products are sold as a collection of a series of its internal characteristics, and those collections affect the choices of consumers in the same time [3]. From a traditional economic view of point, housing price differs a lot due to the different combination of characteristics [4].

Lots of scholars have already done some research about the relationship between the housing characteristics and housing price based on the Hedonic Price Model. Sirpal R. verified the shopping centers can push up the price of housing products around them [5]. Ghebreegziabiher considered the rail traffic could influence the housing price [6]. In China, similar researches were done to figure out how Chinese real estate market works. Yi analyzed the factor affecting the commercial housing in Wuhan city [7]. Huang based on the multiple regression model to analysis how land price affects the housing price [8]. Zhao collected the residual market history trading data of Guangzhou city thinking there was a relationship between the housing price and the trading volume [9].

In the existing relevant studies, few have analyzed and explained the influencing factors of house prices from the perspective of aging. On the other hand, most of the research data samples were based on the real estate and the community, and they studied the influence of location characteristics on the average housing price of the community, ignoring the differences of building characteristics among different residences within the community, such as floor, orientation, apartment type and other factors that will significantly affect the living experience.

In order to explore the impact of relevant factors on housing price and explore the spatial heterogeneity, the paper collected the housing listing data of eleven districts in Guangzhou City form January 1st 2017 to April 30th 2020. Using the data, the paper will establish 3 Hedonic Price Models, and analysis it to know the influence degree of each characteristic on housing price and how they differ among different districts.

2 DATA AND MODEL

2.1 Data and variable description

The paper collected the housing trading records from January 1st 2017 to April 30th 2020 of the eleven districts of Guangzhou, including Tianhe District, Huangpu District, Yuexiu District, Panyu District, Baiyun District, Haizhu District, Nansha District, Huadu District, Liwan District, Zengcheng District, and Conghua District. In order to make the results more convincing, the paper only chose the commercial housing as the research object, excluding the self-built houses, single apartments with a 40-year service life, and the houses built on the funds collected by the buyers. Finally, a total of 13396 samples were selected to enter the overall housing price model of commercial housing market.

According to the existing research results at home and abroad, 15 variables were selected from three aspects: structural characteristics, neighborhood characteristics and location

characteristics [10-11]. The detailed description, quantification and expected impacts of the characteristic variables are shown in Table 1.

Table 1. Variable description, quantization, and expectation

Characteristics type	Variables	Description and quantity	Expectation
Structure characteristic	Area	Housing sales area (m^2)	+
	Floor	The number of the floor where the house is located	/
	First floor	1 if the house is 1st floor, and 0 otherwise	+
	Top floor	1 if the house is the top floor, and 0 otherwise	−
	Orientation	1 if the house faces south (including southeast and southwest), and 0 otherwise	+
	Elevator	1 if the building is equipped with an elevator, and 0 otherwise	+
	Total floors	The total number of the building's floors	−
Neighborhood characteristic	Kindergarten distance	The shortest direct distance from the center of the community to a kindergarten (m)	−
	Primary school distance	The shortest direct distance from the center of the community to a primary school (m)	−
	Secondary school distance	The shortest direct distance from the center of the community a secondary school (m)	−
	Hospital distance	The shortest direct distance from the center of the community to a hospital (m)	−
Location characteristic	CBD distance	The shortest direct distance from the center of the community to the CBD (m).	−
	Subway station distance	The shortest direct distance from the center of the community to a subway stations (m)	−
	Pearl River distance	The shortest direct distance from the center of the community to the Pearl River (m)	−
	Baiyun Mountain distance	The shortest direct distance from the center of the community to the White Cloud Mountain (m)	−

2.2 Model specification

Four functional forms of the Hedonic Price model are frequently used, namely linear form, semi-log form, and linear semi-log form. After continuous trial and comparison, the paper used the logarithm form, taking the logarithmic form of housing price as the dependent variable. The basic functional form is as follows:

$$\ln P = \beta_0 + \sum \beta_i \ln Z_i + \sum \beta_j Z_j + \varepsilon \quad (1)$$

In the formula, P is the total transaction price of the house; β_0, β_i, and β_j are parameters with estimates; Z_i and Z_j take continuous characteristic variable and virtual characteristic variable respectively; ε represents the error.

3 OVERALL HOUSING PRICE MODEL

3.1 Regression results

The paper uses the OLS method to perform regression analysis via SPSS. Through the regression estimation of the model, the significance of Primary School distance reaches to 93.7%, so the paper removes this variable from the model. The final regression results are shown in Table 2 and 3.

Based on Table 2, each VIF value is far lower than 5, means there is no multicollinearity problem in this model. What's more, the adjusted R^2 value of the model is 0.739, which indicates that the model can explain about 73.9% of the difference of dependent variables. The D-W is close to 2, it can be considered that the error terms obey normal distribution and there is basically no heteroscedasticity problem. As shown in Table 3, the probability of non-significance is 0.000, which rejects the hypothesis that all the independent variable coefficients are 0. Therefore, the model has a good fit and good explanatory ability.

Table 2. Coefficients

Variables	Unstandardized Coefficient		Standardized Coefficient	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	1.903	0.160		11.915	0.000		
Area	0.034	0.000	0.777	141.822	0.000	0.816	1.225
Floor	0.004	0.002	0.015	2.132	0.033	0.464	2.154
First floor	0.057	0.068	0.004	0.841	0.400	0.949	1.053
Top floor	− 0.122	0.044	− 0.015	− 2.775	0.006	0.897	1.115
Orientation	0.019	0.027	0.003	0.693	0.488	0.984	1.016
Elevator	− 0.044	0.032	− 0.009	− 1.382	0.167	0.521	1.921
Total floors	0.025	0.002	0.121	13.848	0.000	0.323	3.100
DisKid	0.058	0.018	0.021	3.222	0.001	0.579	1.727
DisSec	0.199	0.016	0.072	12.671	0.000	0.754	1.327
DisHos	− 0.368	0.013	− 0.221	− 27.626	0.000	0.383	2.610
DisCBD	− 0.104	0.014	− 0.045	− 7.603	0.000	0.704	1.416
DisSub	− 0.043	0.014	− 0.025	− 3.191	0.001	0.400	2.499
DisPR	− 0.127	0.010	− 0.067	− 12.551	0.000	0.861	1.162
DisBYM	− 0.059	0.016	− 0.020	-3.782	0.000	0.861	1.161
Adj-R^2	0.739						
D-W	1.904						

Table 3. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	37159.153	14	2654.225	2156.932	0.000
Residual	13093.225	10640	1.231		
Total	50252.378	10654			

3.2 Factor analysis

(1) Structure characteristics

The structure characteristics are the physical features of houses, which directly contribute to the living comfort of residents. Basically, structure characteristics are unchangeable because most features are settled together with the construction of the house. The owners may concern a lot about the structure characteristics since they may influence the living quality in a long term. The paper can tell from the model that the Floor has a positive impact on the total housing price. Residents of all ages enjoy the views from tall buildings, especially the elderly also prefer the adequate sunshine and quite environment on high floors. In addition, the influence of orientation is not significant in our study. It should be because Guangzhou is located south of the Tropic of Cancer, which is different from most parts of China, so the preference for houses facing south is not obvious.

In terms of daily travel of the elderly, living on the first floor means that they can directly enter and exit the house without taking stairs or elevators, which is very convenient for the elderly with physical decline. Similarly, the setting of elevator is also very important for the elderly who have difficulty walking. However, in this study, the impacts of First floor and Elevator are not significant. This may be because the houses on the first floor may have problems such as moisture regain and noise interference, and the elevator will occupy a large part of the area, which reduces the actual use area of the house, which both offset the benefits of convenient travel for the elderly. The impact of Top Floor is as negative as expected. The great dependence on the elevator leads people to try to avoid the top floor when choosing, especially the elderly families.

(2) Neighborhood characteristics

Neighborhood characteristics describe the distribution of public service resources such as schools and hospitals. The distance from houses to these places determines the accessibility of resources. Unexpectedly, according to the regression results of the sample data, the farther away from the school, the higher the house price. Perhaps due to the increasing social competitive pressure, parents try their best to send their children to a better school rather than the nearest school, which leads to the abnormal performance affected by Diskid and DisSec. According to the coefficients table and analyzation, the paper can tell that the Hospital distance is the key factor affecting the housing price. As one of the most important public service resources, hospitals play an important role in people's daily life. Possible emergencies mean that the hospital cannot be too far away from the house. People, especially the elderly with more frequent daily medical needs, prefer to pursue the convenience of medical treatment, so the house prices around the hospital are higher.

(3) Location characteristics

The location characteristics are used to make the comprehensive assessment of a house product's social resources, judging the regional advantages of the house product. The four location characteristics selected in this paper have a negative impact on house prices. The farther the distance, the lower the price. If the distance from CBD and subway station affects the convenience of work, entertainment, shopping and transportation of young and middle-aged residents, the distance from Pearl River and Baiyun Mountain represents the impact of landscape natural environment and leisure vacation. Older people prefer to live in places with beautiful scenery and convenient for walking and exercise, such as around Baiyun Mountain.

4 SUB MODEL

Even in the same city, the factors affecting house prices may be different in different regions. In this part, this paper divides the administrative regions of Guangzhou according to the GDP ranking in 2020. Tianhe, Huangpu and Yuexiu, whose GDP is significantly ahead of other regions, are divided into the first area; Panyu, Baiyun and Haizhu, whose economic level and GDP growth rate are basically the same, are divided into the second area. This paper attempts to construct the sub models of the first zone and the second zone to find out the differences and commonalities of the factors between different models.

4.1 The First Area Sub Model

The paper uses the same method to build the First Area Sub Model. For all the variables entering the model, there is no specific nonsignificant variables. Its adjusted R^2 is 0.829, which shows a better fit than the overall model.

Although the factors influencing the housing price in the First Area Sub Model is kind of similar with the overall model, there are still a few differences. First floor negatively affects the housing price. The paper deduces that the business buildings take up the green area in this area, which causes those first-floor houses lose the accessibility to the green space. With the concentrated distribution of skyscrapers, the elevator has a positive effect on housing price, and this influence is more significant. On the other hand, Hospital distance, Pearl River distance and Baiyun Mountain distance are no longer valid variables for the First Area Model. It may be caused by the main function of the first are, that is, the commercial value of has a huge effect on housing price.

4.2 The Second Area Sub Model

Like the First Area Sub Model, Pearl River distance and Baiyun Mountain distance are not significant. The paper considers that the distribution of the famous tourist attractions like Chimelong Tourist Resort and Haizhu Lake makes the Second Area a special place. The residents here are no longer limited to the pursuit of iconic landscapes such as Baiyun Mountain and the Pearl River. In addition, First floor and Elevator have significant positive impacts on housing price, while Top floor and Hospital Distance have significant negative impacts. This is consistent with the preference of the elderly for travel convenience and medical needs.

5 CONCLUSION

The paper built the Overall Housing Rrice Model, the First Area Sub Model and the Second Area Sub Model of Guangzhou by using hedonic model via SPSS. Based on the analyzation results and the comparison between different models, the paper can draw some conclusions about the factors affecting the housing price from the perspective of aging.

In addition to the consistent and significant effects of Area, Total floors and Subway station distance in the three models, the performance of other factors affecting housing price is very different in different areas. Firstly, the negative impact of Hospital distance reflects the general demand of residents for medical resources, which is also the basic daily needs of the elderly. Secondly, the impact of Elevator is more significant in the two sub models than in the overall model, and has a positive impact on housing price. This shows that in areas with a high level of economic development, the travel convenience brought by elevators has been valued by residents, especially elderly families. This is also in line with the law that the improvement of economic conditions will increase pension demands. Last but not least, affected by regional function and scenic spot distribution, the impact of Pearl River distance and Baiyun Mountain distance on housing price in the sub models is not as significant as that in the overall model. Because other relevant factors, such as parks and small landscapes, are not included in the model, people's preference for beautiful environment and leisure venues needs to be further studied. To sum up, in order to meet the housing needs of the elderly now and in the future, enhancing the accessibility and equitable distribution of medical resources is the primary consideration of the government. It can be predicted that the demand of the elderly for elevators will also increase with the development of economy. Whether it is new houses or the transformation of old residential areas, the installation of elevators has to be taken into account. What’s more, the demand for green environment and leisure space can not be ignored. Even if it is impossible to shorten the distance from the scenic spot, developers should try their best to create a good public environment in the residential area.

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