Influencing Factors of Housing Sales Vacancy in the Guangzhou Metropolitan Area, China

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Abstract: In this paper, nine indicators selected from three perspectives (convenience, environmental and location characteristics) and three regression models (OLS, SLM and SEM) are used to explore the influencing factors of housing sales vacancy in the Guangzhou Metropolitan Area, China. The results show that subway accessibility, peripheral aversion municipal facilities and distance from the CBD (Central Business District) are consistent with theoretical expectations. Subway accessibility is negatively correlated with the housing sales vacancy rates, while peripheral aversion municipal facilities and distance from the CBD are positively correlated with housing vacancy rates.

Keywords: Housing vacancy; Regression models; Sales vacancy; Influencing factors; Guangzhou Metropolitan Area

1. Introduction

Housing vacancies are an important index with which to evaluate the health of the real estate market. The growing housing vacancy problem leads to wasted resources. Only by identifying the causes of housing vacancies can we take effective measures to reduce the vacancy rate. According to the literature, the influencing factors of housing vacancies come from many aspects: for example, housing characteristics, including the building age [1], floor area [2], and orientation. Location factors, including distance from the CBD, living facilities, traffic conditions, educational and medical resources, also have an impact on vacancy rates, as do social factors, such as population density, per capita GDP [3], and housing purchase policies. Other factors, such as property developers' speculation [4], property hoarding, and price rigging lead to a high housing vacancy rate. However, there is still a lack of research on the influencing factors of "sales vacancies."

Taking the Guangzhou Metropolitan Area as an example, this research selects 9 influencing factors from three perspectives and uses three regression models to explore the influencing factors of the housing sales vacancy rate. The influencing factors of the vacancy rate are identified, and this data may be helpful for concerned departments in taking targeted and effective measures to improve the housing destocking degree and reduce the sales vacancy rate.

2. Method and data

2.1. Study area and data

This paper takes as its study area the Guangzhou Metropolitan Area, which is located within the Guangzhou Ring Expressway-Guangzhou-Gaoming Expressway-Guangzhou administrative boundary [5]. The residential housing quarters' sales data from the Net Ease data center in Guangzhou is used to calculate the housing vacancy rate. Considering that the sales cycle of commercial housing in China is generally 2-5 years, this paper selects the 2015-2018 open residential quarters with 70-year property rights in the Guangzhou Metropolitan Area as sample data and screens a total of 101 data points. According to the location of properties, they are grouped into 48 subdistricts, and the vacancy rates of the subdistricts are calculated.

2.2. Calculating average housing vacancy rates of subdistricts

The average housing vacancy rates in the subdistricts were calculated as follows: the sold residential units were subtracted from the total residential units in each subdistrict, and the sales vacancy rate of each subdistrict was calculated according to the formula:

Housing sales vacancy rate = (Total units - Sold units)/ Total units *100%

2.3. The construction of the index of influencing factors

In this paper, 9 influencing factors are selected from three perspectives for scoring evaluation, with scores ranging from 1 to 9. The specific evaluation and calculation methods are based on a study by Wang et al.[6] There are nine factors that affect the sales vacancy rate: 1. Convenience characteristics, including subway accessibility, office accessibility, basic education convenience and business service convenience; 2. Environmental characteristics, including park accessibility, peripheral aversion municipal facilities, industrial pollution, logistics centers and wholesale markets; 3. Location characteristics, including distance from the CBD (**Table 1.**). Finally, we obtain 8 influencing factor scores, distance from the CBD and vacancy rate data for each subdistrict, which is convenient for spatial regression analysis.

Table 1. Evaluation index system of influencing factors of housing sales vacancy in the Guangzhou Metropolitan Area.

Perspectives	Influencing factors	Expected direction
V1 Convenience Characteristics	F1 Subway accessibility	-
	F2 Office accessibility	-
	F3 Basic educational convenience	-
	F4 Business service convenience	-
V2 Environmental Characteristics	F5 Park accessibility	-
	F6 Peripheral aversion municipal facilities	+
	F7 Industrial pollution	+
	F8 Logistics centers and wholesale markets	+
V3 Location Characteristics	F9 Distance from the CBD	+

2.4. Research methods

In this paper, three regression models-namely, the ordinary least square (OLS), spatial lag model (SLM) and spatial error model (SEM)-are comprehensively selected. We choose the optimal model, and then the

influencing factors of the housing sales vacancy rate in the Guangzhou Metropolitan Area are explored.

OLS is a traditional linear regression model that can be used to study the linear relationship between dependent variables and independent variables, that is, to study the linear relationship between the housing sales vacancy rate and 9 influencing factors in the Guangzhou Metropolitan Area. In this model, the variables are independent of each other, and the spatial information of the variables is not considered. The OLS is established the model as follows:

$$(1) \qquad y_s = \beta X_s + \varepsilon_s, [\varepsilon_s \sim N(0, \delta^2 I)$$

In the above formula, $s = 1, 2, …, 48$, which indicates the subdistrict sample data in the Guangzhou Metropolitan Area; y_s is the dependent variable, which is the housing sales vacancy rate of subdistricts in the Guangzhou Metropolitan Area; X_s denotes the i-dimensional row vector ($i = 1, 2, …, 9$) of the vacancy rate influencing factor, representing the observed value of the ith variable of influencing factor in the sth subdistrict; β is the i-dimensional column vector, which is the spatial regression coefficient corresponding to the independent variables of these 9 factors. ε is the error term of the model, $\varepsilon_s \sim N(0, \delta^2 I)$ indicates that the error term follows a normal distribution, and its variance is consistent, that is, the product of error and covariance matrix is 0; I is the identity matrix.

Based on the OLS linear regression model mentioned above, a spatial regression model-the spatial lag model (SLM)-considers the influence of the vacancy rate of a subdistrict on the vacancy rate of other neighboring subdistricts in the study area, that is, the spatial spillover effect. The spatial lag model (SLM) is used to analyze the influencing factors of the housing sales vacancy rate in the Guangzhou Metropolitan Area. The model can be expressed as follows:

$$(2) \qquad y_s = \rho \sum_{j=1}^{n} W_{sj} y_j + \beta X_s + \varepsilon_s, [\varepsilon_s \sim N(0, \delta^2 I]$$

where ρ is the coefficient value of spatial autocorrelation and W_{sj} represents the spatial weight matrix. In the regression analysis of the above model, there may be spatial autocorrelation due to the independent error items in the model. At this time, the spatial error model (SEM) can be introduced, which can consider the spatial spillover effect of independent error terms and solve this problem well. SEM is expressed as:

$$(3) \qquad y_s = \lambda \sum_{j=1}^{n} W_{sj} \varphi_s + \beta X_s + \varepsilon_s, [\varepsilon_s \sim N(0, \delta^2 I)]$$

where φ represents the spatial autocorrelation error term and λ is the spatial autocorrelation coefficient of the error term [6].

3. Results and discussion

GeoDa software is used to run these three models, the FD (Fixed Distance）method is used to determine the spatial weight matrix, and the threshold distance is the default value (5638 m). The regression results of OLS, SLM and SEM are comprehensively compared, and the optimal model is selected. As shown in **Table 2.** below, the results show that R^2 and log likelihood of SEM are the largest and AIC is the smallest, which indicates that SEM should be selected among the three models to explore the influencing factors (**Table 3.**).

In terms of convenience characteristics, this study selected 4 indicators of influencing factors, among which the p values of three indicators were all less than 0.05, passing the 95% significance test. The regression coefficients of subway accessibility, office accessibility and basic education convenience are -0.0345, 0.0538 and 0.0404, respectively. From the regression coefficient, it can be seen that subway accessibility is negatively correlated with the housing sales vacancy rate. The higher the subway accessibility is, the lower the sales vacancy rate, which is in line with the theoretical expectation. Moreover,

the result indicates that the more convenient the subway is, the more attractive the area is for buyers, the better the housing sales and the lower the sales vacancy rate. Additionally, the sales vacancy rate will decrease by 3.45% for every point increase in the convenience score of the subway. Office accessibility and basic education convenience are positively correlated with the housing vacancy rate in the Guangzhou Metropolitan Area, and the housing sales vacancy rate increases by 5.38% for every point increase in office accessibility score. The sales vacancy rate increases by 4.04% for every point increase in the basic education convenience score. These two factors do not match the theoretical expectations. The reasons for this phenomenon may be due to two factors. On one hand, the study area of this paper is the Guangzhou Metropolitan Area, which has a prominent location advantage, and high housing prices will have a significant impact on buyers' behavior. On the other hand, perhaps because the object of this paper is "sales" of housing vacancies, it will be affected by various factors. These factors include brand awareness of real estate, marketing methods of developers, preferential policies, and more.

Table 2. Comparison of main parameters of three regression models in the Guangzhou Metropolitan Area

Model	R^2	AIC	Log likelihood
Ordinary Least Squares Model (OLS)	0.3569	-53.5689	36.7844
Spatial Lag Model（SLM）	0.3665	-52.0705	37.0353
Spatial Error Model（SEM）	0.4001	-55.6376	37.8188

Table 3. The regression coefficient of influencing factors of housing sales vacancy rate based on SEM in the Guangzhou Metropolitan Area

Variables	Coefficient	Std.Error	z-Value	p
CONSTANT	-0.4213**	0.1713	-2.4591	0.0139
F1 Subway accessibility	-0.0345**	0.0174	-1.9794	0.0478
F2 Office accessibility	0.0538***	0.0183	2.9384	0.0033
F3 Basic educational convenience	0.0404***	0.0151	2.6683	0.0076
F4 Business service convenience	-0.0309	0.0218	-1.4168	0.1566
F5 Park accessibility	0.0531***	0.0145	3.6567	0.0003
F6 Peripheral aversion municipal facilities	0.0895***	0.0346	2.5887	0.0096
F7 Industrial pollution	0.0096	0.0105	0.9167	0.3593
F8 Logistics centers and wholesale markets	-0.0128	0.0112	-1.1514	0.2496
F9 Distance from the CBD	0.0130**	0.0061	2.1408	0.0323
LAMBDA	-0.3297*	0.1910	-1.7257	0.0844

R^2：0.4001； AIC：-55.6376； Log likelihood：37.8188

Note: * * *, * * and * represent the 0.01, 0.05 and 0.1 significance levels, respectively.

From the perspective of environmental characteristics, park accessibility and peripheral aversion municipal facilities have a significant impact on the housing sales vacancy rate, and the degree of impact is positively correlated. For every point increase in park accessibility, the housing sales vacancy rate increases by 5.31%, which is inconsistent with the theoretical expectation. The closer the house is to the park, the higher the housing sales vacancy rate, which may be due to the high housing prices around the parks in the Guangzhou Metropolitan Area. Many buyers cannot afford high housing prices and can only

settle for the next best. Therefore, park accessibility is not necessarily a consideration when buying a house. The peripheral aversion municipal facilities have a positive correlation with the sales vacancy rate. The sales vacancy rate increases by 8.95% for every 1 point of peripheral aversion municipal facilities, which is consistent with the theoretical expectation. Because peripheral aversion municipal facilities will adversely affect residents' quality of life and health, buyers will naturally avoid houses near these facilities. As a result, the vacancy of these houses near municipal facilities (including high-voltage wires, garbage disposal fields, railway stations, and airports, etc.) must be relatively high.

In terms of location characteristics, this study only considers the distance from the CBD in a narrow sense. The SEM results show that the influencing factor is significant and has a positive correlation. For every 1 km increase from the CBD, the sales vacancy rate increases by 1.3%; that is, the farther away from the CBD that a residence is, the higher the sales vacancy rate. The closer people are to the CBD, the better the location conditions and resources, such as education, medical care, public services, and transportation. In contrast, the resources enjoyed by residents of houses farther from the CBD are relatively poor, the housing destocking degree is relatively low, and the sales vacancy is relatively high.

4. Conclusion

Housing sales vacancies in the Guangzhou Metropolitan Area are affected by many factors. In this paper, 9 influencing factors are selected by considering 3 perspectives, and the spatial regression model is used to explore them. The results show that subway accessibility has a negative correlation with housing sales vacancy, while office accessibility, basic education convenience, park accessibility, peripheral aversion municipal facilities and distance from the CBD have a positive correlation with housing sales vacancies in the Guangzhou Metropolitan Area. Moreover, the influence of subway accessibility, peripheral aversion municipal facilities and distance from the CBD on housing sales vacancies in the Guangzhou Metropolitan Area agrees with theoretical expectations. Therefore, when analyzing the influencing factors of housing sales vacancy in the Guangzhou Metropolitan Area in the future, we can focus on these three factors. At the same time, we should further explore other factors that have an impact on housing vacancies.

Disclosure statement

The author declares no conflict of interest.

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