Original Paper

Temporal and Spatial Effects of Urban Center on Housing Price

— A Case Study on Hangzhou, China

Haizhen Wen[1] & Luhong Chu[1*]

[1] The Center for Real Estate Study, Zhejiang University, Hangzhou, China

[*] Luhong Chu, Zhejiang University, Hangzhou, 310027, China

Abstract

With the acceleration of urbanization and the rapid development of real estate, people pay more and more attention to the change of urban housing prices. Over time, the change of city center will inevitably affect the urban land or housing prices, which is reflected in the spatial distribution of urban land or housing prices. Therefore, this article attempts to explore the impact of urban center on housing prices from the perspective of multi-center city and study separately from two aspects of time and space. This paper takes the six main urban districts of Hangzhou as the research scope. At the time level, we select the residential data from 2007 to 2015 to construct models respectively based on the hedonic price theory and find that the influence of different urban center on housing price shows a certain change with time. On the spatial level, this paper choses the residential data in 2012 to construct geographic weighted regression model and the result shows that the impact of three centers on housing prices shows a certain degree of spatial heterogeneity.

Keywords

city center, temporal effect, spatial effect, hedonic price model, geographic weighted regression model

1. Introduction

Since the reform and opening, the rapid economic development has promoted the acceleration of urbanization in China. With the acceleration of urbanization, a large number of cities set off a boom in the transformation of old cities and the construction of new districts. The spatial structure of cities is constantly evolving, and many cities have developed from a single-center form to a multi-center form. At the same time, new and old city centers are constantly evolving. The transformation of old city has rejuvenated the old center in city and its economic attractiveness continues to grow. However, the planning and construction of new urban areas not only open up new space for urban economy, but also

shape a new pattern of urban space.

With the rapid development of real estate industry, people are beginning to pay more and more attention to the change of urban housing prices. And the change of urban center will inevitably affect the land or housing prices in city, which is reflected in the spatial distribution of urban land or housing prices. Over time, the spatial distribution of land or housing prices will show significant differences under the influence of urban center evolution.Therefore, it is necessary to study the impact of urban center on housing price from two aspects of time and space, which will provide reference for government to formulate real estate related policies and developers to make development decision.

In recent years, many scholars in China have studied the spatial distribution of housing prices and the factors that affect housing prices. For instance, Dubin and Xu Jiangang (1997) analyzed the location factors influencing the spatial distribution of land prices in Shanghai and found that it has strong centripetality. And the correlation between land price and location factor is related to the commercial distribution pattern, CBD's functional structure and urban morphology of the city. Zheng Zhiqing (2001) explores the spatial and temporal distribution of commercial housing prices in Guangzhou in 1998 and its influencing factors by drawing a contour map of residential prices. It holds that residential prices are mainly related to land prices, urban forms and functional structures, transportation and greening environment, living services facilities and property management level. Based on the basic idea of single-center competitive renting function, Ren Rongrong and Zheng Siqi (2008) explored the spatial evolvement mechanism of office and residential land development theoretically, and conducted an empirical study using office and residential land transaction data from 1993 to 2004 in Beijing. Wen Haizhen, Zhang Ling and Peng Lufeng (2010) constructed a two-dimensional analysis framework of spatial differentiation of urban housing prices from the perspective of the hedonic price, and had an empirical study about the residential market in Hangzhou.

These studies discuss the spatial distribution of urban housing prices and its influencing factors in more detail. However, most of these researches only describe the spatial distribution of residential prices statically, and seldom discuss separately from the time and space levels and quantify the impact of city center on housing prices. With the acceleration of urbanization, many cities have developed from a single-center form to a multi-center form. Therefore, it is necessary to consider the influence of the existence of multi-city center on housing price in some multi-center cities when studying the impact of urban center on housing price, and to study separately from two aspects of time and space.

2. Literature Review

In recent years, many urban economists have conducted theoretical and empirical studies on the impact of urban centers on housing or land prices. Although sometimes the purpose of scholars' research is not to discuss the influence of urban centers on residential or land prices, but consider the impact of the location of urban centers when discussing the factors that influence the urban housing or land price. In

the current literature, residential (or land) price gradients are often used to represent the impact of urban centers on housing (or land), and take the CBD distance, the CBD transit time, or the CBD transit cost as the proxy variable to measure the residential (or land) price gradients. Many scholars domestic and abroad have studied the impact of urban centers on housing prices from the time and space level and have achieved a great deal of success.

McDonald and McMillen (1990) studied the change of land value from 1960 to 1980 in Chicago and analyzed the identification of employment centers and their impact on the residential land value. Atack and Margo (1998) examined the price gradient of vacant land for a total of 66 years from 1835 to 1990 in New York City. Yiu and Wong (2005) used 2095 transaction data from May 1991 to March 2001 in Hong Kong to test the expected effect of traffic improvement on housing prices through adding location dummy variables in the hedonic price model. The results show that the expected traffic improvement will significantly improve the surrounding residential prices. Yiu (2008) first takes Hong Kong and Macau as objects to study the impact of neighboring cities on residential price gradients. The author assumed the two places as two employment centers and used the statistical data from the first quarter of 2000 to the first quarter of 2007 in Hong Kong and Macao, and used the time-space difference method to study the change of residential price gradient between Hong Kong and Macau to test the hypothesis of two employment centers. The result shows that under other conditions remain unchanged, the residential price gradient from Macau to Hong Kong will become more moderate as more non-residents work from Hong Kong to Macao.

Dubin and Sung (1987) attempted to use the price gradient to reflect the unbalanced development of transportation system and also considered the impact of sub-centers on residential value. Coulson (1991) tested the residential price gradient under the single-center model using the linear form of the hedonic price model and the Box-Cox transform based on 406 residential transaction data. The author also considered the interaction of distance variables and directional dummy variables influencing on residential price gradients in the linear model. Domestically, Yu Lu, Zheng Siqi, and Liu Hongyu (2008) conducted an empirical study on the housing price gradient in Beijing using the hedonic price model based on the assumption of single-center city. It is found that the traditional single-center hypothesis is not strong in the model explaining due to its large deviation from reality. After incorporating regional variables in eight directions, the explanatory power of the revised model has been significantly improved, and the housing price gradient shows significant differences in all spatial regions.

3. Data and Model

Hangzhou is located in the north-east coast of China, which is the capital city of Zhejiang Province and the political, economic, cultural, financial and transportation center of Zhejiang Province. In order to make the research object representative, this paper selects the main six urban areas under the jurisdiction of Hangzhou as the research area, including Shangcheng District, Xiacheng District,

91

Gongshu District, Jianggan District, Xihu District, Binjiang District. The real estate market of those areas starts earlierand the market is more mature, which can best represent the level of real estate development in Hangzhou.

The dependent variable in this paper is the average transaction price at the district level. The explanatory variables refer to the residential features in the existing studies. The main variables are location, neighborhood and building, a total of 12 variables. The specific quantification of each variable and its expected impact on residential prices are shown in Table 1.

Table 1. Quantitative Method and Expected Sign of Explanatory Variable

Classification	Variable	Quantitative Method of Variable	Expected Sign
Location variables	Wulin distance	Recently linear distance from the residence community center to the Wulin distance, Unit: Km	-
	West Lake distance	Recently linear distance from the residence community center to the West Lake distance, Unit: Km	-
	Qianjiang New Center distance	Recently linear distance from the residence community center to the Qianjiang New Center, Unit: Km	-
Neighborhood variables	Natural environment	Comprehensive evaluation of the surrounding natural environment, divided into 5 grades: good (5 points), better (4 points), general (3 points), worse (2 points), bad (1 points)	+
	Residential environment	Comprehensive evaluation of the internal environment, divided into 5 grades: good (5 points), better (4 points), general (3 points), worse (2 points), bad (1 points)	+
	Bus routes	Residential area within 800 meters of bus lines (2008) Residential area within 1000 meters of bus lines (2010)	+
	Living facilities	Whether there is a supermarket, terminal market, bank, post office, hospital within 1 km from the residence community, each item is 1 point, a total of 5 points	+
	Cultural atmosphere	Dummy variables: Whether there is a colleges within 1000 meters near the district, the assignment is 1, otherwise 0	+
	Education facilitiesis	Whether there is a kindergarten, primary school, junior high school, or high school within 1 km from the residence community, each item is 1 point, a total of 4 points	+
	Sports facilities	Overall quality of sports facilities in the area, divided into 5 grades: good (5 points), better (4 points), general (3 points), worse (2 points), bad (1 points)	+

92

	Property management	Residential property service management quality, divided into 5 grades: good (5 points), better (4 points), general (3 points), worse (2 points), bad + (1 points)	
Building variables	Room age	Residential building age(year)	-

4. Result and Discussion

4.1 Time Effect Analysis of the Influence of City Center on Prices

In the analysis of the time effect of the impact on housing prices in urban centers, we chose the general feature price model and conducted regression analysis using SPSS17.0 software.

Table 2. Distance Variable Regression Coefficient Table

Distance Variable	2007	2008	2009	2010	2011	2012	2013	2014	2015
Wulin distance	0.021	-0.020	0.001	-0.041	-0.104	-0.099	-0.098	-0.097	-0.115
West Lake distance	-0.214	-0.196	-0.205	-0.160	-0.175	-0.196	-0.154	-0.189	-0.206
Qianjiang New Center distance	-0.046	-0.076	-0.087	-0.073	-0.061	-0.064	-0.068	-0.060	-0.047

The absolute value of the distance coefficient to Wulin Square tended to decrease firstly and then increased. In the years before 2010, the absolute value of the coefficient was obviously smaller than the absolute value of the coefficient of distance of Qianjiang New City, and the coefficient absolute value exceeded the amount of money from 2011 Jiang Xincheng distance coefficient of absolute value, and gradually stabilized. This may be because before 2010, Qianjiang New City in its initial stage had a significant expected effect on the prices of its surrounding houses, causing its influence to exceed Wulin Square. Facing the strong rise of Qianjiang New City, the influence of Wulin Square remained stable or slightly weakened. However, Wulin Square also built a large number of key projects such as West Lake Cultural Square and Canal Improvement Project during this period. In particular, the completion of West Lake Cultural Plaza in 2009 has greatly enhanced the attraction of Wulin Square. The entire West Lake Cultural Square set culture, entertainment, performances, exhibitions, business is equal to one, to enhance the attractiveness of Wulin Square played a significant role. Therefore, the possible situation is that with the gradual completion of these projects, the influence of Wulin Square gradually strengthened and finally surpassed the influence of Qianjiang New City.

The absolute value of the coefficient of Qianjiang New City distance gradually increased in the first few years and then gradually stabilized. This shows that the impact of Qianjiang New Town residential residential prices in the development and construction have achieved initial success, and gradually grow into an important CBD, Hangzhou City, also gradually from the West Lake era into the Qianjiang era. As Hangzhou City, the positioning of the Qianjiang New City is one of the city center, people have

93

a high expected effect of Qianjiang New City, developers in the vicinity of Qianjiang New City real estate development in the construction of Qianjiang New City that is positioned as high-priced real estate. Therefore, Qianjiang New City in the early development of the city's residential prices have had a significant impact.

4.2 The Spatial Effect of Urban Center on Housing Price

Through the SAM software analysis, the regression results of the geo-weighted regression model are shown in Figures 1-3.

Figure 1 visually reveals the significance of the impact of West Lake distance on housing prices and spatial distribution. As can be seen from Figure 1 (b), almost all sample points have reached a significant level, showing that the distance to the West Lake has a more significant effect on residential prices (A stands for West Lake). From Fig. 1 (a), it can be seen that the absolute value of the regression coefficient of the distance from the West Lake to the north and the southeast to the West Lake shows an increasing trend overall, indicating that the distance to the West Lake directly affects the north and the southeast of the West Lake Area residential area prices, the closer the West Lake, the price gradient of the more gradual, buyers in the purchase of housing in the region, the more value of West Lake as a scenic spot, willing to pay for residential closer to West Lake higher prices, with the distance West Lake distance increases, residential prices decline slowly, West Lake residential quarters to enhance the price.
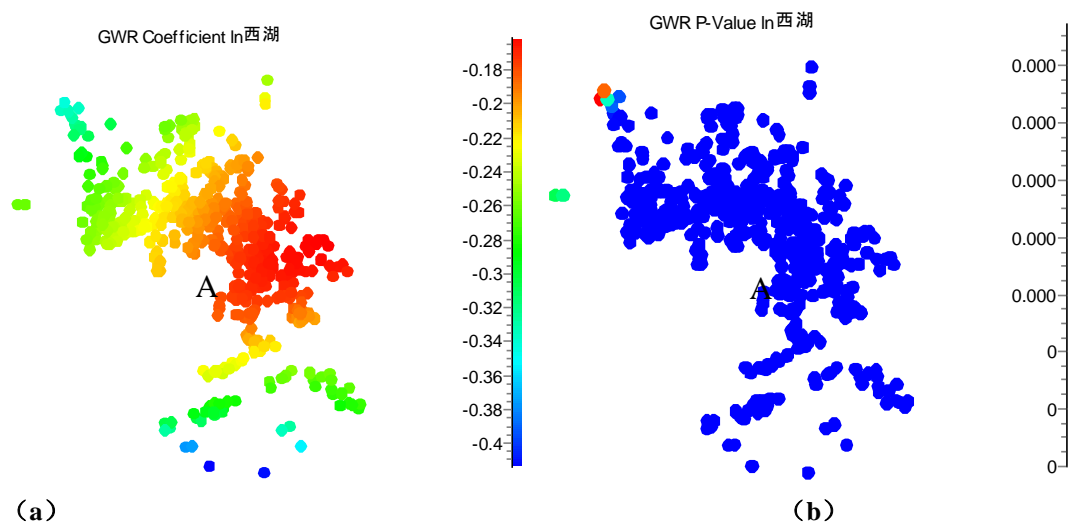

（a）   （b）

Figure 1. The West Lake Distance Regression Coefficient P Value and Regression Coefficient Distribution

Wulin Square (Figure 2, B) is a traditional business center in Hangzhou, surrounded by Hangzhou Tower, Hangzhou Department Store, Hangzhou Theater, etc., while Wulin Square and Hangzhou municipal government and Zhejiang provincial government are ruled by the distance, coupled with the

recent years The development and operation of West Lake Cultural Plaza has enabled Wulin Square to become the political, economic and cultural center of Hangzhou. As can be seen from (b) in Figure 2, most of the sample points are significant, showing that Wulin Square has a significant premium effect on the houses around it. (A) in Figure 2, it can be found that the significance of the regression coefficient to Wulin Square has a significant difference with the spatial location. In addition to the regression coefficients of some sample points to the north of Wulin Square being greater than zero, the coefficients of other regions Less than zero.
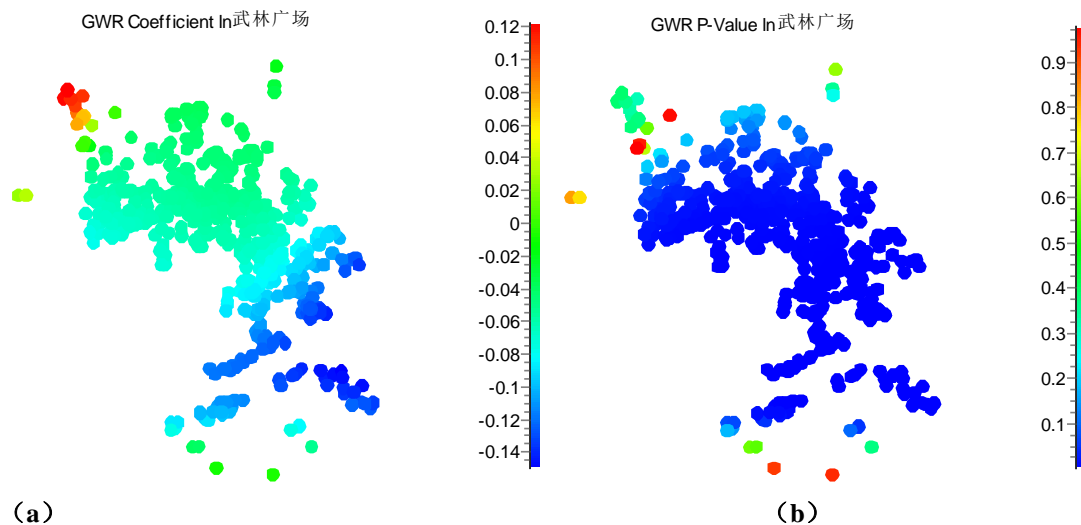

Figure 2.Wulin Square Distance P Value and Regression Coefficient Distribution

The P value of Qianjiang New City can be seen (see Fig. 3 (b)). The influence of Qianjiang New City (C in Fig. 3) on Hangzhou residential quarters is mainly concentrated in the southeast of Hangzhou. Samples of the north and northwest Point almost no effect. This is because Qianjiang New City is located on the southeastern margin of the city of Hangzhou, and thus its impact on housing prices is mainly present in the southeast of the city. As can be seen from Figure 3 (a), most of the regression coefficients of the southeastern region sample points are negative, indicating that for these sample points, as their distance from Qianjiang New City increases, there is a significant drop in residential prices, Qianjiang New City on these sample point residential prices have a significant positive effect. In addition, the absolute value of the regression coefficient gradually decreased from Qianjiang New City to the north, indicating that the price of residential quarters declined more slowly, mainly due to the distribution of Qingchun Road, Yan'an Road and Jiefang Road in the north of Qianjiang New City Many commercial center street, the price has a significant positive effect. And then continue north, the regression coefficient gradually becomes positive, and the level of significance also failed to reach. Visible, and then further north of the residential area affected by the impact of Qianjiang New City.
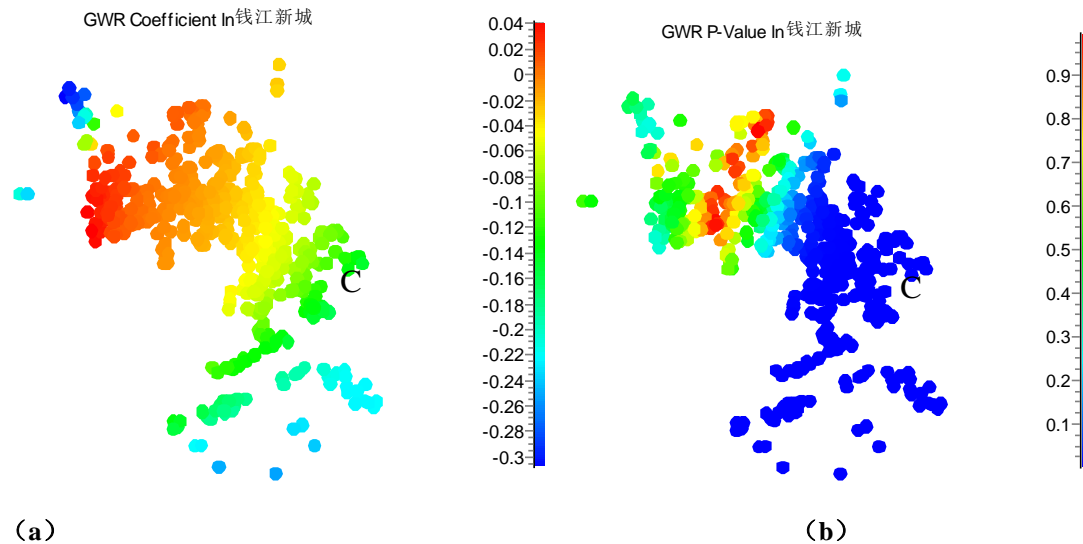
95

Figure 3. Distance P Value Map and Regression Coefficient Distribution of Qianjiang New City

5. Conclusion

This article attempts to base on the city's multi-center perspective to explore the impact of urban center on housing prices. Taking the main city of Hangzhou as the research area, this paper studies separately from two aspects of time and space. At the time level, based on the characteristic price theory, this paper chooses the data of residential quarters from 2007 to 2015 to build a model to empirically analyze the time effect of urban center on housing prices. On the spatial level, based on the theory of geographical weighted model, Chose 2012 residential district level data construction model to empirically study the spatial effect of urban center on housing price. The main conclusions of this paper are as follows:

1）The impact of West Lake, Wulin Square and Qianjiang New City on housing prices is different, showing some changes with time.

West Lake Scenic Area residential prices the greatest impact and in a more stable state. As the most famous scenic spot in Hangzhou, West Lake has always had a great impact on people's housing choices. The impact of Qianjiang New City on housing prices gradually increased to stabilize. This fully shows that in recent years, the Hangzhou Municipal Government has made initial progress in the development and construction of the Qianjiang New City. Qianjiang New City has also gradually grown into an important CBD. Hangzhou has also gradually entered the Qianjiang era from the West Lake era. As a traditional urban center, the impact of Wulin Square on housing prices in the city has undergone a process of first stabilizing and then increasing. Before 2010, the Wulin Square area had less influence than Qianjiang New City, and then gradually increased beyond the influence of Qianjiang New City. This may be because before 2010, faced with the strong rise of Qianjiang New City, the influence of Wulin Square was surpassed by that of Qianjiang New City. However, with the gradual completion of a

large number of key projects such as West Lake Cultural Square and Canal Improvement Project, Wulin Square area also gradually strengthened influence, eventually surpassing the influence of Qianjiang New City.

2）The impact of the three centers of West Lake, Wulin Square and Qianjiang New City on housing prices shows certain regularity and difference in space.

Generally speaking, West Lake has the most extensive influence on the price of residential quarters, followed by Wulin Square and the smallest in Qianjiang New City. The impact of West Lake on the price of residential quarters in downtown Hangzhou is global, with the most obvious impact on the area to the east of the West Lake and the relatively weak on the north and southeast areas of the West Lake. However, due to the existence of the Chengbei Canal and the completion of new business centers in the north of the city, Wulin Square greatly weakened the price of residential quarters in the north of the city. The influence of Qianjiang New City on the price of residential quarters is very obvious concentrated in the southeast of Hangzhou, while the price of residential quarters north of Hangzhou has almost no impact.

3）For Hangzhou City, the impact of urban polycentricity is significant.

From the previous study we can see that in terms of time, from 2007 to 2015, most of the years West Lake, Wulin Square, Qianjiang New City three centers on the impact of residential prices are significant; in space, West Lake, Wulin Square, Qianjiang New City three centers on the surrounding prices have different ranges, to varying degrees, a significant impact. This shows that in terms of time and space, the three centers of West Lake, Wulin Square and Qianjiang New City have significant impact on housing prices, indicating that the multicentre impact of cities in Hangzhou is significant.

References

Atack, J., & Margo, R. A. (1998). *Journal of Real Estate Finance and Economics*, *16*(2), 151-172.

Cai, H., Henderson, J. V., & Zhang, Q. (2013). *Rand Journal of Economics*, *44*(3), 488-521.

Clapp, J. M., Rodriguez, M., & Pace, R. K. (2001) *Journal of Real Estate Finance and Economics*, *22*(1), 43-61.

Dong, G. P., Zhang, W. Z., & Wu, W. J. (2011). *Journal of Geographical Sciences*, *66*(6), 750-760.

Jiang, H. (2014). *The Land Area, the Degree of Competition and its Impact on Land Unit Price* (p.28).

McDonald , J. F., & McMillen, D. P. (1990). *Environment and Planning*, *22*, 1561-1574.

Qin, B., & Sun, L. (2010). *Chinese Journal of Soil Science*, *24*(3), 70-74.

Shen, W. J., Feng, C. C., & Hou, Y. S. (2014). *Research of Urban Development*, *21*(3), 4-8.

Sivitanidou, R. (1997). *Journal of Urban Economics*, *42*(1), 79-97.

Wang, Y., Tang, W., & Jia, S. H. (2016). *The Journal of Real Estate Finance and Economics*, *53*(2), 218-245.

Wu, W. J., Liu, Z. L., & Zhang, W. Z. (2010). *Journal of Geographical Sciences*, *65*(6), 676-684.