Analyses of Spatial-temporal Distribution Changes of Residential Land Prices in Beijing

Zhang Fan
Department of Land Management
Renmin University of China
jason_2246@163.com

Zhang Shaoji
Department of Land Management
Renmin University of China
cskgary@yahoo.com.hk

Keywords: Residential land, land price, area-temporal distribution, Beijing

Abstract: By using ArcGIS and Kriging statistics, this paper analyses characteristics of the prices of the current residential lands area distribution and their temporal changes in Beijing. It points out that at the moment the price of the lands are higher and the number are more in north than in south, extending around main routes in circle. This paper gives a further study on the impact of newly-built gyms for the 29th Beijing Olympic Games on the residential land prices surrounding them and finds that the gyms have brought up the prices.

1. Introduction

As a capital, an international metropolis and a famous historical city, Beijing represents some strong characteristics in the national development of real estate to some degree. In 1992, when the government carried out the policy of leasing land, Beijing suffered a temporary stagnancy in real estate in the early 1990s. Yet, it has been gradually improved by the influence of Asian Financial Crisis on the domestic demands in 1997, the resuscitation brought by the reform of merchandizing individual housing in 1998, and great opportunities emerging after Beijing won the bid of Olympics in 2001. While the research on the area-temporal distribution of residential land price can trace out the city development, human-land relationship, and the factors influencing the distribution. It also gives supports to the policy-making.

This paper is based on the statistics data of residential land leasing prices in eight urban districts, including location, leasing time, area, prices on the contracts, etc. The so-called ‘land price’ in this paper is resulted from the division between the area and the prices on the contracts and converted into 2006, which is the base period for price adjustment, referring to price index of investment in fixed assets of Beijing. Under these conditions, it analyses the area-temporal distribution and the changes of the land price in Beijing by using ArcGIS and some statistics methods.

1 Research Foundation: National Natural Sciences Research Foundation (No. 70373071)
2. Spatio-temporal distribution of premium status

2.1 Data resources

In this paper, the city circles and traffic trunk road are extracted from the land use electronic map of Beijing and the lands are marked according to the location of selling plots in the statistics, as shown in Figure 1. After inspection of the land prices, it finds that the prices would be normal distribution when converted into Log. It also finds that the prices distributes as low, high, low from west to east and from north to south, which means that the price in urban centers is higher than in outskirts. Based on these analyses above, it adopts Ordinary Kriging Interpolation method to simulate spherically spatial distribution of land prices, as is shown in Figure 2.

Figure 1 The residential land plots transacted from 1993 to 2006
2.2 The features of Status

From the figure above, the current distribution of residential land prices in Beijing has the features below:

(1) Ring-shaped Structure. Ring-shaped Structure means that the distribution of land price is oriented to the ring-shaped roads in Beijing, such as the areas between the 2nd and 3rd, 3rd and 4th ring-shaped roads in east, 3rd and 4th in north, 2nd and 3rd in west account as the highest land price region, the areas between 4th and 5th in east and in north, 3rd and 4th in west, 2nd and 3rd in south as the second highest land price region, the areas by the 5th in east, north and west, the 4th in south as the third highest land price region, the rest outside as the lowest. From these distributions it concludes that the land price is greatly influenced by the ring-shaped roads, following the circle-oriented urban expansion.

(2) North-South, High-Low. Considering Chang’an Avenue as the North-South dividing line in Beijing, the land price in the north part is higher than that in the south, being the same distances to Chang’an Avenue, as is shown in Figure 3. This is mainly because Beijing city is on the alluvial fan which are engendered by the river from the northwest to the southeast, the north part gets a better natural environment while the south part is historical undeveloped place with a lot of chemical enterprises. At the same time, the price from the west to the east shares the same feature as that from north to south, under the same reason of the latter.
Figure 3 the Profile of Land Price along the Axes

3. Analysis on the Changes of the distribution of residential land price

3.1 The Changes oriented from the ring-shaped roads

Through the statistics of the number of residential land plots sold each year, it shows that the residential land market in Beijing enters in a high-speed development period after the promulgation of individual housing policy in 1996, which that the annual number of residential land plots transacted increased significantly from 1997 to 2003 while dropped down also greatly from 2004 to 2006. If accounted the numbers annually oriented from the boarder of the ring-shaped road, as shown in Figure 4, it points out that the area between the 2nd and 4th has the most plots transacted, which means that it is the main living area for citizens. Beginning in 1999, the number between the 4th and 5th ring roads has exceeded that between the 2nd and 3rd, and 3rd and 4th in 2003, which reflects the rapid outward expansion. After that, the number within the ring roads reduced gradually, meaning that the urban area can hardly accommodate for residential land.
3.2 Analysis on the motion of the center of gravity (C.G) of residential land price

In order to illustrate the changes of land price in different directions and between different ring-shaped roads, the urban area studied is carved up into eight blocks in accordance with the north-south axis, east-west axis and the diagonals. Then the C.G are calculated refer to the location and price of each land plot according to the following formula and shown in Figure 5.

\[
\bar{x} = \frac{\sum_{i=1}^{n} x_i w_i}{\sum_{i=1}^{n} w_i}, \quad \bar{y} = \frac{\sum_{i=1}^{n} y_i w_i}{\sum_{i=1}^{n} w_i}
\]

which:

- \(\bar{x}\) and \(\bar{y}\) means the coordinate of the C.G in the graph;
- \(x_i\) and \(y_i\) means the coordinate of the land plot \(i\) in the graph;
- \(w_i\) means the price of land plot \(i\).
Figure 5 The motion of the C.G. of the land price

From this Figure, we can see the C.G of land price generally move outwardly as the city expanses. In the east and the north, the motions of C.G are obvious and move closely to the trunk roads, such as Badaling highway and the Jingtong expressway, which reflects good traffic condition gives positive impact on the land price as the urban expansion. The price of the land near these roads will be higher than that of surroundings. The roads act as pull to the distribution.

On the other hand, the spatial distribution of C.G gets a trend of cluster in some blocks. For example, in the southwest and southeast blocks, the C.G move little, testifying again that the real estate develops slowly and residential area gathers in these regions. While in the northeast, the gathering is because of the mutual traction between the Asian Games Village and the Wangjing residential area, for both of these blocks have completed infrastructure, development of high-degree, and bustling commercial facilities.

3.3 Analysis of the impact on the residential land price surrounding the Olympic gyms

In order to study the impact of the regional point on the land price distribution, we take the Olympic gyms and their surroundings. As the host city of the 29th Olympic Games in 2008, Beijing plans to build 12 new large-scaled gyms. For this paper, with no regard of the gyms in universities and out of the study area, there are 7 gyms.

The land plots are selected within the distance of 100 map units to the gyms with no regarding of little cases during 1993-1996 and the development of surrounding area. Then it is marked off two categories, one is the block surrounding the National stadium, the other the left
sports venues. According the subtractions between the average prices each year of total land plots transacted and those selected, which is to remove the trend of the average price of the whole city, it draws out Figure 6.

![Figure 6 The comparison of the average prices](image)

It illustrates that after 2001, when Beijing became the host city, the average prices have been increased in a certain degree compared to those of the whole city, especially around the National stadium. In the vicinity of the stadium the average price is much higher than that of the whole city and gives positive effect on the trend of the average price of the whole city; while in the area around other gyms, even though the average price has negative impact, the impact is weakened, meaning that the gyms is favor to the underdevelopment area.

**4. Conclusion**

Through the analysis above, the distribution of the residential land price gets the characteristics such as Ring-shaped Structure, North-South, High-Low, and Local Highlight due to the natural environment, urban traffic, etc. The further study on the impact of the Olympic gyms on the land price shows that it boost the price surroundings effectively. At the same time, the statistics points out that the studied urban area has been fulfilled by the residential land and in the future, outward expansion, development in the south of the city are the solution for more living space. The old downtown, which locates within the 2nd ring-shaped road and holds the condition of long history, will become the newly primary living area after reconstruction.

Based on the ArcGIS and other statistics method, the analysis on the spatial-temporal distribution of residential land price of previous years can gives support to the policy making and urban planning, provides technical method to land use intensively, living environment improvement and the prosperity of the whole city.
Reference

Journal Articles

2. Jiang Fang, Zhu Daolin, (2005), A GIS-Based Study on Spatial Distribution of Land Price---The Case of Residential Land Prices in Beijing, Economic Geography, 25(2)
5. Zhang An, Qi Qingwen, (2007), GIS-Based Analysis on Spatial Structure Urban Internal Population---A Case Study in Shenzhen City, Progress In Geography, 26(1)