Identifying Green Gentrification in Chongqing Central Park Based on Price Feature Model

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Abstract. As part of urban planning, urban greening plays a significant role in mediating urban development and improving quality of life for residents. However, studies have indicated that urban greening efforts may result in green gentrification, in which the creation of urban green spaces improve the quality of life of residents on the one hand, and increases the house prices in the surrounding area, thereby preventing low-income residents enjoying the ecological environment benefits. Even though, there are only a few studies that examine the connection between green gentrification and urban greenery in China. Moreover, there is a need for further investigation into the manifestations and characteristics of green gentrification and whether it always results in displacement. Therefore, we chose Chongqing Central Park as the study area. The results demonstrated that the house prices have increased exponentially over the past ten years in this area, the neighborhood is largely populated by middle- and high-income individuals, and residents who were more than 30 minutes away from the park no longer enjoyed it as often. By using a price feature model, ecological, architectural, and neighborhood features were correlated with house prices, and it was found that the distance to the park correlated more significantly with house prices. As a result, Chongqing Central Park area has witnessed a green gentrification process in the last decade, which reflects the green paradox to some extent, that is, urban greening brings high quality ecological environment but also reduce the equity of human living conditions. Therefore, we suggest taking social impacts of ecological construction into account while ensuring sustainable urban development in urban greening efforts.

Keywords: Green Gentrification, Urban Green Space, House Price, Hedonic Model.

1. Introduction

During China's urbanization process, quality and sustainable development are becoming increasingly important (Guan et al., 2018), The construction of urban green infrastructure has received the most attention. Urban green spaces (e.g., parks, gardens, street trees, and green roofs) have positive effects on the environment, ecological restoration, and pollution abatement of cities through the construction of green infrastructure and rehabilitation and redevelopment of vacant urban land. It has been recognized that urban green spaces provide a wide range of ecosystem services and benefits that can reduce some of these impacts, including the regulation of ambient temperature (Hamada & Ohta, 2010) and stormwater attenuation (Stovin, 2010), pollution interception, and improved health and well-being of urban residents (Lee & Maheswaran, 2011).

A growing number of studies have determined that, in addition to attracting population, stimulating investment and promoting economic development, the construction of green spaces also increases the value of properties in the region, which may even evict low-income residents and businesses which are not profitable. This phenomenon is referred to as green gentrification. Ultimately, green gentrification can result in a loss of community identity and profound changes to the social and economic fabric of the built environment.

The gentrification of green areas is a common occurrence in urban development, especially in neighborhoods with large, well-designed and well-maintained parks that have seen significant increases in rent and housing prices (Anguelovski et al., 2018). This could even cause the displacement of low-income residents, revealing inequalities in access to green environments (Pineda-Pinto et al., 2022; Sharifi, 2021). It has been demonstrated in several studies that the creation

or restoration of urban greening projects attracts capital investment to the local area, which results in increased and more upscale real estate prices (Wolch et al., 2014). However, it is also evident that the causal role of greenfield supply in these processes is complex and difficult to generalize (Rigolon & Németh, 2020; Sharifi, 2021). Even though we recognize that these inequalities are a result of complex institutional and behavioral interactions (Astell-Burt et al., 2014). However, further research is required to assess whether green gentrification always leads to displacement. Particularly in China, many cities are currently undergoing a "green turn", which involves the construction of large amounts of green space.

In this context, our study extends the ongoing discussion on gentrification related to green space in three ways, using Chongqing Central Park as an example. Initially, we examine house price changes, land supply and transaction patterns, as well as income levels of residents in the Central Park area over the past decade to identify and analyze gentrification trends in the area. Second, we identify whether gentrification is associated with the increase in house prices by comparing it with architectural and neighborhood characteristics based on the price characteristics model. Finally, potential factors associated with urban green space planning and responses to gentrification effects are discussed, followed by recommendations for enhancing environmental equity and sustainable urban development in the Chinese context.

2. Methods

2.1 Study area

In the last 20 years, as the economic center of western China, Chongqing has seen an 8.8-fold increase in parks and a 17-fold increase in land area. The largest of these is the Chongqing Central Park, which covers an area of approximately 15,000 km2, making it the fourth largest urban Central Park in the world. As shown in Figure 1, Chongqing Central Park is located in the Yubei District of Chongqing, where property prices are among the highest in the city, averaging 19,000 yuan per square meter. The Chongqing Central Park was opened to the general public in 2013 as an important part of the renovation and development of the old city of Chongqing. It consists of a variety of landscape panels such as wetlands, corridors, water bodies, grasslands, squares, and forests.

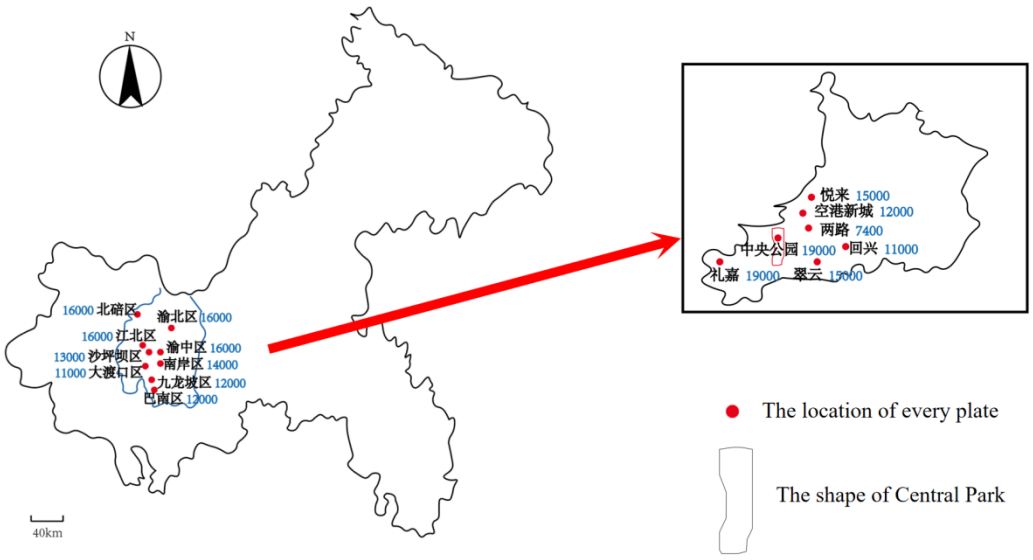

Figure1. Chongqing Central Park location, Chongqing main urban area housing average price and Yubei district board average price (Unit: yuan/m2).

2.2 Data source and Processing

In our study, as shown in Table 1, we obtained ten years of house price information for the Central Park area, including average transaction price, number of units sold, area sold, and supply/demand ratio, from a digital service platform in the real estate industry - KERRY. Following this, six real estate apps were used to collect information about the major properties in the Central Park area, including their prices, property fees, and amenities. Finally, we developed a questionnaire survey (Table 2) to investigate the income of the residents living near Central Park, as well as the price of real estate in the area they reside in and the distance from their neighborhood to Central Park. The results of the survey were authenticated by posting part of them online and recording part of them during field interviews. There was a total of 402 questionnaires collected, and after data cleaning, 319 valid questionnaires were selected for analysis.

Table 1. Data acquisition source and time

Data	Time (year)	Source	Details
House prices in the Central Park area	2012-2021	KERRY - digital service platform in the field of real estate	Average transaction price, number of units sold, area sold, supply/demand ratio, etc.
Property information	2021	Real estate APPs: Anjuke, 58, Beike, Fangtianxia, Daojiale, and Lianjia	Property name, price, property fee, amenities, etc.
Questionnaire	2022	Online and offline surveys	Table 2

Table 2. Questionnaire design for residents of Central Park neighborhood

Number	Question	Option
1	Your age group	
2	Your occupation	
3	Your or your family's income	A. Less than 50000 B. 50000-100000 C. 100000-500000 D. 500000-100000 E. More than 100000
4	Y Your residential area	The housing estate near the Central Park
5	The type of house you or your family bought	A. New house B. Second house
6	Price of the new house you or your family bought	
7	Price of the second house you or your family bought	
8	Distance between your neighborhood and Central Park	A. 0-10 min B. 10-20 min C. 20-30 min D. more than 30 min

9	Your frequency of going to Central Park	A. Once a week B. Three times a week C. Once a month D. Three times a month E. Once a year F. Three times a year G. Never H. Others
10	Your main activities in Central Park	A. Have a walk B. Walk the dog C. Hang out with children D. Have a picnic E. Take photos F. Exercise G. Sel-studying in the coffee house H. Others

2.3 Modeling and Analysis

The Hedonic Price Method (HPM), also known as the Hedonic Model Method. It is often used to analyze the relationship between heterogeneous commodity characteristics and commodity prices (Garrod & Willis, 1992). It consists of sorting out the heterogeneous attributes of a commodity, collecting relevant data, processing those data using appropriate statistical software, and obtaining the regression coefficients of each heterogeneous attribute through regression analysis in order to achieve the desired result.

$$P=f(H_1,H_2...,H_n)$$

Where P is the price of the commodity and H is the characteristic variable of the commodity. Hedonic functions can be expressed in three basic forms: linear (line), semi-log (semi-log model) and log-log (log-log model). Our study adopts the linear form (linear), which takes into account a linear relationship between the house price P and the characteristic variable Hi, which can be expressed as follows:

$$P = a_o + \sum a_i H_i + u$$

Where P is the price of the house price, ao is the constant to be estimated, ai is the coefficient to be estimated, Hi is the ith characteristic variable, and u is generally a non-economic error term. The independent variable Hi and the dependent variable P are linearly related in this model.

In this study, house price was used as the dependent variable. According to the information collected about residential characteristics, the independent variables were categorized into three categories: ecological characteristics, neighborhood characteristics, and architectural characteristics. As show in Table 3, ecological characteristics primarily refer to the distance from home to the park. The architectural characteristics include the size and layout of the property, the maintenance of public facilities, security, and the property fee. The neighborhood characteristics refer to the facilities that surround residential area, such as hospitals, schools, and public transportation. Finally, we conducted a correlation analysis between the independent and dependent variables by using SPSS, aiming to analyze the correlation between each characteristic variable and house prices.

Table 3. Characteristic variables affecting house prices

Characteristic factors	Description factors

Ecological characteristics	The distance from home to the park
Architectural characteristics	Property fee
	Residential area and layout
	Public facilities maintenance
	Security
Neighborhood Characteristics	Public traffic
	Business
	Medical
	Entertainment, etc.

3. Results

3.1 The real estate situation in Chongqing Central Park area in the past ten years

In the past ten years, the house prices in Chongqing Central Park area have demonstrated an exponential increase, as shown in Figure 2. From 2013 to 2016, house prices were relatively stable, with an average price of RMB 7,600/m2. Since then, it increased dramatically every year until it reached RMB 17,910/m2 in 2021, approximately 2.25 times of 2016. In terms of land providing area and transaction area, as shown in Figure 3, the real estate transactions in Chongqing Central Park area were not active from 2012 to 2015. Since 2016, it has increased rapidly and has reached its peak in 2018, when the providing area has far exceeded the market transaction area. After 2018, the providing area started to decrease and the transaction area remained stable.

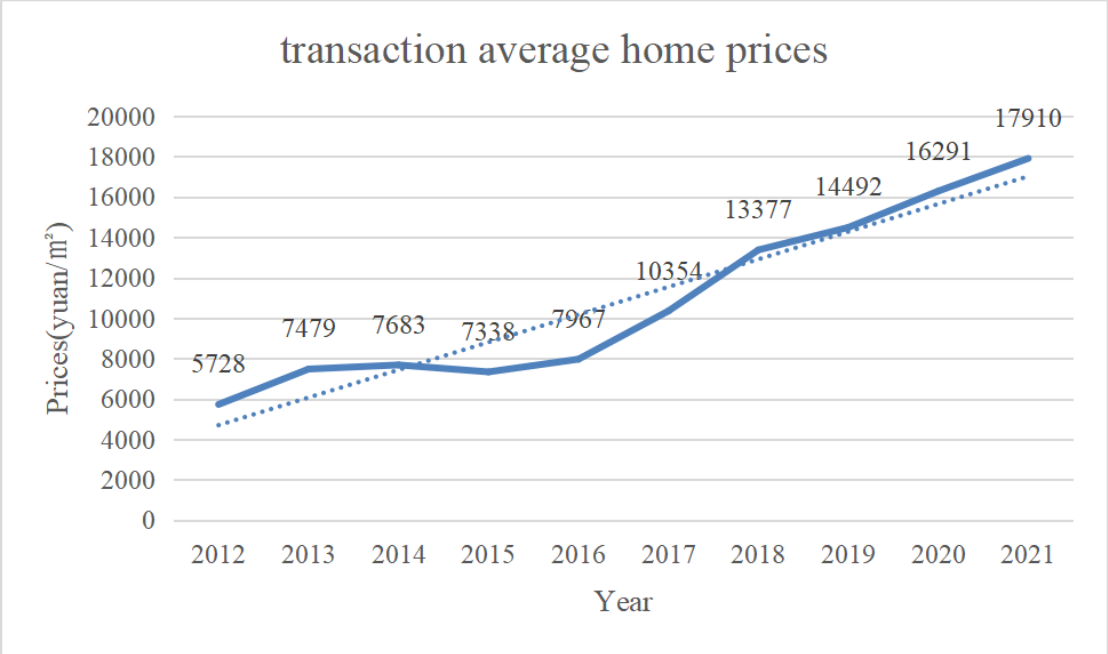

Figure 2. The average transaction price of Chongqing Central Park property in the past ten years

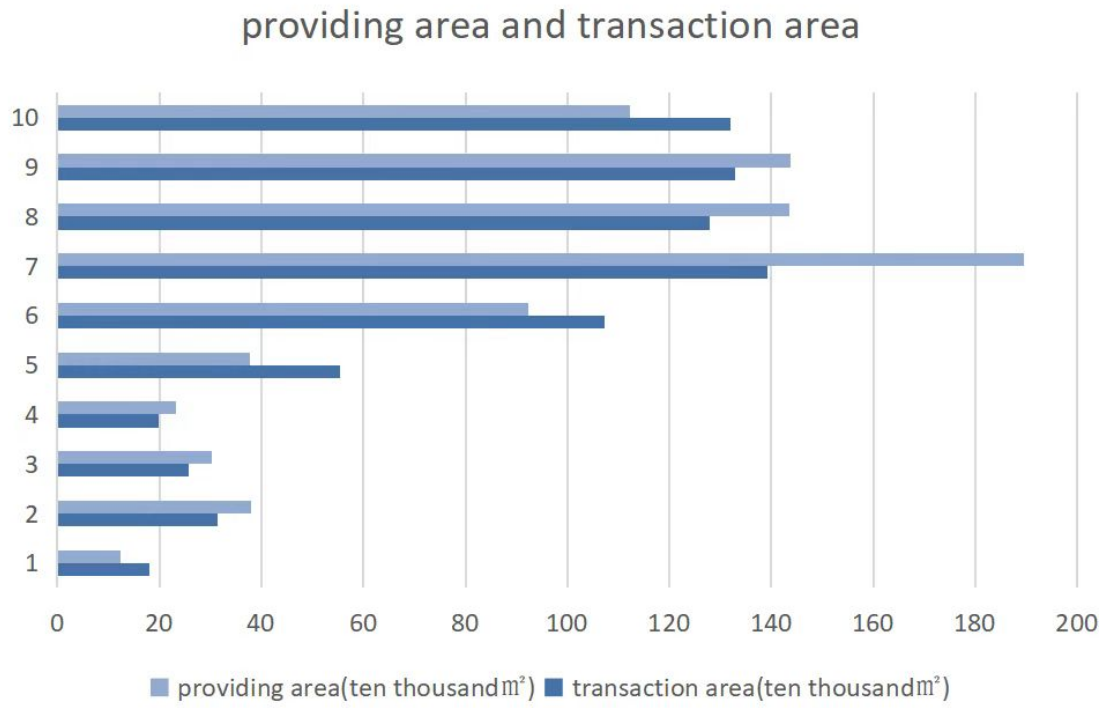

Figure 3. The comparison of the transaction areas and providing areas in Chongqing Central Park area

3.2 Distribution of purchase price and income of the interviewees

As shown in Figure 4, the analysis of the questionnaire data revealed that the average unit price of a house purchase ranged from RMB11,500 to RMB28,300, with most of the prices concentrated between RMB17,800 and RMB24,100. There were 71 families who purchased houses between RMB19,900 and RMB22,000, 33 families who purchased houses below RMB15,700, and 38 families who purchased houses above RMB26,200. Analysis of the households' annual household incomes revealed, as shown in Figure 5, that most households earned between 100 and 500 thousand RMB per year, with a mountainous distribution overall.

Figure 4. The distribution of house purchase price

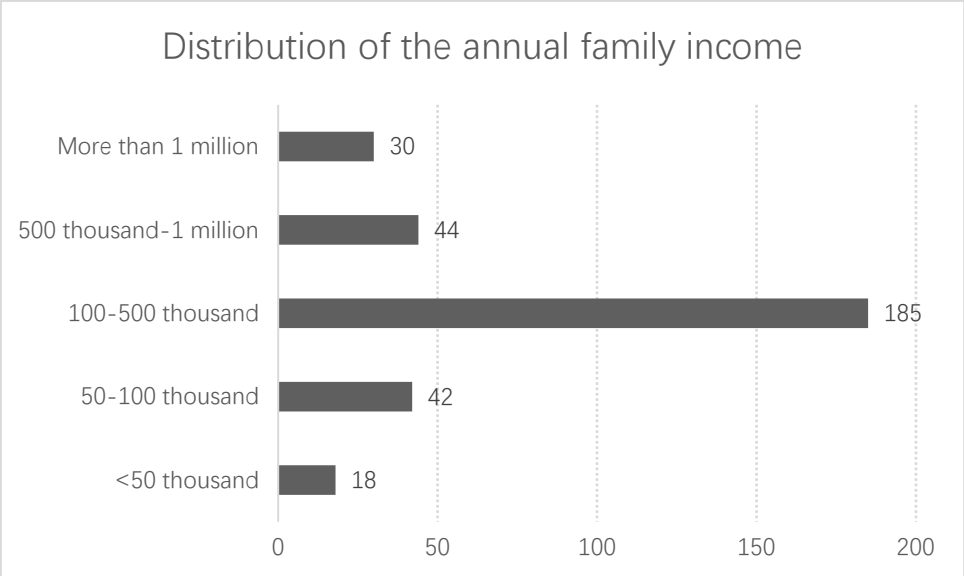

Figure 5. The distribution of the annual family income

3.3 Correlation of house prices with characteristic factors

As a result of the correlation analysis between house price and characteristics presented in Table 4, the p-value for ecological and architectural characteristics is less than 0.05 and the r value is greater than 0.4, indicating that ecological characteristics have a significant negative correlation with house price, architectural characteristics have a significant positive correlation with house price, while neighborhood characteristics do not have a significant correlation with house price. Based on the characteristics described in Table 3, it can be concluded that the further the distance to park, the lower the price, and the better the layout and planning of the property, the higher the price.

Table 4. Characteristic variables affecting house prices, (* Significantly correlated at the 0.05 level)

Characteristic factors	Correlation index (r)	Significance (p)
Ecological characteristics	-0.48*	0.028
Architectural characteristics	0.438*	0.047
Neighborhood Characteristics	0.345	0.126

3.4 The frequency of residentials going to the Central Park

As can be seen in Figure 6, we analyzed the frequency of visits to Central Park for residents living at different distances from the park. It is generally observed that, residents have a high desire to go to the park, regardless the farther or closer distance. Residents who live closer to Central Park visit the park more frequently, for example, about 83% of residents who live within 20 minutes of Central Park visit the park over once a week. Only about 47% of residents who live more than 30 minutes away from the park go to the park once a week, which is the least frequent group of residents.

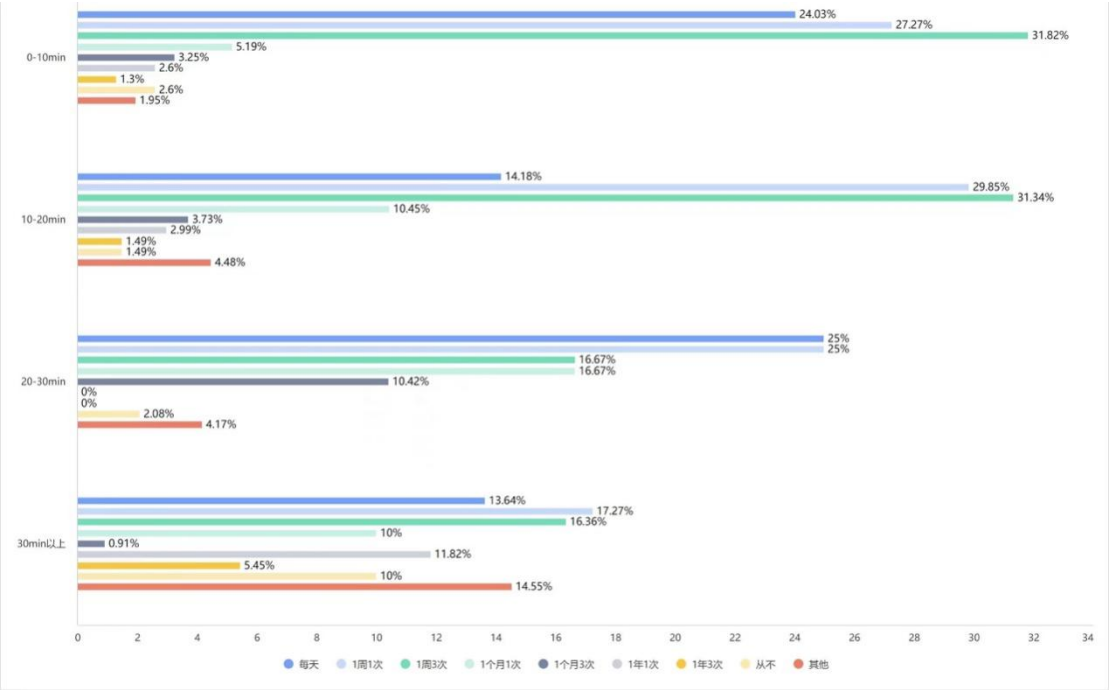

Figure 6. Frequency of residentials going to the Central Park

4. Discussion

4.1 The gentrification process in Chongqing Central Park

We can conclude from the above results that the Central Park area of Chongqing has been experiencing green gentrification over the past 10 years. Firstly, since the completion of Central Park in 2013, housing prices have increased significantly as commercial activities such as the Strawberry Music Festival have moved into the area. Additionally, a survey of Central Park residents revealed that, in relation to the per capita income of 72,000 RMB in Chongqing, the residents in Central Park area are mostly middle- and high-income individuals, with only about 5% of the residents coming from lower income households. Furthermore, we found that the gentrification process in the Chongqing Central Park area has clear regional characteristics, as demonstrated in Figure 3. According to Chongqing's strategic policy of expanding to the north, the once sparsely populated suburbs began to provide a large amount of land in a relatively short period of time. However, the market's capacity was limited, with the area provided far exceeding the area transaction in 2018, and the transaction area in subsequent years no longer increasing, and the area provided decreasing. Therefore, we conclude that the gentrification of Chongqing Central Park is the result of a combination of market forces and government policy.

4.2 The indications of price characteristics model

In this study, the price characteristics model was used to analyze the relationship between price and characteristics. In Table 4, we found that the price of Central Park is more strongly correlated with the distance to the park and the characteristics of the property itself. We can infer that the higher the price, the closer the property is to the park and the better the quality of the property. It should be noted, however, that the correlation index also indicates that the correlation is not very significant, which may be due to the small sample size of our questionnaire and the fact that some respondents did not fully complete it. Furthermore, we have reason to suspect that prices in the Chinese real estate market are more susceptible to policy and market speculation (Minetti et al., 2019).

4.3 The environmental unfairness

According to the gentrification process in Chongqing Central Park, unlike in other countries, the movement of wealthy elites does not lead to the displacement of low-income groups. Chongqing Central Park was originally a suburb and was developed in response to policies that resulted in significant growth. As shown in Figure 3, the Central Park area has plenty of land for development. Additionally, China has good land acquisition and resettlement laws, which ensure the livelihood of low-income groups. However, this does not imply that environmental equity can be achieved. As can be seen in Figure 6, urban gentrification of the Central Park area resulted in low-income people not enjoying the same benefits as those living near green areas, and people living far away from green areas were not able to experience the benefits of green spaces so often. This also reflects the "green space paradox", i.e., the paradox between goals and outcomes in urban greening practices. In other words, building green infrastructure for sustainable urban development and a better quality of life at the expense of social equity leads to green gentrification.

4.4 Proposals for green gentrification and environmental equity

In our research, we have found that large-scale urban greening has been associated with gentrification and an increase in environmental inequities. It may be possible for urban planners to address the green space paradox of gentrification by developing appropriate policies. For example, it may be necessary to construct a greater number of small urban green spaces in urban areas so that residents can benefit from better access to urban green spaces. Furthermore, it is important to discourage speculation in the property market by observing and managing the real estate market strictly in order to prevent the price of property around large green spaces from becoming overinflated, and so that low-income people are able to live in close proximity to these spaces.

4.5 Limitations and prospects of this study

The limitations of our study provide avenues for future research. Firstly, we argue that the prices of houses are influenced by various factors, in Chongqing Central Park, the correlation between distance to the park and the price of houses is higher compared to other factors. However, the characteristic of distance to park is relatively inadequate, and a more comprehensive ecological characteristic may need to be considered in the future. Secondly, we presented three important manifestations of green gentrification: the construction of green spaces and the annual increase in house prices following land supply, the high-income group of residents in the area in general, and the frequency of nearby residents accessing parks, but there is no information as to whether gentrification leads to displacement. Thus, in order to more accurately reveal the manifestations and outcomes of gentrification, future research should be based on multidimensional quantitative studies in order to reveal the manifestations and outcomes in more detail.

Acknowledgements

A year ago, my family moved from Shapingba District to Yubei District. I checked the house price. It is much higher than Shapingba. Therefore, at this time, I tried to find out the reasons. At last, I learned The relationship between urban green land and housing price was reflected in this research. First of all, I wanted to thank my parents, because they gave me money and encouragement, which was very helpful in my investigation. They try their best to comfort me when I am in trouble, and they help me with their own experiences. I'm doing some research.

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