The Effects of Public Green Spaces on Residential Property Value in Beijing

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Abstract: A number of empirical studies in Euro-American region consistently demonstrate that, parks and open space have a positive impact on property values. However, this effect has not been investigated in Beijing, China. And the public and city managers often ignore or underestimate the role of urban green spaces. This paper surveyed the relationship between the average house prices of 76 residential areas and 14 parks in Beijing, and measured the total benefits of 18 070 ha public green spaces on residential property value, by using the inventory data of urban green spaces (2009) and GIS techniques. Results showed that the residential property values located 850–1604 meters away from parks achieved a 0.5% to 14.1% increase in sales price. The overall benefit of Beijing’s public green spaces on residential property was 2.86 billion CNY (1 USD=6.83 CNY), and the average benefit of per hectare public green space was 0.16 million CNY, corresponding to 1.8–3.9 times of the maintenance cost of green space in Beijing. Therefore, there is chance for local governments to increase property tax revenues due to the creation and maintenance of urban green spaces.

Key words: hedonic model; housing price; public green spaces; property value

1 Introduction

Urban parks and open spaces not only provide a pleasant and natural environment but also improve the quality of life in urban areas and undertake essential environmental functions (Bolund and Hunhammer 1999; Jensen et al. 2000; Li and Wang 2003; Chen and Jim 2008; Zhang et al. 2011). Additionally, abundance of literatures reported that the appearance of the park had great influences on neighboring residential property values (for example Espey and Owusu-Edusei 2001; GLA 2003; Jim and Chen 2010). However, there have been few studies undertaken in Beijing, China. For now, almost 85% of parks are free to the public in Beijing, and the local government takes the responsibility of creation and maintenance of urban green spaces. Although the external effects of parks on housing values create extra profits for property owners, few people understand the relationship between urban green space and property value, and therefore the role of urban green spaces is often ignored or underestimated. There is a need for further research to be undertaken with the economic effect of public green spaces on property values in Beijing.

However, the effect of urban open space and parks on residential property values is very difficult to quantify, by the complicated relationship between house price and environmental factors (Hui et al. 2007). The environmental factors are what people would consider before buying a house, and such elements are reflected in the property prices, for instance, noise, air quality, and the accessibility of green areas (Freeman 1979; Tyrvainen 1997). While previous studies presented strong evidence that parks and open space had a substantial positive impact on proximate property values (for example Netusil et al. 2000; Lutzenhiser and Netusil 2001; Irwin 2002; Dunse et al. 2007), there was some findings not supportive of the proximate principle (Crompton 2001, 2005). A useful analogy is with a well-groomed front lawn which is likely to increase the value of a home, but if it is overgrown with weeds then the property value is likely to be diminished (Fox 1990). Since parks and open spaces are homogeneous, there are qualitative differences among them
that are likely to result in different impacts on proximate property values (Crompton 2001). Therefore, these findings emerging from previous studies of park and open space in different areas may not be generalizable to Beijing because of differences in context, scale or mission.

This paper firstly conducts a survey on the property attributes of 76 residential areas surrounding 14 parks in Beijing, then uses a hedonic model to analyze the relationship between property values and parks, finally applies GIS techniques and the Seventh Inventory Data of Beijing’s green spaces to measure the impact of 18 070 ha public green spaces on residential property values. This study not only provide a better understanding of the relationship between house prices and public green spaces in Beijing, but also offer a new perspective of investment strategies on urban green spaces for the city policymakers. This section has provided an introduction. The following section of this paper presents a brief review of relevant literature on the effect of urban green space on property values. Section 3 will elaborate on the methodology of empirical studies. Morales et al. (1999). Payne (1973) was among whom the first to do it. Using traditional valuation techniques, he concluded that the market value of a single-family house received a 7% premium on average (between 5% and 15%) due to arborescent vegetation, provided that there are less than thirty trees on the lot. But this study was fairly rudimentary and naive, reflecting the under-developed nature of the statistical tools and research designs available at the time. Subsequently these developments of hedonic analysis, statistical tools, transaction data in electronic form and GIS techniques facilitated the rapid emergence of empirical studies.

Morales et al. (1976) combined factor analysis and multiple linear regression techniques to study 60 residential sales in Manchester, Connecticut. They concluded that residential properties with good tree cover could raise total sale price by as much as 6% to 9%. Anderson and Cordell (1988) surveyed 844 single-family residential properties in Athens, Georgia, U.S., and found that landscaping with trees was associated with a 3.5% to 4.5% increase in sales price. Besides, Luttik (2000) studied nearly 3000 house transactions in eight towns or regions in the Netherlands, and found that a pleasant view could raise the market value of a house. To support decision-making in landscape management and city planning policies in the cities of Tokyo and Kitakyushu of Japan, Gao and Asami (2007) established a formal framework integrating the analysis of the cognitional judgments of urban landscape and that of their economic impacts. Having reviewed the existing literatures of the impact of parks on property values, we found that urban green space had a positive and statistically significant influence on neighboring property values, on average was a 5%–20% premium. Fig. 1 shows the average premium of urban green spaces on property values in different cities of Euro-American region.

Since urban green space has a positive influence on property values, but how far does this effect reach? Based on the sales data of terraced houses in Salo of Finland, Tyrvainen and Miettinen (2000) found that, distances up to 600 m had a significant positive effect on the price of dwellings. If the distance was more than 600 m, the effect on price was not statistically significant at 5 percent level. Bolitzer and Netsui (2000) also addressed this issue using data of Portland, Oregon. The analysis reported a positive

![Fig. 1 Average premiums of urban green space on property value in Euro-American region.](image)

but not statistically significant effect on the sale price of homes adjacent to (within 30 m of) open space. At distances greater than 30 meters and up to 450 meters from open space, homes were found to sell for a statistically significant greater price than homes more than 450 meters from an open space. Subsequently Lutzenhiser and Netusil (2001) extended this analysis to measure the amenity effects of open space. They reported a home located 121–180 m away from a natural area park on average had a 19.1% premium, and the largest premiums for the urban park, natural area park and specialty park/facilities were in the 61–120m, 121–180m, and 121–180 m distance bands, respectively. In addition, Nicholls and Crompton (2005) demonstrated that greenways might indeed have significant positive impacts on proximate properties’ sales prices in Austin, Texas. And adjacency to a greenbelt produced significant property value premiums in two of three neighborhoods. Table 1 presents the relationships between the largest effect distance and green space type in six previous studies, and we conclude that residential property located 100–500 m away from urban green space have a significant premium.

However, there is a very limited amount of research about the effect of urban green spaces on house prices in China (Yin et al. 2009; Zhong et al. 2009; Shi and Zhang 2010). For example, Hui et al. (2007) investigated the neighboring and environmental characteristics of a residential property on its market value in a high-rise, densely populated living environment. The findings were mostly consistent with previous studies. Households were willing to pay more for apartments with sea view and better air. However, greenbelt was not a significant variable on housing price. Kong et al. (2007) measured the amenity value of urban green space in Jinan City of China, by using GIS techniques and landscape metrics in hedonic price modeling. As expected, the results also confirmed the positive amenity impact of proximate urban green spaces on house price. Besides, Jim and Chen (2010) assessed the external effects of neighborhood parks on the transaction price of high-rise private residential units in Hong Kong. The empirical results derived from 1471 transactions in a district indicated that neighborhood parks could lift price by 16.88%, including 14.93% for availability and 1.95% for view.

These studies reviewed in this section present strong evidence that, urban green space has a statistically significant and positive impact on the sales price of neighboring residential properties. However, not all forms of park and open space are valued equally by households, and there is a limit to how far the externalities from parks extend. Although the urban green spaces have provided impressive economic benefits to residents in Beijing, previous studies have given little clue as to how house prices are related to public green spaces. The existing literatures analyzed more housing structure attributes than neighborhood or environmental characteristics at single-home level. In this study, we will investigate more environmental attributes than house structure features at neighborhood level. Besides, the paper attempts to estimate the overall contribution of public green space in rising property values in Beijing, and to provide a basement for household, real estate agent, and city managers to make decisions or policies.

3. Materials and Methodology

3.1 Study area

Beijing is the capital and densely populated city in China. It has a land area of 1.68 million km² and a population of 19.61 million in 2009. There are four zoning areas: the core district of capital function (Dongcheng and Xicheng), the urban function extended district (Chaoyang, Haidian, Fengtai and Shijingshan), the new district of urban development (Changping, Shunyi, Tongzhou, Fangshan and Daxing) and the ecological preservation development district (Huairou, Pinggu, Mentougou, Yanqing and Miyun). Its population density is among the higher in the world, at 22 849 person km⁻² in the core district of capital function (Beijing Municipal Statistics Bureau 2010). Likewise, housing prices in Beijing are one of the highest countrywide, more specifically, they are increasing rapidly after 2004. Fig. 2 showed that the average property price was about 4500 CNY m⁻² in 2003, and was 13 200 CNY m⁻² in 2009. Housing prices indeed varied greatly across the city. In December 2009, according to Beijing Statistical Information Net (http://www.bjstats.gov.cn/), the average housing price was as high as 28 605 CNY m⁻² in Dongcheng, 16 785 CNY m⁻² in Chaoyang district while it

Table 1 The largest distance away from urban green spaces in the existing literatures.

<table>
<thead>
<tr>
<th>Country, city</th>
<th>Distance</th>
<th>Type</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA, Worcester</td>
<td>500 feet</td>
<td>Park</td>
<td>More et al. 1982</td>
</tr>
<tr>
<td>USA, Worcester</td>
<td>2000 feet</td>
<td>Park</td>
<td>More et al. 1988</td>
</tr>
<tr>
<td>Finland, Salo</td>
<td>600 meters</td>
<td>Forested park</td>
<td>Tyrväinen and Miettinen 2000</td>
</tr>
<tr>
<td>USA, Portland</td>
<td>1500 feet</td>
<td>Natural area</td>
<td>Lutzenhiser and Netusil 2001</td>
</tr>
<tr>
<td>USA, Austin</td>
<td>2–3 neighborhoods</td>
<td>Greenway</td>
<td>Nicholls and Crompton 2005</td>
</tr>
<tr>
<td>USA, Portland</td>
<td>1500 feet</td>
<td>Open space</td>
<td>Wachter and Gillen 2006</td>
</tr>
</tbody>
</table>

Fig. 2 Average housing prices in Beijing from 1991 to 2009.
was only 5303 CNY m⁻² in Yanqing County.

There are four classes of green space system in Beijing such as public green space, affiliated green space, defensive green space and productive green space. The total area of green space is 61 695 ha, of which 19.7% is represented by affiliated green space, 24.1% by defensive green space, and 2% by productive green space; they amount to a total green space area of 43 626 ha. The remaining 29.3% is the public green space of 18 070 ha. In order to conduct a detail analysis, the public green space is further subdivided into six categories: comprehensive park, community park, topic park, belt-shaped park, green area nearby street and landscape green space in isolated areas. Their definitions are provided in Table 2 below. Fig. 3 shows the spatial distribution of public green spaces in Beijing.

3.2 Methodology

The paper aims to measure the economic effects of proximity to Beijing’s public green spaces. We firstly investigate the property characteristics of 76 residential area proximate 14 parks, and apply the hedonic price method to analyze the relationship between property value and its nearby park. Then we adopt GIS technology and the inventory data of urban green spaces in Beijing (2009) to estimate the overall benefit of 18 070 ha public green spaces on property value.

3.2.1 Sample investigation

Since previous studies have given little clue as to how house prices are related to public green spaces in Beijing, we firstly design a scheme and conducted a survey on the property attributes of 76 residential areas surrounding 14 parks. The investigated residential areas and parks are showed in Fig. 4 and Table 3. In order to obtain a representative sample of residents in each neighborhood, the respondents include ten real estate agents, ten households and five planned property buyers. In the investigation process, we create a survey form to record the neighborhood

Table 2 Beijing Municipal Bureau of Landscape and Forestry’s definition of public green spaces.

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition/Description</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive park</td>
<td>With larger area and multiple facilities, the park is suited for outdoor activities, including municipal and regional comprehensive parks</td>
<td>9857</td>
</tr>
<tr>
<td>Community park</td>
<td>The green space serves for residents within some distance, including residential district park (serve radius range from 0.5 to 1 km) and garden (serve radius range from 0.3 to 0.5 km)</td>
<td>692</td>
</tr>
<tr>
<td>Topic park</td>
<td>The park has special subject or style, such as botanical garden, zoo, children park, etc.</td>
<td>2302</td>
</tr>
<tr>
<td>Belt-shaped park</td>
<td>A stripe of green space, distributed along with street, wall and river, often is larger than 8 m in width</td>
<td>235</td>
</tr>
<tr>
<td>Green area nearby street</td>
<td>Beside of city road, the green space is relative independent, such as street and square area, small green land along the street</td>
<td>2146</td>
</tr>
<tr>
<td>Landscape green space in isolated area</td>
<td>The green space patch with the purpose of ecological protection or landscape in isolated area, and other independent forestry parcels</td>
<td>2838</td>
</tr>
</tbody>
</table>
characteristics of each sample property and its surrounding areas. Factors among which are the average sale price, location, public transportation condition, distance to the nearest park, community greening rate, floor area ratio, house decoration, public (school and hospital) facilities, and shopping centre. Then we invited each respondent to make his or her judgment in the interview form, and finally deal with these significant determinants and data by employing principal component analysis. Table 4 presents the descriptive statistics of key variables of the survey results.

3.2.2 Hedonic regression analysis of survey data

Hedonic pricing models are an example of a revealed preference method. Under the HPM framework, a commodity is assumed to be characterized by the set of all its characteristics, and the preferences of the economic actors with respect to any commodities are assumed to be solely determined by its corresponding characteristic vector. Then a functional relationship between the price and characteristic vector is formed since purchasing a commodity is treated as purchasing a basket of “characteristics”. Likewise, the average house prices in this study are assumed to be affected by their structural, neighborhood and environmental attributes. Therefore, we choose average house price of per residential district as the housing price (P); floor area ratio (FAR), community greening rate (CGR) and house decoration level (HDL) as the structural attributes (S); and the neighborhood attributes (N) include public service facilities (PF), public traffic condition (PT), distance to the nearest park (DP),

Table 3 Investigated resident areas, parks and their locations.

<table>
<thead>
<tr>
<th>Code</th>
<th>Park name</th>
<th>Park location</th>
<th>Park type</th>
<th>Number of residential areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temple of heaven park</td>
<td>Inside the 2nd ring road</td>
<td>Historic garden</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Taoranting park</td>
<td>Inside the 2nd ring road</td>
<td>Comprehensive park</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Longtan park</td>
<td>Inside the 2nd ring road</td>
<td>Comprehensive park</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Zizhuoyuan park</td>
<td>Between the 2nd and 3rd ring roads</td>
<td>Comprehensive park</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Beijing zoo</td>
<td>Between the 2nd and 3rd ring roads</td>
<td>Topic park</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Yuyuantan park</td>
<td>Between the 2nd and 3rd ring roads</td>
<td>Comprehensive park</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>Sun palace park</td>
<td>Between the 3rd and 4th ring roads</td>
<td>Community park</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Chaoyang park</td>
<td>Between the 3rd and 4th ring roads</td>
<td>Comprehensive park</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>Haidian park</td>
<td>Between the 4th and 5th ring roads</td>
<td>Comprehensive park</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Older Summer Palace</td>
<td>Between the 4th and 5th ring roads</td>
<td>Historic garden</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Summer Palace</td>
<td>Between the 4th and 5th ring roads</td>
<td>Historic garden</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>North creek park</td>
<td>Between the 4th and 5th ring roads</td>
<td>Belt-shaped park</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Olympic park</td>
<td>Between the 4th and 5th ring roads</td>
<td>Community park</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Olympic forest park</td>
<td>Between the 5th and 6th ring roads</td>
<td>Community park</td>
<td>4</td>
</tr>
</tbody>
</table>
The integration function of GIS allows the measurement of impacts of many place-based variables at several geographical scales, for neighborhoods and for the city as a whole. With the aid of GIS, we are able to identify whether the property is located on the public green space edge, and it is possible to measure the area and perimeter of each green space. In order to identify the effect zone of urban green spaces on residential property in Beijing, we applied the buffer tool of Arcgis 9.3, and viewed the effect distance of park on housing price as the buffer radius to calculate the area of effect zone, the formula is below:

\[ F_h = \sum_{i=1}^{n} \text{buffer}(r_i) \]

where \( F_h \) is the effect zone of public green spaces on housing price (ha), \( r \) is the effect distance of park (m), the \( i \) subscript indicates each public green space.

Average building density is the total standing area of all buildings to the total area of the interest area, indicating the general features of buildings’ stretching on the surface in Beijing built-up area. Therefore, we can approximately determine the area of house properties affected by public green spaces, with the aid of effect zone (\( F_h \)) and average building density (BD). Based on the premiums of park on housing price deprived from the hedonic pricing models analysis and average house prices in different area, the total value of public green spaces on residential property is calculated by:

\[ V_h = \sum_{i=1}^{n} 100 \times F_{hi} \times BD \times z_i \times P_i \times 70 \]

where \( V_h \) is the total benefit of public green spaces on property values in Beijing (CNY y²), \( F_{hi} \) is the effect zone of public green spaces on housing price (ha), \( BD \) is the average building density (%), \( P_i \) represents the average housing price of different areas (CNY m⁻²) in Table 6, and \( z_i \) is the premium of park on residential property (%).

### 3.3 Data

A high-quality evaluation of the economic effect of green areas on residential property in Beijing demands comprehensive data on the house attributes and the individual green areas. The paper collected the property attribute data from 76 surveyed residential areas as well as related published literature. And another data came from

### Table 4 Descriptive statistics of the key variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Abbr.</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average sale price (CNY m⁻²)</td>
<td>P</td>
<td>23 000</td>
<td>80 000</td>
<td>40 066</td>
<td>12 621.48</td>
<td>Average house price of the same neighborhood</td>
</tr>
<tr>
<td>Public traffic condition</td>
<td>PT</td>
<td>1</td>
<td>10</td>
<td>3</td>
<td>2.46</td>
<td>Public transportation (Bus stop or railway station) situation of surrounding neighborhood, 1 represents the best and 10 the worst</td>
</tr>
<tr>
<td>Distance to the nearest park (m)</td>
<td>DP</td>
<td>50</td>
<td>2000</td>
<td>818</td>
<td>578.05</td>
<td>Distance from sample neighborhood to the nearest park</td>
</tr>
<tr>
<td>Floor area ratio</td>
<td>FAR</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>1.14</td>
<td>The ratio of the floor area of buildings on a certain location to the size of the land of that location</td>
</tr>
<tr>
<td>Community greening rate</td>
<td>CGR</td>
<td>0.20</td>
<td>0.75</td>
<td>0.34</td>
<td>0.10</td>
<td>The coverage rate of green area to the all area of neighborhood</td>
</tr>
<tr>
<td>House decoration level</td>
<td>HDL</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>1.71</td>
<td>The level of house decoration, 1 represents the best and 5 the worst</td>
</tr>
<tr>
<td>Public service facilities</td>
<td>PF</td>
<td>1</td>
<td>3</td>
<td>1.47</td>
<td>0.66</td>
<td>Such situation as hospital and school nearby neighborhood, 1 represents the best and 3 the worst</td>
</tr>
<tr>
<td>Shopping centre</td>
<td>SC</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>0.68</td>
<td>Commerce prosperity degree nearby neighborhood, 1 represents the highest and 3 the lowest</td>
</tr>
</tbody>
</table>

### Table 5 Three forms of the hedonic price model.

<table>
<thead>
<tr>
<th>Type</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear model</td>
<td>( P = a_0 + \sum a_i \times C_i + \xi )</td>
</tr>
<tr>
<td>Semi-logarithmic</td>
<td>( \ln P = a_0 + \sum (a_i \times C_i)^\xi + \xi )</td>
</tr>
<tr>
<td>Logarithmic model</td>
<td>( P = a_0 + \sum (a_i \times \ln C_i)^\xi + \xi )</td>
</tr>
</tbody>
</table>

where \( P \) is the average house price (CNY m⁻²); \( C_i \) is the ith attribute variable; \( \xi \) is error term, \( a_0 \) and \( a_i \) are the estimated coefficients. In the linear model, \( a_i \) is the housing price variation of the unit house attribute change. In the semi-logarithmic model, \( a_i \) represent the percentage of housing price variation related to the unit attribute change in house. And \( a_i \) is the percentage of housing price variation when 1% of houses attribute change in logarithmic model.

and shopping centers (SC). Table 4 presents summary statistics of the eight variables. In empirical studies, various equations have been developed, such as linear, semi-logarithmic, double logarithmic, quadratic, reciprocal, and Box-Cox forms (Kong et al. 2007; Jim and Chen 2010). In this paper, the direct linear, semi- and double-logarithmic regression modeling are formulated in Table 5, to interpret the relationship between property value and nearby park in Beijing. Another analysis will be performed using an extreme value regression technique in the SPSS software to reveal the effect radius of different parks.

### 3.2.3 Overall benefit of public green space on property value

The buffer tool of Arcgis 9.3, and viewed the effect distance of park on housing price as the buffer radius to calculate the area of effect zone, the formula is below:

\[ F_h = \sum_{i=1}^{n} \text{buffer}(r_i) \]

where \( F_h \) is the effect zone of public green spaces on housing price (ha), \( r \) is the effect distance of park (m), the \( i \) subscript indicates each public green space.

Average building density is the total standing area of all buildings to the total area of the interest area, indicating the general features of buildings’ stretching on the surface in Beijing built-up area. Therefore, we can approximately determine the area of house properties affected by public green spaces, with the aid of effect zone (\( F_h \)) and average building density (BD). Based on the premiums of park on housing price deprived from the hedonic pricing models analysis and average house prices in different area, the total value of public green spaces on residential property is calculated by:

\[ V_h = \sum_{i=1}^{n} 100 \times F_{hi} \times BD \times z_i \times P_i \times 70 \]

where \( V_h \) is the total benefit of public green spaces on property values in Beijing (CNY y²), \( F_{hi} \) is the effect zone of public green spaces on housing price (ha), \( BD \) is the average building density (%), \( P_i \) represents the average housing price of different areas (CNY m⁻²) in Table 6, and \( z_i \) is the premium of park on residential property (%).
4 Results and discussions

4.1 Premium of park on property value

Housing is a multi-attribute commodity, accessibility to work, transport and amenities, and its neighboring properties are routinely considered by housing buyers. The previous studies consistently demonstrated that, urban green space had a 5%–20% premium on neighboring property values. What is the magnitude of this effect in Beijing? When we choose three house structure attributes (FAR, CGR and HDL) and four neighborhood factors (PF, PT, DP and SC) as independent variable \( C_i \), and the average housing price as dependent variable \( P \), three hedonic price models can be applied in SPSS software (see Table 5). The regression results are showed in Table 7, and the logarithmic model has the best fitting effect. Therefore, we analyze the premiums of seven variables by using the logarithmic model. The results suggest that, at neighborhood level, the structural variable of house decoration level (HDL) possesses the largest effect on residential property value, the neighborhood environmental variable of shopping center has the least influence. Overall, the city parks are more highly valued with an average premium of 10.9%, and followed by public traffic (8.2%) and floor area ratio (6.1%). All the premiums of seven variables are presented in Table 8. Furthermore, we find that the parks in different ring roads contribute differently on property value. The parks inside 2nd ring road can increase property value by about 14.1%, while the parks beyond 5th ring road only add 0.5% in house prices. Table 9 presents those premiums attached to properties in close vicinity to the park in different locations. Therefore, a property located on the edge of a park could potentially attract a premium of between 0.5% and 14.1% in Beijing. This variation tendency of premium of park on property values maybe related to the urgent green demand of residents in different ring roads. There is a high population density and small areas of green space in inner city, while a low population density and large areas of green space in suburbs (Beijing Municipal Statistics Bureau 2010).

4.2 Proximity to park

The above analyses showed that the park has a positive influence on property values in Beijing. Subsequently, a regression analysis is conducted to explore how far does this effect reach, by employing the binary quadratic model in SPSS software. Results show that, the distance from the
sample property to the nearest park is negatively correlated with average housing price, and the average effect distance of park in Beijing can reach 1.38 km. The adjacent topic park and comprehensive park generate significant premiums within 1.60 km and 1.22 km, while community park has a positive effect only when property located within 0.85 km. So, by and large, the effect distance of parks on property values range from 850 to 1604 meters in Beijing. However, a few previous studies demonstrated that the residential property located 100–500 m away from urban green space had a significant premium. This unexpected finding may be explained by: (i) the larger area and attractive of sample parks, which resulted their effect radius are longer than common; (ii) there is short distance between adjacent parks, therefore, the surveyed park is more park zone than isolated park.

4.3 Total economic benefit

Owing to the knowledge gap for the relationship between park and property value, the benefits of green areas are usually ignored or underestimated by urban planning policymakers, with the result that remnant urban green spaces are being gradually encroached upon by urban sprawl. Therefore, this study attempts to provide an important step in quantifying the total benefits from preserving open space in an urban environment. Based on the equation (1) and (2), as well as the inventory data of urban green spaces in Beijing (2009) and GIS techniques, we estimate that the 18 070 ha public green spaces of Beijing could affect the sale prices of residential properties in 0.18 million ha. The overall benefit from Beijing’s public green spaces on residential property is 2.86 billion CNY, and the average benefit of per hectare public green space is 0.16 million CNY.

Furthermore, the economic benefits of public green spaces on residential property vary from different regions. From a regional perspective, the public green spaces in Chaoyang, Haidian, Xicheng, Dongcheng and Fengtai contribute nearly 94% of the total benefit of property increment. And specifically, the public green space in Chaoyang can achieve 928 million CNY from the increment property value, followed by Haidian 603 million CNY, Xicheng 507 million CNY, Dongcheng 400 million CNY and Fengtai 261 million CNY. The residential properties in Changping and Shijingshan receive 72 million CNY and 68 million CNY due to public green spaces, respectively. The green spaces in other districts or counties provide only 2% of the total benefit. However, the average value increment of per unit area green space does not follow the same order. The highest value increment is the public green space in Xicheng, which is larger than 1.15 million CNY ha⁻¹, then followed with Dongcheng of 0.7 million VNY ha⁻¹. The value increment of per unit green space in Haidian, Chaoyang and Fengtai are 0.7 million, 0.19 million and 0.19 million CNY ha⁻¹, respectively. And the rest public green spaces in Beijing have minor economic effect on property values. The total and average value increments of public green spaces in different districts or counties are showed in Fig. 5.

5 Conclusions

Since urban green spaces have a positive impact on proximate property values, this represents a “capitalization” of park land into increased property values of proximate land owners. In some instances if the incremental amount of taxes paid by each property that is attributable to the presence of the public green space is aggregated, it will be sufficient to pay the annual debt charges required to retire the bonds used to acquire and develop the park. In these circumstances, urban green space is obtained at no long-term cost to the jurisdiction. Thus, the incremental return to the city alone is sufficient to pay the cost incurred by the city maintain the public green space. This creates a major policy issue. This study concluded that, the increase in property tax revenue received by Beijing as a result of the enhanced value of properties around the public green spaces amounted to 2.86 billion CNY annually, the annual maintenance cost incurred by 18 070 ha public green spaces are 0.7–1.6 billion CNY (according to the code for management of landscape greening in Beijing, the per year maintenance cost of grass space in first grade is 9 CNY m⁻², and the maintenance cost per year in second and third grade is 6 and 4 CNY m⁻², respectively), so the net annual income accruing to the city its investment in the public green space is 1.2–2.1 billion CNY. On the other hand, the paper also suggests that, the annual average value increment is 0.16 million CNY per hectare of green space, which is corresponding to 1.8–3.9 times of the maintenance cost of per hectare green space. Therefore, the indirect benefit of urban green space on property value should attract more attention from city managers and policy-makers.

This study summarized what the effects of public green spaces are on property values in Beijing, China. The findings are mostly consistent with previous studies in Euro-American region. Results show that proximity to a park has a statistically significant effect on the neighborhood property value, of which effect can reach 850–1604 m,
and the price premiums vary from 0.5% to 14.1% by park location. Besides, this study provide an important step in quantifying the total benefits, and an interesting implication is that property tax revenues to local governments will increase due to the creation of certain types of open spaces.

By and large, the study presented a strong evidence that park has a statistically significant and positive impact on the prices of neighboring residential properties, and discussed the distribution of these benefits across regions. Besides, the current research can contribute to a better understanding of the role of urban green spaces in Beijing. However, the relationship between house price and location is more complicated. All results in this study to a large extent relate to the notion of property value of “location”.

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Bolitzer B and N Netusil. 2000. The effect of open space on a home’s property and the property value it commands. Such simple estimation may sometimes generate biased results over or under-estimate the value of individual housing attributes. Hence, future research should devote to developing a comprehensive model with more factors and conducting more empirical studies from a large number of actual transactions in Beijing.

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**北京城市公共绿地对房地产价值的影响研究**

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**摘 要**：欧美地区大量研究表明，城市公园对附近房地产价值有明显增值效应，但是关于北京城市绿地与房地产价值之间的关系还未有研究，阻碍了社会公众和城市管理者对绿地资源重要功能的认识。本研究首先采用问卷调查与享乐价格法，分析了北京城区14个公园绿地与附近76个居住小区房产价格的关系，并借助北京市第七次园林绿化资源普查数据（2009）与GIS技术测算了18 070 ha城市公共绿地的房产增值总效应。结果表明，在北京地区，公园绿地能对其附近850-1604 m范围的房产价格有0.5%-14.1%的增值效应。北京城市公共绿地共产生28.6亿元的房产增值，约合每公顷绿地平均增值16万元，相当于绿地维护成本的1.8-3.9倍。因此，通过提高绿地附近房产的部分税收作为绿地建设与维护资金具有一定的现实意义。

**关键词**：享乐价格模型；房产价格；公共绿地；房产价值