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Research Paper

Does happiness data say urban parks are worth it?

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ABSTRACT

Urban planners emphasize that urban nature plays an important role in providing social and psychological benefits to urban dwellers. Particularly, it provides space not only for the improvement of public health, but also for social interaction and community cohesion. However, less scientific attention has been paid to the effects of urban parks on the subjective well-being of urban dwellers who live in high density cities. In this study, we examine the relationship between individual subjective well-being and urban parks with individual survey data for self-reported happiness in Seoul. We obtain longitudinal Seoul Survey Data (SSD) conducted by the Seoul government between 2005 and 2015, and employ pooled cross-section data analysis with location-specific and time-specific fixed-effects to estimate the effects of urban parks on the subjective well-being of urban dwellers. In addition, we estimate the monetary value of urban parks using the average marginal rate of substitution between urban parks and household income. Our findings show that urban parks are associated with residents' subjective well-being. Specifically, on average, an individual household has an implicit willingness-to-pay of approximately 129,300 won (approximately 110 U.S. dollar) in monthly household income for a 100 m^2 increase in urban parks. High-income residents' willingness-to-pay is approximately seventeen times more than that of low-income residents. Seniors also have more willingness-to-pay for urban parks.

1. Introduction

Contemporary urban life generates numerous physical illnesses and chronic stress that lead to disease and cancer. Residents who live in large cities (e.g., New York, Tokyo, London, and Seoul) are likely to experience such physical stresses that decrease individual subjective well-being (Lewis & Booth, 1994; White, Alcock, Wheeler, & Depledge, 2013). Scholars have emphasized that urban parks, green spaces, and recreational places are important for providing residents with physical and emotional benefits in a variety of ways (Grahn & Stigsdotter, 2010). More specifically, people can relieve mental fatigue in urban green spaces, which serve as a resource for physical activities as well as relaxation and restoration (Booth, Roberts, & Laye, 2012). There is much empirical evidence to support the idea that natural amenities (e.g., urban parks, forests, and green belts) in an urban area contribute to the quality of life of urban dwellers. For example, natural amenities not only function as important environmental services such as purifying air and water, filtering noise and wind, and stabilizing microclimate in urban contexts, but also provide social and psychological services that improve residents' subjective well-being (Chiesura, 2004). Urban parks also offer opportunities for contact with other people, which enhances social engagement and cohesion of those who live alone or are isolated (Pfeiffer & Cloutier, 2016).

In spite of the recognition of these important roles of urban parks, less scientific attention has been paid to the effects of urban parks on the subjective well-being of urban dwellers. In addition, most previous studies have not addressed the relationship between urban parks and human well-being as a concept that encompasses the physical, mental, and social domains (van Kamp, Leidelmeijer, Marsman, & Hollander, 2003). They have only focused on specific functions of urban parks, such as the improvement of physical health (Maas, Verheij, Groenewegen, Vries, & Spreeuwenberg, 2006; Mitchell & Popham, 2007), reductions in stress (Berman, Jonides, & Kaplan, 2008), and increases in recreational activities (Santos, Mendes, & Vasco, 2016). This leaves a gap in our understanding of how providing urban parks affects urban residents' subjective well-being, especially their overall happiness.

Recently, scholars have begun to use happiness data measured using one question to assess experienced life satisfaction, in order to examine how neighborhoods or environmental factors affect individual subjective well-being. (Brereton, Clinch, & Ferreira, 2008; Dolan & Kahneman, 2008; Frey, Luechinger, & Stutzer, 2010; Kahneman & Sugden, 2005; Levinson, 2012). They have argued that subjective well-being (Individual self-reported "subjective well-being", "happiness", or "life satisfaction" can be used as an empirical approximation to "experienced utility", see MacKerron, 2012) is affected not only by

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individual characteristics such as age, marital status, income, and physical health, but also by living environment characteristics such as public services, transportation infrastructures, and natural amenities. Although increasing attention has been paid to the function of urban parks on the subjective well-being of urban dwellers in various cities (Ambrey & Fleming, 2014; Scopelliti et al., 2016), there is still not enough understanding of the effects of urban parks on residents' overall happiness. Particularly, there is only a few studies to connect the benefits of urban parks and individual happiness using self-reported happiness data (Ambrey & Shahni, 2017). A more comprehensive assessment of urban parks based on individual subjective well-being with additional case studies focusing on large cities is worthwhile for reconsidering the importance of urban parks for residents in large urban areas (Cloutier & Pfeiffer, 2015).

Seeking to address this gap, we explore the relationship between individual subjective well-being and urban parks using individual survey data for self-reported subjective well-being focusing on Seoul, one of the highest density cities in the world. Specifically, the objective of this study is to address two questions that are pertinent to the issue of the relationship between urban parks and subjective well-being. First, we focus on how urban parks affect the subjective well-being of local residents who live in Seoul. Second, we estimate how much residents value urban parks. We use the Seoul Survey Data (SSD) conducted by the Seoul government between 2005 and 2015, and employ pooled cross-section data analysis with location-specific and time-specific fixed-effects to estimate the effects of urban parks on the subjective well-being of urban dwellers. And then, we estimate the monetary value of urban parks using the average marginal rate of substitution between urban parks and household income. The fact that urban parks are positively associated with individual well-being is not new, but this approach with the self-reported survey data is novel in terms of providing evidence of the relationship between urban parks and overall happiness of urban dwellers. Valuing public urban parks can also provide useful information to local government agencies, especially on the benefits of providing urban parks.

The rest of the paper is organized as follows. In the next section, we review previous studies relevant to the relationship between happiness and urban parks. Section 3 presents an empirical model to estimate the effect of urban parks on individual subjective well-being, and to estimate the monetary value of urban parks. In section 4, we describe the data used in this study. Section 5 presents the empirical results and estimated values of urban parks. In the last section, we summarize and discuss our findings and suggest policy implications.

2. Literature review

2.1. Urban parks and happiness

Traditionally, scholars and scientists have focused on large ecosystem protection because it provides considerable benefits to human society (Lindsey & Knaap, 1999). For example, ecosystem services include water purification, water retention, soil fertility, carbon sequestration, and coastal protection. Thus, small-scale green spaces in urban areas are often disregarded (Chiesura, 2004). However, over the past couple of decades, interest in urban parks has increased because of growing attention to the quality of life for people who live in urban areas. Urban green spaces include a wide range of different components such as parks, woodland, street tree and square plantings, green roofs, sports complexes, and community gardens. Such green spaces and natural amenities contribute to personal physical and mental health by reducing stress, offering opportunities for restoration, and increasing physical activities (Grahn & Stigsdotter, 2010; Hansmann, Hug, & Seeland, 2007; Lafortezza, Carrus, Sanesi, & Davies, 2009; Troy & Grove, 2008). Urban planners emphasize that urban nature plays an important role in providing social and psychological benefits to urban dwellers. For example, it provides space not only for the improvement of public health, but also for social interaction and community cohesion (Loukaitou-Sideris, Levy-Storms, Chen, & Brozen, 2016).

Moreover, a number of empirical studies have demonstrated the positive relationship between urban parks and quality of life of urban dwellers. For example, when people have better access to parks, they exercise more. Such increased physical activities have been shown to improve personal health conditions and reduce psychological stresses, anxiety, and depression (Berman et al., 2008). Urban residents with greater exposure to green spaces (green colors) can directly benefit from lower mental distress, reduced stress, and refreshed mood (White et al., 2013), and urban parks also indirectly increase personal happiness by providing space for physical exercise and social interaction (Saw, Lim, & Carrasco, 2015). However, evaluations of the effects of urban parks have been partial rather than comprehensive (van Kamp, Leidelmeijer, Marsman, & de Hollander, 2003) because studies have focused on the functions of urban parks separately. That is, while some have examined their effect on physical health (Zhai & Baran, 2016), others have focused on mental health (Grahn & Stigsdotter, 2010; Hansmann et al., 2007; Thompson et al., 2012). Hence, little is still known about the relationship between urban parks and overall happiness of urban dwellers. Scholars have pointed out that an overall assessment that can evaluate the effects of urban parks on mental and physical health, human well-being, quality of life, and life satisfaction is needed to establish efficient and appropriate plans for urban green spaces (Ambrey & Fleming, 2014; Pfeiffer & Cloutier, 2016).

Recently, scholars have become interested in the concept of individual subjective well-being, which is a comprehensive framework to address physical, psychological, and social indicators, that can be used to assess the impact of public goods, especially urban parks (Ambrey & Fleming, 2014; Loukaitou-Sideris et al., 2016; White et al., 2013). In addition, several planning scholars have emphasized that open spaces and urban parks are considered to be important contributing factors to the happiness of local residents (Loukaitou-Sideris et al., 2016; Pfeiffer & Cloutier, 2016). They have also pointed out that urban parks improve the subjective well-being of low-income people and seniors by providing important physiological and psychological benefits (Loukaitou-Sideris et al., 2016).

2.2. Research on happiness

Economists and psychologists have recently paid growing attention to happiness research (Diener & Seligman, 2002; Dolan, Peasgood, & White, 2008; Frey & Stutzer, 2002; MacKerron, 2012). Since Richard Easterlin's (1974) pioneering work on happiness, numerous scholars have examined the role of demographic characteristics such as age, gender, and marital status as well as socioeconomic characteristics such as income, employment status, and household tenure on individual subjective well-being. They have demonstrated that these personal characteristics directly influence individual subjective well-being. For example, happiness has a U-shaped relationship with age (Blanchflower & Oswald, 2004). There is a positive relationship between income and happiness, but diminishing returns to income (Frey & Stutzer, 2002). Marriage is positively associated with life satisfaction (Blanchflower & Oswald, 2004; Stutzer & Frey, 2006). Poor health conditions and unemployment both lower individual happiness levels (Powdthavee & van Praag, 2011). In addition to these socioeconomic factors, numerous studies have found that psychological factors such as social interactions and social capital improve happiness levels (Diener & Seligman, 2002; Dolan et al., 2008).

More recently, scholars have become interested in neighborhood environmental factors, which are also associated with individual happiness (Ambrey & Fleming, 2014; Cloutier & Pfeiffer, 2015; Dolan et al., 2008; Ferreira & Moro, 2010). They have argued that good neighborhood environments are positively related to the quality of life, and thus local governments' public policies are important in improving local residents' happiness. For example, scholars have found that there is

association between individual subjective well-being and public investment in rail transit (Wu, 2014), public green space (Ambrey & Fleming, 2014), and natural amenities (Winters & Li, 2016). Planners and policy makers have also begun to take an interest in geographical factors that influence individual happiness because regional, local, and neighborhood factors may play a role in the happiness of local residents (Pfeiffer & Cloutier, 2016). Brereton et al. (2008) suggested that public policies related to spatial planning such as improving urban amenities and living environments would provide great benefits for individual subjective well-being.

Among these various neighborhood components, urban parks have long been recognized as an important place that contributes to the physical health of urban dwellers. A large body of literature has clearly demonstrated that urban parks and green space make people feel happier in a variety of ways. For example, they provide a healthier microclimate (Lafortezza et al., 2009) and biodiversity (Alvey, 2006), as well as promote physical activity (Pretty, Peacock, Sellens, & Griffin, 2005), psychological restoration (Kaplan, 1995), and a reduction in emotional stress (Berman et al., 2008). More recently, scholars have begun to examine the effects of urban parks on individual subjective well-being measured by the self-reported happiness score. They have found that people who live in an urban neighborhood with more parks and more green spaces are likely to feel much happier (Ambrey & Fleming, 2014; Scopelliti et al., 2016).

2.3. Valuing urban parks

As planners and policy makers have become concerned about changes in environmental quality, growing attention has been paid to estimating the monetary value of environmental amenities (Frey et al., 2010). Over the past decades, a traditional way of valuing environmental quality has been to use property data with hedonic price model or to use contingent valuation method (CVM) by asking people whether they would vote for a proposed change at specified cost (Boyle, 2017; Johnston et al., 2017). Thus, numerous studies have used a hedonic model with housing price data (Anderson & West, 2006; Mansfield, Pattanayak, McDow, McDonald, & Halpin, 2005) and contingent valuation with survey data (Brandli, Prietto, & Neckel, 2015; Groothuis, Groothuis, & Whitehead, 2007; Latinopoulos, Mallios, & Latinopoulos, 2016) to estimate the monetary value of amenities. Brander and Koetse (2011) conducted meta-analyses with the results of contingent valuation and the hedonic price model in 90 empirical studies. They found that urban parks are highly valued, as compared to other types of urban green spaces such as forests, agricultural land, and undeveloped land.

Recently, researchers have begun to use life satisfaction data to estimate the value of environmental amenities, such as scenic amenity (Ambrey & Fleming, 2011), weather (Feddersen, Metcalfe, & Wooden, 2012), and air quality (Ferreira et al., 2013; Levinson, 2012). This approach estimates the implicit willingness to pay (denoted WTP) for a marginal change in environmental factors using the partial derivative of environmental variables and the partial derivative of household income (Dolan & Kahneman, 2008; Kahneman & Sugden, 2005; Welsch & Ferreira, 2013). It is complementary to the hedonic property pricing method. Some scholars have argued that the hedonic approach has a critical assumption that wages and housing prices fully adjust to equalize individuals' utility across locations (Nilsson, 2017; Roback, 1988; Voith, 1991). However, this equilibrium condition does not hold because of market imperfections due to moving costs and imperfect information. In this case, household income and housing prices do not fully capitalize differences in amenities. A life satisfaction data approach can compute the "residual" externality of the non-market good not captured in the hedonic approach (Ferreira & Moro, 2010). In other words, the total value of urban parks can be calculated by the sum of any amenity-related housing costs plus the benefits estimated via the life satisfaction approach.

3. Empirical model

The main objective of this study is to examine the relationship between urban parks and individual subjective well-being. Therefore, to estimate the effect of urban parks on individual subjective well-being, we adopt an indirect utility function for resident i in location k, as follows:

$$u_{i,k,t} = \alpha + \beta P_{k,t} + \gamma (lnY_{i,k,t}) + \delta X_{i,k,t} + \theta_t + \theta_k + \varepsilon_{i,k,t} \quad (1)$$

where $u_{i,k,t}$ is the utility of individual i in location k at time t, $P_{k,t}$ is the total area of urban park in location k at time t, $Y_{i,k,t}$ is the household income of individual i in location k at time t, and $X_{i,k,t}$ is socioeconomic characteristics of individual i in location k at time t. θ_t is the time-specific fixed-effects, and θ_k is the location-specific fixed-effects. In the micro-econometric function, the individual's true utility cannot be observed. Scholars have argued that self-reported happiness scores can be used as a proxy when estimating the effects of non-market goods, such as environmental amenities (Ambrey & Fleming, 2014; Ferreira & Moro, 2010; Levinson, 2012). We follow the approach used in previous studies that have investigated the effects of environmental amenities on individual subjective well-being.

Once estimated, by totally differentiating the above equation and holding happiness constant (i.e., setting ($\partial u = 0$), we can also estimate the value of urban parks using the ratio of the estimated coefficients. Particularly, based on the average marginal rate of substitution between urban parks and household income, it is possible to estimate the implicit willingness to pay (WTP) for a marginal change in urban parks. The method suggested by previous studies (Ferreira & Moro, 2010; and Welsch, 2006) can be presented as follows:

$$MRS = \frac{\frac{\partial u}{\partial P}}{\frac{\partial u}{\partial Y}} = \overline{Y}\frac{\beta}{\gamma} \quad (2)$$

where $\overline{Y}$ is the mean value of household income. Recently, this approach using self-reported happiness data has been adopted in many empirical studies. For example, it has been used for evaluation of monetary values of public goods such as air quality (Levinson, 2012), public green space (Ambrey & Fleming, 2014), and scenic amenity (Ambrey & Fleming, 2011). Although this approach does not provide absolute values of the public goods, estimating the relative values of non-market public goods provides important policy implications for policy makers and planners in future plans for urban parks and green spaces.

Ordered probit by maximum likelihood estimation has been generally used in estimating the parameters because some scholars have argued that OLS produces biased and inconsistent results if the self-reported happiness score is ordinal (Blanchflower & Oswald, 2004; Finkelstein, Luttmer, & Notowidigdo, 2009). However, others have shown little difference in results between OLS and the ordered probit. Particularly, Levinson (2012) argued that OLS is less sensitive to the statistical issue because its intention is not to estimate the marginal utility of income and non-market goods separately, but to estimate the ratio of the two. Hence, we use OLS to estimate the parameters, which should not produce biased results. We also report the results of probit model in an Appendix for comparison.

4. Data

We use individual survey data from the Seoul Survey Data (SSD), which is a pooled cross sectional survey obtained by collecting random samples from a large population at different points in time. The SSD is an annual survey covering 25 local regions in Seoul, and a unique survey that has been published by the Seoul government since 2005. The Seoul government conducts the survey to examine the relationship between participants' individual subjective well-being and their socioeconomic characteristics, and uses it for suggesting local policy

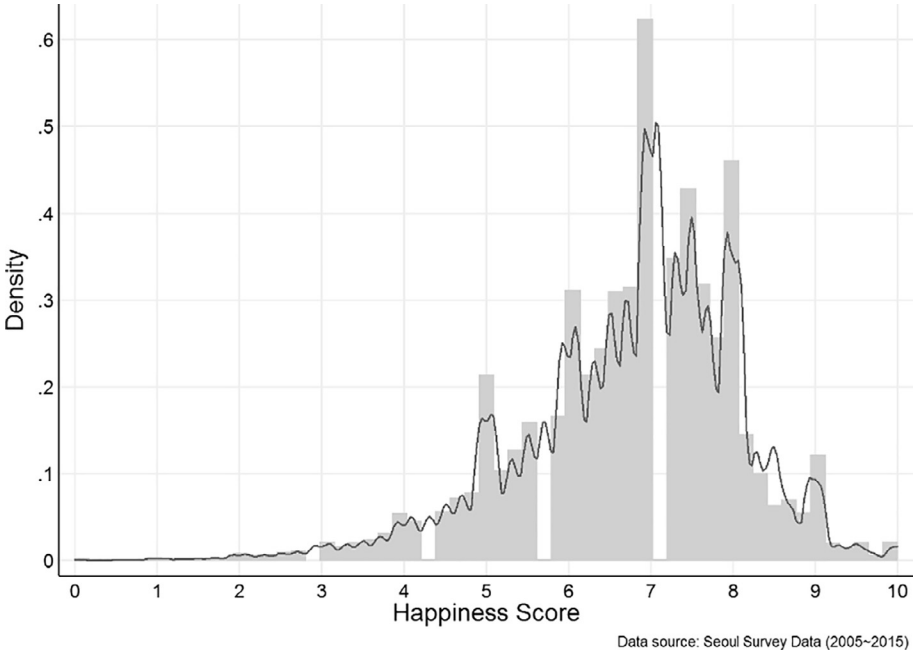

Fig. 1. Histogram of happiness score.

implications. Hence, the SSD includes information on the individual happiness score and socioeconomic characteristics such as monthly household income, age, gender, housing ownership, housing type, and marital status, as well as a unique regional code that indicates where they live. Annually, about 47,000 residents in Seoul are interviewed in person. They are asked, "Taken all together, how satisfied are you with your life?" Responses range on a scale from 0 to 10. 0 means "completely dissatisfied" and 10 means "completely satisfied". Fig. 1 shows the distribution of the self-reported happiness score in our sample.

In addition to the SSD, we obtained urban park data that includes information on the types, numbers, and areas of urban parks of 25 local regions in Seoul between 2005 and 2015. Fig. 2 shows the spatial distribution of urban parks as well as urban natural parks. We excluded urban natural parks, which are generally distant from local residents, and most of them consist of mountains in Seoul, in our analysis because we focus only on the impact of urban parks that provide amenities to local residents for daily life activities such as rest, refreshment, and meeting friends or new people. These include neighborhood parks, cemetery parks, children's parks, cultural parks, small parks, waterfront parks, historic parks, sports parks, and other park facilities. The Seoul government has expended parks and green spaces to encourage residents to participate in recreational activities for the past decades. Particularly, since 2006, the city has built a number of eco-friendly parks to improve the quality of life of Seoul citizens (Kim, 2015). Fig. 3 shows an increasing trend of urban parks in Seoul; the average area of urban parks in 25 regions has increased between 2005 and 2015 (from 3979 m^2 to 4318 m^2). Fig. 4 shows the time trend of the area of urban parks per person, which has also increased during the period (from 10.12 m^2 to 11.19 m^2). To merge the SSD with the urban park data, we use a unique regional code that indicates the individual interviewees' residential locations.

5. Results

5.1. Descriptive statistics

Table 1 shows descriptive statistics for our explained and explanatory variables. The mean value of happiness score is 6.765. The average area of urban parks in 25 local administrative regions of Seoul is 4354 m^2. Monthly mean household income between 2005 and 2015 is 4,290,000 won (approximately 4000 US dollars). Average age of the interviewees is 43. Among them, 37% live in an apartment and 58% are home owners. 51% are female, and 55% are married. 31% have an education level above bachelor's degree, and 58% have a job.

Our data also reveal that the happiness level of low-income residents is lower than that of high-income residents (Fig. 5), and that seniors' happiness levels are relatively lower than other age groups (Fig. 6). Previous studies have noted that urban parks are important places for seniors who live in an inner-city neighborhood (Loukaitou-Sideris et al., 2016), and preferences for the amenities provided by urban parks may be different among different income groups (Ambrey & Fleming, 2011; Scopelliti et al., 2016). Thus, we also explore the effects of urban parks on the subjective well-being of groups by income and age. As shown in Figs. 5 and 6, we divide groups into income and age to compare the different effects of urban parks on different social groups. High-income people are defined as having a monthly income above 6,000,000 won (approximately the top 20%), while low-income people are defined as having a monthly income below 1,500,000 won (approximately the bottom 20%). Seniors are defined as people whose age is more than 65, whereas adults and young adults are defined as people whose age is between 36 and 65 and less than 36, respectively.

5.2. Estimation results

We estimate five different specifications of the model presented in Section 3. Table 2 presents our estimation results of the relationship between urban parks and the subjective well-being of urban dwellers. In order to check for the model consistency, we include only our key variable (i.e., area of urban park) in the first model as a simple version, and then include income and socioeconomic variables in Model 2 and Model 3. Because the average happiness level has changed over time, as shown in Figs. 5 and 6, we include time-specific fixed-effects in Model 4. Finally, we include region-specific fixed-effects variables in Model 5 to account for unobserved characteristics at the local level. After accounting for the region-specific fixed-effects, the magnitude of the coefficient of urban park increases, indicating that spatial heterogeneity has a strong relationship with the happiness level of urban residents. We did additional tests by adding regional variables such as air pollution (SO2), traffic congestion (the number of cars), and regional annual budget. We could not identify any difference between Model 5 and the

Fig. 2. Spatial distribution of urban parks in Seoul, 2012 (source: Seoul Statistics).

model using more regional variables, indicating that our fixed-effects model is not sensitive to the inclusion of other regional variables. Adding more variables improves the explanatory power (adj-R-square) across the models. Hence, our interpretation focuses on the results of Model 5.

Our result shows that the coefficient of urban parks is positively associated with the subjective well-being of local residents. The coefficient of urban parks also became larger after controlling for the control variables. Specifically, an increase of 100 m^2 in urban parks is associated with an increase in happiness of 0.015 points. This implies that

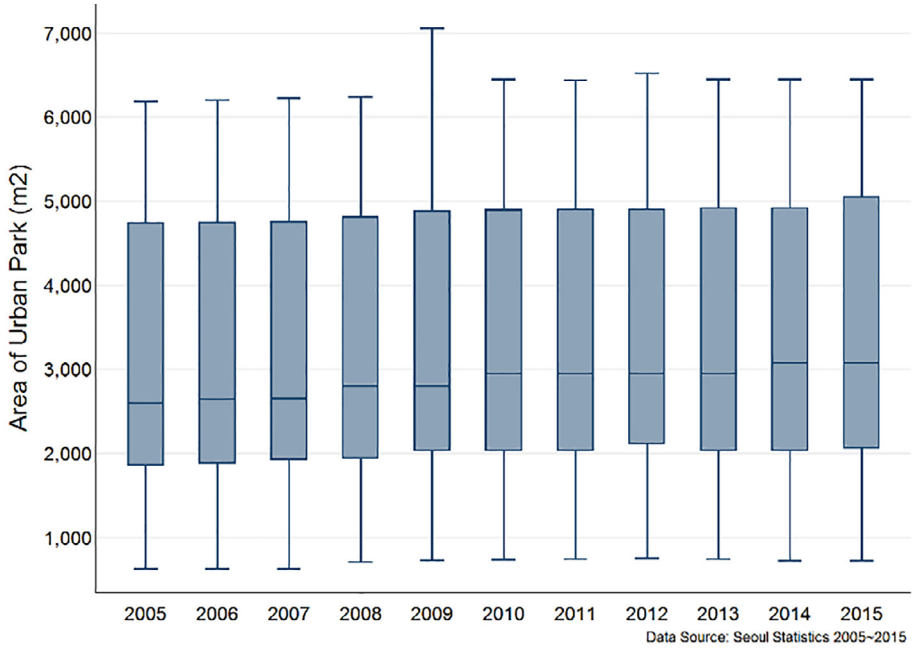

Fig. 3. Box plot of area of urban parks in Seoul, 2005–2015.

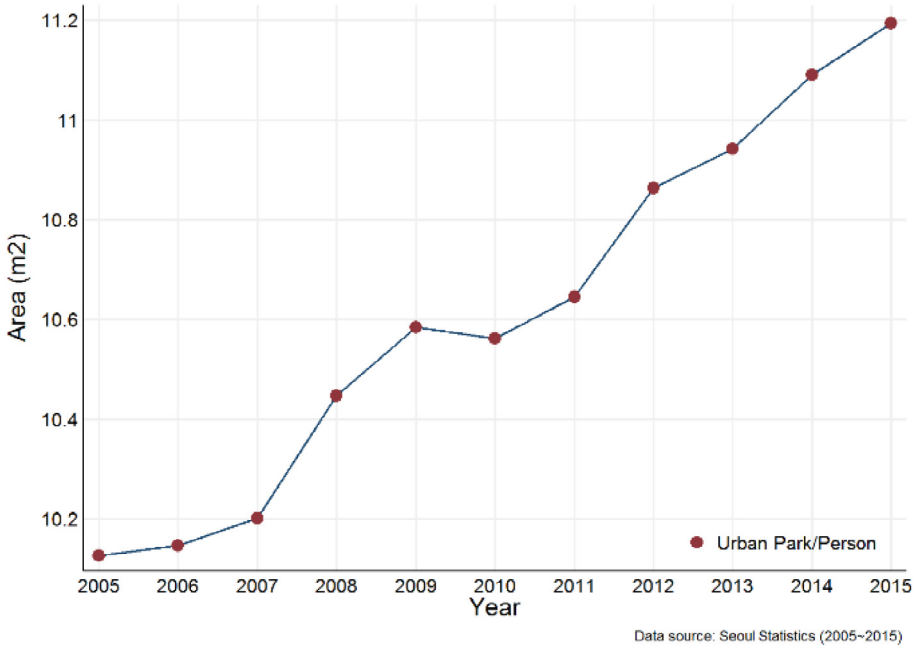

Fig. 4. Time trends of the area of urban parks per person, 2005–2015.

Table 1
Descriptive statistics.

Variable	Definition	Mean	Std.	Min	Max
Happiness Score	Ranging from 0 to 10	6.765	1.322	0	10
Urban Park Area	Area of Urban Park (m^2)	4354	3879	622	15,072
Monthly Income	Monthly Household Income (1000 won)	4291	1695	50	765
Age	Respondent age	43.131	15.502	15	102
Apt	Housing type (APT = 1 or 0)	0.372	0.483	0	1
Housing Ownership	Housing owner = 1 or 0	0.580	0.494	0	1
Female	Respondent gender type (Female = 1 or 0) (%)	0.509	0.500	0	1
Married	Marital Status (Married = 1 or 0) (%)	0.553	0.497	0	1
Education	Education level (Above B.A. degree) (%)	0.317	0.465	0	1
Work	Employment Status (Employed = 1 or 0) (%)	0.583	0.493	0	1

Note: The number of observations is 501,906.

providing urban parks to the local residents improves their subjective well-being. As discussed above, this is probably because urban parks are spaces that allow for health-promoting activities and mental/physical relaxation. As many studies demonstrate that urban park projects increase residential property values because of their aesthetic characteristics and functionality (Hammer, Coughlin, & Horn, 1974; Troy & Grove, 2008), urban planners and landscape architectures should take into account that they also improve the subjective well-being of urban dwellers.

The impacts of individual characteristics on subjective well-being are similar to the previous studies (see Dolan et al., 2008). As expected, household income is positively associated with individual subjective well-being, meaning that higher household income is related to higher individual happiness in the city of Seoul. Housing ownership is also found to be positively associated with individual subjective well-being, and people who live in an apartment are likely to be much happier than those who live in other types of housing. Females are found to be less happy than males. In terms of marital status, people who are married are much happier than those who have never been married. People whose education level is higher than a bachelor's degree are much happier than less educated people. Finally, people who have a job are much happier than those who do not work.

However, unlike previous studies, the effect of age is negative, indicating that the happiness level of an individual person decreases as people get older. This is an inconsistent result as compared to the previous studies arguing that life satisfaction is U-shaped in age. In many advanced countries in Europe, individual happiness level is at the lowest between a person's mid-30 s and early 50 s because of higher expectations for those ages. Happiness level then increases once more as they age because the elderly learn to adapt to their abilities and thus become more realistic (Clark & Oswald, 1994; Landeghem, 2012). But, in the city of Seoul, the happiness level is negatively associated with age. This is probably because welfare policies for seniors have not been executed well enough as compared to other advanced countries, despite increasing concerns about physical health among older adults. Although further investigation with consideration of the local contexts is necessary, that work is beyond the scope of this paper.

As shown in Figs. 5 and 6, we found that happiness levels are different among different age and income groups, which indicates that further investigation with consideration of different individual characteristics would be meaningful. Hence, we examine how residents' preferences for urban parks vary depending on their income status and age groups. We assume that different income groups have different preferences for urban parks. Also, most seniors who live in an urban area may be retired and thus have fewer opportunities for social contact, so they need more spaces to rest, exercise, and meet friends or other people. In this sense, seniors may have more preferences for urban parks than other age groups. Hence, we do the same analyses with subsamples of people on high incomes and low incomes, and people aged over 65 and people aged under 65.

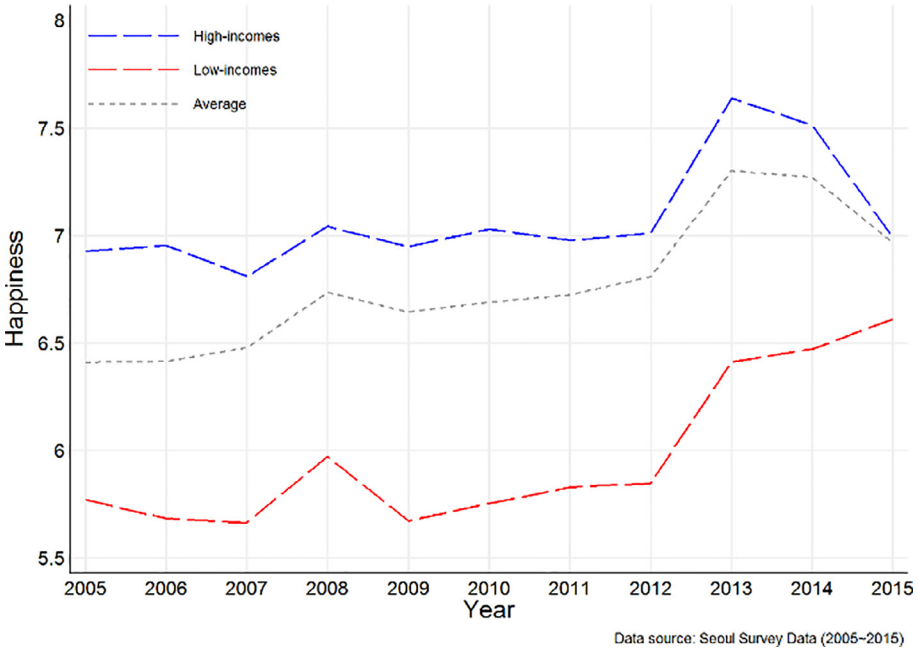

Fig. 5. Time trend of happiness score by income.

Table 3 presents the additional estimation results. There is no difference between the association of urban parks with the happiness levels of high-income people and with that of low-income people. Notably, urban parks offer many more benefits for seniors with respect to subjective well-being than for the non-elderly. Specifically, a 100 m^2 increase in urban parks is associated with an increase in happiness of 0.01 for people with high incomes and low incomes, on a ten-point scale. Likewise, a 100 m^2 increase in urban parks is related to an increase in happiness of 0.02 for seniors, while it is related to an increase in happiness of 0.013 for people whose age is under 65. The results suggest that the effects of urban parks on the happiness of high income and low income people are not distinguishable. However, there is a difference in the effects of urban parks on those over and under 65.

5.3. Monetary value of urban parks

Using the estimation results, we calculate the monetary value of urban parks based on the equation discussed in Section 3. Table 4 presents the calculated values of the WTP. Plugging in 0.00015 for $\hat{\beta}$, 0.4978 for $\hat{\gamma}$, and 4,291,590 for the mean household income (won), the WTP is 1293 won (approximately 1.1 US dollar). This means a 100 m^2 increase of urban park increases an average person's stated happiness by an amount equal to a 110 dollar increase in monthly household income. We also calculate the WTP by different groups in terms of incomes and age. As expected, individuals with higher household incomes are found to be willing to pay more for improvements in urban parks than people with lower incomes because their incomes are relatively higher than the incomes of low-income people. Specifically, their

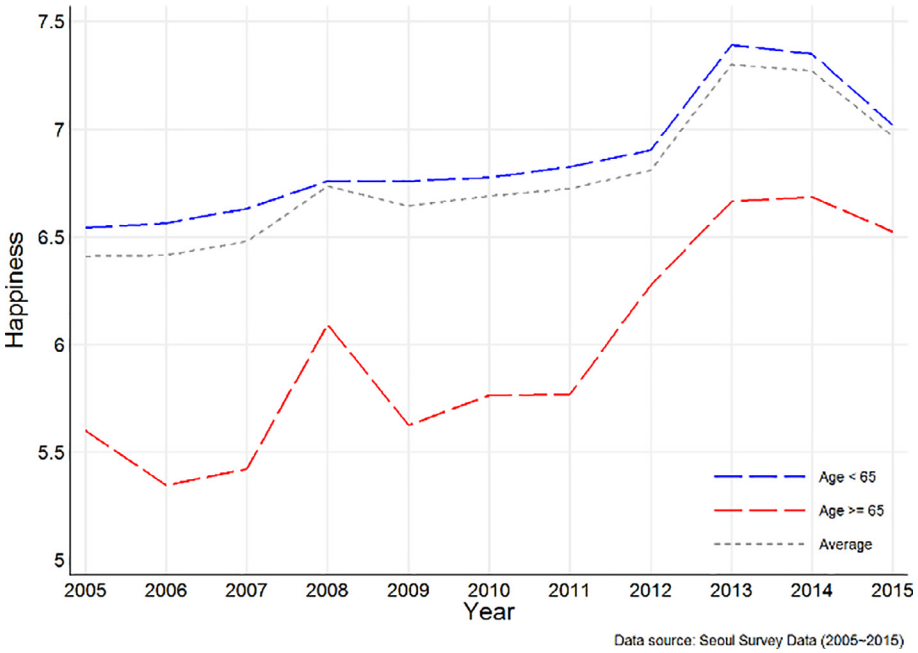

Fig. 6. Time trend of happiness score by age group.

Table 2
Estimation results.

	Model 1	Model 2	Model 3	Model 4	Model 5
Urban Park Area	0.00002***	0.00001***	0.00001***	0.00001***	0.00015***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00001)
ln(income)		0.7253***	0.5280***	0.5083***	0.4978***
		(0.0034)	(0.0036)	(0.0036)	(0.0036)
Age			−0.0153***	−0.0160***	−0.0162***
			(0.0001)	(0.0001)	(0.0001)
APT			0.0105***	−0.0072*	0.0076**
			(0.0037)	(0.0037)	(0.0038)
Housing ownership			0.1009***	0.1213***	0.1245***
			(0.0037)	(0.0036)	(0.0036)
Female			0.0005	−0.0207***	−0.0203***
			(0.0037)	(0.0036)	(0.0036)
Married			0.2604***	0.1562***	0.1553***
			(0.0036)	(0.0038)	(0.0038)
Education (Above B.A.)			0.1950***	0.1699***	0.1638***
			(0.0039)	(0.0039)	(0.0039)
Work			0.0969***	0.0851***	0.0883***
			(0.0039)	(0.0038)	(0.0038)
_cons	6.6958***	2.4069***	3.9202***	3.8669***	3.0409***
	(0.0028)	(0.0204)	(0.0228)	(0.0227)	(0.0573)
Time-fixed	No	No	No	Yes	Yes
Region-fixed	No	No	No	No	Yes
N	501,906	501,906	501,906	501,906	501,906
adj-R2	0.0022	0.0846	0.1265	0.1637	0.1679

***, ** and * indicate significance at the 0.1%, 1% and 5% levels, respectively.

estimated WTP is (2263 won/m^2), which is approximately seventeen times more than the WTP of low-income people (134 won/m^2). In addition, seniors aged over 65 are likely to be willing to pay more for improvements in urban parks than those aged under 65.

The calculated values shown in Table 4 are based on the assumption that the benefits of urban parks exhibit a constant and linear relationship with an individual's subjective well-being. This indicates that an improvement of an additional increment of urban parks has an equal effect on utility, regardless of the current amount of urban parks. Hence, urban park projects in dense urban areas are expected to provide significant benefits with respect to the happiness of urban dwellers.

6. Discussion and conclusions

Urban parks are important places providing substantial benefits that improve physical and psychological health, facilitate social engagements, as well as increase the individual subjective well-being of urban dwellers. Particularly, the amenities of urban parks can promote a quality of life for those who live in a high density urban area. However, few studies have supported it from the perspective of happiness. This study attempts to fill the gap by revealing how urban parks affect the subjective well-being of urban dwellers, especially focusing on the city of Seoul.

Through the pooled cross-section data analysis with Seoul Survey Data between 2005 and 2015, we found that an improvement in urban parks is positively associated with residents' subjective well-being. For example, an increase in 100 m^2 of urban park is associated with an increase in a 0.015 increase in happiness. In other words, an increase in 3333 m^2 (it is the about 1/1000 of the Central Park in NYC) of urban park in each region is related to a 0.5 increase in happiness of urban dwellers. In addition, on average, an individual has an implicit willingness-to-pay of approximately 129,300 won (approximately 110 U.S. dollar) in monthly household income for a 100 m^2 increase in urban parks. This result does not suggest an absolute value of urban parks, but suggests individual implicit willingness-to-pay for the urban parks in the city of Seoul. The value of urban parks (the average marginal rate of substitution between urban parks and income) can be different from the results of other empirical studies because the abundance of urban parks is not the same among different urban settings across the world. Nevertheless, most studies, including this study, suggest a positive relationship between urban parks and the subjective well-being of urban dwellers (Ambrey & Fleming, 2014; White et al., 2013). We acknowledge that the effects of urban parks on the subjective well-being of urban dwellers is not large. However, they are significantly important in improving their happiness. If people cannot easily change their own socioeconomic characteristics, public policy for providing more and better urban green spaces would contribute to making residents happier, especially for people who live in a large city. In addition, the

Table 3
Estimation results by income and age.

	High Incomes	Low Incomes	Age over 65	Age 36–64	Age 18–35
Urban Park Area	0.00010***	0.00009***	0.00020***	0.00013***	0.00014***
	(0.00002)	(0.00003)	(0.00003)	(0.00001)	(0.00001)
ln(income)	0.2757***	0.4427***	0.3394***	0.6032***	0.3918***
	(0.0708)	(0.0135)	(0.0081)	(0.0055)	(0.00692)
Age	−0.0129***	−0.0196***	−0.0386***	−0.0133***	−0.0149***
	(0.0002)	(0.0004)	(0.0013)	(0.0003)	(0.0005)
APT	0.0116*	0.0039	0.0216*	−0.0123**	−0.0084
	(0.0075)	(0.0146)	(0.0130)	(0.0050)	(0.0062)
Housing ownership	0.0903***	0.3928***	0.3409***	0.1339***	0.0248***
	(0.0067)	(0.0129)	(0.0135)	(0.0049)	(0.0060)
Female	−0.0366***	0.0453***	−0.0933***	−0.0229***	−0.0113**
	(0.0063)	(0.0125)	(0.0130)	(0.0054)	(0.0056)
Married	0.1083***	0.1868***	0.2305***	0.1350***	0.0967***
	(0.0073)	(0.0134)	(0.0168)	(0.0082)	(0.0063)
Education (Above B.A)	0.1436***	0.3831***	0.3639***	0.1469***	0.1819***
	(0.0064)	(0.0188)	(0.0216)	(0.0054)	(0.0060)
Work	0.0970***	0.1557***	0.2098***	0.0260***	0.0643***
	(0.0069)	(0.0133)	(0.0147)	(0.0061)	(0.0069)
_cons	6.3157***	3.6085***	4.8089***	2.4895	3.7248
	(0.4959)	(0.2050)	(0.2045)	(0.0798)	(0.0971)
Time-fixed	Yes	Yes	Yes	Yes	Yes
Region-fixed	Yes	Yes	Yes	Yes	Yes
N	131,986	62,742	56,244	267,849	177,813
adj-R2	0.0823	0.1458	0.2120	0.1347	0.0839

***, ** and * indicate significance at the 0.1%, 1% and 5% levels, respectively.

Table 4
Marginal rate of substitution between income and urban parks.

	Model 5	High Incomes	Low Incomes	Age over 65	Age 36–64	Age 18–35
β	0.00015	0.00010	0.00009	0.00020	0.00013	0.00014
γ	0.4978	0.2757	0.4427	0.3394	0.6032	0.3918
$\overline{Y}$	4,291,590	6,240,000	660,000	3,020,000	4,062,391	4,018,586
WTP	1293	2263	134	1780	875	1436

cumulative effect would be much larger, although the individual effect may be small (Stokols, 1996). Therefore, neighborhood level interventions have the potential to provide great benefits to many residents at the same time.

One interesting result of this study is that the effect of urban parks on subjective well-being is different among groups by age. Particularly, the impact of urban parks is much larger in the group of people with seniors compared to the group of people with young adults, although the relationship between urban parks and subjective well-being is positive in all groups. As compared to the level of willingness-to-pay for urban parks between the groups, people on high incomes and seniors are likely to pay much more for urban parks than others. Particularly, the willingness-to-pay of people with high incomes is approximately seventeen times more than that of people with low incomes. Seniors also have more willingness-to-pay for urban parks than people whose age is less than 65. This is probably because they are much more concerned about their physical health as they age. In addition, seniors especially value opportunities for social interaction with others in their communities as they age (Loukaitou-Sideris et al., 2016).

The results in this study provide several important policy implications for improving levels of happiness in urban dwellers. People who live in a large and dense urban area generally have lower levels of subjective well-being because they are more likely to experience stressors from urban settings such as noise, crowding, air pollution, and traffic congestion than those who live in rural areas (Lewis & Booth, 1994). Providing urban parks is one way that planners can improve subjective well-being of urban dwellers at the neighborhood level by reducing physical and mental stresses. Although park designs or detailed strategies should be discussed in more depth with urban designers and landscape architectures, urban planners need to find acceptable ways to create neighborhood parks that can attract local residents and visitors to improve their happiness. There are many ways to increase residents' access to parks, even where land is scarce. For example, abandoned infrastructure can be repurposed into linear parks or local governments can provide incentives to property owners to construct public rooftop gardens. One more important thing that planners should consider is that urban parks can provide more benefits to inner-city seniors. Seniors especially value opportunities for social interaction with others in their communities as they age. Consequently, their WTP for urban parks is relatively higher than that of younger people. Offering better opportunities for socializing and exercising in public parks as well as securing safety and providing programs and facilities for seniors is a challenge for planners.

Our approach has some limitations. First, we use urban park data at the 25 local administrative regions in Seoul. This approach suffers from the modifiable areal unit problem. However, this is the best way for estimating the effects of urban parks on residents' subjective well-being because spatially more disaggregated data for 10 years are not available. And our econometric analysis with longitudinal data has many advantages over using only cross-sectional data. Second, our analysis focuses on the city of Seoul, so that our results may not be generalized to other cities. More studies utilizing our approach would provide interesting results that can be compared with each other. Third, a variety of urban park characteristics can influence visitors and local residents differently, although our analysis only used the area of urban parks. Future research is needed to investigate other specific characteristics of urban parks, such as size, types, design, locations, and facilities to develop a deeper understanding of the effects of urban parks on residents' subjective well-being. Fourth, people value different types of urban parks differently. Future study should consider heterogeneous urban parks in estimating their value. Finally, there may be the endogeneity issues between income and individual subjective well-being. For example, more income may make people happier, whereas happier people may earn more money. Also, self-selection bias can exist in our analysis. Therefore, there are potential threats in our estimation results. More efforts using instrumental variables or other econometric methods should be followed for valuing urban parks more accurately.

In spite of several limitations, our findings of the relationship between urban parks and happiness with monetary valuation of urban parks are important for providing a future direction for urban planning. We suggest that our results should be considered with a view to future landscape and urban planning, especially planning for urban parks to improve the happiness level of urban dwellers.

Appendix A. Results of ordered probit mode

	Ordered Probit
Urban Park Area	0.00012***
	(0.00001)
ln(income)	0.37901***
	(0.00306)
Age	−0.01308***
	(0.00010)
APT	−0.00203
	(0.00314)
Housing ownership	0.09718***
	(0.00302)
Female	−0.02094***
	(0.00303)

Married	0.11477***
	(0.00316)
Education (Above B.A)	0.14857***
	(0.00328)
Work	0.05691***
	(0.00318)
Time-fixed	Yes
Region-fixed	Yes
N	501,906
Log-Likelihood	−1,734,471
WTP	1358

***, ** and * indicate significance at the 0.1%, 1% and 5% levels, respectively.

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