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Estimating the environmental effects and recreational benefits of cultivated flower land for environmental quality improvement in Taiwan

Chin-Huang Huang*

Department of Sport Management, National Taiwan University of Sport, Shuang-Shih Road, Taichung, Taiwan

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Abstract

The main purpose of this study is to measure environmental effects and recreational benefits under different hypothetical scenarios program, involving quality improvement in Tien-Wei Highway Garden, which is the biggest cultivated flower land in Taiwan. The contingent behavior model was adopted. The data combined actual number of trips under current quality of environment combined and the intended number of trips for expected scenarios of environmental quality improvement and congestion mitigation. For the empirical model, on-site Poisson model was performed to correct truncated and endogenous stratification issues from on-site surveys. The results show that the estimated average consumer surplus is greater in contingent behavior method than the one in the traditional travel cost model. Also, the estimated recreational benefits in contingent behavior method are more precise than those in the traditional travel cost method. The environment benefits to consumers are communicated with the programs that changes in environment quality. Meanwhile, the incremental economic benefits comprise the gain associated with the improvement of environmental quality.

JEL classifications: Q26

Keywords: Recreational benefits; Environmental effects; Contingent behavior; Environmental quality

1. Introduction

Environmental quality has become crucial for the sustainable development of tourism in the 21st century. Objective measures of environmental quality are available, and recreation choices are influenced by scientific measures of environmental quality such as dissolved oxygen, nitrogen, and phosphorous loadings, and other environmental variables (Clark and Kahn, 1989; Smith and Desvousges, 1985). The quality measurements remain constant among individuals at a single recreation site, creating a challenge in assessing the quality at a single site. However, the experiences of visitor perceptions of environmental quality still vary among individuals (Whitehead et al., 2000). According to economic theory, value is based on the ability of a good to satisfy human needs and wants or to increase the well-being or utility of individuals. The economic value of quality measures its contribution to human well-being (Freeman, 2003). Meanwhile, economic welfare increases individual well-being. Changes in environmental equality can affect individual welfare. An improvement in an attribute of environmental quality at a site will shift the demand curve. The area between the two demand curves precisely measures the welfare change, which is approximated by the changes in consumer surplus (Freeman, 1993). The benefits of recreation represent a real economic value, namely participants' well-being can be expressed in dollar terms (Loomis and Walsh, 1997). Consequently, environmental quality is an important variable in the demand function for recreational benefits. Thus, this study tries to measure the economic benefits derived from tourist attitudes toward environmental quality.

Economic well-being (or economic welfare) is considered in terms of the contribution of income to well-being through its ability to secure possession of goods and services (Van Praag et al., 2003). The resource environment system provides amenity services including recreation, wildlife observation, and scenic views, which directly generates benefits to people (Freeman, 2003). Economists believe that willingness to pay provides a straightforward measurement of the economic value of individual recreation benefits. Net willingness to pay or consumer surplus has been recommended as the preferred measures of the economic benefits of outdoor recreation programs

*Corresponding author. Tel.: +886-4-2221-3108 extension 6160; fax: +886-4-2229-0412. *E-mail address:* hch55@ntupes.edu.tw (C.-H. Huang).

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by an interagency committee of the U.S. government (U.S. Water Resource Council; U.S. Department of the Interior; Loomis and Walsh, 1997).

The Tien-Wei Highway Garden in Chang-Hua County is the largest area of land cultivated with flowers (30.27%, in 2007) in Taiwan. The amenities associated with the flower industry have attracted many tourists and generated recreational benefits. Recently, the annual number of visitors to Tien-Wei Highway Garden was approximately 1.8 million. The capacity of the highway garden did not suffice to accommodate all visitors. Many visitors had to wait for parking for a long time, which reduces their satisfaction and recreational enjoyment.

The Tien-Wei Highway Garden not only offers environmental benefits in the form of positive externalities, but also generates the negative externalities, such as congestion and waste. Those amenities are providing intangible benefits and services, and are often misconstrued as non-market value products, which are not traded in a real economic market. The recreational and environmental benefits from the Tien-Wei Highway Garden cannot be assessed using market price, directly. Underestimating the economic value of agriculture land will result in incorrect decision making. Therefore, this study adopts nonmarket goods valuation methods to measure these benefits.

The next section reviews the literature on environmental quality and recreational benefits, and introduces the previous studies on the contingent behavior model. Third, the theory and empirical estimation models illustrate how to value the benefits under different quality improvement scenarios. The estimation of demand model for tourists includes perceived environmental quality of the recreation site. Meanwhile, the pooled demand model combines the revealed and stated preference data to estimate environmental effects and recreational benefits. Finally, the empirical results and conclusions, specifically main management implications, are discussed to provide direction for devising methods to improve environmental quality and develop business strategies to achieve land cultivated sustainability.

2. Literatures

2.1. Environmental quality and recreational benefits

Tourists' attitudes on environment are significant explanatory factors in analysis of recreation decisions (Manfredo et al., 1992). With appropriate evaluation, environmental attitudes that include economic explanatory models can improve descriptive and predictive ability (Luzar and Cosse´, 1998). Many studies have indicated a positive correlation between environmental values and environmentally conscious behaviors (Granzin and Olsen, 1991; Hines et al., 1987). However, further understanding of environmental attitude–behavior relationship does not provide enough guidance for explaining economic behavior (Kotchen and Reiling, 2000). The quality of recreation resources has been included in demand functions to estimate specific demand and willingness to pay (Loomis and Walsh, 1997). Consequently, perceived environmental quality or environmental image influence tourist decisions (Mihalič, 2000), and perceived values of environmental quality also influence tourist preferences with regard to recreational site selections (Jurowski et al., 1995). Physical environment becomes an important determinant of consumer perceptions, and hence of their behaviors (Hightower et al., 2002). High quality of physical environment increases consumer satisfaction, repurchase intention, and willingness to pay, and also increases service providers' revenue (Baker and Crompton, 2000). Omitting the environmental quality effect from a demand model would result in underestimating recreational benefits and lead to poor decision making. Managers can only design good marketing strategies based on environmental quality information and thus attract more visitors (Huang et al., 2011). However, the valuation of environmental quality at the same recreation site is a difficult task due to no variation in quality (Whitehead et al., 2000).

Many studies have adopted factor analysis and introduced valuation function to estimate WTP (Luzar and Cossé, 1998; Nunes, 2002; Willis et al., 2005). The factor analysis is to reduce the number of origin variables and extracts a greater amount of variance to be a new dimension factor (Nunes, 2002). The attitudinal variables increase the explanatory and predictive power of valuation function. Omission of appropriately specified variables suggests a specification bias and inconsistent estimators (Luzar and Cosse´, 1998). The variation of environmental attributes in perceptions data may capture more information in the observed component of estimation model (Adamowicz et al. 1997). Based on above reasons, this study investigates perceived environmental quality of visitors and performs factor analysis to extract the major factorial dimensions. The factor of perceived environmental quality represents current quality effects and influences current visitation of respondents, which will introduce into the estimation model.

2.2. Contingent behavior model for quality improvement

The travel cost method (TCM) is a popular nonmarket valuation technique, and is commonly used to measure the value of environmental goods, including tourist recreational benefits (Eom and Larson, 2006). TCM is a revealed preference approach for non-market goods, which measures the use value of the recreational benefits of individuals and reflects the consumer demand in market prices. The traditional TCM measures Consumer Surplus (CS), which is below the demand function and above the implicit price of recreation sites (Freeman, 1993), but TCM is only for historical data (Layman et al., 1996).

The estimation of revealed preferences of visitors' TCM can only reveal the preferences of current users (Cameron, 1992). The problem of how to measure the benefits associated with quality improvement is to identify the changes in quality influence on recreation demand (Haab and McConnell, 2002; Whitehead et al., 2000). To evaluate the quality improvement effect, the most common approach is TCM by using pooled data from recreation sites with different levels of recreational quality (Bockstael et al., 1989; Smith and Desvousges, 1985). The researchers have attempted to value quality changes at a single site combining revealed and stated data (Alberini et al., 2007; Bhat, 2003; Cameron, 1996; Eiswerth et al., 2000; Englin and Cameron, 1996; Layman et al., 1996; Loomis, 1997; Richardson and Loomis, 2004; Prayaga et al., 2010; Rosenberger and Loomis, 1999; Whitehead et al., 2000). Contingent behaviour not only provided a measure to estimate recreational benefits and historically unobservable quality changes (Adamowicz et al., 1994), but also to improve the efficiency of estimation (Huang et al., 1997).

A panel recreation demand model with the pooled data of current and expected hypothetical scenarios is applied to measure consumer benefits under quality improvement (Bhat, 2003). The full panel data changes the structure of demand function, which considers new participants who are attracted by higher environmental quality (Alberini et al., 2007; Whitehead et al., 2000). The demand model of this study is also based on TCM theory, and adopts panel model that follows the methods of Alberini et al. (2007) and Whitehead et al. (2000) to avoid bias in measuring consumer surplus. Later, using contingent scenarios in combination with actual and intend condition to create a panel data set, that can gather each individual respondent in one cross-sectional sample survey. The gains in efficiency from data collection can also reduce sample sizes from repeated observations for each individual (Englin and Cameron, 1996) without incurring additional costs.

This study extends the research of Huang et al. (2011). Contingent behavior model is adopted to estimate recreational benefit, which combines observed behavior data from actual trips with contingent behavior data regarding visit intentions given quality improvement. The improvement programs are explored from the survey item that the item scale exhibits apparently need to improve in pretest. The design of improvement programs are close to real situation that provides the convergent validity of individuals' responses between actual quality changes and hypothetical quality changes.

3. Theoretical framework

3.1. Travel cost method

The basic theory of TCM is that demand is determined by trip number and price per trip, and travel cost is assumed to increase proportionally with distance from home to the trip site. Travel costs include transportation cost, round-trip distance from visitor's home to the destination expressed in monetary terms, and on-site spending. In addition, round-trip cost needs to consider opportunity cost in terms of time. Wilman (1980) suggested that on-site time should be valued in terms of opportunity cost. Cesario (1976) and U.S. Water Resources Council (1983) recommends that the opportunity cost of travel time may be valued as one-third of the wage rate for adults as a proxy for the trip cost. On-site time generates utility and imposes a time cost (Kealy and Bishop, 1986). The research of MCconnell (1992) showed that on-site time would be a component of travel cost to estimate the recreational benefit. Freeman (1993) recognized that on-site time should be valued in travel cost. The omission of the opportunity cost of travel time would severely underestimate the total travel costs and thus underestimate the consumer surplus (du Preez, 2011). However, the recreation demand model must contain the costs of visiting alternative sites, since omitting such information overestimates consumer surplus (Rosenthal, 1987). Omission of the quality effects in the demand model also leads to underestimate recreational benefits and results in poor tourist decisions. Environmental effects thus must be introduced to the recreation demand model for unbiased estimation.

This study tried to estimate the demand model of environmental quality, visitors' perceptions of environmental quality and improvement of environmental quality. Suppose all respondents have a utility function, $u(x, q, Z)$, where x is denotes the number of trips to Tien-Wei Highway Garden, q represents environmental quality of the Tien-Wei Highway Garden, and Z represents all other goods. Then, maximization of utility is subject to income constraints, i.e., $y = px + q$, where y denotes income and p represents trip price. The Marshallian demand function will be $x(p, q, y)$. Hence, price decreases as quantity demand increases, and increasing income results in the increase of quantity demand for normal goods.

3.2. On-site Poisson model

The on-site sample is truncated to zero, which implies the number of trips become a nonnegative integer over a season or a year. Therefore, the trip demand is nonnegative and occurs in integer quantities. As a result, the count data model is an appealing tool for estimating recreation demand (Hellerstein and Mendelsohn, 1993). The samples used in the on-site survey are truncated in situations where there is a lack of non-users and are endogenously stratified according to tourist frequency. Count data models make count data estimators more reflective of the data generating process and are increasingly used to estimate travel cost (Chakraborty and Keith, 2000). The estimators of the truncated Poisson model are more appropriated for estimating and predicting the demand and recreational benefits than the untruncated models (Creel and Loomis, 1990). Furthermore, Shaw (1988) developed a Poisson model to correct the issues of truncated and endogenous stratification. Many studies have focused on truncated count data models to correct non-users and endogenous stratification (Chakraborty and Keith, 2000; Creel and Loomis, 1991; Englin and Shonkwiler, 1995a, Englin and Shonkwiler, 1995b; Grogger and Carson, 1991; Hellerstein and Mendelshon, 1993). The Poisson probability density function is as follows.

$$P(x_i = n) = \frac{e^{-\lambda_i} \lambda_i^n}{n!}, \quad n = 1, 2, \ldots. \tag{1}$$

The parameter λ_i is both the mean and variance of the distribution, and is expressed as an exponential function, $\lambda_i = \exp(z_i\beta)$, where z_i are independent variables and β are parameters of the function. The independent variables include travel cost, substitute site, socioeconomic characteristics, and perception of environmental quality. As an increase in travel cost, a substitute site will be available. Some people will tend to switch to the substitute and decrease the number of trips (Loomis and Walsh, 1997). Perceived environmental quality also influence tourist decisions (Huang et al., 2011; Mihalič, 2000), and indicates a positive correlation to number of trips (Granzin and Olsen, 1991; Hines et al., 1987; Loomis and Walsh, 1997). The log-likelihood function of Poisson is as follows:

$$\ln L = \sum_{i=1}^{T} \left[z_i \beta x_i - e^{z_i \beta} - \ln(x_i!) \right]. \tag{2}$$

The on-site Poisson model corrected both the truncation and endogenous stratification of the on-site samples (Shaw, 1988), and the function is $h(x_i|x_i > 0) = \frac{e^{-\lambda_i}\lambda_i^{x_i-1}}{(x_i-1)!}$. Let $w_i = x_i - 1$ the above equation can be rewritten as follows.

$$h(x_i|x_i > 0) = \frac{e^{-\lambda_i}\lambda_i^{w_i}}{w_i!}. \tag{3}$$

Equation (4) is a parameter w_i that follows Poisson, and the log-likelihood function of truncated and endogenous stratification for on-site Poisson distribution is (Shaw, 1988)

$$\ln L = \sum_{i=1}^{T} \left[z_i \beta (w_i) - e^{z_i \beta} - \ln\left[(w_i)!\right] \right]. \tag{4}$$

The consumer surplus of tourists equals the area under the expected demand function, E $(x_i) = \lambda_i$, and the willingness to pay for access is (Creel and Loomis, 1990; Haab and McConnell, 2002)

$$CS = \int_{p_o{}^0}^{p^c} x(\cdot)dC = \left[\frac{e^{\beta_0+\beta_1 C}}{\beta_1} \right]_{C=C^0}^{C\to\infty} = -\frac{x}{\beta_1}, \tag{5}$$

where C denotes travel cost, β_1 represents the coefficient of C, x is the mean number of observed trips for individual visits to Tien-Wei highway, and $\beta_1 < 0$. When the environmental quality improves from q to q', visitor recreational demand shifts rightward. The change of consumer surplus for quality improvement in environment can be measured as follows:

$$\Delta CS = \frac{x'}{\beta_1'} - \frac{x}{\beta_1}, \tag{6}$$

where β_1 and β_1' are the coefficient of the price variable in the demand model, x is the number of trips with current quality, and x' is the number of trips with expected improvement quality, respectively.

3.3. *Empirical research design for improving program*

On-site random sample was performed from March 19th to 25th in 2007. Data were collected with face-to-face interview questionnaires by trained interviewers on the daily base between 9:00 am and 16:00 pm, Monday through Sunday. During this period, 400 people were asked to fill the survey, and 390 were completed, yielding a response rate of 98%. In addition, the frequency of visitors on weekdays or weekends can be found easily, because the information of intensity is important for managers to plan their business scheme to meet the tourists' needs.

The main items of the questionnaire on visitor perceptions of environmental quality were based on previous studies (Hightower et al., 2002; Kotchen and Reiling, 2000; Manfredo et al., 1992). Other items dealt specifically with the scenarios of Tien-Wei Highway Garden. Based on subjects' responses, the administrators of the questionnaire who evaluate tourist perception were required to rate all statements on a five-point Likert scale (1 = strongly disagree and 5 = strongly agree).

The questionnaire was designed to ask respondents about their observed behavior and intended behavior with hypothetical changes under certain circumstances, including improved quality of environment. The observed behavior question asked subjects how many trips they had taken to the Tien-Wei Highway Garden during the past year. The contingent behavior question asked subjects whether they would increase their current visitation if the environmental quality of the Tien-Wei Highway Garden were improved. Subjects were then asked to quantify the change, if they indicated to change their visit frequency. This additional information enhances the pooled demand model, which combines actual and intended trips. The recreational benefits of the quality improvement can be measured as the change in consumer surplus between the demand function of actual trips and intended behavior trips. The pooled data model checks the effects of contingent behavior scenarios with dummy variable.

4. Results

The data of this study are based on the research of Huang et al. (2011), adding contingent behavior information into their data set. Table 1 lists the characteristics of respondents. The sample consisted of 390 respondents, with 237 women and 153 men. 60.8% is female, which is unsurprising because females are typically the main purchaser of flowers. The sample is slightly skewed toward younger and more educated respondents.

4.1. *Tourist preferences regarding environmental quality*

The first step of exploring visitor perceptions of the environment is using exploratory factor analysis, which extracts the major factorial dimensions and obtains the factor score for the demand model. The next step is based on TCM, and uses the count data model to estimate recreational benefits. On-site Poisson and pooled data are applied to empirical

Table 1
Socioeconomic characteristics of respondents

Characteristics	Frequency	Percent (%)
Gender		
Male	153	39.2
Female	237	60.8
Marital status		
Married	216	55.4
Single	161	41.3
Others	13	3.3
Age		
Under 20	18	4.6
21–30	151	38.7
31–40	106	27.2
41–50	59	15.1
51–60	47	12.1
Over 61	9	2.3
Education		
Under elementary school	24	6.2
junior high school	25	6.4
Senior high school	110	28.2
Undergraduate	206	52.8
Graduate school	25	6.4
Personal monthly Income		
Less than NT$ 20,000	138	35.3
NT$ 20,001–40,000	171	43.8
NT$ 40,001–60,000	55	14.1
NT$ 60,001–80,000	13	3.3
Over NT$ 80,000	13	3.3

models, including two traditional demand model with and without the environmental variable and two contingent behavior models for the hypothetical quality improvement scenarios.

This study uses exploratory factor analysis to extract the major factorial dimension. Bartlett's test of sphericity and the Kaiser Meyer Olkin (KMO) test were used to examine the appropriateness of the sample data (Kaiser, 1974). The results show that the KMO value is 0.85, and the Bartlett test of sphericity has a P value smaller than 0.01, which indicates that the variables were correlated and the factor analysis is appropriate.

The principal component method and varimax rotation are performed to extract 15 items of consumer behavior into fewer factor dimensions. Calculation of the factor scores enables extraction of the interrelated variables and a smaller number of the uncorrelated variables. Table 2 lists the results of factor analysis, which revealed three dimensions with factor loadings exceeding 0.5, indicating a high correlation between the delineated factors and individual items. The factors with Eigenvalues exceeding 1 together explain 56.72% of the total variance.

The first dimension was "environment/service quality," which accounted for 31.41% of the total variance with a reliability of 0.85. This factor explained a relatively large proportion of the total variance, because the "environment/service quality" was the central factor in tourist perceptions.

The other dimensions were "congestion" and "facility/transportation" attributes, which accounted for total variances of 17.34% and 8.24%, respectively. The reliabilities of the coefficients are 0.83 and 0.65. The factors influencing environmental quality are introduced to the demand model to test its influence.

4.2. Estimating Recreational Benefits and Environmental Effects

The demand function using the TCM model depicts a relationship between the number of trips and direct price for individual. The on-site sample caused both truncation and endogenous

Table 2
The factor analysis result of perception for environmental quality

Items	Factor loading			Original mean score
	Environment/service quality	Congestion	Facility/transportation	
I consider transportation communication-channel system well.	0.79			3.02
I consider the streets clean.	0.78			3.15
I consider the quality of outward roads fine.	0.75			3.20
I do not think there is noise pollution.	0.74			3.10
I consider the setting of vendors neat.	0.66			2.97
I think the traveller service centre can provide complete travel information.	0.62			3.35
I think the quality of air good.	0.50			3.54
I think there are too many vehicles.		0.84		3.37
I think the parking lot too crowded.		0.83		3.12
I think the biking path is too crowded.		0.79		3.47
I think the number of tourists huge.		0.77		3.06
I think public toilets sufficient.			0.80	2.94
I think public toilets clean.			0.70	2.95
I consider the parking places adequate.			0.55	3.33
I consider public transportation convenient.			0.54	2.78
Eigenvalue	4.67	2.60	1.24	
Cumulative variance %	31.14	48.48	56.72	
Cronbach's α	0.85	0.83	0.65	

Table 3
Definition of the variables and descriptive statistics

Variable	Definition	Mean	SD
TRIPS1	The number of observed trips for individual visits to Tien-Wei highway garden under the current quality.	4.82	6.20
TRIPS2	The number of observed trips + intended trips for individual visits to Tien-Wei highway garden under quality improvement for service quality and facility.	6.44	7.15
TRIPS3	The number of observed trips + intended trips for individual visits to Tien-Wei highway garden under quality improvement for congestion mitigation.	6.47	7.21
COST	Total round trip travel costs to Tien-Wei highway garden, the costs is measured with New Taiwan dollars (NT$). The components of travel costs including:	1,311	1,301
	Transportation cost	1,274	1,287
	Round-trip travel time cost	12.64	19.62
	On-site time cost	24.98	19.89
SCOST	Total round trip travel costs to substitute site-lavender forest in Taichung.	1,704	1,327
GENDER	Male, 1; female, 0.	0.39	0.49
MARITAL	The marital status of visitor. Married, 1; otherwise, 0.	0.55	.050
AGE	The age of visitor.	34.59	12.32
EDU	The educated years of visitor.	13.94	3.14
LINCOME	The log of respondent monthly income.	4.43	0.22
FAC1	The factor score of "environment/service quality" attributes.	–	–
FAC2	The factor score of "congestion" attributes.	–	–
FAC3	The factor score of "facility/transportation" attributes.	–	–
DUMMY1	Dummy, 1, if the respondents changed behaviour to expand two public toilets and keep environmental sanitation and facility clean than before; 0, otherwise.	0.93	0.27
DUMMY2	Dummy, 1, if the respondents changed behaviour to expand the parking facilities to mitigate at least 50% vehicles; 0, otherwise.	0.92	0.27
HOLIDAY	Dummy, 1, if visitor go to Tien-Wei highway garden on Saturday or Sunday; 0, otherwise.	0.75	0.43

stratification problems. To correct these two assessment problems, this research adopts count data and on-site Poisson model (Shaw, 1988). This study not only considers visitor travel costs, substitute travel costs, and socioeconomic factors, but also introduces perceptions of environmental quality variables into the demand function, from where they were extracted by factor analysis including three dimensions: "environment/service quality," "congestion," and "facility/transportation." In addition, two hypothetical scenarios involving quality improvement in Tien-Wei Highway Garden were considered. The first hypothetical scenario is that "If this recreation site expands two public toilets and keeps environmental sanitation and facility cleaner than before, are you willing to increase your visit to the Tien-Wei Highway Garden?" The second hypothetical scenario is that "If this recreation site reduces the parking facilities to relieve at least 25% vehicles entering Tien-Wei Highway Garden, are you willing to increase your visit to the garden?"

Table 3 lists the definition and statistics description of variables. TRIPS1 is the number of trips to Tien-Wei Highway Garden taken by visitors during the past year, and represents the dependent variable. TRIPS2 and TRIPS3 denote the actual number of trips under current quality, and combined with the intended number of trips for expected quality scenarios of environmental quality improvement and congestion reduction, respectively. The results show that both scenarios of quality improvement would increase intended trips by 1.6 times. COST represents respondent's travel costs, including immediate transportation costs and round-trip travel time costs from their home to the destination, as well as time spent on-site, but excludes weekend respondents. Travel cost also includes opportunity costs that arise from visiting time and are converted this travel cost into dollar values of the product of total visiting hours and one third of the hourly wage (Cesario, 1976; U. S. Water Resources Council, 1983). Failure to estimate travel time would lead to an underestimation for the recreational benefits on the demand model (Loomis and Walsh, 1997). McConnell (1992) suggested that on-site time can be treated as a component of travel cost or an endogenous travel cost. On-site time can also be ignored, if the correct model cannot be estimated.[1] Both travel cost and travel time variables have been calculated as a function of distance. Separating travel cost variable in the demand function tended to cause multicollinearity, which can be eliminated by combining all travel costs and time costs into one cost variable (Bockstael et al., 1987). Therefore, SCOST represents the travel cost associated with a visit to a substitute site. The price of substitution is measured by the distance from a visitor's home to an alternative site, where offers similar attractions and same expenditure. Respondents were asked where they were going to make a trip, if they would not go to Tein-Wei Highway Garden. The most frequent choice for substitute site is the Lavender Forest in Taichung, which was used in this study. Furthermore, GENDER, MARITAL, and AGE represent characteristics of respondents' gender, marital status, and age. EDU represents respondent's years of education.

[1] However, this study tried to separate the on-site time cost from travel costs, and introduced it into the estimated model as an independent variable. Please see appendix table.

Table 4
Parameter estimates for the travel cost model

Variable	Model A	Model B	Model C	Model D	Model E
INT	4.0196	4.0106	3.6382	3.3317	3.281
	(6.662)	(6.606)	(10.068)	(9.172)	(9.164)
COST	−0.0006	−0.0006	−0.0005	−0.0004	−0.0005
	(−10.899)***	(−10.868)***	(−15.208)***	(−14.777)***	(−14.754)***
SCOST	0.0004	0.0004	0.0003	0.0003	0.0003
	(8.149)***	(7.835)***	(10.601)***	(10.439)***	(10.438)***
GENDER	−0.0369	−0.0242	−0.0112	−0.0253	−0.2589
	(−0.627)	(−0.410)	(−0.318)	(−0.724)	(−0.740)
MARITAL	0.4831	0.4815	0.4135	0.4075	0.4061
	(6.369)***	(6.322)***	(9.221)***	(9.144)***	(9.097)***
AGE	−0.0118	−0.0114	−0.0100	−0.0097	−0.0097
	(−4.030)***	(−3.908)***	(−5.734)***	(−5.545)***	(−5.521)***
EDU	−0.0622	−0.0594	−0.0493	−0.0489	−0.0491
	(−7.025)***	(−6.580)***	(−9.074)***	(−9.073)***	(−9.905)***
LINCOME	−0.4946	−0.5301	−0.4758	−0. 4682	−0.4650
	(−3.393)***	(−3.624)***	(−5.472)***	(−5. 438)***	(−5.391)***
FAC1	–	0.0662	0.0958	0.0946	0.0948
		(2.511)**	(6.100)***	(6.041)***	(6.050)***
FAC2	–	−0.1071	−0.0859	−0.0852	−0.0845
		(−3.082)***	(−4.173)***	(−4.165)***	(−4.122)***
FAC3	–	−0.0238	0.0165	0.0094	0.0083
		(−0.902)	(1.045)	(0.598)	(0.527)
HOLIDAY	0.6338	0.7846	0.6457	0.6391	0.6379
	(7.724)***	(8.147)***	(11.707)***	(11.652)***	(11.625)***
DUMMY1	–	–	0.4849	–	
			(7.221)***		
DUMMY2	–	–	–	0.7739	0.8245
				(9.565)***	(6.889)***
DUMMY1*					−0.0587
DUMMY2					(−0.576)
Log likelihood function	−1,569	−1,560	−3,605	−3,633	−3,633
Chi-squared	466***	484***	1,113***	1,123***	1,124***
Sample	390	390	780	780	780

Log-likelihood ratio = (−2) × (Restricted log-likelihood − Log-likelihood), $\chi^2(8,0.95) = 15.5073$, $\chi^2(11, 0.95) = 19.6752$, $\chi^2(12,0.95) = 21.0261$, $\chi^2(13,0.95) = 22.3260$.
*$P < 0.1$, **$P < 0.05$, ***$P < 0.01$, t values in parentheses.

LINCOME denotes the log of respondent's monthly income. FAC1, FAC2, and FAC3 are factor scores, which represent the dimensions of "environment/service quality," "congestion," and "facility/transportation" attributes. Meanwhile, HOLIDAY is a dummy variable, and it denotes visitors who visited Tien-Wei Highway Garden on the weekend. Finally, DUMMY1 and DUMMY2 are dummy variables that indicate if visitors would like to visit the recreation site under hypothetical scenario one and two situations, respectively.

This study compared recreational benefits of actual trips from the observed behavior model with those of pooled trips from the contingent behavior model. The on-site Poisson empirical models include the observed behavior model with and without environmental quality variable (model B and model A, respectively). The contingent behavior model under the hypothetical scenarios includes scenarios with environmental quality and facility improvement (model C) and with congestion reduction (model D), as listed in Table 4. The combination effect of environmental quality and congestion mitigation was not included in this study, which is also the limitation of this research. Because the dependent variable cannot be added together directly in the estimation models, this study tries to test the interaction effect of two hypothetical scenarios and examine the collinearity among DUMMY1, DUMMY2, and DUMMY1*DUMMY2. The results found that DUMMY1 and DUMMY1*DUMMY2 is collinearity, but DUMMY2 and DUMMY1*DUMMY2 is not. Hence, the revision work adds the interaction term DUMMY1*DUMMY2 to model E, and this coefficient is not significant.

Likelihood ratio was used to test the goodness-of-fit of models. Chi-square distribution is associated with the degrees of freedom, and differed significantly from 0 at the 0.01 significance level, which means the null hypothesis of all variables equal zero was rejected. The signs of price variables are consistent with the demand rule for all models. Also, coefficients for travel cost and substitute site are significant at the 0.01 level. The analytical results also demonstrate that the coefficient of MARITAL, AGE, EDU, LINCOME, and HOLIDAY are all significant in models. AGE, EDU, and LINCOME are negatively related to the dependent variable for all estimation equations. MARITAL is positively related to number of trips. Overall, the visitors who are married, younger, lower income, and lower educated are more likely to visit Tien-Wei Highway Garden. Their recreational benefits are higher than others who are the single, older, higher income, and higher educated.

Income elasticity is computed based on coefficient multiply the mean of LINCOME (4.43). The estimation of income elasticity of visitors is negative for each model (from Model A to Model E: −2.19, −2.22, −2.11, −2.07, and −2.06). Visitors with higher income are less likely to visit the recreation site, which is consistent with the definition of inferior good. The explanation is due to the entrance of Tien-Wei Highway Garden is free, which makes it more affordable and attractive for young couples. The results coincide with the sample characteristics, which comprises 55.4% married, 70.5% age under 40, and 79.1% income less than NT$ 40,000. The environmental quality variables, FAC1 and FAC2, are significant at the 0.01 level in model B, C, D, and E; and FAC3 is not significant from model B to E. The positive effect of FAC1 indicates that high-quality environment and service stimulates tourist intension to visit Tien-Wei Highway Garden. However, the negative effect of FAC2 demonstrates that congestion decreases visit willingness. The dummy variables, DUMMY1 and DUMMY2, are significant in contingent behavior models C, D, and E at the 0.01 level, which means respondents will increase their intension to visit the recreation site under quality improvement. The interaction effect of environmental quality and congestion mitigation is not significant.

Consumer surplus is obtained by integrating the demand curve from the initial price to the choke price, which is calculated by using Eq. (5). The observed behaviour model without the environmental variable (model A) produces a point estimation of consumer surplus, that is, NT$ 8,271 (4.82 trips/ −0.00058272 coefficient of direct cost) for a consumer who makes the mean number of trips.[2] The observed behavior model with environmental variable (model B) indicates a consumer surplus of NT$ 8,300, which is higher than model A. The difference between model A and model B is primarily resulted from the net effect of perceived quality of NT$ 29.[3] Finally, the contingent behavior model under the hypothetical scenarios of environmental quality and facility improvement (model C) yields a consumer surplus of NT$ 13,719. Meanwhile, improvement in the congestion reduction hypothesis also yields consumer surplus of NT$ 14,369. The incremental effect of quality improvement in environmental quality and facility improvement is NT$ 5,419 per trip (model C − model B). The increased recreational effect for congestion mitigation is NT$ 6,069 (model D − model B) per trip. In addition, the total net environmental effect based on current perceptions of the quality of Tien-Wei Highway Garden is roughly NT$ 62.263 million in 2007, based on 2,147,000 visitors multiplied by NT$ 29. The total incremental effect of quality improvement in terms of environmental quality and facilities improvement is approximately NT$ 11.63 billion, whereas congestion reduction is approximately NT$ 13.03 billion. The incremental benefits of recreation are real economic value in our quality of life, and thus recreation contributes to visitor well-being. Various scenarios results are detailed in Table 5.

Table 5
The Recreational benefits and environmental effects

Value (NT$)	Model A (1)	Model B (2)	Model C (3)	Model D (4)
Recreational benefits(average)	8,271	8,300	13,719	14,369
Environmental effects (column (2)– column (1))	–	29	–	–
Incremental effect of quality improvement (column (3), (4)– column (2))	–	–	5,419	6,069
Total recreational benefits (NT$, thousand)	17,757,837	17,820,100	29,454,693	30,850,243
Total incremental effects (NT$, thousand)	–	62,263	11,634,593	13,030,143

5. Conclusion

This study adopted a contingent behavior method that combines actual and intended behavior data to measure the environmental effects of quality improvement and to compare the recreational benefits with different demand models. The traditional demand models include: exclusion of the environmental quality variable (model A) and inclusion of the environmental quality variable (model B). The net environmental effect of visitors' perceived quality is only NT$ 29. Considering that there were 2,147,000 visitors who visited Tien-Wei Highway Garden in 2007, the aggregated consumer surplus with perceived quality of environment is NT$62.263 million, which indicates changes in recreational benefit due to perceived environmental quality in recreation site. The changes in aggregated consumer surplus for improving environmental quality and facility and reducing congestion are NT$ 11.63 billion and NT$ 13.03 billion, respectively. Furthermore, the contingent behavior pooled data

[2] Appendix Table 1 to 2 lists the results of estimation models that on-site time cost separates from travel cost as an independent variable. The results show that on-site time cost is significant and positive in all estimated model. The sign of price variable is also consistent with the demand rule. The recreation benefits of model A is NT$ 8,325 per trip (see appendix Table 2), which is larger than original model in Table 5 (NT$ 8,271). The evidence demonstrates the decreasing travel cost and adding on-site time cost as an independent variable in demand model, which results in the increase of recreational benefits.

[3] When the environmental variables are introduced into estimation model B, the environment effects are negative (−NT$ 57, in Table A2), and larger than positive effect of on-site time cost. However, the incremental effects of quality improvement of model C and D in Table A2 is larger than that in Table 5.

combined current visitation quality and quality improvement in environmental quality and facility terms (model C) and in congestion reduction (model D). The empirical results also deal with visitors' intension to visit Tien-Wei Highway Garden under hypothetical scenarios of environmental quality improvement. Based on the analytical results, quality improvement will increase number of trips by visitors to the Tien-Wei Highway Garden. The incremental effects of improving environmental facility and transportation and reduced congestion are NT$ 5,419 and NT$ 6,069, which exceed those values in the traditional demand model with perceptions of environmental quality. The results closely echo the findings of Alberini et al. (2007) and Whitehead et al. (2000). Above evidence indicates that the pooled data contains the actual number of trips under current quality combined with the intended number of trips for hypothetical scenarios of improved environmental quality and reduced congestion. These values should help the managers of Tien-Wei Highway Garden improve environmental quality to attract more tourists. The benefit of recreation is real economic value and represents the improvement of environmental quality those undertaking the recreational activity. Economists define well-being as individual's preferences regarding improvements in quality of live and willingness to pay for such improvements (Freeman, 2003). The incremental consumer surplus from quality improvement is the net contribution of individual economic well-being and visitors' quality of life. Specifically, well-being depends on the quality of the goods or services available at a recreation site. Thus, increasing environmental quality improves individual quality of life and becomes a communicator to individuals.

The estimated recreational benefit reveals that the pooled data of contingent behavior models exceed the actual trips demand model. The results offer useful information to government officials who are trying to reduce congestion and create a more convenient transportation system for visitors. This study also finds that the combination offers advantages for estimating recreational benefits in terms of quality changes that were unobservable in most previous studies, and our results are the same as Adamowicz et al. (1994). Omitting the environmental quality in the demand model would underestimate recreational benefits and also leads to a poor decision-making. The estimated result of environmental quality is also consistent with the study of Huang et al. (1997), which means that if environmental benefit to the individual decreases, the quality of life will decrease. Economic benefit is the most objective indicator to assess quality of life, and is also a major factor for measuring life satisfaction (Marsella et al., 1997).

The contributions of this article are as followings: displays that the pooled data resolves the difficulty of no variation of environmental quality at the same recreation site and reduces sample sizes from repeated observations for individual without incurring additional costs. The programs of quality improvement are surveyed from perceived quality of visitors at recreation site. The contingent behaviour model provides more information than traditional travel cost model that helps managers to develop a useful strategic policy for cultivated flower land quality improvement and sustainability. However, the limitation of this study is that the combination effect of environmental quality and congestion mitigation is absent. Future studies should consider adding the combination effect in the model.

Whitehead et al. (2000) stated that the variables used to measure environmental quality are visitors' perceptions of the recreational experience, involving subjective evaluation of well-being. Quality improvement may potential structurally change the recreation demand due to new participants and variations. Future studies should explore quality and structural changes in the shape of demand curve based on the perspectives of new participants to value the recreational benefits associated with the combination of actual and stated behavior data.

Appendix

Table A1
Parameter estimates for the travel cost model

Variable	Model A	Model B	Model C	Model D	Model E
INT	9.0940	9.1900	7.7694	7.4524	7.4504
	(11.644)	(11.492)	(16.517)	(15.786)	(15.779)
	−0.0006	−0.0006	−0.0005	−0.0004	−0.0004
	(−10.847)***	(−10.885)***	(−15.184)***	(−14.699)***	(−14.642)***
SCOST	0.0004	0.0004	0.0003	0.0003	0.0003
	(7.827)***	(7.646)***	(10.242)***	(10.094)***	(10.053)***
GENDER	−0.0139	−0.0044	−0.0019	−0.0148	−0.0149
	(−0.234)	(−0.075)	(−0.054)	(−0.420)	(−0.425)
MARITAL	0.4781	0.4736	0.4080	0.4064	0.4059
	(6.258)***	(6.196)***	(9.056)***	(9.078)***	(9.050)***

(*Continued*)

Table A1
(*Continued*)

Variable	Model A	Model B	Model C	Model D	Model E
AGE	−0.0065	−0.0064	−0.0060	−0.0059	−0.0059
	(−2.178)**	(−2.141)**	(−3.393)***	(−3.306)***	(−3.300)***
EDU	−0.0484	−0.0450	−0.0375	−0.0369	−0.0370
	(−5.527)***	(−5.204)***	(−6.931)***	(−6.873)***	(−6.869)***
LINCOME	−1.8149	−1.8562	−1.5337	−1.5211	−1.5197
	(−9.315)***	(−9.394)***	(−13.201)***	(−13.158)***	(−13.123)***
FAC1	–	0.0847	0.1110	0.1104	0.1105
		(3.239)**	(7.104)***	(7.091)***	(7.093)***
FAC2	–	−0.0407	−0.0361	−0.0351	−0.0348
		(−1.217)	(−1.809)*	(−1.766)*	(−1.749)*
FAC3	–	−0.0260	0.0150	0.0075	0.0072
		(−0.984)	(0.951)	(0.479)	(0.452)
HOLIDAY	0.5621	0.6143	0.5190	0.5138	0.5134
	(6.795)***	(6.424)***	(9.462)***	(9.427)***	(9.414)***
ONSITE	0.0173	0.0172	0.0141	0.0139	0.0139
	(10.883)***	(10.587)***	(14.404)***	(14.298)***	(14.286)***
DUMMY1	–	–	0.4728	–	
			(6.989)***		
DUMMY2	–	–	–	0.7511	0.7686
				(9.278)***	(6.529)***
DUMMY1*					−0.0205
DUMMY2					(−0.205)
Log likelihood function	−1,515	−1,508	−3,509	−3,538	−3,538
Chi-squared	573***	587***	1,305***	1,314***	1,314***
Sample	390	390	780	780	780

Log-likelihood ratio = (−2) × (Restricted log-likelihood − Log-likelihood), $\chi^2(9, 0.95) = 16.9190$, $\chi^2(12,0.95) = 21.0261$, $\chi^2(13, 0.95) = 22.3260$, $\chi^2(14,0.95) = 23.6848$.
$^*P < 0.1$, $^{**}P < 0.05$, $^{***}P < 0.01$, t values in parentheses.

Table A2
The recreational benefits and environmental effects

Value (NT$)	Model A (1)	Model B (2)	Model C (3)	Model D (4)
Recreational benefits (average)	8,325	8,268	13,722	14,478
Environmental effects (column (2)–column (1))	–	-57	–	–
Incremental effect of quality improvement (column (3),(4)–column (2))	–	–	5,454	6,210
Total recreational benefits (NT$, thousand)	17,873,775	17,751,396	29,461,134	31,084,266
Total incremental effects (NT$, thousand)	–	−122,379	11,709,738	13,332,870

References

Adamowicz, W.L., Louviere, J., Williams, M., 1994. Combining stated and revealed preference methods for valuing environmental amenities. J. Environ. Econ. Manag. 26, 271–292.

Adamowicz, W., Swait, J., Boxall, P., Louviere, J., Williams, M., 1997. Perceptions versus objectives measures of environmental quality in combined revealed and stated preference models of environmental valuation. J. Environ. Econ. Manag. 32(1), 65–84.

Alberini, A., Zanatta, V., Rosato, P., 2007. Combining actual and contingent behaviour to estimate the value of sports fishing in the Lagoon of Venice. Ecol. Econ. 61(2–3), 530–541.

Baker, D.A., Crompton, J.L., 2000. Quality, satisfaction and behavioural intentions. Ann. Tourism Res. 27(3), 785–804.

Bhat, M.G., 2003. Application of non-market valuation to the Florida keys marine reserve management. J. Environ. Manag. 67(4), 315–325.

Bockstael, N.E., McConnell, K., Strand, I.E., 1989. Measuring the benefits of improvements in water quality: the Chesapeake Bay. Mar. Resour. Econ. 6(1), 1–18.

Bockstael, N.E., Strand, I.E., Hanemann, W.M., 1987. Time and the recreational demand model. Am. J. Agric. Econ. 69(2), 293–302.

Cameron, T.A., 1992. Combining contingent valuation and travel cost data for the valuation of nonmarket goods. Land Econ. 68(3), 302–317.

Cameron, T.A., 1996. Using actual and contingent valuation data with different level of time aggregation to model recreation demand. J. Agric. Resour. Econ. 21(1), 130–149.

Chakraborty, K., Keith, J.E., 2000. Estimating the recreation demand and economic value of mountain biking in Moab, Utah: an application of count data models. J. Environ. Plan. Manag. 43(4), 461–469.

Cesario, F.T., 1976. Value of time in recreation benefit studies. Land Econ. 52(1), 32–41.

Clark, D.E., Kahn, J.R., 1989. The two-stage hedonic wage approach: a methodology for the evaluation of environmental amenities. J. Environ. Econ. Manag. 16(2), 106–120.

Creel, M.D., Loomis, J.B., 1990. Theory and empirical advantages of truncated count data estimators for analysis of deer hunting in California. Am. J. Agric. Econ. 72(2), 434–441.

Creel, M.D., Loomis, J.B., 1991. Confidence intervals for welfare measures with application to a problem of truncated counts. Rev. Econ. Stat. 73(2), 370–373.

du Preez, M., 2011. The opportunity cost of travel time in recreational fishing demand analysis: A South African case study. J. Stud. Econ. Econometrics. 35(1), 45–57.

Eiswerth, M., Englin, J., Fadali, E., Shaw, W.D., 2000. The value of water levels in water-based recreation: A pooled revealed preference/contingent behaviour model. Water Resou. Res. 36(4), 1079–1086.

Englin, J., Cameron, T.A., 1996. Augmenting travel cost models with contingent behaviour data. Environ. Resour. Econ. 7(2), 133–147.

Englin, J., Shonkwiler, J.S., 1995a. Estimating social welfare using count data models: an application to long-run recreation demand under conditions of endogenous stratification and truncation. Rev. Econ. Stat. 77(1), 104–112.

Englin, J., Shonkwiler, J.S., 1995b. Modelling recreation demand in the presence of unobservable travel costs: toward a travel price model. J. Environ. Econ. Manag. 29(3), 368–377.

Eom, Y.S., Larson, D.M., 2006. Improving environmental valuation estimates through consistent use of revealed and stated preference information. J. Environ. Econ. Manag. 52(1), 501–516.

Freeman, A.M. III., 1993. The Measurement of Environmental and Resource Values: Theory and Methods. Resources for the Future, Washington, DC.

Freeman, A.M. III., 2003. Economic valuation: what and why. In Champ P.A., Boyle K.J., Brown T.C. (Eds.), A Primer on Nonmarket Valuation. Kluwer Academic Publishers, Dordrecht.

Grogger, J.T., Carson, R.T., 1991. Models for truncated counts. J. Appl. Econ. 6(3), 225–238.

Granzin, K.L., Olsen, J.E., 1991. Characterizing participants in activities protecting the environment: a focus on donating, recycling, and conservation behaviour. J. Public Policy Marketing 10(1), 1–27.

Haab, T.C., McConnell, K.E., 2002. Valuing Environmental and Natural Resources. Edward Elgar Publishing Inc., Massachusetts.

Hellerstein, D., Mendelsohn, R., 1993. A theoretical foundation for count data models. Am. J. Agric. Econ. 75(3), 604–611.

Hightower, R., Brady, M.K., Baker, T.L., 2002. Investigating the role of the physical environment in the hedonic service consumption: an exploratory study of sporting events. J. Bus. Res. 55(9), 697–707.

Hines, J.M., Hungerford, H.R., Tomera, A.N., 1987. Analysis and synthesis of research on responsible environment behaviour: a meta-analysis. J. Environ. Educ. 18(1), 1–8.

Huang, J.C., Haab, T.C., Whitehead, J.C., 1997. Willingness to pay for quality improvements: should revealed and stated preference data be combined? J. Environ. Econ. Manag. 34(3), 240–255.

Huang, C.H., Huang, Y.H., Lin, W.L., Hsiao, P.H., 2011. Estimating recreational benefits and environmental effects for the amenities of flowers industry. Adv. Manag. 4(3), 60–65.

Jurowski, C., Uysal, M., Williams, D., Noe, F., 1995. An examination of preferences and evaluations of visitors based on environmental attitudes: Biscayne Bay National Park. J. Sustain. Tour. 3(2), 73–86.

Kaiser, H.F., 1974. An index of factorial simplicity. Psychometrics. 39(1), 31–36.

Kealy, M.J., Bishop, R.C., 1986. Theoretical and empirical specification issues in travel cost demand studies. Am. J. Agric. Econ. 68(3), 660–667.

Kotchen, M.J., Reiling, S.D., 2000. Environmental attitudes, motivations and contingent valuation of nonuse values: a case study involving endangered species. Ecol. Econ. 32(1), 93–107.

Layman, R.C., Boyce, J.R., Criddle, K.R., 1996. Economic valuation of the Chinook Salmon sport fishery of the Gulkana River, Alaska, under current and alternate management plans. Land Econ. 72(1), 113–128.

Loomis, J.B., 1997. Panel estimators to combine revealed and stated preference dichotomous choice data. J. Agric Resour. Econ. 22(2), 233–45.

Loomis, J.B., Walsh, R.G., 1997. Recreation Economic Decisions: Comparing Benefits and Costs, Venture Publishing, Inc., Pennsylvania.

Luzar, E.J., Cossé, K.J., 1998. Willingness to pay or intention to pay: The attitude- behaviour relationship in contingent valuation. J. Soc. Econ. 27(3), 427–444.

Manfredo, M., Yuan, S., McGuire, F., 1992. The influence of attitude accessibility on attitude-behaviour relationships: Implications for recreation research. J. Leisure Res. 24(2), 157–170.

Marsella, A.J., Levi, L., Ekblad, S., 1997. The importance of including quality-of-life indices in international social and economic development activities. Appl. Prev. Psychol. 6(2), 55–67.

MCconnell, K.E., 1992. On-site time in the demand for recreation. Am. J. Agric. Econ. 74(4), 918–924.

Mihalič, T., 2000. Environmental management of a tourist destination- A factor of tourism competitiveness. Tourism Management 21(1), 65–78.

Nunes, P.A.L.D., 2002. Using factor analysis to identify consumer preferences for the protection of a natural area in Porturgal. Eur. J. Oper. Res. 140(2), 499–516.

Prayaga, P., Rolfe, J., Stoeckl, N., 2010. The value of recreational fishing in the great barrier reef, Australia: A pooled revealed preference and contingent behaviour model. Mar. Policy. 34(2), 244–251.

Richardson, R.B., Loomis, J.B., 2004. Adaptive recreation planning and climate change: a contingent visitation approach. Ecol. Econ. 50, 83–99.

Rosenberger, R.S., Loomis, J.B., 1999. The value of ranch open space to tourists: combining observed and contingent behaviour data. Growth and Change 30(3), 366–383.

Rosenthal, D.H., 1987. The necessity for substitute prices in recreation demand analysis. Am. J. Agric. Econ. 69(4), 828–837.

Shaw, D., 1988. On-site samples' regression: problem of non-negative integers, truncation and endogenous stratification. J. Econometrics 37(2), 211–223.

Smith, V.K., Desvousges, W.H., 1985. The generalized travel cost model and water quality benefits: A reconsideration. Southern Econ. J. 52(2), 371–381.

U. S. Water Resources Council, 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. U. S. Government Printing Office, Washington, DC.

Van Praag, B.M.S., Frijters, P., Ferrer-i-Carbonel, A., 2003. The anatomy of subjective well-being. J. Econ. Behav. Organ. 51(1), 29–49.

Whitehead, J.C., Haab, T.C., Huang, J.C., 2000. Measuring recreation benefits of quality improvements with revealed and stated behaviour data. Resour. Energy Econ. 22(4), 339–254.

Willis, K.G., Powe, N.A., Garrod, G.D., 2005. Estimating the value of improved street lighting: a factor analytical discrete choice approach. Urban Study. 42(12), 2289–2303.

Wilman, E.A., 1980. The value of time in recreation benefit studies. J. Environ. Econ. Manag. 7(3), 272–286.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix.