農村公園への訪問頻度と評価の関係に関する分析 —農村アメニティに対するCVMの適用—

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An Analysis on the Relation between the Visit Frequency of the Rural Park and its Evaluation: For Measuring Rural Amenity by CVM Application

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Contents

Ⅰ. Introduction

In past decades, there used to be plenty of nature and amenity spaces where people could recreate in rural areas. In proportion to economic growth in Japan, nature and amenity spaces have become less common even in rural areas. To improve and recover the amenity of rural areas, many rural parks with water front space have been built in rural areas. Agricultural canals, ponds, and dams are used for the base of the park. These parks are constructed by local governments and almost all construction costs are subsidized by central and local government. Therefore, people should not ignore either usage of these parks, or the effectiveness of construction costs subsidized by their own taxes.

In general, benefit of rural park is thought to be relaxation and communication, forming of the rural landscape, and securing residents' and their descendants' visitation opportunities. The first benefit implies creation of a use value, while the second and the third imply a passive use value (Turner et al.,1993). These benefits cannot be evaluated by market price because there is no private market for rural parks. According to the evaluation guidebook of the Ministry of Agriculture, Forestry and Fishery (MAFF, 2000), it is decided that rural park benefits must be evaluated by CVM quantitatively; and the project plan must confirm the way in which benefits exceed construction cost. The CVM is the stated preference research method which is most typical for non-market goods evaluation. The Hedonic Price Method (HPM) and Travel Cost Method (TCM) are also used to evaluate non-market goods. However, the effect of a rural park cannot be specified by HPM, because there is little purchasing data of land in rural areas. Also, TCM cannot be used to evaluate rural park effects because it is difficult to collect an entrance fee for the rural park and to check travel costs including on-site time consuming costs of resident who visits the park irregularly (for a recent discussion on on-site time in TCM see Berman and Kim, 1999). In addition to these reasons, because both methods cannot evaluate the passive use value that is an important role of the rural park, the evaluation value by these methods is limited in a part of all effects. On the contrary, CVM can evaluate use and passive use values of an object by using questionnaire data (Loomis; 1988, Shechter et al.; 1998, and Mullarkey and Bishop; 1999). Up to the present, CVM has been

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applied to evaluation of several objects, such as rare animals, rare plants, scenery in rural areas, and cost benefit analysis of public goods (Yoshida; 1997, Yabe; 1999, Terawaki; 2000, Kunimitsu; 2001).

Honestly, there are some problems in applying CVM to project evaluation. One serious problem is the imprecision of whether residents evaluate an additional one park or evaluate the general idea without any relation to the number of parks. This problem is also known as scope insensitivity or the embedding effect (Desvousages et al., 1993) and may cause a serious influence on planning of one rural park project. Another problem in CVM is that the willingness to pay (WTP) value is rarely concerned with the visit frequency of the residents related to the distance between residential area and the park. Because the rural park is constructed for residents' visits, it is no use to evaluate the park without considering visit frequency of residents.

On the basis of the above problem, this paper aims at analysis of the relation between the evaluation, e.g., WTP, and the visit frequency to the rural park. To put it more concretely, WTP values with respect to the visit frequency and a distance are estimated by CVM with questionnaire data on 15 rural parks in Japan.

II. Data Sources and Descriptions

The questionnaire surveys to residents on sites were conducted with assistance of the Advice Center for Rural Environment Support (ACRES, 2001) and MAFF in July 1999. The survey questionnaire was administered to residents who lived around a rural park which had been constructed by the local government. Fifteen parks with almost same contents were selected as research objects from all around the country after considering the cooperation of the local management organizations. All of them had been constructed with water front space on agricultural canal. There are other types of rural parks that had been constructed on agricultural ponds or dams. Compared to other types, the canal type of rural park is located near a rural and is surrounded by residences. All investigated parks can be considered as having similar conditions in their situation and contents as a result of such selection.

We classified survey data into four groups by the visit frequency for the control variable. Cases that are used in estimation are *MVG* (monthly visiting group), *YVG* (yearly visiting group), *OVG* (only once visiting group), and *NVG* (non-visiting group). The *MVG* consists of residents who have visited the park more than 11 times in a year; *YVG* consists of those who have visited the park from 2 to 10 times in a year; *OVG* consists of those who have visited the park only once, but never visited more; and *NVG* consists of those who have never visited the park.

Four questions about resident attributes, a distance from home to park, the visit frequency, and willingness to pay for visiting the rural park under contingent conditions were prepared in a questionnaire sheet. Contingent conditions were established as: 1) if the rural park were completely managed with resident contributions, and 2) if residents did not agree with the proposed price of donation, the rural park would be destroyed without maintenance and construction for renewal in the near future. Also, residents were asked whether they agreed with avoidance of this contingent situation by donating the proposed price. If residents felt that the park value was higher than the proposed price, they would agree to pay, otherwise, they would reject the payment.

Based on NOAA guidelines and previous surveys, the discrete choice question was applied and questionnaire sheets were distributed and collected by hand by the neighborhood self-governing body in order to minimize questionnaire biases. The simple "yes-no" type of discrete choice question helps residents to decide easily only whether the proposed price sounds reasonable or not. Hanemann et. al.(1991) suggested that estimation efficiency was improved by a dichotomous choice type of question, so the questionnaire was designed as a double bounded dichotomous choice survey.

Each resident was asked the second dichotomous choice question that depends on the response to the first question. For residents who accepted the first bidding price (BD), the second bid (BD^U) was higher than the first by a certain amount. For residents who denied the first bid, the second bid (BD^D) was lower than the first. Seven sets of hypothetical bidding prices were used for the questionnaire —i.e. 500 /1000 /250 yen/year (BD,

BD^U and BD^D, respectively), 1000 /3000 /500, 3000 /5000 /1000, 5000 /10000 /3000, 10000 /30000 /5000, 30000 /50000 /10000 and 50000 /100000 /30000 — and each resident was asked to respond to one of these values. Next to these questions, skeptical or magnanimous examinees were asked reasons for their absolute refusal or absolute agreement. Skeptical examinees, who answered to both donations in the negative, were asked whether their decisions were based on price or on other factors, such as disagreement of donation, not knowing the meaning of the question, and so on. Magnanimous examinees, those that answered both to donations affirmatively, were asked whether they accepted donation without considering price or not.

Examinees were sampled at random from the residents' certification list that covered almost all residents in the investigation area. Questionnaire results are shown in Table 1. The collection rates were not bad as compared to previous research; the effective response rates were over 50%, which are sufficient for the following analysis. Effective responses do not include inadequate data that consist of blank, mistaken, resistant and magnanimous answers except for the price reason.

Table 1 Contents of research objective parks and questionnaire results.

No.	Prefecture	Area (m^2)	Amusement	Distribute	Collection Rate	Efeective Res. Rate
1	Hokkaido	98,378	○	1,050	70%	86%
2	Iwate	5,895	○	1,050	40%	83%
3	Miyagi	4,700		1,050	41%	86%
4	Yamagata	5,532	○	1,050	83%	66%
5	Gunma	18,000	○	1,040	40%	84%
6	Fukui	900	○	1,050	34%	77%
7	Shiga	22,000	○	1,352	100%	56%
8	Shiga	9,013		1,050	75%	74%
9	Tottori	2,000	○	1,050	80%	62%
10	Shimane	805	○	1,050	28%	85%
11	Okayama	14,284	○	1,050	92%	73%
12	Kumamoto	9,689		1,050	74%	70%
13	Ooita	4,000		1,047	71%	61%
14	Miyazaki	8,000		1,050	68%	82%
15	Okinawa	5,850	○	1,050	35%	98%
Total		209,046		16,039	63%	73%

Note: "O" shows the existence of the amusement facilities like sliders and swings.

Ⅲ. Model

Let us think the decision making of residents on the evaluation of rural amenity by using individual questionnaire data of residents. Aside from observable variables, there might be many factors in the background of evaluation. Therefore, it is assumed that residents evaluate rural amenity based on individual utility functions which are influenced by several factors. The researcher cannot know residents' utility function. For the researcher, residents' behavior and questionnaire evaluation results would be encompassed in a stochastic error.

The WTP value on rural amenity affected by the rural park can be estimated from the bidding price function of CVM. Bidding price function, so called the WTP function, was induced from the resident's utility function with an error term which represents unobservable variables (Hanemann, 1984). Supposing that real WTP is affected by resident attributes (X), charm of the park (Z), and distance (L), WTP is defined as follows under the hypothesis that each resident acts to maximize their utility with income (I) restriction.

(Both answers are "yes")

$$\pi^{yy}=\Pr(BD_i^U \le WTP)=1-G\{a'+b'\ln(X)+c'\ln(Z)+d'\ln(L)+e'\ln(I)+\gamma\ln(BD_i^U)\}$$
$$=1-G(BD_i^U;\ \theta)$$

(The second answer is "no" followed by "yes")

$$\pi^{ny}=\Pr\left(BD_i \leq WTP \leq BD_i^U\right)=G\left(BD_i^U;\ \theta\right)-G\left(BD_i;\ \theta\right)$$

(The second answer is "yes" followed by "no")

$$\pi^{ny}=\Pr\left(BD_i^D \leq WTP \leq BD_i\right)=G\left(BD_i;\ \theta\right)-G\left(BD_i^D;\ \theta\right)$$

(Both answers are "no")

$$\pi^{nn}=\Pr\left(WTP \leq BD_i^D\right)=G\left(BD_i^D;\ \theta\right) \qquad (1)$$

Here, π^{yy}, π^{yn}, π^{ny}, and π^{nn} are acceptance probabilities of each resident who responds "yes-yes," "yes-no," "no-yes," and "no-no" for first and second steps, respectively. Also, BD_i, BD_i^U and BD_i^D are the first bidding price, second higher bidding price provided to accepted residents, and the second lower bidding price provided to rejected residents, respectively. Supposing that M is the number of samples, the log likelihood function is as follows:

$$\ln(L)=\sum_{i=1}^{M}\left[D_i^{yy}\ln\{\Pr(BD_i^U \leq WTP)\}+D_i^{yn}\ln\{\Pr(BD_i \leq WTP \leq BD_i^U)\right.$$
$$\left.+D_i^{ny}\ln\{\Pr(BD_i^D \leq WTP \leq BD_i)\}+D_i^{nn}\ln\{\Pr(WTP \leq BD_i^D)\}\right] \quad ,$$

where D_i^{yy}, D_i^{yn}, D_i^{ny} and D_i^{nn} are binary-valued indicator variables; each of them equals unity if the i th individual gives the response "yes-yes," "yes-no," "no-yes," or "no-no" for first and second steps, respectively. Otherwise, these variables equal zero.

Average WTP value of each visit frequency group is defined as follows (Boyle et al., 1988):

$$WTPm_j=\frac{\int_0^{BD_{\max}}\{1-G(BD;\ \theta_j)\}\,dBD}{1-\{1-G(BD_{\max};\ \theta_j)\}},\ J \in (MVG,\ YVG,\ OVG,\ NVG) \qquad (2)$$

where $BD_{\max}$ is the maximum value of proposed bidding price in the questionnaire, and θ_j is the parameter vector that defined the WTP function of j th group.

IV. Estimation Results

Table 2 shows explanatory variables for estimating Eq. (1), those averages, standard deviations, and sources. The D_{sim}, D_{sub}, and D_{amu} are all binominal variables: D_{sim} is equal to one in the case of the residents who live in the outer range beyond the similar park, and is equal to 0 otherwise; D_{sub} is equal to one in the case of the residents who live in the suburban area; D_{amu} is equal to one in the case of parks where amusement facilities, such as slides and swings, were situated, and is equal to 0 otherwise (Talen and Anselin, 1998, analyzed the relation between access to the playgrounds, travel distance, and nearest playground by using gravity model).

Estimation results of the WTP function in CVM are shown in Table 3. Since age and numbers of families were insignificant compared to t-statistics, Eq. (1) was estimated except for these variables. Distance and influence of similar parks were preserved in order to show spatial effects, even though t-statistics were insignificant.

The result shows that distance from the park does not affect visit frequency of the park remarkably because the coefficient is thought to be equal to 0 compared to the t-statistic. The similar park dummy variable is also insignificant in *MVG*, *YVG*, and *OVG* cases. On the contrary, this dummy has a significant positive coefficient in the *NVG* case, indicating confused recognition of the objective park and similar park independently. Other variables, such as high income, old age, and large number of families tend to have a positive effect on WTP. These influences are consistent with intuition.

Structural difference in each group was tested by the log-likelihood ratio; $\lambda=-2\left[\ln L(\theta_r)-\sum_{g=1}^{G}\ln L(\theta_g)\right]$, calculated from log likelihood values of dummy-less models. Here, $\ln L(\theta_r)$ and $\ln L(\theta_g)$ are log-likelihood values of pooled data estimation and g-th group estimation, respectively. Calculated λ $(=75.3 > \chi^2_{[\alpha=0.95]}=23.7)$ is significant compared to the χ^2-statistic, indicating that each structure is different from others. Therefore, when

Table 2 Explanatory variables for equations (l) and (2)

Variables	Contents	Unit	Average	Std. Dev.	Data Source
Inter Relational Situation					
L	Distance (log converted)	Km	2.43	3.82	Questionnaire
Dsim	Similar park (Binomial)	1 (exist) / 0 (non)	0.25	0.43	Project Plan
Attribute of examinees					
Inc	Family Income (log converted)	10,000 yen	533.32	376.85	Questionnaire
Age	Age of respondent (log converted)	years old	53.38	14.45	Questionnaire
Fam	Number of Family member (log converted)	person	3.78	1.72	Questionnaire
Scale & Contents of Rural Park					
Ar	Area of park (log converted)	m^2	16821.48	25848.74	Project Plan
Dsub	Sub-urban Area (Binomial)	1 (Suburban) / 0(non)	0.14	0.35	Project Plan
Damu	Amusement Facilities (Binomial)	1 (exist) / 0(non)	0.65	0.48	Project Plan

Note: Project plan is made by the local government in each site of research site.

Table 3 Estimation Results of the WTP Function in Equation (1)

Indipenden t Variables	*MVG* Coeff.	t−stat.	*YVG* Coeff.	t−stat.	*OVG* Coeff.	t−stat.	*NVG* Coeff.	t−stat.
Logisitic Function								
Const	8.518	8.2 **	5.960	2.2 **	7.229	4.1 **	4.840	6.1 **
ln(*L*)	−0.210	−1.6	0.193	1.0	0.036	0.3	−0.243	−4.0 **
Dsim	0.433	0.9	−0.294	−0.5	−0.343	−1.1	0.342	2.3 **
ln(*Inc*)	0.402	2.6 **	0.446	1.8 *	0.441	2.9 **	0.340	4.9 **
ln(*Age*)	—		0.965	2.1 **	0.653	2.0 **	0.672	4.4 **
ln(*Fam*)	—		—		—		0.353	3.5 **
ln(*BD*)	−1.389	−17.0 **	−1.534	−11.0 **	−1.602	−19.6 **	−1.329	−40.1 **
Log *L*	−556.8		−229.0		−605.5		−2546.9	
F.C.P.	0.43		0.46		0.55		0.54	
n	405		180		517		2069	
Normal Distribution Function								
Const	4.900	8.1 **	3.689	2.3 **	3.917	3.7 **	2.868	6.4 **
ln(*L*)	−0.118	−1.5	0.083	0.7	0.034	0.5	−0.137	−3.9 **
Dsim	0.310	1.1	−0.075	−0.2	−0.216	−1.2	0.203	2.4 **
ln(*Inc*)	0.245	2.7 **	0.223	1.6 *	0.268	2.9* *	0.187	4.8 **
ln(*Age*)	—		0.542	2.0 **	0.384	2.0 *	0.363	4.1 **
ln(*Fam*)	—		—		—		0.214	3.7 **
ln(*BD*)	−0.805	−20.7 **	−0.881	−13.0 **	−0.902	−24.6 **	−0.755	−49.8 **
Log *L*	−553.6		−227.6		−605.9		−2552.4	
F.C.P.	0.40		0.43		0.56		0.53	
n	405		180		517		2069	

Note:“ ** ”means significant at 5%, “ * ”means significant at 10%, nothing means insignificant at 10%

CVM is applied to facilities with resident visits, such as the rural park, there would be some bias in estimation results unless WTP functions were estimated according to classified frequencies of visit.

V. Evaluation Values

Table 4 shows the average and median WTP value for each frequency group, indicating the relationship between the WTP and the visit frequency. The variance of estimated WTP values was also showed calculating by 1000 samples of bootstrap simulation for each group. The following points were found in this table.

Firstly, the average WTP value of *MVG* is the highest compared to other groups. The *YVG* follows and is nearly equal to *MVG*. Cases of *OVG* and *NVG* are lower than the other two cases, and both are almost equal to each other. Since *MVG* and *YVG* consist of frequent visitors to the rural park, it can be said that the evaluation value of frequent visitors is greater than that of an infrequent visitor or a non-visitor.

Secondly, the variances of average WTP values in *MVG* and *YVG* are larger than those in *OVG* and *NVG*, because the number of data in the former groups is less than the latter groups. However, the 90% confidence interval of average WTP values in frequent visitors (*MVG* and *YVG*) never overlaps with that in infrequent visitors (*OVG* and *NVG*), indicating obvious difference between frequent visitors and infrequent visitors.

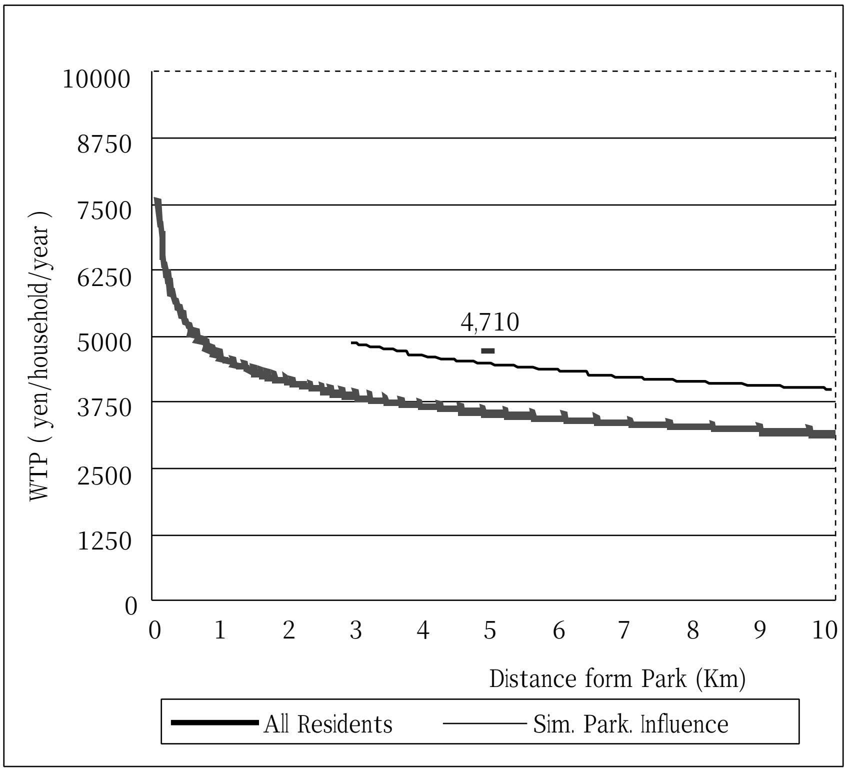
Thirdly, each average WTP value is smaller than each medium WTP value that shows the value at an indifferent point for acceptance and rejection. This feature is similar to the previous CVM studies, showing distorted error in the WTP function.

Fig. 1 is the WTP function of *NVG* that only has significant coefficients of distance and similar park among all groups. In this figure, the inclination of the curve is steep within about 4 km radius, but the inclination becomes gentle at over 4 km. To be more concrete, the marginal decrease values in WTP with regard to distance, such as $\partial WTP/\partial L$, are -780 (at L=1 km), -498 (at L=2 km), -267 (at L=3 km), -179 (at L=4 km), -133 (at L=5 km), -105 (at L=6 km) and -80 (at L=8 km) showing great change between L=3〜4 km and L=4〜5 km. Since this curve was estimated with non-visitors data, it corresponds to the passive use value of the rural park. Therefore, the passive use value has decreasing tendency with respect to distance. The thin curve shows the WTP value evaluated by residents who live in the outer range beyond a similar park. It shows that non-visitors evaluate the object park more highly than non-existence of the similar park. It is thought that non-visitors tend to evaluate both the object park and the similar park together. Therefore, if rural parks were evaluated with passive use value, there would be possibilities that the evaluation value is not independent of the similar park.

Table 4 Average and median WTP values for each visit frequent group

(Yen/household/year)

	MVG	*YVG*	*OVG*	*NVG*
Average WTP	6,710	6,690	4,480	4,710
90% confidence interval	5,936 〜 8,004	5,225 〜 8,011	3,906 〜 5,040	4,325 〜 5,073
Median WTP	3,150	3,310	2,270	1,820



Note: WTP=4,710 yen/household/year is an average value of WTP at the average distance of surveyed residents.

Fig. 1 The WTP function with respect to distance in NVG.

VI. Conclusions and Future Subjects

In order to contribute better planning of the rural park, analyzing the relation between evaluation value and frequency of visit to the park is highly needed but was not regarded in the previous studies. This paper analyzed such relation by applying CVM to the 15 rural parks in Japan. In order to show the above relation, we classified the questionnaire data into four visit frequency groups as a control variable. As a result, the CVM provided useful information on the residents' preference, especially in the case of rural amenity improved by the rural park. The following points can be remarkable.

Firstly, the evaluation values, i.e. WTP vaues, of frequent visitors are greater than that of non-visitors and occasional visitors. This is because frequent visitors evaluate the rural park with not only the use value but also the passive use value, while non-visitors and occasional visitors evaluate the park only from the passive use value. However, the difference of WTP value between visitors and non-visitors is not so great due to over-estimation of non-visitors about the rural parks.

Secondly, to avoid over-estimation in WTP value of non-visitors, the survey range of CVM for the rural park should not be widened in view of the cost benefit analysis of the park. For rigid cost benefit analysis, it would be better to limit the benefit range of a park within a 4 km radius from the park. If there is another park within this range, the planner should consider the embedding effect or scope insensitivity problem on the object park.

Thirdly, the WTP value of individual residents has no relation to a distance between the park and living places, but that of non-visitors is decreased according to distance. If we use the travel cost method to evaluate park amenity, benefit of the individual visitor should increase according to distance in general in order to compensate the cost of a long trip. The insignificant coefficient of distance in results of CVM does not correspond to the travel cost theory. The reason why WTP values of visitors have not been related with a distance significantly is that the WTP value consists of both the use value and the passive use value. Also; the passive value of the rural park has an opposite influence to the use value with respect to distance. It is thought that the increasing tendency of the use value is cancelled out by the decreasing tendency of the passive use value with respect to distance even in the frequent visitors; and therefore WTP of visitors, who evaluate the rural park in view of the use and passive use values, shows insignificant relation with a distance.

Lastly, there are several subjects to solve in the future, such as improved questionnaire research, investigation of project site differences, applicability of these models to other facilities (e.g., natural parks, amusement parks, museums), and so on.

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農村公園への訪問頻度と評価の関係に関する分析

― 農村アメニティに対するCVMの適用―

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要　約

農村公園の計画策定に当たり，定量的な便益評価が重要な課題となっている．本研究は、農村公園への訪問頻度と評価の関係をアンケート・データにもとづく仮想状況評価法（CVM）を用いて分析することを目的とする．分析結果から３つの点が明らかとなった．すなわち，第１に、農村公園の使用価値と非使用価値に関して、訪問頻度によって住民の支払い意志額（WTP）が異なり，特に，頻繁に公園を利用する住民と利用しない住民とでは，評価構造が異なること，第２に、非使用価値を含めて農村公園を評価する場合，過大評価とならないように，CVMの調査範囲を拡大しすぎないように留意する必要があること，第３に、頻繁に利用する住民の場合は，個々の住民の農村公園のWTP値が農村公園と生活場所との距離に無関係に関係に評価されるが，利用しない住民の場合は，WTP値が距離が遠くなるほど減少すること，が明らかとなった。

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キーワード：農村公園，仮想状況評価法（CVM），支払い意志額（WTP），訪問頻度，使用価値，非使用価値