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MTT Discussion Papers 6 • 2006

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Abstract

This study presents a framework for investigating responses to the supply of public recreation opportunities when supply affects both probability of use and frequency of use days. These components are used to estimate the marginal social net benefits of an exogenous increase in the supply of public recreation opportunities. The study investigates distributional patterns of visiting behavior and benefit estimates for alternative supply strategies, i.e., reduced distance or increased acreage. The results indicate that the probability of participation and the number of use days respond differently to alternative supply strategies and that response varies by income group.

Key Words: recreation area supply, participation, use frequency, travel cost method, income groups

1. Introduction

While national parks are primarily established to protect the environment, they are also expected to provide all citizens with equal opportunities to experience nature. Increasing demand for recreation (e.g., Gartner and Lime 2000) has led to pressure to designate additional wilderness and public lands for this purpose. An interesting question is whose demand is actually met when decisions on the supply of recreation opportunities are made. On the one hand, the awareness of recreation areas and the possibilities of using them vary among different segments of society. On the other hand, nature tourism will only bring significant gains for rural areas if the areas can attract wealthy user groups. As there may be conflicting interests in public provision of recreation opportunities, studying the distribution of benefits of recreation areas is of utmost importance. We investigate whether public supply treats citizens differently by income group as reflected in participation and frequency of use.

A policy factor describing the supply of recreation resources (e.g., forested acres) has been included as an explanatory variable in several empirical analyses showing that the supply of such resources affects demand (Hof & Kaiser 1983; Rockel & Kealy 1991; Walsh et al. 1992; Loomis 1999; Zawacki et al. 2000). Yet, few studies have investigated distributional impacts of the provision of public recreation areas. Assessments of the distribution of benefits in recreation have focused on recreation fees, which have been widely debated and studied (see, e.g., Adams et al. 1989; Richer & Christensen 1999; Huhtala & Pouta 2004). There is some indication that provision of recreation opportunities benefits high-income more than low-income households (Kalter & Stevens 1971); at least there is considerable evidence from visitor surveys that recreation services are more often used by relatively wealthy people (e.g., Vaux 1975, Cordell et al. 2002). Studies on the income elasticity of the demand for public parks (recreation expenditures) have categorized recreation as a luxury good (Boercherding and Deaton, 1972;

Bergstrom and Goodman, 1973; Gibson 1980), but the data used in these studies are now dated. Recently, Feinerman et al. (2004) have raised a concern that developing national parks at the expense of urban parks disproportionately benefits high-income households.

The supply of public recreation areas may increase visitation for two reasons: non-users may start using the areas or users may make additional visits. It is essential that these two components be taken into account when investigating distributional impacts of the policies adopted.[1] In modeling recreation demand, it becomes crucial to ask whether users' decisions on participation and frequency are intertwined and what the model's behavioral implications and statistical properties are (see, e.g., Bockstael et al. 1990, Phaneuf 1999). If these decisions are analyzed by sample selection methods, the same independent variables explain both the decision to participate and the decision on the number of use days. In reality, for some individuals the decision on the number of use days is not relevant at all, due to their preferences, a lack of suitable areas or lack of other resources, i.e., income. Phaneuf and Smith (2004) conclude that it is realistic to assume that participants and non-participants have different preference functions.

The contribution of this study is to present a framework for investigating responses to the supply of public recreation opportunities that will make it possible to value the corresponding welfare effects in a consistent manner. Our theoretical model elaborates certain features of the household production model to show how the estimated response functions affect valuation when supply may affect both the likelihood of non-users becoming users and previous users increasing their number of use days. Our econometric estimations rest on decomposition of these two effects. The consumer surplus from recreation accruing to visitors is computed using a production function for recreation and the travel cost method. These components are then used to estimate the marginal social net benefits of an exogenous increase in the supply of public recreation opportunities. The framework clarifies distributional issues related to supply factors as reflected in visiting behavior in different income groups. The analysis is particularly helpful for comparison of impacts of alternative supply strategies that public agencies can adopt.

Our empirical illustration is based on an extensive data set of the Finnish national outdoor recreation demand assessment (Virtanen et al. 2001). Pouta and Sievänen (2001) have shown that a high level of education, male gender and white-collar socio-economic status characterize a relatively high proportion of the users of state-protected and recreation areas (SPRA). The user profile raises a question as to whether the supply of these areas has induced a bias towards relatively wealthy users. Measuring supply by two distinct variables, the distance to the nearest SPRA and the total area of such areas in the respondent's home municipality, we can compare the impacts of alternative land-management strategies for the siting of outdoor recreation opportunities. If distance matters, the number of areas rather than the size of individual areas is a supply factor to be taken into account in planning for reasons of equity. Our results indicate that the probability of using state SPRAs and the number of use days respond differently to alternative supply strategies and, interestingly, vary by income group. Of course, our framework can be used for analyzing a decrease or an increase in supply, but our empirical illustration uses computations for increased supply as this is the most relevant policy choice in Finland.

In the following, we first develop the analytical model based on the household production framework to clarify the effect of an increase in the supply of recreation areas on participation and number of visits. Second, we specify the econometric models describe the econometric models in detail. Section three presents empirical models of the use of the public conservation and recreation areas in Finland. Finally, we discuss the distributional effects of a change in supply.

2. Deriving welfare impacts of recreation supply

The objective of our analytical framework is to determine the components of the benefits of an increase in public provision of recreation opportunities when the increase may affect both the likelihood and the frequency of participating in recreation. Decomposition of these two effects gives additional insight into assessment of the social benefits of outdoor recreation. Our analysis builds upon and elaborates the household production model, which has been extensively applied in the literature of environmental and health economics in general and in recreation studies in particular (e.g., Feather et al. 1995, McConnell 1999 based on Becker 1991). In this tradition, recreation is typically modeled as a final good that is produced by allocating time, l, and money (travel costs), k, to recreation activities. We assume that exogenous supply factors, S, e.g., the acreage designated as public recreation areas and distance to recreation sites, as well as individual characteristics, x, affect recreation frequency such that $r=r(l,k;S,x)$.

Recreation is a component of an individual's utility function of the form

$$U=U(c,L,r(l,k;S,x)), \qquad (1)$$

where c represents goods consumed and L is leisure time. When an individual is not participating in recreation, r is zero and we express her utility as $U^0=U(c,L,0)=U^0(c,L);$ otherwise $U^R=U^R(c,L,r(l,k;S,x))$. We specify the probability of her participating in recreation as $p(S,x)$ such that the probability depends on the supply factors and her individual characteristics. She maximizes her expected value of utility ($U_c>0,\ U_L>0, U_r>0$)

$$\max_{C,L,l} \mathrm{E}(U) = p(S,x) * \mathrm{U}^{\mathrm{R}}\left[c, L, r(l,k;S,x)\right] + (1 - p(S,x)) * U^0(c,L) \tag{2}$$

with respect to her budget constraint

$$\begin{aligned} I + w(T - L - l) &= c + p_k k \qquad \text{if } U{=}U^R \\ I + w(T - L) &= c \qquad \text{if } U{=}U^0 \end{aligned} \tag{3}$$

where I is non-wage income, w is the wage rate, T is total time available, and p_k is the unit cost of travel expenses. Eliminating c by including the budget constraint in equation (3), the expected utility can be rewritten as

$$\begin{aligned} E(U) &= p(S,x) \cdot U^R\left[(I + w(T - L - l) - p_k k), L, r(l,k;x,P)\right] \\ &+ (1 - p(S,x))U^0\left[(I + w(T - L), L\right]. \end{aligned} \tag{4}$$

and the first order conditions are

$$\frac{\partial E(U)}{\partial L} = p(\cdot)U_L^R + (1 - p(\cdot))U_L^0 - w\underbrace{\left(p(\cdot)U_c^R + (1 - p(\cdot))U_c^0\right)}_{\mu} = 0 \tag{5}$$

$$\frac{\partial E(U)}{\partial l} = p(\cdot)(U_r^R r_l - wU_c^R) = 0 \Leftrightarrow p(\cdot)\frac{U_r^R}{U_c^R} = p(\cdot)\frac{w}{r_l}. \tag{6}$$

$$\frac{\partial E(U)}{\partial k} = p(\cdot)(U_r^R r_k - p_k U_c^R) = 0 \Leftrightarrow p(\cdot)\frac{U_r^R}{U_c^R} = p(\cdot)\frac{p_k}{r_k}. \tag{7}$$

In equation (5), we denote the expected marginal utility of income by μ. Equations (6) and (7) determine the optimal amounts of time and money (in the form of travel costs), respectively, used for recreation. The maximized objective function in equation (4) gives the maximum expected utility obtainable for a given set of parameter values, or the expected indirect utility, which we denote by $E(U)^*$. Holding the expected indirect utility function constant, we can derive the value of an exogenous change in supply of recreation opportunities, *S*, in terms of the required simultaneous change in income, *I*. Along the indifference curve dE(U)*=0, we have

$$\frac{dI}{dS} = -\frac{E(U)^*{}_S}{E(U)^*{}_I}, \tag{8}$$

which after computation yields

$$\frac{dI}{dS} = \underbrace{\frac{\left(U^0 - U^R\right)}{\mu}}_{CS^R}\frac{\partial p(\cdot)}{\partial S} - p(\cdot)\cdot\underbrace{\frac{U^R{}_r}{\mu}}_{\frac{\Delta CS^R}{\Delta r}}\frac{\partial r(\cdot)}{\partial S}. \tag{9}$$

Equation (9) gives a measure for the change in income that would be required to keep the utility constant when there is an exogenous change in the supply of public recreation opportunities. The first term on the right-hand side is the product of the difference in utility for those who use recreation areas and those who do not, expressed in monetary terms by dividing by the marginal utility of income, and the change in the probability of being a user of recreation areas. The second term is the expected marginal value of change in the use of recreation areas as measured, for example, by, use days.

In essence, equation (9) gives guidelines for the empirical estimation and valuation of social net benefits from a policy that increases the supply of public recreation opportunities. Non-market valuation techniques such as travel cost models of recreation demand can be used for measuring the consumer surplus generated by recreation, $\frac{\left(U^0 - U^R\right)}{\mu}$, and its marginal change, $\frac{U^R{}_r}{\mu}$. Interestingly, the latter term - the value of marginal utility of recreation - is proportional to the prices and marginal products of inputs used in producing recreation. This can be seen by rearranging equations (6) and (7) as follows:

$$p(\cdot)\frac{U^R{}_r}{\mu} = \theta \frac{p_k}{r_k} = \theta \frac{w}{r_l}, \qquad (10)$$

where $\theta = \frac{p(\cdot)U_c^R}{\mu}$ is smaller than one as the marginal utility of income is $\mu = p(\cdot)U_c^R + (1 - p(\cdot))U_c^0$. Hence, the value of recreation services at the margin in an optimum where the marginal products of inputs equal input prices, or $\frac{r_l}{r_k} = \frac{w}{p_k}$, can also be determined from a production function defined for recreation, *r(l,k)*, such that $\frac{p_k}{r_k} = \frac{w}{r_l}$ gives an upper bound on the value (as $\theta < 1$).

Probability of participating in recreation $p(\cdot)$ can typically be estimated from national recreation participation survey data; its marginal change, $\frac{\partial p(\cdot)}{\partial S}$, measures the change in the likelihood of using recreation services as a response to policy. Finally, users respond to policy by adjusting their frequency of use, $\frac{\partial r(\cdot)}{\partial S}$.

In light of the decomposition above, several factors can be seen as contributing to the overall welfare impact of a policy change when measured by a corresponding change in income, $\frac{dI}{dS}$. As the significance of each component contributing to the ultimate impact is an empirical question, we illustrate the welfare impact by carrying out an analysis using Finnish recreation data. From a policy point of view, the decomposition is interesting if, for instance, users and non-users react differently to different supply measures, as this emphasizes the importance of considering distributional aspects before policy implementation.

Econometric specification of the models

Binary choice models are an appropriate way to model recreation participation probabilities, $p(\cdot)$, and to test how supply of public recreation opportunities affects participation, $\frac{\partial p(\cdot)}{\partial S}$. An individual either visits these areas in a certain period of time or not, and we assume that an individual's decision is a function of supply of recreation areas, *S*, and socioeconomic characteristics, *x*, particularly income. We apply a logit model in which participation is modeled as a binary variable and the distribution assumed for the random error is logistic (e.g., Hosmer and Lemeshow 2000). The probability that the individual will use the recreation areas is

$$prob(USER = 1) = E(USER \mid x, S) = \frac{1}{1 + \exp(\beta x + \gamma S)} \qquad (11)$$

where USER receives the value 0 or 1. The marginal impact of additional supply can be derived from the above as

$$\frac{\partial p}{\partial S} = -\left(\frac{1}{1+\exp(\beta x + \gamma S)}\right)^2 \gamma \exp(\beta x + \gamma S)\,. \qquad (12)$$

The visitation frequency, $r(\cdot)$, is estimated in order to examine whether the supply of areas affects annual number of use days for the users of these areas, i.e., the term $\frac{\partial r}{\partial S}$. Given that the dependent variable measured by the number of use days can receive only non-negative integer values, count data econometric techniques, such as the negative binomial regression model applied here, are appropriate for estimation purposes (e.g., Cameron and Trivedi 1998). As the sample does not include non-users, the distribution of use days is left-truncated. Again we assume that individuals' number of use days is a function of supply of recreation areas and socioeconomic characteristics, particularly income. The zero-truncated negative binomial regression model applicable here is of the form

$$prob(r = R | r > 0) = \left[\Gamma(R+1/\alpha)/\Gamma(R+1)\Gamma(1/\alpha)\right](\alpha\lambda)^R(1+\alpha\lambda)^{-(R+1/\alpha)}\left[1-F_{NB}(0)\right]^{-1}, \quad R = 1,2,\ldots \qquad (13)$$

where Γ indicates the gamma function and α is the overdispersion parameter. The conditional mean of this model is $E(r \mid x,S) = \lambda[1-F_{NB}(0)]^{-1} = \exp(\beta x + \gamma S)\,[1-F_{NB}(0)]^{-1}$ (Grogger & Carson 1991). The marginal impact of an exogenous change in *S* can be derived as follows

$$\frac{\partial r}{\partial S} = \gamma \exp(\beta x + \gamma S)\left[1 - F_{NB}(0)\right]^{-1}. \quad (14)$$

Finally, we apply the negative binomial count data model described above to derive a benefit estimate of the monetary value of recreation per use day from trip frequency data. As we are interested in SPRAs as a whole, we model the demand for a "representative" SPRA (Creel and Loomis 1990, Zawacki et al. 2000) instead of for a specific area, as would be done in traditional travel cost models. When the number of trips to a destination area and the associated travel costs are known, the expected trip demand, r_{tc}, can be modeled as a function of travel cost, tc, and individual characteristics, x, or $E(r_{tc} \mid tc, x) = \lambda = \exp(\beta_{tc} tc + \beta x)$. Integrating the demand function, we have an estimate for the consumer surplus of trips to recreation areas:

$$CS = \int r_{tc} dtc = -\frac{r_{tc}}{\beta_{tc}}. \quad (15)$$

Accordingly, consumer surplus per additional predicted trip is

$$\frac{\partial CS}{\partial r_{tc}} = -\frac{1}{\beta_{tc}}. \quad (16)$$

Approximating the length of a "representative" trip by an average number of use days per trip, we obtain an estimate of the monetary value of recreation per use day, $\frac{\Delta CS^R}{\Delta r}$.

As shown in equation (10), the value of an additional trip can alternatively be determined from a production function for recreation. For example, assuming that trips, TR, are produced using a Cobb-Douglas technology $TR = A \cdot TK^{\alpha} TL^{1-\alpha}$, where time, TL, and travel costs, TK, are inputs, then $\underbrace{\frac{TR}{TL}}_{r} = A\underbrace{\left(\frac{TK}{TL}\right)}_{k}^{\alpha} \Leftrightarrow r = Ak^{\alpha}$ yields the marginal products $r_k = A\alpha k^{\alpha-1}$ and

$r_l = A(1-\alpha)k^{\alpha}$. The marginal products can be computed by taking the logarithms of $r = Ak^{\alpha}$,

and estimating the parameters α_0 and α:

$$\log r = \underbrace{\log A}_{\alpha_0} + \alpha \log k\,. \tag{17}$$

Having shown that all of the components of the analytical model can be estimated to calculate marginal changes, we proceed to illustrate the model's applicability in an empirical analysis.

3. Empirical illustration of recreational use responses to supply

3.1 State-protected and recreation areas in Finland

The empirical application of modeling distributional impacts focuses on the supply of state-protected and recreation areas in Finland. The categories of SPRA include national parks, national hiking areas and wilderness areas; there are 54 such areas in total. The twelve wilderness areas in northernmost Finland have been established to preserve wilderness in its original state, to secure the status of the Sami culture and natural sources of livelihood and to diversify the use of nature. The primary purpose of the 35 national parks (as of 2003) is conservation of the original biotic and abiotic features of nature, including traditional landscapes (The principles of protected areas…2002). According to the principles established for managing Finland's national parks, the national parks also have an important role in providing all citizens with opportunities to hike and experience nature. The seven national hiking areas have, in turn, been established by statute on state-owned land that is of considerable general importance for outdoor recreation.

Currently, about one-fifth of adult Finns use SPRAs for recreation every year. About one-fourth of all overnight nature trips take place in state-owned areas, as does about 5% of the outdoor recreation pursued close to the primary residence. Interestingly, a high level of education, male gender and white-collar socio-economic status characterize a relatively high proportion of users even in Finland (Pouta and Sievänen 2001). This user profile raises a question as to whether the supply policies adopted have induced a bias towards relatively wealthy users. This concern should be borne in mind as there is still pressure to increase the proportion of public conservation and recreation areas in the total land area of the country. In Finland, as in many other Western countries, the recreational use of nature and nature tourism is expected to contribute to employment and income in rural areas (Programme for developing recreation 2002). For example, employment in nature tourism is expected to double in the next ten years. These general objectives also set goals for the management policy of state lands, implying a need for bringing new areas into recreational use by developing recreation services. In the following, we examine empirically whether the supply of recreational opportunities treats different income groups differently.

3.2. Data

The data were obtained from the national inventory of outdoor recreation in Finland, which contains information on the recreation behavior of Finns aged 15–74 years (Virtanen et al. 2001). The data were collected every other month from August 1998 to May 2000 as 12 split samples. Data collection was carried out in two phases, telephone interviews and a postal survey. The telephone interviews consisted of questions concerning respondents' participation in ninety recreational activities. The response rate was 84% (10,651 interviewees). The postal survey was sent to about 8500 of the telephone respondents who had indicated that they would be willing to answer one. It elicited more detailed information on the respondent's most recent recreation visits, use of time, money and various recreation area types. A total of 5535 respondents answered the mail inquiry, yielding a response rate of 65%. The mail survey data were found to be representative of the population with respect to age and gender (Virtanen et al. 2001). Of the responses to the survey, 2632 contained information concerning the use of SPRAs.

Respondents indicated whether they had visited a SPRA during the last 12 months. Such areas include national parks, wilderness areas, hiking areas and other areas in which the state has provided trails or recreation services. SPRA use is captured by a variable that indicates visitation on at least one occasion of an area during the past 12 months. In a separate item, respondents were asked how many days they had spent altogether in SPRAs during the past 12 months.

The data set for the travel cost analysis was obtained from the mail survey containing data on the last visit and trip to those areas which were the destinations of the respondents' most recent visits (cf. Creel and Loomis (1992), who used travel cost data on the most recent trip). In the mail survey, each respondent was asked a series of questions concerning his or her last close-to-home recreation visits, defined as a one-day trip conducted for outdoor recreation, and last "nature trip", defined as a trip conducted for outdoor recreation that included at least one overnight stay at the destination. Of the close-to-home trips, 228, and of the nature trips, 562 were directed to SPRAs. Of these 790 observed trips, 567 provided data corresponding to all the variables necessary for our travel cost analysis: travel expenses, number of visits to the destination site and household income. The travel cost variable consisted of round-trip travelling expenses per person as reported by the respondent in the survey. In an alternative estimation, we approximated the opportunity cost of leisure time as a fraction (25%) of the individual's wage rate which according to Parsons et al. (2003) has been accepted as the lower bound in the literature. As expected, welfare estimates became higher when cost of time was included in the travel cost variable. (See discussion on the opportunity cost of time, e.g., in Shaw & Shonkwiler (2000)). For nature trips, the question on number of visits focused on the last 5 years but was converted to annual number of visits, the measure used in close-to-home visits. Figure 1 illustrates the procedure, data and subsamples used in the estimations.

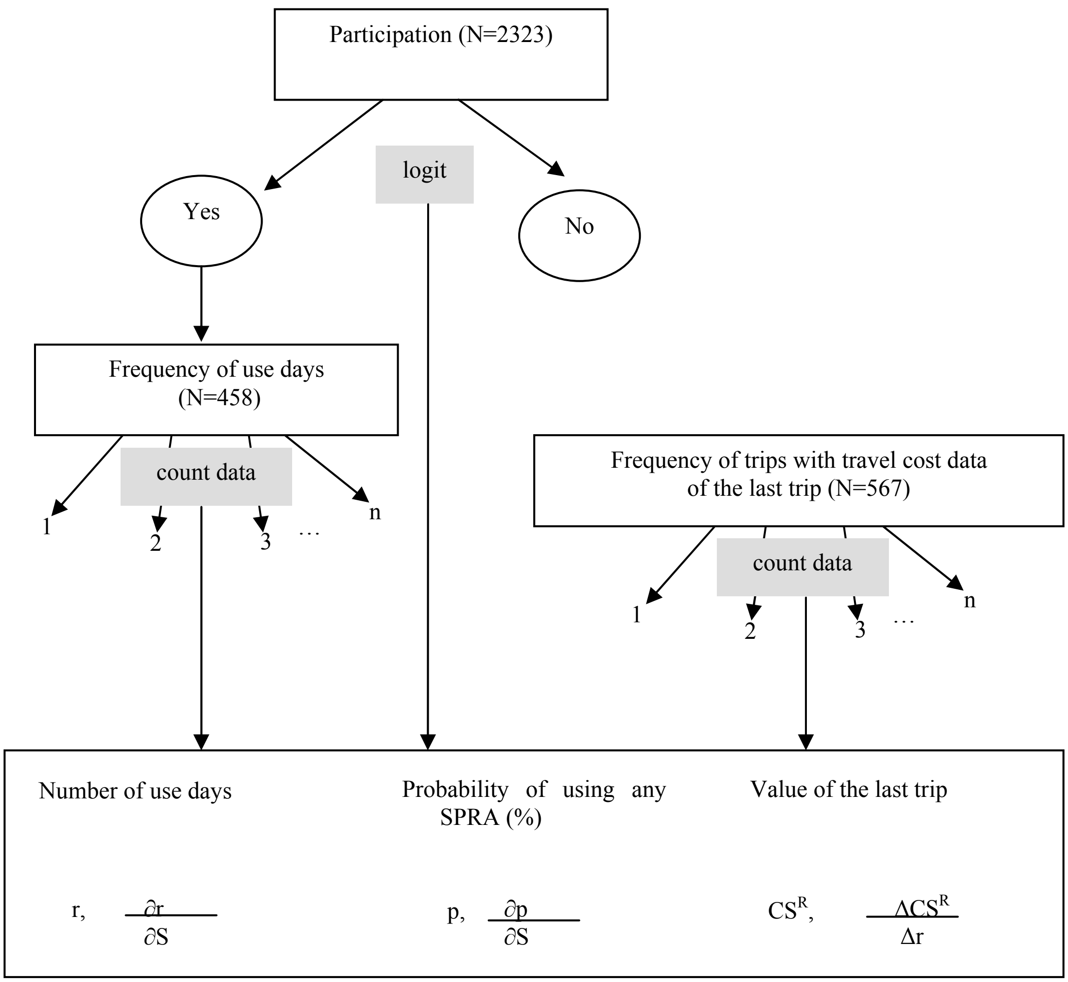

Figure 1. The modeling approach.

The respondents' background variables were obtained in the telephone interviews and postal questionnaires and were used as explanatory variables. Gross household income per month was measured using a measurement of 11 income classes from under FIM 3000 (US$ 625) to over FIM 30 000 (US$ 6250). The Income variable was recoded to the class means. 5% of respondents belonged to the lowest income class and 7 % to the highest. Mean income in the sample was FIM 15 464 (US$ 3221) and the median FIM 13 750 (US$ 2865). Furthermore, variables which describe the supply of SPRAs were obtained from the databases of Metsähallitus (Finnish Forest and Park Service)[2]. These were the total area of the national parks, wilderness areas and national hiking areas in the respondent's home municipality and the distance from the center of the municipality in which he or she lived to the nearest state area.

3.3. Estimation results

To determine empirically the components of the welfare change we start by estimating the participation rate, $p(\cdot)$. Second, we estimate visitation frequency measured by use days, $r(\cdot)$. Finally, we use the travel cost method for estimating the consumer surplus accruing from the use of recreation areas. In the following estimations, we focus on modeling the effects of supply. Two variables describing the provision of SPRAs were included in the model: the total area in respondent's home municipality measured in 100 hectares, S_a, and the distance to the nearest SPRA in kilometers, S_d. On the demand side, special emphasis is placed on the role of income as we are ultimately interested in distributional issues related to supply factors. For this reason, we left out socio-economic variables that typically correlate with income (age, education, socio-economic status).

During the 12 months prior to the survey, 22% of the respondents had used a state area for recreation at least once. Table 1 shows the estimation results of a logit model explaining the use of SPRAs. The distance to the nearest SPRA proved to be statistically significant such that a long distance to the nearest SPRA decreased the probability of participating in recreation in that area. The other variable of interest, income, was also significant: the higher the income, the more likely a respondent used SPRAs. Income and supply also had an interaction effect: in the highest income group the interaction variable had a positive coefficient. Interpreted together with the plain distance variable, this effect means that in the highest income group the distance to the nearest area does not play a crucial role but in lower-income groups it decreases the probability of participation.

Table 1. Probability of using state-protected and recreation areas, logit model.

	Coefficient	p-value	Mean
Constant	-1.5236	0.0000	
Total area of SPRAs in home municipality (100 ha), S_a	-0.0001	0.8715	5.25
Distance to nearest SPRA (km), S_d	-0.0081	0.0004	37.32
Income (log, FIM 1000)	0.1991	0.0134	2.53
Income dummy (>3rd qrtl) x distance to nearest state area	0.0122	0.0009	4.40
N	2323		
Correctly classified, (%, cutpoint 0.50)	77.6		
Pseudo R^2	.016		
Log-likelihood (constant only)	-1236		
Log-likelihood (model)	-1216		

In Table 2 we report the results of the effects of supply on demand for use days spent in SPRAs. Of the two supply variables, only total area of SPRAs in the respondent's home municipality, S_a, was significant. It appears that distance separates users from non-users but high acreage increases the number of use days in that it provides more variety in recreational opportunities. In this model, the respondent's household income did not have a statistically significant impact on recreation use. It seems that as income affects the selection of users it no longer interacts with number of use days.

Table 2. Expected number of use days in state-protected and recreation areas, truncated negative binomial regression model.

	Coefficient	p-value	mean
Constant	1.7717	0.0000	
Total area of SPRA in home municipality (100 ha), S_a	0.0047	0.0454	5.15
Distance to nearest SPRA (km), S_d	-0.0023	0.4587	33.52
Income (log, FIM 1000)	-0.0982	0.1935	2.67
Income dummy (>3rd qrtl) x total area of SPRA	-0.1761	0.6697	0.05
Alfa	2.5889	0.0000	
N	458		
Pseudo R^2	0.48		
Log-likelihood (constant only)	-2479		
Log-likelihood (model)	-1288		

To evaluate supply effects on consumer surplus we estimated a travel cost model based on a truncated negative binomial regression (Table 3). The model shows the expected inverse relationship between the number of trips and travel costs. As we are particularly interested in the welfare effects in various income groups, we formed three interaction variables for income dummies and travel cost. These interactions show that travel costs had less importance in the two highest income groups. In these groups the positive coefficient of interaction partly compensates for the negative effect of travel cost.

Table 3. Expected number of trips to a state-protected and recreation area, truncated negative binomial regression model.

	Coefficient	p-value	mean
Constant	2.4335	0.0000	
Travel cost	-0.0084	0.0000	295.04
Income dummy (<1st qrtl) x travel cost	-0.0031	0.0000	62.04
Income dummy (2nd qrtl-3rd qrtl) x travel cost	0.0047	0.0000	82.22
Income dummy (>3rd qrtl) x travel cost	0.0058	0.0000	62.13
Alpha	8.0812	0.0064	
N	567		
Pseudo R^2	0.76		
Log-likelihood (constant only)	-4680		
Log-likelihood (model)	-1141		
Consumer surplus per trip,	179.52	Conf.interval[1)]	
- income <1st qrtl (FIM)	87.72	[81,95]	
- income between 1st qrtl – 2nd qrtl (FIM)	120.48	[111,129]	
- income between 2nd qrtl – 3rd qrtl (FIM)	277.78	[217,363]	
- income over > 3rd qrtl	384.62	[318,486]	

[1)] 90 % confidence intervals were calculated using the method applied by Krinsky and Robb (1986).

In the case of income groups other than the base group (income between 1st and 2nd quartile) the term β_{tc} is of the form $\beta_{tc} = \beta_{tc,all} + \beta_{tcxincome}$. The estimated coefficients produced consumer surplus estimates per predicted trip ranging from the lowest quartile of FIM 87 (US$ 18) to the highest of FIM 384 (US$ 78). The average consumer surplus, FIM 180 (US$ 36), was obtained by weighting the value for each income group by the proportion of observations in that group.[3] We also constructed a value for the wage rate by deducting from a self-reported monthly gross income the corresponding progressive income tax. When an opportunity cost of time of one-fourth of the wage rate was included in the travel cost variable, the estimation produced an average consumer surplus of FIM 263 with a range from the lowest quartile of FIM 198 to the highest of FIM 426. (See Appendix 2 for estimation results.) That inclusion of income increases consumer surplus is a typical finding in the literature. However, relative magnitude of consumer surplus in relation to income remains the same; that is, the highest consumer surplus accrues to the highest income quartile and so on.

For comparison purposes, we estimated the production function in equation (17) to calculate the marginal products of time and travel costs, and the value of additional trip. The results are reported in Appendix 3. When one-fourth of the wage rate was used as a value of time input, w, the estimation resulted in an average value for an additional trip of FIM 280. In the lowest quartile, the corresponding value was FIM 160 and in the highest FIM 430. These values are relatively close to the consumer surplus measures obtained through estimates travel cost that included the opportunity cost of time.

3.4. Welfare effects of increasing the provision of SPRAs

Empirical estimates of the welfare components are presented in Table 4. Models for participation and number of use days with only significant variables included were used for predictions and are reported in Appendix 1. The model predicts a participation rate of 0.22. A marginal change of one kilometer in the distance to the nearest SPRA caused a 0.14% change in the probability of using the SPRA. The use day model gave a prediction of 3.99 days per year. A one-hundred-hectare increase in the supply of areas in an individual's home municipality increased the number of use days by 0.02 days per individual. In terms of welfare measures, a marginal decrease in distance would be worth FIM 0.24, and a marginal increase in acreage FIM 0.18 per individual.

Table 4. Empirical estimates of welfare components.

Welfare component		empirical estimate
$p(\cdot)$	participation rate	0.22
$\frac{\partial p(\cdot)}{\partial S_d}$	marginal change in participation rate	0.0014
$r(\cdot)$	annual user days per user	3.99
$\frac{\partial r(\cdot)}{\partial S_a}$	marginal change in user days	0.02
CS^R	consumer surplus (FIM)	172
$\frac{\Delta CS^R}{\Delta r}$	marginal/average change in consumer surplus (FIM)	43
$\frac{dI}{dS_d} = CS^R \frac{\partial p(\cdot)}{\partial S_d}$	welfare impact (FIM) of a marginal change in distance (km), S_d	0.24
$\frac{dI}{dS_a} = p(\cdot) \frac{\Delta CS^R}{\Delta r} \frac{\partial r(\cdot)}{\partial S_a}$	welfare impact (FIM) of a marginal change in area (100 ha), S_a	0.18

In the following, we use the estimation results (Appendix 1) to illustrate the effects of a hypothetical policy that increases the average acreage of SPRAs by 50% and decreases the average distance to the nearest SPRA by 50%[4]. In the illustration, we use the quarters of the sample at the lowest and highest income levels. Table 5 shows the recreation benefits before and after the policy, and Table 6 illustrates the relative and absolute effects of the policy.

In Table 5 the logit model was used to analyze by income group the effects of policy on the probability of being a user of SPRAs. Presently, the predicted probability is 17% in the lowest income group and 29% in the highest income group. The increase in supply did not increase the number of users in the high-income group, while in the low-income group the number of users increased to 19%. Based on these probabilities, the total number of users before and after implementation of the policy was calculated. Second, the average number of use days per individual user was predicted using the estimated negative binomial model. Even though the policy had a comparatively small impact on number of use days per individual user, the increase it brought about in total number of users increased aggregate use days, producing a total increase of 11% in use days (Table 6). In the lowest income group, the increase was 15%; in the highest the policy even caused a slight decline.

Table 5. Users, use and benefits of SPRAs before and after implementation of the hypothetical policy: increase (+50%) in total area of SPRAs and decrease (-50%) in distance to nearest SPRA.

	All	**Income level below 1st income quartile**	**Income level over 3rd income quartile**
Present state			
Population	3 900 000	975 000	975 000
Predicted probability of using SPRAs	0.22	0.17	0.29
Number of users	857 617	165 570	281 762
User days / user	3.98	3.98	3.98
Total number of user days	3 411 629	658 642	1 120 859
Consumer surplus per day	43.26	21.14	92.68
Consumer surplus per year	172.10	84.08	368.68
Annual benefits of area use	147 593 844	13 921 837	103 879 414
After policy implementation			
Predicted probability of using SPRAs	0.24	0.19	0.28
Number of users	939 927	187 111	274 453
User days / user	4.04	4.04	4.04
Total number of user days	3 795 214	755 510	1 108 180
Consumer surplus per day	43.26	21.14	92.68
Consumer surplus per year	174.68	85.35	374.21
Annual benefits of area use	164 188 522	15 969 355	102 704 344

Third, the estimated use days were valued in monetary terms by multiplying the number of days by consumer surplus estimates per day, which were obtained by dividing per trip estimates by average length of the trip. As the consumer surplus was independent of the supply level of the area, it remained on the pre-policy level (Table 5). Thus, the total welfare effects followed the same pattern as in the case of use days: in the lowest income group the policy increased welfare but in the highest the change in welfare was slightly negative. Compared with the considerable increase in provision the change in welfare of 9.6% is quite moderate (Table 6).

Table 6. The effects of the hypothetical policy.

	All	Income level below 1st income quartile	Income level over 3rd income quartile
Total increase in number of users	82 311	21 541	-7 309
(%)	(9.60)	(13.01)	(-2.59)
Total increase in use days	383 586	96 868	-12 679
(%)	(11.24)	(14.71)	(-1.13)
- new users	332 352	86 977	-29 511
-old users	51 234	9 891	16 832
Total increase in welfare by components (FIM)	16 594 678	2 047 518	-1 175 071
(%)	(9.60)	(13.01)	(-2.59)
Sd	14 378 196	1 838 448	- 2 735 074
Sa	2 216 482	209 070	1 560 003

Table 5 also indicates strikingly how unequal the distribution of the benefits of using SPRAs is today. At the current level of provision of areas, the annual use value is about FIM 150 million (US$ 30 million), with about 70% of these benefits enjoyed by the highest income group. Even though the hypothetical policy would equalize the distribution to a certain extent, the high-income group would still receive over 60% of the total benefits of the use of the areas. It should be noted that inequality in the distribution of benefits also remained significant when we used consumer surplus measures including time input in the calculations for Tables 5 and 6 (available from the authors upon request).

The hypothetical policy induced an increase in use days in two ways: by attracting new users and increasing the use days of old users. Table 6 shows how these effects differ by income group. In the low-income group (1^{st} quartile), an increase in use days comes mainly from new users starting to visit SPRAs, whereas among high-income users (4^{th} quartile) the effect is positive only among old users. Table 6 also illustrates how the two strategies of area provision differ in welfare effects. Providing areas close to users is a strategy that brings larger welfare gains than merely increasing the acreage of SPRAs. From a policy point of view, it is interesting that the effects of these two strategies differ considerably between income groups. The positive welfare effect of the shorter distance strategy occurs in the low-income group. In the high-income group, only the acreage-based strategy produces positive welfare effects.

4. Discussion and conclusions

The theoretical framework of the study decomposed the effect of provision of public recreation sites on both the likelihood of participating in recreation in public areas and the frequency of participation. The empirical analysis showed that not only did the supply have these two effects but it had two dimensions. The proximity of the nearest state-protected and recreation areas influenced the probability of their use. The prevalence of such areas in an individual's home municipality had an effect on frequency of use. The results show that combining these two decisions − participation and number of days − in the same model may not bring out the whole picture of the effects of increased supply.

The users of state-protected and recreation areas are more often people from higher-income groups. The travel cost model showed that in lower-income households the demand for visits to an area was on average more sensitive to travel costs. This had implications for consumer surplus estimates, which were considerably higher among high-income households. While income level determines the selection mechanism for becoming a user of recreation areas, there is no significant difference in the number of use days between income groups. In terms of area use, increased supply has distributional consequences.

Our results are in line with those of Feinerman et al. (2004) in that we can conclude that if the objective is to make special nature experiences in state-protected and recreation areas available to as many people as possible, including lower-income groups, these areas should be located as near as possible to large potential user groups. However, the amount of land area per site need not be large. Furthermore, our study has shown that an abundant supply of state areas near an individual's primary residence encourages repeated visits and that this impact of additional acreage is independent of the user's household income.

Our hypothetical policy scenario predicted that an increase in supply would very likely lead to an increase in new use days among low-income households. In the highest income group, the total demand for public recreation opportunities seems to be saturated, since additional recreation areas did not increase the number of use days in this group. This is a disturbing implication if the objective of policy is to bring new paying customers to rural areas. If the goal is to provide recreation areas equally for all citizens, the hypothetical policy would equalize the distribution of benefits of use to a certain extent, but the quartile with the highest income would still receive over half of the total benefits to be had from use of the areas.

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Appendix 1. Models with only significant variables included were used in predictions.

	Logit model			NegBin-model		
	Coefficient	p-value	Mean	Coefficient	p-value	Mean
Constant	-1.5266	0.0000		1.3594	0.0000	
Total area of SPRA in home municipality (100 ha)				0.0047	0.0486	4.89
Distance to nearest SPRA (km)	-0.0080	0.0004	37.32			
Income (log, FIM 1000)	0.1997	0.0130	2.53			
Income dummy (>3rd qrtl) x distance to nearest state area	0.0122	0.0009	4.40			
Alpha				2.690	0.000	
N	2323			499		
Correctly classified, (%, cutpoint 0.50)	77.6					
Pseudo R^2	.016			0.47		
Log-likelihood (constant only)	-1236			-1383		
Log-likelihood (model)	-1216			-2629		

Appendix 2. Expected number of trips to a state-protected and recreation area, truncated negative binomial regression model when opportunity cost of time included in travel cost.

	Coefficient	p-value	mean
Constant	2.6198	0.0000	
Travel cost with time	-0.0043	0.0000	617.11
Income dummy (<1st qrtl) x travel cost with time	-0.0008	0.0032	98.78
Income dummy (2nd qrtl-3rd qrtl) x travel cost with time	0.0010	0.0000	163.58
Income dummy (>3rd qrtl) x travel cost with time	0.0058	0.0000	157.44
Alpha	7.4551	0.0077	
N	549		
Pseudo R^2			
Log-likelihood (constant only)	-4360		
Log-likelihood (model)	-1076		
Consumer surplus per trip,	263.24	Conf.interval[1)]	
- income <1st qrtl (FIM)	198.02	[184,215]	
- income between 1st qrtl and 2nd qrtl (FIM)	234.74	[217,254]	
- income between 2nd qrtl and 3rd qrtl (FIM)	305.81	[270,352]	
- income > 3rd qrtl	425.53	[354,526]	

1) 90 % confidence intervals were calculated using the method applied by Krinsky and Robb (1986).

Appendix 3. Number of trips, estimated using a Cobb-Douglas production function with an OLS regression model for equation (17)

	Coefficient	p-value	mean
Constant, α_0	-3.4650	0.0000	
Travel cost/time (log), α	0.1657	0.0870	0.89
N	353		
R^2	0.08		
Upper bound on value per trip	p_k/r_k	w/r_l	
average (FIM)	923	280	
- income <1st qrtl (FIM)		159.34	
- income between 1st qrtl and 2nd qrtl (FIM)		266.43	
- income between 2nd qrtl and 3rd qrtl (FIM)		306.30	
- income > 3rd qrtl		430.81	

[1] In fact, Loomis (1995) has identified four phases of recreation choice behavior: 1) the decision whether to participate in recreation (activity) or not 2) the decision which site to visit 3) the decision how many trips to take to a given site and 4) the decision of how long to stay. Decisions on participation and frequency are the most interesting ones from the point of equity when the policy focus is to inform decisions on the supply of recreation opportunities in general. Furthermore, there are a number of studies which have examined how supply, measured by quality aspects such as marine pollution (Kaoru et al. 1995) forest features (Boxal et al. 1996) or crowding (Hanley 2001), affects site selection in particular, but this is another line of literature (see, e.g., Englin et al. (1997) and the references therein). However, according to Parsons et al. (1999) previous studies have not been completely successful in finding a convincing, utility theoretically consistent model for recreation demand regarding site choice and trip demand. We thank a referee for pointing out a study by Shaw and Shonkwiler (2000) who derive recreation demand from a single, integrated utility maximization problem. They use the total travel instead of trips as aggregate demand, and number of trips and total travel are jointly estimated.

[2] Initially, we examined whether provision of state-protected and recreation areas differed between income groups. For this purpose we compared the two measures of provision, distance and acreage, in income groups, using analysis of variance. Acreage of areas did not significantly differ between income groups in the sample, but distance to areas was significantly longer for low-income groups.

[3] The consumer surplus estimate is in line with previous Finnish valuation results. A willingness-to-pay study based on another sub-sample of the extensive mail survey carried out for the national inventory indicated that people would pay roughly FIM 111 (US$ 23) on average per person per year for access to public recreation areas and services such as campfire sites, firewood, and waste disposal (Huhtala 2004).

[4] If the spatial distribution of areas is assumed to follow the pre-policy pattern, a 50% increase in SPRA acreage would correspond to approximately a 33% decrease in distance.

MTT Discussion Papers 6 • 2006

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ISSN 1795-5300