“Demand elasticities of recreational amenities from environmental resources: empirical evidence from Ayubia National Park, Pakistan”

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ARTICLE INFO	Himayatullah Khan (2013). Demand elasticities of recreational amenities from environmental resources: empirical evidence from Ayubia National Park, Pakistan. *Environmental Economics*, *4*(1)
RELEASED ON	Thursday, 28 March 2013
JOURNAL	"Environmental Economics"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES
0

NUMBER OF FIGURES
0

NUMBER OF TABLES
0

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Demand elasticities of recreational amenities from environmental resources: empirical evidence from Ayubia National Park, Pakistan

Abstract

This study estimated demand elasticities of recreational amenities including bird watching and sightseeing in Ayubia National Park in Northern Pakistan. The data were collected from 300 visitors randomly selected for this study. A pre-tested interview schedule was used to collect data from respondents who visited park for bird watching and sightseeing. The data showed that income influenced willingness to pay positively and significantly. The analysis showed that the point estimates of the income elasticity of demand for recreational amenity tended to be greater than unity. This implies that improved quality of recreational amenities is a luxury good. The confidence interval for the base case suggested that a 1% increase (decrease) in income would result in about 0.7-1.5% increase (decrease) in the demand for improved recreational benefits.

This indicates that income changes will indeed cause changes in the demand for this particular environmental service. Regarding the price elasticity of demand, the results clearly suggested that improved quality effects of recreational benefits are an ordinary and price elastic good. This suggested that technological innovations that would make it possible to supply the improved environmental services at a lower cost would have a relatively large impact on the demanded quantity.

Keywords: demand elasticity, recreational value, environmental resources, national parks, Pakistan.
JEL Classification: Q50, Q51, Q57, Q58, Q59.

Introduction

Keeping in view the importance of environmental resources, it is important to know how man values these resources. Can we think of the environmental goods and services as economic goods? If yes, can we classify environmental goods into luxuries or necessities, substitute or complements, and inferioir, Giffen or normal? The focus of this study is on answering these questions.

The microeconomic theory categories various goods and services as luxuries or necessities, substitutes or complements, and inferior, Giffen, or normal. We can also apply this approach of classifying goods and services to study environmental goods and services[1]. There is a debate among economists on whether environmental goods and services can be classified as luxuries or not. Alternatively speaking, whether these services are characterized by an income elasticity of demand greater than unity or not (Pearce, 1980; Kristrom and Riera, 1996; Hobky and Soderqvist, 2003; and Khan, 2010). Regarding the debate on whether environmental services are luxuries or not, there are also distributional reasons to be concerned about if low income groups in society exhibit greater willingness to pay than high income groups for an improved quality of environmental services (Kanninen and Kristrom, 1992; Kristrom and Riera, 1996). This calls for information on the magnitude of the income elasticity of willingness to pay for environmental services, i.e., a measure of how willingness to pay is affected by changes in income (Hobky and Soderqvist, 2003). From the point of view of the environmental policy-makers, there is another useful piece of information that how the quantity demanded of environmental goods and services is affected by price changes. Technical innovations might imply reduced costs of supplying environmental services, and knowledge of price elasticities of demand might thus predict how consumers would respond to such a change. One might also be interested in predicting the response from introducing economic policy instruments such as taxes, charges or subsidies in order to influence people's and firms' behavior vis-a-vis the environment (Hobky and Soderqvist, 2003).

Recreational amenity is an integral part of the environment. Like other environmental public goods, amenities services have their total economic value (TEV) which includes use values (i.e., direct use, indirect use, and option values) and non-use values (i.e., bequest values and existence values). This study estimates demand elasticities and willingness to pay for recreational amenity of the Ayubia National Park, in Northern Pakistan. In this study we use data collected by travel cost methods in combination with the CVM. The paper is organized as follows. Sections 1 and 2 give description of the study area and a theoretical background and define elasticity measures, respectively. Estimates of income elasticities of willingness to pay for environmental services found by various studies are pre-

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[1] Hobky and Soderqvist (2003) and Khan (2010) use the label "environmental services" for all goods and services provided by the environment and the ecological systems, including quality of environmental resources. An environmental amenity in this study refers to bird watching and sightseeing.

sented in section 3. The demand for improved environmental quality effects of the recreational amenity is modeled and estimated in section 4, which also includes estimates of income and price elasticities of demand for this particular environmental good. Finally, conclusions are drawn in the last section.

1. Description of the study area

Ayubia National Park is a small national park in the Murree hills. It is located North of Murree in the Himalayan Range Mountains. Ayubia consisting of four hill stations, namely, Khaira Gali, Changla Gali, Khanspur and Gora Dhaka is spread over an area of 26 kilometers. These hill stations have been developed into a hill resort known as Ayubia. The chairlifts provided at this place are a matter of great attraction. It is an important place from the viewpoint of wildlife, nature, ecotourism, and education. This park provides refuge to the elusive leopard and the black bear. Bird watching is excellent here. There are steep precipices and cliffs on one side and on the other are tall pine trees. The scenery is superb with huge pine forests covering the hills and providing shelter to the larger and smaller mammals. Wild animals are also found in the thick forests around. Mammals in the park include Asiatic leopard, black bear, yellow throated marten, Kashmir hill fox, red flying squirrel, himalayan palm civet, masked civet and rhesus macaque. Birds in the park are golden eagle, griffin vulture, honey buzzard, peregrine falcon, kestrel, Indian sparrow hawk, hill pigeon, spotted dove and collared dove.

The data used in this analysis come from Ayubia National Park. The survey was used to obtain the origin and frequency of the visits as well as the visitors' perceived costs. The survey was conducted in summer 2010. The questionnaire consisted of two parts. The first part contained general information about the visitor including gender, education, marital status, age, income, place of living, etc. The second part of the questionnaire is concerned about the visitor's recreational behavior. The data used in this study were collected from 300 visitors by following systematic random sampling. A pre-tested interview schedule was used to ask respondents about their socioeconomic characteristics including education level, age, income and cost incurred on visiting the park. The date showed that on average, the sample respondents visited nature-based recreation about 8 times per year with their mean yearly spending on recreation of Rs 5800. Their mean monthly income is Rs 14,500. About 64 percent of the respondents are male and 36 percent are female. As many as 65 percent were married and 35 percent single. The average age of the respondents was 41 years and the average household size was about 6. More than 75 percent were literate and 25 percent were illiterate. Half of the respondents (50 percent) considered quality of the park as good compared to 35 percent who viewed it bad or very bad, with about 15 percent answering with don't knows. Majority (62 percent) of the visitors were from urban areas compared to 38 percent of the visitors who were from rural areas. Similarly, more than 65 percent of the respondents wanted improvement in the quality of services of the park. The visitors visited the ANP for different reasons. Recreational activities at the Park include sightseeing, bird watching, walking, relaxation, exercising, eating seafood, swimming and water sports like boating and sailing. In order to know the purpose of travelling the respondents were asked why they came to Galliat. More than two-third (80 percent) of visitors came to Galliat for recreation purposes. Regarding income distribution as many as 48 percent of sample households fall in income group of Rs 10,000-20,000 per month. One-fifth (20 percent) households have monthly income in the range of Rs 5,000-10,000. Some 18 percent households have income of Rs 20,000-50,000. Some 20 percent had monthly income of more than 50,000. Taken together 68 percent households fall in income range of Rs 5,000-20,000.

2. Demand elasticities and willingness to pay[1]

Following Freeman (1993) it is assumed that an individual maximizes utility (u), which is determined by the consumption of private goods (a n-vector x) and the levels of public environmental resources (recreational amenities including bird watching and sightseeing). The latter is for notational simplicity assumed to be a single environmental service z. In real-world settings, the public nature of z implies that no market price exists for this service. In a CVM setting, a market for z is set up, and respondents are asked to state or show their preferences. Since no real exchange of goods and money takes place, one cannot take for granted that the responses obtained in a CVM survey correspond to the behavior that would arise if the hypothetical CVM setting was turned to a real market situation. The suggestion that CVM responses are influenced by a "hypothetical bias" has been discussed and analyzed with mixed results elsewhere (Carson et al., 1996; Cummings et al., 1995; Khan, 2006). In this paper, results from CVM studies are however used without any attempt to adjust for the possible existence of hypothetical (or other) biases. A CVM market setting advanced enough to allow choices between different price and quantity combinations

[1] Sections 2-4 draw heavily on Freeman (1993) and Hobky and Soderqvist (2003).

would imply that the individual can be assumed to maximize an utility function $u = U(x, z)$ in x and z. The maximization is carried out subject to a budget constraint $qx + pz = y$, where q is an n-vector of market prices of private goods, p is the virtual price of the environmental service, and y is income. Solving this maximization problem would give a set of Marshallian demand functions, including one for z: $z = D_z(q, p, y)$. Inserting them in the utility function results in an indirect utility function $v = V(q, p, y)$, where v is indirect utility function. From Dz (•), the price elasticity of demand (ε_p) and the income elasticity of demand (ε_y) are defined as:

$$\varepsilon_p = \frac{p}{Z}.\frac{\partial D_z}{\partial P} = \frac{\partial(\ln D_z)}{\partial(\ln P)}, \quad (1)$$

$$\varepsilon_Y = \frac{y}{Z}.\frac{\partial D_z}{\partial P} = \frac{\partial(\ln D_z)}{\partial(\ln Z)}, \quad (2)$$

where ε_p is used for defining Giffen goods ($\varepsilon_p > 0$), ordinary goods ($\varepsilon_p < 0$), price inelastic goods ($-1 < \varepsilon_p < 0$), price unit elastic goods ($\varepsilon_p = -1$) and price elastic goods ($\varepsilon_p < -1$), and ε_y is used for defining inferior goods ($\varepsilon_y < 0$), normal goods ($\varepsilon_y > 0$), necessities ($\varepsilon_y < 1$) and luxury goods ($\varepsilon_y > 1$) (Hobky and Soderqvist, 2003).

In most CVM applications, welfare change is estimated as *WTP*, where the *WTP* for an increase in z from z^0 to z^1 is implicitly defined from the indirect utility function as $V(q, y - WTP, z^1) = V(q, y, z^0)$, i.e., *WTP* corresponds in this case to the compensating variation (Johansson, 1993; Hobky and Soderqvist, 2003). The *WTP* is estimated from respondents' answers to a *WTP* question, which might be of a discrete choice (DC) type, so that respondents are asked to accept or reject to pay a given price for obtaining the change in z. The main alternative is to pose an open-ended (OE) question. In this case, respondents are instead asked to state their maximum *WTP* for obtaining the change in z. Such restricted CVM market settings do not allow the estimation of a demand function and thus not the elasticities defined above. CVM studies include however often an estimation of a function $WTP = W(r)$, usually referred to as a "valuation function" or a "*WTP* function". Such a function tries to explain the variation in *WTP* by regressing *WTP* on a vector of explanatory variables r, e.g., income and other socio-economic characteristics of the respondents to the CVM survey. The inclusion of income as an explanatory variable makes it possible to use the estimated valuation functions for a computation of the income elasticity of willingness to pay (ε_w):

$$\varepsilon_w = \frac{y}{WTP}.\frac{\partial W}{\partial Y} = \frac{\partial(\ln W)}{\partial(\ln Y)}. \quad (3)$$

Does an estimate of ε_w give any information on ε_y? That is, is it possible to use an estimated valuation function for concluding whether a particular environmental service is a luxury good or not? The results of Flores and Carson (1997) indicate that the answer is pay and demand elasticities are negative. Their analysis show that a substantial divergence is possible, so that, for example, an environmental service characterized by $\varepsilon_y > 1$ may have an income elasticity of willingness to pay that is greater than unity or less than unity. Hence, estimates of ε_w are in general of no use for resolving discussions of whether environmental services tend to be a necessities or luxuries (Hobky and Soderqvist, 2003).

However, estimates of ε_w are of great interest for distributional reasons. Following Kristrom and Riera (1996), if $\varepsilon_w < 1$, then $q\ (WTP/y)/qy < 0$, i.e., the proportion of income that is assigned as WTP for an increase in z decreases with income. If so, a project suggesting this particular environmental improvement would be relatively more beneficial for low-income groups than for high-income groups. However, given no weighting of *WTP* of different income groups and the use of the Kaldor compensation criterion, this project is less likely to pass than a project that would primarily benefit high-income groups. If no weighting takes place, the sum of *WTP*s decides the social profitability of the project, and rich people are less constrained by income than poor people. The consequences of introducing weights thus seem crucial to study in cases where $\varepsilon_w < 1$ (Kanninen and Kristrom, 1992).

3. Income and price elasticities of demand

One of the most complete surveys of studies valuing environmental change is available in Soderqvist (1996). Most of these studies have used the contingent valuation approach. Soderqvist (1996) shows that these studies have estimated a valuation function with income as an explanatory variable. The study reports the type of environmental service valued, the number of observations obtained through the CVM survey and the type of valuation function estimated. Most of the studies have used a simple open ended question for eliciting *WTP*, and then simple linear or semilog regression models have been estimated. Tobit models have been used in some studies in order to take a large number of zero *WTP* responses into account. Other studies have employed discrete choice (DC) *WTP* questions and primarily probit or logit models for studying the relationship between the answers to the DC questions and explanatory variables. Note also that the valuation functions estimated from DC question data imply a slight modification in the computation

of ε_w; $\frac{\partial W}{\partial Y}$ in equation (3) is replaced by ∂E[*WTP*]/∂y, where *E*[.] is the expectations operator. The ε_w tends to take values between 0 and 1, and this is a finding consistent with those reported by Kristrom and Riera (1996). It is also striking that the four estimates of ε_w greater than unity reported in Soderqvist (1996) are from CVM studies with small-size samples. The environmental services valued are highly diverse and on the whole difficult to categorize in groups, the exception being a few studies which have all valued reduced marine eutrophication effects. Considerably more attention is devoted to this environmental service in the next section; here it suffices to note that the estimates of ε_w associated with these studies fall within the quite narrow interval [0.24, 0.35].

4. Income and price elasticities of demand

4.1. Modeling the demand for improved quality of drinking water. The main approach for estimating the demand for public goods – such as many environmental services, including better environmental services – is survey-based and is introduced by Bergstrom et al. (1982), who estimated elasticities of demand for local public school services in the U.S. Other applications include Gramlich and Rubinfeld (1982). Let a_i denote the improvement in quality of drinking water suggested to the *i*th (i = 1,..., m) respondent at a price p_i. The demanded improvement in quantity (z_i) is assumed to depend on the following relationship:

$$\ln Z_i = \ln D(\bullet) - \ln e_i = \alpha_0 + \alpha_1 \ln y_i + \\ + \alpha_2 \ln P_i + \sum \eta_j \ln S_{ij} - \ln e_i, \quad (4)$$

where $D(\bullet)$ is the demand function, y_i is the *i*th respondent's income, s_{ij} (j = 1,... ,0) are other variables that might influence demand, and ln e_i is an independently and identically distributed random variable.

While the demanded quantity (z_i) is unobserved, the merged data set gives information on whether a respondent would be willing to pay a given price for a certain suggested improvement in quality or not. There are two possibilities:

- If $z_{i \geq} a_i$, the *i*th respondent would accept to pay the price, and $z_i^* = 1$ is observed.
- If $zi < ai$, the *i*th respondent would not accept to pay the price, and $z_i^* = 0$ is observed.

Using equation (4), these two conditions can be rewritten as:

- $Z_i^* \geq 1$ if $\ln e_i < \ln D(\bullet) - \ln a_i$.
- $Z_i^* < 0$ if $\ln e_i > \ln D(\bullet) - \ln a_i$.

Assume that the error term is normally distributed, so that ln $e \sim N(0, \delta)$. Then ln $e / \delta \sim N(0, 1)$ and the probability that a respondent would accept to pay the price can be written as follows:

$$\text{Prob}\left\{z_i^* = 1\right\} = \text{Prob}\left\{\ln e_i \leq \ln D(\bullet) - \ln a_i\right\} = \\ = \text{Prob}\left\{\ln e_i \leq \alpha_0 + \alpha_1 \ln y_i + \alpha_2 \ln P_i + \sum_j \eta_j \ln s_{ij} - \ln a_i\right\} = \\ = \Omega\left[\left(\frac{\alpha_0}{\varphi}\right) + \left(\frac{\alpha_1}{\varphi}\right)\ln y_i + \left(\frac{\alpha_2}{\varphi}\right)\ln P_i + \sum_j \left(\frac{\eta_j}{\varphi}\right)\ln s_{ij} - \left(\frac{1}{\varphi}\right)\ln a_i\right] \quad (5)$$

where $F[\bullet]$ denotes the cumulative standard normal distribution.

The coefficients α_0/φ, α_1/φ, α_2/φ, η_j/φ and $1/\varphi$ in equation (5) can be estimated by a probit analysis. While a complete demand function cannot be uniquely identified, equations (1), (2) and (4) imply that the results can be used for computing income and price elasticities of demand as:

$$\varepsilon_y = b_1 = \left(\frac{(\alpha_1/\varphi)}{(1/\varphi)}\right), \quad (6)$$

$$\varepsilon_p = b_2 = \left(\frac{(\alpha_2/\varphi)}{(1/\varphi)}\right). \quad (7)$$

4.2. Estimation results. Limdep 7.0 (Greene, 1998) was used for carrying out the probit analyses. Coefficient estimates for the two empirical specifications are presented in Table 1. The coefficient signs correspond to those found by Bergstrom et al. (1982) and Hobky and Soderqvist (2003) and income has a positive effect on the probability to accept a suggested price, whereas and price and suggested quality improvement are negatively related to the probability to accept. Table 1 also shows that a null hypothesis that coefficient estimates are equal to zero can be rejected at a significance level less than 1%. In addition, the results of the χ^2 tests indicate that the estimated models also work satisfactory as a whole.

The elasticities in Table 1 are computed from the coefficient estimates, following equations (6) and (7). The point estimate of the income elasticity of demand for the base case is 1.10, indicating that improvement in drinking water quality are a luxury good. However, a 95% confidence interval for ε_y ranges from 0.71 to 1.49, which means that the luxury label is not statistically significant. Those improvements in drinking water quality are an ordinary and price elastic good seems to be clear. A 95% confidence interval for ε_p around the point estimate of -2.15 is [-2.45,-1.85].

The price and income elasticities of demand for recreational amenities were computed using constant elasticity regression model (Table 1). The point estimate of the income elasticity of demand for the base case is 1.8, indicating that improvement in drinking water quality are a luxury good. However, a 95% confidence

interval for ε_y ranges from 0.71 to 1.49, which means that the luxury label is not statistically significant. Those improvements in drinking water quality are an ordinary and price elastic good seems to be clear. A 95% confidence interval for ε_p around the point estimate of -2.15 is [-2.45,-1.85].

Table 1. Estimated demand elasticities from two specifications (n = 300)

	Specification 1			Specification 2		
	Estimate	Standard error	p value	Estimate	Standard error	p value
α_0/δ	-3.31	0.500	< 0.001	-2.81	0.514	< 0.001
α_1/δ	2.23	0.049	< 0.001	0.289	0.053	< 0.001
α_2/δ	-0.549	0.029	< 0.001	-0.567	0.031	< 0.001
η/δ				-0.641	0.073	< 0.001
$1/\delta$	0.3231	0.019	< 0.001	0.259	0.027	< 0.001
Log-likelihood = - 1073; Restricted log-likelihood = - 1353; χ^2 (3) = 540; p value of χ^2< 0.001				Log-likelihood = - 1043; Restricted log-likelihood = - 1353; χ^2 (4) = 615; p value of χ^2< 0.001		
ε_y	0.717	0.150	0.061[a]	1.10	0.20	0.635[a]
ε_p	-1.73	0.095	<0.001[b]	-2.15	0.151	<0.001[b]

Notes: [a] Wald test of H_0: $\varepsilon_y = 1$. [b] Wald test of H_0: $\varepsilon_p = 1$.

Conclusions

That income tends to influence willingness to pay positively and significantly is a basic finding from the analysis in section 2 of the income elasticites of *WTP* for the case of environmental services in Pakistan. Consistent with the findings of Kristrom and Riera (1996) and Hobky and Soderqvist (2003), the analysis showed that the point estimates of the income elasticity of demand for this environmental service (recreational amenity) tended to be greater than unity. This implies that improved quality of drinking water is a luxury good. The confidence interval for the base case suggests that a 1% increase (decrease) in income would result in about a 0.7-1.5% increase (decrease) in the demand for reduced eutrophication effects. This indicates that income changes would indeed cause changes in the demand for this particular environmental service, but not any dramatic ones.

Turning to the price elasticity of demand, the results clearly suggest that improved quality effects of recreational benefits are an ordinary and price elastic good. According to the confidence interval for the base case, a 1% increase (decrease) in price would result in about 1.8-2.4% decrease (increase) in the demand for reduced eutrophication effects. This suggests that technological innovations that would make it possible to supply the improved environmental services at a lower cost would have a relatively large impact on the demanded quantity.

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