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RESEARCH ARTICLE

Economic Valuation of Arasbaran Forests' Non-use Values in Iran

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ABSTRACT

Covering an area of around 148,000 hectares, Arasbaran forests are located in the northernmost parts of East Azerbaijan and Ardabil provinces in Iran. Arasbaran have provided unique treasures of environmental resources in the northwestern Iran due to rare plant and animal species they host as well as intact and broad landscapes within them. The present study aims to estimate non-use value of Arasbaran forests using contingent ranking method. Data was gathered through questionnaires filled by 334 visitors and citizens from ten cities in three provinces: East-Azerbaijan, West Azerbaijan and Ardabil. Based on the valuation method used in this study, the ranked ordered logit regression model was applied. Results showed that option value is the most and the existence value is the least important values of the forests Based on the results, respondents' level of education, income, number of annual visits from the forests and their friendly attitudes towards Arasbaran forests had significant positive impacts on WTP of respondents for the values of the forests. Results of the present study can be served as proper guidelines not only for policymaking and planning purposes, but also to attract public participation in the course of conservation and sustainable use of the valuable resources.

Key words: Arasbaran forest, contingent ranking, ranked ordered logit, l economic valuation, non-use values

INTRODUCTION

The total areas of East Azerbaijan's forests are about 188,000 hectares in which about 164000 hectares of forest belongs to Arasbaran. The area of 148,000 hectares of this forest has been reported as conservational and protected forests. (Approximately 78,560 hectares-about 56% of the area-are specified as protected forests). With respect to Arasbaran's specific climatic conditions, the existence of 1072 species of plants and 97 species of would have been reported in the area; therefore, it is supported as a reserve of "Biosphere" by UNESCO since 1976 and is one of the ten Biosphere reserves in Iran. Arasbaran with its beautiful nature, pleasant landscapes, historical monuments and places of power has a powerful potential to attract tourists. Medicinal plants in the region with significant value, as one of the pillars of regional development can be of particular importance (Department of Natural Resources in East Azerbaijan, 2003).

There are various divisions of the economic value of natural resources such as forests. However, considering the characteristics of Arasbaran forest, the economic values of forests can be divided into two general categories: a) Use values and b) non-use values. A) Use values are means of three categories:

1- Direct consumption values consisting of production value (Such as firewood).
2- Indirect consumption values, which are: information functions consisting of "recreation value," "research and educational value," "historical value" and "aesthetic value."
3- Non-consumption values consisting of "refugium function" (Protection of animal species) and "regulation function" (Regulation of gas, conservation of water and soil).

b) The non-use values are divided into three categories:
1) Existence value (The value that a person gives to an environmental resource's existence, even without using it),
2) Bequest value (The value of the forest resources for future generations) and
3) Option value (the value which a person gives to an environmental resource for future possible usage of it) (Heal et al 2005, Watson 2007, Pascual et al, 2010, Pak et al, 2010).

Due to extensive use of wood for coal production in the past, the present situation of the forests is delicate and fragile, and they are in the danger of demolition (Department of Natural Resources in East Azerbaijan, 2003). According to estimates presented by the World Bank, the net present value cost of damages caused by deforestation and degradation of forests in the Caspian Sea in Iran, which is the loss of benefits and functions of the forest in 2002, is about 760 $ and 147 million dollars respectively, which is 0.8 percent of Iran's GDP in this year (World Bank, 2005). Arasbaran forests are one of the natural treasures, which are located in Iran's North West region and like any other natural sources consist of non-use values. The overall purpose of this study is to estimate the non-use value of Arasbaran forests which could reveal the importance of these forests for society even in the case of not using them.

Due to the importance of economic valuation of environment, including the forests, many researchers have addressed this issue. In some studies, Contingent Valuation Methods have been applied to estimate the economic value of forests and other environmental services (Sattout et al. 2007, Khodaverdizadeh et al. 2008, Barala, et al. 2008, Mollaee, 2009, Pattison, 2009, Jahanshahi and Mousavi, 2011, Tao et al., 2012).

Some other researchers have used the choice experiment for environmental valuations. (Meyerhoff et al. 2009, Taylor and Tongo 2010, Wallmo and Lew 2011, Cerda et al. 2013, Salehnia 2011). In other studies, contingent ranking approach is applied for economic valuation of environment (such as: Garrod and Willis 1997, Kumar and Kant 2007). In some studies, to assess the recreational value of the environmental services, the travel cost method is used (such as: Hayati et al. 2011, Chae et al. 2012). While some studies have used two valuation methods and tried to compare their results in valuation of environment (like: Sayyadi et al. 2005, Bateman et al. 2006, Mogas et al. 2009).

Results from literature review indicate that despite the various effects of variables in the studies, briefly, factors such as demographic, economic and social variables associated with each studied resource's characteristics, besides respondent's environmental attitudes could influence respondent's willing to pay (WTP) for different features of environmentalresource.

The emphasis of this study is estimation of non-use value (the option, existence and bequest value using the Contingent Ranking (CR) method, which seems to be compatible with the general behavior of a consumer which is based on ranking of preferences and choosing between them. Therefore, The rank-ordered logit model, which is also suitable for CR method and is introduced by Beggs et al(1981) is applied in this study

MATERIAL AND METHODS

non-use functions of Arasbaran forests

If there was a direct market for environmental goods and services, using the normal pricing methods to value environmental services, would be possible. However, the lack of a suitable market for many environmental functions including non-use services, makes usage of these methods almost impossible.

In the present study, the contingent ranking method is applied to measure non-use values of forests. In this approach, the respondent is asked to rank his choices according to his preferences from the most important to the least important alternatives. For this reason, ranking data, could offer more information comparing with the choice experiment (in which respondent is asked to choose between deferent alternatives). However, this method is more complicated compared to other methods. Contingent ranking method could result in welfare- adapted estimations, provided that the status quo option is one of the alternatives in the choice series. So that in the case the respondent does not interested in any of improvement alternatives, could choose that one (Liu and Wirtz, 2010).

Implicit price of each attribute is the final rate of substitution between non-monetary and monetary attributes, and it is calculated from the ratio of the non-monetary factors to the monetary one:

$$M\arg inal\,WTP = -\left[\frac{\beta \quad non-monetary}{\beta \quad monetary}\right] \qquad (1)$$

The first and most important step in multiple valuation techniques, including contingent ranking, is designing of choice cards. To this end, the main attributes of the resource and the level of each attribute are identified; then the cards and henceforth the questionnaires are designed according to the characteristics of the test. In practice, attributes are selected from reviewing of previous studies or interviewing with the experts group (target group). It should be noted that the prices paid for the studied resources are one of the reviewed attributes and through the monetary factor, it is possible to estimate the willingness to pay for each attributes of the forest. Furthermore, the levels of each attribute are identified through the exploratory studies, literature reviews and interviews with the target groups. The statistical design theory is used for level composition and formation of appropriate scenarios to present to the respondents. Complete factorial design is one of the available options at this stage.

However, because of a large number of compounds in this technique, alternative methods such as "Partial factorial design" is used in which the number of possible combinations are greatly reduced. Table 1. shows the selected attributes in valuation of Arasbaran forests' non-use services. As it can be seen, the non-use values of Arasbaran forests are divided into three attributes with two levels. In this regard, the six alternatives and three choice set was determined that were gathered in one trio-blocks. The SAS 9.2 software was used for designing the cards. Each choice

set, includes the existence and non-existence conditions besides one status quo option. Also is observed that the existing, option e and bequest value have two levels (important or not important), while the bid price has three levels.

Figure 1, shows a sample ofthe selected cards to calculate non-use values of Arasbaran forests.

Ranked ordered Logit model (exploded logit regression)

The exploded logit regression conducted in many marketing researches. This model, in fact, is the expanded conditional logit model of McFadden (1987) which is presented by beggs et al (1981) in the economic literatures. The model was developed by Hausman and Rudd (1987) and presented entitled Ranked ordered logit model. The Basic techniques of this model are based on random utility model (RUM) (kummar and count, 2007).

It is supposed that respondent i derive utility U_{ij} for each forest value j, which includes a systematic component μ_{ij} and a random component ε_{ij} :

$$U_{ij} = \mu_{ij} + \varepsilon_{ij} \quad (2)$$

The respondent i would rank the forest attribute j upper than forest value k, providing that $U_{ij} > U_{iik}$. The error terms ε_{ij} is supposed to be independent and identically distributed, and assuming that:

$$\Pr ob(\varepsilon_{ij} < t) = \exp\{-\exp(-t)\} \quad (3)$$

Therefore the odds of ranking j higher that k could be explained through:

$$\exp\{U_{ij} - U_{ik}\} \quad (4)$$

The utility's systematic component U_{ij} can be specified through a linear function of a set of explanatory variables X_i s as below:

$$U_{ij} = \beta_j X_i \quad (5)$$

In which the X_i vector contains some variables which describe respondents' characteristics yet they do not differ among various attributes of the forest. Also β represent coefficients' row vector which should be estimated. The coefficients for those variables would differ among forest values, moreover one of the β_j vectors needs to be set equal to 0 for the identification achievement (the selection of the reference forest value is arbitrary). The model is equipollent to the common multinomial logit regression model. although, the name "exploded logit" name is applied to indicate an observed rank ordering of J forest attributes and could be regarded as an "explosion" into J-1 independent observations, in a way that if $U_{i1} \succ U_{i2} \succ ... \succ U_{ij}$, it can be expanded as: $U_{i1} \succ U_{ij}$, $j = 2,...,J$ و

$U_{i2} \succ U_{ij}$, j = 3,...,J و ... و $U_{ij-1} \succ U_{ij}$ (Salomon, 2003). Therefore, the data are considered to be a sequence of choices, in which the forest attribute or value with the highest preference is chosen over all other forest attributes, while the value with the second highest preference is picked out over all but the first one, and this can be continued like above. This explosion is possible through the independence assumption from irrelevant alternatives (IIA) which is also known as Luce's choice axiom, which indicates that the relative preference for any two forest attribute is indifferent to the choice set's other features (kummar and count, 2007).

The random utility model connotes the following likelihood L_i for a single respondent as below:

$$L_i = \prod_{j=1}^{j} \left[\frac{\exp\{\mu_{ij}\}}{\sum_{k=1}^{j} \sigma_{ijk} \exp\{\mu_{ik}\}} \right] \quad (6)$$

in which the σ_{ijk}=1 , if $Y_{ik} > Y_{ij}$, and σ_{ijk}=0 , otherwise.

The statistical population of this study, is approximately 334 people, which are chosen randomly between visitors of the Arasbaran forests and also citizens of ten neighborhood cities (all were within a radius of 250 km from the forests), from three abutting provinces: West Azerbaijan, East Azerbaijan and Ardabil. It should be noted that the sample size is calculated using the formula introduced by Orme (1998).

RESULTS AND DISCUSSIONS

Statistical characteristics of respondents are presented in Tables 2. The mean of age variable represents a middle-aged population of respondents. The majority of study subjects were married men and individuals with small families. The mean of annual gross income indicates a normal income for the majority of respondents, which have less than one visit per year from the forests. The ars variable indicates individuals' friendly attitude toward Arasbaran forests. (Index of friendly attitude towards Arasbaran). The index was consisted of 10 speeches to measure respondents' friendly attitudes towards the forests, such as ignoring some utilities for safeguarding them. Each speech is evaluated through codes from 5 (very important) to 1 (not important). Mean of this variable indicates relative importance of Arasbaran forest from respondents' point of view. Furthermore, the variable edu represent the education level of respondents, which is an ordinal variable identified as: 1=Illiterate, 2= Primary School, 3= Junior high school, 4= Senior high school, 5= Associated Diploma (AD), 6= BSc, 7=Msc and 8=PhD. Mean of this variable states that most respondents have academic education levels.

Table 3, shows the result of estimation of ranked ordered logit regression to non-use values of Arasbaran forests. The variable exist, opt and beqst show the importance of existence value, option value and bequest value for the respondents, respectively. Furthermore, the variable **P**, shows the bid price.

To infer the effects of individual variables that influence people's willingness to pay, the ranked ordered logit model with interactions of the bid price (p) with these factors was also estimated, which the results of estimation of both models are presented in the table 5.

According to the result, importance of each attributes has a positive effect on respondents' WTP, as expected. Moreover, based on the interaction model results, respondents' level of education, their income, their number of annual visits from the forests and their friendly attitudes towards Arasbaran forests have positive effect on WTP of respondents for the forests' non-use values. Using equation (1), the monthly, annual and total WTP for each value is calculated and the results are presented in the table 6.

As it is presented in the table, the option and the existence values are the most and the least important values, respectively. The same ranking results were obtained through the direct ranking question of the attributes which was asked from the respondents in the questionnaire. According to the conditions of the region which is unsuitable for public transportation and comfortable visits, yet, the importance of option vale is expected.

CONCLUSION

Table 4 reveals that public willingness to pay for non-use values of Arasbaran forests is a large amount of money. This issue shows the great importance of environmental valuation especially the non-use values of these Forests.

The study's results showed that is considerable amount of money. This issue could be helpful in the policy making for the improvement of forests condition, since the people's aid, considering the present situation of Iranian economic, could provide a major amount of money for preserving the environmental resources including Arasbaran forests.

The positive relation between income and WTP indicates that improvement of income in forested areas could help to better the habitant conditions. In this respect suitable policies and employment programs along with policy makings which support the environmental protection programs are suggested.

Furthermore, since based on the results the number of annual visiting of forests positively could increase the WTP for forests values, making opportunity for people, preparing tours and encouraging people to visit the forests, not only could increase the tourism income of region, but it also can help to preserve the forest and gather public aids to conserve them.

Finally since the study shows a significant link between respondents' positive tendencies towards Arasbaran forests, assisting NGO's formation regarding environment, especially forests, and related subjects, along with encouraging them to do activities to develop society's awareness of environmental resources and their values, besides disadvantages of deforestation and other environmental damages, is another suggestion; since the philosophy and nature of such organizations is to raise these kinds of information in the society or do activities like that. Besides them, governmental activities, like special TV programs, or advertisement billboards in appropriate places to augment society's knowledge towards natural treasures like forests is suggested.

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Table 1. The studied Attributes and their levels of Arasbaran forests

Non-use value of Arasbaran forests				
10000	Bequest value	option value	Existence value	Value
20000	important	important	important	levels
30000	Not-important	Not-important	Not-important	

Table 2. Variable definition and sample statistics

Variable	**definition**	**Mean**	**SD**	**Min**	**Max**
Respondent's Income (Rials)	inc	5343000	740.761	250	6000
Age of respondent	age	40.396	7.70	23	71
Gender(1=male, 0 otherwise)	gndr	0.73	0.445	0	1
Level of education	edu	5.86	1.01	4	8
Family size	fmlsz	3.46	1.3	1	7
Number of annual visits	vst	0.63	0.73	0	3
Index of respondents perspectiveon forests	arsb	3.71	0.68	2	5

Table3: Estimation result of rank-ordered Logit model non-use values of Arasbaran forests

Rank-ordered logit regression with interactions		Rank-ordered logit regression		Variable
Standard eror	coefficient	Standard eror	coefficient	
0.0000878	***-0.0013	0.0000273	**-0.000193	P
0.062	**0.143	0.060	***0.117	exist
0.065	***0.623	0.064	***0.606	opt
0.045	***0.218	0.046	***0.119	beqst
0.000011	***0.0000321	-	-	pedu
0.000000013	***0.000000037	-	-	pinc
0.000021	***0.00016	-	-	pars
0.000017	***0.000076	-	-	pbaz
LR chi2= 801.77*** , Pseudo-R^2=0.39		LR chi2= 391.02*** , Pseudo-R^2=.36		

***: P<0.01, **: P<0.05, *: P<0.1

Table4: Results of WTP extractingand ranking of non-use values

İmportence of bequest value	İmportence of option value	İmportence of existant value	values
1914.79	5477.40	1262.55	Ind. monthly WTP(Rials)
22977.48	65728.89	15150.6	Ind. annual WTP(Rials)
185.05	529.35	122.01	Total WTP(million Rials)
2	1	3	Ranking of values

Alternative C	Alternative B	Alternative A	attributes/ levels	Question 1
None of these things are important to me and I am not willing to pay any price for it.	Importance	Importance	**Existent value** The valuefor the existence ofthe forest, notto use it	
	Importance	Importance	**option value** The value of forests for future uses	
	Unimportant	Importance	**bequest value** The value of forests for use of future generations	
	10000	50000	 **WTP(Rials)**	
○	○	○	Please selectfrom 1 to3 above,you will prefer **(1 is the best)**	

Figure 1: Examples of chosen cards for the calculation of non-use values