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Economic Valuation of Local Environmental Amenities: A Case Study of Bahir Dar City, Amhara Regional State, Ethiopia

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Abstract

This study estimates the economic value of local environmental amenities in Bahir Dar city which is one of the tourist attraction sites in Ethiopia. The study employed choice experiment valuation method by identifying four environmental amenities attributes (Lake Tana, urban park, palm tree and street cleanliness). The study used probability multi-stage random sampling technique. The analysis was based on primary data surveyed from households in Bahir Dar city. The study presented nine choices set for each respondent; each choice set has three alternatives including the status quo option. The study employed a mixed logit model. The result showed that all improved attribute levels have positive signs and statistically significant. As expected and consistent with economic theory the monetary cost has negative signs and significant. The mixed logit model showed that there is preference heterogeneity in some attribute levels. Based on the finding, the study recommends that the city administration and the concerned body expected to implement the hypothetical policy scenario so as to improve environmental amenity.

Keywords: Bahir Dar City, choice experiment, valuation, environmental amenity, mixed Logit

Introduction

Environmental amenities, like beautiful vistas and famous natural landmarks, are highly valued by many people, but it is difficult to determine what would constitute an optimal supply of them (Lanz & Provins, 2013). Environmental amenities in large part are collective goods since it is impossible or impractical to exclude individuals from them (Eagle, 2004). High quality environment can bring joy and a healthy lifestyle to people, and their design and location constitute a key component of urban planning in the quest for healthy communities and sustainable cities (Jim & Chen, 2006). Within cities and across cities, non-market amenities are an important determinant of where people choose to live and work (Kahn, 2014). Environmental amenities provide a major attraction for tourists and are an important element in the development of a tourist industry. However, much of these environmental amenities are under threat through neglect, decay, removal or destruction as well as through the less visible and tangible impacts of changing socio-economic values (Mossu, 2015). Bahir Dar city as one of the urban areas has some challenges that are hindering the existing quality from being a place for tourism to the maximum extent that the city full potential can be

reflected and especially the direction of the development (Samson, 2010). Many environmental amenities exhibit public good characteristics and generate significant externalities. Thus, the understanding of economic value of environmental amenity service has always been hindered by lack of tangible economic values for environmental pleasures (Lern, 2012). Since environmental amenities are non-market benefits, the consumer is both the producer and consumer. Thus, measures of non-market benefits are concerned with estimates of consumer demand and consumer surplus (Lipton, Wellman, Scheifer & Weiher, 1995). Environmental amenities cannot be directly priced due to their non-consumptive nature. The provision of non-market environmental amenities can be identified via proxy market approach to exploiting relationships between consumption of a market good and the amenities of interest (Lanz & Provins, 2013).

To settle any competing preferences, environmental amenities need to establish economic value from society's point of view (Dikgang & Muchapondwa, 2017). Bahir Dar city where this study was conducted is one of the leading tourist destinations in Ethiopia, with a variety of attractions in the nearby Lake Tana and an attractive environment (Nigussie, Genetu, Atushi, Mistru & Dereje, 2012). Environmental amenities bring benefits to people and improve their quality of life both with the city border and the surrounding areas. A growing urban population increases the demand for ecosystem service in cities and extensive areas around them (Samson, 2010). Bahir Dar city is known for its wide avenues lined with palm trees and varieties of comfortable environmental amenities including green areas (urban parks) (Kassahun & Gebre-Egziabher, 2019). Having this, some studies were conducted with the hedonic pricing method to measure the amenity value of environmental quality through the implicit price of houses and other related properties. For instance, Carriazo's (2008) value of air quality, Khorshiddoust's (2013) correlation between environmental quality and preference of buying a house, Hoshino and Kuriyama's (2010) measuring urban park amenities, Hiebert and Allen's (2019) environmental amenities across space and Engström and Gren's (2017) value of green space. But it is difficult to provide an objective measure of environmental amenity change or in other words subject to the measurement problem.

Further, some studies were conducted with the appropriate choice experiment method to estimate the value of environmental amenities. For instance, Jim and Chen (2006) recreational amenities of urban green space, Bennett, Dumsday, Howell, Lloyd, Sturgess and Van Raalte (2008) environmental quality of rivers, Arabamiry, Khalid, Rahim and Khademfar (2013) economic valuation of Marine park, Lanz and Provins (2013) preferences for the spatial provision of local environmental improvements, Dikgang and Muchapondwa (2017) valuation of environmental amenities and Chen and Chen (2019) preference of local residents and tourists regarding green island. However, they focus on environmental specific goods like rivers, lakes, parks and the like. Besides this, the types and characteristics of environmental goods which generate environmental amenity service for reisdents are different which needs valuation for environment specfic goods in this area that generate amenity for local resients. The main objective of this study is to estimate the economic value of local environmental amenities in Bahir Dar city with choice experiment method. The specific objectives were too estimate the marginal willingness to pay for each environmental amenity attribute and the welfare change of environmental amenity improvement from the hypothetical scenario.

Materials and methods

Bahir Dar city is one of the major tourist destinations of the country with a variety of attractions in the nearby Lake Tana (Ethiopia's largest lake and famous for churches and monasteries on the lake's 37 islands), Blue Nile river and enjoys tropical type of climate with

an average elevation of the city is estimated 1801 m above sea level (Kassahun Tassie, 2018). Specifically, the city is one of the leading tourist destinations in Ethiopia, with a variety of attractions in the nearby Lake Tana and other attractive environmental characteristics. Environmental amenities bring benefits to the residents and improve their quality of life through well-being improvement enjoys from the environment. Therefore, it is a need to establish the economic value of environmental amenities from the household's point of view to settle any competing preference.

The study used primary data gathered from sample households using a structured questionnaire by applying face to face interviews to reduce the non-response rate and incompleteness of data. A list of households was generated from Kebelle administrations to form the sampling frame. The objective of this study was to determine the economic value of local environmental amenities in Bahir Dar city. For such quantitative research, the probability sampling technique is appropriate as compared to the non-probability sampling technique because it gives every sample household an equal chance of being interviewed. The study area has been divided into 17 administrative Kebelles. So, for the purpose of this study, all Kebelles categorize into three main groups: Core, Middle and Outer depending on geographical location and its respective characteristics for primary data collection from sample units. Thus it employs a multi-stage sampling technique: the first stage is stratification of the study area second stage is selection of city Kebelle administrations and the third stage is selection of households from each sample Kebelles) to make the sample representative and more homogenous characteristics of the study population. The sample size determination for the discrete choice model when considering the main effect or fraction factorial design the rule of thumb as proposed by Johnson and Orme (2003) cited in Bekker-grob et al.(2015) suggests that the sample size required for the main effect depends on the number of choices set per respondents, the number of alternatives for each alternative, the number of blocks and the number of largest level from any attribute which the researcher identified.
The equation is given by:

$n \geq \frac{500 \times largest\ level}{choice\ set\ per\ individual \times alternatives} \times b$, where 'n' is the sample size and 'b' number of blocks.

Accordingly, for this study as identified the number of levels is three for all non-monetary attributes and the monetary attribute has seven levels including the constant base (status quo) the level of each attribute including monetary cost is determined by focus group discussion. The number of choice tasks for each respondent was 9 with two blocks and a total of 18 choice tasks because it is difficult for each respondent can answer all 18 choices set without blocks and results in vague responses from the respondents. Finally, the numbers of possible alternatives for each respondent regarding environmental amenity improvement options (utility improvement) were three including the constant base and two other future improvement alternatives. Therefore, the minimum required sample size for this study becomes:

$n = \frac{500 \times 7}{9 \times 3} \times 2 = 260$

The first step in designing a choice experiment is to define the decision problem under consideration. The key decision problem addressed by this study is the lack of information about economic values of environmental amenity improvement in Bahir Dar city regarding

household's preferences. In order to measure the welfare effect of an alternative environmental characteristics (attributes) improvement option (level), a constant base option (status quo) needs to be included in the model. This allows the resulting welfare estimates are expressed as the additional costs and benefits of alternative amenity improvement options.

Attribute definition and level selection

The second major design stage in the construction of the choice model involves defining the attributes and levels which describes the alternative environmental amenity improvement options. A combination of primary data collection and secondary research methods are utilized to select attributes which are consistent with the decision problem. Some documents and face to face interviews from the administration of city green development office staff relating to specifically the study area environmental amenity characteristics are analyses to gain an understanding of current environmental issues and compile an initial list of potential attributes. This list is presented to the focus group discussion with previous amenity services experiences in Bahir Dar city. Participants were then asked which attributes played an important role in determining household's choices and were given an opportunity to add additional attributes. A refined list of attributes was provided to city green development staff for comment and final approval.

For this study, a decision is to restrict the number of attributes into five including the monetary attribute. Throughout this process, the researcher takes care to avoid the exclusion of salient attributes which could potentially introduce problems surrounding omitted variable bias. The final lists of attributes included for this study are Lake Tana, palm trees, urban parks, street cleanliness and annual monetary cost for environmental quality as a payment vehicle. With attributes defined, the levels which describe the potential future environmental amenity improvement options are developed.

Experimental design

The aim of a choice experiment method is to estimate the weights that respondents place on each of the attributes which define the alternatives. A respondent acting rationally is expected to evaluate the alternatives in a choice task and choose the alternative which gives the greatest relative utility. This study is used experimental design procedures in the choice model to formulate various attribute profiles and choice sets presented to the respondents. Even if the full factorial design has the capablity of being able to estimate both main and interaction effects (all possible attribute-level combinations), the combination of attributes with each level results large number of unique treatment combinations. Due to this, it is not simply practical for respondents to simultaneously evaluate such large number of alternatives. Due to the difficulty of full factorial design, this study used fractional factorial design which is a sample of the previous one by assuming implicitly all attribute interaction is negligible.

According to Greiner, Bliemer and Ballweg (2014), experimental design stage considers at least three basic issues. Firstly, the number of alternatives, attributes, and attributes levels are identified above. Secondly, response mechanism, a response in discrete choice experiment can take different formats including 'pick-one' and 'best-worse'. This study is used pick-one response format which is better mimics real-life decision making and captures only the first preferences. Finally, the number of choice tasks answered by each respondent also considered during experimental design. The total choice sets which are designed by algorithmic design with R software were 18 with two blocks, which was optimal and its respective d-error was 17.6% which is acceptable and best. To be attribute levels balanced the total number of choice set should be a common multiple of different levels of attributes and each level from its respective attribute had an equal chance of occurrence.

Accordingly, those attributes which have 3 levels had a chance of 6 times occurred each level in a choice set ($\frac{18}{3} = 6$), similarly the monetary attribute with 6 levels excluding the constant base, each level had an equal chance of occurrence 3 times in a choice set ($\frac{18}{6} = 3$).

Econometric models

The theoretical foundation of choice modeling rests up on random utility theory. The central idea behind random utility theory is that consumers derive satisfaction not from the goods themselves but from the characteristics (attributes) they provide. Accordingly, the individual depends on the choices that an individual made from a given choice set which includes the possible environmental amenity improvement options (Metkel Aregay and Wassie Berhanu, 2019). This study follows the standard random utility model (RUM), where an individual *i* chooses an alternative j over k in choice task t if the utility of j is greater than the utility of k. Individuals are asked to choose between alternative goods, which are described in terms of their attributes. Consider the two alternatives case. The underlying utility function of individual 'i' is of the form:

$U_{ij} = U(X_j)$
$U_{ik} = U(X_k)$

Where: X_j and X_k are vectors of attributes including price attributes which are describing alternatives j and k. Individual i will choose alternative j over alternative k, if and only if $U_{ij} > U_{ik}$.

The utility of respondent i associated with alternative j is:

$U_{ij} = V_{ij} + \varepsilon_{ij}$, i= 1, 2……N, j= 1, 2……J,

The utility of respondent i associated with alternative k is:

$U_{ik} = V_{ik} + \varepsilon_{ik}$, i= 1, 2……N, k= 1, 2……K,

Where $V_{ij}$and V_{ik} are the deterministic components of the utility functions, and $\varepsilon_{ij}$and $\varepsilon_{ik}$are the stochastic components which arise because the researcher only imperfectly observe how individuals process the information. The probability of observing individual i choosing alternative j over k is: $Pr(U_{ij} > U_{ik}) = Pr(\varepsilon_{ik} < \varepsilon_{ij} + V_{ij} - V_{ik})$, $j \neq k$ or $pr(j/C) = pr(Vij + \varepsilon ij > Vik + \varepsilon ik)$, where C is the complete set of alternatives (in this case alternative j and alternative k). This is the cumulative distribution of ε_{ik} conditional on ε_{ij}, V_{ij} and V_{ik}. In order to make this equation empirically acceptable, assumptions must be made regarding the structure of the error terms. As usual, the researcher assumes that the random error is independently and identically distributed (IID) according to a Gumbel distribution, which implies that: $Pr(j/C) = \frac{e^{(\eta Vij)}}{\sum C_e^{(\eta ViC)}}$, where η is a scale parameter which is inversely proportional to the standard deviation of the error distribution. This parameter cannot be separately identified and is therefore typically assumed to be one. In other words, the same parameter for all individuals for all attributes since the model is a conditional logit model. This means homogeneous taste and preference. This assumption implies a constant error variance and also implies that as $\eta \rightarrow \infty$ the model becomes deterministic.

In order to derive an explicit expression for this probability, it is necessary to make an assumption regarding the distribution of the error terms. A typical assumption is that they are independently and identically distributed with an extreme value distribution. This distribution for the error term implies that the probability of any particular alternative being chosen as the most preferred can be expressed in terms of the logistic distribution, which results in a specification known as the conditional logit model (Hanley et al., 2006).

Now the equation becomes $Pr(j/C) = \frac{e^{(Vij)}}{\sum C_e^{(ViC)}}$.

Now impose structure on V_{ij} and assume it is a leaner function of attribute levels.

$V_{ij}^{CL}=\sum_a B_a X_{aj} + \alpha P_j$, where the B's measure the marginal utility for improvements undertaken, 'a' is attribute, X_{aj} levels of improvement specified in alternative j, α coefficient of monetary cost, and P_j is the price attribute. The utility specific to the status quo is capture by an alternative specific constant (ASC). In this case, marginal utility coefficients have estimated via maximum likelihood. The log-likelihood function is given by:

$lL = \sum_i \sum_j y_{ij} lnPr_{ij}(X_{ij}, P_{ij}, \theta)$, where θ is the vector of parameters estimated from the data, y_{ij} is an indicator variable which is equal to one if individual i choose alternative j, zero otherwise. This structure is known as the conditional logit choice model (Lanz & Provins, 2013). The conditional logit model is convenient for its tractability, but it imposes heavy structure on observed choices. Specifically, the IIA property of the error term across alternatives, homoskedasticity assumption among individuals, and the assumption that all respondents make their choices based on the same utility function imply restrictive substitution patterns among alternatives, known as the 'irrelevance of independent alternatives' property. Independence of irrelevant alternatives captures all sources of correlation over alternatives in the representative utility. However, the researcher was unable to capture all sources of correlations among alternatives, so that unobserved part of utility has correlated as result IIA not hold. Hence more general model than the standard logit model is needed because IIA failed. A more flexible alternative is the 'mixed logit'(MXL) model, which exploits the panel data structure to accommodate preference heterogeneity at the individual level (Hanley et al., 2006). Mixed logit model can consider the random preference variations among individuals and it allows correlation of unobserved portion of utility over time. Under mixed logit model coefficients of attributes are random to account taste of respondents. The odds of probabilities of two alternatives could not be affected by adding or removal of other alternative.

$Pr(U_{ij} > U_{ik}) = \int \frac{e^{(V_{ij})}}{e^{(V_{ij})} + \sum_k e^{(V_{ik})}} \phi(\theta/\bar{\upsilon}, \Sigma)d\theta$, where ϕ(.) is the multivariate normal density and $\bar{\upsilon}$ is the mean of θ. Therefore the utility of alternative "j" of individual "i" is given by: $U_{ij} = ASC_0 + \beta_i AL_i$ where, ASC_0 represent alternative specific constant which accounts the mean effect of unobserved factors in the error term for each alternative, "β_i" represents parameters of attribute levels "AL_i" represents attribute levels.

Estimation of marginal WTP and welfare change

The marginal WTP is given by the ratio of the parameter of attribute levels to the ratio of price parameter multiplied by the negative sign. This measure the marginal WTP of improved environmental amenity attributes give other attributes constant. $WTP = -\left(\frac{B_{level}}{\beta_{price}}\right)$ where B_{level} represents parameter of attribute level and β_{price} represents parameter of monetary cost. Beyond marginal WTP for each attribute level, the study also estimated total economic value

in terms of total willingness to pay. According to Lanz and Provins (2013) the cost of environmental amenity improvement is estimated through willingness to pay for improved environmental amenity alternatives. The WTP is estimated by scaling the utility function with the marginal utility of income. The estimation was based on simulation maximum likelihood and assumes that individual WTP is normally distributed. Choice experiment able to estimate the welfare effect of changes in attributes. The study estimated welfare change or consumer surplus in two proposed hypothetical scenarios. The study estimated the welfare change through comparison of the utility of the two policy scenarios with the utility of the status quo.

Welfare change = $\frac{1}{P_\beta}(V_i - V_0)$ Where, V_0 is indirect utility from the status quo alternative, V_i is indirect utility from improved alternatives. P_β is estimated parameter of the monetary cost.

Results and discussion

Respondents' characteristics

The survey contains 65% and 35% in terms of gender males and females respectively from the sample population. Regarding with marital status of the sample population 60.77% was married and the remaining 39.23% single. The distribution of respondents' age is skewed towards younger 80.77% of respondents being younger 40 years of age. In case of educational level, respondents had a high level of educational attainment with 58.46% having some form of tertiary qualification and above. The remaining 21.92% and 19.62% were primary education attainment including illiterate and secondary educational attainment respectively. In terms of household annual income 23.85% of respondents recorded annual household income less than Birr 36,000 and only 11.92% of respondents recorded household annual income greater than Birr 120,000. The remaining 64.23% of respondents recorded annual income between these gaps (Birr 36,000-Birr 120,000). Finally from the given alternative presented the respondents select 89% and 11% of improved alternative and status quo alternatives respectively.

Econometric model

The IIA assumption does not hold the conditional logit model would yield biased estimates. The study employed Hausman and McFadden test under the null hypothesis no violation to test the IIA assumption and the assumption is violated. This test is indicated in Table 1. Hence, the conditional logit model is not an appropriate model. Due to the violation of IIA property, the study considered alternative models namely mixed logit model and mixed logit model with interaction to identify the source of heterogeneity.

Independent irrelevant assumption test

Despite the violation of IIA assumption the conditional logit model further assumes homogeneity across individual preferences. Since preferences are heterogeneous the study considered and takes into account this heterogeneity in order to obtain unbiased estimates of individual preferences. Mixed logit model relaxes the property of IIA and allows the parameters of observed variables to vary randomly across individuals rather than being fixed (Cheng & Yang, 2015).

Table 1 Independent irrelevant assumption test

Drop alternative	Chi-sq	Degree of freedom	Decision
Alternative 2	80.1	10	Reject IIA
Alternative 3	59.4	10	Reject IIA

Table 2 Estimated result of mixed logit model

	Variables	Coefficient	Std. Err.	Z	P>z	[95% Conf. Interval]
Mean	ASC0	46.54312	.	.	.	..
	Price	-.0094913	.0044653	-2.13	0.034	-.0182431 -.0007394
	tana2	.8077139	.1403525	5.75	0.000	.5326281 1.0828
	tana3	1.266744	.1942437	6.52	0.000	.8860332 1.647455
	palm2	2.293247	.2467449	9.29	0.000	1.809635 2.776858
	palm3	2.576425	.2326646	11.07	0.000	2.120411 3.032439
	park2	.9790602	.1148302	8.53	0.000	.7539971 1.204123
	park3	.7171971	.1449938	4.95	0.000	.4330144 1.00138
	scl2	.4067104	.1449726	2.81	0.005	.1225694 .6908514
	scl3	.38779	.1686538	2.30	0.021	.0572347 .7183453
SD	tana2	.3949197	.3022471	1.31	0.191	-.1974737 .9873131
	tana3	1.560518	.2433866	6.41	0.000	1.083489 2.037547
	palm2	.9871458	.1974337	5.00	0.000	.6001828 1.374109
	palm3	-.3038715	.2155115	-1.41	0.159	-.7262664 .1185234
	park2	.5134793	.1691038	3.04	0.002	.182042 .8449165
	park3	.1677824	.2266922	0.74	0.459	-.276526 .6120909

AIC = 2437.253				Number of obs = 7020		
LR chi2(7) = 106.23						
Log likelihood = -1201.6265				Prob > chi2 = 0.0000		
	scl2	.8766893	.167019	5.25	0.000	.549338 1.204041
	scl3	-.9164167	.1432041	-6.40	0.000	-1.197092 -.6357418

The result of mixed logit model from **Error! Reference source not found.** shows that all improved levels of environmental amenity attributes of Bahir Dar city are positive as expected and statistically significant at 1 percent level of significance except one level of street cleanliness which positive and statistically significant at 5 percent level of significance. The positive sign and significance of all non-monetary attribute levels indicate that households preferred improved environmental amenity relative to the current situation or status quo. One important environmental amenity attributes are urban park which is positive and statistically significant. This indicates that as the quality and quantity of urban parks improved the utility of residents generated from the environment increased and they preferred the improved level of urban parks relative to the current situation which is in line with the previous finding conducted by Engström and Gren (2017). Contrary, the finding conducted by Hoshino and Kuriyama (2010) indicated that the existence of urban parks reduced the utility of residents and hence, less likely preferred by the residents. This is because large parks often present external diseconomies like congestion and noise for residents around the parks. Interestingly, the study conducted by Jim and Chen (2006) confirmed with this study indicated that cities characterized with insufficient urban parks discouraging the recreation use of residents result increasing the number of urban parks more preferred than the current situation or status quo in this study. Urban trees like palm trees are a powerful symbol for city beautifulness and provide benefit through amenity service and hence improve the welfare of the residents who live in the city this indicated by positive sign or positive marginal utility from both improved levels of palm tree attribute which is consistent with the previous finding Giergiczny and Kronenberg (2014). Similarly, the study conducted by Sander, Polasky and Haight (2010) confirmed that local tree cover like palm trees are more preferred and valued by the residents in the city. The other environmental amenity attribute identified by this study is street cleanliness as mentioned above it positively signed and statistically significant this indicates that the improvement of local environmental amenity in terms of improved street

cleanliness is preferred and valid from households point of view this result is confirmed with Lanz and Provins (2013). The monetary cost coefficient of mixed logit model is negative as expected and statistically significant at 5 percent level of significance. This implies that households' demand to improved amenity decrease as the cost of improvement increase. The alternative specific constant of mixed logit model is positive but it is statistically insignificant. The overall fit of the basic mixed logit model was best fit and better than the conditional logit model based on pseudo R^2. This can be calculated as: Pseudo $R^2 = 1 - \frac{LR_{ur}}{LR_r}$, where LR_{ur} is the log likelihood of unrestricted model when the parameters vector is at convergent and LR_r is the log likelihood of restricted model when all parameters set to zero. $R^2 = 1 - \frac{-1201.6265}{-2568.3} = 0.532$. This indicates that the model is best fit by conventional standard and estimation of mixed model improves model fitness than the conditional logit model. Likewise, the joint test indicates that the amenity attribute levels of improvement jointly influence the decision of respondents. Overall the mixed logit model allows parameters variation across alternatives. Preference variation over alternatives from the mixed logit model is indicated by the standard deviation of attribute levels. The significance of the standard deviation of this model indicates the structural advantage of the mixed logit model over the conditional logit model. The mixed logit model estimation result also reveals the significance and large derived standard deviation for five attribute levels i.e. tana3, palm2, park2, scl2 and scl3 this indicates that the data supports choice specific unobserved heterogeneity for these attribute levels. The result shows that the standard deviation of tana3, palm2, park2, scl2 and scl3 attribute levels statistically significant at 1 percent level of significance. This indicates preference heterogeneity of respondents in terms of these attribute levels.

Mixed logit model with interaction

The mixed logit model does not show a source of heterogeneity. Hence it needs a mixed logit model with interaction. To estimate the mixed logit model with interaction the study included the interaction of individual-specific socioeconomic characteristics with attribute levels in the utility function. The interacted variables are obtained by interacting random parameters with other socioeconomic variables decomposes any heterogeneity which observed with the random parameter from the basic mixed logit model indicated by their statistically significant standard deviation and hence showing the source of heterogeneity in the mixed logit model with interaction. This study conducted various interactions of different environmental amenity attribute levels which have individual heterogeneity in the basic model with different socioeconomic characteristics of the respondents observed from the survey. The socioeconomic factors which affect the preference of households for an improved level of environmental amenity attribute were age, annual income, level of education in terms of year of schooling, gender of respondents being male or female, occupation being government employee or not and family size of respondents have to influence the preference of households.

Estimation of WTP

To estimate the willingness to of environmental amenity attributes the study assumes that the monetary cost is fixed. This means all respondents have the same preference for a cost which is quite unreasonable and also the distribution of preference for cost attribute is normally distributed. The marginal willingness to pay was estimated by computation of the marginal

rate of substitution between environmental amenity attributes and the marginal utility of income represented by the monetary cost coefficient.

The study estimated marginal willingness to pay for improved level environmental amenity attributes from mixed logit model. The marginal willingness to pay for all improved attribute levels estimated was positive. This is an indication that the average respondents would experience an improvement in welfare with an increase in the level of environmental amenity attributes and hence would choose an intervention that maximizes their utility. The estimated marginal willingness to pay that all attribute levels are statistically significant at 5 percent level of significance based on the confidence interval test.

Table 3 Marginal willingness to pay result

Attribute levels	MWTP	[95% conf. Interval]
Tana2	85.100576	15.95079, 154.25036
Tana3	133.46389	19.581164, 247.34661
Palm2	241.61601	15.476386, 467.75563
Palm3	271.45162	30.093947, 512.80929
Park2	103.15359	8.0177708, 198.28941
Park3	75.56375	16.829209, 134.29829
Scl2	42.850927	4.164623, 81.537231
Scl3	40.857478	9.9807006, 71.734256

The result from Table 3 indicates that the MWTP of palm tree attribute levels are dominated over the other attribute levels which indicate that from the household's point of view on average the palm tree attribute of environmental amenity is more preferable than the other environmental amenity attributes identified by the researcher based on focus group discussion followed by the recreation comfortability of Lake Tana which is the second preferable environmental amenity attribute and it followed by the other environmental amenity attribute which is the quality and quantity improvement of urban park. The least preferable environmental amenity attribute is street cleanliness which measured by decreasing the stock of pollution and makes the streets comfortable for enjoyment. This is confirmed with the previous finding Sander et al. (2010) urban trees are more preferable for residents in the city.

Welfare estimation

The estimated MWTP indicates that the average willingness to pay for environmental amenity improvement. This cannot provide welfare estimate for future policy scenarios proposed by this study. The study needs to compare the utility of status quo with the future proposed policy intervention each described attribute levels improvement employed in the experiment. The utility estimated from each separate policy intervention proposed by this study is transformed into impacts that different policy interventions on the respondent's welfare. To estimate welfare effect the study proposed the following two policy intervention scenario: *Scenario one (medium improvement):* improved lake Tana by building public lodge, improved urban parks by building standardized toilet and DSTV for the existing parks, improved palm tree by replacing the old trees but stay the existing quantity, and improve the quality of street cleanliness by reduced the stock of pollution by 25%. *Scenario two (higher improvement):* improved Lake Tana by building public loge and treatment plant, improved urban park by building standardized toilet and DSTV and expand availability by increase additional parks, improved palm tree by replacing old trees and increased availability by adding additional tree and the quality of street cleanliness more improved by reducing stock of pollution on the street by 50%.

Table 4 Welfare estimation result

Attributes	Scenario one: medium improvement	Scenario two: higher improvement
Lake Tana	Building public lodge	Building public lodge and treatment plant
Urban Park	Building standardized toilet and DSTV	Building standardized toilet and DSTV and expand the park in terms of quantity
Palm Tree	Replacing the old trees	Replacing old trees and increased in terms of quantity
Street Cleanliness	Reduced stock of pollution by 25%	Reduced stock of pollution
Welfare change	ETB 68978.75796	ETB 90527.33733

The welfare change estimation result is presented in
Table 4. The compensating surplus from the status quo to the alternative policy scenarios increase with improved environmental amenity attributes described by its level of improvement as expected. The higher improvement scored ETB 90527.33733 welfare change this indicates that when if this scenario is implemented the welfare gain from the policy intervention will be this amount expresses in terms of monetary terms. Similarly when if the first scenario will implement the welfare gain will be ETB 68978.75796, which is lower as compared to the second scenario. Therefore, implementation of the second policy scenario will be better to gain more welfare change to the residents'.

Conclusion

Bahir Dar city is the third largest and fast-growing city in Ethiopia. Now a day Bahir Dar is one of the tourist destinations in Ethiopia, with a variety of attractions in the nearby Lake Tana and attractive environmental amenities like urban parks, palm trees and comfortable streets bordered by different tree species. This study aimed to estimate the economic value of local environmental amenities in Bahir Dar city. The study conducted mixed logit model to estimate the economic value of environmental amenity attributes and analyses the preference of households. The study found that there are positive and significant benefits of various levels of environmental amenity attributes in Bahir Dar city. As expected and consistent with economic theory, the monetary cost is negative and significant. The study also found that considerable preference heterogeneity indicated by the significance of their standard deviation from the mixed logit model. The source of heterogeneity was identified by conducting mixed logit model with interaction which to a large extent determined by age of respondents, gender of respondents, family size, annual income, respondents occupation being government employee or not and educational level of respondents. From this, the study concludes that the socioeconomic factors which affect the preference of households for an improved level of environmental amenity attribute were age, annual income, level of education in terms of year of schooling, gender of respondents being male or female, occupation being government employee or not and family size of respondents have to influence the preference of households. The study estimated marginal willingness to pay for each improved level of environmental amenity attributes. The study concludes that households have the willingness to pay for the improved level of environmental amenity. Regarding the order of preference improvement, palm tree quality and quantity is the most preferable amenity attribute from the household's point of view followed by improvement of Lake Tana more comfortable for recreation by building public lodge and treatment plant. The improvement of an urban park in terms of improving the quality of the existing quantity as well as increasing quantity in the city has significant and positive marginal willingness to pay and ranked the third preference from the households' point of view. The least preferable amenity attribute from the identified amenity attributes is the improvement of the quality of street cleanliness in terms of reducing the stock of pollution on the street. Finally, the study estimated welfare change by proposed two hypothetical policy scenarios. The study

concludes that the welfare changes from the two hypothetical scenarios of environmental amenity improvement would be ETB 68978.75796 and ETB 90527.3373 for medium and high improvement.

The final task of the study is to provide some policy recommendations for the policymakers, the beneficiary (public) and other concerned bodies. Hence, some policy recommendations can be highlighted from the study. Firstly, the estimated economic value can inform the improvement of environmental quality as the source of residents' utility by providing amenity service. Hence, the city clean, beauty and green development administration expected to build quality environmental situations by improving the quality and quantity of palm trees and urban parks so as to comfortable for recreation and provide utility to the residents. Secondly, the estimated value also informed that Lake Tana is one source of residents' utility by providing recreational service. Hence, the government expected to build a public lodge as well as treatment plant so as to make it more comfortable Lake Tana for recreation. Thirdly, the estimated marginal willingness to pay informed that the quality of streets needs to improve to some extent even if it is last preferred from households point of view. Hence, the city administration expected to control the society from exerting solid waste on the street so as to eliminate at least reduced stock of pollution on the street and hence, make the streets more comfortable for recreation.

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