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Elicitation Format Effects on Welfare Estimates of Riparian Habitat Protection in Kenya

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Abstract: Despite the values associated with riparian habitats (RH), in Nairobi County these habitats are under pressure from human activities such as: - urban farming, informal settlements and dumping of solid wastes. Recently, the Kenyan National Environmental Management Authority (NEMA) demolished structures along RH to promote their health. The intervention could be rational with economic and environmental implications on RH protection, but empirical evidence is lacking. Therefore, understanding welfare effects associated with change in Elicitation Formats (EF) could explain the observed behavior. Multistage sampling procedure was used to sample 774 households. Stochastic Payment Card (SPC) and Multiple Bound Discrete Choice Payment Card (MBDC) generated the data. Data were: - collected through interview schedule, analyzed using Two Stage Random Valuation model and processed with STATA. MBDC willingness to pay (WTP) seemed inconsistent even though it was 1.26 times that of SPC. At 1% significance level, a statistical difference in mean WTP values was observed between the SPC and MBDC data, leading to rejection of null hypothesis in favor of the alternative (There's a significant difference in mean WTP value between SPC and MBDC formats). Determinants (Age, Gender, Income, Distance, Necessity to protect and Land ownership) significantly influenced WTP across the three models. Standard deviations of WTP distributions were significantly influenced by (Distance, Age, Gender, Household size, Certainty of future incomes, Necessity to protect and Land ownership). The Kenyan residents were willing to pay positive amounts towards RHP. SPC valuation format was most preferred for valuation of RHP since it led to underestimation of RHP in Kenya. Change in EF positively influenced welfare estimates at 1% significance level leading to the rejection of the overall null hypothesis (Changing the EF does not significantly affect individual welfare estimates towards RHP in Kenya). Therefore, city authorities can now use the mean and SD estimates to benchmark their budget and policy proposals for RHP, with adjustments for individual WTP uncertainties, socio-economic and other characteristics of individuals, given they have proved to be important drives of welfare estimate decisions. Valuation estimates can now be used to formulate policies for restoration and protection of RH in Kenya and beyond to enhance their functioning. Moreover, more comparative studies can be done on valuation of other environmental goods and services with change in in EF as a variable.

Keywords: Contingent Valuation, Stochastic Payment Card (SPC), Multiple Bound Discrete Choice (MBDC), Willingness to Pay

1. Introduction

The word riparian habitat (RH) owes its origin from the Latin word 'riparius' which means "of or belonging to the bank" implying that any area or land adjacent to the water bank is regarded as a riparian area as per references [22, 37, 48]. Some studies have defined a riparian zone as "land within a minimum distance of 6 meters and a maximum distance of 30 meters from the water course" [23, 49, 27, 26, 37, 48]. Whenever the conditions in the riparian areas are favorable to support biotic systems, then these areas become

riparian habitats (RH) which simply means a home for riparian resources. In this study, the term RH was used to mean any land adjacent to water bodies such as (rivers, lakes, oceans, seas, swamps, dams, springs, marshes) with a minimum distance of 6 Meters from the bank of a water course to the nearby agricultural activity, place of residence or business and with good conditions to support riparian resources.

RH have been known over time for their provision of essential services such as hosting flora and fauna, acting as wildlife corridor and habitats, ecosystem services which contributes to both ecological and environmental conservation among others [26]. Most riparian areas are characterized by riparian resources such as: - plants, herbs, fish and livestock forage, shade, fuelwood, timber, idyllic setting for recreational and aesthetic purposes as noted by reference [35].

Despite the importance attached to the RH, in Kenya, these habitats have been endangered by frequent urban subdivisions, construction of residential and commercial buildings, human settlements, industrial activity and urban agriculture. Their health, has been degraded by dumping of solid wastes, discharge of harmful chemical effluents and untreated sewages into these areas, hence hindering their proper functioning and provision of essential services in line with references [39, 26, 14, 35]. In a quest to protect these habitats, the Kenyan government in partnership with non - governmental organization (NGO's) have been holding educational campaigns on the benefits of RH and ecosystem protection, which is in line with different provisions of the law. Emphasis has been on RH support for flora and fauna, regulation of water bodies, mitigation of floods and adoption of environmental friendly agricultural practices among others as per reference [8].

With the existence of different Acts and laws in regard to environmental conservation, it is expected that the construction of buildings and structures on these areas, coupled with environmental unfriendly agricultural practices, should be prohibited. However, in Kenya, urban agriculture, human settlement, erection of commercial buildings, and dumping of solid wastes is on the rise on these areas. This raises questions to any researcher on why the observed behavior, could it be happening that most people view these habitats as public good? Is it that individual interests and benefits surpasses societal benefits? Could it be that there are no proper policies on protection of these habitats? The observed scenario called for measures to combat people encroachment into these habitats in order resuscitate the lost glory of the Kenyan RH.

The Kenyan government has been slow in protecting RH simply because there is no single sectoral Act or law or provisions governing the use and protection of these habitats. Mostly, there is tendency to rely on general principles of environmental law and other general provisions from the Constitution and enabling Statutes to manage the riparian zones. Literature is huge on economic evaluation studies using stated and revealed preference approaches. However, revealed preference method has been criticized due to its failure to effectively measure non-use values which lack market value as stipulated in reference [29].

Stated preference method such as contingent valuation (CV) allows for elicitation of non-use values because of its simplicity and flexibility as noted in references [2, 3, 32] hence its commonly used. Valuation studies done so far on riparian zones range from: riparian forests and vegetation conservation practices as per reference [39], legislative framework for sustainable protection of riparian lands in reference [26] and riparian management as observed in reference [18]. Some studies such as reference [21] have focused on restoration of degraded riparian lands, using willingness to pay (WTP) as a proxy for measuring welfare estimates. Other researches as noted in references [28, 35, 34], have used descriptive statistics and Likert scale respectively to measure WTP. However, these methodologies failed to consider the fact that one's true WTP lies within a given range of values as observed by references [50, 45, 32]. As much as reference [35], appreciate the fact that individuals can be certain or uncertain in making good their true stated WTP, references [28] and [34] do not. For those individuals who are certain of making good their stated WTP, understanding their certainty levels and probabilities associated with those certainties would inform more on WTP studies. For those who are uncertain, they have uncertainty preference levels which vary across individuals, hence understanding the effect of this preference uncertainty on the true stated WTP would equally be informative on individual decision making process as advised in reference [30].

Computation of WTP as a proxy for welfare estimates using contingent valuation is common. According to references [6, 32, 40], a good contingent welfare valuation study should comprise of elicitation format (EF) as a key aspect. Therefore, understanding the effect of change on EF on WTP values could inform a better understanding on welfare estimates for riparian habitat protection (RHP), in a country where moral duty of care of RH is presumed to be a government role.

2. Literature Review

2.1. Theoretical Framework

The Consumer utility maximization theory which was developed by Alfred Marshall in 1860 was used. As per the theory, any rational consumer is after utility maximization subject to the budget constraint, or expenditure minimization subject to utility constraint. Thus, consider the following expenditure function for a utility maximizing household from RHP

$$e\ (p,s,x\ u) = y \tag{1}$$

where e is the expenditure function, p is a price vector, s is the state of the RH, x is the individual social economic characteristics, u is the level of utility, and y is the minimum income necessary to allow an individual to maintain utility level in the city. Furthermore, consider the situation where a

policy is proposed for RHP through reduced degradation. The policy, thus, prohibits degradation activities. An individual is then asked about the amount he/she would be WTP towards RHP through reduced degradation. The expenditure function for the initial period before the proposed policy would be:

$$e\ (p,\ s_o,\ x_o,\ u_{o)} = y_o \tag{2}$$

where u_o is the initial level of utility that an individual can enjoy given prices p, s_o is the initial un-protected state of RH, xo is the individual socio economic characteristics, and y_o represents the minimum level of income required to attain utility level u_o. Since the new policy is expected to improve the state of RH in the city from unprotected to protected, the new expenditure function would therefore be of the form:

$$e\ (p,\ s_1,\ x_o,\ u_o) = y_1 \tag{3}$$

where s_1 is the improved state of RH after the implementation of the proposed policy and y_1 represents the minimum income level required to attain utility level u_o after the implementation of the proposed policy. The level of utility, u_o, is held constant since Hicksian welfare measures assume that utility remains constant. Hence, the individual's WTP for improved state of RHP would be a compensating variation (CoV) measure since an individual would have to part with a certain amount for the improvement to occur. The CoV is equal to the individual's WTP and is given by difference between the expenditure functions y_1 and y_0:

$$CoV = WTP = y_{1-}\ y_0 \tag{4}$$

$$\text{CoV} = \{e\ (p,\ s_1,\ x_o,\ u_o) - e\ (p,\ s_o,\ x_o,\ u_o)\} \tag{5}$$

The improved state of RH denoted by s_1, is supposedly greater than the initial state of the habitat, s_o. As utility and prices are held constant, y_1 (the minimum income level required to attain utility level u_o after implementation of the proposed policy) is less than y_0. Therefore, the CoV would be negative meaning that an individual has to pay some dollar amount to enjoy the improved state of RH. Assuming that WTP is a random variable as observed from references [50, 45], and an individual's true WTP, is known to lie within a given range say (Q_i, Q_{i+1}), then the two stage random valuation model can be used to determine both mean and standard deviation together with their determinants.

2.2. The Stochastic Payment Card (SPC)

The SPC was first developed by reference [47] to estimate individual valuation distributions. The SPC is an extension of the payment card approach and is used capture uncertainty. In the SPC approach, an individual is presented with an array of prices or bid amounts represented in vertical axis whereas voting uncertainty levels accompanied by probabilistic value are represented on horizontal axis. The uncertainty ranges from as "definitely yes or strongly agree," "probably yes or agree," "not sure," "probably no or disagree," and "definitely no or strongly disagree as observed in references [37, 32, 19, 49].

From the respondent's choice of bid amounts and preferred probability levels measured under uncertainty scale, a response likelihood matrix is formed comprising of both numerical and probabilistic component, that can be interpreted as a record of an individual's cumulative valuation distribution function observed in reference [19]. The matrix is assumed to be random and can be used to predict an individual's true WTP for a commodity under uncertainty conditions as exhibited in reference [46]. Unlike other approaches, this method embeds uncertainty into the analysis by allowing respondents to state their own degree of certainty regarding their answers to each of the bid amounts offered and thereafter perform statistical analysis of the responses taking into account the different levels of certainty.

Methods such as dichotomous choice and conventional payment card assumes that each respondent has a single point value for a good or service in question, whereas, SPC assumes that an individual's valuation is best viewed as a random variable with an associated distribution as observed in reference [45]. The major limitations of SPC method is that it assumes all respondents interpret the certainty levels in the same way, which is unrealistic. More so there is a likelihood of raising the same type of range bias found in PC application, if the range values are not obtained from open ended approach. In summary the stochastic payment card asks an individual to indicate the probability that he will actually pay the stated bid amounts on the payment card and this probabilities ranges from zero to one. The probabilities are distributed across uncertainty preferences ranging from definitely yes to definitely no.

2.3. The Multiple Bounded Discrete Choice

This approach was developed by reference [50]. In this approach it is possible to provide respondents with a broad range of bids, like the PC method and a certainty range to allow respondents to express their uncertainty, similar to Polychotomous choice models. This elicitation format is in two stages whereby in stage one a respondent is asked to choose their preferred bid amounts then followed by individual expression of the level of voting certainty for each bid amount and by so doing the method is capable of introducing respondents' uncertainty into the analysis as noted by references [50, 15]. Just like SPC, MBDC method will lead to a two dimensional matrix where the first dimension (rows) provides the bid amounts and the second dimension (columns) allows respondents to express their level of certainty about each bid amount as expressed in references [32, 37, 29]. This is accomplished by substituting the yes/no choice given by the dichotomous choice method with a range of five possibilities similar to that used in Polychotomous choice: "definitely yes', "probably yes", "not sure", "probably no" and "definitely no" as observed in references [42, 44].

The advantages of MBDC are as follows: - the method presents respondents with a range of bid values unlike in the conventional payment card the MBDC circumvents incentives for starting point bias and the difficulty inherent to

the process of bid selection. MBDC method is slightly more efficient from a statistical point of view, thus provides a higher level of precision of its estimated parameters and estimates of central tendency as supported by reference [2]. The method is cheaper to implement given that it can be conducted with a mail survey, thus it avoids expensive personal or telephone interviews required by the DC approach as observed in references [50, 45]. Lastly the approach is applicable for policy purposes. For example, benefits of a policy can be measured by respondents who say definitely yes and if they exceed the budgeted policy costs, the policy will pass as advised in reference [31]. Reference [45] highlights on the major weaknesses of MBDC method in that there is a possibility of inducing the same type of range bias that has been found in PC and SPC applications. Moreover, the method assumes that the certainty levels are interpreted by all respondents the in the same way, which is impracticable.

3. Research Design and Methodology

3.1. The Study Area

The study was done in Nairobi County which covers approximately 696 square kilometers with a population of 4.4 million people and a population density of 6,300 persons per square kilometer [10]. The county is located at the south-eastern end of Kenya's agricultural heartland, at approximate longitude of 1° 9'S, 1° 28'S and latitude 36° 4'E, 37° 10'E. It has an altitude of between 1,600 and 1850 meters above sea level as noted in reference [32]. The county is endowed with well-drained, rich and fertile arable land which supports agricultural production. Almost 8 per cent of the Kenya's total population and 25 per cent of Kenya's urban population live in Nairobi according to reference [9]. The high population growth coupled with rural urban migration, act as drives of environmental change and major determinants of: - land-use patterns and settlement, consumption patterns and environmental quality as observed by references [27, 31, 26].

3.2. Targeted Population and Sample

Both riparian and non-riparian land owners available within the RH during the interview period were contacted. This population was estimated at 4.4 million people as per reference [10]. The composition of this population was heterogeneous due to their diverse socio economic and demographic characteristics besides their perceptions towards Riparian Habitat Protection (RHP). As such, multistage sampling technique was used to select 774 respondents from each of the sixteen locations. However, it is not clear whether this sampling technique is a probability or non-probability sampling method as found out in reference [1]. Most studies presume that it makes use of both probability and non-probability sampling methods, hence its regarded as flexible and broad in scope as per reference [13], and that is why it was used in this study.

3.3. Contingent Valuation Survey Technique

Personal interviews (PI) coupled with interviewer administered questionnaires were used to collect data. PI were chosen to enable the interviewer to motivate respondents to participate fully in the interview process. Moreover, PI allows one to clarify unclear questions to the respondent and even probe for more information according to references [31, 30]. The survey instrument used was a questionnaire. The questionnaire was divided into six sections, namely: Section one which sought the respondents' general knowledge of current state of RH in Nairobi, a section describing the RHP plan, another section describing the effects of RHP plan, a section describing the costs of the protection plan, a section having the valuation questions and lastly questions on respondents socioeconomic, environmental and demographic characteristics in line with environmental valuation literature as outlined in references [36, 29].

3.4. Survey Implementation

A pre-test of the survey instrument (questionnaire) was done on thirty respondents who were asked to complete the survey questionnaire [4, 12, 36, 39]. In the pretest, respondents were asked to comment on the suitability of the questions posed, paying close attention to wording, clarity, relevance and interpretation of each question in the survey and other anomalies [3]. The bid ranges for the study were established or collected from the pre-test exercise and they were used to determine the minimum, maximum and mean WTP values. Based on the responses and comments provided by the respondents during the pre-test, a final draft of the survey questionnaire was prepared.

3.5. Payment Vehicle

The study used a special trust fund as a payment vehicle. In this fund, respondents were required to make a one-time contribution, exclusively for the purpose of RHP. This vehicle was used given that in other studies it has been regarded as a neutral payment vehicle with minimal emotional reactions and protests. Moreover, given its ability to enhance the plausibility of the hypothetical scenario compared to other alternative payment vehicles considered by references [4, 31, 37], it was preferred.

3.6. Environmental Good Valued

Riparian habitats were valued using contingent valuation survey design. In Kenya, riparian habitats have been presumed to be a public good which exhibit public good characteristics such as:- poorly defined property rights, externality and free riding problems. However, there is no empirical evidence to support this assumption. In addition the good is regarded to be non- rivalrous and non-excludable besides being non- marketable, hence the use of CVM to elicit WTP for their protection as advised in reference [5].

3.7. Contingent Valuation Data Elicitation Format

Data for this study were elicited using the payment card (PC) format/approach, to establish peoples' preferences for RHP. Cards were given to respondents who were asked to circle the highest amount they would be willing to pay for protection of riparian habitats. From the responses given, inferences were made about their true WTP, which was equal to or greater than the circled value but less than the next higher value as indicated in references [4, 31, 37]. This approach was chosen because it offers a respondent the opportunity to visually scan through a given set of value intervals and hence one can easily determine the range within which his/her WTP lie. Equally, the format does not suffer from yeah-saying and starting point bias like other contingent valuation formats observed in references [4, 16, 19, 32, 37]. Although PC questions are theoretically susceptible to range and mid-point bias, there is little empirical evidence of the existence of range or mid-point bias as supported by reference [12]. In addition, while the format still has the possibility of yielding protest zeros, it has not been found to give very high proportion of protest zero responses compared to other contingent valuation formats as noted in reference [31]. Thus, the valuation question was formulated as follows:

"*Suppose the presented policy to protect RH in the city of Nairobi will actually be implemented, what is the maximum amount of money you would be WTP per month for one-year to the special trust fund to achieve this? (circle or tick a single amount on the card).*"

The PC included 15 different dollar bid amounts, namely: Kshs. 0, 50, 100, 150, 200, 250, 300, 400, 450,500, 550, 1000, 1950 and finally Kshs. 2,000, in which case respondents were required to circle a single amount on the card.

3.8. Analytical Model

The Two Stage Random Valuation Model was used to test the overall hypothesis that changing the Elicitation Format (EF) does not significantly affect individual welfare estimates towards RHP in Kenya. The model assumes that one's WTP denoted say by letter $Z_{j,}$ is a random variable which takes a cumulative distribution function say $\lambda(t)$ and the mean value of $Z_{j,}$ is $\mu_{j,}$ and the standard variance is σ_j , then the WTP model can be formulated as:

$$Z_{j,} = \mu_{j,} + \varepsilon_j \tag{6}$$

where ε_j is a stochastic term. If individual j knows her valuation distribution, given a bid price L_{ji} , then the probability of individual j saying 'yes' to the offer L_{ji} is possible, if the WTP is greater than the bid price, or 1 minus the probability distribution of the bid price as shown below.

$$P_{ji} = 1 - \lambda(L_{ji}) \tag{7}$$

Suppose the probability of the j^{th} person saying yes to the bid price L_{ji} is known either through assigning numerical values to the verbal MBDC likelihood data or through asking the individual to state his/her numerical probabilistic data as with the SPC format, then equation (7) can be estimated for each individual using the following estimation model.

$$P_{ji} = 1 - \lambda(L_{ji}) + e_i \tag{8}$$

where e_i is the random term which is normally distributed with zero mean and constant variance (δ^2) for respondent *j*, but different for different respondents. P_{ji} is the dependent variable, taking any value between 0 and 1. On the other hand L_{ji} is the explanatory variable representing bid price for individual j. Assuming the probability P_{ji} takes a normal cumulative density distribution function of the form $\lambda_j(.)$, with a mean μ_i and a standard variance σ_i , such that $\lambda(L_{ji}) = \phi\left(\frac{l_{ji}-\mu_i}{\sigma_j}\right)$, then the model (8) becomes:

$$P_{ji} = 1 - \phi\left(\frac{l_{ji}-\mu_j}{\sigma_j}\right) + e_j \tag{9}$$

Given that the specific objective of this study is to estimate and analyze μ_i and σ_i , which are functions of personal characteristics and uncertainties among others, equation (9) can be estimated for each individual j using two stage random valuation method. In stage one assuming that e_j takes a normal distribution, then equation (9) can be transformed as follows:-

$$\frac{P_{ji}-1+\phi\left(\frac{l_{ji}-\mu_j}{\sigma_j}\right)}{\delta} \sim N(0,1) \tag{10}$$

The standardized log function would give rise to:

$$\text{Log}\,(L_i) = \sum_{j=1}^{i} \text{Log}\,\Omega\left\{\frac{P_{ji}-1+\phi\left(\frac{l_{ji}-\mu_j}{\sigma_j}\right)}{\delta}\right\} \tag{11}$$

where $\Omega(.)$ represents a standard normal distribution probability density function. In stage two, μ_j and σ_i can be estimated for each individual. For example from equation (11), μ_j and σ_i can be estimated for each individual *j*, and models can be constructed to estimate their determinants as follows.

$$\text{Log}\,\mu_i = z_0 + q_i' z + e_1 \tag{12}$$

$$\text{Log}\,\sigma_i = \alpha_0 + y_i' \alpha + e_2 \tag{13}$$

where q_i' and y_i' are determinants of the mean and SD respectively. z and α are parameter estimates to be estimated; e_1 and e_2 are random errors. Two stage approach was chosen because it provides a less biased estimation of the mean, variance and standard deviation of individual valuation distributions since no econometric models are introduced at the first stage, unlike in one stage model as observed in reference [45]. Moreover, the results of the mean values and variances and standard deviations can easily be modelled and compared to other CV approaches as suggested in references [45, 46].

4. Empirical Results and Discussions

Two EFs were compared namely SPC and MBDC. In this study, three specific objectives were addressed in stages as follows: - first, estimation of WTP values and testing them for any significant differences, then determination of the effect of the determinants on WTP values and testing whether those determinants were significantly different from zero and lastly assessing the standard deviations of WTP values together with their determinants which were equally tested for any significant differences across the samples.

The following minor hypotheses on both mean WTP and SD of mean WTP values were formulated and tested as follows.

1) There is no significant statistical mean WTP difference between SPC and MBDC format empirical distributions.

H_0: $WTP^{SPC}=WTP^{MBDC}$ OR $WTP^{SPC}=WTP^{MBDC}$.

H_A: $WTP^{SPC}\neq WTP^{MBDC}$ OR $WTP^{SPC}\neq WTP^{MBDC}$.

2) There is no significant statistical mean standard deviation (SD) difference between SPC and MBDC format empirical distributions.

H_0: $SD^{SPC}= SD^{MBDC}$ OR $SD^{SPC}= SD^{MBDC}$.

H_A: $SD^{SPC}\neq SD^{MBDC}$ OR $SD^{SPC}\neq SD^{MBDC}$.

Table 1 presents findings on estimation of welfare estimates (Mean WTP and standard deviation of mean WTP values). The mean WTP values of the two formats were compared and tested for any significant differences using Mann-Whitney test statistic. The results show that MBDC format had a higher mean WTP (US$10.27±0.69) compared to SPC mean WTP of (US$8.15±0.43), a value slightly lower than that observed by reference [45], but very close to that realized by reference [46]. However, the finding was contrary to what was observed by reference [31] where MBDC had lower WTP values than SPC. This could be associated to the differences in sample sizes and analytical models used. The fact that SPC format yielded lower WTP estimates is consistent with what was found out by reference [46] for SPC format, and the difference could be attributed to the Elicitation Format used as shown by the Mann-Whitney test statistic (α=2.717).

When the two formats were compared based on coefficient of variation (CfV) which shows relative variability in WTP estimate between independent distributions, MBDC format mean WTP estimates showed a higher degree of dispersion as shown by the CfV (131%) unlike in SPC format whose CfV estimate was (103%), a result similar to that of reference [46]. This implies that MBDC individual WTP estimates were highly variable from the mean estimate, when compared to those of SPC format. The mean standard deviation (SD) of (Ksh. 1529.556 or $13.45) in MBDC format was higher when compared to (Ksh. 953.2753 or $8.38) in SPC format. Meaning that MBDC WTP values were highly inconsistent/uncertain when compared to those of SPC format. As much as studies like reference [46] have shown higher variability of individual estimates for SPC format, comparative studies on both SPC and MBDC formats are limited. The Mann-Whitney test statistic showed a significant difference in both mean WTP and SD values at 1% significance level as shown by (MWT α=2.217; p<0.01), implying that the mean values were significantly different from zero, hence leading to the rejection of their associated null hypotheses in favor of the alternatives, an observation in line with that of references [11, 46].

Table 1. *Evaluating differences in mean WTP estimates for different value Elicitation Formats.*

Descriptions	SPC (n=390)	MBDC (n=384)
Mean WTP in Ksh. (μ)	925.51	1167.60
Standard error of the mean	48.31	78.04
Coefficient of variation (σ/μ)	1.03	1.31
MWT-value (α)	2.717	
P-value (WTP)	0.007***	

Explanatory notes: Ksh means Kenya shillings, MWT implies Mann - Whitney Test; * p < 0.1; ** p < 0.05; *** p < 0.01.

To determine the effect of explanatory variables on average WTP, and on SD of WTP values, the following hypothesis was tested for SPC, MBDC and SPC-MBDC models in both cases.

HO: The parameter estimates are not significantly different from zero.

HA: The parameter estimates are significantly different from zero.

The joint effect of the determinants on mean WTP estimates in each of the three models was tested using F test and Table 2 presents the results. Factors (Age, Gender, Income, Necessity to protect RH and Distance) significantly and positively influenced mean WTP estimates across the models, while land ownership within the riparian area significantly and negatively influenced mean WTP values in the three models. The individual effect of these determinants are explained as follows: -

Older people had higher WTP towards RHP compared to the young, a plausible explanation could be that older people have less serious financial obligations compared to the young, hence can spare some monies for RHP. It could also mean that older people value and benefit more from RH services such as sightseeing, recreation and bird watching to kill boredom and enhances their quality of life, since most of the time they feel lonely as observed by references [17, 30]. Moreover, it could happen that older people are more susceptible to effects of unprotected RH as noted by references [7, 17].

Male headed households had higher WTP compared to female headed households contrary to reference [24]. A possible explanation for this positive influence is that men make decisions on financial matters at household level and control key resources besides their quicker access to information unlike women, a finding in line with references [41, 32, 31]. Income was significant with a positive sign as per the economic theory, implying that respondents would only protect RH if they have higher incomes as opined in references [33, 45, 25].

Distance significantly and positively influenced WTP estimates. Meaning that people who resided far from riparian habitats were willing to pay more unlike those who resided near, contrary to reference [43]. A plausible explanation could be that those who resided near gained less benefits from RHP and benefited more from alternative land use practices, hence they were less willing to pay towards protection. Necessity to protect RH positively and significantly influenced WTP values across the three models. Respondents who found it necessary to protect habitats had higher WTP compared to their counterparts. It could happen that those respondents were cautious with their health and social challenges associated with unprotected RH such as diseases and insecurity and thus their WTP was higher, a finding supported by references [38, 32].

Ownership of land in riparian areas significantly and negatively influenced WTP values across the models, implying that WTP estimates declined with land ownership. A plausible explanation could be that respondents who owned land in riparian areas found less need of protecting those lands for environmental gains instead they found pleasure in using them for alternative uses such as farming, building residential and commercial houses and brick making as observed by reference [33]. This confirms the need to sensitize land owners within the riparian areas that they can still make more profits through riparian ecotourism which is an opportunity for developing countries as noted by reference [41].

Household size was significant with a negative sign for only SPC and SPC-MBDC models. Meaning, WTP declined with increase in family sizes. A plausible explanation could be that larger family sizes were associated with more financial obligations unlike smaller families. Education level and certainty of future incomes positively and significantly influenced mean WTP in the pooled model. Meaning that households who had attained post-primary education and who were certain of their future incomes, were WTP more for protection compared to their counterparts, an observation similar to that of references [46, 45]. This is because those who had attained post-primary education found it easier to access information and could better understand the extent of unprotected RH problems and feasible solutions to those problems and therefore had higher levels of awareness as per reference [29]. Uncertainty of future incomes decreased WTP values, a result similar to that of references [46, 45]. This is because one would only pay more when he/she is certain of future incomes. Of importance is the effect of change in EF on WTP values. When EF was included in the pooled model as one of the explanatory variables, the results showed that change in format from SPC to MBDC increased mean WTP values by 6.7%.

It was realized that determinants (Age, Gender, Distance, Necessity to protect RH, Land ownership in riparian land, EF, Income, Household size, Certainty of future incomes and Education level) significantly and differently influenced average WTP values across the three models at 1% level as shown by their respective F tests ($p<0.01$, F=22.681; $p<0.01$, F=56.234; $p<0.01$, F=32.15) leading to rejection of null hypothesis in favor of the alternative (The parameter estimates across the three models were significantly different from zero) and hence they differently influenced WTP values. The overall models were fit at 1% level with adjusted R^2 of about 0.60 across the three models an observation slightly above that observed by reference [41] and the variation attributed to EFs used. From the pooled model, older and male headed households who had attained post primary education and whose data was generated using MBDC format, resided far from RH and found it necessary to protect the habitats even though they didn't own land near those habitats, leading to higher mean WTP estimates. Moreover, their income levels were high and more certain into the future thus their higher WTP.

Table 2. *Mean WTP estimates and the determinant factors for different Elicitation Formats.*

Characteristics	SPC Model DV=Log(μ_i)		MBDC Model DV=Log(μ_i)		SPC-MBDC Model DV=Log(μ_i)	
	Coefficient	Std error	Coefficient	Std error	Coefficient	Std error
Age (Years)	0.030***	0.003	0.007***	0.001	0.003*	0.002
Gender (1=Male)	0.093*	0.050	0.056**	0.024	0.074**	0.032
Income (KES)	0.119*	0.068	0.085**	0.033	0.087**	0.043
Distance (Metres)	0.267**	0.067	0.093***	0.029	0.089**	0.040
Education (1= Post primary)	0.028	0.017	0.010	0.008	0.037***	0.011
Household size (Number of persons)	-0.098*	0.050	-0.032	0.022	-0.078***	0.030
Necessary to protect riparian habitat (1=yes)	0.189*	0.107	0.098*	0.051	0.116*	0.068
Certainty of future income (1=Yes)	0.075	0.049	0.098***	0.024	0.061**	0.031
Owning land within riparian area (1=Yes)	-0.111*	0.062	-0.051**	0.028	-0.077**	0.038
Elicitation Format (1=MBDC)	-	-	-	-	0.067**	0.032
Constant	0.912***	0.287	1.276***	0.146	0.407**	0.183
Summary statistics						
F-statistic	22.681		56.234		32.150	
Prob > F	0.0000		0.0000		0.0000	
Adjusted R-squared	0.6708		0.6945		0.6872	
Number of observations	390		384		774	

Explanatory notes: the character 'μ_i' refers to the mean willingness to pay values of the ith individual; * p < 0.1; ** p < 0.05; *** p < 0.01.

The joint effect of the determinants on dispersions across the models was tested using F test and Table 3 presents the

findings. Distance was significant and positive across the models. This could be attributed to the fact that the utility derived from the use of the habitat was constrained by higher transport costs and other travelling expenditures to the RH, which in turn could have reduced the respondents travelling frequency to the habitat leading to greater dispersion in their distributions, an observation in line with that of references [7, 42].

Certainty of future incomes was significant and positively influenced dispersions in SPC and MBDC models, implying that inconsistency in WTP estimates increased with certainty of future incomes. This finding is similar to that of reference [46] however, contrary to that of reference [47], where uncertainty of future incomes led to higher variances in valuation distributions. A larger proportion of respondents in this study were uncertain of their incomes and for the few who were certain it could happen that once they received their incomes, they allocated it among competing priority family needs leading to inconsistencies in their valuation distribution. Gender significantly and negatively influenced dispersions in SPC and SPC-MBDC models, implying that female headed households had larger dispersion of their valuation distributions than men contrary to references [46, 47]. This could be associated with the fact that women in developing countries lack access to key resources in the family and many at times they don't make key decisions at household level hence their access to finances is limited. An observation similar to that of reference [16].

Both Age and Land ownership within the riparian area positively and significantly affected dispersion in SPC and MBDC models. This implies that older respondents had a tendency to save more to cater for their medical needs and retirement as they aged, a finding strongly supported by references [7, 17]. Ownership of land led to higher dispersion meaning that those respondents who owned land within riparian area had higher inconsistencies in their WTP valuation distributions. The reason could be associated to their less WTP towards protection given that they preferred alternative land use practices as observed by reference [33].

In SPC model, increase in Income significantly led to lower dispersion contrary to reference [47]. A plausible explanation could be that respondents with lower incomes were more constrained financially and had varied and serious competing needs such as food, rent, and medication which required more and urgent financial allocations hence causing larger dispersion in their WTP values unlike their counterparts with higher incomes. Moreover, given that the study was conducted during the COVID-19 pandemic coupled with a lot of uncertainties, majority of the households spent sparingly into the future as indicated by reference [20].

Household size significantly and positively influenced dispersions in SPC model. Increase in family size increased dispersion given that economically large family sizes have more financial obligations leaving little monies left for RH protection, a finding similar to that of reference [32]. During school opening days more money could be required to pay fees, and when schools are closed, much money goes towards the purchase of food hence higher inconsistencies were expected during such time periods leading to higher dispersion.

Necessity to protect RH significantly declined with dispersions in the pooled model. Majority of the respondents who found it necessary to protect RH had highly dispersed WTP values by 8.2% compared to their counterparts. This could be attributed to the fact that as much respondents found need to protect the habitats, their WTP was constrained by uncertainties associated with COVID-19 pandemic. In addition, it could happen that such respondents had more financial obligations which could have led to higher variability in their WTP distribution. Change of EF from SPC to MBDC increased deviations in the pooled model by 9.8%. This is because MBDC sample was associated with higher CfV of 131% and higher SD of 78.04 units unlike in SPC, hence causing higher variability in their distributions.

The significant determinants influenced SD at 1% level ($p< 0.01$, F=19.67; $p < 0.01$, F=44.78; $p < 0.01$, F=31.32) respectively across the SPC, MBDC and SPC-MBDC models, leading to rejection of H0 in favor of the H1 (The parameter estimates are significantly different from zero) hence differently influenced deviations. The models were fit and significant at 1% level with adjusted R^2 of about 0.60 across the three models an observation which is three times that observed by reference [46] even if the analytical models used were similar. The divergence could be associated with variations in sample sizes and independent variables used.

Table 3. *Dispersion in the WTP estimates and the determinant factors for different Elicitation Formats.*

Characteristics	SPC Model DV=Log(σ_i)		MBDC Model DV=Log(σ_i)		SPC-MBDC Model DV=Log(σ_i)	
	Coefficient	Std error	Coefficient	Std error	Coefficient	Std error
Age (Years)	0.003	0.002	0.004***	0.001	0.003*	0.001
Gender (1=Male)	-0.061*	0.034	-0.021	0.017	-0.046**	0.022
Income (KES)	-0.081*	0.046	-0.035	0.024	-0.056	0.029
Distance (Metres)	0.099**	0.045	0.077***	0.021	0.441***	0.027
Education (1= Post primary)	-0.014	0.012	-0.008	0.006	-0.005	0.007
Household size (Number of persons)	0.065*	0.034	0.022	0.016	0.005	0.021
Necessary to protect riparian habitat (1=Yes)	-0.073	0.072	-0.046	0.037	-0.082*	0.046
Certainty of future income (1=Yes)	0.070**	0.033	0.033*	0.017	0.002	0.021
Owning land within riparian area (1=Yes)	0.067	0.042	0.036*	0.020	0.046*	0.026
Elicitation Format (1=MBDC)	-	-	-	-	0.098***	0.022
Constant	1.391***	0.194	0.754***	0.104	0.076	0.125
Summary statistics						

Characteristics	SPC Model DV=Log(σ_i)		MBDC Model DV=Log(σ_i)		SPC-MBDC Model DV=Log(σ_i)	
	Coefficient	Std error	Coefficient	Std error	Coefficient	Std error
F-statistic	19.67		44.78		31.32	
Prob > F	0.0000		0.0000		0.0000	
Adjusted R-squared	0.6501		0.6899		0.6829	
Number of observations	390		384		770	

Explanatory notes: the character 'σ_i refers to the standard deviation of the mean willingness to pay values of the ith individual; * p < 0.1; ** p < 0.05; *** p < 0.01.

To answer the overall effect of change in EF on welfare estimates, the results showed that there was a significant difference at 1% level in mean WTP and SD of WTP values between SPC and MBDC formats shown by Mann Whitney test statistic ($p<0.01$, α=2.717). Equally the parameter estimates for WTP determinants were significantly different from zero across the three models and their joint effects on WTP values significantly varied as one moved from SPC to MBDC to SPC-MBDC models as evidenced by their respective F tests ($p<0.01$, F=22.681; $p<0.01$, F=56.234; $p<0.01$, F=32.15). In addition, the estimates for dispersion of WTP determinants were significantly different from zero and their joint effects on dispersion significantly varied across the three models at 1% level as can be shown by their respective F tests ($p<0.01$, F=19.67; $p<0.01$, F=44.78; $p<0.01$, F=31.32). When EF was regressed on both pooled WTP and SD estimates, the results were significant and positive. This observation implied that change of EF from SPC towards MBDC increased welfare estimates, leading to the rejection of the overall null hypothesis in favor of the alternative (Changing the Elicitation Format does significantly affect individual welfare estimates towards RHP in Kenya), a finding similar to that of reference [40].

5. Conclusions and Recommendations

From the study, MBDC format exhibited inconsistent and higher mean WTP value which was almost 1.26 times that of SPC format. This means that use of data generated using MBDC format in valuation of RHP overstated the WTP values. On the other hand, the use of SPC data generation format undervalued the WTP for RHP in Kenya, hence was most preferred for future valuations of RH's. The Kenyan respondents showed positive willingness to pay amounts towards RHP. In addition, a significant difference in mean WTP values was observed at 1% significance level between the two data elicitation formats leading to rejection of null hypothesis (There is no significant difference in mean WTP value between SPC and MBDC formats).

Male respondents who were older and who earned higher Incomes found it Necessary to protect RH hence had higher WTP, despite the fact that they didn't own Land within the RH neither did they stay near the RH. WTP declined with Household size in SPC and SPC-MBDC models, but increased with Education level and Certainty of future incomes in the pooled model. It was interesting to note that change in EF led to an increase in mean WTP value by 6.7%. The participation of female respondents and the youth in RHP was minimal thus the need to for the Kenya National Environmental Management Authority to come up with sensitization programs geared towards educating women and the youth on the importance of riparian habitat protection. Moreover, women and youth should be involved in making key decisions especially on RHP issues. Education level has proved to be a key determinant in valuation of RHP, thus people should be encouraged by the ministry of education to advance their knowledge and skills by registering into environmental conservation programs and attending public lectures and conferences on conservation aspects.

Smaller families whose future incomes were certain, had showed support for the RHP policy and if the policy was to be implemented, it is less likely to face protests. Distance was crucial in RHP. Given that residents who stayed near RH and owned Land within the RH, found no need for RHP since they had converted their lands to other alternative uses. However, there is need to sensitize them and educate them on environmental friendly practices which are sustainable since such practices have succeeded in other countries. It would also be prudent for the Kenyan Government to consider privatization of those habitats by renting, leasing and other mechanisms to promote their protection and conservation. Elicitation format significantly and positively influenced mean WTP values in the pooled model. Implying that change in Elicitation Format from SPC towards MBDC, overstated the mean WTP values with a lot of certainty. SPC data understated mean WTP values which were associated with high levels of uncertainty for the valuation of RH's. Hence, if the RHP policy could pass, the policy implementers should consider using data generated by SPC format given that it has proved favorable for valuation of RHP in Kenya.

The SD values increased with Distance across the models. This implied that the utility derived from the use of RH was constrained by higher transport costs and other travelling expenditures to the RH, which led to reduced travelling frequency to the habitats. Therefore, there is need for the Government in partnership with the Ministry of Transport to review the transport charges downwards to encourage more residents to visit the habitats. Moreover, the study was done during the pandemic when the transport sector was paralyzed and for the few public vehicles which were in operation, charged exorbitant prices, therefore the valuation values may not be a true reflection of what could be happening now in the economy after the economic shock, hence more studies could be undertaken after the economy has recovered.

Deviations in SPC and MBDC models increased with Age, Land ownership within the riparian area and Certainty of future incomes. As much as Old people had shown higher WTP, their spending was constrained given the need to save

monies to cater for their health and other precautionary needs leading to higher deviations. Moreover, a lot of uncertainty in financing was experienced in the health sector during the pandemic, implying that even those residents who had taken medical insurance schemes were not sure of the treatments during that period thus residents preferred holding cash for transactionary motive, leading to higher deviations. Majority of respondents were uncertain of their future incomes given some had lost their jobs temporarily, and for those who were certain it could happen that as soon as they received their incomes, they allocated it among competing priority family needs leading to inconsistencies in their valuation distributions. This resulted due to the unpredictable nature of the COVID-19 Pandemic. The deviations increased with Land ownership within the riparian area, hence the government should intervene and prohibit residents' encroachment into the riparian areas and encourage those using riparian habitats to practice eco-friendly land uses.

The individual dispersions increased with Household size and declined with Income and Gender in SPC model. Families with few households showed strong support towards protection, however given time, larger families which seemed to be constrained with family obligations would adjust their financial base and in future, perhaps more families might be willing to participate thus reducing their valuation deviations. Equally given time, respondents who had lost jobs could become employed again and that will increase their chances of participation in RHP hence reducing the deviations. Lack access to key resources in the family by women contributed to their higher deviations, thus for women to participate in RHP, they should be given opportunity to share in ownership of family resources to broaden their financial base and make key decisions at household level.

SD in the pooled model declined with Gender and Necessity to protect RH, and increased with change in EF. Women had higher deviations in their valuations given they didn't own key resources in the society and at times cultural beliefs inhibited their participation leading to higher deviations, thus future studies can consider establishing the constraints of women participation in RHP. Conservationists need to sensitize people on the need to conserve and protect our environment and through that, a smaller share of respondents who found it unnecessary to protect RH can be exposed and widen their knowledge base such that they can also find it necessary to protect such habitats going forward, and that will reduce their individual valuation distributions. Given that change in EF increased the mean WTP and SD values at 1% significance level in the pooled models, it was evident that EF influenced valuation of RH in Kenya. Therefore, city authorities can now use the mean and SD estimates to benchmark their budget and policy proposals for RHP, with adjustments for individual WTP uncertainties, socio-economic and other characteristics of individuals, given they have proved to be important drives of welfare estimate decisions. The valuation estimates can now play a great role in determination of policies for restoration and protection of RH in Kenya, thus enhancing their functioning in Kenya and beyond. Moreover, more comparative studies are required on valuation of RHP and other environmental goods: - using split samples, different analytical models and consideration of change in EF as a variable.

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References

[1] Acharya, A. S., Prakash, A., Saxena, P. and Nigam, A. (2013). Sampling: Why and How of it? *Indian journal of medical specialties, Vol. 4 (2): 330-333.*

[2] Alberini, A., & Cooper, J. (2000). Application of the contingent valuation method in developing countries. *Journal of Economic and Social Development* 146: 7-22.

[3] Braun, C., Rehdanz, K, &Schmidt, U. (2016). Validity of Willingness to Pay Measures under Preference Uncertainty. PLoS ONE 11 (4): e0154078. DOI: 10.1371/journal.pone.0154078.

[4] Cameron, T. A. and Huppert, D. D. (1989). OLS versus ML estimation of non-market resource values with payment card interval data. *Journal of Environmental Economics and Management, 17: 230-246.*

[5] Carson, R. T., Florece. N. E., & Meade, N. F. (2001). Contingent valuation: controversies and evidence. *Journal of environmental and resource economics vol. 19, pp. 173-210.*

[6] Carson, R. T. (2000). Contingent valuation: a user's guide. *Environmental Science and Technology*, *Vol. 34 (8), 1413-1418. doi: 10.1021/es990728j.*

[7] Colby, B. & Orr, P. (2005). Economic Tradeoffs in preserving Riparian Habitat. *Natural resources Journal,* vol. 45, Issue 1.

[8] Constitution of Kenya, Article 69 (a) of 2010. *Kenya gazette*. Nairobi, Kenya.

[9] CBS (2001). Economic Survey (2001). *Central Bureau of Statistics (CBS),* Nairobi, Kenya.

[10] CBS (2019). Economic Survey (2001). *Central Bureau of Statistics (CBS)*, Nairobi, Kenya.

[11] Champ, P. A., and Bishop, R. C. (2006). Is willingness to pay for a public good sensitive to the elicitation format? *Journal of land economics*, 82 (2), pp, 162–173.

[12] Chanel, O., Makhloufi, K., & Abu-Zaineh, M. (2016). Can a Circular Payment Card Format Effectively Elicit Preferences? Evidence from a survey on a mandatory health insurance scheme in Tunisia. *Applied Health, equity and development research working paper No. 2/2016.*

[13] Ebeto, C. (2017). Sampling and sampling methods. *Biometrics and biostatistics international journal. Vol. 5 (6).*

[14] Environment Management and Coordination Act 1999. National council for law reporting press, Kenya.

[15] Evans, M. F., Flores, N. E. & K. J. Boyle, (2003), 'Multiple Bounded Uncertainty Choice Data as Probabilistic Intentions'. *Land Economics*, Vol. 79, Issue. 4, p549-560.

[16] Fonta, W. M., Ichoku, H. E., &Ogujiuba, K. K. (2011). Estimating Willingness to Pay with the Stochastic Payment Card Design: Further Evidence from Rural Cameroon. *Environ Dev Sustain (2010) 12: 179–193. DOI 10.1007/s10668-009-9188-1.*

[17] Gobbens, R. J. J. & Van Assen M. A. L. (2018). Associations of Environmental Factors with Quality of Life in Older Adults. *The genontological society of America vol. 58, No. 1, pp 101-110.*

[18] Hughes, A. O. (2016). Riparian Management and Stream Bank Erosion in New Zealand, New Zealand. *Journal of Marine and Freshwater Research, 50: 2, 277-290, DOI: 10.1080/00288330.2015.1116449.*

[19] Ichoku, H. E., Fonta, W. M., & Kedir, A. (2009). Measuring Individuals' Valuation Distributions Using a Stochastic Payment Card Approach: Application to Solid Waste Management in Nigeria. *Journal of Environ Dev Sustain*, *11: 509–521. DOI 10.1007/s10668-007-9127-y*.

[20] IMF (2020). *Regional economic outlook. Middle east and central Asia.* International Monetary Fund, Publication Services P. O. Box 92780, Washington, DC 20090, USA Tel.: (202) 623-7430 Fax: (202) 623-7201.

[21] Jeffrey, S. Koeckhoven, D. Trautman, B. Dollevoet, J. R. Unterschultz & Ross, C. (2014). Economics of Riparian Beneficial Management Practices for Improved Water Quality: A Representative Farm Analysis in The Canadian Prairie Region, *Canadian Water Resources Journal / Revue canadienne des resources hydriques, 39: 4, 449-461*, DOI: 10.1080/07011784.2014.965035.

[22] Johnson, R. R., and Carothers, S. W. (1982). Riparian Habitats and Recreation: Interrelationships and Impacts in the Southwest and Rocky Mountain Region. *Eisenhower Consortium Bulletin 12.*

[23] Kenya, Republic of. (2002). Water *Act 2002: Laws of Kenya*. Nairobi: Government Printer.

[24] Laroche, M., Bergeron, J., Forleoa, B. (2001). Targeting Consumers Who Are Willing to Pay More for Environmentally Friendly Products. *Journal of consumer marketing vol. 18 No. 6 pp 503-520.*

[25] Lewis, S. E., Popp, J. S., English, L. A., & Odetola, T. O. (2017). Willingness to Pay for Riparian Zones In Ozark Watershed. *Journal of water resource planning and management, Vol. 143 (5); 04017006.*

[26] Matunda, J. M. (2015). *Sustainable Management of Riparian Areas in Kenya: A Critique of the inadequacy of the Legislative Framework Governing the Protection of Sustainable Management of Riparian Zones in Kenya*. A Dissertation Submitted to the School of Law, University of Nairobi in Partial fulfillment of Requirements for the Award of a Master of Laws Degree (Llm) Environmental Law.

[27] Muketha, S. M. (2014). *Riparian zone conservation in a changing urban land use environment: a case of Nairobi River basin, Kenya.* A thesis submitted in fulfillment of the award of the degree of Doctor of Philosophy of the University of Nairobi, Department of Urban and Regional Planning School of Built Environment.

[28] Mwaura, F. Muwanika, F. R. and Okoboi, G. (2010). Willingness to pay for extension services in Uganda among farmers involved in crop and animal husbandry. *Contributed paper presented at the joint 3rd African association of Agricultural economists' association of South Africa conference, Cape Town, South Africa.*

[29] Neupane, D., Kunwar, S., Bohara, A. K., Risch, T. S., &Johnson, R. L. (2017). Willingness to Pay for Mitigatigating Human Elephant Conflict by Residents of Nepal. *Journal of nature conservation*, *Vol. 36. pp 65-76.*

[30] Ndambiri, H., Brouwer, R. and Mungatana, E. (2017). Scope Effects of Respondent Uncertainty in Contingent Valuation, Evidence from Motorized Emission Reduction. In The City of Nairobi, Kenya. *Journal of environmental planning and management,* DOI: 10.1080/09640568.2016.1140024.

[31] Ndambiri, H., Brouwer, R. and Mungatana, E. (2016). Comparing Welfare Estimates Across Stated Preference and Uncertainty Elicitation Formats for Air Quality Improvements in Nairobi, Kenya. *Journal of environment and development economics, Vol. 21 (5).*

[32] Ndambiri, H., Brouwer, R. and Mungatana, E. (2015). Stated Preferences for Improved Air Quality Management in The City of Nairobi, Kenya. *European journal of applied economics, vol 12 (2), pp. 16-26.*

[33] Nyongesa, J. M., Bett, H. K, Lagat, J. K and Ayuya, O. I. (2016). Estimating Farmers Stated Willingness to Accept Pay for Ecosystem Services, Case of Lake Naivasha Watershed Payment for Ecosystem Services Scheme –Kenya. Ecological processes 2016, No. 5: 15.

[34] Onoh, P. A., Omeire, C. O, Echetama, J. A., Ukpongson, M. A., Ugwoke, F. O., Ejiogu-okereke, E. N., Onoh A. L., and Ogomuo, C. I. (2014). Analysis of Livestock Farmers' Willingness to Pay for Agricultural Extension Services in South East Nigeria. *Journal of agriculture and veterinary science, vol. 7 (7), pp 55-60.*

[35] Ozor, N., Garforth, C. J. & Madukwe, M. C. (2013). Farmers' Willingness to Pay for agricultural Extension Service: Evidence from Nigeria. *Journal of International Development*, Vol. 25, Pp. 382–392 (2013).

[36] Pate, J., & Loomis, J. (1997). The Effect of Distance On Willingness to Pay Values: A Case Study of Wetlands And Salmon In California. *Journal of Ecological Economics 20 (1997), pp 199-207.*

[37] Qureshi, M. E and Harrison, S. (2002). Economic Instruments and Regulatory Approaches in Implementing Riparian Revegetation Options: Observations of the Queensland System. *Australian Journal of Environmental Management, 9: 2, 89-98*, DOI: 10.1080/14486563.2002.10648547.

[38] Remoundou, K. & Koundouri, P. (2009). Environmental Effects on Public Health an Economic Perspective. International journal of environmental research and public health. Vol. 6 pp 2160-2178.

[39] Ryan, R. L., Erickson, D. L., & Young, R. De. (2003). Farmers' Motivations for Adopting Conservation Practices along Riparian Zones in a Mid-Western Agricultural Watershed, *Journal of Environmental Planning and Management, 46: 1, 19-37, DOI: 10.1080/713676702.*

[40] Svenningsen, L. S., &Jacobsen, J. B. (2018). Testing The Effect of Changes in Elicitation Format, Payment Vehicle and Bid Range On the Hypothetical Bias for Moral Goods. *Journal of Choice Modelling* (2018), DOI: 10.1016/j.jocm.2018.08.001.

[41] Tran, H. T. & Navrud, S. (2007). Valuing Cultural Heritage in Developing Countries: Comparing and Pooling Contingent Valuation and Choice Modelling Estimates. *Journal of Environ Resource Econ (2007) 38: 51–69.*

[42] Vossler, C. A. & Poe, G. L. (2005). Analysis of Contingent Valuation Data with Multiple Bid and Response Options Allowing Respondents to Express Uncertainty: A Comment. *Journal of Environmental Economics and Management*, 49, 197–200.

[43] Vossler, C. A., Poe, G. L., Welsh, M. P. & Ethier, R. G. (2004). Bid Design Effects in Multiple Bounded Discrete Choice Contingent Valuation. *Journal of Environmental and Resource Economics* 29: 401–418, 2004.

[44] Vossler, C. A., (2003). Multiple Bounded Discrete Choice Contingent Valuation: Parametric and Nonparametric Welfare Estimation and A Comparison to The Payment Card. Online at https://mpra.ub.uni-muenchen.de/38867/ MPRA Paper No. 38867, posted 18 May 2012 12: 47 UTC.

[45] Wang, H. & Jie, J. (2010). Estimating Individual Valuation Distributions with Multiple Bounded Discrete Choice Data. Applied Economics, first published on: 13 July 2010. To link to this Article: DOI: 10.1080/00036840903299789. URL: http://dx.doi.org/10.1080/00036840903299789

[46] Wang, H. & Whittington, D. (2005). Measuring Individuals' Valuation Distributions Using a Stochastic Payment Card Approach, *Journal of Ecological Economics*, 55, 143–54.

[47] Wang, H. (1997). Treatment of 'Don't-Know' Responses in Contingent Valuation Surveys: A Random Valuation Model. *Journal of Environmental Economics and Management,* 32, 219–32.

[48] Water Act No. 43 of 2016 of the laws of Kenya, Environmental laws of Kenya. *Kenya government press*, Nairobi Kenya.

[49] Water Resources Management Rules (WRMR) 2007. Legislation number 171 of 2007. *Kenya government press*, Nairobi Kenya.

[50] Welsh, M. & G. L. Poe (1998). Elicitation Effects in Contingent Valuation: Comparisons to a Multiple Bounded Discrete Choice Approach'. *Journal of Environmental Economics and Management*, 36, pp. 170-185.