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RESEARCH ARTICLE

LABOR AS A PAYMENT VEHICLE FOR THE RANGELAND IMPROVEMENT: AN APPLICATION OF CONTINGENT VALUATION METHOD IN YABELLO DISTRICT, SOUTHERN ETHIOPIA

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ABSTRACT

Studies conducted regarding goods and services exhibit a low willingness to pay (WTP) in developing countries. However, many scholars found that this may not be the preference for the good but the result of the choice of payment vehicle. Thus, low WTP for ecosystem conservation may not indicate a low welfare for the ecosystem service. There's the argument that the choice of the payment vehicles may be needed to obtain exact welfare estimates where there is imperfect substitutability between money and labor. Otherwise, there might occur underestimating of the welfare benefit of ecosystem services. Thus, the ultimate objective of this study is to investigate the labor-as a payment-vehicle by using a CV method and estimating the factors influencing pastoralists' decision to contribute labor for the rangeland improvement. This study demonstrates it through a rural pastoralists' choice to elicit their willingness to contribute a labor for the rangeland improvement in Yabello District, southern Ethiopia. A total of 228 sample respondents were selected randomly from the two adjacent *Kebeles*. Logit model was used to identify the factors that influence pastoralists' willingness to contribute the labor for the rangeland improvement. The result shows that the endowment of household's active labor highly influence respondents' willingness to contribute. In addition to that, variables like sex, age, dominant livelihood activities, livestock holding, perception towards the rangeland improvement, dependency ratio, and initial bid value were significantly influence pastoralists' willingness to contribute the labor for the rangeland improvement. To sum up, the findings of this study suggest that, just like the monetary value, the labor value can also be used to evaluate the demand of community for the ecosystem services improvement. Thus, employing the labor as a means of payment vehicle for accurate welfare estimations might be a practical alternative, and also giving a chance for the respondents to indicate their willingness to contribute for rehabilitation of degraded ecosystem in developing countries.

KEYWORDS

Contingent Valuation, Ecosystem Service, Payment Vehicle, Welfare, Willingness to Contribute

1. INTRODUCTION

In recent years, the application of contingent valuation (CV) and choice experiments (CE) methods for the valuation of ecosystem goods and services are more commonly applied in developing countries (Kassahun et al., 2020; Meginnis et al., 2020). Many stated preference studies conducted in developing countries provide low willingness to pay (WTP) for a wide range of goods and services in comparison to the cost of provision (Whittington, 2010). For the external examiners the low WTP might seem less consideration of that goods and services under valuation in developing country settings. However, there might need for a more careful interpretation of low WTP estimates in developing countries (Abramson et al., 2011). It should be known that low WTP may not be the indicator of a low demand for public projects in developing countries.

The public distrust in the implementation of environmental goods and services projects; and the form in which payments for goods and services made matter the respondents' decision for willingness to pay in developing countries (Birol and Das, 2012; Oh and Hong, 2012). Thus, in order to obtain the exact welfare estimate through a stated preference study, choosing a widely used payment vehicle is required. In rural areas of developing countries where the cash economy is of limited importance, the estimated value of WTP based on monetary contributions alone may result in understated welfare effects for environmental goods and services (Abramson et al., 2011; Gibson et al., 2016). As a result, many studies found that considering alternative payment vehicle systems for welfare measurement in valuation studies, specially labor contributions is very important for valuing ecosystem services.

Rangelands are one of the dominant ecosystem goods and service which provide the biggest bulk and least costly feed resources in arid and semi-arid parts of the world (Zerga, 2015). The ecological features of the rangelands are characterized by high temperatures, low and high variables rainfall regimes, low vegetation cover density and fragile soil and are found in several parts of the world (Charles, 2010). The area coverage of Ethiopian rangelands are estimated to be 78 million ha and most of them located at the border of the country (Abebe, 2000). Rangelands contribute a lot for the provision of ecosystem services such as: fodder, fuel wood, resin, construction materials, and traditional medicines (Berhanu et al., 2022). In Ethiopia; several studies revealed that rangeland degradation have been increasing at an alarming rate, thus, proper management is needed to optimize the aggregate benefit of the society

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(Berry et al., 2009).

Many efforts were done by different organizations to reverse the effects of degradation. Ethiopia's Climate-Resilient Green Economy (CRGE) initiative aimed to increase the productivity and resource-efficiency of the livestock planned to manage rangeland, so that the ecosystem services of rangelands in terms of carbon storage could be realized and productivity of the land improved. Country's Programming Paper (CPP) for the 'Ending Drought in the Horn of Africa Initiative' has been prepared under the leadership of the Ministry of Agriculture to serve as a framework for long-term investment intervention in pastoral and agro-pastoral communities in a more coordinated manner. AFR100 initiative has pledged to support for rehabilitation of 15 million hectares of Ethiopia through the Bonn challenge and the New York Declaration on Forest.

However, the degradation of forest and rangeland resources continues to increase due to natural and anthropogenic factors (Arnalds and Barkarson, 2003). The Borana rangeland which is located in the southern part of Ethiopia faced various natural and man-made problems, such as recurrent drought, floods, bush encroachment and conflict of resource competition (Berhanu et al., 2022). Thus, local communities' involvement in decision making process to extend the research findings through societal demand and rangeland improvement through pastoralists' community participation is required. Thus, the primary focus is to compare preferences across payment vehicles with the goal of helping policymakers. Study conducted in various developing countries used combined payment vehicles both money and labor to value environmental goods and services (Asrat et al., 2004; Kassahun and Jacobsen, 2015; Amare et al., 2016; Kassahun et al., 2020).

However, the use of labor contribution for ecosystem conservation is often motivated by the potentially more lasting benefits as cash payments are more vulnerable to rapid spending (Wunder and Wertz-Kanounnikoff, 2009). Based on the work of a labor contribution has received increasing attention in the valuation of ecosystem services in developing countries (Swallow and Woudyalew, 1994). With empirical evidence, using labor as payment vehicle in valuation studies can capture the communities' demand for the environmental good in a more flexible and accurate manner. Hence, giving opportunity to choose payment vehicle is an important thing for the valuation of ecosystem services in the developing countries and thus help to avoid the rejection of socially desirable projects due to inappropriate payment vehicle.

The significance of this study is thus, taking into consideration labor contribution as an alternative payment vehicle to estimate the welfare measures could come up with obtaining the right value of ecosystem services and thus avoid the underestimation of the ecosystem benefits which otherwise may cause the rejection of projects that would be socially desirable. Thus, the current study focuses on the importance of accounting for labor-payment-vehicle using a CV survey and the factors influencing pastoralists' decision to realize rangeland rehabilitation. The results of this study contribute a lot to narrowing zthe knowledge gap regarding the payment vehicles that are designed for valuation study to provide a context for the methods.

2. Materials and Methods

2.1 The Study Area Description

The study was conducted on the two kebeles of Yabello district in Borana zone, southern Ethiopia. Yabello is located around 600 km to the south of the capital city Addis Ababa. Borana zone shares a regional boundary with Somali regional state to the East and SNNPR in the North while it shares zonal boundary with Guji zone in the NE (Berhanu et al., 2022). The Borana rangelands cover a total area of 95,000 km2 (Coppock, 1994). The area extends from 4.600 N to 4.900 N latitude 37.900 E 38.400 E longitudes (Figure 1). The region is characterized by a semi-arid climate where the annual mean temperatures vary from 19 to 24°C with bimodal rainfall pattern. The dominant vegetation species in the region are the savannah communities containing mixtures of perennial herbaceous and woody vegetation.

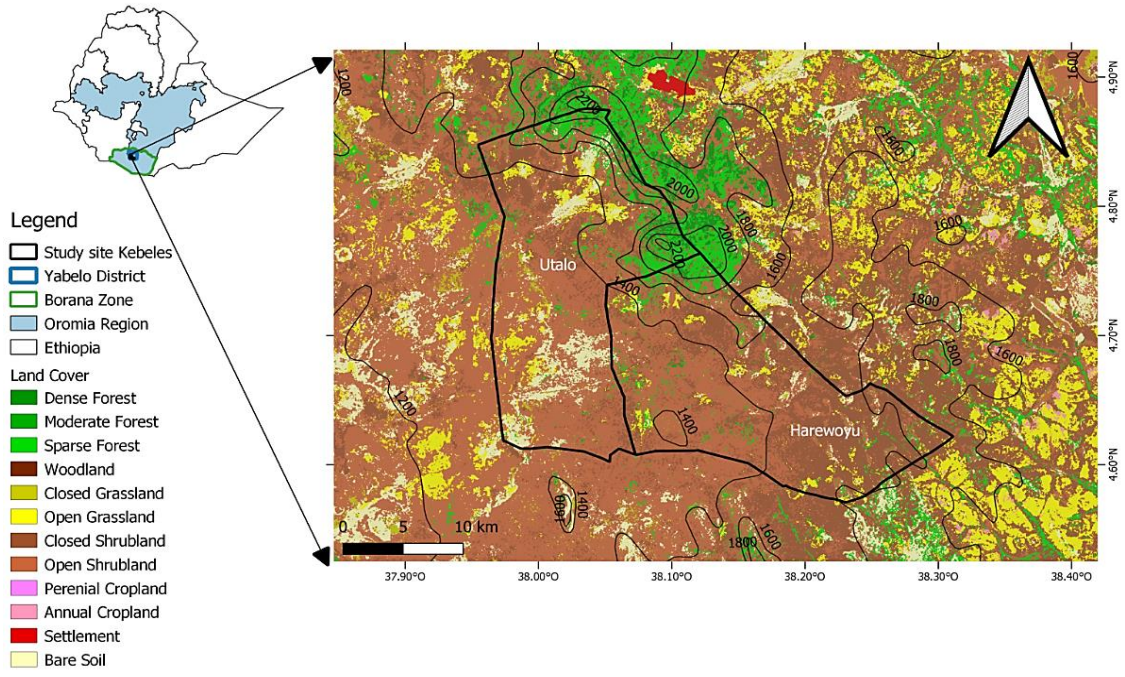

Figure 1: Location map of the study Kebeles

2.2 Sampling Design and Sample Size

Multistage sampling techniques were used for this study. The first was the purposive selection of the study district based on the potential existence of the rangeland resources and its degradation extent. The second, the random selection of the study kebeles namely Harewoyu and Utalo, from the Yabello district, as the representative because of their large area coverage of degraded rangelands. Then the sample size was determined using the formula n = N/1+N (e) 2 (Israel, 1992). Finally, 227 sample respondents (from a total of 1240 households of the two kebeles) were selected randomly following Probability Proportional to sampling size procedure.

n = N/1+N (e) 2 (1)

2.3 Data Collection Techniques and Experimental Design

Contingent valuation method (CVM) in the form of double-bounded dichotomous choice elicitation method was employed to elicit households' WTC for the rangeland improvements. The double-bounded dichotomous choice format (yes-no, no-yes responses) helps to make a clear bound on unobservable true WTC. Prior to conduct final survey, a pre-test survey was held with 20 randomly selected households for the focus group discussion to determine initial bids in terms of both cash and labor through open-ended contingent valuation format. The purpose of cash and labor contributions was clearly explained to the households before they were asked to contribute. However, all communities participated in the pre-test survey were agreed only labor contribution for the rangeland improvement. Pastoralists were well known about the severity of the

problem related with the rangeland degradation which in turn leads them to food insecurity, expansion of aridity and the need for alternative livelihood.

Moreover, it has increasingly become a threat to the pastoral production systems. To solve these problems, there might need a mega project to rehabilitate the degraded rangelands in the area. Pastoralists have been informed and aware about the purpose of the labor contribution. The man power they contribute helps to remove bushes, to replant grass and permanent trees to serve as a shade and fodder for their animals. The kind of an improvement like building ponds and other permanent water sources so that they will no longer need to move long distances to water their animals, become part of the project. However, when these all things are put in place, they need proper maintenance to sustain for the long time. Thus, community involvement is critical for successful interventions because government lonely could not achieve all these labor intensive work without community participation.

Thus, every person in the community required to contribute manpower so that this infrastructure belongs to them. As individuals are often asked to make contributions in terms of labor for such projects, CV surveys that address payments in terms of labor often seem more plausible than those that address cash payment. Then, four starting point bids (frequent responses) determined in terms of labor days were 5, 10, 15 and 20 labor days per month and the group participants agreed for these initial labor bids (labor days) per month. The national index of the conversion of labor work to ETB might be lower than the labor rate of the pastoralists' area because of its arid weather condition. The average wage rate for a farm laborer in the study area was 75 ETB per day which I used to convert labor days to cash for this study.

Hence, the climatic condition of the study area compels the contribution of labor to work for only one working season (winter) per year, the time schedule for working this project become three consecutive years to accomplish the specified 1340 hectare of degraded rangeland. Thus, every willing person was agreed to contribute predetermined labor days per month only for three months per year (Berhanu et al., 2022). Therefore, the total sampled households were divided randomly into four groups relative proportion to those initial labor bids and these sets of bids were selected for the final survey. The respondents were asked a yes/no questions to elicit their willingness to contribute. If the respondent's answer was yes for the first labor bid, the next higher amount of labor contribution was asked. Finally, the survey was successfully completed without protest zero bidders.

2.4 Contingent Valuation Method

Contingent Valuation Method (CVM) and choice modeling are among the frequently used methods of stated preferences. Contingent valuation method (CVM) is the method in which we construct a hypothetical market while users are asked to express their willingness to pay (WTP) for gaining the benefits or willingness to accept (WTA) compensation for losing them. Although there are a number of valuation methods in environmental economics, many of them are not an appropriate method to derive the values. Thus, in this case CV study involves directly asking pastoralists how much they would be willing to contribute or work in exchange for reliable improvement service with a capacity to feed their livestock during drought season. In the valuation scenario, respondents were informed about the potential threat of labor contribution for rehabilitation of degraded rangeland. The purpose of labor contributions was explained to the respondents before they were asked to contribute. The fundamental reasons for incorporation of labor contribution as payment vehicle for the valuation of environmental services in developing countries is that scarcity of cash exchanges may lead to underestimation of the value of ecosystem services. Therefore, it is hypothesized that a using labor contribution as a payment vehicle gives more flexibility for the majority of the poor rural households to reveal their preferences (Schiappacasse et al., 2013). Since the rangeland rehabilitation works are labor intensive, pastoralists' communities are asked to contribute their productive labor time per year.

2.5 Data Analysis

The STATA software was used to analyze collected data and binary logistic model was employed to identify the factors that influence pastoralists' decision on WTC labor. Pastoralists' willingness to contribute labor for the rangeland improvement in the study area is the dependent variable. WTP/WTC is a powerful tool used for assessing the perception and acceptability of the ecosystem service. In discrete choice analysis with repeated responses, the correlation between observable and unobservable components of utility is a well-documented. According to Train, accounting for this effect is a routine procedure in double-bounded dichotomous choice format (Train, 2009). The function of dependent and independent variables were set below as follow:

WTC =f (age, sex, marital status, education level, household's active labor, dominant livelihood Activities, cultivated land size, Total livestock owned, satisfaction with status quo, perception towards rangeland rehabilitation, type of housing, dependency ratio and initial labor bid value). Table 1 summarizes the hypothesized effect of the independent variables on the dependent variable.

Table 1: Explanation, Type, and Expected Sign of The Independent Variables

Independent variables	Explanation	Types of variable	Expected sign
sex	Sex of the respondent	Dummy variable	Positive
age	Age of the respondent	Continuous variable	Positive/negative
marital	Marital status of the respondent	Categorical variable	Positive
educ labor	Education of the respondent household's active labor	Dummy variable Continuous variable	Positive positive
dominant	Dominant livelihood activities	Categorical variable	Positive
tot land	Total cultivated land size	Continuous variable	Negative
TLU satisfaction Perception	Total livestock in tropical livestock unit Satisfaction at existing rangeland resource Perception towards rangeland rehabilitation	Continuous variable Dummy variable Dummy variable	Positive negative positive
housing dependency	Type of housing Dependency ratio	Dummy variable Dummy variable	Positive Negative
bid1	Initial bid value	Continuous variable	Negative
_cons	Constant		-

2.6 Empirical Model Specification

The Logit and probit models are the popular statistical techniques in which the probability of a dichotomous outcome is related to a set of explanatory variables (Neupane et al, 2010). However, logistic probability function is acknowledged as computationally easier to use than the probit model (Pindyck and Rubinfeld, 1981). The logistic regression analysis helps to estimate the probability of an event whether or not will occur, through the prediction of a binary dependent outcome from a set of independent variables (Ayenew et al., 2019). Thus, logistic regression model was employed for this study. The pastoralists' responses to the willingness to contribute questions were regressed against the labor bids that they are willing to contribute for the rangeland improvement and other socioeconomic characteristics of the individual households. The regression logit model is specified as:

$$Pi = E(Y=1/Xi) = 1/(1+ e\ \beta 0 + \beta 1\ X1) \quad (2)$$

Where Y = pastoralists' response, either Yes or No, β0 = constant, β1 = coefficient of the labor bid, X1 = the labor bid that the households are

willing to contribute for the improvement.

$$Y=1/1 + expz \quad (3)$$

Where Y = responses of household WTC which is either 1 for Yes and 0 for No

$$Z = \beta0 + \beta1 X1 + \beta2 X2 + \ldots\ldots\ldots\ldots + \beta n Xn \quad (4)$$

X1, X2, X3 = Explanatory variables and β0, β1, β2 = coefficient of explanatory variables.

Mean WTC= 1/ β*ln (1+exp α) where α is a coefficient for the constant term, and β is a coefficient for offered bids to the respondents.

3. Results and Discussion

3.1 Socio Demographic Characteristics of Respondents

The main livelihood strategy of the community of the study area is livestock production. Household members typically consist of a male household head, wife and children dependent upon the livestock. Men are largely involved on livestock rearing, while women carry out day-to-day management. The overall labor budget indicate that, labor is likely to be a common constraint in dry seasons. The summary statistics was computed for the total sample and compared respondents willing and with the non-willing respondents. The average age of the respondents was 45 years. The mean age of willing households was lower than the mean age of the total respondents. This show, the willing households were younger than non-willing households. The average number of active labor of the willing respondents was higher in comparison to the average number of active labor of non-willing respondents. Respondents with large number of active labor would contribute more for the improvement which is in line with (Ayenew and Meride, 2015). The household's active labor is different from total family size of the respondents. The average numbers of livestock of the willing respondents were 11 while non-willing respondents were 4. The more the number of livestock, the higher the possibility of willingness to contribute labor for rangeland improvement, the result is in lined with the finding of (Belay et al., 2020). **Error! Not a valid bookmark self-reference.** summarizes the above-mentioned continuous variables.

Table 2: Definition, Expected Sign and Summary of The Continuous Variables

Variable name	Definition of variables	Measurement	Expected sign	Descriptive statistics (mean)		
				Willing n=192	Non willing n= 35	Total n=227
Age	Respondent's age	Continuous	-	44	51	45
Tot land	Total cultivated land	Continuous	+	0.5	1	0.75
TLU	Livestock number in TLU	Continuous	+	13	4	11
labor	household's active labor	Continuous	+	4.8	2	3.3

Moreover, the result revealed that 90% of the respondents were male-headed households. 82% of them were willing contribute labor and 18% not willing to contribute labor for rangeland improvement. Majority of respondents were illiterate, the only literate households were 19.7%. Regardless of willingness to contribute, no respondent was satisfied by the status quo level of rangeland resources in the area.

3.2 Results of the Bivariate Probit Model

The results showed that about 84.6% of the total sample households were willing to contribute their active labor for the rangeland improvement. Double bounded dichotomous choice format was used to estimate the MWTC. The result of bivariate probit model is summarized in Table 3 below.

Table 3: Result of Bivariate probit model

Variables	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
bid1	-.131981	.0235495	-4.31	0.000	-.1828785	-.0684646
_cons	2.38511	.3313067	5.90	0.000	1.349218	2.708436
bid2	-.132231	.04067	-3.58	0.000	-.2318123	-.0634578
_cons	1.20115	.4654487	2.23	0.026	.1164584	1.876921

Log likelihood = -116.922, No. of obs = 227 Wald chi2 (1) =.010672, chi2 (2) = 30.13, Prob > chi2 = 0.000, LR test of rho=0: Mean WTP = 13.57 (at 95% CI, 18.06 to 9.08 man-days per household per month).

3.3 Aggregate Willingness to Contribute Labor for the Rangeland Improvement

The mean WTC were estimated from the responses of the first and the second labor bids using double bounded dichotomous choice format. The negative result of the correlation coefficient of the error term shows that the random component of WTC for the first question is not perfectly correlated with the follow-up questions. At 95% confidence interval the average WTC from the double bounded question varies between 18.06 to 9.08 man-days per month for the first and second bids respectively. The average WTC labor is around 14 man-days per month. The aggregate WTC labor was the product of average willingness to contribute and the total number of households who have a valid response in the study area. No protest zero was expected from the population because there was no protest zero in the sampled households. Based on the double bounded dichotomous questionnaires, the aggregate WTC for rangeland improvement was computed at 50,480.4 labor days per year which is equivalent to 3,786,030 Birr (72,896.98 USD; Table: 4)

Table 4: Summary of aggregate benefit

Method	Total households (X)	Expected households to have a protest zero (Y)	Expected households with valid responses (Z)	Mean WTC	Aggregate Benefit (in labor days)	Aggregate Benefit (in Birr)
Double bounded questions	1240	0	1240	13.57	50,480.4	3,786,030

Aggregate labor days contribution = MWTC*1240*3, where MWTC is mean willingness to contribute obtained from bivariate probit model, 1240 is total households of the two kebeles (Harewoyu & Utalo) and 3 indicates the total number of months pastoralists are willing to contribute per year.

3.4 Determinants of Pastoralists' Willingness to Contribute Labor

Table 5 below presented the result of factors affecting the households' WTC for rangeland improvement. Twelve independent variables were included in the model to predict willingness to contribute labor for the improvement. Out of the total variables hypothesized to influence willingness to contribute labor, seven variables were statistically significant at less than 1% (p-value <0.01). These variables are sex (X1), age (X2), dominant livelihood activity (X6), livestock holding in tropical livestock unit (X8), active labor (X5), perception towards rangeland rehabilitation(X10), high dependency ratio(X12) and initial bid value (X13). The coefficients associated with sex, dominant livelihood activity, active working labor, perception towards rangeland rehabilitation and livestock holding are positive, while the coefficients associated with the age and initial bid value are negative.

Table 5: Determinants for Pastoralists' Willingness to Contribute

Variables	Coefficient	Std. Err.	z	P>|z|	odds ratio
sex	2.987368	.9560154	3.12	0.002	19.23341
age	-.0953504	.0273129	-3.49	0.000	.9090544
marital	1.330628	2.048796	0.65	0.516	3.783422
edu	-1.190441	.8575196	-1.39	0.165	.3040871
active labor	.62189642	.2124863	2.93	0.003	1.812846
domin_liv	3.596297	.9508979	3.78	0.006	36.46296
tot land	-.13349	.6374518	-0.21	0.834	.87503622
TLU	3557544	.1176131	3.02	0.002	1.427257
satisfaction	-.3536541	.1274132	2.87	0.003	1.631257
perception	2.289968	.9650154	3.31	0.009	21.82314
housing	-1.565673	1.435637	-1.09	0.275	.2089474
dependency	-.5879213	.3254168	2.34	.0071	.9564123
bid1	-.2808196	.0924830	-3.04	0.002	.7551646
_cons	-5.170255	4.586105	-1.14	0.261	.0056831

Log likelihood = -35.345769, Obs = 227, Pseudo R2 = 0.749, Prob > chi2 = 0.0000

The results show that a variable sex had significant and positive effect on WTC labor. This means that male households are more likely willing to contribute their active working time for the rangeland improvement than the females. Female-headed households had less time as they are fully responsible for more jobs in pastoralists' area. Result revealed that being male increases the probability of one's willingness to contribute labor by 19.2 times than female and is significant at (p-value 0.002). In other words, men were 92% more likely to be willing to contribute in labor for the rangeland improvements than women. The other findings in this area are households' income and wealth are mainly controlled and dominated by men. This implies that the opportunity cost of obtaining the fodder for their livestock is high for the male, thus, the prospects of obtaining willingness to contribute responses from the male respondents for the rangeland improvement are high.

Age of the household head negatively and significantly affect households' WTC in man-days contribution at less than 1% (p-value=0.000). This may be due to the older aged people fail to have capacity to spend their working power on labor work and tend to refrain from labor intensive activities. Keeping the influence of other factors constant, an increase in household head age by one year reduces the odds of willingness to contribute labor days by 10%. The negative relationship between WTC and age is consistent with the finding of (Ayenew and Meride, 2015; Belay et al., 2020).

The results also show that household's active labor was statistically significant with the expected positive sign ($p<0.01$). Under the hypothetical market scenario, the probability of pastoralists' WTC for the rangeland improvement increases as the number of active labor increases. Keeping other factors constant, an increase in the number of household's active labor by one unit, the odds of willingness to contribute labor increases by 87%. This is the fact that, rangeland improvement practices like clearing of the bush, building local water storing ponds bring good benefit for the community; hence, households with large active labor power are willing to contribute more in these practices. This result is consistent with the findings of (Gebremariam, 2012; Ayenew and Meride, 2015).

Livestock holding in tropical livestock unit has positive and significant influence on the probability of WTC for the rangeland improvement at 1%. In other words, as the number of livestock increases, the probability of WTC will also increase. This is because the improving rangeland was the major source of their livestock. The odds ratio shows the citrus paribus effect of TLU variable, on which keeping the other variables constant, each additional increment of livestock, will increase the odds of the households' willingness to contribute labor for the improvement by 43%. This is consistent with the findings of (Gebremariam, 2012; Mezgebo et al., 2013; Ayenew and Meride, 2015).

The variable (dominant livelihood activity) also determines respondents' decision on their WTC for the rangeland improvement. As the livestock is the major source of livelihood for pastoralists' community, it is expected to be significantly affecting pastoralists' decision on their WTC for rangeland improvement. The result shows that the dominant livelihood activities had positive and significant influence on pastoralists' WTC at p-value 0.000. Respondents whose major livelihood activity was livestock have high chance to contribute labor for the rangeland improvement than those whose livelihood depends on crop production and safety net. On the other hand, the high the dependency ratio of the household on daily laborer, the low the probability of the pastoralists' community to willingly contribute their labor to improve degraded rangelands.

Pastoralists' perception on the rangeland rehabilitation: could be explained by the level of WTC labor; when an individual has a significant commitment to rangeland rehabilitation and understands its importance to ecosystem services provision, he/she will be willing to contribute a higher amount of labor for its improvement (Schiappacasse et al., 2013). Therefore, payments in terms of labor could effectively be providing a more flexible framework for respondents to state their "true" value for the rehabilitation, which would be underestimated if cash payment was asked. Thus, in this case, it determines respondents' decision on their WTC for the rangeland improvement. Result reveals that the perception on rangeland rehabilitation had positive and significant effect on pastoralists' WTC at p-value 0.009.

The finding of the study revealed that the coefficient of labor bid has negative sign and significant at $p<0.01$. The negative sign and the significance of this coefficient showed that, as the starting bid value increases by one unit, the log odds of household's willingness to contribute labor will be reduced by 75.5%. This is consistent with the findings of (Carlsson et al., 2004; Mousavi et al., 2011). To sum up, the goodness of fit, R2 =0.748, this means, the dependent variable (WTC) is explained by the explanatory variables by 74.8%, and the remaining 25.2% of the WTC variation is not explained. Thus, based on the results, there are a lot of factors that can contribute to pastoralists' decision on WTC.

4. Conclusions

East African counties in general and Ethiopia in particular, where the population grows rapidly, rangelands degraded progressively over time majorly due to natural and anthropogenic factors. Land became fragmented and over utilized to meet the demand of pastoral communities. The Borana pastoralists have developed an exceptionally efficient system of range land management strategies to respond for the rangeland degradation to rehabilitate the areas. However, only indigenous management technique is not sufficient to solve the problem regarding the impacts of rangeland degradation continuously. Thus, the area needs further improvements with the help of government intervention and community participation in terms of their WTP. Considering the limited access of the cash economy in rural areas of the developing countries, many researchers proposed WTC as a means of welfare measurement over the WTP in monetary value. The issue of considering labor-time elicitations for the estimation of welfare measures in CV is central to ecosystem management. Thus, for further demonstration, the use of labor contribution as a payment vehicle is needed in developing countries to give a valid welfare estimate where the cash payment vehicle is not smooth.

The paper demonstrated this through a rural household contingent valuation survey designed to elicit pastoralists' willingness to contribute labor at Yabello district of Southern Ethiopia. The overall objective of this study is to estimate pastoralists' average willingness to contribute labor (AWTCL) for the rangeland improvement and factors influencing their decision on WTC using binary logistic model. Indeed, the results of the contingent valuation survey showed that the pastoralists of the area were preferred willingness to contribute labor over willingness to pay cash for the rangeland improvement. The main caveat with this study is that the results may be context dependent in the sense that the option to use labor/man-days as a payment vehicle was available as a credible option.

Hence, the households' mean WTC for the rangeland improvement was computed at 40.71 labor day per household per year. This is to say that, the opportunity cost of time that one individual's willingness to contribute his/her working labor for the rehabilitation project is 3,053.25 ETB (US$58.78) per year. The aggregate benefit or aggregate WTC for rehabilitation was found to be 50,480.4 labor days per year, which is equivalent to 3,786,030 ETB (US$72,890.16). This implies that policy instruments designed for rangeland instruments could thus harness pastoralists' labor availability and pastoralists could play a bigger role in contributing to rangeland rehabilitation efforts if supported by relevant policies. Here, considering the lower-income respondents who are not able to contribute in cash, the total value of reliable contribution for the rehabilitation of degraded rangeland could be underestimated if the contribution would have been estimated using WTP cash. Furthermore, among all the factors influencing pastoralist's decision on WTC labor, being male household heads, younger age of household head, large productive labor, livestock farming as dominant livelihood, total livestock in TLU, positive perception towards rangeland improvement, satisfaction at existing rangeland resource, dependency ratio on daily laborer and initial labor bid found to be significant factors. Thus, the rangeland rehabilitation efforts could purposefully address pastoralists with the above-mentioned characteristics.

In fact, we believe that this finding has important practical implications, especially for the application of environmental valuation methods in emerging and developing economies. However, the value estimation that incorporates labor contribution for cost-benefit analysis should consider estimation of the shadow wage rate for the conversion of labor into a monetary unit. In addition to that, decision makers often request a cost–benefit analysis as part of their deliberations, and CV is increasingly being used to measure the economic benefits of environmental goods. Thus, if we do not take labor contribution as a payment vehicle to estimate the welfare measures, we could come up with underestimating the benefits estimated when applying CV and may cause the rejection of projects that would be socially desirable. Perhaps, this study can inspire further efforts to test this payment vehicle against others in relevant contexts and hopefully enable applied stated preference studies in developing countries. Thus, labor payment vehicles are potentially useful in the context of developing countries and in settings where the ecosystem services to be valued require the participation from the intended beneficiaries. Policymakers can use this result as an input to help design such kind of effective payment vehicle for valuing ecosystem services in the rural area of developing countries to obtain appropriate value of ecosystem services.

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Authors' Contributions

DB (corresponding author) performed all tasks starting from study design to the manuscript writing.

Competing Interests

The author declares that no one has competing interests for this study.

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