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Economic Valuation of *Lippia adoensis*, implication for Access and Benefit Sharing agreement in Sidama and WestArsi Zones, SNNPR and Oromia Regions, Ethiopia

Abstract

Biodiversity has major economic value. Most of these values are often not captured by the market. Hence, the potential of biodiversity is often underestimated. Such an underestimation is considered as one of the factors for rapid depletion of biodiversity and loss of habitats and species. Valuation of bio-resources would facilitate in identifying the real value of genetic resources and obtaining a reasonably better share of the overall benefits of genetic materials to the local communities, who are involved in its management. Accordingly, the Economic Valuation of *Lippia adoensis* was conducted implication for ABS. The result of this study identified the direct and indirect use values of *Lippia adoensis*. Majority of the respondents (98.33%) were willing to pay for use values of *Lippia adoensis*. Moreover, (80.8%) of the respondents were willingness to pay for Conservation of *Lippia adoensis*. Furthermore, 95(79.2%) of the respondents were willingness to pay for non-use value of *Lippia adoensis* in the study areas. The cumulative estimates of willingness to pay for use of values *Lippia adoensis* were 30,437.50 birr with an average annual willingness to pay of 253.64±275.63 birr for *Lippia adoensis.* The maximum willingness to pay was 1000 birr while the minimum WTP was 125 birr with range 875 birr. The value of R^2 for linear function (model) was 0.541, semi log R^2=0.452 and double log R^2=0.291.From the given result the linear regression function (R^2=0.541) the one with the best performance. The R^2=0.541or 54.1%, this means that the dependent variable can be explained by the independent variable. In this study, household size (Sig.0.000), income level (Sig.0.000), number of *Lippia adoensis* (Sig.0.044) and distance of the market (Sig. 0.051) of the respondents made a unique and statistically significant, contribution to the prediction of willingness to pay for *Lippia adoensis*. Of the nine variables, household size of the responders makes the largest unique contribution (beta=0.490), followed by income level of the respondents (beta -0.396). Therefore, because of its prospect for the production of many preservative, spices, aromatherapy, medicine and pharmaceuticals industry, bio prospecting companies require to access the genetic resources following the Ethiopian legislation of Access and Benefit Sharing.

Keywords: *Lippia adoensis*, valuation, willingness to pay, dependent and independent variable

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Abbreviations: WTP, willingness to pay; ABS, access and benefit sharing; ESs, ecosystem services; TVE, total economic valuation; TEV, total economic value; UV, use value; NUV, non-use value; DUV, direct use values; IUV, indirect use values; OV, option values

Introduction

Biodiversity has major economic value that is both implied and overt. Most of these values are often not captured by the market .Biodiversity valuation normally entails measuring the economic value of 'biological resources', not the intrinsic value of biodiversity. Instead, valuation typically focuses on the economic values of the goods and services generated by biodiversity resources and/or functions-the so-called ecosystem services.[1–3] Although all people depend on nature for their well-being, the benefits of nature are often neglected in policies; moreover, losses in natural capital have direct economic consequences that are often underestimated. The benefits deriving from ESs and the costs of the degradation and loss of ecosystems and biodiversity are incur incurred on the ground but may be largely unnoticed at a larger scale.[4] Valuation can be defined as the process of attributing a certain economic or non-economic value to something. It aims to measure, in monetary terms, people's preferences for the benefits they obtain from (for example) ESs. Valuing ESs is part of informing political decision making: it can help in balancing the trade-offs in resource allocation when designing projects or investments and choosing among alternative land uses.[5]

The framework commonly used for valuing natural resources is known as the Total Economic Value (TEV). This comprises use values (direct, indirect and option value) and non-use values.[4] Conceptually, TEV of an environmental resource (ecosystem) consists of its Use Value (UV) and Non-Use Value (NUV). A use value is a value (in the form of commodities and services) arising from an actual use made of a given resource.[5,6] This might be the use of a forest for timber and non-timber forest products, or of a wetland for recreation or fishing.

Use values are further divided into Direct Use Values (DUV), which refer to actual uses such as fishing, timber extraction and others; Indirect Use Values (IUV), which refer to the benefits deriving from ecosystem functions such as a forest's function in protecting the watershed; and Option Values (OV), which is a value approximating an individual's willingness to pay to safeguard an asset for the option of using it at a future date, like an insurance value.[7]

In the Access and Benefit Sharing perspective, the direct use value of the ecosystem or biodiversity, particularly the goods that have market potential and business scope, is significant. In brief, from an ABS perspective, use value - particularly direct use values - in the form of goods/resources which are tangible or visible is significant and should be considered as paramount in working on valuation related processes rather than using the tradition valuation methodology. These resources, which include different genetic materials, are extracted by local communities with the help of their unique traditional knowledge on their use and sold to prospectors at low or negligible prices. Since there are no proper markets for such resources at its collection point, the existing price for the product is not revealing its actual value. Actual value may be more than the existing market price.[8,9]

Providers of biological/genetic resources have limited knowledge and information about both the "price" and "value" of a product. On the contrary, the users of bio-resources (prospectors) have better knowledge about their potential value than the providers. However, the providers (local communities) are often exploited since they are little aware of about the potential of resources for value addition, product development and subsequent commercialization. Thus, the negotiations on determining the benefit sharing element could be potentially compromised where the provider is unaware of the potential use and value while the user has specific use and potential market in mind.

In this context, the valuation of biodiversity/ecosystem goods is a fundamental step towards determining the real value of bio-resources, and prepared the ABS provisions under Nagoya Protocol on ABS to capture the 'fair and equitable' provision of the ABS negotiations appropriately with full and informed participation of providers of the resources. Ethiopia is endowed with rich plant biodiversity and associated traditional plant genetic resources which make an environment for successful bio-prospecting.[10] In this regards, *Lippia adoensis* (cultivated) is rich in linalol (as much as80%), which has many prospects for preservative, spices, aromatherapy, medicine and pharmaceuticals, which shows the ability of this resource for access and benefit sharing.[11] Because of its prospect for the development of these products, bio prospecting companies require accessing the resources following the domestic legislation of ABS.

However, *Lippia adoensis* is one of the cultivated endemic plants which have not been properly valued.[12] The purpose of valuation is to establish what the weight of biodiversity conservation should be when the interest of the whole society is taken into account. Economic valuation helps authorities to make informed decision about the biodiversity conservation. Accordingly, *Lippia adoensis* is being widely used for preservative, as spices for butter preparation or flavor butter and other cultural food, traditional medicine and income generation.[13] Though the Ethno-medicinal uses and chemical composition have been carried out on *Lippia adoensis* in Ethiopia, much has not been done on economic valuation.[14,15] Proper understanding of the direct and indirect use values of this species in the study areas contributes to the conservation, sustainable utilization, and access and benefit sharing.[16,17] Therefore, this study focused on the economic valuation of *Lippia adoensis* in Sidama and West Arsi Zones, SNNPR and Oromia Regions , Ethiopia and the implication for ABS agreement.

Methodology

Description of the study areas

Sidama Zone is a zone in the Southern Nations, Nationalities, and Peoples' Region (SNNPR) of Ethiopia. It is named for the Sidama people, whose homeland is in the zone. Sidama is bordered on the south by the Oromia Region , on the west by the Bilate River, which separates it from Wolayita zone, and on the north and east by the Oromia Region. Towns in Sidama include which includes Hawassa, the capital of Sidama and SNNPRS, Yirgalem and Wendo. West Arsi zone is one of the zones of the Oromia Region in Ethiopia which shares borderlines with the Regional State of Nations, Nationalities and People of Southern Ethiopia and borderlines with East Shewa and Bale (Figure 1)?[18]

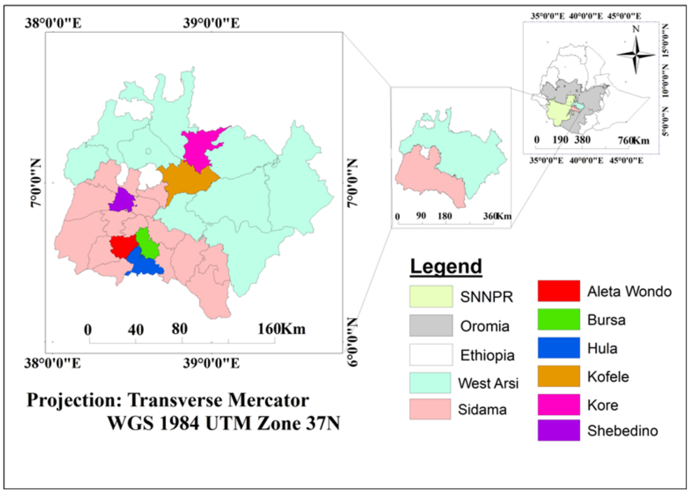

Figure 1 Administrative Map of the study areas.
Projection: Transverse Mercator WGS 1984UTM Zone 37N

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Sampling design/ techniques

The study areas were selected based on the abundance of *Lippia adoensis*. Based on the recommendations of zonal agricultural office six potential *Lippia adoensis* growing districts were selected from Sidama and West Arsi Zones, four districts from Sidama (Bursa, Hula, Aleta Wondo and Shebedino) and two districts from West Arsi (Kofele and Koree) Zones. In addition, two Kebeles were selected from each district bringing the total number of sampled Kebeles to 12 where *Lippia adoensis* is abundantly found Guchi, Qabete, Shire kobolcha and Meja Yedel were selected from West Arsi. Qenqelcha, Hoba Gangawa, Bursa Qosercha, Chelbesa, Titira, Woto, Termesa and Fura from Sidam Zone were selected to conduct the study.

Sample size determination

Taking into consideration cost, labor and time, the researchers determined the sample size, using the formula:- N>50+8m where N is sample size and m number of independent variables.[19]

Methods of data collection

A reconnaissance survey was made to determine the initial bid of *Lippia adoensis*, to select the study districts and kebeles and to pre-test the questionnaires which were helped to make necessary modifications according to the prevailing local circumstances.

The main instrument of primary data collection was a structured and pretested questionnaire. Additional data was obtained from the agricultural office of the districts, from different books, journals and research articles. For this study both qualitative and quantitative data was collected from primary and secondary sources. Respondents were selected with the help of kebeles extension agents based on experiential ethno botanical knowledge of *Lippia adoensis*.

Variables determining willingness to pay

It was assumed that the explanatory variables/factors that determine willingness to pay of *Lippia adoensis* was: age, sex, income level, marital status, household size, size of land, distance from the market and education status following Adekunle and Agbaje (2011) (Table 1).

Table 1 Factors selected to determine willingness to pay of *Lippia adoensis*

S.No.	Variables	Descriptions	Remark
1	Age	Age of the respondents	
2	Sex	0 : Female 1 : Male	
3	Income level	0 : Low 1 : Medium 2 : High	
4	Marital status	0: Married 1:Unmarried 2: Divorce 3 :Widowed	
5	Household size	Number of people in the given family	Independent variables
6	Size of land	The size of land the respondents possess in hectare	
7	Distance from the market	Distance of the market in which *Lippia adoensis* is sold	
8	Education status	0: Non educated 1 :Informal education 2:Primary education 3: Secondary education 4: Higher education	
9	Number of individual *Lippia adoensis*	Number of individual *Lippia adoensis* present in at the respondents land	
Amount of money Willingness to pay for *Lippia adoensis*			**Dependent/ output variable**

Data analysis and interpretation

The collected data was subjected to SPSS software version 21 and analyzed and interpreted using descriptive and inferential statistics. Regression Analysis was used to test models to predict outcomes of variables. The predictor (independent) variables can be either categorical or continuous, or a mix of both in the same model. An inferential method was used for detail analysis of the variables. The appropriate model for the nature of the dependent variable was served as an inferential model. Mean willingness to pay, standard deviation, confidence interval and the relationship between WTP and categorical variables was analyzed using descriptive statistics. The WTP bids were also regressed with various explanatory variables. The bid functions were arrived at using multiple linear regression analysis, starting from all the potential explanatory variables, removing the least significant one, re-estimating the model and so on until all remaining variables was significant at 95% level.[5] The valuation function will be:

$$WTP = \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5\text{-----------}\beta_nX_n+\beta_nX_n+e_n$$

WhereWTP= farmers willingness to pay for *Lippia adoensis*, $\beta_{0=}$ constant, β_1-$\beta_{n=}$ coefficients, X_1-X_n= variables influencing WTP, e_n= random error or in elaborated manner :-

$$WTP = f(X_1+X_2+X_3+X_4+X_5+X_6+X_7+\ldots\ldots\ldots.X_n+e) \quad (1)$$

Where WTP = Willingness to pay, X_1=Age, X_2=Sex, X_3=Income level, X_4=Marital status, X_5=Household size, X_6=Size of land in hectare, X_7=Distance from the market, X_8=Education status, X_9=number of individual *Lippia adoensis*, e = error term

Three functional forms was tried in order to choose the one with the best performance.

Linear: $WTP = b_o+b_1X_1+b_2X_2+\text{ - - - - - - - - }b_7X_7+Ed$ (2)

Semi log: $WTP = L_nb_o+b_1L_nX_1+b_2L_nX_2+\ldots\ldots\ldots\ldots..\ b_7L_nX_7+ L_nEd$ (3)

Double Log: $L_nWTP=L_nb_o+b_1L_nb_1X_1+b_2L_nX_2+b_7L_nX_7+L_nEd$ (4)

Where, b_o = constant, $b_1b_2\ldots b_7$ = Regression coefficient for WTP

Ed = Residual or error term, L_n = Natural logarithm

Results and discussions

Demographic characteristics of the Respondents

A total of 120 respondents, 64 female (53.3%) and 56 male (46.7%), were interviewed from February to April 2019. The age of respondents ranged between 20 and 72 years old with mean age of 37.9±11.99 years, and range 52years. A majority of the respondents 112(93.3%) were married, 7 (5.8%) were widowed and an insignificant number of the respondent was divorced. Among the respondents interviewed, 34 (28.3%) were non-educated, 8 (6.7%) had informal education, 54 (45%) received primary education and the rest (24,20%) were educated in secondary schools. Moreover, the income level of the respondents were medium, low and high {71 (59.2%), 35 (29.2%) and 14 (11.7%)} respectively.

Direct and indirect use values of Lippia adoensis

The use value of *Lippia adoensis* consists of direct and indirect use values. The direct use values of this plant include use for spices, butter preparation or as flavor, traditional medicine, and food preservative etc.[20] All of the respondents (100%) reported the use of *Lippia adoensis* for spices, preservatives, providing good aroma for food, as spice for butter preparation and flavoring of food. Moreover, most of the respondents (59.2%) reported using *Lippia adoensis* for traditional medicine (Table 2).

a. The willingness to payof the respondents for Lippia adoensis

A majority of the respondents (119, 98.33%) were willing to pay for use values of *Lippia adoensis*. According to the respondents reports, the main reasons of willing to pay for *Lippia adoensis* were due to its different use values such as using as spice, preservative, traditional medicine, etc... Moreover, 97(80.8%) of the respondents were willing to pay for the conservation of *Lippia adoensis* (willing to pay the minimum amount of compensation required to maintain its original utility level), whereas 23 (19.2%) of the respondents were not willing to pay for the conservation of *Lippia adoensis* in the study areas. Furthermore, 95(79.2%) of the respondents were willing to pay for non-use value, of *Lippia adoensis* (willing to pay for bequest value/inter-generational equity concern/and altruist/intra-generational equity concern) where as 25(20.8%) of the respondents were not willing to pay for the non-use value of *Lippia adoensis* in the study areas (Table 3).

Table 2 Respondents' statements on the use values of *Lippia adoensia* in the study areas

The uses of *Lippia adoensis*	Yes		No	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Spices and flavoring of food	102	85%	18	15%
Preservative & providing good smell for food	120	100%	-	---
Traditional medicine	71	59.20%	49	40.80%
Providing good smell to the surrounding	119	99.20%	1	0.83
Income source	115	95.80%	5	4.20%

Table 3 Respondents statement on willingness to payfor *Lippia adoensis*

Category		Yes	No	Total
Willingness to pay for use values	Frequency	118	2	120
	Percent	98.3	1.7	100
Willingness to pay for conservation activities	Frequency	97	23	120
	Percent	80.8	19.2	100
Non-use values(Bequest value/Inter-generational equity concern/ and Altruist/Intra-generational equity concern)	Frequency	95	25	120
	Percent	79.2	20.8	100

b. The mean willingness to pay for use values of *Lippia adoensis* across different socio –economic classes

The annual mean willingness to pay of the respondents across different socioeconomic classes (age, sex, marital and educational status and income level) for use values of *Lippia adoensis* was investigated.- In the age-related socio-economic class, the mean willingness to pay were 245.83, 267.23, 255.77 and 244.81birr within the ranges of 15-24, 25-44, 45-64 and 45-80 age classes respectively. There was a very little variation in the mean willingness to pay for use values of *Lippia adoensis* across different age classes. This result suggests that the willingness to pay for use values of *Lippia adoensis* did not depend on ages of the respondents.

As to gender class, the mean willingness to pay of females respondents (275.74birr) was somewhat greater than males respondents (230.08birr). Regarding to the impact of marital status of the respondents on willingness to pay for *Lippia adoensis*, mean willingness to pay by married, unmarried and divorce respondents were 257.23, 234.04 and 268.96 birr respectively. This would suggest that willingness to pay of *Lippia adoensis* does not depend on marital status of the respondents. This could be because all married, widowed and divorced respondents had almost similar views on the use values of *Lippia adoensis*.

As to the educational status of the respondents, the highest mean willingness to pay was recorded with non-educated respondents (292.18birr), followed by respondents with informal (262.62birr) and primary level education (237.19birr) however, the minimum average willingness to pay was recorded at secondary school respondents (213.66birr). This indicated as education levels increase, the average willingness to pay of the respondents' decrease. This could be because as the educational level of the respondents increase, the consciousness to traditional use value of the genetic resource decrease which is directly related to the current modernization.

Regarding to the income level of the respondents, the highest mean willingness to pay was recorded at high income level (296.26birr) followed by respondent with medium income level (257.57birr) and the lowest mean willingness to pay was recorded at low income level of the respondents (206.41birr).This indicated that as the income level of the respondents increases the mean willingness to pay also increases. This could be due to as the income level of the respondents increase, they are stressed-free to pay for the use values of the genetic resources but as their income level decrease, they become hesitant to pay the use value of the given genetic resources (Table 4).

Table 4 Mean Willingness to Pay for use values of *Lippia adoensis* per year across Different Socio –Economic Classes

No.	Socio –economic classes	Number of respondents in each socio –economic classes		Mean willingness to pay in Birr per year	Total
		Willing to pay	Not willing to pay		
	Age				
	15 _ 24	8	-	245.83	
1	25 _ 44	79	1	267.23	120
	45 _ 64	27	1	255.77	
	65_80	4	-	244.81	
	Sex				
2	Female	63	1	275.74	120
	Male	55	1	231.09	
	Marital Status				
3	Married	110	2	257.23	
	Divorce	1	-	268.96	120
	Widowed	7	-	234.04	
	Educational Status				
	Non-Educated	33	1	292.18	
4	Informal Education	7	1	262.62	120
	Primary Education	54	-	237.19	
	Secondary Education	24	-	213.66	
	Income Level				
5	Low	35	-	206.41	
	Medium	71	2	257.57	120
	High	14	-	296.26	

c. Average and cumulative estimates of WTP for use and non-use values of *Lippia adoensis*

The cumulative estimates of WTP for use of values *Lippia adoensis* were 30,437.50 birr with an average annual willingness to pay of 253.64±275.63birr. The maximum WTP was 1000 birr while the minimum WTP for *Lippia adoensis* was 125 birr with range 875birr. Concerning to the cumulative estimates of willingness to pay for non-use values of *Lippia adoensis* was 23,437.70birr with an average annual willingness to pay of 195.30±169.65birr. The maximum WTP to pay was 500birr while the minimum WTP was 125 birr with range 375birr. The most frequent willingness to pay was 250birr.

The mean willingness to pay for conservation activities of *Lippia adoensis* was 197.40±168.10 with cumulative estimates of willingness to pay of 23,687.50birr. The maximum willingness to pay was 500 birr while the minimum WTP was 125 birr with a range of 375birr and a mode of 250birr. The largest cumulative estimates of willingness to pay for use values were 39,658.80birr followed by 23,687.50birr WTP for conservation activities and 23,437.70birr for non-use values).

d. Results of multiple regression analysis

The independent variables show at least some relationship with the dependent variable. In this study, household size (0.566) and income level (-0.562) of the respondents correlate with amount of money the respondents were willing to pay for *Lippia adoensis*. This was followed by the number of individual *Lippia adoensis* plants present on respondents land (0.194), the size of land (0.147), educational status (-0.099),distance of the market from respondents home (0.081), age(0.064), marital status (0.058) and gender (-0.001) respectively. The correlation between each of the independent variables is not well correlated. If two variables with a bivariate correlation of 0.7 or more occur in the same analysis, it is probably not necessary to include them in the given analysis. In this situation, one may need to consider omitting one of the variables or forming a composite variable from the scores of the two highly correlated variables.[21] The correlation of the independent variable income level with household size (-0.302), income level /marital status (0.141), income level /educational status (-0.073) and income level/size of land (-0.121) etc... Generally, in the current study, the correlation of each of the independent variable to each other is less than 0.7; therefore all variables were retained in the analysis.

i. Multicollinearity

Multicollinearity exists when the independent variables are highly correlated (r=0.9 and above); subsequently, multicollinearity did not exist since the independent variables were not highly correlated. The existence of multicollinearity can also be determined by tolerance, an indicator of how much of the variability of the specified independent variables are not explained by the other independent variables, and is calculated as $1–R^2$. In this study, the tolerance values were large, ranging between 0.773 and 0.918, thus indicating multicollinearity did not exist. The variance inflation factor (VIF), which is the inverse of tolerance, ranged between 1.089 and 1.293 which is less than 10, indicating-multicollinearity did not exist (Table 5).

Table 5 Multiple regressions output (Coefficients, Confidence Intervals for B, Correlations and, Collinearity statistics

Model		Un-standardized coefficients		Standardized coefficients	t	Sig.	95.0% Confidence interval for B		Correlations		Part	Collinearity statistics	
		B	Std. Error	Beta			Lower bound	Upper bound	Zero-order	Partial		Tolerance	VIF
1	(Constant)	346.552	74.872		4.629	0	198.17	494.9					
	Age of the responders	-1.682	1.216	-0.098	-1.384	0.169	-4.091	0.727	-0.064	-0.131	-0.089	0.837	1.195
	Household size	33.623	5.037	0.49	6.675	0	23.64	43.606	0.566	0.537	0.431	0.773	1.293
	Size of land in hectares	2.692	15.333	0.012	0.176	0.861	-27.694	33.078	0.147	0.017	0.011	0.891	1.122
	Distance of the market	-10.511	5.325	-0.137	-1.974	0.051	-21.064	0.041	-0.081	-0.185	-0.127	0.869	1.151
	Number of Lippia adoensis	2.735	1.341	0.142	2.04	0.044	0.078	5.393	0.194	0.191	0.132	0.863	1.159
	Sex(0)	-0.989	29.491	-0.002	-0.034	0.973	-59.434	57.455	0.001	-0.003	-0.002	0.814	1.228
	Educational status(0)	41.905	32.65	0.092	1.283	0.202	-22.8	106.61	-0.099	0.121	0.083	0.814	1.228
	Income level(0)	-197.484	36.392	-0.396	-5.427	0	-269.605	125.363	-0.562	-0.46	-0.35	0.784	1.275
	Marital status(0)	-55.57	55.547	-0.067	-1	0.319	165.651	54.512	-0.058	-0.095	-0.065	0.918	1.089

a. Dependent Variable: Amount of money willing to pay for *Lippia adoensis*

ii. Evaluating the model

The R^2 value indicates how much of the dependent variable (WTP) can be explained by the independent variables (age, sex, marital status, educational status, household size, size of land, income level, number of individual *Lippia adoensis* plants and distance from the market).There are three functions which were attempted to choose the one with the best performance (the dependent variable explained best by the independent variables). Generally the function for willingness to pay is WTP = f(X1+X2+X3+ X4 + X5 + X6 + X7 + ……….Xn+e) (where WTP = Willingness to pay, X1 = age, X2 = sex, X3 =marital status, X4 = educational level, X5 = household size, X6 = size of land, X7= income level, X8=number of individual *Lippia adoensis* plants,X9= distance from the market, and e = error term.

In this study, the value of R^2 for the linear model was 0.541, semi log model R^2=0.452 and double log model R^2=0.291. Based on R^2, the linear regression model performed the best. The R^2 value indicates that the independent variables explained54.1% of the variance in WTP (Table 6).

Table 6 Regression results for explanatory variables that determine WTP of *Lippia adoensis*

Regression	Bo	X1 Age	X2 Sex(0)	X3 Marital Status(0)	X4 Education level(0)	X5 Household size	X6 Size of land in hectare	X7 Income level(0)	X8 Number of *Lippia adoensis*	X9 Distance from the market	R2	Adj. R2	Sig. F
Linear	346.552 -74.872	-1.682 -1.216	-.989 (29.491)	-55.570 (55.547)	41.905 (32.650)	33.623 (5.037)	2.692 (15.333)	-197.484 (36.392)	2.735 -1.341	-10.511 -5.325	0.541	0.504	14.413
Semi-Log	198.049 (205.284)	-35.385 (53.076)	-11.275 (32.436)	51.015 (60.931)	-44.878 (35.906)	114.548 (27.177)	13.269 (22.093)	213.567 -40.785	28.695 -16.854	-34.799 -24.71	0. 452	0.407	10.067
Double-Log	4.901 (0.608)	0.006 (0.162)	-0.064 (0. 080)	0.203 -0.151	-0.003 -0.089	-0.415 -0.076	0.022 (0.069)	0.799 -0.101	0.15 -0.05	-0.011 -0.076	0.291	0.26	9.376

From the three functional forms that were tried in order to choose the one with the best performance, linear regression function has the best having the highest coefficient of determination (R^2) of 54.1% which intern helped to identify the best explanatory variables that determine WTP of *Lippia adoensis* (Table 6). The respondents' household size (sig.0.000), income (sig. 0.000), number of individuals *Lippia adoensis* plant (sig.0.044) and distance of the market (sig. 0.051) had significant influence on the amount of the respondents willing to pay for *Lippia adoensis*. This is an indication that WTP for *Lippia adoensis* might be determined through the household size, income level, number of individuals *Lippia adoensis* plant present at the respondents land and distance of the market from the respondents' home. In constructing a regression equation, it would be used the un-standardized coefficient values in Table 5 above.

iii. Evaluating each of the independent variables

In comparing the contribution of each independent variable, the beta values were used by finding the largest beta value (ignoring any negative signs out the front). In this study, the largest beta coefficient was 0.490 for household size of the responders. This means that this variable made the strongest unique contribution in explaining the dependent variable, followed by income level of the respondents (-0.396), number of *Lippia adoensis* (0.142) and distance of the market(-0.136).The Beta values for the other variables were lower, indicating that they made less unique contribution to the dependent variable. If the significance value is less than 0.05, the variable is making a significant unique contribution to the prediction of the dependent variable. If greater than 0.05, it can be concluded that the variable is not making a significant unique contribution to the prediction of the dependent variable. This may be due to overlap with other independent variables in the model. In this study, household size (Sig.0.000), income level (Sig.0.000), number of *Lippia adoensis* plants (Sig.0.044) and distance to the market (Sig. 0.051) of the respondents made a unique and statistically significant, contribution to the prediction of WTP for *Lippia adoensis*.

In the coefficients table, the other potentially useful information is the Part correlation coefficient which is referred as semi partial correlation coefficients.[21] The square of this value is an indication of the contribution of that variable to the total R square. In other words, it indicates how much of the total variance in the dependent variable is uniquely explained by that variable and how much R square would drop if it wasn't included in study model. In this study, the age, sex (0), marital status (0), educational status (0), household size, size of land in hectares, income level (0), number of individuals *Lippia adoensis* and distance of the market had a part correlation co-efficient of -0.131,-0.002,-0.065, 0.083, 0. 431, 0.011, -0.350, 0.132 and -0.127 respectively. The square of these values were 0.0172, 0.000004, 0.0042, 0.0069, 0.1858, 0.00012,0.1225,0.01742 and 0.01613 respectively, indicating that each of the independent variable in this study (Age, Sex (0), marital status (0), educational status (0), household size, size of land in hectares, income level (0), number of individuals *Lippia adoensis* and distance of the market) uniquely explained 1.72%, 0.0004%, 0.42%,0.69%, 18.58%, 0.012%,12.25%,1.742% and 1.613% of the variance in the total willingness to pay for *Lippia adoensis* respectively (Table 5).

The total R square value for the model (in this study,0.541, or 54.1% explained variance) did not equal all the squared part correlation values added up (1.72% + 0.0004% + 0.42% + 0.69% + 18.58% + 0.012% + 12.25% + 1.742% + 1.613%= 37.03). This is because the part correlation values represent only the unique contribution of each variable, with any overlap or shared variance removed. The total R square value (54.1%), however, includes the unique variance explained by each variable and also that shared. However, in this study, the nine independent variables were not strongly correlated with each other's which were between, r=-0.302 income level/Household size and r= -0.003 Number of *Lippia adoensis*/Marital status as shown in the coefficient Table 5; therefore, there was a small difference between all the squared part correlation values added up (37.03%) and the total R square value of the model (54.1%).

Finally, the model, which includes Age, Sex (0), Marital status (0), Educational status (0), Household size, Size of land in hectares, Income level (0), number of individuals *Lippia adoensis* and distance of the market, explained 54.1% of the variance in willingness to pay for *Lippia adoensis*. Of the nine variables, household size of the responders make the largest unique contribution (beta = 0.490), followed by income level of the respondents (beta -0.396).[22]

Conclusion and recommendation

Valuation of genetic resources help to identify the real value of the resources and obtaining a reasonably better share of the overall benefits of it related economic activities to the local communities, who are involved in its management. Accordingly, the Economic Valuation of *Lippia adoensis* was conducted implication for Access and Benefit Sharing Agreement. The result of this study identified the direct and indirect use values of *Lippia adoensis* (Spices, food flavoring, as preservative, traditional medicine, income source, provide good smell to the surrounding, increase soil fertility and honeybee forage).

Majority of the respondents119 (98.33%) were willing to pay for use values of *Lippia adoensis*. Moreover, 97(80.8%) of the respondents were willingness to pay for Conservation of *Lippia adoensis*. Furthermore, 95(79.2%) of the respondents were willingness to pay for non-use value of *Lippia adoensis* (willing to pay for Bequest value/ Inter-generational equity concern/and Altruist/Intra-generational equity concern) in the study areas. The cumulative estimates of willingness to pay for use of values *Lippia adoensis* were 30,437.50 birr with an average annual willingness to pay of 253.64±275.63 birr for *Lippia adoensis*. The maximum willingness to pay was 1000 birr while the minimum WTP for *Lippia adoensis* was 125 birr with range 875birr. The annual mean willingness to pay of the respondents across different socioeconomic classes (age, sex, marital and educational status and income level) for use values of *Lippia adoensis* had been also investigated. Accordingly, the highest mean willingness to pay was recorded in the high income socioeconomic class (296.26birr) and the lowest mean willingness to pay was recorded at low income status of the respondents (206.41birr).

In this study, the value of R^2 for linear function (model) was 0.541, semi log R^2= 0.452 and double log R^2=0.291. From the given result the linear regression function(R^2=0.541) the one with the best performance(the dependent variable explained best by the independent variables).The R^2= 0.541, this means that the model which includes (Age, Sex, Marital status, Educational status, Household size, Size of land in hectares, Income level, number of individual *Lippia adoensis* and distance from the market) explained 54.1% of the variance in amount of money willing to pay for *Lippia adoensis* or, R^2=0.541or 54.1% of the dependent variable can be explained by the independent variable.

In this study, household size (Sig.0.000), income level (Sig.0.000), number of *Lippia adoensis* (Sig.0.044) and distance of the market (Sig. 0.051) of the respondents made a unique and statistically significant, contribution to the prediction of willingness to pay for *Lippia adoensis*. Of the nine variables, household size of the responders makes the largest unique contribution (beta=0.490), followed by income level of the respondents (beta -0.396). Consequently, because of its prospect for the production of preservative, aromatherapy, cosmetics, medicine and pharmaceuticals, bio prospecting companies require accessing the resources following the domestic legislation of ABS.

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Conflicts of interest

The authors declared that there no conflicts of interest.

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