Preferences of the Poor Farming Household for Credit-Based Payment for Environmental Services: Attributes for Environmental Resource Conservation in the Oyo State Farm Settlements

O. I. Adesiyan[1*], M. O. Rauf[1] and W. A. Adewole[2]

[1]*Department of Agricultural Economics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.*
[2]*Department of Agricultural Extension and Rural Devlopment, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Previous studies affirmed that both poverty and environmental resources degradation need to be tackled concomitantly. The reason is that poverty and environmental resources (agricultural land) are intertwining as a nexus; hence a one traffic-proffered solution is not sufficient enough to reduce the afterward menace poverty and environmental resource caused. An incentive that serves as an 'adjudicator', a credit-based payment for an environmental service is recognized for this task.

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Corresponding author: E-mail: segun.adesiyan@yahoo.com;

Though this is a hypothetical case of Payment for Environmental Services (PES) that understudied the would-be response of the poor farming household through their preferences of PES attributes of environmental resource conservation and poverty reduction. This was designed with the use of choice experiment method, which is a multi-attribute approach of valuing non-market goods (agricultural land). Evidently, this study has convincingly proved that the poor farmers are willing to conserve their agricultural land, if the provision of necessary incentive is presented to them. The examined three farm settlements in Oyo state are: Afijio, Ijaye and Ido farm settlements. Educationally poor farming household shows that, 93(65.49%) preferred both options, whereas consumption poor farming house have 162(68.5%) respondents that sought for both option 1and 2.Housing/standard of living farming household recorded 98(34.63 %) for option 1 PES attributes and 95(33.57%)responded were for option 2 of PES attributes. The T-t test revealed that four of the paired poverty categories with respect to their preferences for the PES attributes options were significant. This study therefore suggests that poor farming household, whose farming is their livelihood should be sensitized to the provision of a deliberately designed poverty-environmental resource conservation credit-based PES, with a more flexible conditions. This will enable the poor farmers to be encouraged to participate in conservation of natural resource and by extension reducing poverty.

1. INTRODUCTION

The concept of conservation of environmental resources has raised various debates among the concerned stakeholders of natural resources conservation. It appears evident that ecosystem can no longer conserve the biodiversity nature of the environmental resources, hence the need for complimentary means to conserve the ever exploited ecological resources such as (agricultural land), is inevitable [1]. Payment for Environmental Services (PES) is a promising market incentive for environmental resources conservation. Payment for Environmental Services is an incentive-based mechanism for sustainable conservation and management of environmental resources [2]. Applicability of PES in biodiversity and watershed protection, landscape beauty, carbon sequestration and storage and more especially in agricultural land conservation/management among the poor farmers had been found to be a noble development in studies related to conservation and management of natural resources [3,4,5]. Property rights of land have been majorly emphasised on as a necessary 'ingredient' for the participation of respondents in environmental resources conservation [6]. The principle of PES is that the sellers and buyers of environmental resources must have a mutual confidence and trust [3]. The environmental service sellers received the amount of payment and benefits agreed upon, while the environmental service buyers will enjoy the environmental services paid for [5]. PES, distinguishes itself from other known conservative market incentives, in which it recognizes hard trade-off among alternatives attributes presented to the respondents. Other elements of PES include: well-defined environmental services to be provided, at least there must be a buyer of the environmental service, and at least an environmental service seller must also exist (Wunder, 2008).

The operationalisation of PES that ensures a remarkable contribution to the conservation of the agricultural land and rural poverty reduction needs the rural dweller involvement, hence PES attributes and potential should be uncovered. The success of PES hinges on the extent to which rural farmers are willing and able to be involved in the planning and execution of PES scheme.

Based on the above discussion, the core objective of this study is to analyze the poor farmers' preferences for PES attributes that spur them to participate in PES program activities in Afijio, Ijaye and Ido farm settlements in Oyo state, Nigeria. To have a better capturing of the preferences for the attributes of PES, the study distinguishes between the categories of the poor (i.e. educational, consumption and living standard poor).

2. METHODOLOGY

2.1 Choice Experiment Design Procedure for the PES Attributes

Meetings were held with the stakeholders in the Oyo State Ministry of Agriculture and Natural

resources, Director of the Oyo State farm settlements, farmers in the farm settlements, the farm managers of the farm settlements, Oyo State Ministry of Environment stakeholders, district heads, Nigerian Agricultural Credit and Rural Development Bank (NACRDB) stakeholders, Microfinance Bank Managers and Agricultural unit of the Central Bank of Nigeria, Ibadan branch, Oyo State, Nigeria.

The reason for contacting the above institutions was to have a good understanding of the relevant attributes and attribute levels for the study. Sequel to this, a total number of seven attributes (amount of loan, payback period, interest rate, task to perform, labour provision, land provision, the guarantor for the loan), also 25 levels and three alternatives were used in the design of the experiment as contained in Table 1. This was achieved with the aid of the manually constructed design method suggested by Johnson et al. (2013). Amount of loan has eight levels, payback period has two levels, task to perform has three levels, the interest rate has six levels, land, labour and guarantor provision have two levels each. The levels for the amount of loan, are: N1,000,000, N900,000, N800,000, N700,000, N600,000, N500,000, N400,000 and N300,000, for payback period, the levels are: long time and medium time period, for the task to perform the levels are:1/4,1/2 and 1 acre conversion of land into agro forestry, for the interest rate, the levels are: 3%, 4%, 5%, 6%, 7% and 8%, for land provision, the levels are: Environmental Service seller (ESseller,) Environmental Service buyer (ESbuyer) to provide. Labour provision levels are Environmental Service seller (ESseller) to provide and guarantor provision for the loan levels: Are Environmental Service Seller (ESseller), Microfinance/agricultural bank to provide. The given condition is that agro forest of choice by each of the farmers will be planted and maintained for five years. The methodology developed by Alkire and Foster [7] was used to measure multidimensional poverty. This has also been recently used by Alkire and Santos [8] to obtain multidimensional poverty indices for developing countries. This methodology essentially uses a dual cut-off approach to generate a new class of dimension -adjusted measures of multidimensional poverty [9].

In designing of choice experiments, there are some important decisions to be made with regards to the number of attributes, the appropriate number of levels for each of the

attributes and the right description of the levels and attributes considered in the design. According to Hanley et al. (1998), a combination of attributes and levels should give rise t alternatives, which respondents were requested to choose from. Aside from the alternatives, a status quo option is also included. As suggested by Hanley et al. (2001), the inclusion of the status quo option allows the respondents to be at liberty to choose, even from none of the array of packages presented to them. This will aid a better interpretation of the result in a typical welfare economics term. The design ensures (i) orthogonally (ii) balanced design and (iii) efficiency to check correlation and minimize standard errors. Ten choice cards were given to each of the respondents to choose among three alternatives 1, 2 and 0 (0 is the status quo option). Multistage sampling technique was employed for this study and primary data were exclusively used for this study. Data were collected through the use of well-structured questionnaires and interview schedule for the literate and non-literate farmers respectively. The nature of this study demands collection of two main data; data for multidimensional rural poverty and data for the respondents' preferences/perspectives of the set of PES attributes presented to them. Information was elicited from the respondents concerning multidimensional poverty on (i) education, (ii) consumption, (iii) housing/living conditions.

In this choice experiment, the hypothetical situation presented was as realistic as possible and involved a conversation between the survey implementer and respondents that covered these key points:

- Credit could be borrowed for any other purpose in addition to participation in PES program.
- That reduction in interest rate, however, is only available if you are able to meet the contractual agreement conditions.
- If you do not meet the conditions, you will have to pay back the loan at the interest rates of your chosen option.
- The PES organizers would like to see an increase in agro forestry activities.

This paper makes the following contributions to the literature. First, it adds to the limited amount of non-market valuation studies on environmental resources conservation/management in sub-Saharan Africa and in Nigeria especially, by means of choice experiments. This is a relatively

new technique in this field of study. Second, our study contributes to the debate on the extent to which the conservation of environmental resources/management via a credit-based PES can transform into socio-economic benefits for rural communities. Hence, this study finding can be useful as a veritable tool for the concerned stakeholders in the making of applaud decisions and improvement of the lives of the poor.

3. RESULTS AND DISCUSSION

3.1 Preferences of the Educationally Poor Farmers on PES Attributes

Table 1, shows that those farming households that are educationally poor have a preference for option 1 and 2{i.e. 93 (65.49%)} and 49 (35.51%) of them choose not to opt for either of the options (i.e. they remain status quo). This revelation depicts that a greater proportion of the poor household farming in the three farm settlements (i.e. Akufo, Ilora and Ijaye) were interested in conserving agricultural land if the opportunity is presented to them. However, almost equal preferences (i.e.46 (32.39%) in option 1 and 47 (33.10%) in option 2 respectively) were chosen by the farming households that are educationally poor in the three farm settlements under consideration. The implication of this statistics is that there is no significant difference in the utility to be enjoyed in both options 1 and 2 respectively; hence either of the two options could stimulate the respondents to participate in the conservation of agricultural land.

3.2 Preferences of the Consumption Poor Farmers on PES Attributes

Table 1 statistics below; showed that 162 (68.35%) denoted poor farming house heads preferred options 1 and 2, while 75 (31.65%) respondents are indifferent. The statistics breakdown shows that option 1 attributes takers are 77 (32.49%), and option 2 attributes seekers are 85 (35.86%). The above revealed statistics could be reasoned that the poor farming households in the three farm settlements will desire to involve in environmental resource conservation/management in their locations.

3.3 Preferences of the Housing/Standard of Living Poor Farmers on PES Attributes

The results indicate that housing/ standard of living poor farming household are interested in conserving agricultural land, consequently, 193 (68.20%) of them showed interest in both options 1 and 2 while 90 (31.80%) respondents choose status quo option (Table 2). The breakdown of their choices indicated that 98 (34.63%) respondents are interested in option 1 whereas 95 (33.57%) respondents opted for option 2. By and large, the results indicated that different categories of the poor respondents are more interested in benefits they stand to enjoy if they involve in PES program. This is in line with the rational choice theory {(i.e. consumers can rationally order preference of events when they are presented with an event subject to some constraint(s)}. Oyekale [10], affirmed that previous approaches to analyse poverty in Nigeria focused on income/expenditure approach. This could be responsible for the failure of the government antipoverty measures, as the real poor in the society may not be adequately identified with income/expenditure approach, since poverty has been defined in a multi-dimensional manner.

Table 1. Attributes and levels for choice experiment, presented in the PES hypothetical contract

Attribute	Description	Level
1.Amount of loan	Amount of money provided to farmers for conversion of land to Agroforestry	N1,000,000,N900,000 N800,000,N700,000,N600,000 N500,000,400,000, N300,000
2.Payback period	Time period to pay back the loan	Medium,long terms
3.Interest(per year)	Amount charged on top of the loan given	3%,4%,5%,6%,7%,8%
4 Task to perform	Conversion of land into agroforestry	1/4, 1/2, 1
5.Land provision	Land provided for the task	ESseller,ESbuyer
6.Labour provision	Labourers to do the task	ESseller, ESbuyer
7.Guarantor provision borrower of loan	The person to stand as a surety	ESseller provide, the Microfinance/Agriculturalbank

Table 2. Respondents choices of options of PES attributes

Educational Poverty

Choice card	Options			
	0	1	2	Total(1&2)
	Freq.	Freq.	Freq.	Freq.
1	4	3	6	9.00
2	4	5	7	12.00
3	7	7	3	10.00
4	7	6	6	12.00
5	7	6	5	11.00
6	4	5	5	10.00
7	2	3	2	5.00
8	8	2	3	5.00
9	2	6	4	10.00
10	4	3	6	9.00
Total	49(34.51%)	46(32.39%)	47(33.10%)	93(65.49%)

Consumption poverty

Choice card	Options			
	0	1	2	Total(1&2)
	Freq.	Freq.	Freq.	Freq.
1	9	9	7	16.00
2	10	9	9	18.00
3	8	10	9	19.00
4	3	7	8	15.00
5	7	9	8	17.00
6	8	7	9	16.00
7	7	6	9	15.00
8	8	6	9	15.00
9	7	7	7	14.00
10	8	7	10	17.00
Total	75(31.65%)	77(32.49%)	85 (35.86%)	162(68.35%)

Housing/Standard of living

Choice card	Options			
	0	1	2	Total(1&2)
	Freq.	Freq.	Freq.	Freq.
1	10	10	9	19.00
2	10	10	11	21
3	8	11	9	20.00
4	10	10	11	21.00
5	10	11	11	22.00
6	9	10	8	18.00
7	8	7	8	15.00
8	7	10	10	20.00
9	10	10	10	20.00
10	8	9	9	18.00
Total	90(31.86%)	98(34.63%)	95(33.57%)	193(68.20%)

3.4 Preferences of Respondents for Choice Card and Attributes

From Table 3, 22 farming households preferred attributes in option 1, while 20 respondents opted for attributes in option 2 in the choice card 1. A good number of respondents favoured attributes in option 2 than 1 in choice card 2. Respondents in all the three categories of the poor favoured attributes in option 2 then option 1 in all the

choice cards. However, choice card 6 shows an equal number of respondents preferring attributes in option 1 and 2. The statistics also show that choice cards 3, 5 and 9 have more farming households interested in attributes in option 1 than 2. Choice cards 2, 4, 7, 8 and 10 indicated more preference for attributes in option 2 than 1. From the above discussion, it could be observed that the farmers are not unconcerned and rational, in that they realised that agricultural land is their productive asset which needs to be conserved/managed and sustained, hence their more preference for options 1 and 2 for all the choice cards. This finding is supported by both Lipton [11] and Boyowa [12]. The duo submitted that the poor are essentially rational not to destroy the natural capital (e.g. agricultural land) that are germane to their livelihood, except unaffordable situation forced them to do so.

3.5 Paired T-test for Preference of the Respondents

Table 4 shows the result of paired (dependent T-test) for the preferences of the multidimensional poor, educational poor, consumption poor and housing/ living standard poor respondents. Paired T-test is employed if observations in the sample are dependent on one another. In this study, the same respondents picked options 0, 1 and 2 for all the given ten choice cards which contain different attributes of PES. Each of the options was paired (option 0 versus option 1, option 1 versus option 2 and option 0 versus option 2 respectively). It is expected to have a relationship between the options chosen by each of the respondents. For each respondent, we are importantly interested in differences in the values of the two options and also testing whether the mean of these differences is zero. In all the paired options for each category of poor, the following were significant:

(i) Consumption poverty option 0 versus consumption poverty option 1
(ii) Housing/living standard poverty option 0 versus housing/living standard option 1
(iii) Multidimensional poverty option 0 versus multidimensional poverty option 1 and
(iv) Multidimensional poverty option 0 versus multidimensional poverty option 2.

(i) In the consumption poverty category that chooses option 0 (status quo) and option 2 for all the choice cards (4-13) in the questionnaire, N=237, p-value = 0.1278, indicating that there was a statistical difference between the two options for all the choice cards (4-13) in the questionnaire, since the corresponding two-tailed p-value is significant at 0.1278 (i.e. at 10%). In the consumption poverty option 0, M=7.5, S.D = 0.582 and consumption poverty option 2, M=8.5, S.D = 0.972, T= -1.677, P≤ 0.1078, CI. 95= 6.183-8.817 and 7.805-9.195.

(ii) For the housing/living standard poverty group, option 0 versus option 1 for all the choice cards, N=283. There was a difference in the mean, since the corresponding two-tailed p-value = 0.0868 (i.e. 0.1). For the housing/ living standard poverty group, option 0, M=9.0, S.D= 0.365 and housing/ living standard poverty group 1, M= 9.8, S.D= 0.4013, T= -1.9215 and CI= 8.174 - 9.826 and 8.988-10.612.

Table 3. Preferences of respondents for choice cards and attributes

	Options 1 (PES attributes and levels)				Option 2 (PES attributes and levels)			
Card	Educ. poverty	Consump. poverty	Livistd. poverty	Total	Educ. poverty	Consump. poverty	Livistd. poverty	Total
1	3	9	10	22	6	7	7	20
2	5	9	10	24	7	9	11	27
3	7	10	11	28	3	9	9	21
4	6	7	10	23	6	8	11	25
5	6	9	11	26	5	8	11	24
6	5	7	10	22	5	9	8	22
7	3	6	7	16	2	9	8	19
8	2	6	10	18	3	9	10	22
9	6	7	10	23	4	7	10	21
10	3	7	9	19	6	10	8	24
Total	46	77	98		47	85	95	

(iii) Multidimensional poverty options; N=260. Multidimensional poverty option 0 versus multidimensional option 1 is significant at the 0.01% level since the p-value is 0.000, which shows there is difference in the mean. Multidimensional poverty option 0 has M=25.8, SD=8.390, while multidimensional poverty option 1 has M= 116.4, SD=21.823.

The pair (i.e. option 0 & 1) have, T= -17.7894, CI.95 = 19.798-31.802 and 100.788- 132.012 respectively.

(iv) Multidimensional poverty option 0 versus multidimensional poverty option 2, has P-value of 0.000, therefore there is statistically significant difference between the mean. Multidimensional poverty option 0 has M= 25.8, SD=8.3905 and multidimensional poverty option 2 has M=117.8, SD=28.878. The values for T= -7.970, p≤ 0.05 and CI.95 = 19.798-31.802, 97.141-138.458.

From the statistics above, there is no difference in options for consumption poverty option 0 versus consumption option 2, housing/ living standard poverty option 0 versus option 1, multidimensional poverty option 0 versus multidimensional poverty option 1 and multidimensional option 0 versus multidimensional option 2. The study, therefore, concludes that those respondents that choose options 1 and 2 for the 10 choice cards preferred those attributes for the options, hence they could participate in the PES program if it is implemented.

Table 4. Paired T-statistics results for the respondents mean preferences

Education poverty respondents

1. Option 0 and 1

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Educ.option 0	10	4.9	0.69	2.18	3.34	6.46
Educ.option 1	10	4.6	0.542	1.713	3.38	5.82

t = 0.3734   degrees of freedom = 9   P-value = 0.7175

2. Option 1 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Educ.option 1	10	4.6	0.54	1.71	3.37	5.83
Educ.option 2	10	4.7	0.52	1.64	3.53	5.87

t = -0.1416   degrees of freedom = 9   P-value = 0.8905

3. Option 0 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Educ.option 0	10	4.9	0.69	2.18	3.34	6.46
Educ.option 2	10	4.7	0.52	1.64	3.53	5.87

t = 0.2308   degrees of freedom = 9   P-value = 0.8227

Consumption poverty respondents

4. Option 0 and 1

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Consump.option 0	10	7.5	0.58	1.84	6.18	8.82
Consump.option 1	10	7.7	0.45	1.42	6.69	8.71

t = -0.3375   degrees of freedom = 9 P-value= 0.7435

5. Option 1 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Consump.option 1	10	7.7	0.45	1.42	6.69	8.71
Consump.option 2	10	8.5	0.31	0.97	7.80	9.19

t = -1.3501   degrees of freedom = 9   P-value = 0.2100

6. Option 0 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Consump.option 0	10	7.5	0.58	1.84	6.18	8.82
Consump.option 2	10	8.5	0.31	0.97	7.80	9.20

t = -1.6771 degrees of freedom = 9   P-value= 0.1078 *

Housing/living standard poor respondents

7. Option 0 and 1

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Livgstd.option 0	10	9.0	0.37	1.15	8.17	9.83
Livgstd.option 1	10	9.8	0.36	1.14	8.99	10.61

t = -1.9215   degrees of freedom = 9   P-value = 0.0868*

8. Option 1 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Livgstd.option 1	10	9.8	0.36	1.14	8.99	10.61
Livgstd.option 2	10	9.5	0.40	1.27	8.59	10.40

t=0.8182   degrees of freedom =9   p-value = 0.4344

9. Option 0 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Livgstd.option 0	10	9.0	0.37	1.15	8.17	9.83
Livgstd.option 2	10	9.5	0.40	1.27	8.59	10.41

t = -1.3416   degrees of freedom = 9   P-value = 0.2126

Multidimensional poor respondents

10. Option 0 and 1

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Mpov. Option 0	10	25.8	2.65	8.39	19.80	31.80
Mpov. Option 1	10	116.4	6.90	21.82	100.79	132.01

t = -17.7894   degrees of freedom = 9   P-value = 0.0000**

11. Option 1 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Mpov. Option 1	10	116.4	6.90	21.82	100.79	132.01
Mpov. Option 2	10	117.8	9.13	28.88	97.14	138.46

t = -0.0877   degrees of freedom = 9   P-value = 0.9321

12. Option 0 and 2

Variable	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.Interval]	
Mpov. Option 0	10	25.8	2.65	8.39	19.80	31.80
Mpov. Option 2	10	117.8	9.13	28.88	97.14	138.46

t = -7.9701   degrees of freedom = 9   P-value = 0.0000 **

*** ** * significant at 1%, 5% and 10% respectively
M= mean, T=T-value, SD= standard error, CI=confidence interval

4. CONCLUSION

Both preferences for a choice card with regards to PES attributes potions each farming house preferred showed that poor farming households were concerned in conserving the natural resources (agricultural land), which serve as their productive asset. The flexible condition of PES which allows poor farmers to invest the given credit to other means of livelihood also contributed to the overwhelming desire to be involved in the conservation of natural resources. The t-test revealed that four of the paired poverty categories with respect to their preferences for the PES attributes options were significant. This study, therefore, suggests that poor farming household, whose farming is their livelihood should be sensitized to the provision of a deliberately designed poverty-environmental resource conservation credit-based PES, with more flexible conditions. Reducing in the interested rate for a good performance of the assigned tasks is laudable. Nevertheless, some of the poor farming households could not fathom the benefits awaiting them for participation in conservation of environmental resource as is depicted in the revealed statistics in the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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