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FOREST INCOME DETERMINANTS AMONG RURAL HOUSEHOLDS OF ETCHE LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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ABSTRACT

Against the backdrop of increasing emphasis on empirical linkage between poverty and deforestation that portends danger to forest conservation, this study was designed to determine the major factors that influence incomes of rural communities that live near open forest reserves in a very important oil community of Nigeria. Six (6) farmers were randomly selected from each community in Etche Local Government Area of Rivers State, giving a total number of sixty (60) respondents. Primary data were collected from them via the use of questionnaires. A multiple regression analysis model (using three functional forms) was used to evaluate the model. All the variables entered conformed to a priori expectations. The count of forestry resources sourced, awareness of the existence of a common forest, season, and age of the respondents were significant income determinants observed. The model had an R^2 value of 61% and an F-ratio estimate of 7.09 against a critical value of 6.03. Environmental education, youth training on forestry management, massive formal education for the youths among others were recommended.

Keywords**:** Forest, income determinants, poverty reduction, deforestation, Rivers State, Nigeria.

INTRODUCTION

Tropical forests are disappearing fast, while the number of people depending on them grows steadily (Scherr, White, and Kaimowitz, 2005). As over one billion people live on forest resources, there is fear that this dependency can lead to a poverty trap in which people never increase their incomes above basic level. Some research reports (Institute of Development Studies, 2005) asserted that forests have the

potential of contributing to poverty reduction, if the rural communities are given greater control and access to these resources.

Nigeria is naturally endowed with forests, most of which are situated in the southern part of the country. About two decades ago, a total of 10.1 million hectares of land out of a total of 90.3 million hectares possessed by the nation were estimated to be forest. These figures are, however, not feasible today as a result of de-reservation by the Rivers State Government, conversion of forest land to agriculture and so on (Akinsanmi, 2006). Research evidence has shown that the high forest cover in Nigeria decreased from 20 million hectares at the beginning of 20th Century A.D. to only 2 million hectares in the 90's, representing about 10% of its original size, mostly in high forest reserves (Oguntala, 1996). Nwafor (2006) put the estimate of the rate of deforestation in Nigeria at 0.7% for the period of 1981 to 1990. Regardless of the alarming rate of deforestation, the country's forest still makes significant contribution to the nation's economy. This is because sustainable growth in forestry is essential to the welfare of the majority of Nigerians, whose 23.3 percent (2005 estimate in Microsoft 2009) of population relies on agriculture as a way of earning a living.

A recent World Bank (2009) report held that despite the country's relative oil wealth, GDP per capita is about US$1,161 (2007), and poverty is widespread – about 54 percent of the population lives on less than 1 dollar per day. As of 2008, the total life expectancy in Nigeria was estimated at 47.8 years (Microsoft, 2009). Microsoft (2009), relying on World Bank, IMF, and WHO data, put Nigerian's infant mortality rate at 94 deaths per 1,000 live births (2008 estimate), population per physician of 3,715 people (2004), population per hospital bed of 599 people (1990), literacy rate total of 70.7 percent (2005 estimate); education expenditure as a share of gross national product (GNP) of 0.7 percent (1999-2000); number of years of compulsory schooling of 9 years (2002-2003), while number of students per primary school teacher stood at 42 students per teacher (2002-2003 estimates).

Experience in Sub-Saharan Africa, including Nigeria, has shown that the lifestyle of people linked with the production of firewood and charcoal hardly improves beyond survival as most of the marginal gains go to the transporters (Davidson & Sokona, 2001 in FEMA, 2006). On the contrary, those involved in employment linked with Liquified Petroleum Gas (LPG) or electricity resulted in improved lifestyles (Prassad, 2002). Access to LPG by urban households in Senegal led to major time savings and improved

nutrition (Sokona, 2000). Given that the majority of the poor in Sub-Saharan Africa depend on agriculture for their livelihoods, efforts to address land degradation are crucial in achieving the Millennium Development Goals, as well as national-level goals to significantly reduce poverty in the region (International Food Policy Research Institute - IFPRI, 2009). According to The World Bank (2006) and The Forum of Energy Ministers of Africa (2006), understanding the linkages between land degradation, land management, and poverty is essential for designing policies that simultaneously reduce poverty, reverse land degradation, and encourage the adoption of sustainable land management practices. The World Bank (2006) noted that many scholars hypothesized that a downward spiral of poverty and land degradation (or, more broadly, environmental degradation) exists in developing countries. Past studies have shown that the relationships between poverty and land management are complex, context specific, and resource specific (World Bank, 2006). Hence, The World Bank (2006) asserted that more empirical evidence is needed to assess this complex relationship and to formulate policies for reducing poverty sustainably. This is even more crucial, especially for a state like Rivers State in Nigeria, which had been for years a frontier in environmental unrests. Microsoft (2009) noted that several Nigerian groups have campaigned actively, but with little success, to compel the government and major oil companies to introduce environmental safeguards in the Niger Delta (including Rivers State). In 1988, the government created the Federal Environmental Protection Agency (FEPA) to address problems of desertification, oil pollution, and land degradation, but the FEPA has had only a minor impact. In 1995, the weak and fragmented environmental movement was dealt a sharp blow when the government executed Ken Saro-Wiwa, a well-known writer who struggled to stop environmental degradation in the Niger River Delta. Recently (in 2008) the federal Government created the Ministry of Niger Delta as a way of resolving the crisis arising from the struggle on the above issues in the Niger Delta. It is, however, doubtful whether this measure can solve the problem.

Against this backdrop, this study was designed to investigate the possible linkages between the farmers' socio-economic status and the level of benefits derivable from utilizing forestry resources in Rivers State, one of the Niger Delta States. Such relationships may give results that will be useful for policy of environmental quality improvement, as well as poverty reduction, in the Niger Delta and Nigeria as a whole.

RESEARCH OBJECTIVE

The specific objective of this research is to determine the effects of some demographic and socio-economic variables on the income level of the farmers exploiting forestry resources in the study area.

RESEACH HYPOTHESES

Three null hypotheses were formulated to guide the study:

Ho1 Awareness of the presence of Government Reserves in the community has no significant effect on the level of income derived from exploiting forestry resources by farmers in the study area.

Ho2 Income derived from on-farm business has no significant influence on forest reserve income difference of the farmers in the study area.

Ho3 Seasonality has no significant influence on the level of income derived from exploiting forestry resources by farmers in the study area.

THEORETICAL FRAMEWORK

Hoffman and Ashwell (2001) stressed that desertification and land degradation are clearly issues of concern among rural communities, farmers, and natural resource managers, who experienced their effects first hand. Eboh (1995) corroborated the reality of environmental problems in Nigeria when he observed that "whereas, deforestation, erosion, and land depletion constitute major environmental concerns in the rainier, forested areas of the southeast and south-west of the country, the principal worries in the drier areas of the north-east have to do with growing desertification and occasional droughts. He showed the interrelatedness of poverty, population, and environmental degradation in Nigeria, just as Hoffman and Ashwell noticed that poverty was largely linked to environmental degradation in South Africa. Among the strategies suggested for combating the environmental problems by researchers (Hofmann and Ashwell, 2001; and Vereijken, 1999) were the promotion of the development and transmission of environmental friendly agricultural systems.

ANALYTICAL FRAMEWORK

Regression Analysis

Regression analysis is used to investigate the association of a dependent variable with one or more independent variables (Koutsoyiannis, 2001; Lesschen, Verburg, and Staal, 2005). In linear regression, a

straight line is used to represent the association of the explanatory variables with the dependent variable. More complex methods of regression exist and are intended for different types of dependent variables and data structures. According to Lesschen, Verburg, and Staal (2005), these include linear regression (for continuous dependent variable e.g. income level), logistic regression (for discrete bivariate dependent variable), multinomial regression (for discrete multivariate endogenous variable), ordered logit/probit (for discrete ordered dependent variable), tobit analysis (censored continuous dependent variable), simultaneous regression (interdependent/simultaneous relations), and multilevel models. In this study, regression analyses, using continuous endogenous variable (income level arising from use of forestry resources), was applied using three functional forms.

MATERIALS AND METHODS

Study Area

Rivers State is one of the 36 States of Nigeria. Rivers State is divided into twenty-three local government areas (LGAs) one of which is Etche Local Government Area. According to Wikipedia (2009), Rivers State in Nigeria is bounded on the South by the Atlantic Ocean, to the North by Imo and Abia States, to the East by Akwa Ibom State, and to the West by Bayelsa and Delta states. The inland part of Rivers State consists of tropical rainforest; towards the coast the typical Niger Delta environment features many mangrove swamps. Etche LGA has ten (10) rural communities. These include Umnechem, Egwu, Ulakwo, Okomoko, Chokocho, Igboh, Igbodo, Olehi, Abara, and Elele. Six (6) farmers were randomly selected from each of these communities, giving a total number of sixty (60) respondents.

Data Analysis

A multiple regression model with three functional forms, linear, semi-log, and double log was used to analyze one of the study objectives. The implicit form of the model is given by:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, + u)$.

The explicit forms of the models are:

$Y_t = bo + b_1 X_1, + b_2X_2 + b_3X_3 + b_4X_4 + b_5 X_5 + b_6X_6 + b_7X_7 + u$ … Linear Form

$Y_t = bo + b_1 \ln X_1, + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5 \ln X_5 + b_6\ln X_6 + b_7\ln X_7 + u$ … Semi-log

$Y_t = bo + b_1 \ln X_1, + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5 \ln X_5 + b_6\ln X_6 + b_7\ln X_7 + u$ … Double log

Where, ln = natural log to base e

bi = coefficients of the explanatory variables

u = stochastic error term

Y = income derived from forestry resources in a year (in Naira)

X_1 = number of forestry resources sourced (count)

X_2 = awareness of the existence of the forest (Dummy, 1, Yes and 0 if otherwise)

X_3 = age of the respondents (years)

X_4 = distance of the respondents to the forest (in Kilometres)

X_5 = income derived from on-farm activities (in Naira, N and kobo, K)

X_6 = number of years spent on formal education (years)

X_7 = season at which forest resources are demanded (Dummy, 1 = high demand season, 0 = off season of high demand).

Results and Discussion

The estimated model is as follows:

$\ln Y = 6.556580675 + 15798.1222 \ln X_1, + 12556.27 \ln X_2 + 390.689294 \ln X_3 - 20.2462415 X_4$

S. E. (70326.4467) (4853.013549) (17482.13551) (1134.753853) (6055.349271)

P values [0.924416] ^{NS} [0.002463]* [0.056106]** [0.026763]* [0.669113] ^{NS}

$- 0.35259506 \ln X_5 - 1291.47086 \ln X_6 + 32187.725 \ln X_7 + u$

S. E. (0.22630742) (2171.392895) (17402.67701)

P values [0.186358] ^{NS} [0.401904] ^{NS} [0.012382]*

*NB: * = p values significant at 5%.; **= p value significant at 10% level; *** = significant at 1% level. NS = Not significant.*

The intercept showed a positive sign indicating that even when the explanatory variables in the model are at zero level, the community was still capable of harnessing the forestry resources above zero percent level (earning at least N6.55K income), but the p value is not significant (implying that the rate of forestry utilization is not significant when the explanatory variables of the model are at zero level). For the first explanatory variable, the coefficient shows a positive sign indicating that the increase in the number of resources harnessed by the farmers in the area is accompanied by some units change in the income of the beneficiaries of the forest. The coefficient value of 15798.12 indicates that a percentage

increase in forestry resources can increase the off- farm income of the forest users by about N15,798.12 K. The change is significant at 5% level. Similarly, in the second variable, X_2, as the community members become more informed about the presence of the government forest, or common forest in the area, they tend to increase their use of the resource and this increases the income derivable from the forest resource. The increase in income brought about by this awareness is significant at 10% level (with p value of 0.056); but for each person who gets the awareness, his income derivable from using the resource will be at least

N12,556.27 K. Since the p value is significant at 10% alpha level, we therefore reject the first null hypothesis which held that "awareness of presence of Government Reserves in the community has no significant effect on the level of income derived from exploiting forestry resources by farmers in the study area." The positive sign of the coefficient for age showed that age of the respondents have positive effects on the ability of the community members who use the forest reserve to harness more of the forestry resources and, thus, increase the income from use of forestry resources. Thus, the coefficient value of 390.689294 implies that for every extra year in the forestry users' life, he gets additional experience and skill that will enable him increase income from forestry resource by at least N390.69 K. This change is significant with a p value of 0.027 (i.e. at 5% level of significance). Thus, the age of the farmers have positive effect on the utilization level of forestry resources in the area. For the fourth variable, the sign is negative and in line with a priori expectation that as one gets farther away from the forest area, he tends to use less of the forestry resource. The coefficient value of 20.2462415 indicates that for each kilometer away from the forest reserve, the income foregone by virtue of being far from the forest is N20.25K. In any case, this income loss is not significant as a good transport system can help users who have knowledge of the forest reserve to still come there and harness the resource. As expected, income derivable from on-farm activities' increase is capable of reducing the potential incomes from use of forestry resources, given the negative sign of the variable's coefficient. This is possibly because as farmers spend more time increasing on-farm activities, the reward from these becomes higher and the tendency to lose interest in harnessing forestry resources for sale dwindles, thus reducing the income from forestry resources. Thus, for a percentage increment in income earned from the on-farm activities of the farmers living in the study area, a drop in forest resource income earnings of 35 Kobo is experienced. This is a negligible amount of money (with a p value of 0.186) probably due to the poverty level of the farmers in the area who may still rely on the forest resource for additional income. Since the p value is greater than 10% level of significance, we therefore uphold the second null

hypothesis which held that “income derived from on-farm business have no significant influence on forest reserve income difference of the farmers in the study area”. The number of years spent on formal education has a negative coefficient in line with a priori expectation. This is more so because as a community member gets higher education the tendency for him to engage in white-collar job is very high; hence, he may hardly have sufficient time to harness forestry resources as a major way of earning his income. So, for additional years spent in gaining formal education, the income derivable from using forestry products tends to drop by N1, 291.47 K. This drop or change in income arising from an increase in education level is, however, not significant with a p value of 0.402. This could be related to the low income or poverty experienced by civil servants in the study area who can hardly rely wholly on their salary for a living, and so have to use the forest reserve to boost or supplement their incomes. The last variable, seasonality, also gave an expected sign. The positive sign implies that as the seasons of high demand for forestry products arrives, income change derived from use of forestry resources may increase; and this change is statistically significant with a p value of 0.012 (at 1% level), we therefore reject the third null hypothesis which held that “seasonality has no significant influence on the level of income derived from exploiting forestry resources by farmers in the study area”.

The Model Fitness Test showed that the model has a good fitting and reliable for forecasting with the following results:

Regression Statistics	
Multiple R	0.779739812
R Square	0.607994174
Adjusted R Square	0.555224159
Standard Error	0.512276119
Observations	60

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	21.16500923	3.023573	11.52158	9.94633E-09
Residual	52	13.64619476	0.262427		
Total	59	34.81120399			

With a multiple R of 0.78, the model indicated that there is a very high correlation between the explanatory variables and the dependent variable. An R square of 0.61, recorded by the model, showed that the selected variables in the model explained the variation of the endogenous variable of the model very well with 61% of the change in the endogenous variable being explained by the joint variation of the exogenous variables of the model, while the remaining 39% was accounted for factors not present in the model. The ANOVA result indicated that the joint variation of the endogenous variable of the model was significant since the F ratio of the model estimate (11.5216) is higher than the critical value (9.9463).

CONCLUSION

This research has shown that the quantity or count of forestry resources sourced, awareness of the existence of a common forest, and age of the respondents are significant determinants of the level of income derivable from using forestry resources in the study area. In addition to these, seasons which affect forest resources' demand, proves to be significant too in determining the level of income from forestry resources in the study area. The study has proved that the model used here is appropriate since all the variables showed the expected theoretical signs and expected F value, which rejected the null hypotheses of no significant joint effect of the explanatory variables used in the model on forestry income earned by the farmers. The R square value of 61% (which is fairly high) corroborated our stand that the model has a good fitting. Out of the three null hypotheses of the study tested, two (the 1st and 3rd) were rejected while one (the 2nd hypothesis) was upheld.

RECOMMENDATIONS

Based on the above research findings, the following recommendations are hereby made:

1.) Government and community leaders, where open forests exist, should properly inform the communities about the existence and the aim of maintaining such reserves so that the households who desire to use the forestry resources can use them sustainably without some members being cheated. That way the effect of such forestry on poverty reduction can be attained reasonably.

2.) Particular seasons that increase the demand of forestry resources could put undue pressure on the forest reserve. At such seasons, the forest guards must be vigilant to prevent the forest

users from stretching the use of the forest reserves to the limit where regeneration and regrowth will be neglected.

3.) Young people in the communities sharing or having forestry resources must be given special sensitization and training on how to manage forest resources effectively, since the study showed that age was a factor in determining the level of utilization of the forestry resource in the area. This can be done via Young Farmers' club or appealing to them during their age grade meetings.

4.) Parents in the community should ensure they allow their children to go to school and have adequate formal education that will enable them to gain opportunity of being employed to work under white-collar job as well so that their sources of income should not be fixed solely on forestry resources. The study's findings that white-collar workers had less income from exploiting forestry resources tells us the potentials inherent in educating the youth to get white collar jobs and stop stressing the forests for income.

APPENDIX 1

LINEAR FORM

SUMMARY

OUTPUT

Regression Statistics	
Multiple R	0.69894896
R Square	0.48852966
Adjusted R Square	0.41967788
Standard Error	52602.4431
Observations	60

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.37431E+11	1.9633E+10	7.095382	6.02838E-06
Residual	52	1.43885E+11	2767017024		
Total	59	2.81316E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-6704.46481	70326.4467	-0.09533348	0.924416	-147825	134415.8716
NFP	15798.1222	4853.013549	3.25532208	0.001995	6059.838	25536.4061
AEF	12556.27	17482.13551	0.71823433	0.475828	-22524.2	47636.74055
AGE	390.689294	1134.753853	0.34429431	0.732013	-1886.36	2667.739439
DF	-20.2462415	6055.349271	-0.00334353	0.997345	-12171.2	12130.70076
NFI	-0.35259506	0.22630742	-1.55803577	0.125291	-0.80671	0.101523995
LFED	-1291.47086	2171.392895	-	0.554579	-5648.69	3065.747659

			0.59476609			
PSFP	32187.725	17402.67701	1.84958469	0.07006	-2733.3	67108.75041

DOUBLE LOG FORM

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.779739812
R Square	0.607994174
Adjusted R Square	0.555224159
Standard Error	0.512276119
Observations	60

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	7	21.16500923	3.023573	11.52158	9.94633E-09
Residual	52	13.64619476	0.262427		
Total	59	34.81120399			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	6.556580675	2.288042611	2.865585	0.005994	1.965287382	11.14787397
lnNFP	0.620053191	0.194815369	3.182773	0.002463	0.229127562	1.010978819
lnAEF	0.329987738	0.168889834	1.953864	0.056106	-0.0089145	0.668889976
lnAge	1.128409725	0.495001147	2.27961	0.026763	0.135117277	2.121702174
lnDF	0.022924949	0.053338011	0.429805	0.669113	-0.084105599	0.129955496
lnNFI	-0.104751107	0.078224233	-1.33911	0.186358	-0.261719512	0.052217297
lnLFED	-0.089413724	0.105797336	-0.84514	0.401904	-0.301711606	0.122884158
lnPSFP	0.448837857	0.173213165	2.591246	0.012382	0.101260221	0.796415494

SUMMARY OUTPUT (SEMILOG FUNCTION)

Regression Statistics	
Multiple R	0.685626957
R Square	0.470084324
Adjusted R Square	0.398749521
Standard Error	53542.55237
Observations	60

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.32E+11	1.89E+10	6.5898314	1.38588E-05
Residual	52	1.49E+11	2.87E+09		
Total	59	2.81E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-21935.29044	239143.8	-0.09172	0.9272696	-501812	457941.8
lnNFP	67176.91217	20361.89	3.299148	0.0017549	26317.78	108036
lnAEF	18447.87929	17652.18	1.045076	0.3008217	-16973.8	53869.58
lnAge	30619.89458	51736.99	0.591838	0.5565239	-73198	134437.8
lnDF	4132.163738	5574.832	0.741218	0.4618959	-7054.55	15318.88
lnNFI	-12658.97702	8175.913	-1.54833	0.127609	-29065.1	3747.193
lnLFED	-3930.467277	11057.82	-0.35545	0.7236928	-26119.6	18258.68
lnPSFP	34219.80776	18104.05	1.890174	0.064314	-2108.64	70548.25

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