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Determinants of forest households' income and participation in forest-related enterprises in South-western Nigeria

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Abstract

This study assesses determinants of forest households' income and participation in forest- based enterprises in South-western Nigeria. The study adopted a multi-stage random sampling approach in selecting the respondents' sample. Descriptive analysis was used to describe the respondents' demographic characteristics and Heckman's two-step procedure was used in determining factors influencing participation in forest-related enterprises and level of participation by rural households while Tobit model was used to examine the determinants of forest households' income. The study reveals that labour cost, market availability and membership of association have significant effects on the choice of participation of the households in forest-based businesses. Also, the study reveals that the higher the market activities index and the poverty index, the higher the level of participation of the households in forest-based businesses. Furthermore, Tobit regression model reveals that forest management laws, age, labour cost and forest products availability have significant effects on forest income of the households. The study thus recommends that labour cost should be minimal and affordable to the forest-based entrepreneurs in order to reduce households' input cost and to increase their earnings while among other things, adopting good forest management laws and practices should be prioritized to improve the chances of forest income generation to the households.

Keywords: Poverty; Forest-Based Enterprises; Households' Income, Forest Resources; South-Western Nigeria

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1. Introduction

Forest indigenous people in developing countries usually derive a substantial part of their earnings from activities related to the forest (Angelsen et al., 2014). Many studies on income undertaken by the Centre for International Forestry Research (CIFOR) in 2011 on approximately 6000 households across the Congo basin confirmed that on average, forest households derive between one-fifth and one-fourth of their revenues from forest-based enterprises (Wollenberg et al., 2011; Makoudjou et al., 2017).

Income from forest-based enterprises appears to be greatly important to the poorer households who largely depend on low value forest products while those wealthier households that tend to focus on more profitable activities (Bwalya, 2013; Makoudjou et al., 2017).

Further, the enormous economic contributions of forests (cash and non-cash income) continue to enhance human livelihoods but the huge importance of non-cash income greatly surpasses cash income in most cases particularly at the rural household level (Makoudjou et al., 2017).

According to Agrawal (2013), non-cash income from forests is referred to as the forest products collected by the households but consumed or used in the home rather than selling. For instance, timber, fuel wood, fodder or fibre (used for making mat and basket as well as for house construction), forest foods and medicines among others.

However, households' economy comprises both cash and non-cash income along with other cash from employment, trade and forest enterprises, farming business and consumption. The total households' economy thus varies hugely in the way it is made up in different situations. It is thus through understanding of all the types of income that are coming into a household that the role of forest economic activities in the household economy is clarified. It is within that context that the level of forest reliance can be understood, and the balance between cash and non-cash income from forests in particular cases can be examined (Shepherd, 2012; Agrawal, 2013).

Cash and non-cash uses are frequently entwined at the household and community levels so much so that their influences can be hardly extricated. However, in this paper, only cash income at the forest households' level was measured as the unit of analysis because literature shows that using income, as a measure of source of revenue is disposed to several errors, particularly in Sub-Saharan African countries (Datt and Jolliffe, 1999; Omonona, 2009).

Moreover, there was paucity of reliable measurable estimates of the value of forest in terms of their indirect contributions (non-cash income) to the households' income due to the following reasons. First, most households are unable or usually do not like declaring their true consumption estimates (such as food, fuel, building materials, herbs for medicine, fibre for ropes, baskets etc) (Ferraro et al., 2012; Omonona, 2009). Secondly, environmental benefits (carbon storage and sequestration, forest habitats and biodiversity, protection of hydrological services, eco-tourism etc); employment and local multiplier effects (social benefits and other trickle-down effects) which also constitute non-cash income to the households were difficult to measure (Langat et al., 2016). Thus, the survey appropriately used the households' cash income with a view to avert having subjective parameters estimates.

Further, given the fact that poverty is a common phenomenon among community dwellers in and around the natural forests of the world; hundreds of millions of people thus depend on forests for survival (UNFF, 2013:10). Nigeria is blessed with forest resources, accounting for about 2.5 per cent of the Gross Domestic Products (GDP). Yet, forests provide a wide range of non-wood products and environmental functions which are not adequately quantified and are under-estimated in national accounting (Agrawal, 2013). Besides, it is somehow difficult to explicitly determine the situation of rural households' income in terms of their level of involvement in forest based income generating activities (UNFF, 2013).

Nigeria falls short of the basic standard of acquiring regular and up to date data on the forest resources utilization because most of the information documented may not properly reflect the actual situation but merely indicative (FRA/FAO, 2010). In other word, little is known about factors that influence rural households' participation with respect to the huge contributions derivable from forest in improving the livelihood of the rural dwellers (Heubach et al., 2011). It is against this backdrop, this study assesses factors that influence participation of rural households in forest related enterprises in South- western Nigeria. The study goes further to assess the determinants of forest households' income in the study area.

2. Methodology

2.1. Study area

This study was carried out in South-west Nigeria; one of the six geo-political regions in the country (Agunwamba et al., 2009:8). Yoruba is the main ethnic group in the region, which comprises several dialects. Southwest lies within latitudes 4^{o} – 14^{0}N and longitudes 3^{0} – 14^{0}E and exhibits the typical tropical climate of averagely high temperature and high relative humidity. The temperature is relatively high during the dry season with the mean around 30°C and low temperature is experienced during the rainy season, especially between July and August when the temperature could be as low as 24°C. The distribution of rainfall varies from about 1000 mm to about 2000 mm (Idowu et al., 2013).

The South-western part of Nigeria has three main types of vegetation, namely, mangrove forest, tropical rain forest and guinea savannah. The tropical rain forest is found mainly in Ogun, Ondo, Ekiti states and some part of Oyo state while the mangrove forest is found mainly in Lagos state and some part of Ogun and Ondo states. Guinea and derived savannah are found mostly in Osun and some part of Oyo and Ogun states. The data were collected precisely in Ogun, Osun and Oyo States (figure 1) due to their forestry potentials (Idowu et al., 2013).

2.2. Sampling procedure

The sample frame for the study include rural households' heads who engage in forest-related enterprises (FREs) such as plank trading, carpentry/furniture, basketry/mat/bag making, wood carving, rattan and bamboo utilization, rattan and bamboo utilization, charcoal production and selling, fuel wood collection and

selling, chew stick, bush meat, snail, fish, fruits and vegetables, medicinal plants, gum and dye, broom, poles, locust bean, spices/ leaves and fibre, mushroom, honey, shea butter, local wine, local wineand farmers who practise agro-forestry system within and around the forest community using a structured questionnaire to generate information based on individuals' participation in various forest based enterprises with respect to their income. Focus Group Discussion (FGD) method was also adopted in this regard.

Table 1. Description of respondents based on LGAs and villages

State	LGAs	Villages	No. of respondents
Oyo	Afijio	Elepe	25
	Itesiwaju	Ariyo	25
	Ori Ire	Akute	25
	Kajola	Isemi	25
	Akinyele	Alabata	25
	Ibarapa North	Opomu	25
Osun	Ori Ade	Aba Lawani	25
	Isokan	Alara	25
	Boripe	Idi Osan	25
	Atakumasa	Odesomi	25
	Ejigbo	Isoko	25
	Ede North	Elero	25
Ogun	Ado Odo/Ota	Agbojedo	25
	Odigbo	Agunla	25
	Ewekoro	Akinbo	25
	Obafemi owode	Asore	25
	Imeko Afon	Araromi	25
	Ifo	Itoki	25
Total			450

Source: Computed by the Author, 2016

Figure 1. Map of South-west Nigeria (Source:https://www.google.com/searchmapofsouthwesternnigeria)

The study adopted a multi-stage random sampling approach in selecting the respondents' sample. Firstly, three states such as Oyo, Ogun and Osun states were randomly selected from the five states that make up the

South-west geo-political region of the country apart from Lagos state which is less forested and cosmopolitan in nature.

Secondly, six Local Government Areas (LGAs) in each of the three states (Table 1) were purposively chosen making eighteen LGAs in total (considering their population sizes as well as their forestry potentials) whereas one forested village was randomly chosen per each selected LGA totaling eighteen villages.

Thirdly, a random selection of twenty-five households from each village was done which led to four hundred and fifty households' heads being interviewed in the eighteen selected villages (206 males and 243 females). Each respondent was interviewed separately and each interview lasted for about 1 hour. The exercise was carried out between December 2015 and April 2016.

2.3. Analytical procedures

Descriptive analysis using frequency distribution and percentage analysis was used to describe the socio-economic characteristics and statistics of the rural households. For the empirical models, two empirical models such as Heckman's two-step procedure and Tobit model were adopted for the analysis. Specifically, Heckman's two-step procedure was used to determine factors influencing households' participation in forest based enterprises and level of participation while Tobit model was used to examine the determinants of forest households' income.

2.4. Model specification

2.4.1. Heckman's two-step procedure

The Heckman's two-step comprises estimation of two equations such as selection equation and outcome equation (Heckman, 1979). First is whether a household participates in forest-based enterprises or not, then second is the level of participation (number of forest-based businesses and their magnitude). The number of related business and magnitude of the enterprise(s) is a function of the household determination to participate in forest related enterprise. It is however evident in the literature that, estimation of such relationships is typically difficult due to bias in sample selection (Idowu et al., 2013).

The first step involves a Probit model for participation or selection equation. This step evaluates the probability of group participation (See equation 1 below).

$$P_i = \delta Z_i + \varepsilon_{i,} E\left(\frac{\varepsilon_i}{Z}\right) = 0 \quad \text{..... (1)}$$

Where, P_i is a dummy for participation in FREs while Z_i is a vector of variables that influence participation choice.

Equation 2 explains the level of participation:

$$Y_i = X_i'\beta + \mu_i, \text{ E } (\frac{\mu_i}{X}) = 0 \quad \text{..... (2)}$$

Where; Y_i is the level of participation measured in terms of number and magnitude of FREs undertaken by a household, X_i is a vector of variables which analyse the levels of participation, ε_i and μ_i are the error terms.

Probit model adopts that Z and X are observable exogenous variables while X is a subset of Z. There would be selection bias problem if the correlation between ε_i and μ_i is not equal to zero. Thus, after estimating the selection equation, a non-selection bias is computed using equation 3 below which is known as Inverse Mills Ratio (IMR) λ_i when P_i=1.

$$E\left(\frac{\varepsilon_i}{P_i}, Z_i\right) \quad \text{(3)}$$

Then the new lambda is used in the selection equation (6) as an explanatory variable. The new equation for the second stage regression is therefore represented as follows:

$$EY_i =, P_i = 1 = \beta X_i + \rho\lambda_i \quad \text{(4)}$$

Equation (4) gives the expected number of enterprises Y_i given vectors of observable factors Z_i and given that the household has already made the decision to participate in forest related business. This can be explained by vector of observable characteristics X_i and the Inverse Mills Ratio evaluated as, λ_i.

If P_i= 0, then there is no evidence of the selection bias and the regression reverts to OLS. But

if$P_i \neq 0$, then there were omitted variables in the initial model correlated with X_i which is corrected by including IMR in the second regression.

The two steps are specified as follows

Step 1. Selection equation (Probit):

$$Y_i = \beta_0 + \beta_1 X_i + \in_i \quad \text{(5)}$$ Y_i = Participation

β = Coefficient of X_i

X_i= Explanatory variables

$\in_i$ = Error term

X_1 = Age of household head (years), X_2 = Sex, X_3 = Years of education, X_4 = Marital status, X_5 = Household size, X_6 = Other sources of income, X_7 = Forest products availability, X_8 = market availability, X_9 = Labour cost (Naira) X_{10}= Membership association

Step 2. Outcome equation:

$$Y_i = \beta_o + \beta_1 X_i + \rho\lambda_i + \in_i \quad \text{(6)}$$

Where:

Y_i = Level of Participation

β = Coefficient of X_i,

X_i= (IP, ISE, IFA, IMA),

$\in_i$ = Error term

IP= Index of poverty (proportion of family members below a pre-set poverty line, other source of income).

ISE= Index of socio-economic characteristic of the households (such as age, sex, marital status, educational level, family size, years of experience, farm size).

IFA= Index of forest resource availability (such as forest products availability, forest income, forest distance, institutional laws, cultural beliefs, awareness, transportation).

IMA= Index of market activities (such as price, incentives, credit facility, social capita, and infrastructural facilities) (Balogun and Yusuf, 2011; Idowu et al., 2013).

2.4.2. Tobit model

In estimating forest households' income determinants using Tobit model, Forest Resources Income (FRI) was considered as a dependent variable representing the amount realized from forest related enterprises capable of lifting the rural households to or above a pre-set poverty line. FRI was computed as a percentage of total household income. The variable was zero if the FRI was lower than the amount needed to lift the household out of poverty line and was equal to 100 if the per capita expenditure of the households is more than the amount set as poverty line. Tobit regression model which is based on maximum likelihood technique (Gujarati, 2003) was used. The specification of the Tobit regression model is given as:

$Y_i^* = X_i\beta +$ .... (7)

Where Y_i^* represents latent variable for the ith forest entrepreneur that is observed for values greater than Y_i and censored for values less than or equal to 0. The Tobit model can be generalized to take account of censoring both from below and from above. X is a vector of independent variables postulated to influence forest income. The β's are parameters associated with the independent variables to be estimated. The ε is the independently distributed error term assumed to be normally distributed with a mean of zero and a constant variance. Of course, we could collapse all positive observations on Y_i and treat this as a binomial probit or logit estimation problem, but doing so would discard the information on the amount generated by entrepreneur as at a certain time. Hence observed Y is defined by the following generic equation:

$Y_i = 0$ if $y_i^* \leq 0$.

$Y_i = y_i^*$ if $y_i^* > 0$. That is,

$Y_i = Y_i^*$ if $Y* > 0$

$Y_i = Y_i^*$ if $Y* \leq 0$.. (8)

Usually, the Tobit model assumes that $Y_i = 0$ which means that the data is censored at zero.

Though, forest resources income ranges between 0-100 percent, thus substituting Y_i in equation 8 above, it gives;

$Y_i = Y_i^*$ if $0 < Y^{*}* < 100$

$Y_i = 0$ if $Y_i \leq 0$

Y_i=100 if $Y^* \geq 100$ .... (9)

Tobit model assumes that there is a certain income equal to $Xi\beta + \varepsilon i$ which is observed only when the forest income falls between 0 and 100; if not, it is regarded as an unobserved latent variable. The dependent variable is not normally distributed since its values range between 0 and 100. Therefore, this study adopts an empirical Tobit model using the following form:

$$Y_i^* = \beta_0 + \sum_{n}^{n} = 1\, \beta_n X_i + \varepsilon_i$$

Y_i^* = β_0+ $\beta_i X_1$+ $\beta_1 X_2$+ $\beta_2 X_3$+ $\beta_3 X_4$+... $\beta_n X_n$+..... (10)

(Y_i^*) FRI = β_0 + $\beta_1$age + $\beta_2$sex + $\beta_3$education + β_4 marital status + $\beta_5$labour cost+$\beta_6$market access+$\beta_7$forest availability e+$\beta_8$transportation+β9forestdistance+β_{10}market distance +β_{11} price +β_{12}forest management law +ε.....(11)

Giving credence to the fact that valuing the model using OLS would produce both inconsistent and biased estimates (Gujarati, 2003). The reason being that OLS underestimates the true effect of the parameters through reduction of the slope (Goetz, 1995). So, the maximum likelihood estimation is recommended for Tobit analysis.

3. Results and discussion

3.1. Socio-economic characteristics of forest users' households

This section presents the socio-economic characteristics of the rural households that engage in forest related enterprises. The distribution of age of the households' head shows that 47.2 per cent of the respondents were between 41 - 60 years, followed by 37.4 per cent that corresponds to 21 - 40 years. A total of 14.7 per cent respondents were over 60 years of age whereas only 0.7 per cent of the respondents were less than or equal to 20 years of age in the study areas. This reflects that about 80per cent of the respondents are still in their working age. Table 2 reflects the distribution of the socio-economic characteristics of rural households.

Table 2. Socio-economic characteristics of rural households

Item	Frequency	Percentage
Household's Head Age		
≤ 20	3	0.7
21 – 40	168	37.4
41 - 60	212	47.2
61 - 80	66	14.7
Household's Head Sex		
Male	206	45.8
Female	243	54.2
Household's Head Year of Education		
No Formal Education	60	13.4
Primary	107	23.8
Secondary	184	41.0
Tertiary	98	21.8
Marital Status		

Single	54	12.0
Married	325	72.4
Divorced	18	4.0
Separated	52	11.6
Religion		
Islam	213	47.4
Christianity	223	49.7
Traditional	13	2.9

Source: Calculated from field survey, 2016

Furthermore, the results from table 1 reveals that majority of the respondents were female (about 54.2 per cent), while the remaining 45.8 per cent were male. In terms of education, less than 22 per cent of household heads had tertiary education. Large proportion of households (about 41 per cent) had secondary education while only 23 per cent had primary or elementary school and about 13 per cent had no formal education. It is apt to note that the level of education in the study area is commendable which aligns with the general perception that households in South-west Nigeria are well educated. Also, almost three quarter of the sampled households were married while the remaining one quarter shares 12 per cent as single, 4 per cent as divorced and 11.6 per cent separated.

Moreover, it was also revealed from the Table 2 that 47.4 per cent of the respondents were Muslims while 49.7 per cent were Christians and less than 3 per cent were practising traditional religion. This therefore indicates that religious factors may not have much influence on the choice of the households in going into forest related businesses particularly the two most commonly practised religions in the study site, that is Islam and Christianity which abhors the traditional use of forest products through trado-medicine or alternative medicine most especially when fetish beliefs are attached to its usage.

Thus, the study recognises the impartial roles of religion in influencing the participation of the households in FREs as well as their level of participation. Although, according to Colfer et al. (2006), forests provide frontline intervention for household's health care through the use of herbal medicine particularly in traditional setting.

3.2. Rural households' participation in forest extraction

This section presents the estimated parameters and the statistically significant variables explaining the participation choice. The diagnostic test (Table 3) records a log likelihood of about 65.024 reporting the log likelihood of coefficients estimates assuming that they are normally distributed. Chi-square test was significant at both 1 per cent and 5 per cent suggesting that the model had a goodness of fit to the observed variables and there is a high degree of association between the dependent and independent variables. Table 3 reflects factors that influence rural households' participation in forest extraction.

Also, the test reports R^2 of about 0.4150 confirming that the explanatory variables were 42 per cent relevant in explaining the participation decision in forest-based enterprises. The Z test statistics reveals that three key policy driven variables were statistically significant such as market availability, labour cost and membership

of association. This therefore implies that these variables have significant effects on the choice of participation of the households in forest-based businesses.

Table 3. Factors that influence rural households' participation in forest extraction+D76

Variable	*Coefficient*	*Standard Error*	*Z*	P-value
Constant	2.6245	1.1212	2.34	0.019
Age	0.3164	0.1885	1.68	0.093
Sex	0.0507	0.2701	0.19	0.851
Education	-0.0704	0.1425	-0.49	0.621
Marital Status	-0.0273	0.1914	-0.14	0.886
Household size	-0.0633	0.0472	-1.34	0.18
Other income	0.1125	0.3291	0.34	0.732
Forest availability	0.2495	0.2495	-0.65	0.513
Market availability	-0.8566**	0.3673	-1.79	0.02
Labour cost	-0.5181**	0.3743	-1.38	0.016
Membership Assoc.	2.112***	0.3933	-5.37	0
Log likelihood	-65.024			
χ^2	92.24			
Probability of χ^2	0.0000***			
Pseudo R^2	0.416			
N	390			

****, ** Significant at 1% and 5% respectively*

Availability of market is one of the key policy driven variables which is about 86 per cent negatively associated with participation in resource extraction decision. The negative association of the coefficient means that for every unit increase in product supply in the market, there is a decrease in the likelihood of participation in resource extraction holding other things constant. Respondents from the study area explained that easy access to natural resource markets leads to market flooding forcing prices down since saleable products are common pool open access resources freely available. Usually, over infiltration of markets in the neighbourhood crashes the market price due to high level of competition in the market typical for raw homogeneous forest produce.

As a result, more households would tend to be indifferent in participating in the business in order to avoid selling their forest products below the cost price or to evade unhealthy rivalry. However, contrary observations were noted by some authors (Dewees, 1995; Dove, 1995; Gilmour, 1995; Shively, 1999) who posited that market access is capable of hastening households' participation in establishing farm forests through two distinct channels - providing market for products of farm forests and creating alternative off-farm income generating avenues which compels households to set their own sources of fuel wood and other forest products.

Similarly, Emtage and Suh (2004) argued that market access would encourage farm households to plant high value timber and fruit trees, not only to satisfy their monetary needs but also for subsistence requirements provided that markets work fairly well. The study therefore argues that for homogenous raw forest products, increase in supply may crash market prices capable of sending a negative signal towards participation in forests extraction.

The results also revealed a negative and significant relationship between participation in resource extraction and labour cost by magnitude of 52 per cent. The negative association of the coefficient implies that for every unit increase in labour cost, there is a decrease in likelihood of participation in resource extraction all things being equal. This is logical since increase in labour cost will increase the cost of production as households have to pay more on labour across various production and transaction stages (such as establishing forest plantation, harvesting, gathering, processing, packaging, transporting, loading/unloading, supervising/monitoring, selling etc.) which may dissuade many households in participating in forest resources extractions. This scenario may be so especially for some labour–intensive and technical forest activities (e.g. logging) where manual skidding and forwarding or semi-mechanised operations are required. These expenses will increase the households' labour cost and may therefore reduce their propensity to participate in forest extractions. In the same vein, these findings comply considerably with the assertion of Dos Santos (2015) who presumed that reduced labour cost would lead to increased participation and productivity on timber harvesting practices for experienced and inexperienced crews in Tanzania because the timber harvesters (employers) tend to get high returns.

Furthermore, the parameter estimate for membership of association was significant and positively associated with probability of participation. The positive association means that a unit increase in membership of association by the household would result into an increase in the likelihood of participation in forest resources extractions. Based on oral interview with most respondents in the study site, household members who joined one forest association or the other gained a lot of experiences from the group because it helps them to develop ability to solve joint action problems peculiar to common pool resource management. It also helps them to ease institutional and communal performance towards common pool resource management and a source of relevant information, including information on policy changes that directly affect forest communities.

Similar to these findings, Fonta and Ayuk (2013) inferred that increase in membership of association will increase participation rate in forest resources extraction. Likewise, Jumbe and Angelsen (2007) noted that a positive impact of social capital is vital for inducing greater participation. Shackleton and Campbell (2001) also attributed the success of the forest co-management programme in Chimaliro Malawi to the respect people have towards local chiefs. This invariably indicates that 'social capital' is key to a successful operation of forest management programmes.

3.3. Level of participation in forest related enterprises (FREs)

Here, the study reports the factors that are contributing to the level at which individual rural households are involved in forest related enterprises. The results show that the error terms of both the selection and outcome equations are associated as shown by the highly significant chi-square p-value of < 0.000 and the significance

of the inverse Mills ratio. This significant level justifies the use of Heckman's procedure. Given that lambda is significant and positive implies that the level at which forest household participates in forest related enterprises would increase as long as those factors influencing the participation in FREs are favourable. This means that there is correlation between households which self-select themselves into FREs and the level of their participation. So, Table 4 reports factors that influence level of participation in FREs.

Table 4. Factors influence level of participation in FREs (outcome equation)

Variable	*Coefficient*	*Standard Error*	*Z*	*P-value*
Constant	0.9183	1.212921	0.76	0.449
SEI	0.0347	0.045682	0.76	0.447
IP	0.1320***	0.383903	4.34	0
IFA	-4.01E-06	2.94E-06	-1.36	0.173
IMA	0.0219**	0.064529	3.95	0.002
Mills Ratio Lambda	0.003**			
Rho	-0.79			
Sigma	0.951			
χ^2	62.29			
Probability of χ^2	0.0000***			
N	390			

****, ** Significant at 1% and 5% respectively*

Furthermore, the table also suggests that Index of Market Activities (IMA) and Index of Poverty (IP) have significant relationship on the level of participation of the households in the forest-based businesses in the study area. Y_i is the level of households' participation in the forest-based businesses? The estimate suggests that keeping all other predictors constant, for a unit increase in ISE, IP and IMA, we expect 0.0347, 0.1320 and 0.0219 respective increase in the log-odds and 4.01E-06 decrease in the log-odds of IFA on the level of participation accordingly. IP (proportion of family members below a pre-set poverty line, other sources of income) being one of the policy relevant variables has positive relationship with the level of participation in forest related enterprises. This being so since forest has however been identified and considered as a preference for poverty alleviation as it often serves as soft landing and last resort for economically marginalized people (William et al., 2003).

Likewise, IP being one of the policy relevant variables has positive relationship with the level of participation in forest-based enterprises by a magnitude of 13 per cent. This association is conceivable since forest has however been identified and considered as a preference for poverty reduction especially among the rural dwellers and other economically disadvantaged people (William, 2003).

So, rural poor tends to involve more in forest extraction activities (such as wild fruits, vegetables, firewood, charcoal trading etc) as they contribute significantly to households' income and food security among forest

indigenous households (Jimoh, 2006; Kabubo-Mariara and Gachoki, 2008). Likewise, forests contribute in the diversification of household income sources as some households adopt a number of specialized forest strategies to augment their livelihoods; these include forest grazing, forest crop farming and forest gathering activities to corroborate one another[1]. Though according to Inoni (2009), many authors have argued that poor households with small income earning alternatives tend to spend more time and effort collecting forest products (Lopez, 1997; Durraiappah, 1998 and Baland et al., 2010). However, it is expected that increase in other income sources may increase the propensity of the households in expanding the scope of their forest based businesses provided that there is a comparative advantage in such businesses. Hence, the participation level increases.

Another policy relevant variable that influences level of participation in FREs by rural households (Table 4) is IMA. The results reveal positive and significant relationship between IMA and level of participation in resource extractions by a magnitude of 2 per cent. The positive association of the coefficient implies that improvement in IMA variables (such as price, incentives, credit facility, social capital, and infrastructural facilities) would result into an increase in participation level in resource extractions because households would have greater opportunity to access forests products, they spend less time and resources in collecting them (forest products) and market their products with ease (Fisher, 2004).

Specifically, considering price variable as one of the IMA and giving credence to easy access to natural resource markets which normally leads to market flooding and price crash, forest products are usually sold at depressed prices which becomes disincentives to the forest households. This development therefore translates into poor returns to rural households who sell most of their forest products at poor farm-gate prices. This perfect competitive market structure forces most forest entrepreneurs to adopt Value Added Pricing Strategy (VAPS) in differentiating their forest products by adding features or services (such as sorting/grading, packaging, advertising, incentives, good customer relations etc.) that other competitors may not have in order to command higher price for their forest products. This strategy was not only meant to just increase their sales and prices but also to make their customers loyal to them because they offer services which their customers rarely find in other places.

Therefore, VAPS is usually used as a common tool by most forest entrepreneurs in the study site to outsmart their counterparts since every household is interested in maximizing profit from the sales of his/her forest products. Consequent upon that, increase in price of forest products (through value addition) is positively associated with increased level of participation in FREs. This view has been supported by Inoni (2009) who argued that price of fruits among other factors such as household sizes as well as educational level are statistically significant determinants of wild fruits harvesting in rural communities in Delta State, Nigeria.

Furthermore, a focus group discussion (FGD) conducted during the survey revealed that, those forest entrepreneurs who adopt VAPS got the experience and the initiatives through various forest group associations they belong to. It helps them to develop ability to solve collective action problems peculiar to common pool resource mobilization. It is likewise considered as a way of facilitating institutional and

[1] Making the Link Between Forests and Poverty Reduction A Resource Valuation Study from Kenya: Policy Brief of the Centre for Environmental Economics and Policy in Africa, University of Pretoria, South Africa (CEEPA, 2009).

communal incentives that motivate common pool resource mobilization. In the same vein, it is seen as an important source of relevant information, particularly on policy changes that directly affect not only forest enterprises but also forest communities (Adhikari, 2005; Fonta and Ayuk, 2013).

Another market activity index variable subset that increases the level of participation is market distance. The closer the market to the forest is, the lesser efforts and resources to transport the products to the market. Thus far, given the competitive nature of markets for forest related raw products that are almost homogenous, distance to market will significantly affect the net benefit that the participants will get. Similar notable remarks were made by Jumbe and Angelsen (2007) in their findings on determinants of forest dependency and participation in Malawi that 'the shorter the distance for forest products market in Liwonde, the greater the inducement for commercialization of forest products'.

Furthermore, level of participation increases when the necessary infrastructural facilities such as storage facilities, means of transportation, implements etc. are in place. These infrastructural facilities such as improved sanitation facilities, stores, water source, road access, electricity, communications etc. would aid the level of participation across all the value chain of the business because the goal of VAPS could hardly be achieved in absence of good infrastructural facilities. This argument is supported by the findings of Charlery et al., (2016) which stated that the poorest households gained most from the basic infrastructural facilities, making it a pro-poor development intervention. Other authors like Inoni (2009) and Henk (2013) also shared similar view. In sum, this paper therefore posits that VAPS is a unique tool in forest related businesses that can change the course of business from low-price profile to high-price profile particularly when markets for such businesses are perfectly competitive in nature or markets that are almost homogenous.

Summarily, these findings thus suggest that poverty is one of the factors that determine the level at which rural households participate in FREs. Similarly, the study also suggests that if market conditions such as market access, price, market distance and infrastructural facilities are improved, majority of forest indigenous people would tend to participate in FREs more than ever before while social capital factors should also not be undermined.

3.4. Determinants of forest households' income

This section presents the determinants of forest households' income using Tobit regression model (Table 5). The Tobit regression suggests that forest management laws, age, labour cost and forest product availability have a significant effect on forest income of the households. The diagnostic statistical test also validated the goodness of fit of the model since chi-square test statistics is significant at 5 per cent. The test records R^2 of about 0.5245 which therefore confirms that the explanatory variables are 52 per cent relevant in explaining the forest income earnings of the households.

The share of income derived from forest activities is the dependent variable; the age of the households' heads was negative and statistically significant. This negative association thus implies that forest extraction income decreases as the head of household's age progresses. The negative coefficient of age (Table 5) implies that for a one standard deviation positive change in age of households' heads holding other predictor variables constant, there is a decrease in households' forest income by 0.0991 standard deviations. Vedeld et al. (2004)

and Kohlin et al. (2001) note a similar negative association when they argue that older people may have less time and physical strength to engage in forest activities. In contrast, Kabubo-Mariaraand Gachoki (2008) notes a positive association suggesting that young households may be more willing to venture into cropping than forest gathering.

Table 5. Determinants of Forest Households' income

Variable	*Coefficient*	*Standard Error*	*Z*	*P-value*
Constant	1.0526	0.2281	4.61	0
Age	-0.0991**	0.0348	2.85	0.005
Sex	0.0406	0.0489	0.83	0.408
Education	0.0349	0.0251	1.39	0.166
Marital status	-0.0116	0.037	0.31	0.754
Labour cost	-0.0787***	0.0177	4.44	0
Market access	0.013	0.0595	0.22	0.827
Forest availability	0.1263**	0.0453	2.79	0.006
Transportation	-0.0831	0.0518	-1.6	0.111
Forest distance	-0.0109	0.0186	0.59	0.559
Market distance	-0.0228	0.0291	0.78	0.434
Price	-0.00709	0.022	0.32	0.748
Forest mgt. laws	0.1744***	0.0456	3.82	0
Log Likelihood	-46.851			
χ^2	28			
Probability of χ^2	0.0000***			
Pseudo R^2	0.5245			
N	390			

****, ** Significant at 1% and 5% respectively*

Likewise, the study identifies about 8 per cent significant negative impact of labour cost on the forest income of the households which implies that a unit standard deviation increase in labour cost lowers the households returns from the forest business by 8 per cent and vice- versa if all things being equal. Households that enjoy the services of family labour may have some respites in this regard as family labour would reduce the cost of labour and consequently increase such household's profits from forest related businesses.

This study equally identifies about 13 per cent significant positive impact of forest availability on forest income earnings. Forest income increases usually in the midst of available forest resources since there would be high potential for increased turnover and would subsequently bring high income. This simply observes the economic principle of return – to – scale, that is, the higher the income, the higher the willingness to supply,

because such households would have greater accessibility to the forest products as explained by Azeez et al. (2011).

Furthermore, forest management laws is positively associated with forest income earnings in the study area. This means that a one standard deviation positive change in forest management laws holding other predictor variables constant increases households' forest income by 0.1744 standard deviations. It is observed therefore that improved forest management laws will increase households' forest income when carried out with management and practice standards designed to protect natural resources. Agroforestry is a good example of such forest management practices that provide additional income to the households and thus reduce deforestation. In contrast, Kaimowitz (2003) however noted that as much as forestry and conservation laws increased, the rural households' income tends to be reduced because such legislation often prohibits forestry activities such as small-scale timber production, fuel wood collection, and hunting that millions of poor rural households depend on.

4. Conclusion

This study analysed households' income and participation in forest- related enterprises in South-western Nigeria using Heckman's two stage model to estimate the probability of households' participation as well as level of participation in forest related enterprises while Tobit model was used to determine the influence of forest extraction on households' income.

In terms of participation decision, the study reveals negative relationship between the probabilities of participation in forest related enterprises and labour cost as well as market access by magnitude of 52 per cent and 86per cent respectively while there was a positive and significant relationship between participation in resource extraction and membership of association. This therefore suggests that the market availability, the labour cost and membership of association have significant effects on the choice of participation of the households in forest related businesses.

Regarding the level of participation, the study shows that improvement in IMA index variables (such as price, incentives, credit facility, social capital, and infrastructural facilities) would trigger participation level in resource extractions because households would have greater opportunity to access forests products, they spend less time and resources in collecting them (forest products) and market their products with ease. The paper further posits that value added pricing strategy (such as price depression, promotion, giving incentives, good customer relation, rebranding, packaging etc) is a unique tool in forest related businesses that can change the course of business from low-price profile to high-price profile particularly in averting the effect of market flooding which usually crash the market prices of forest related raw products that are almost homogenous. Likewise, poverty index (such as proportion of family members below a pre-set poverty line and other sources of income) also reveal positive and significant relationship with level of participation in FREs in the study site.

Furthermore, Tobit regression model reveals that age, labour cost, forest management laws and forest products availability have significant effects on the forest income of the households. The coefficient of age shows that age is a negative and significant factor since a one standard deviation positive change in age of

households' heads holding other predictor variables constant, decreases households' forest income by 10 per cent standard deviations. The study also identifies about 7.8 per cent negative and significant impact of labour cost on forest income of the households while forest management laws being positively signed implies that improved forest management laws will increase households' forest income if such management laws are carried out with cautions to protect natural resources.

Finally, this paper reveals positive and significant impact of forest products availability on households' forest income meaning that a unit standard deviation increases in forest products availability holding other predictor variable constant will increase households' forest income in the study area.

5. Recommendations

Regarding the market availability factor being negatively associated with FREs participation as revealed by the findings, there should be an improved understanding and cooperation among all forest related stakeholders (such as farmers, marketers, leadership of market unions, forest extension agents etc) on how to take responsibility of managing the market structure in curbing the menace of over infiltration of markets in the neighbourhood. Since high level of competition in the market of raw homogeneous forest produce may crash the market price, such a better market structure management will therefore regulate unguarded entry and exit into and from forest related ventures as well as market price related upheavals.

Government should assist forest indigenous people who engage in logging and other labour intensive forest operations by providing them with the required, affordable and improved technologies (machineries and technical know-how) to reduce cost of labour and ease their works instead of hiring too much labourers who most often use traditional methods. This will not only improve the participation of households in forest related businesses but will also reduce the cost of labour and increase their income.

In addition, improved social capital system among forest related entrepreneurs should be given a priority to avail themselves of some benefits embedded in such associations. Social capital comprises a lot of mutual benefits such as grants, loan, advice, training, technical supports among others which are open to any forest households who is a member of such associations.

Similarly, there is urgent need for the improvement of IMA by the concerned government authorities and relevant forestry stakeholders in the region. The Governments of the six South-western states should launch an important scheme that will link forestry value chains (such as removing tenure and regulatory restrictions; improving marketing arrangements for marginal people; creating partnerships between the poor and forest enterprises among others) and the financial value chain (credit access, incentives provision, entrepreneurial skill acquisition scheme etc). This is expected to boost the forest entrepreneurship through lending from the commercial banks and to also facilitate the processing of such forest products to attract more income to the forest users.

Besides, measures to reduce poverty among rural households in Nigeria should be targeted at improving working conditions of forest entrepreneurs (especially the rural downtrodden), through provision of

incentives, forest products subsidy regime and basic infrastructural facilities particularly in the rural areas. All these are necessary requirements for improving the level of participation of the rural households in FREs.

Furthermore, increasing the participation of younger population in small and medium-scale forest ventures and market-oriented activities in agroforestry should be a good policy target in order to encourage youths to venture into FREs. This will boost the earning capacity of the forest households since younger population are expected to be very agile and active with high propensity to multiply the households' income.

Likewise, labour cost should be minimal and affordable to the forest entrepreneurs in order to reduce households' input cost and to increase their earnings. Finally, adopting good forest management laws and practices will improve the chances of forest income generation to the households.

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