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Women Participation in Agricultural Production: A Probit Analysis

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Abstract: Women play a very significant role in agricultural production in Nigeria. They are however accorded little attention. Inadequate information on the level of women participation in agriculture has helped to under estimate their importance in the economy and hence led to their neglect in policy issues. This study therefore employed the Probit analysis to investigate the determinants of women participation in agricultural production. It was found that the level of the disposable income, perception, tenure rights and the level of the contribution of the women to agriculture had significant impact on the women participation in agricultural production.

Key words: Agricultural production, participation, probit analysis, women

INTRODUCTION

The role of women in agricultural production in Nigeria can never be over emphasized. Various researches conducted on the contribution of women to agricultural development in the country (Amali, 1988; Auta *et al*., 2000) suggest that women contribution to the farm work is as high as between 60 and 90% of the total farm task performed. The contribution of the women ranges from such tasks as land clearing, land tilling, planting, weeding, fertilizer/manure application to harvesting, food processing, threshing, winnowing, milling, transportation and marketing as well as the management of livestock. The Nigerian woman is therefore saddled with most of the tasks in agricultural production 'supposedly' meant for the man but the benefits gained by them are not commensurate to the hours they spend on the task. Despite the dominant and important role women play in agricultural production in the country, they are hardly given any attention in the area of training and/or visitation by extension agents with improved technologies. Banks hardly grant them loans and they are hardly reached with improved seeds, fertilizer and other inputs (Saito and Spurling, 1992). These conditions have entrenched the women in a vicious cycle of poverty that places them at a less advantageous vantage of income and resource empowerment. Policy issues in the past failed to address the unpleasant and deploring condition under which women in the country contribute to agriculture. This might not be unconnected with the negative perception of policy makers who are predominantly men that assume women to play only second fiddle in economic and resource importance. This negative perception arises as a result of the ignorance of the policy makers to the enormous contribution of women to the food production in the country in particular and the economy as a whole.

There is therefore the need to correct for this anomaly. Inadequate information on the level of women participation in agriculture has helped to under estimate their importance in the economy and hence led to their neglect in policy issues. An investigation into the level and determinants of women participation in agriculture is therefore necessary. The information generated will provide an insight for development planning and policy formulation that is more relevant to the need of women farmers. It will also provide a basis for further research on the impact of women in agriculture and rural development in Nigeria.

MATERIALS AND METHODS

The study was conducted in Chukum Local Government Area of Kaduna State, Nigeria. Farming is the predominant occupation of the people in this area. A double stage random sampling was applied to in obtaining the sample for this study. Six villages were randomly selected. The villages were Udawa, Jan-Ruwa, Gonigora, Kakau, Kujama and Sabon-Tasha. In each village 20 women were randomly selected. Therefore a total of 120 women were selected from a population of 866. Data were collected during the 2003/2004 cropping season by oral interview and administration of structured questionnaire. The information collected include women membership of cooperative societies, their contribution to household farm production, level of disposable income, farm size,

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education status, source of credit, number of children, age, input availability and contact with extension agents.

Theoretical framework: The empirical specification of the dichotomous binary choice model is employed to investigate the agricultural practice decision of women. A probit model was developed to examine the relationship between socio-economic characteristics and the level of participation of women in agriculture. This according to Rodolfo and Nayga (1996) is affected by the level of information acquired. Previous studies in Sub-Saharan Africa suggest that information acquisition and the eventual practice (adoption) behaviour is influenced by various individual characteristics (Adesina, 1996; Nkamleu *et al*., 1998). Consequently, these factors are hypothesised to be important determinants of an individual ability to process new information into changed behaviour (Nkamleu and Abesina, 2002).

The demographic variables included in the empirical model are given in Table 1. The dependent variable is whether or not the woman participates in any agricultural production. The women demographic variables are age of the woman (X_1), household size (X_2), marital status (X_3), level of education (X_4), years of experience(X_5), distance of the woman's farm from homestead (X_6), disposable income level of the woman (X_7), perception (X_8), extension services (X_9) and tenure rights (X_{10}).

AGE is a variable that measures the age of the woman in years. Age may influence an individual's level of participation in agriculture. It could be that older women have access to information or technologies through extension services or development projects that work in the region. It could also be that with age the individual has accumulated more capital which could be spent on hired labour. However it may also be possible for younger individuals to participate in food production since they have more energy that could be spent on farm labour.

HSIZE measures household size. A large household size measures a number of working members. Generally an increase in family size is likely to increase the probability of participation in agricultural production (Adesina, 1996; Nkamleu and Abesina, 2000).

MSTATUS is a dummy variable which measures the marital status of the farmer. It takes on the value of 1 if woman is married and 0 if not.

LEDUmeasures level of education of the woman. The more educated the woman is, the less likely she would participate in agricultural production due to more and better available job offers than farming. It could also be that the more educated the woman is, the more likely to adopt new technologies (Norris and Batie, 1987; Kebede *et al*., 1990) that would enhance her status as a farmer.

YEXP is the woman's years of experience in farming. It reflects the number of years since farm operator first began farming. With increasing experience, a woman farmer may be able to better assess benefits of farming.

DFARMis the distance of the farmer's field from the homestead. It is expected that the long distance (high X_6,) the will discourage the woman's participation in agriculture due to the labour and logistics involved.

LINCOMmeasures the level of income of the woman farmer. It is expected that the sign of this coefficient be positive. The higher the value of X_7 variable, the greater is the level of participation of the woman in agricultural production. More income would be made to her disposal to meet her technical and logistic needs in production.

PERCEP measures the perception of the woman. It has to do with the views of the farmer relating to agricultural production. A positive sign would make the

Table 1: Definition and descriptive statistics of the explanatory variables used in the probit analysis

		Continuous variable		
Variables	Description	Mean	SED	Categorical variables
PART	Value 1 if the *i*-th woman practices agriculture; 0 otherwise			1 = 80
				0 = 40
AGE	Age of farmer(years)	38.56	19.42	
HSIZE	Household size	5.17	2.41	
MSTATUS	Marital status. Value 1 if married; 0 otherwise			1 = 86
				0 = 34
LEDUC	Farmers' level of education. Value 0 if no education; 1 if non formal education,			
	number of years spent in school will be for formal education	15.37	11.89	
YEXP	Farmer's years of experience in farming	15.37	9.45	
DFARM	Distance of the farmer's farm from residence (km)	3.44	6.18	
LINCOM	Total disposable income of the farmer (₦)	15,896.81	5,321.35	
PERCEP	Index for farmer's perception towards participation in agricultural production	2.109	0.18	
EXT	Index for extension contacts	0.21	0.08	
TEN	Indexes the land tenure rights. Value 1 if farmer has permanent tenure rights;			1 = 23
	0 otherwise			0 = 97
MCOOP	Value 1 if a farmer is a member of any local NGO; 0 otherwise.			1 = 21
				0 = 99
CONT	This is the financial commitment of the farmer to agricultural production (₦).	1,121.21	987.39	

woman to participate more in agricultural production. This variable is calculated as an index in this study.

EXT is index for extension visits, training and field visits. Women farmers who have contact with extension agents will tend to have better access to information technology. This may improve their satisfaction and hence raise their level of participation in the agricultural production. It is hypothesized that X_9 is positively related to the participation of women in agricultural production.

TEN is a binary variable indexing the land tenure rights. It assumes the value of 1 if the woman farmer has permanent land rights and 0 otherwise. Farmers with permanent land rights are not restricted in land management decisions that could bring about increase in their job satisfaction which could result in increased level of participation. Permanent land tenureship rights also readily makes land available for farming practices anytime the land is sought for.

MCOOP is a dummy variable that measures if the woman belongs to any cooperative membership. It is expected that women that are into cooperatives will receive assistances that will enable them to increase their level of involvement in agricultural production.

CONT is a variable that measures the level of contribution of the women to agricultural production. It is a proxy for the level of involvement in agricultural production and it is valued in naira. It is the total capital spent on agricultural production during the production season. It is expected for women with high CONT to participate more in agricultural production.

The X-variables involved in the logistic regression model are defined in Table 1 and their summary statistics are presented in Table 2. Most of the variables are self explanatory except for extension (X_{10}) and perception (X_9) towards agroforestry. The index for extension is computed as follows:

$$EXT = NAWSA + NVEWF + NFVEO \quad (1)$$

Table 2: Maximum likelihood of probit estimates of women participation in agriculture

Variables	Coefficients (β)	t-value
Constant	3.982*	2.682
Age	-1.110	1.014
Hsize	1.321	0.356
Mstatus	0.893	1.122
Leduc	-0.530	-0.870
Yexp	1.543	0.567
Dfarm	-0.389	2.931
Lincom	-1.057*	2.581
Percep	1.468*	3.149
Ext	0.980	2.156
Ten	0.756*	2.834
Mcoop	1.235	1.175
Contr	2.003*	3.878

*p<0.05

Where

EXT = Extension index
NAWSA = Number of agricultural seminars and workshops attended
NVEWF = Number of visits of Extension workers to the respondent's farm
NFVEO = Number of respondent's visit to extension office

The respondents' perceptions to agricultural production were recorded as Profitable, Not profitable and Do not know. This was then converted to an index by assigning numerical value 1, -1 and 0 for Profitable, Not profitable and Do not know responses, respectively. The agricultural production perception index was then calculated as:

$$PCEPT = PP+NP+DNK \quad (2)$$

Where

PCEPT = Agricultural production perception index
PP = Profitable
NP = Not profitable
DNX = Do not know

Model specification: Women participation in agriculture was measured as a discrete choice variable (yes or no) where a sample of women was asked to individually indicate whether they were engaged in agricultural production or not. A lot of research has been carried out on the influence of socio-economic variables on farmers' adoption decision. In most cases, the use of Probit, Tobit or Logit was applied (Hailu, 1990; Kebede *et al*., 1990; Nkamleu and Adesina, 2000; Ransom *et al*., 2003). Farmers were assumed in these models to make adoption decisions based on an objective of utility maximization. If, $U^a \geq U^b$, then the farmer would either prefer U^a to U^b or would be indifferent.

Given agriculture as an occupational technology, the socio-economic and demographic characteristics of the woman may influence the level of her participation in agricultural production.

A Probit model was used to capture the participation process. Probit modelling is used for explaining a dichotomous dependent variable with the empirical specification formulated in terms of latent response variable (Verbeke *et al*., 2000). Defining Y_i as the utility index of participation in agricultural production then Y_i is a function of the socio-economic and demographic characteristics of the woman: $Y_i = 1$ for woman participation in agricultural production and $Y_i = 0$ for non-participation in agricultural production.

$$Y_i^* = \beta_0 + \sum_{k=1}^{k} \beta_i X_{ki} + \varepsilon_i \quad (3)$$

$$E(\bar{X}) = 0 \qquad E(\varepsilon) = 0 \quad Var(\bar{X}) = 1 \; Var(\varepsilon) = 1$$

Where Y^* is the latent or unobservable variable. The observable variable is a dummy representing the agricultural participation decision of the operator. Y = 1 if $Y^*>0$ and Y = 0 otherwise. i is the respondent, X_{ki} : k = 1 through k independent variables explaining the phenomenon of respondent, i, β_i is the parameter that explains the effect of X_i on Y^*_i; β_0 is the intercept that shows the expected value of Y^* when all X_k have a value of zero. ε_i is the stochastic error term for respondent i, E = the expected value and Var = variance, $\bar{X}$ = the mean of X. As such Y^*_i ~N(0,1) Since utilities are random, the i-th woman farmer will agree to participate in agricultural production if and only if $U^a_i>U^b_i$ For the i-th woman therefore, the probability of participating in agricultural production is given by the utility maximization function

$$\begin{aligned} P(Y=1|X_{ij}) &= P(U_i^a > U_i^b) \\ &= P(\beta_1 X_i + \varepsilon_i^a > \beta_0 X_i + \varepsilon_i^b) \\ &= P(\varepsilon_i^b - \varepsilon_i^a < \beta_1 X_i - \beta_0 X_i) \\ &= P(\varepsilon_i < \beta_i X_i) \\ &= \Phi(\beta_i X_i - \varepsilon_i > 0) \end{aligned} \quad (4)$$

Where, Φ is the cumulative distribution function for ε_i. The functional form for Φ depends on the assumptions of ε_i. Since Y^*_i ~N(0), then probability of the i-th participation of the -th woman in agricultural production is thus given by

$$P(Y=1|X_{ij}) = \Phi(Z_i) \frac{1}{\sqrt{2\Pi}} \int_{-\infty}^{Z_i} e^{-\frac{1}{2}Z^2} dZ \quad (5)$$

where

$$Z_i = \beta x$$

It is important to note here that the parameters of the model like those of any non linear regression model are not necessarily the marginal effects that we are accustomed to analyzing (Green, 2000). In general, marginal effects are given by

$$\frac{\partial E[Y=1|X_{ij}]}{\partial X} = \left\{ \frac{dF(\beta' X)}{d(\beta' X)} \right\} \beta \quad (6)$$

$$= f(\beta' x)\beta$$

Where f(.) is the density function that corresponds to the cumulative distribution. For the probit model Eq. 4 results to

$$\frac{\partial E[Y=1|X_{ij}]}{\partial X} = \Phi(\beta' X)\beta \quad (7)$$

RESULTS AND DISCUSSION

Maximum likelihood estimates of parameters of the univariate Probit model characterising the participation of women in agricultural production are presented on Table 2. The Pearson Goodness of Fit Chi-square which describes the goodness of the model is 66.54 and is significant at $p<0.05$.

Four of the variables [level of income (LINCOM), perception (PERCEP), contribution of the women to agriculture (CONT) and tenure rights (TEN)] were found to be significant at the 5% level. The coefficient of LINCOM is negatively significant at $p<0.05$; implying an inverse relationship with the level of participation of the women in agricultural production. This is contrary to apaori expectation and could possibly be due the risk and uncertainty associated with agricultural production such that women with high disposable income level would prefer to diversify their resource base in less risky investments than to be fully embedded in agriculture.

Perception, tenure rights of the women farmers and their level of contribution to agriculture on the other hand are positively significant at $p<0.05$. The contribution of the women to agriculture has the highest significant impact on the level of participation of the women in agriculture. The probability of the respondents, participation in agricultural production given the significant factors was 91%. There is therefore a high rate of involvement of the women in agricultural production in the study area. As expected, farmers with high levels of perception and permanent tenure rights were more involved in agriculture. The women in the area of study see agriculture as the major means of livelihood and therefore put high expectation of returns on the occupation. Majority of the women farmers were between the ages of 30 and 50. This might have accounted for the negative even though significant coefficient of the education variable (EDU). The higher the education levels of the woman farmer, the more the likelihood of her to out-migrate to seek for better placed employment.

Extension has an insignificant influence on the level of women participation in agriculture. This is quite expected since most of the women interviewed claimed they have never come in contact with any extension agent. This goes to support the claim of women being side lined in important agricultural policy matters.

CONCLUSIONS

It can be concluded from the study, that despite the constraints, there is a high level of women participation and commitment in agricultural production. The level of their contribution is an indication of their level of commitment in agriculture. The effect of the level of contribution to agriculture has the highest significant level ($p<0.001$). Also the CONT variable gave the highest marginal increase in probability (1.8). If measures that will enlighten women's burden (such as improving upon the efficiency of the extension services, easy accessibility to input and farming technology) are put in place, it will thus go along way in improving upon the women farmers' participation in agriculture.

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