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Profit Efficiency among Female Smallholder Farmers in Atiba Local Government Area of Oyo State

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Abstract: This study was carried out in Atiba Local Government Area of Oyo State. The main objective was to analyze profit efficiency among female small holder farmers. The data was collected from 50 female smallholder farmers with the use of structured questionnaire. The data collected was analyzed using the normalized stochastic frontier profit function to estimate the profit efficiency of the female smallholder farmers in the study area. The maximum likelihood estimate of the profit frontier function reveals that labour has a positive and insignificant among female respondents, which indicate that, labour is an important factor explaining changes in profit among the female smallholder farmers. Also, equipment has a significant but negative relationship with profit among the female smallholder farmers. This implies that equipment is negative factor that influences profit in the study area. The profit efficiency ranged between 0.062 and 0.963 with a mean of 0.447 for the male farmers. This means that the average farmers could increase profits by 55.3% by improving their technical and allocative efficiency.

Key words: Normalized, smallholder, profit, frontier, function, efficiency, Nigeria

INTRODUCTION

In Nigeria, it seems myths about rural women's roles and contribution still persist, while cultural constraints in many Nigeria, communities, economic roles of rural women continue to be invisible or at best viewed as an extension of their domestic roles until very recently and little definite effect were made to evolve policies that will increase rural women's access to education training, credit, land resources etc., necessary for incorporating them into the real main stream of rural development (Aishatu, 2002). Rural societies are not homogenous, but are differentiated along socio-economic lines. Adeyeye (1986) stated that the female members of rural households belong to different socio-economic strata and perform different roles. Whatever, the differences, their roles are vital to the substance of their families, communities and society at large. In many areas, they have the roles of working in the fields and farms to produce food and or tend animals, market farm produce in addition to bearing and rearing children and market farm produce in addition to bearing and rearing children and manage large households with very scanty or no amenities including such basic necessity as potable water and fuel.

In Nigeria, food crop production remains a major component of all production activities in the agricultural sub-sector. Food-crop production comes under different agricultural systems. Most commonly are mixed farming, mixed cropping or mono-cropping. Further, activities in the food crop sub-sector have contained to dominate the category farms variously referred to as small-holder farms, small-scale farm, low-resource farms or small farms (Olayide and Heady, 1980).

This category of farms represent as much as 95% the total food-crop farming units in the country and produces about 90% of the total food-crop output (Okuneye and Okuneye, 1988a). These farms are characterized by low level of operation, illiteracy of operation and a labour intensive production technology with hired labour cost constituting about 60% of the total cash cost of production (Olayemi, 1980; Aromolaran, 1992). In small-scale agriculture; the farming system is embedded in the household economy, which integrates both production and consumption and it shaped by the multiple goals that are operative in the system (Norman *et al*., 1982).

Many authors as indicated by Adeyeye (1986) investigated the extent of rural women's contribution in terms of labour to agricultural production. Rural women are involved in many activities relating to food production. Some are farmers in their own right producing food crops for family consumption and sale, some work on their husband's farms carrying out varieties of operation while, some women are traders of food crops, selling processed and unprocessed forms of agricultural products.

Adekanye (1985) declared that over the past 10 years, women's contribution to family income have been well documented and that official agencies are beginning to recognize women as producers of goods not just consumers of reservists. Also, that in many cases, there is a growing realization that in many cases, development programmes have not only failed to benefit women, but also have hurt them.

The U.N. decade for women (1975-1985) showed that legitimized women's status has contributed immensely to the awareness of women's major contribution to their societies. Studies by women researcher, which revealed the true circumstance of rural women's lives have made some impacts on development policies of government and donor agencies and a major impact on women's programmes in most third world countries. As a result, how best to integrate women into the development process has been consistently and systematically questioned by both researchers and practitioners from the beginning of the century (Aishatu, 2002).

The pivotal role of the efficiency in accelerating agricultural productivity and output has been applauded and investigated by numerous researchers and policy makers within Africa and outside alike. An underlying premise behind much of the research on efficiency is that, if farmers are not making efficient use of existing technology, then efforts designed to improve efficiency would be more cost-effective than introducing new technologies as a means of increasing agricultural output (Belbase and Grabowski, 1985; Shapiro, 1983; Bravo-Ureta and Pinheiro, 1994). However, the aim of every farmer is to make profit whether much or litter here, profit efficiency can be defined as the ability of a firm or farm to achieve potential maximum profit, given a level of fixed factors and prices faced by the firm (Adesina and Diato, 1996).

The labour force during those times is household consisting of men, women and children, as a result of this, rural smallholder agriculture remained the major power for rural growth and livelihood improvement. The rural population provides about 90.0% of the food produced in Nigeria while, the remaining 10.0% is assumed to be obtained through importation which means Nigeria is yet to be self-sufficient in food production (Okuneye and Okuneye, 1988b). The outcome of the study will make us know the profit efficiency level among the female smallholder farmers.

Literature review: Fresco (1993) affirmed that the women farmer's productivity is hindered by inferior educational status, inferior access to resources like land, credit and others. Most research centers are crusading for the improvement of women farmers productivity in Africa, most especially IITA (International Institute of Tropical Agricultural) with 2 fundamental objectives, which are:

- To increase food production.
- To promote social equity.

Women in years past tried to cope with their multiple responsibilities, which vary in degree with culture, income level, literacy, age and marital status, but have been confronting a range of obstacle which affect them in all or some of their roles. The constraints affecting women farmers in Africa and the global world were broadly grouped into 2:

- Constraints, which are of primary importance to the human capital development of women.
- Constraints, which are of importance to the economic productivity of women (Karl, 1983).

One of the specific intervention, aimed at freeing up the economic productivity of women in Nigeria is the women-in-agriculture (WIA) component as part of the work relating training programmes, aimed at removing the economic productivity constraints of women with special emphasis on mental strength rather than the focus of physical strength (Adeyemo, 1991).

One of the major reasons for the neglect of women in food crop development project in West Africa is the error, yet the pervasive assumption that the female farmers are less efficient than the male farmers. Thus even in regions of West Africa where women are the traditional maize growers together with some crops (vegetable, cassava) which are considered as women's crop, development project choose to focus on men and women (Ekandem, 1962).

Women play a dominant role in agricultural production in the developing economics as well as Nigeria. They are involved in practically all aspects of agricultural production. Chiebowska (1990) reported that women living in rural areas represented 60% of the world's female population with as much as 70% of them in the developing countries.

In Nigeria, women constitute 49.7% of the national population and majority of them reside in the rural areas, where they live mainly by exploiting the resources of nature (CBN, 1994; NPC, 1998). They are involved in agriculture as suppliers of labour, food crops and livestock producers, processors of food and fish products, marketers of peasant farm surplus and transporters of farm supplies and farm products between the farm and the home.

According to the World Bank (1995), women in sub-Sahara Africa, Nigeria inclusive are responsible for the production of about 70% of the total staple food supply in the region. This contribution is higher than that of the women in other regions of the world.

Odurukwe and Anuebunwa (1997) stated that in most part of rural Nigeria, division of labour within the household is gender-specific and according to age women play a prominent role in agricultural production. The extent of their involvement in agricultural production and their contribution to the household food basket vary from one ethnic group to another.

Normalized profit function: The actual normalized profit function which was assumed to be well-behaved can be expressed as:

$$\Pi (P_1 Z) = Y (X^*, Z) - \Sigma P_1 X_1^*$$
$$X^* = g (P_1 Z) \quad (1)$$

where,

* = The profit function is non-increasing in input prices and non-decreasing in output prices, homogenous of degree zero in input and output prices and convex in input and output prices.

Y (X *, Z) = The production function, the asterisk denotes optimized values.

$$P_1 = w/p$$

where,

P and W = The output and input prices, respectively.

p_1 = The normalized price of input.

The stochastic profit function can then be expressed as:

$$\Pi_j = f (P_{ij}) = \exp e_j \quad (2)$$

where,

Π_j = Normalized profit of the jth farm, computed as gross revenue less variable cost, divided by farm specific output pric p.

P_{ij} = The normalized price of input I for the jth farm, calculated as input price divided by farm specific output price p_j.

z_{kj} = The level of the kth fixed factor for the jth farm

e_j = Error terms.

The error term e_j, is assumed to behave in a manner consistent with the frontier concept:

$$e_j = V_j + U_j \quad (3)$$

where,

V_j = The symmetric error term.

U_j = A one sided error term.

The V_j's are assumed to be independently and identically distributed (i.i.δ) as N (O, δ^2v); we assumed that V_j has a half-normal non-negative distribution, N (O, δ^2u) U and n are also assumed to be independent of each other. U_j is used to represent inefficiency that is, it represents profits short fall from its maximum possible value given by stochastic frontier. Thus, if U_j = O, the firm lies on the profit frontier, obtaining potential maximum profit given the prices it faces and the levels of fixed factors. If $U_j > 0$, the firm is inefficient and loses profit as a result of inefficiency.

An average frontier model result of the frontier model is estimated without the one-side disturbance term, U_j. This approach has been criticized by Farrell. On the other hand, a full deterministic or full frontier model, often estimated by linear programming techniques, results if the random error term V_j is omitted. If Eq. (2) is estimated econometrically rather than a model consisting of Eq. (2) and (3), an average as opposed to the frontier is obtained. It is therefore, essential to estimate the frontier function to provide and estimate of industry best practice profit for any given level of prices and fixed factors.

Given the specification of U, the population mean and variance of U:

$$E (u) = \delta u \sqrt{(2/\psi} \quad (4)$$

$$V (u) = \delta^2 u (\Psi - 2) / \Psi \quad (5)$$

where,

Ψ = A constant equal to 3.14 the expected inefficiency in the population is then given as:

$$E (e^{-u}) = 2 \frac{e\delta^2 u}{2} [1 - F (\delta u)] \quad (6)$$

where, F is the standard normal distribution function.

The farm-specific representation of conditional inefficiency (U_j/e_j) for each observation is derived from the conditional distribution of U_j, where, $U_j = e_j + V_j$ and it has an expectation of:

$$E (U_j/e_j) = \frac{du\, dv}{d} \frac{F (e_{j\lambda}/d) - e_{j\lambda}}{1 - F (e_{j\lambda}/d)} \quad (7)$$

where, $\lambda = \delta u/\delta v$, $\delta^2 = \delta^2 + \delta^2$ and f and d f are the standard normal density and cumulative distribution functions, respectively, evaluated at $e_{j\lambda}/\delta$. The farm-specific profit efficiency index (PIE) derived using the results from Eq. (7) as given as:

$$PIE = [1 - \exp (U_j)]$$

Profit loss due to inefficiency is represented as potential maximum profit given farm specific prices and fixed factors, multiplied by farm-specific profit inefficiency index. The second objective of the study is achieved by relating the profit inefficiency index to farm and household attributes. This can be specified as:

$$PIE = g(X),$$

where,

PIE = The profit inefficiency index.
X = A vector of farm household attributes.

The profit inefficiency index is therefore, hypothesized to be related to attributes of the farm household.

MATERIALS AND METHODS

The study area: The study was carried out in Atiba Local Government Area of Oyo State in the south-west zone of Nigeria. The local government has about 153 villages most of which are predominantly rural with special interest in agriculture. The main occupation in this local government, is farming due to favorable climatic condition.

The study area is situated with the tropical rainforest region and the existence of a large number of smallholder farmers in the area, thus allowed for a reasonable selection of the representative sample of smallholder farmers. The climate in the study area is of tropical type with 2 distinct rainfall patterns. The rainy season which marks the agricultural production season is normally between the months of April and October. The heaviest rainfall is recorded between the months of June and August while, the driest months are November to March. Agriculture is the main occupation of the people and small-scale traditional farming system predominate the area. The major food crops grown in the states include maize, yam, cassava, rice, cocoyam while, the major cash crops grown are cocoa, kola nut and oil palm.

Sampling procedure and sample size: The study used a multi-stage stratified random sampling technique. The first stage involved purposive selection of Atiba Local Government Area of Oyo State. The 2nd stage involved random selection of major villages from the list of villages obtained from the information units of the Local Government Area. A total of 6 villages were sampled and these include: Baale Agba, Oja Kesan, Oja-Koso, Eleke and Ajiroba. The last stage involved a random selection of 10 smallholder farmers from the five selected villages in the Local Government area. A total of 50 female farmers were interviewed with the aid of a structured questionnaire.

Method of data collection: The primary data was mainly used. The primary data was collected with the used of structured questionnaires. Input-Output data were also collected. Output data include quantity and values of output, market prices, while, input data include quantity and cost of inputs such as farm size, hired labour, family labour, fertilizer, seeds, cutting, sets, pesticides, herbicides and amount on farm implements. The data obtained pertained to 2007 planting season and were obtained between the months of Aprils and June, 2007.

Method of data analysis: The analytical techniques that were used in this analysis, include stochastic frontier profit function.

The general form of the translog profit frontier is defined as:

$$\ln\Pi=\alpha+\sum_{j=1}^{4}\alpha_j \ln p_j +\tfrac{1}{2}\sum_{j=1}^{5}\sum_{j=1}^{5}\alpha_{jk} \ln p_j \ln p_k +\sum_{j=1}^{5}\sum_{i=1}^{m}\alpha_{ji}$$

$$\ln p_j \ln Z+\Sigma ß_l \ln z_i +\tfrac{1}{2}\Sigma\Sigma ß_u \ln Z_i + e_1$$

where,

P : Restricted profit (total revenue less total cost of variable inputs normalized by price of output (P_y).
j = 1 : Labour wage.
j = 2 : Material input price.
j = 3 : Fertilizer.
j = 4 : Agro chemical price.
Z_i : Equipment cost.
Σ_j : Error term.

Where, $\varepsilon_j = V-U$

The profit efficiency of the jth farm is given by exp ($-U_j$), or profit inefficiency by [1-exp ($-U_j$)]. Profit loss due to inefficiency was then calculated as maximum profit at farm-specified prices and fixed factors multiplied by farm specific profit inefficiency = max profit (1-PE) where, PΣ = profit efficiency.

The objective of identifying the factors associated with profit loss was achieved by estimating the Ordinary Least Squares (OLS) multiple regression model.

$$PL = F(Z_1, Z_2, Z_3, Z_4, Z_5, e)$$

where,

PL = Profit loss.
Z_1 = Years of schooling.
Z_2 = Years of farming experience.
Z_3 = Farm size (Ha).
Z_4 = Labour (Mandays).
Z_5 = Family size.
e = Error term.

A linear function using profit loss as the dependent variable was estimated to determine the significance of these factors to profit inefficiency.

Measurement of variables: There are 2 types of variables in this study, the dependent and independent variables. The dependent variable is the profit measured in naira while, the independent variables includes labour measured in Naira and mandays; material input measured in Naira; Fertilizer measure in Naira and Kg; Agrochemical measured in Naira and litres; Equipment cost measured in Naira.

RESULTS AND DISCUSSION

Profit efficiency estimatio

Maximum likelihood estimate of profit frontier function: The MLE estimates of Eq. 1 are presented in Table 1. The result of the analysis reveals that labour has a positive and insignificant relationship among the female farmers. This indicates that labour is an imported factor explaining changes in profit. The coefficient of materials inputs was found to be insignificant and negative among the female farmers. This implies that material input is a negative factor that influences profit in the study area. Hence, the more the cost of material inputs, the less the profit. Moreover, it was also observed that, the coefficient of fertilize have a significant and negative relationship with profit among the female respondents. This indicates that, as the cost of fertilizer increases, profit decreases. Agrochemical was found to be significant in the study area but it has a negative relationship with profit in female respondents. Equipment has a significant but negative relationship with profit among the female farmers. This implies that equipment is negative factor that influences profit in the study area.

The estimated sigma-squared (δ^2) is significantly different from zero at the 1% level. This indicates a good fit and correctness of the specified distributional assumptions of the composite error term. The observed significance of δ^2 conforms to Rahman (2003), Hjalmarsson *et al.* (1996) and Sharma *et al.* (1991). This suggests that conventional production function is not an adequate representation of the data. Moreover, the estimate of gamma (γ), which is the ratio of the variance of farm-specific profit efficiency to the total variance of profit, is 0.999 among the female farmers. This means that 99.9% of the total variation in crop production is due to profit inefficiency among the female farmers.

Frequency distribution of profit efficiency: The distribution of profit efficiency of smallholder farmers is presented in Table 2. The profit efficiency for female farmers ranged between 0.0225 and 0.995 with an average of 0.534. The average profit efficiency score of 0.534 implies that the average female farmers could increase profits by 46.6% by improving their technical and allocative efficiency. The female farmers also exhibit a wide range of profit inefficiency ranging from 1-97.8%. For example, Ali and Flinn (1989) reported mean profit efficiency level of 0.69 (range 13-95%) for Basmati rice producers of Pakistan Punjab. Ali Reported mean profit efficiency level of 0.75 (range 4-90%) for rice producers in North West frontier province of Pakistan. Ohajianya (2005) reported mean profit efficiency level of 0.32 for cocoyam producers in Nigeria. Rahman (2003) reported mean profit efficiency level of 0.77 range for Bangladesh rice farmers. The Table 3 also shows that majority (38%) of the female respondents have profit efficiency <0.5 while, few (12%) of them had profit efficiency between 0.9 and 0.99.

Table 1: Maximum likelihood estimates of profit frontier function in Atiba Local Government Area

Variables	Female
Constant	68.012 (69.030)*
Ln P_1	0.030 (0.035)
Ln P_2	-0. 0753 (-0.742)
Ln P_3	-3.699 (-3.901)*
Ln P_4	-6.999 (-6.793)*
Ln Z_1	-7.440 (-8.032)*
½ Ln P_1^2	0.136 (0.889)
½ Ln P_2^2	0.072 (0.809)
½ Ln P_3^2	-1.281 (-2.238)*
½ Ln P_4^2	0.01 (0.059)
½ Ln Z_1^2	-0.397 (-1.679)*
Ln P_1 Ln P_2	0.259 (1.768)*
Ln P_1 Ln P_3	-0.434 (-2.065)*
Ln P_1 Ln P_4	-0.095 (-0.609)
Ln P_1 Ln Z_1	0.141 (1.266)
Ln P_2 Ln P_3	0.156 (1.311)
Ln P_2 Ln P_4	0.203 (1.241)
Ln P_2 Ln Z	-0.0431 (-1.556)
Ln P_3 Ln P_4	0.260 (1.172)
Ln P_3 Ln Z	1.243 (3.050)*
Ln P_4 Ln Z	0.832 (5.093)*
δ^2	8.129 (5.767)*
γ	0.999 (427.456)*
Log likelihood function	-57.720

-Figure in parentheses are the t-value; * Estimates are significant

Table 2: Frequency distribution of profit efficiency for smallholder farmers in Atiba Local Government Area

Profit efficiency	Female
<0.5	19 (38)
0.5-0.59	6 (12)
0.6-0.69	6 (12)
0.7-0.79	4 (8)
0.8-0.89	9 (18)
0.9-0.99	6 (12)
Total	50
Mean	0.534
Minimum	0.0225
Maximum	0.995

Figure in parentheses are the percentages

Table 3: Determinants of Profit Loss by Smallholder Farmers in Atiba Local Government Area

Variables	Female
Constant	-62183.00 (-0.465)
Education	-2878.719 (-0.268)
Experience	5649.295 (1.727)*
Farm size	-4206.780 (-0.337)
Hired labour	3.232 (0.482)
Family size	5439.408 (0.254)
R2	0.144
F-value	1.477

Figure in parentheses are the t-value

Determinants of profit loss: The OLS estimates of the relationship between loss of profit and farm household characteristics showed that Experience was found to be significant and positive among the female respondents. The positive relationship implies that female farmers with more years of experience exhibited significantly less loss of profit than farmers with less years of experience. Large farms of the female respondents did not exhibit a significantly higher profit loss than smaller farms in male respondents and pooled data. This finding is consistent with those of Saleem (1978), Ohajianya (2005) and Bravo (1984). Farmers with more family size exhibited significantly less loss of profit than farmers with less family size among the female farmers.

The broad objective of this study was to analyze the profit efficiency among female small holder farmers in Atiba Local Government Area of Oyo State. The maximum likelihood estimate of the profit frontier function reveals that labour is positive and insignificant among the female farmers which indicate that labour is an imported factor explaining changes in profit. Also, equipment has a significant but negative relationship with profit among the female farmers. This implies that equipment is negative factor that influences profit in the study area.

The profit efficiency for female farmers ranged between 0.0225 and 0.995 with an average of 0.534. The average profit efficiency score of 0.534 implies that the average female farmers could increase profits by 46.6% by improving their technical and allocative efficiency. The female farmers also exhibit a wide range of profit inefficiency ranging from 1-97.8%.

CONCLUSION

The study shows that, small-scale farming is profitable in the study area and the result also shows that resources were utilized effectively. The acceleration of the economic development with respect to agricultural development, there is need to put in place appropriate policies as well as focus on food crop production by smallholder farmers.

RECOMMENDATIONS

Based on the results and various observations from findings, the following recommendations were made:

- Agricultural inputs, improved seed varieties should be made available to small holder farmers in order to improve production.
- Bodies that could loan out money should be set up by the government apart from cooperatives.
- Education and skill acquisition programmes should be organized for the smallholder farmers in the study area to enable them maximize the use of the available technology thereby improving their productivity.
- Female farmers should be encouraged by eliminating any barrier that can engender inequalities in their access to the productive resources of the farm.

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