Economic Efficiency and Food Security Status of Rural Farm Households in Abia State of Nigeria

Iheke O. R., C. O. Onyendi

Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Nigeria

Email address
ralphiheke@gmail.com (Iheke O. R.), iheke.onwuchekwa@mouau.edu.ng (C. O. Onyendi)

Citation

Abstract
Global food insecurity remains a serious problem and more than 900 million people are still hungry in 2010 [7]. With high level of poverty, malnutrition, low agricultural productivity, and followed by considerable and continuous increase in food prices over the past few years, the issue of increasing agricultural productivity has become the main concern to governments. How efficient a farmer is determines his level of productivity and income, and subsequently how food secure he is. This study therefore, examined the economic efficiency and food security status of farm households in Abia State of Nigeria. Multi stage random sampling technique was employed in selecting the respondents and data was collected using structured questionnaire. The economic efficiency of the respondents was analysed using stochastic frontier Cobb-Douglas profit function and the food security status was analysed using food security line. The result of data analysis revealed that education, age of the farmer, primary occupation, farming experience, farm size, credit, membership of association and extension contact were the significant factors influencing the economic efficiency of the farm households. Ninety percent of the respondents were found to be more than 70% economically efficient. The most efficient farmers are found to operate at 99 percent while the least efficient farmers were found to operate at 13.4 percent efficiency level. The average level of economic efficiency was 85.5 percent. Also, the food security needs were not adequately met as 31.25% were food secure while 68.75% were food insecure. Adequate enlightenment and education of the farm households is therefore recommended for the farm households so as to improve their efficiency, as this will lead to increased productivity and food availability. This calls for the strengthening of the agricultural extension system provide the informal training that helps to unlock the natural talents and inherent enterprising qualities of the farm household for increased productivity.

1. Introduction

Poverty and malnutrition continue to be major problems in Sub-Saharan Africa. Agricultural production increased to 12.3 percent of gross domestic product in 2009. Yet, 72.9 percent of the population live on less than US$2 per day, 27.5 percent consume inadequate calories, and 23.6 percent of children under five are underweight [6, 16]. Despite of the significant progresses made in the agriculture in the past decade, poverty and malnutrition continue to be major problems in Sub-Saharan Africa [20]. In Nigeria, despite its vast agricultural resources and oil wealth, poverty is widespread in the country and has increased since the late 1990s [16].
The challenge that is currently confronting Nigeria’s agriculture is related to the problem of low production resulting from inefficient use of resources [32]. Nigeria is one of the populous countries with an estimated population of 191.8 million people [48]. Approximately 68% of this population are women and children with over 70% residing and securing their livelihood in the rural areas [22]. Raising the productivity of rural households is crucial in reducing rural poverty and hunger [16].

The Nigerian agricultural sector is of notable relevance in the country’s economic development and growth. It contributes immensely to the GDP (gross domestic product) and employs about 68% of the working population [27]. Agriculture as one of the critical sectors of the economy contributed about 33% of the total GDP of $183 billion in 2008 and 41.8% to real GDP in 2009 [26].

Despite these notable roles, food insecurity ranks top most among the developmental challenges facing Nigeria [4]. The level of food insecurity and poverty has continued to rise steadily in Nigeria. About 70 percent of Nigerians live on less than US$1.25 per day. Poverty is especially severe in rural areas where up 80 percent of the population live below the poverty line and social services and infrastructure are limited [8, 265, 21]. It rose from about 18% in 1986 to about 41% in 2004 [46]. Also, [19, 12] noted that growth in population and rapid urbanization has fuelled an increased demand for agricultural goods that regional production is increasingly failing to meet. Iheke, 2006 noted that although food production increased at an impressive rate in developing countries during the 1980’s, it failed to keep pace with population growth in two third of the developing African countries. The situation has not only contributed to food insecurity among households but has led to adoption of inappropriate land use practices which have resulted to soil degradation and loss of fertility [12].

Admittedly, food security is strategic in that it is a measure of stability of the Nigerian Agriculture, the achievement of food self-sufficiency and self-reliance objectives of Nigerian government [37]. The reality is that Nigeria has not yet been able to attain self-sufficiency in food production annually. Many regard the Nigerian food problem as a paradoxical situation because, Nigeria appear to have the human and physical resources necessary to provide ample food and fibre for its domestic population and the export market [40].

Africa’s low agricultural productivity has many causes, including scarce and scant knowledge of improved practices, low use of improved seed, low fertilizer use, inadequate irrigation, conflict, absence of strong institutions, ineffective policies, lack of incentives, and prevalence of diseases [18]. With scarcity of land, water, energy, and other natural resources, meeting the demands for food and fiber will require increases in productivity. The constraints to the rapid growth of food production seem to be mainly that of low crop yields and resource productivity [47]. According to [3], most of the essential farm inputs are rather not readily available or their cost is beyond the reach of most farmers. He equally observed other problems to include; lack of access to credit facilities, funding of research and inadequate storage facilities. The premise is that the level of technology prevailing in a given society reflects its capacity to optimize the use of natural and human resource in production [31]. This low state of technology has been the problem of agriculture and technical progress. The constraints to the rapid growth of food production seem to be mainly that of low crop yields and resource productivity [47]. Therefore, inefficiency in the use of resources constitutes the major constraints to increased agricultural production in Nigeria [35].

According to [14], efficiency has become a very significant factor in increasing productivity. They stated that assessing the relative performance of the processes used in transforming given inputs into output is key to increasing agricultural productivity and enhancing food security and income.

Activities in the food crop sub-sector have continued to dominate the category of farms variously referred to as smallholder farms based on size of the farm, size of holdings, scale of production [39]; low resource farms or small farms [1]. This category of farms, represent as much as 95% of the total food-crop farming units in the country and produces about 90% of the total food output [36]. It was assumed that the main objectives pursued by the farmers in the study area include provision food for his family throughout the year, accumulation of monetary income and ensuring minimum use of paid labour (in other words improve on the utilization of family labour).

It suffices to say that the knowledge of efficiency of resource use is vital to farmers in agricultural productivity. To this effect, the household food insecurity can be overcome either by strengthening the household’s resources or by enhancing their control and management of these resources [24, 9]. It therefore becomes very imperative to examine the efficiency of resource use and current food security status of farming households in Abia state of Nigeria.

2. Methodology

The study was conducted in Abia State of Nigeria. Abia is a State in South Eastern Nigeria. It is located latitude 4° 40' and 6° 14’ North and longitude 7° 10’ and 8° East of the equator. Abia has a total land area of 5,243.7km² approximately 5.8%land area of Nigeria. It has a total population of 2,833,999 from the 2006 population census, with a population density of 448.4 persons per square kilometre [28, 49]. Agriculture is the major economic sector of the rural inhabitants.

Multi-stage sampling technique was adopted in selecting the samples used for the study. In the first stage, all rural Local Government Areas (LGAs) were purposively selected. From the list, two LGAs were randomly selected. This formed the second stage and the third stage involved the selection of two communities. In the fourth stage, five villages were selected. The list of crop farm households in
each chosen village formed the respective sampling frames from which four farm households were randomly selected. In all, a total of eighty rural households were used for the study.

Primary data was collected using structured questionnaire and interview schedules. The data was collected in 2011 and re-validated in 2016. Information collected include, labour input, capital input, output and prices of inputs and outputs, farmer socio-economic characteristic such as age, farming experience in crop production, level of education, household size and credit use, income, farm size, age of household head, membership of cooperative society, educational status, access to consumption credit, input and output data, quantity of food consumed from own production as well as from purchases and household size etc.

A stochastic profit function is given as:

\[ \Pi_i = f(P_{ij}, Z_{kj}) \exp{(V_j - U_i)} \] (1)

Where \( \Pi_i \) is the normalized profit of the j-th farm defined as gross revenue less variable costs divided by farm specific output price; \( P_{ij} \) is the price of the i-th variable input faced by the j-th farm divided by the price of output; \( Z_{kj} \) is the level of the k-th fixed factor on the j-th farm; \( f \) is an appropriate function such as Cobb-Douglas, translog, etc; \( V_j \) is stochastic disturbance term representing the effect of random factors beyond the control of the farmer e.g. weather, diseases outbreaks, measurement errors, etc. \( V_j \) is assumed to be independently and identically distributed as \( N(O, \delta^2) \) random variables independent of the \( U_i \) which is a non-negative random variable representing profit or economic efficiency. The \( U_i \) are assumed to be non-negative truncations of the \( N(O, \delta^2) \) distribution (i.e. half normal distribution) or have exponential distribution. If \( U_i = 0 \), the farm lies on the profit frontier obtaining maximum profit given the prices it faces and levels of fixed factors. If \( U_i > 0 \), the farm is inefficient and losses profit because of inefficiency. The stochastic frontier model was independently proposed by [2, 23]. The economic efficiency of an individual farmer is defined in terms of the ratio of the observed profit to the corresponding frontier profit given the prices and levels of fixed factors of production of the farmer.

Economic (profit) efficiency (EE) = \( \Pi/\Pi^{*} \) = \( \text{exp} (V_{j} - U_{i}) \) (7)

Where \( \Pi \) is the observed profit and \( \Pi^{*} \) is the frontier profit and other parameters were as previously defined. The parameters of the stochastic frontier models are estimated using the maximum likelihood techniques [2]

The economic efficiency was analyzed using the Cobb-Douglas profit function. It is given by:

\[ \Pi_i^{*} = \ln b_0 + b_1InP_1 + b_2lnP_2 + b_3lnX_1 + b_4lnX_4 + V_i - U_i \] (3)

Where \( P_1^{*} \) = normalized price of fertilizers; \( P_2^{*} \) = normalized price of labour; \( X_1 \) = farm size (ha); \( X_4 \) = capital inputs in naira; \( b_0, b_1, b_2, b_3, b_4 \) are parameters to be estimated.

In order to determine the factors contributing to economic efficiency, the following model was formulated and estimated jointly with the stochastic frontier profit model in a single stage maximum likelihood estimation procedure using the computer software frontier version 4.1 [5]:

\[ \text{EE}_i = \exp (-U_i) = \delta_0 + \delta_1Z_1 + \delta_2Z_2 + \delta_3Z_3 + \delta_4Z_4 + \delta_5Z_5 + \delta_6Z_6 + \delta_7Z_7 + \delta_8Z_8 + \delta_9Z_9 + \delta_{10}Z_{10} \] (4)

Where \( \text{EE}_i \) = economic inefficiency effect of the ith farm; \( Z_1 \) = educational level of farmer in years of formal education completed; \( Z_2 \) = household size; \( Z_3 \) = sex of farmer (dummy; 1= male, 0 female); \( Z_4 \) = age of farmer in years; \( Z_5 \) = primary occupation; \( Z_6 \) = years of farming experience; \( Z_7 \) = farm size (ha); \( Z_8 \) = credit access (dummy: 1 for access and 0 if otherwise); \( Z_9 \) = Membership of association (dummy: 1 for membership and 0 if otherwise); \( Z_{10} \) = extension contact (numbers of contacts); and \( \delta \) = parameters to be estimated.

The food security line was used to determine the food security status of the farm households. Food security line classified households into either food secure or food insecure depending on which side of the line they fall. The food security line was the recommended daily per capita calorie intake of 2470kcal [38]. The household calorie intake was obtained through the household consumption and expenditure data. The quantity of every food item consumed by the household in 3 days was converted into its calorie content. This was further converted into per capita calorie by dividing the estimated total household calorie intake by the adjusted household size in adult equivalent. Furthermore, the per capita calorie intake was converted into daily per capita intake by dividing by 3 days. A household whose daily per capita calorie intake is up to 2470 kcal capita intake is regarded as food secure and those below 2470 kcal relevant for targeting assistance and for the formulation were regarded as food insecure households.

The shortfall/surplus indexes were calculated for the sampled households based on the food security line. The shortfall/surplus index (P) measures the extent to which households are below or above the food security line.

It is expressed as:

\[ P = 1/M \sum_{j=1}^{M} G_j \] (5)

Where:
- \( G_j = (Y_j - R)/R \)
- \( G_j \) = Deficiency or surplus face by households
- \( M \) = Number of food insecure households
- \( Y_j \) = Calorie available to the jth household
- \( R \) = Recommended per capita calorie intake

3. Results and Discussion

3.1. Economic Efficiency

The maximum likelihood (ML) estimates of the stochastic frontier Cobb-Douglas profit function of the respondents is presented in Table 1. The estimated variance (\( \delta^2 \)) was statistically significant at 1 percent indicating the goodness of
fit and correctness of the specified distribution assumptions of the composite error. Gamma (γ) is 0.631 and is statistically significant at 1 percent. These imply that 63.1 percent of the variations in farm profit was due to economic inefficiency.

<table>
<thead>
<tr>
<th>Production Factor</th>
<th>Parameters</th>
<th>Coefficient</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>B₀</td>
<td>-6.428</td>
<td>-4.063***</td>
</tr>
<tr>
<td>Price of fertilizer</td>
<td>B₁</td>
<td>-0.221</td>
<td>-2.026**</td>
</tr>
<tr>
<td>Price of labour</td>
<td>B₂</td>
<td>0.419</td>
<td>0.297</td>
</tr>
<tr>
<td>Farm size</td>
<td>B₃</td>
<td>1.053</td>
<td>36.281***</td>
</tr>
<tr>
<td>Capital</td>
<td>B₄</td>
<td>0.189</td>
<td>1.646*</td>
</tr>
<tr>
<td>Diagnostic statistics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sigma squared (total variance)</td>
<td>δ²</td>
<td>0.557</td>
<td>6.237***</td>
</tr>
<tr>
<td>Gamma (variance ratio)</td>
<td>γ</td>
<td>0.631</td>
<td>3.852***</td>
</tr>
<tr>
<td>Log likelihood</td>
<td></td>
<td>-90.138</td>
<td></td>
</tr>
</tbody>
</table>

Source: computed from frontier 4.1 survey data, 2016

*** Coefficient Significant at 1% ** Coefficient Significant at 5% * Coefficient Significant at 10%

The coefficients of the price of fertilizer has the theoretically expected negative sign indicating that profit decreases with increase in the price of fertilizer, ceteris paribus. Farm size and capital show positive relationship with profit indicating that farm profit increases with increase in the quantities of these fixed inputs.

### 3.2. Sources of Economic Efficiency

Table 1 shows that education, age of the farmer, primary occupation, farming experience, farm size, credit, membership of association and extension contact were the significant factors influencing the economic efficiency of respondents.

Education is positively related to economic efficiency and implies that higher the education attainment of the farmer the higher his efficiency. According to [16, 17], education increases the ability of the farmers to adopt agricultural innovation and hence improve their efficiency and productivity. Educating the farmers is of great importance as snail farming requires technical skills. Therefore, education and training programmes should be organized for these farmers to enable them acquire the necessary skills for the operations as snail farmers. Age of household head was significant at 10 percent and negatively related to economic efficiency in concordance with a priori expectation. This result is consistent with [10, 12, 16, 17]. They reported that the risk bearing abilities and innovativeness of a farmer, his mental capacity to cope with the daily challenges and demands of farm production activities and his ability to do manual work decrease with advancing age; and the more he or she is unable to combine his or her resources in an optimal manner given the available technology. Therefore, economic policies for enhancing arable crop production should be skewed more towards encouraging the youths to get involved in farming.

Primary occupation is significant at 10 percent and positively related to economic efficiency. This implies that the economic efficiency of the farmer increases if his primary occupation is farming. Farming experience is significant at 10 percent level of significance and positively related to economic efficiency. This result is consistent with a priori expectations and has some positive implications for increased crop productivity because according to [30], the number of years a farmer has spent in the business of farming may give an indication of the practical knowledge he has acquired on how to overcome certain inherent farm production problems. Therefore, policies that harness the experience and practical knowledge of the farmers for increased production should be used.

Farm size, credit, cooperative membership/ farmers’ associations, and extension contact were significant at 1 percent, 10 percent and 1 percent level of probability respectively and positively related to economic efficiency.

Arable land rather than land per se has remained the greatest constraint in arable crop production in Nigeria [11, 30]. The result is consistent with [41, 44, 43, 45, 33]. However, researchers have observed that given the severe scarcity, unsustainability and insecurity of land and its fast deterioration [29, 11]; increase in arable crop output should be expected more from the application of superior technology rather than land area expansion.

Credit is essential in the purchase of production inputs, improves access to land, and in adoption of innovations which enhances productivity. Hence, the positive and significant (P = 0.10) relationship between credit and economic efficiency conforms to a priori expectations. This result agrees with [15, 17, 14, 42, 43, 45]; but is not consistent with [34] found a negative relationship between credit and economic efficiency.

Cooperative membership/ farmers’ associations are sources of good quality inputs, labour, credit, information and organized marketing of products. This explains the significant (P = 0.10) and positive relation between membership of association and economic efficiency. This result is consistent with [43 42, 34] posited that members of cooperative societies have enhanced ability to adopt innovations than non members.

Extension services provide informal training that helps to unlock the natural talents and inherent enterprising qualities of the farmer, enhancing his ability to understand and evaluate new production techniques leading to increased farm productivity and incomes with concomitant increase in the welfare of the farmer [30]. It is hoped that farmers’ interactions with extension agents would help them to receive and synthesize new information on economic activities in his
locality and beyond. The positive and significant relationship between extension contact and economic efficiency implies that the higher the number of contacts a farmer made with an extension agent, the higher his economic efficiency, which is in consonance with a priori expectations.

3.3. Distribution of Economic Efficiency

The frequency distribution of economic efficiency of farmers in the study area was presented in Table 2. From the table, 90% of the respondents were to be found to be more than 70% economically efficient. The most efficient farmers are found to operate at 99 percent while the least efficient farmers were found to operate at 13.4 percent efficiency level. The average level of economic efficiency was 85.5 percent. The level of economic efficiency obtained in this study suggests that ample opportunities exist for the farmers to increase their productivity and income through increased efficiency in resource utilization in their farm operations.

<table>
<thead>
<tr>
<th>Range of Efficiency</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 – 0.20</td>
<td>3</td>
<td>3.75</td>
</tr>
<tr>
<td>0.21 – 0.40</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>0.41 – 0.60</td>
<td>3</td>
<td>3.75</td>
</tr>
<tr>
<td>0.61 - 0.80</td>
<td>15</td>
<td>18.75</td>
</tr>
<tr>
<td>0.81 – 1.00</td>
<td>57</td>
<td>71.25</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean Value of Efficiency 0.855
Minimum Value of Efficiency 0.134
Maximum Value of Efficiency 0.990

Source: computed from frontier 4.1/ survey data, 2016

3.4. Food Security Status Among Farming Household

The distribution of the respondents based on their food security status is presented in Table 3. Based on the recommended daily calorie intake of 2470kcal, 31.25% of the farming households were food secured, while 68.75% were found to be food insecure. This conforms to the findings of Ibrahim and Bello (2009). Thus more than half of the households were consuming less than the daily per capita calories content. The shortfall/ surplus index (p) measured the extent to which household are below or above the food security line. The result above therefore indicate that a higher proportion of the households in the study were still food insecure. This may be attributed to seasonality of agricultural crops, low crop yields and resource productivity [47], adoption of inappropriate land use practices which have resulted to soil degradation and loss of fertility [12] and instability in food production, food price increases or income shortfalls [9].

<table>
<thead>
<tr>
<th>Food security status</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food secure</td>
<td>25</td>
<td>31.25</td>
</tr>
<tr>
<td>Food insecure</td>
<td>55</td>
<td>68.75</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field survey, 2016

4. Conclusion

It could be concluded from this study that food insecurity is prevalent among the farm households and that absolute was not achieved by any of the households. Education, age of the farmer, primary occupation, farming experience, farm size, credit, membership of association and extension contact were the significant factors influencing the economic efficiency of the farm households. Adequate enlightenment and education of the farm households is therefore recommended for the farm households so as to improve their efficiency. This calls for the strengthening of the agricultural extension system which provides a medium for the transfer of innovation. Also, farm households should be further enlightened on the nutritional implication of various food items such as fish, soybean and egg especially for growing children to increase protein intake in their diet and their calorie content.

References


