Food Insecurity Determinants among Rural Farm Households in Nigeria

Benjamin C. Asogwa and Joseph C. Umeh

Abstract—This paper investigated food insecurity determinants among rural household in Nigeria using farm-level data collected on 220 rural farm households from Benue State. Data were analysed using Tobit regression model. The study revealed that a unit increase in the number of household members working (-0.9726451) generated the highest fall in household food insecurity among the respondents. Furthermore, the study showed that a unit increase in the number of household members in school (0.8081805) generated the highest rise in household food insecurity among the respondents. Larger family size had higher probability to be food insecure. Policy should also be directed towards measures leading to the release of the “educational-financing burden” from farm households as this would also help to improve food security among the respondents.

Keywords—determinants, farm households, food insecurity, rural Nigeria, tobit model

I. INTRODUCTION

Food security is defined as access by all people, at all times to sufficient food for an active and healthy life and includes at a minimum the ready availability of nutritionally adequate and safe foods, and an assured ability to acquire acceptable foods in socially acceptable ways [1, 2]. Access to adequate food is a necessary but not a sufficient condition for a healthy life; a number of other factors, such as the health and sanitation environment and household or public capacity to care for vulnerable members of the society, also come into play [3]. The inability of the poor to have access to needed food can be attributed to low income and food production. Food insecurity on the other hand connotes a temporary shortfall of adequate food for a proper diet (transitory food insecurity) as well as a long term food shortage called chronic food insecurity.

As it is defined above, food security refers to access by all people at all time sufficient food for an active and healthy life, whereas food insecurity refers to the lack of access to enough food for an active healthy life. Thus, according to many researchers the determinants of food insecurity are also classified in to three groups within the framework of the general definition of food security, that is, food availability, access, and utilization [4, 5, 6, 7] while some other researchers gave more attention only on access and utilization of food and the determinant of food security can be seen as a combination of two distinct problems [8, 9].

The majority of the poor people in developing country are engaged in subsistence farming. They also depend on agriculture both for their incomes and food entitlements. So agriculture production is the main determinant of food security of the household and that the role of agriculture is crucial to the eradication of poverty and food insecurity in the rural households. The leading determinant of food insecurity in the Horn of Africa is low levels of per capita food production. Food insecurity can be tackled most effectively through policies that promote agricultural productivity, rural incomes and food production [12].

Food security is a broad concept that is more than food production and food accessibility. In reality it revolves round four pillars namely, food availability, food accessibility, nutritional factors and stability of supply [13]. Achieving food security requires that the aggregate availability of physical supplies of food is sufficient, that households have access to those food supplies through their own production, through the markets (given sufficient purchasing power) or through other sources and that the utilization of those food supplies is appropriate to meet the specific dietary needs of individuals households or individuals in the households [10, 11].

In Nigeria, the percentage of food insecure households was reported to be 18% in 1986 and over 40% in 2005 [14]. Although, figures released by food and agricultural organization in 2005 on the state of food insecurity in the world, indicated that 9% of the Nigerian population was chronically undernourished between 2000 and 2002 [15]. This was less than the regional average of 33% for Sub-Saharan Africa. However, the 9% or about 11 million undernourished Nigerians translate to about 5.4% of total number of undernourished people in Sub-Saharan Africa as a whole. On the national level, per capita growth of production of major food items in Nigeria has not been sufficient to satisfy the demand of an increasing population. The result is a big gap between national supply and demand for food. Several reports have been published that show a consistent increase in the production of staple food in the country especially between

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1999 and 2005, but there is still an observable gap between food demand and food supply [14].

In view of the foregoing, this study is aimed at investigating the determinants of food insecurity among the rural farm households in Nigeria. The null hypothesis that the specified explanatory variables do not significantly influence food insecurity among the rural farm households in Nigeria was stated and tested.

II. METHODOLOGY

A. The Study Area

For this study, farm level data were collected on 220 rural farmers in Benue State, Nigeria. Benue State is one of the 36 states of Nigeria located in the North-Central part of Nigeria. The State has 23 Local Government Areas, and its Headquarters is Makurdi. Located between Longitudes 6° 35'E and 10°E and between Latitudes 6° 30'N and 8° 10'N. The State has abundant land estimated to be 5.09 million hectares. This represents 5.4 percent of the national land mass. Arable land in the State is estimated to be 3.8 million hectares [16]. This State is predominantly rural with an estimated 75 percent of the population engaged in rain-fed subsistence agriculture. The state is made up of 413,159 farm families [17] and a population of 4,219,244 people [18]. These farm families are mainly rural. Farming is the major occupation of Benue State indigenes. Popularly known as the “Food Basket” of the Nation, the State has a lot of land resources. For example cereal crops like rice, sorghum and millet are produced in abundance. Roots and tubers produced include yams, cassava, cocoyam and sweet potato. Oil seed crops include pigeon pea, soybeans and groundnuts, while tree crops include citrus, mango, oil palm, guava, cashew, cocoa and Avenga spp.

B. Sampling Technique

In this study, the multi-stage random sampling technique was used for sample selection. Benue State is divided into three (3) agricultural zones viz: Zone A, Zone B and Zone C. Zone A and Zone B are made up of seven Local Government Areas each while Zone C is made up of nine Local Government Areas. Using a constant sampling fraction of 45%, three Local Government Areas were randomly selected from Zone A and Zone B while four Local Government Areas were randomly selected from Zone C under the guide of Benue ADP workers in BNDARAD. From each of the selected Local Government Areas, one rural community and one peri-urban community were randomly selected. Finally, from each community, households were randomly selected on the basis of the community’s population size using an appropriate sampling fraction in order to make the sampling design to be self-weighting thereby avoiding sampling bias [19]. Based on the foregoing, 220 farm households were randomly selected from rural communities for the study.

C. Data Collection

Data were collected mainly from primary sources. The primary data were obtained through the use of a structured questionnaire, copies of which were administered to the selected 220 rural farm households in Benue State of Nigeria.

D. Analytical Technique

The cost of Calorie Index method was used for the measurement of food insecurity among the respondents while the Tobit model was used for the analysis of the determinants of food insecurity in this study. The null hypothesis was tested using Wald statistics tests for joint significance of parameters and linear restriction of parameters.

E. Model Specification

1. Estimation of Food Insecurity Line

To analyze the food security status of households, a cost-of calorie index was constructed, followed by the use of a Tobit regression model to identify the major determinants of household food insecurity.

2. Cost-of-Calorie Index

The cost-of-calorie method proposed by [20] was used in this study to determine a threshold food security line. The method yields a threshold value that is usually close to the minimum calorie requirement for human survival. Two steps — identification and aggregation — are involved in constructing the index. Identification is the process of defining a minimum level of nutrition necessary to maintain a healthy living. This minimum level is referred to as the “food insecurity line”. In the context of this study, the food insecurity line is the calorie level below which people are classified as being food insecure or are subsisting on inadequate nutrition in the study area. Calorie adequacy was estimated by dividing the estimated calorie supply for each household by the household size, adjusted for adult equivalent, and using the consumption factors for various age–sex configurations. This method has been applied in several studies with a main focus on food security [21].

Following the method, the food insecurity line is given as:

\[ \ln X = \alpha + \beta C \]  

where X is the adult equivalent food expenditure and C is the actual calorie consumption per adult equivalent in a household. The recommended minimum daily calorie requirement per adult equivalent is 2250 kcal [22] [23] and this was used to determine the food insecurity line, using the equation:

\[ Z = e^{(a+\beta L)} \]  

where, Z = the cost of buying the minimum calorie intake requirement (i.e., the food insecurity line); a and b = parameter estimates in equation 2, and L = recommended minimum daily calorie intake level.

Based on the calculated Z, households were classified as being food secure or food insecure, depending on which side of the line they fell. But due to differences in household composition in terms of age and sex, there was a need to calculate the levels of expenditure required in households with different age–sex compositions. The approach used to achieve this was to divide household expenditure by household size to
get the per capita expenditure as used by the [24] and in several other studies. The household expenditure was then decomposed on per adult equivalent basis, using the conversion factor as adapted by [25].

3. Determinants of food insecurity
   The Tobit model
   To see the factors influencing food insecurity among the insecure part of population following [26], Tobit regression model was adopted and estimated. It was used to examine and establish statistical relationships between the dependent variable (i.e., food insecurity) and independent variables (demographic and socioeconomic variables) that are expected factors influencing food insecurity at household levels. It showed the marginal effect of the explanatory variables on the food insecurity status of the households.

   The model used in this thesis research can be expressed as follows:

   \[ F_{ini} = \beta Q_i + e_i \] ............................(3)

   Where, \( F_{ini} = 0 \) for \( X_i > Z \), and \( F_{ini} = (Z - X_i)/Z \) for \( X_i < Z \)

   \( Q_i \) = Vector at explanatory variables,

   \( \beta \) = Vector of respective parameters

   \( e_i \) = Independent distributed error term

   \( F_{ini} \) = Food Insecurity Status of Household i (0-1)

   \( Z \) = Food Insecurity line

   The independent variables are captured as:

   \( Q_1 \) = Economic efficiency Household Size (number)

   \( Q_2 \) = Farm income

   \( Q_3 \) = Non-farm income

   \( Q_4 \) = Per capita income

   \( Q_5 \) = Farm size

   \( Q_6 \) = Household size

   \( Q_7 \) = Transfer income

   \( Q_8 \) = Age

   \( Q_9 \) = Educational Level of Household Head

   \( Q_{10} \) = Age of Household Head’s (in years)

   \( Q_{11} \) = Household expenditure on education

   \( Q_{12} \) = Dependency ratio

   \( Q_{13} \) = Extension access

   \( Q_{14} \) = Household food expenditure

   \( Q_{15} \) = Credit access

   \( Q_{16} \) = Household members in school

   \( Q_{17} \) = Household members working

   \( Q_{18} \) = Household membership of farmer association

   \( Q_{20} \) = Household distance to urban market

   \( Q_{21} \) = Total value of output

   III. RESULTS AND DISCUSSION

A. Tests of Hypotheses

   The result in Table I shows that at 5% level of significance, the hypothesis that there is no significant relationship between food insecurity and the specified explanatory variables is rejected by Wald test of linear parameter restrictions, suggesting that there is a significant cause-effect relationship between food insecurity and the specified explanatory variables among the respondents.

<table>
<thead>
<tr>
<th>WALD TESTS OF HYPOTHESES INVOLVING LINEAR PARAMETER RESTRICTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test for Joint Restrictions of Parameters</td>
</tr>
<tr>
<td>Wald test</td>
</tr>
<tr>
<td>p-value</td>
</tr>
<tr>
<td>*Critical value</td>
</tr>
<tr>
<td>Conclusion</td>
</tr>
</tbody>
</table>

   Source: Field Survey, 2012

   *Critical value is significant at 5% level of significance.

B. Food Security Determinants

   From the maximum likelihood estimates of the Tobit regression (Table II), the results show that the model (regression line) fits the data reasonably. For example, the (maximum likelihood) estimates maximize the log likelihood functions. This implies that among all the possible regression lines, the coefficients (b’s) of this regression line maximizes the joint (total) probability (likelihood) of observing the \( n \) sample values of the food insecurity. This indicates that variation in food insecurity is explained by the (maximum likelihood) estimates of the selected explanatory variables, suggesting that the model as specified explained significant non-zero variations in factors influencing food insecurity among the respondents. The calculated Wald test (statistics) values are greater than the critical values (at 5% level of significance), implying that there is a significant cause-effect relationship between food insecurity and the specified explanatory variables.

   Furthermore, the Pseudo R-square (coefficient of determination) is 0.83355, suggesting that the model has a good fit to the data. This indicates that 83.36% variation in food insecurity is explained by variations in the specified explanatory variables, suggesting that the model has good explanatory power on the changes in food insecurity among the respondents with 95% level of confidence.

   The coefficient of economic efficiency of the household is statistically significant at 5% and has negative sign. This implies that the more economically efficient the farmers are in their farm operations the less food insecure they tended to be. This is because improvement in agricultural productivity improves returns to the household from agricultural activity [27]. Such an increase in household incomes would lead to reduction in food insecurity of the household. Improving the productivity of rural farm households, therefore, should play a key role in a broad-based economic growth strategy and food insecurity reduction for Nigeria. [28] observed that improvement in the farm productivity of the smallholder farmers in Nigeria brought about improvement their income generation and consequently poverty reduction.
TABLE II
FOOD SECURITY DETERMINANTS AMONG RURAL FARM HOUSEHOLDS IN NIGERIA

<table>
<thead>
<tr>
<th>Variable</th>
<th>ML Estimate</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.2100392</td>
<td>16.6516</td>
</tr>
<tr>
<td>Economic efficiency (Estimates)</td>
<td>-0.260389</td>
<td>-1.8135*</td>
</tr>
<tr>
<td>Farm income (Naira)</td>
<td>0.0022661</td>
<td>1.5683*</td>
</tr>
<tr>
<td>Nonfarm income (Naira)</td>
<td>-0.0034768</td>
<td>-2.5597**</td>
</tr>
<tr>
<td>Share of own-produced food</td>
<td>-0.0100413</td>
<td>-3.4540**</td>
</tr>
<tr>
<td>Farm size (Kilograms)</td>
<td>-0.5924156</td>
<td>-2.7426**</td>
</tr>
<tr>
<td>Household size (Number)</td>
<td>0.3220362</td>
<td>6.6446**</td>
</tr>
<tr>
<td>Transfer income (Naira)</td>
<td>-0.0652454</td>
<td>-1.6628*</td>
</tr>
<tr>
<td>Age (Years)</td>
<td>-0.4966673</td>
<td>-8.1831**</td>
</tr>
<tr>
<td>Education (Years)</td>
<td>-0.5088501</td>
<td>-2.3970**</td>
</tr>
<tr>
<td>Household expenditure on education (Naira)</td>
<td>0.6371307</td>
<td>3.7362**</td>
</tr>
<tr>
<td>Dependency ratio</td>
<td>0.5127705</td>
<td>1.0419</td>
</tr>
<tr>
<td>Access to agricultural extension services (0-1)</td>
<td>-0.0182540</td>
<td>-2.6926**</td>
</tr>
<tr>
<td>Household food expenditure (Naira)</td>
<td>-0.7995055</td>
<td>-2.8402**</td>
</tr>
<tr>
<td>Access to credit (0-1)</td>
<td>-0.4300663</td>
<td>-1.1948</td>
</tr>
<tr>
<td>Household members in school (Number)</td>
<td>0.8081805</td>
<td>2.1734**</td>
</tr>
<tr>
<td>Household members working (Number)</td>
<td>-0.9726451</td>
<td>-2.9242**</td>
</tr>
<tr>
<td>Household membership of farmer association (0-1)</td>
<td>-0.6961171</td>
<td>-2.5489**</td>
</tr>
<tr>
<td>Household distance to urban market (Kilometer)</td>
<td>0.5955996</td>
<td>0.1419</td>
</tr>
<tr>
<td>Ownership of household assets (Naira)</td>
<td>-0.0075220</td>
<td>-5.6489**</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-1653.08405358</td>
<td>-0.83355</td>
</tr>
</tbody>
</table>

**t-ratio is significant at 1% level of significance.
*t-ratio is significant at 5% level of significance.

The coefficient of farm income of household is statistically significant at 5%. Farm income generation is a measure of the extent of agricultural production commercialization and is expected to affect food insecurity negatively. The coefficient of the variable exhibits a positive relationship with food insecurity status, suggesting that the higher the farm income generation from agricultural production commercialization, the higher the food insecurity tends to be and vice versa. As a household’s farm size increases, food insecurity tends to decline. [29] observed that greater efficiencies in the use of resources are associated with the large farms than the small farms. They pointed out that the smallness of holdings deters the use of mechanization and does not allow the use of modern inputs due to lack of purchasing power in the hands of small farmers. [30] noted that in reality, small scale producers are not always efficient. This results in low productivity and low income, and consequently incidence of food insecurity among the farm households.

The result shows positive and significant influence of household size on food insecurity of a household. This means that each additional member of a household increases household food insecurity. This finding is consistent with theoretical and empirical evidences [31, 32]. Household size exerts more pressure on consumption than it contributes to production [33].

The coefficient of transfer income is negative and significant at 5% level. This signifies that for a unit rise in transfer income, the level of food insecurity will reduce by 0.0652454. This is due to the fact that an increase in income will have an effect because the change in income will lead to constant change in expenditure. Thus, the additional income received increases the stable income so that capacity of the households to consume more will increase.

The result showed that age has a negative and significant influence on household food insecurity. This suggests that the higher the age of the household head, the better the food security situation as there may be more options of making food available from both agricultural and non-farm opportunities. The coefficient of years of formal education is statistically significant at 5% level and carries a negative sign, thus suggesting that the higher the educational level of the household head, the more food secure (or less food insecure) the household tends to be and vice versa. This is as expected, since the level of education should positively affect the income earning capacity and level of efficiency in managing relationship with food insecurity status. This is because off-farm activity is one of the coping mechanisms that provides additional income to rural household. It enhances household economy and food security by giving additional income and decrease food deficit when agricultural production falls short and also avoids grain sales. This is plausible because households with other sources of income, in addition to farming alone tend to be more resilient in times of food crisis than those engaged in farming alone. Alternative income sources outside farming provide enhanced security for household livelihood.

The coefficient of Share of own-produced food in the total quantity consumed statistically significant at 5% and exhibits a negative relationship with food insecurity status. This shows that the higher the share or ratio, the lower the food insecurity tends to be, and vice versa.

The coefficient of farm size is negative in sign and statistically significant at the 5% level, meaning that farm size exhibits a negative relationship with the food insecurity status of a household. That is, households with larger farm sizes tend to be more food secure than those with smaller sizes, and vice versa. As a household’s farm size increases, food insecurity tends to decline. [29] observed that greater efficiencies in the use of resources are associated with the large farms than the small farms. They pointed out that the smallness of holdings deters the use of mechanization and does not allow the use of modern inputs due to lack of purchasing power in the hands of small farmers. [30] noted that in reality, small scale producers are not always efficient. This results in low productivity and low income, and consequently incidence of food insecurity among the farm households.

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the household’s food resources. This result implies that households who have household heads with relatively better education are more likely to be food secure than those headed by uneducated (illiterate) household heads. The result coincides with the theoretical evidences that educational improvement could lead to awareness of the possible advantages of modernizing agriculture and improve the quality of labor. It is similar with the findings of [34] and [31].

The coefficient of household expenditure on education is statistically significant at the 5% level and carries a positive sign, suggesting that the higher a household’s expenditure on education, the higher the food insecurity tends to be and vice versa. This is plausible, as the education of children is a priority area for which a household could deny itself some food and other necessities. This is because as much income is committed to education it reduces its (income) availability for food expenses.

The share of food expenditure as a percentage of total expenditure has a negative coefficient and it is statistically significant at 5% level. This suggests that as the share of food expenditure increase household food insecurity decreased. This is so because households that spend a high portion of their income on food are likely to be food insecure. Thus, the percent of total household expenditure spent on food is used to show household vulnerability. Particularly when the households rely on market purchases as an important source of food, cash incomes (or expenditure levels) are likely to be a more or less important indicator of their food security status.

The coefficient of household members working is statistically significant at the 5% level and carries a negative sign. This is because the larger the number of household members working the less the number of dependants in a household and hence the higher the share of income expenditure on food. The bigger the share of income expenditure invested on household food, the less the food insecurity in the household tends to be.

The coefficient of household members in school is statistically significant at the 5% level and carries a positive sign. This is because as the number of household members in school increases much income is committed to education thereby reducing its (income) availability for food expenses.

The coefficient of household membership of farmer association is statistically significant at 5% level and carries a negative sign. This implies that households whose heads were members of cooperative societies or other farmers’ organizations had higher tendency of being less food insecure than those households whose heads were not members. This can be closely linked to the beneficial effects of their membership, in terms of production and other welfare-enhancing services that these societies and organizations often offer.

The coefficient of access to extension services is statistically significant at the 5% level and has a negative relationship with the food insecurity status of a household. This implies that households with access to agricultural extension services tended to have less food insecurity than those that did not have such access and vice versa. This is because contact with extension services tends to enhance the chances of a household having access to better crop production techniques, improved inputs, as well as other production incentives that positively affect farm productivity and production and thus household food security status. [35] observed that high level of technical inefficiency among small-holder farmers in the rural and peri-urban areas of Nigeria were highly attributable to low availability of extension services and information about technical aspects of crop technologies.

The coefficient of ownership of household assets is statistically significant at 5% level and carries a negative sign. Ownership of household assets is considered to be one of the strategies for enhancing households’ resilience in the face of economic crisis and adverse circumstances, such as crop failure, drought, and so on. It is believed that some of the assets could be disposed of to cushion the effects of a transitory economic crisis on the households.

REFERENCES


